SUMMARY EVALUATION,
CORRECTIVE OPTIONS,
AND ESTIMATED CORRECTIVE COSTS

PERTAINING TO THE

ALASKA STATE CAPITOL

Juneau, AK.

PREPARED FOR

Legislative Affairs Agency

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APPLICABILITY

Each building displays unique behavior characteristics, reflecting numerous complex interactions between its particular structural systems, cladding elements, orientation and exposure to elements, and various other factors. Appropriate design recommendations must take these factors into account to minimize the danger of unsatisfactory performance.

This report provides general guidance for the Alaska Capitol building in Juneau. Extrapolation from the suggestions contained herein to other projects is not recommended, and may result in inadequate performance in some cases and needless expense in others. No warranty is provided that these recommendations can be successfully applied to other buildings. Any use of any information in this report for any purpose is strictly at the user’s risk, and PAUL LUKES: Building Envelope Consulting Services LLC accepts no liability for any consequences arising from such use.

EXECUTIVE SUMMARY

1. GENERAL INTRODUCTION

The Alaska State Capitol Building is a concrete-frame structure built in 1930. Its exterior skin consists of a multitude of masonry elements, extruded aluminum and steel sash windows, and EPDM and built-up asphaltic roofs. Due primarily to a combination of some ill-advised initial design approaches and material selections, as well as the effects of 80 years of Juneau's climate, many of the building's exterior elements have begun to display signs of leakage, degradation, and stress.

PAUL LUKES: Building Envelope Consulting Services, (PL:BECS), was initially retained in 2006 to perform a quick examination of the building's exterior masonry and windows and provide an overall summary for these elements. This investigation revealed a large variety of significant problems plaguing the building's exterior masonry, and the front portico appeared particularly worrisome.

In 2010, PL:BECS was asked to perform a more detailed evaluation focused on the front portico. This produced a portico-focused report dated 12/31/10.

In 2012, PL:BECS was asked to assemble a team of specialized consultants to perform a multidisciplinary evaluation of the entire structure, help determine recommended solutions, and provide very rough cost estimates for seemingly viable options. This report represents the culmination of this 3rd phase of this building's evaluation.

2. OVERVIEW OF PROBLEMS & CORRECTIVE RECOMMENDATIONS

This building's design appears to fall within the technically-typical range for its time, and is thus not "deficient" in the "legal" sense of being outside then-current industry standards. However, a number of vulnerabilities are inherent to the design. Combined with the building's 80+ years spent in Juneau's very masonry-challenging climate, these vulnerabilities have begun to manifest, in places fairly seriously, in degradation of much of the building's exterior masonry. In addition, the building was not designed to current seismic standards, and poses significant safety hazards and risk of earthquake damage.

This section outlines these concerns and related corrective recommendations under individual headings for clarity. While such subdivision helps clarify many issues, it can also obscure the highly intertwined nature of these problems. The reader should mentally re-integrate these individual issues into a holistic understanding of the building.

This report outlines three different primary corrective approaches, which can be summarized as "**Option 1: Restoration Approach**", which attempts to save as much of the existing exterior masonry as is feasible; "**Option 2: New Masonry Veneer Over Concrete Walls**", which proposes to reconstruct the exterior cladding with a new but similar-looking masonry veneer placed over new concrete shear walls; and "**Option 3: New Masonry Veneer Over Concrete and Steel-Framed Walls**", which is very similar to Option 2, and also replaces the entire exterior cladding system, but provides both concrete and steel-framed back-up walls. Option 3 was evaluated only because it initially appeared to represent a possibly less costly approach. However, the cost estimate revealed this to be the most costly option. In view of this, Option 3 is not recommended, as it represents a technically lesser approach for higher cost.

PL:BECS strongly recommends the Option 2 approach as technically optimal, safer, and far longer-lived than Option 1. In view of this option's relatively small cost premium compared to Option 1, and its many significant advantages, as outlined in in Part III, PL:BECS considers this the only viable approach. As Option 1 cannot correct the most fundamental design vulnerabilities of the existing building, it poses inherent limitations, and will require notably higher operating costs related to ongoing maintenance of the masonry and appreciably higher energy costs. Further, it is seismically a less safe approach. In brief, the required masonry maintenance inherent in the Option 1 approach relates to the already seriously damaged brickwork and its specific configuration. Further damage to the brickwork can be slowed down, but cannot be stopped, and the brickwork's many ledges will inherently increase moisture absorption and consequent damage. However, these limitations should not obscure the fact that even this Option 1 approach will greatly enhance both the overall building's as well as the entry portico's seismic safety, reduce interior infiltration, and restore and slow-down further degradation of the many exterior masonry elements. Please see Part III for a more detailed discussion of corrective approach considerations.

With these “Corrective Approach” clarifications made, let me outline issues and recommendations for the building’s major elements. With regard to the **Building’s Basic Structure**, a 2002 evaluation by Berger/Abam concluded that the structure is lacking in capacity of the primary concrete frame to resist lateral loads, making the building vulnerable to serious seismic damage. This same conclusion was confirmed by Swenson Say Fagét as part of this phase-3 evaluation. Additional structural concerns include inadequate and damaged foundations; somewhat damaged concrete floor systems; a seismically-vulnerable masonry chimney; inadequate securement of most exterior masonry elements; and un-braced interior hollow clay tile partitions and mechanical equipment. In addition, much of the portico’s structure is fairly seriously damaged, and was never adequate to begin with. Combined, these pose safety hazards for occupants as well as risk of costly damage in case of earthquake. The building already manifests signs of past seismic damage, particularly at the portico. Please refer to sections II-2 and II-5 for a more detailed summary of the building’s structural concerns.

This report outlines three different approaches, and Recommended Corrective Actions for the structural concerns vary to between them. However, all include addition of reinforced concrete shear walls to enhance seismic capacity of the entire building, epoxy injection and other repairs to damaged concrete elements, lowering of the masonry chimney, securement of exterior masonry elements, and bracing of interior masonry partitions and equipment. Please refer to sections IV-2 & IV-5, V-2 & V-5, and VI-2 & VI-5 for a more detailed description of recommended corrective actions for the three primary approaches.

The building’s **Primary Exterior Enclosure Assemblies & Elements** include 13 different components, precluding an overall quick summary. In skeletal form, problems affecting these include widespread spalling and reinforcing corrosion affecting the foundations and lowest level floor level near the very wet crawl space under the building; cracking and some leakage via on-grade floor slabs; probable leakage via sub-grade foundation walls; effective moisture destruction of the building’s stone-clad exterior wall base; inadequate securement, anchor corrosion, and weathering damage to the stone-clad south wall bottom; widespread weathering damage, inadequate securement, lintel corrosion, and interior leakage affecting the brick-clad walls; cracking and weathering damage at the terra-cotta clad wall panels; ill-suited, leaky, and in places deflected windows; and ill-suited roof assemblies and some leaky roof-related conditions. All of the masonry elements also share the large-scale flaw of a complete absence of flashings and drainage provisions to limit water-infiltration and damage to the masonry. Please see section II-3 for a more detailed summary of the issues affecting the Primary Exterior Assemblies.

Recommended Corrective Actions for these Primary Enclosure Elements within the Option 1 approach include addition of a drainage system in the lowest-level crawl space; epoxy injection of cracked floor slabs and sub-grade walls; reconstruction of the destroyed stone base; restoration of the stone-clad south wall; re-anchoring and restoration of the brick-clad walls; reconstruction of the terra-cotta wall panels; re-cladding of two small metal-clad wall areas; replacement of all windows; and some perimeter detailing of the primary roofs. Please see section IV-3 for a more detailed summary of the Option 1 corrective recommendations for the Primary Exterior Assemblies.

Recommended Corrective Actions for these Primary Enclosure Elements within the Option 2 approach are in many respects similar to Option 1, and include addition of a drainage system in the lowest-level crawl space; epoxy injection of cracked floor slabs and sub-grade walls; reconstruction of the destroyed stone base; reconstruction of the stone-clad south wall; reconstruction of the brick-clad walls; reconstruction of the terra-cotta wall panels; re-cladding of two small metal-clad wall areas; replacement of all windows; and some perimeter detailing of the primary roofs. Please see section V-3 for a more detailed summary of the Option 2 corrective recommendations for the Primary Exterior Assemblies.

Recommended Corrective Actions for these Primary Enclosure Elements within the Option 3 approach are in most regards identical to Option 2, and include addition of a drainage system in the lowest-level crawl space; epoxy injection of cracked floor slabs and sub-grade walls; reconstruction of the destroyed stone base; reconstruction of the stone-clad south wall; reconstruction of the brick-clad walls; reconstruction of the terra-cotta wall panels; re-cladding of two small metal-clad wall areas; replacement of all windows; and some perimeter detailing of the primary roofs. The primary difference between Options 2 and 3 is that Option 3 includes steel-framed back-up walls as well as concrete ones inward of the exterior cladding, while Option 2 includes only concrete back-up walls. Please see section VI-3 for a more detailed summary of the Option 3 corrective recommendations for the Primary Exterior Assemblies.

The building's **Exterior Masonry Sub-Elements** include seven different components. In skeletal form, problems affecting these include inadequate securement and weathering damage affecting the level 2 stone water table; cracking, spalling, and other damage affecting the terra-cotta window bay surrounds; serious weathering damage to the level 5 terra-cotta water table; inadequate securement and weathering damage to the level 5 exterior marble panels; also seriously degraded, hazardous upper cornice-parapet band; inadequate securement and variable weathering and seismic damage to the stone window sills; and variable corrosion of steel window-head lintels. Please see section II-4 for a more detailed summary of the issues affecting the Exterior Masonry Sub-Elements.

Recommended Corrective Actions for these Exterior Masonry Sub-Elements within the Option 1 approach include re-anchoring, restoration, and flashing of the level 2 water table; replacement of the terra-cotta window bay surrounds; reconstruction of the level 5 terra-cotta water table; re-anchoring of the level 5 marble panels; reconstruction of the roof-level cornice-parapet band; re-anchoring, restoration, and flashing of the stone window sills; and replacement and flashing of accessible window-head lintels. Please see section IV-4 for a more detailed summary of the Option 1 corrective recommendations for the Exterior Masonry Sub-Elements.

Recommended Corrective Actions for these Exterior Masonry Sub-Elements within the Option 2 approach include reconstruction and flashing of the level 2 water table; replacement of the terra-cotta window bay surrounds; reconstruction of the level 5 terra-cotta water table; re-anchoring of the level 5 marble panels; reconstruction of the roof-level cornice-parapet band; replacement and flashing of the stone window sills; and replacement and flashing of all window-head lintels. Please see section V-4 for a more detailed summary of the Option 2 corrective recommendations for the Exterior Masonry Sub-Elements.

Recommended Corrective Actions for these Exterior Masonry Sub-Elements within the Option 3 approach are essentially identical to Option 2, and include all of the same work. Please see section VI-4 for a more detailed summary of the Option 3 corrective recommendations for the Exterior Masonry Sub-Elements.

The building's **Entry Portico** includes six different components. In skeletal form, problems affecting these include displacement and some cracking in the stone support base; absence of inter-connections, inadequate securement, and damage and degradation affecting the marble columns; inadequate securement, anchor corrosion, absence of flashings, and serious seismic damage affecting the load-bearing stone cladding under the portico roof; nearly absent and compromised securement and serious seismic and water damage to the portico roof structure; lack of securement, absence of flashings, and weathering damage affecting the portico railing; and improper integration with abutting walls and complete failure of the portico roof membrane. Please see section II-5 for a more detailed summary of the issues affecting the Entry Portico.

Recommended Corrective Actions for the Entry Portico are essentially identical in all three options, and include reinforcing and re-anchoring, restoration, and flashing of the marble columns; replacement of the stone wall cladding with color-matched pre-cast concrete; complete replacement of the entire portico roof structure above the column capitals; complete replacement and flashing of the portico railing; and replacement and re-flashing of the portico roof. Please see sections IV-5, V-5, and VI-5, for more detailed summaries of the Option 1, 2, and 3 corrective recommendations for the Entry Portico.

There are no particular concerns with regard to the building's interior **Architectural Elements**, and **Mechanical** and **Electrical Systems**. However, along the inner faces of the exterior walls, these will necessarily be affected by the needed structural and masonry work.

Recommended Corrective Actions for the Architectural, Mechanical, and Electrical Elements largely aim to relocate and modify existing systems where needed to accommodate the structural and masonry work, and to reinstall interior finishes matching existing ones. Some modifications to the mechanical systems will be made generally per a previous upgrade design which had not yet been executed.

3. SUMMARY OF CORRECTIVE COSTS

This report outlines three different primary corrective approaches, described in detail in parts IV, V, and VI. Each of these is subdivided into three construction phases, which would be executed over the course of three consecutive summers for logistical and feasibility reasons.

Before delving into the actual cost estimates, a few clarifications should be made.

The first of these is that Phase 1 of each option consists of the reconstruction of the entry portico, and the work of this phase is essentially identical in all three options. Consequently, the costs of Phase 1 for all three options are also the same.

Second, Phase 2 of each option consists of corrective work affecting the building's primary south façade. As Option 1 involves primarily restoration of the existing masonry, this approach inherently involves a greater degree of uncertainty in determining the costs of this work, as it can not be fully known ahead of time what fraction of the existing brickwork will require replacement, for example. To account for this, a somewhat higher contingency was assumed in the Phase 2 work for Option 1 than for Options 2 or 3, which both assume removal of all existing exterior masonry, allowing for a greater degree of certainty.

Third, Phase 3 of each option consists of corrective work affecting the remaining east, west, north, and courtyard sides of the building. As with Phase 2, the Option 1 approach inherently involves a greater degree of uncertainty in determining costs, and to account for this, a somewhat higher contingency was assumed in the Phase 3 work for Option 1 than for Options 2 or 3.

It should further be noted that this preliminary evaluation obviously did not attempt to design in detail every aspect of each option, but rather attempted to define each approach to a schematic level, sufficient to allow only very rough construction cost estimates to be prepared. The primary intent of this evaluation was to help determine the relative construction costs of each of the three approaches. For this reason, the costs of each phase of each option are rounded to the nearest $ 100,000, and realistically, even this level of precision implies a higher degree of certainty than can be justified by the schematically-defined work scope descriptions. The reader is encouraged to round these estimates to the nearest $ 1,000,000.

Finally, it should also be clarified that these estimates relate only to the projected construction costs, and that in any case and with any approach, appreciable additional costs should be anticipated to cover temporary relocation of occupants, design and engineering fees, possible soil studies, and other, non-construction related expenses.

With these clarifications made, let me dive into the cost estimates.

In brief, the estimated construction cost of all three phases of the **Option 1: Restoration Approach**, described in Part IV, is $18.1 million. This breaks down to $ 1.1 million for Phase 1, $ 4.8 million for Phase 2, and $ 12.2 million for Phase 3.

The estimated construction cost of all three phases of the **Option 2: New Masonry Veneer Over Concrete Walls** approach, described in Part V, is $ 21.9 million. This breaks down to $ 1.1 million for Phase 1, $ 6.7 million for Phase 2, and $ 14.1 million for Phase 3.

The estimated construction cost of all three phases of the **Option 3: New Masonry Veneer Over Concrete and Steel-Framed Walls** approach, described in Part VI, is $ 22.5 million. This breaks down to $ 1.1 million for Phase 1, $ 6.9 million for Phase 2, and $ 14.5 million for Phase 3.

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I. INTRODUCTION

1. GENERAL

The Alaska State Capitol Building is a concrete-frame structure built in 1930. Its exterior skin consists of a multitude of masonry elements, extruded aluminum and steel sash windows, and EPDM and built-up asphaltic roofs. The building's exterior masonry elements include multi-wythe brick walls; terra-cotta claddings, water tables, and window surrounds; stone claddings, water tables, ceilings, and similar elements; marble columns and decorative panels; and granite cladding and paving at the entry. Small areas of stucco also occur near the building's upper reaches, in the back.

Due primarily to a combination of some ill-advised initial design approaches and material selections, as well as the effects of 80 years of Juneau's climate, many of the building's exterior elements have begun to display signs of leakage, degradation, and stress.

PAUL LUKES: Building Envelope Consulting Services, (PL:BECS), was initially retained to perform a quick examination of the building's exterior masonry and windows and provide an overall summary for these elements. This investigation and summary report took place in late summer of 2006. This investigation revealed a large variety of significant problems plaguing the building's exterior masonry.

In 2010, PL:BECS was asked to perform a more detailed evaluation focused on the front portico, as the initial investigation revealed that this portico displayed truly severe symptoms of degradation and appeared to pose some of the most immediate risks to public safety. This effort produced a 12/31/10 report outlining the portico's problems and possible solutions. Although this report focused on the portico, it also addressed several of the building's other elements, such as its brick and stone-clad walls, as these directly affected the portico.

In 2012, PL:BECS was asked to assemble a team of specialized consultants who could perform a multidisciplinary evaluation of the entire structure, help determine recommended solutions, and provide very rough cost estimates for executing seemingly viable options. This report represents the culmination of this 3rd phase of this building's evaluation.

In addition to PL:BECS LLC, this evaluation involved the Architectural firm of Jensen Yorba Lott Inc., Structural Engineering firm of Swenson Say Fagét, Murray & Associates, P. C. Mechanical Engineers, Electrical Engineering firm of Haight & Associates, and Construction Cost-Estimating firm of HMS Inc.

Within this phase-3 effort, PL:BECS was primarily responsible for evaluating the building's exterior envelope elements, such as its masonry claddings and windows, and recommend appropriate corrective approaches for these, as well as for integrating these with needed structural corrections.

The firm of Swenson Say Fagét evaluated and developed appropriate solutions for the building's overall structure and its sub-elements.

As the work affecting the building's structure and its exterior masonry claddings would necessarily affect the building interiors, as well as various embedded mechanical and electrical systems, the Architectural firm of Jensen Yorba Lott developed the design for the resulting interior architectural work, and coordinated the work of the Mechanical, Electrical, and Cost-Estimating consultants.

Murray & Associates evaluated and outlined appropriate solutions for the various mechanical systems affected by the Structural/Masonry work.

Haight & Associates evaluated and outlined appropriate solutions for the various electrical systems affected by the Structural/Masonry work.

Dylan Johnson Architects assisted with preparing initial drawings of possible corrective approaches included in a start-up presentation.

Finally, HMS reviewed the entirety of the corrective work recommended by these consultants, and prepared rough cost estimates for three primary approaches outlined in this report.

2. SCOPE AND LIMITS OF REPORT

The purpose of this report is multifold, and includes an evaluation of the building's immediate structural and exterior envelope needs, development of plausible corrective approaches, and preparation of rough construction cost estimates for these corrective approaches. The ultimate purpose of this report is to serve as a basis for determining the specific corrective approach to be developed in detail.

To help determine the likely construction costs, this report includes drawings for many of the various possible corrective approaches. Although many of these may appear quite detailed, it is critical to note that these are intended primarily to allow rough cost estimates to be prepared for the various options, and do not necessarily represent the actual designs for the miscellaneous sub-elements, which are to be developed in subsequent phases.

3. INVESTIGATION METHOD

Each consulting firm performed its own investigation to arrive at the team's overall set of recommendations.

In brief, each firm reviewed the building's construction drawings of relevance to its discipline, and supplemented this with at least several days of field examination to confirm and document actual construction. The information gathered in this phase-3 evaluation was supplemented by each firm's prior familiarity with this building, which ranges up to several decades in the case of Jensen Yorba Lott.

Additional testing was performed as needed by the structural engineer, who tested the existing concrete for compressive strength, and PL:BECS, including random moisture testing in interior and exterior elements, cladding anchor detection, and absorption testing of various masonry elements.

4. ORGANIZATION OF REPORT

This report is divided into six major parts.

Part I is this **Introduction**.

Part II is a **Summary of Observations and Analysis**. It is organized by the building's various elements. This summarizes observations relevant to each system, provides an analysis of what the symptoms and design imply, and describes the projected future behavior of the specific element.

Part III, **General Discussion of Corrective Options**, provides a holistic review of the relative advantages and inherent limitations of each of the three primary approaches outlined in this report.

Part IV, Approach 1: Retrofit Existing Masonry & Structure, describes the first, "Retrofit" corrective approach, which can be summarized as an effort to save as much of the building's existing exterior masonry as is reasonably feasible, while also enhancing the structure's seismic safety. It also provides a very rough cost estimate for what this approach may cost. Generally feasible corrective measures are outlined for each building element within this approach.

Part V, Approach 2: New Masonry Veneer Over Concrete Walls, describes the technically optimal corrective approach, which also enhances the building's seismic safety while replacing the exterior wall claddings with a new masonry veneer over new and existing concrete back-up walls. It also provides a very rough cost estimate for what this approach may cost. Generally feasible corrective measures are outlined for each building element within this approach.

Part VI, Approach 3: New Masonry Veneer Over Concrete and Steel-Framed Walls, describes a less-costly, as well technically less optimal corrective approach, which also enhances seismic safety while replacing the exterior claddings with a new masonry veneer over new and existing concrete, as well as steel-framed back-up walls. It also provides a rough cost estimate for what this approach may cost. Generally feasible corrective measures are outlined for each building element within this approach.

Each Part is further subdivided into Sections, each of which addresses the various individual primary elements.

II. SUMMARY OF OBSERVATIONS AND ANALYSIS

1. GENERAL INTRODUCTION

This part is divided into eight Primary Sections, as follows:

1. General Introduction
2. Structure
3. Primary Exterior Enclosure Assemblies & Elements
4. Exterior Masonry Sub-Elements
5. Entry Portico
6. Interior Architectural Elements
7. Mechanical Systems
8. Electrical Systems

Each of the primary sections is further subdivided to address sub-components of these sections. For example, section 5, which addresses this report's "Entry Portico" focus, is further subdivided into six Subsections, as follows:

- 5.0 General
- 5.1 Support Base for Portico Entry and Stairs
- 5.2 Marble Columns
- 5.3 Stone Cladding on Exterior Building Wall
- 5.4 Portico Roof Structure
- 5.5 Stone Railing
- 5.6 Portico Roof, Drains, and Associated Flashings

Each of these primary subsections is yet further subdivided into four secondary subsections. For example, subsection 5.2, which addresses the Portico's Marble Columns, is subdivided as follows:

- 5.2.0 General
- 5.2.1 Summary of Observations
- 5.2.2 Analysis
- 5.2.3 Projected Future Behavior

The first such subsection merely describes the general element to which the section applies, and provides any other general background information.

The second subsection is a <u>Summary of Observations</u> pertaining to each element.

The third constitutes the <u>Analysis</u>, which provides an evaluation of the appropriateness of the observed construction, and explains the likely genesis of any observed problems with that element.

Finally, the fourth subsection describes the <u>Projected Future Behavior</u> of the affected element(s) if no corrective actions are taken.

2. STRUCTURE

2.0. General

This section of the report addresses issues related to the building's overall structural frame, without any consideration of specific structural details, etc.

2.1. Basic Structure of Building

2.1.0 General

This subsection pertains to the building's basic structural design in the most general terms.

2.1.1 Summary of Observations

Per the drawings, this building's basic structural frame consists of a grid-work of reinforced concrete columns supporting a series of reinforced concrete beams, which in turn support reinforced concrete slabs with integrally cast concrete joists.

Along the building's exterior walls, the concrete beams and columns are typically embedded within somewhat longer wall sections comprised primarily of brick masonry. The drawings also typically show 4" thick, non-structural terra-cotta along the interior faces of these exterior masonry walls, with plaster or other interior finish applied over this.

The concrete columns and beams are not well reinforced, limiting their capacity to resist lateral loads, such as would occur in seismic events. However, in various locations, these concrete columns are embedded within appreciably longer, non-structural masonry walls and interior partitions, possibly offering opportunities for retrofitting of shear walls.

As the structural elements are embedded within masonry, I could not personally verify that the actual structure aligns with the original design. However, all visible aspects are consistent with this original design, and the observable construction aligns quite well, though not perfectly, with the design. It thus appears probable that the building's actual structure mimics the design to a high degree.

Figure II-2.1(1) shows the building's SW corner at the 2nd floor level, which illustrates the typical plan section through the exterior walls.

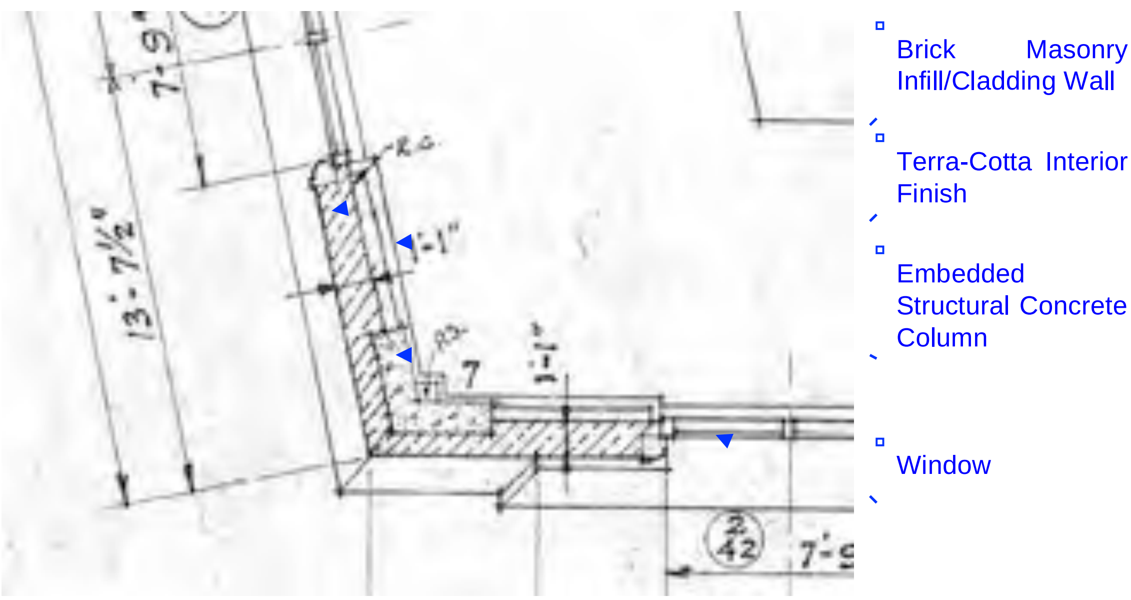


Figure II-2.1(1): Typical Exterior Wall Type, SW Corner, Level 2

A structural evaluation report by the engineering firm of Berger/Abam, dated 7/29/2002, titled "Seismic Assessment and Retrofit Concept Study", concludes that many of the building's primary structural elements, including its columns, beams, floor and roof diaphragms, and foundation pedestals, are structurally deficient and could experience significant damage in a seismic event. To address these deficiencies, the report recommends that concrete shear walls be added to the structure, along with the strengthening of the floor and roof diaphragms with composite and concrete overlays, addition of concrete drag struts, strengthening of the foundation pedestals, and removal of the interior tile/plaster partitions and finishes.

2.1.2 Analysis

As part of my earlier Phase 2 evaluation, I made no effort to analyze the building's overall structural adequacy, as this fell outside that evaluation's scope as well as my particular expertise.

However, the structural engineering firm of Swenson Say Fagét performed a structural analysis of the existing building, per ASCE 41-06 "Seismic Rehabilitation of Existing Buildings", using Basic Safety Objective 1, as part of this Phase 3 evaluation, and this analysis confirmed that this building possesses excessive vulnerability to seismic damage.

2.1.3 Projected Future Behavior

Based on the previous Berger/Abam report, as well as on the detailed analysis by Swenson Say Fagét, the building's basic structural design appears deficient with regard to plausible seismic forces. The building may be vulnerable to potentially severe damage in a plausible earthquake.

This concern is exacerbated by my field investigation, which revealed evidence of some previous seismically induced damage, which may have weakened some sub-elements of the building.

The combination of these conclusions would also appear to pose significant risk to life safety of the occupants and nearby pedestrians in the event of an earthquake.

2.2. Foundations

2.2.0 General

This subsection pertains to the building's basic foundation system in general terms. See also section II-3.1: Lowest-Level Crawl Space for related information.

2.2.1 Summary of Observations

Three foundation plans exist for this building, but the most recent plan indicates that the foundation consists of a grid-work of many individual, mostly square footings of reinforced and un-reinforced concrete. This is true even along the building's outer perimeter, and the only continuous footing occurs along the north wall of the west wing.

A cursory examination of accessible portions of the crawl space under the building revealed rather wet conditions, with a small but continuous stream running through this space. Consequently, the individual foundations displayed expected symptoms, including variable degrees of corrosive spalling and efflorescence, a powdery white crystalline substance that invariably indicates moisture passage through masonry materials.

Figures II-2.2(1-4) illustrate these observations.

Fig. II-2.2(1): Corrosive Concrete Spalling

Fig. II-2.2(2): Concrete Spalling

Fig. II-2.2(3): Spalling, Efflorescence

Fig. II-2.2(4): Efflorescence

2.2.2 Analysis

Issues germane to the foundations relate to structural adequacy and degradation.

With regard to structural adequacy, analysis of the original design by the structural engineering firm of Swenson Say Fagét revealed that the foundation system is generally adequate for resisting vertical gravity loads, but does not fully suffice to resist lateral loads, such as might occur during earthquakes.

The concrete spalling and efflorescence reflect degradation caused by moisture intrusion into the concrete. Some of the moisture enters the concrete from the damp atmosphere resulting from the running water within the crawl space. However, the specific pattern of the efflorescence on the concrete columns reveals that water also enters from the soils directly below the footings.

The corrosive spalling of the concrete results from corrosion of the embedded reinforcing. As steel corrodes, it experiences large volumetric expansion, thus popping concrete off the surface.

The white efflorescence consists of salts that had been extracted from the concrete by water migrating through it. This passing water first dissolves these salts, then leaves them behind upon evaporation from the surface. The white salt crystals become concentrated along the transition between wet and dry concrete, and this reveals that water migrates roughly 18" -24" upward from the soils.

The surface spalling located away from steel reinforcing can result from freezing expansion of embedded water as well as through concentrated recrystallization of salts. Both mechanisms appear plausible, even probable, in this case.

2.2.3 Projected Future Behavior

Future behavior of these foundations can also be viewed from structural and moisture-degradation perspectives.

With regard to structural concerns, the foundation system appears vulnerable to seismic damage, which can affect the entire structure above the foundations as well.

Left uncorrected, the present moisture degradation will continue. Continuation of steel corrosion, moisture migration, freezing, and salt recrystallization will cause ongoing spalling of the concrete.

2.3. Lowest-Level Concrete Floor Framing

2.3.0 General

This subsection pertains to the raised, concrete-framed floor directly above the crawl space.

2.3.1 Summary of Observations

This floor consists of a concrete slab integrally poured with concrete floor beams and joists.

Examination of this floor framing from the crawl space revealed widespread and fairly serious corrosive spalling, which appeared to affect most of the integrally cast joists, particularly near their midspans. The bottoms of these joists had in most locations spalled off, exposing corroding reinforcing steel.

Figures II-2.3(1-8) illustrate these observations.

Fig. II-2.3(1): Spalling @ Joist Midspan

Fig. II-2.3(2): Spalling @ Jst. Bottoms

Fig. II-2.3(3): Spalling @ Joist Midspan

Fig. II-2.3(4): Spalling @ Jst. Bottom

Fig. II-2.3(5): Spalling @ Joist Midspan **Fig. II-2.3(6): Spalling @ Jst. Bottom**

Fig. II-2.3(7): Spalling @ Joist Midspan **Fig. II-2.3(8): Spalling @ Jst. Bottoms**

2.3.2 Analysis

The concrete joist spalling reflects degradation caused by moisture intrusion. However, in contrast to the spalling affecting the foundations, the only moisture source reaching these joists consists of atmospheric humidity resulting from the wet crawl space.

The corrosive spalling of the concrete results from corrosion of the embedded reinforcing. As steel corrodes, it experiences large volumetric expansion, thus popping concrete off the surface.

2.3.3 Projected Future Behavior

Future behavior of these foundations can also be viewed from structural and moisture-degradation perspectives.

Left uncorrected, the present degradation will continue, causing ongoing spalling of the concrete. This will eventually compromise the structural integrity of the entire floor system.

2.4. Level 1 Concrete Floor Slab

2.4.0 General

This subsection pertains to the raised, concrete-framed floor directly above the ground floor level.

2.4.1 Summary of Observations

Nearly all of this floor slab is concealed from view from below by ceilings and from above by floor finishes. However, a small portion of it could be examined from the shop area in the west wing, where it is exposed to view from below.

This floor consists of a concrete slab integrally poured with concrete floor beams and joists.

Where it was visible, significant cracking was observed very near the building's outer corners, where typically fairly wide, often closely spaced cracks were located.

In addition, one continuous, completely straight crack was observed running a few feet south of the wall separating the boiler room from the shop. The crack parallels this wall, and runs across the entire width of the west wing.

Figures II-2.4(1-4) illustrate these observations.

Fig. II-2.4(1): Straight Crack in Floor Slab

Fig. II-2.4(2): Diagonal Cracks in Slab

Fig. II-2.4(3): Diagonal Crack in Floor Slab

Fig. II-2.4(4): Diagonal Cracks in Slab

2.4.2 Analysis

The straight crack across the west wing most likely occurs along a pour joint, where curing shrinkage would be expected to create such a crack. However, this crack is wider than one would expect from shrinkage alone, and it appears probable that it has been exacerbated by subsequent seismic displacement.

The diagonal cracks near the outer building corners cannot reflect curing shrinkage restraint, as these cracks are also typically far too wide, and often occur in closely spaced pairs. Shrinkage cracks would not occur closely spaced, as the initial crack would relieve any tensile stress, thus precluding the second crack from occurring. Due to their size, locations, and spacing, these cracks appear seismically induced.

These cracks may slightly weaken this floor slab, mildly increasing future seismic risk. The floor system in general appears structurally adequate.

2.4.3 Projected Future Behavior

These cracks may have some marginal detrimental effect on the building's performance in any future earthquakes.

2.5. Brick Chimney

2.5.0 General

This subsection pertains to the relatively tall brick chimney above the main roof, near the inside corner where the west wing joins the main portion of the building.

2.5.1 Summary of Observations

The drawings indicate that this chimney's structure consists of 2-wythe, 9" wide brick walls, which are lined with 4 ½" thick firebrick spaced 3" from the brick walls. The chimney is capped with two stone rings, each made of fairly large stone pieces, which appear to be secured to the chimney only with mortar bond.

The chimney brick and stone caps are largely painted with an elastomeric coating, apparently to limit moisture intrusion into the brickwork, which is fairly degraded, with extensive erosion of outer brick faces and mortar, mortar cracking, etc. The coating is delaminating in various locations, indicating moisture intrusion behind it.

In addition, the chimney's junctures to the roof and parapets are not executed properly, in that the EPDM roof membrane and parapet flashings are sealed to the outer brick face, with no through-wall flashings to drain water out from behind the outer brick wythe.

Figures II-2.5(1-6) illustrate these observations.

Fig. II-2.5(1): General Chimney View **Fig. II-2.5(2): Chimney Location**

Fig. II-2.5(3): Coating Delamination **Fig. II-2.5(4): Coating & Brick Degr.**

Fig. II-2.5(5): Brick & Mortar Degradation **Fig. II-2.5(6): Improper Roof Junct.**

2.5.2 Analysis

Issues of pertinence to this chimney relate to structural considerations as well as to moisture infiltration.

Structural concerns relate to the chimney's overall stability as well as to securement of its stone cap elements. Based on the chimney's construction and height, it appears vulnerable to overturning failure in a seismic event. The absence of any mechanical securement of its heavy capstones to the primary chimney structure, combined with its degraded mortar, increase vulnerability of these capstones to seismic displacement. As the chimney occurs above one exit-way from the building, these issues represent a life-safety hazard to people existing the building in an earthquake.

From a water-infiltration perspective, the chimney suffers from ill-conceived masonry design, especially for Juneau's climate, though it represents typical construction of its time. The basic flaws are that it lacks any flashing caps to preclude water entry into the stone caps, and similarly lacks any flashings to drain water out from behind the brick along junctures where the roofing or parapets meet the chimney brick.

As masonry is inherently absorbent, the absence of flashing caps greatly exacerbates moisture intrusion into the stone and brickwork. As Juneau's climate includes roughly 220 rainy days each year, and low temperatures drop below freezing through five months annually, this can greatly accelerate degradation, lead to freeze-spalling, mortar erosion, and similar symptoms, which are in fact evident.

Along the chimney's base, its juncture to the roof membrane and parapets is improperly executed, as any water that permeates into and behind the outer brick drains downward into the roof assembly, posing a risk of interior leakage. The application of the elastomeric coating to the brickwork may in fact reflect an effort to limit interior moisture intrusion, although it may well exacerbate degradation by entrapping moisture. These junctures should have included continuous through-wall flashings above the roof membrane and flashing terminations to drain water harmlessly from behind the outer brick wythe and to preclude its drainage into construction elements below.

2.5.3 Projected Future Behavior

In its present configuration, this chimney appears vulnerable to seismic failure, posing a hazard to people exiting the building during earthquakes.

The degradation of the chimney's masonry will continue and will accelerate. Although frequent re-coating with elastomeric coating can temporarily retard the masonry degradation, I believe this may need to be done a near-annual basis to provide much benefit, and more importantly, if the coating is allowed to fail near the chimney tops, as was the case during my recent August 2012 visit, it can actually exacerbate degradation by entrapping moisture within lower portions of the brick, leading to freeze-spalling and mortar erosion in Juneau's wet and cold climate.

The improper, non-draining junctures of the chimney base with the roof and parapets will pose ongoing risk of interior moisture intrusion and associated damage.

2.6. Securement of Large Masonry Cladding Elements

2.6.0 General

This subsection pertains to the securement of the various stone cladding elements to the primary building structure and to each other in a general fashion. Such elements occur throughout the building's exterior cladding, and include the stone cladding along the building base, stone and terra-cotta water tables, terra-cotta wall panels, chimney caps, window sills, essentially all of the portico's sub-components, etc. These are also discussed in subsequent subsections in greater detail, and this subsection focuses on the "securement issues" applicable to all of these elements in general.

2.6.1 Summary of Observations

Examination of the drawings and past PL:BECS field investigations revealed that, in general, these large masonry elements are either not secured to the primary construction in any fashion other than with mortar bond alone, or where various steel anchors had been used, they appear widely spaced and minimal in many locations. Anchorage of some elements appears beefier, and specific quantitative analysis would be needed to evaluate adequacy. Such detailed evaluation falls outside this report's scope, whose primary purpose is to determine reasonable, large-scale costs of corrective options.

Large masonry elements which appear to lack any mechanical securement, other than mortar bond, include the chimney capstones, stone window sills, some portions of the stone railing atop the portico, the stone water table elements atop the portico, the stone portico ceiling elements, and probably some other elements. Similarly, the multi-wythe brick walls, which sit atop steel lintels and the concrete floor slabs and ledges, do not appear otherwise mechanically secured to the primary concrete structure. Further, my examination often revealed that the mortar bond securing these elements had degraded, and in some cases had become completely compromised. For example, I was able to freely, though with effort, move one very large stone cap atop the portico railing. Some of these elements had also become cracked, further compromising their securement. Figures II-2.6(1-6) depict a few of these un-secured elements.

Fig. II-2.6(1): Un-Secured Chimney Caps

Fig. II-2.6(2): Un-Secured Stone Sill

Fig. II-2.6(3): Un-Secured, Cracked St. Sill **Fig. II-2.6(4): Un-Scrd. Stone Railing**

Fig. II-2.6(5): Un-Secured Stone Railing **Fig. II-2.6(6): Un-Scrd. Cracked Rlng.**

The tall stone columns supporting the portico roof also appear un-secured to the stone roof beams, and the very large column sections are not attached to each other in any way, having only very small, short "cube-dowels" between sections, which act more to center the sections relative to each other than to secure them. Some of these columns also display rust staining, which may indicate corrosion of these dowels, while others have seemingly significant cracks. See Figures II-2.6(7 & 8).

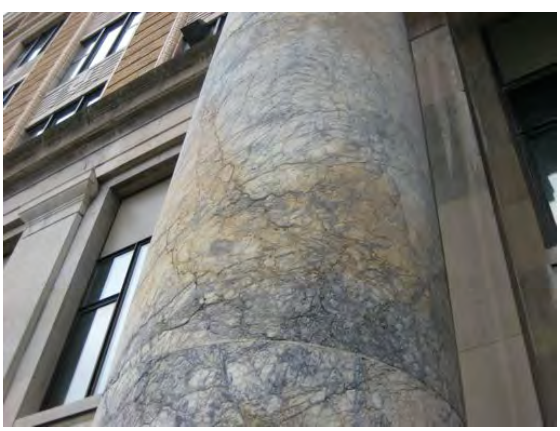


Fig. II-2.6(7): Un-Scrd., Rust-Stained Col. **Fig. II-2.6(8): Cracked Column**

The large marble panels near the top of the south façade, directly above the portico, also do not appear to have any mechanical securement stipulated in the drawings, though some weak metal signals were detected in a few locations at some panels, indicating possible anchorage of some sort. Cracking observed at some panels may also indicate that these may be somewhat compromised. See Figures II-2.6(9 & 10).

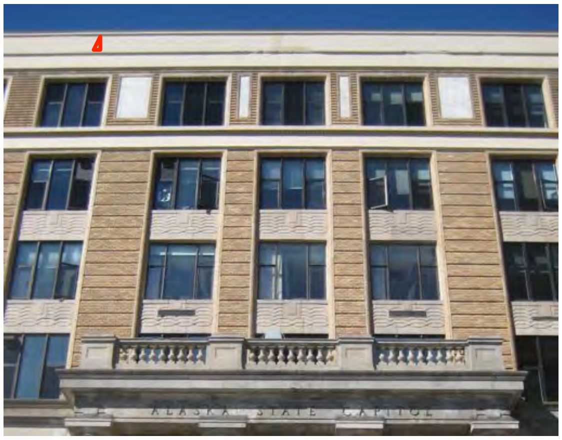


Fig. II-2.6(9): Un-Secured, Marble Panels **Fig. II-2.6(10): Possible Small Anchor**

Some elements have a degree of mechanical securement, via steel dowels, straps, and similar methods, but such securement appears blatantly inadequate for holding these components in place under plausible seismic stresses. For example, the entire portico structure, which in totality weighs roughly 170 tons and consists of many individual stone elements, is secured to the primary structure with 7 or 8 small steel straps, each 2 ½" wide and ½" thick. These straps cannot resist lateral racking of the portico in the E-W direction, and the cracking pattern affecting the portico elements and the supporting stone cladding indicates that such racking had taken place. Further, though these straps, which are embedded within the portico ceiling, could not be examined, widespread staining on the portico ceiling indicates that these minimal straps have by now been largely compromised by corrosion. See Figures II-2.6(11-14).

Fig. II-2.6(11): Minimally Secured Portico **Fig. II-2.6(12): Water-Damaged Clg.**

Fig. II-2.6(13): Cracked Portico Beams **Fig. II-2.6(14): Cracked Prtco. Beams**

Similarly, the large stone cladding pieces along the bottom two levels of the south façade are secured with a single 3/8" ø steel wire looped around the concrete columns and recessed into the stone about 2". In some cases, this yields a single point of marginal attachment for stones with a 13 SF face area, 20 CF volume, and over 3,000 lb. weight. The distribution of such anchors allows these stone pieces to rotate or buckle away from the building, and the cracking pattern in some of these elements under the portico indicates that such rotation had taken place, compromising these elements further. Also, though the drawings in a few locations call for "non-corroding" metal anchors, evidence of corroded anchors was observed in various locations. Figures II-2.6(15-18) illustrate these observations.

Fig. II-2.6(15): Minimal Anchor Location **Fig. II-2.6(16): Cracked Stone Cldng.**

Fig. II-2.6(17): Corroding Anchor **Fig. II-2.6(18): Cracked Stone Cldng.**

Securement of a few elements is more difficult to judge without specific analysis. For example, many of the terra-cotta elements, such as the upper water table, the spandrel panels between windows, and the window bay surrounds, as well as possibly the stone water table at level 2, appear to contain somewhat beefier securement via steel anchors. However, given the building's length of exposure to the wet Juneau climate, it appears probable that corrosion has begun to compromise these anchors, and some of the cracking observed in these elements coincides with locations of embedded steel, and resembles cracking one would expect of corrosive steel expansion. Figures II-2.6(19-22) illustrate these observations.

Fig. II-2.6(19): Stone Water Table

Fig. II-2.6(20): Cracks Near Anchor

Fig. II-2.6(21): Crack Near Embedded Steel

Fig. II-2.6(22): Crack Near Anchor

2.6.2 Analysis

In very broad terms, the building appears lacking with respect to the securement of many large masonry elements to the structure and to each other. Many elements rely entirely on mortar bond, and in various locations, such mortar bond is largely or entirely compromised. Even those elements that have some sort of embedded steel anchorage appear inadequately secured, and this has been further impaired by corrosion and past seismic damage.

While this consideration does not threaten the integrity of the building as a whole, it poses appreciable risk to pedestrians below in case of an earthquake, as many such large pieces could fall off the building.

2.6.3 Projected Future Behavior

The securement of these elements will continue to degrade with ongoing loss of mortar bond and corrosion of steel anchors, posing increasing risk to pedestrians below.

2.7. Interior Hollow Clay Tile Walls

2.7.0 General

This subsection pertains to the interior partition walls comprised of hollow clay tile, referred to in the drawings as terra-cotta walls.

2.7.1 Summary of Observations

Many interior partition walls consist of 4" or 6" hollow clay tile, with plaster or other finishes applied over these. In many locations, these heavy partition walls do not extend to the underside of the concrete floor slabs or beams above them, and stop above the ceilings, with no connections to the upper floor slabs. Figure II-2.7(1) shows a typical example of this condition.

Fig. II-2.7(1): Un-Secured, Un-Braced Tops of Hollow Clay Tile Walls

In a few locations, such as around the stair and elevator shafts, these partitions extend full height, but are not adequately secured.

2.7.2 Analysis

These partition walls are quite heavy, and as their tops are not secured or braced in any way, they pose a risk of collapsing in earthquakes. This risk is particularly significant near the stairs and elevators, where they could block egress in case of seismic collapse.

2.7.3 Projected Future Behavior

In their current configuration, these walls will remain vulnerable to seismic collapse, posing a hazard to occupants, particularly near stairs and elevators.

2.8. Large Mechanical Equipment

2.8.0 General

This subsection pertains to various pieces of large mechanical equipment, such as the boiler, within the building.

2.8.1 Summary of Observations

The building contains various large mechanical equipment units, such as the boiler, ductwork, piping, and similar elements that are not secured or braced in any fashion. Figures II-2.8(1 & 2) depict a couple of examples.

Fig. II-2.8(1): Un-Braced Piping & Ducts

Fig. II-2.8(2): Un-Secured Boiler

2.8.2 Analysis

These equipment elements are quite heavy, and as they are not secured or braced, they pose a risk of overturning or falling in earthquakes. This poses some risk to any people nearby, but further, it greatly exacerbates risk of damage to the equipment, which is typically much costlier to repair, compared to the cost of preventive bracing.

2.8.3 Projected Future Behavior

In their current configuration, these elements will remain vulnerable to seismic overturning or falling, posing a hazard to occupants.

3. PRIMARY EXTERIOR ENCLOSURE ASSEMBLIES & ELEMENTS

3.0. General

This section of the report addresses issues related to the building's primary exterior elements, such as wall assemblies, ground-level floor slabs, windows, roofs, and similar major components, without any consideration of specific details, etc.

3.1. Lowest-Level Crawl Space

3.1.0 General

This subsection pertains to the crawl space located under the building's main body and under the southerly portions of both north-extending wings, in general terms.

3.1.1 Summary of Observations

A crawl space of variable height occurs below the building's main body and southerly portions of both wings. Exposed sloping soil forms the crawl space floor, and the underside of the concrete-framed ground floor level comprises its ceiling. As also outlined in subsections II-2.2.1 and II-2.2.2, very wet conditions prevail, and even a small but continuous stream runs through this space. Perceived humidity was also palpably high. Consequently, many visible concrete elements, such as the foundations and ground floor level concrete floor joists, displayed corrosive spalling and efflorescence, both absolute indicators of water's passage through concrete or other masonry. Corrosive spalling appeared to be affecting most floor joists. See Figures II-3.1(1-8).

Fig. II-3.1(1): Fndtn. Spalling, Wet Soil

Fig. II-3.1(2): Sloping, Wet Soil

Fig. II-3.1(3): Fndtn. Spalling, Effloresc.

Fig. II-3.1(4): Fndtn. Efflorescence

Fig. II-3.1(5): Spalling @ Joist Midspan   Fig. II-3.1(6): Spalling @ Jst. Bottoms

Fig. II-3.1(7): Spalling @ Joist Midspan   Fig. II-3.1(8): Spalling @ Jst. Bottoms

3.1.2 Analysis

The exposed, water-saturated soils, which must characterize this crawl space year-round, are having a very visible, cumulative, and detrimental effect on the integrity of all exposed concrete within the space, especially where steel-reinforced. The corrosive spalling and efflorescence represent the smoking-gun evidence for this. Water is being absorbed directly from soil into the foundations, but atmospheric moisture alone is causing the concrete floor joists to spall.

3.1.3 Projected Future Behavior

Left uncorrected, the present degradation of the concrete and its steel reinforcing will continue, causing ongoing corrosion and spalling. This will eventually compromise the structural integrity of the entire floor system.

3.2. Concrete On-Grade Floor Slabs

3.2.0 General

This subsection pertains to the on-grade concrete floor slabs that occur at the base of the northern portions of both north-extending wings.

3.2.1 Summary of Observations

These floor slabs were examined only in the west wing. Random moisture readings at the shop area revealed elevated moisture levels within this slab, and occupant-staff reported occasional leakage via a crack in the slab and along the slab-floor juncture, both near the west wing's NW corner. No leakage was reported at the east-wing floor slab during a brief visit to this restricted-access space. Water and staining were visible along the floor crack and the floor-wall juncture where occasional leakage was reported. See Figures II-3.2(1 & 2).

Fig. II-3.2(1): Wet Concrete Along Fl. Crack

Fig. II-3.2(2): Stained Floor Near Wall

It is unclear whether any sub-slab drainage and waterproofing measures had been installed under these floors, as there are three different foundation plans. Though the most recent plan on sheet 400-B, dated 12/3/29 is assumed to represent the built condition, it is plausible that the perimeter sub-slab drainage system shown on sheet 400-A, dated 11/6/29, had been installed, as this reveals that soil moisture was a known concern. Similarly, the original foundation plan on sheet 400, dated 2/2/29, reveals a high level of soil-moisture awareness during the design, as portions of the original floor slab, such as under the boiler room, are shown consisting of a 3" thick "rat-slab", covered with "3-ply membrane waterproofing", and finally capped with a 5" thick topping slab. Section A-A on sheet 400-C, dated 12/3/29, shows that this waterproofed sandwich-slab does not extend under the shop area, which was originally designed for coal storage, and that this portion consists of a 5" thick on-grade slab, with no waterproofing.

3.2.2 Analysis

It is evident that very wet soil lies beneath these floors. The drawings reveal that this moisture was a well-known design consideration, so while the multitude of conflicting foundation drawings raises some confusion, it is likely that the floor under the boiler room had been built as a waterproofed sandwich slab, that a simple perimeter sub-slab drainage system had been installed, and that the shop floor consists only of a floor slab with no waterproofing. This is also consistent with the observation that infiltration via the floor appears limited only to this shop area.

3.2.3 Projected Future Behavior

With regard to the floors alone, as a minimum, recurring infiltration via floor cracks and along floor-wall junctures will continue to be a nuisance. It would become problematic if any moisture-sensitive floor finishes, such as floor coatings, linoleum, vinyl tile, etc., were to be placed directly over these. Corrosive spalling may begin popping off the floor surface along reinforcing lines.

3.3. Concrete Sub-Grade Walls

3.3.0 General

This subsection pertains to several sub-grade concrete walls that occur primarily at the base of the northern portions of both north-extending wings.

3.3.1 Summary of Observations

The exterior portions of these sub-grade walls could not be examined, and the drawings raised some confusion concerning what type of waterproofing may have been incorporated. For example, the sections on sheet 400 call for "Applied Surface Waterproofing" on interior faces of some walls. On the other hand, section A-A on sheet 400-C calls for "Waterproofing and Brick Protection" on the exterior face of a sub-grade wall. Further, section E-E on sheet 400-E shows "3-Ply Waterproofing" applied to the exterior wall face. To add to the confusion, the sub-grade space below the east wing had been excavated after the building's original construction, and as I do not have any drawings for this later work, I cannot determine what type of waterproofing may have been applied in that location.

A brief examination of accessible interior wall portions at the west wing revealed some floor staining near this wing's NW corner, and occupant-staff reported occasional water accumulation along this floor-wall juncture. No other locations of leakage were observed below the west wing.

In contrast, the newer sub-grade walls below the east wing displayed various leak symptoms, at least from the past. However, I was informed that no current leakage affects this east-wing basement, adding more to confusion. Leak symptoms at this wing include staining, plaster damage, and streaks running down the walls. Figures 3.3(1-8) illustrate these observations.

Fig. II-3.3(1): Fl. Stain, NW Corner, W. Wing

Fig. II-3.3(2): Plaster Dam., E. Wing

Fig. II-3.3(3): Streaks Bel. Duct, E. Wing

Fig. II-3.3(4): Streaks, E. Wing

Fig. II-3.3(5): Streaks, Plstr. Dam., E. Wing **Fig. II-3.3(6): Plaster Dam., E. Wing**

Fig. II-3.3(7): Stains Below Wall, E. Wing **Fig. II-3.3(8): Plaster Dam., E. Wing**

3.3.2 Analysis

The apparent drawing contradictions raise confusion about whether waterproofing had been used on these walls. Further, the observed symptoms below the east wing seem to contradict reports that no leakage affects this space. However, for the purpose of this report, which is to develop corrective cost estimates, I believe some reasonable conclusions can be made.

The west wing basement is part of the original building design, and the drawings reveal high awareness of this site's wet conditions. Further, only one leak was reported in this wing, along a floor-wall juncture. Based on these observations, it appears most probable that 3-ply asphaltic waterproofing had been applied to the exterior faces of this wing's sub-grade walls. The one leak in this space most likely enters via a floor-wall or footing-wall cold-joints.

In contrast, the east wing basement had been excavated after the building was in place. Although no leakage was reported in this space, the relatively ample leak symptoms imply otherwise. In view of this, it appears most prudent to assume that leakage is affecting these walls, most likely via shrinkage cracks, cold-joints, and possibly rock-pockets.

3.3.3 Projected Future Behavior

Left uncorrected, the one leak reported in the west wing's basement will continue to be a recurring nuisance, but will have limited effect.

It appears probable that some leakage is occurring at the east wing, despite reports to the contrary. If so, this will continue to damage interior plaster, stain walls, etc. Over the long term, this could begin affecting the walls' integrity through reinforcing corrosion.

3.4. Stone-Clad Exterior Wall Base

3.4.0 General

This subsection pertains to the lowest-level stone base along the building's south elevation. This stone base extends from grade up to a projecting stone water table, which separates it from the stone cladding above.

3.4.1 Summary of Observations

This stone base probably consists of limestone, though it also resembles sandstone, and the distinction was not investigated, as it has little effect. Either type is poorly suited to the essentially permanently wet conditions along the building base, and the stone, especially along the very bottom, has effectively been destroyed. An entirely secondary consideration concerning this base is that the securement of the stone to the structure is minimal. See Figures II-3.4(1-8).

Fig. II-3.4(1): Spalled Stone Base

Fig. II-3.4(2): Spalled Stone Base

Fig. II-3.4(3): Spalled Stone Base

Fig. II-3.4(4): Spalled Stone Base

Fig. II-3.4(5): Spalled Stone Base **Fig. II-3.4(6): Spalled Stone Base**

Fig. II-3.4(7): Spalled Stone Base **Fig. II-3.4(8): Spalled Stone Base**

3.4.2 Analysis

This stone base, particularly along the grade, has effectively been destroyed, largely through moisture absorption from the ground, followed by freeze-spalling. Sedimentary stone in general is poorly suited to such wet, often freezing conditions.

The steel wire anchors securing this base to the building are minimal to begin with, and it is highly probable that these have been further compromised by corrosion.

While the stone's appearance could temporarily be restored with restoration mortars, this would not last very long, and the same symptoms would continue to manifest.

3.4.3 Projected Future Behavior

Left uncorrected, the current spalling will continue, and will eventually destroy the entire base portion.

Similarly, continued corrosion of the anchors will also compromise these anchors, leading to instability of this stone base.

3.5. Stone-Clad Exterior Walls Along Bottom 2 Levels

3.5.0 General

This subsection pertains to the stone-clad walls directly above the stone base addressed in subsection II-3.4. The stone cladding extends from this base upward to a projecting stone water table above the first floor windows, and clads most of the building's south elevation. While this base is contiguous with and similar to the stone cladding below the portico, the portico-related cladding is addressed separately in subsection II-5.3.

3.5.1 Summary of Observations

Observations related to these stone-clad walls can be divided into at least three categories pertaining to their general design, the condition of its cladding, and the walls' and cladding's anchorage to the primary structure.

The primary factor relating to the design of these walls is the fact that they completely lack any flashings or other means to limit water intrusion and to drain any water back out the cladding at appropriate locations. This general observation pertains to all masonry-clad walls on this building.

With regard to its general condition, this cladding displays scattered erosion, cracking, mortar delamination, and similar symptoms. See Figures II-3.5(1-6).

Fig. II-3.5(1): Stone Cladding Erosion

Fig. II-3.5(2): Stone Cladding Erosion

Fig. II-3.5(3): Spalled-Off Stone Capital

Fig. II-3.5(4): Stone Cldng. Spalling

Fig. II-3.5(5): Surface Cracking of Stone **Fig. II-3.5(6): Stone Cracking**

A related interesting observation is that all ground-level stone sills within this cladding are cracked at one side, and all sills located west of the central entry are cracked at their west ends, while all sills located east of the entry are cracked at their east ends. See Figures II-3.5(7-10).

Fig. II-3.5(7): W. Sill Cracked @ W. End **Fig. II-3.5(8): E. Sill Cracked @ E. End**

Fig. II-3.5(9): W. Sill Cracked @ W. End **Fig. II-3.5(10): E. Sill Crckd. @ E. End**

The stone cladding's securement to the structure is also addressed in a general fashion in subsection II-2.6. In brief, at least two observations can be made with regard to the stone cladding's securement. First, the drawings indicate that the securement is achieved with a single 3/8" ø steel wire drilled 2" into each of the largest stones. In some cases, this yields a single point of marginal attachment for stones with a 13 SF face area, 20 CF volume, and over 3,000 lb. weight. Second, though the drawings in a few locations call for "non-corroding" metal anchors, evidence of corroded anchors was observed. See Figures II-3.5(11 & 12).

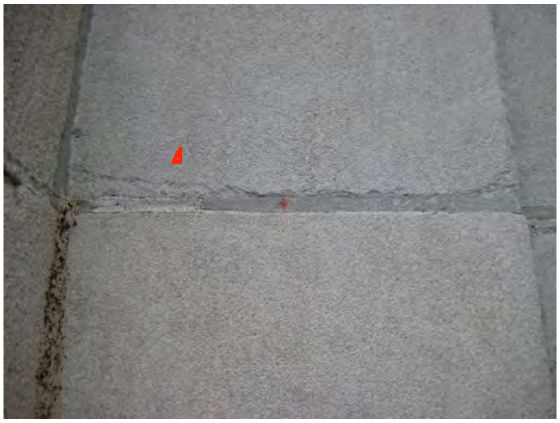


Fig. II-3.5(11): Location of Wire Anchor

Fig. II-3.5(12): Corroded Wire Anchor

3.5.2 Analysis

Let me address the three primary factors individually, including general design, the stone cladding's condition, and the walls' and cladding's anchorage to the primary structure.

With regard to the general design, the absence of flashings to limit water intrusion and drain it back out of the cladding exacerbates moisture intrusion and interior leak risk, and accelerates degradation of the stone cladding and its metal anchors.

This leads to the second issue concerning the cladding's condition. The stone is moderately degraded, and displays scattered erosion, cracking, mortar delamination, etc. Though less visible, it also appears very likely that the metal anchorage has also been at least partly degraded by corrosion. The cracking of the stone sills appears to reflect seismic damage, and it further exacerbates moisture intrusion and anchor corrosion.

The anchorage of the stone cladding to the structure was insufficient to begin with, and this inadequacy has been further exacerbated by anchor corrosion. Many of the stone elements weigh several thousand pounds each, and anchorage failure would cause these, and the supported brick above, to fall off the building.

While this consideration does not threaten the integrity of the building as a whole, it poses appreciable risk to pedestrians below in case of an earthquake, especially near the south entry, and could injure people exiting the building, or could block the exit-way, in earthquakes.

3.5.3 Projected Future Behavior

The degradation of the existing cladding will accelerate, and pieces of stone may fall off from time to time. Risk of interior leakage, especially below window sills and above the lower window heads will also persist. Risk of seismic displacement will also persist, and will increase with continued anchor corrosion.

3.6. Brick-Clad Exterior Public Façade Walls, All Levels

3.6.0 General

This subsection pertains to the brick-clad exterior walls at all floor levels and at all of the building's "public" façades, including its south, east, and west elevations, and the north elevations of its east and west wings. Although the specific brick bond patterns vary between locations and floor levels, these walls are all fundamentally similar. Elements integral to these walls, such as steel lintels above the windows, are also addressed here.

3.6.1 Summary of Observations

Observations related to these brick-clad walls can be divided into two broad categories, one pertaining to their general design and the resultant condition of its cladding, and the second relating to the walls' and cladding's anchorage to the primary structure.

General design considerations can be divided into several sub-categories. First, the composition of these walls varies appreciably between where these occur over the concrete columns and between the columns. Where these occur over the concrete columns, which represents the majority of locations, the brick walls consist of double-wythe brick placed outward of the concrete columns. Between columns, such as above and below some windows as well as adjacent to some windows, the brick walls contain 3 brick wythes. In all cases, the brick wythes contain interlocking header or rowlock courses, wherein the brick is turned 90 degrees to span across two adjacent wythes to secure them together. Figures II-3.6(1 & 2) depict this header coursing.

Fig. II-3.6(1): Recessed Header Coursing **Fig. II-3.6(2): Recessed Hdr. Course**

Further, none of these brick walls incorporate any flashings or weep holes to help drain any water back out of the brickwork. Consequently, expected symptoms of infiltration are scattered around the building, such as interior plaster damage near windows, elevated moisture levels within the stone cladding below these brick walls, extreme infiltration into the portico roof structure and stone cladding below, etc. Absence of flashings above steel lintels that support the brick above some windows has also contributed to variable degrees of lintel corrosion, even at some sheltered locations. Figures II-3.6(3-10) illustrate some examples of observed symptoms.

Fig. II-3.6(3): Interior Plaster Damage

Fig. II-3.6(4): Interior Plaster Damage

Fig. II-3.6(5): Portico Ceiling Damage

Fig. II-3.6(6): Portico Ceiling Damage

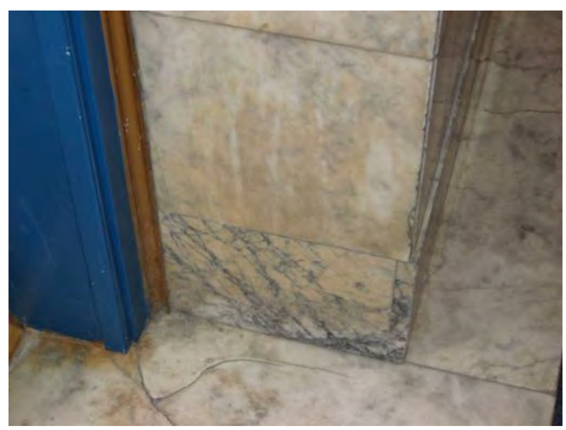


Fig. II-3.6(7): High Moisture in Stone Bel.

Fig. II-3.6(8): Corrosion Staining

Fig. II-3.6(9): Lintel Corrosion **Fig. II-3.6(10): Lintel Corrosion**

Although the specific bond pattern varies between different levels, all of the visible brickwork is similar in that it is characterized by typically recessed header courses and deeply raked mortar joints. Both of these factors increase the brickwork's weather-exposed surface area, and create many water-catching ledges throughout the exterior brick surface. This design approach, though adding visual interest, greatly increases moisture intrusion and associated degradation of the brick and mortar, and widespread spalling and surface erosion affects the brickwork, especially at highly exposed locations. Figures II-3.6(11-18) illustrate some of these observations.

Fig. II-3.6(11): Brick Spalling **Fig. II-3.6(12): Brick Spalling**

Fig. II-3.6(13): Brick Spalling **Fig. II-3.6(14): Brick Spalling**

Fig. II-3.6(15): Brick Surface Erosion

Fig. II-3.6(16): Brick Surface Erosion

Fig. II-3.6(17): Brick Surface Erosion

Fig. II-3.6(18): Brick Surface Erosion

In addition to widespread spalling, the brickwork also displays scattered cracks through both the brickwork and mortar. Figures II-3.6(19-24) illustrate some of these observations.

Fig. II-3.6(19): Brick & Mortar Crack

Fig. II-3.6(20): Brick & Mortar Crack

Fig. II-3.6(21): Brick & Mortar Crack

Fig. II-3.6(22): Brick & Mortar Crack

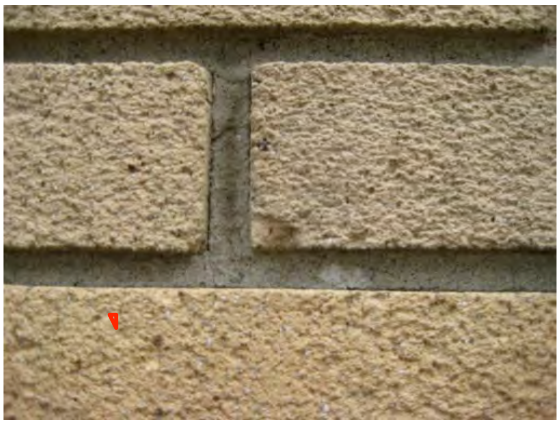


Fig. II-3.6(23): Mortar Cracks & Delam.

Fig. II-3.6(24): Mrtr. Crck. & Delamin.

The mortar condition varies greatly between locations, with some areas displaying largely sound, well-bonded mortar, while eroded, cracked, and delaminated mortar typifies other locations. Figures II-3.6(25 & 26) illustrate this variation.

Fig. II-3.6(25): Well-Bonded Mortar

Fig. II-3.6(26): Mrtr. Crck. & Delamin.

Several observations can be made regarding the anchorage of the brick wythes together, and of the brick walls to the structure. The brick wythes are well interconnected via the many header courses. On the other hand, the brick walls themselves appear to rely primarily on mortar bond to the floor slabs that support them. It is not clear whether the brick walls are connected to the concrete columns that occur inward of many such walls.

3.6.2 Analysis

Let me begin the analysis by addressing the easier primary consideration, relating to anchorage of these brick walls.

In brief, adjacent wythes of brick are mutually well-secured to each other via the interlocking header or rowlock courses. However, the brick walls connect to the floor slabs and concrete column edges only via mortar bond. My examination of the drawings did not reveal any specific connections between the double-wythe brick walls and the concrete columns, but if any had been installed, they would typically consist of metal straps, which by now would be compromised by corrosion, especially near tops of weather-exposed walls. Although much of the brickwork is likely to remain in-place due to its interlock with concrete perimeter beams, significant spalling and localized failures are probable in case of earthquakes, particularly near the level 2 water table and near windows. As with the stone-clad walls, this does not threaten the integrity of the building as a whole, but poses appreciable risk to pedestrians below in case of an earthquake.

The issue of the cladding's design and its resultant condition is more complex and requires more explanation. A confluence of technically flawed, though for its time typical, design and Juneau's conditions has caused greatly accelerated degradation of the masonry, including its brickwork. Put another way, the building's general design is not particularly well suited to Juneau's climate.

To illustrate this, it is important to note that what kills masonry is freezing of absorbed water and persistent one-directional moisture migration through it. Freezing of embedded moisture causes spalling of the masonry's outer face, as the expanding ice rips the surface apart. One-directional moisture migration through masonry dissolves its integral salts and carries them inward, leaving these to recrystallize near the inner masonry surfaces as the water evaporates. This crystallization has much the same effect as freezing water, and typically causes the innermost masonry surface to pulverize. Fairly extensive spalling affects the exposed brickwork, and the inner-face pulverization was also observed and reported, so both phenomena affect these walls.

Juneau's climate greatly accelerates both effects. Its 220 days of annual rain, combined with a 5-month period when sub-freezing temperatures occur, are a deadly combination, providing both the water and the freezing ice. In addition, fairly frequent strong winds appear to accelerate surface erosion.

The cladding's design further exacerbates degradation. The many ledges and deeply recessed raked mortar joints greatly increase the weather-exposed surface of the masonry, thus causing it to both absorb much more water and reach lower temperatures on cold nights. The recessed header and rowlock courses, though needed for interlocking adjacent wythes, also serve as ledges which help water enter more deeply into the walls, especially via the many head joints. This increases risk of interior leakage, and also complicates flashing retrofit work. The absence of drainage flashings at appropriate locations, most notably above the portico roof, among many others, allows water to drain into lower walls below, causing widespread damage.

The use of light-colored brick, which is often an indicator of lower-strength, more absorbent brick, as explained in greater detail in the 12/31/10 PL:BECS portico report, section IV-4.4.2, page 146, may also have contributed to the fairly widespread spalling and surface erosion.

The improper initial design of the projecting cornice near the roof level, which led to severe infiltration and efflorescence directly below it, and to the cornice's subsequent removal, further contributed to the damage affecting the brickwork by significantly increasing the frequency of wetting of the walls below, as explained in greater detail in section II-4.5.

Though I have only observed comparable levels of surface erosion on similarly-aged brick which had been actively sandblasted for cleaning, my recent observation that the serious erosion does not appear to affect more sheltered exposures could indicate that in this case, Mother Nature alone may have caused this. The marble columns, for example, also display serious erosion on their SW, SE, and NE faces, while their NW exposures retain much of their original polish, implying that severe weather hits this building from the southeast.

3.6.3 Projected Future Behavior

The projected behavior of these walls is already described in greater detail in section IV-4.4.3, page 148 of the 12/31/10 PL:BECS Portico report.

In brief, absence of adequate securement of these brick walls to the structure increases seismic risk to pedestrians below.

Infiltration into the brickwork will also continue, leading to recurring interior leakage and plaster damage, progressive corrosion of embedded lintels and other steel anchors, continued degradation of the brick and other masonry below it, progressively worsening degradation and destabilization of the entry portico, and related symptoms. Infiltration into the brickwork can be reduced through a combination of measures, but due to the existing, multi-wythe brick construction, infiltration cannot be reliably fully stopped with the existing configuration.

Unfortunately, the specific configuration of the brickwork, combined with the already advanced erosion of the outermost brick faces, will lead to ongoing spalling, which can be slowed down, but cannot be effectively stopped, by treating with consolidating agents.

3.7. Terra-Cotta-Clad Exterior Walls at Levels 2-4

3.7.0 General

This subsection pertains to the terra-cotta exterior wall panels that occur between windows at floor levels 2-4.

3.7.1 Summary of Observations

Each of these terra-cotta spandrel panels consists of six individual terra-cotta pieces, which are secured to the back-up brick walls with steel anchors. The apparent condition of these elements varies appreciably between different locations. Many appear to still be in reasonably good condition, with minor surface spalling.

However, the design of these elements lacks any drainage provisions, as is typical of all masonry elements on this building, and as was typical of masonry in general during this building's construction. Consequently the bottoms of many panels in weather-exposed locations are degrading, with spalling and efflorescence evident.

In addition, various panels display both vertical and horizontal cracking, which often coincides with locations of embedded steel, and can be an early indication of corrosion of embedded steel.

Above the entry portico, several of these panels have sloping mortar-wash sills, which are degrading seriously. Several panels in the same general location also have some grille penetrations with moss growth. Figures II-3.7(1-12) illustrate examples of these observations.

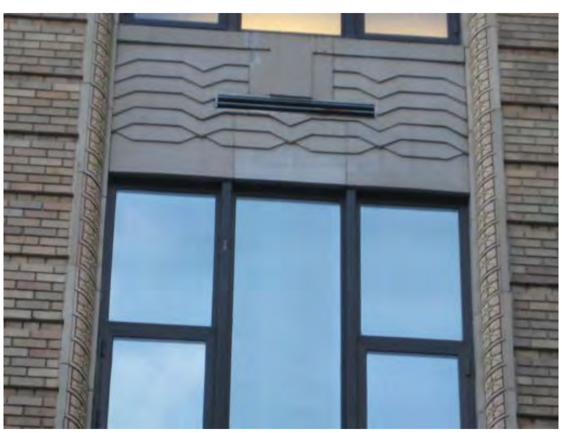


Fig. II-3.7(1): Moderate Degr. of T-C Panel

Fig. II-3.7(2): Mod. Degr. of T-C Panel

Fig. II-3.7(3): Minor Degr. of T-C Panel

Fig. II-3.7(4): Serious Spalling @ Bot.

Fig. II-3.7(5): Serious Degr. of T-C Pnl. Bot.

Fig. II-3.7(6): Serious Spalling @ Bot.

Fig. II-3.7(7): Vertical Cracking in T-C Pnl.

Fig. II-3.7(8): Horiz. Crack in T-C Pnl.

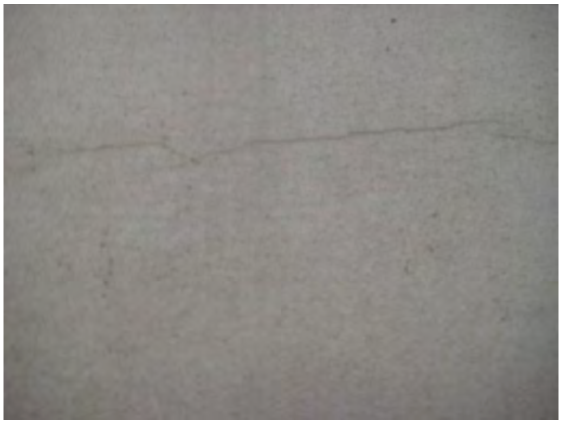


Fig. II-3.7(9): Horiz. Cracking in T-C Panel **Fig. II-3.7(10): Sill Degradation**

Fig. II-3.7(11): Sill Degradation **Fig. II-3.7(12): Grille Penetration**

3.7.2 Analysis

These terra-cotta panels repeat the same basic errors common to all of this building's masonry. Namely, they lack flashing caps over upward-facing surfaces, and they do not accommodate drainage from behind the panel bottoms. Based on the initial cracking visible at some panels, it also appears probable that embedded steel anchors and reinforcing consist of standard steel, and have begun to corrode.

The absence of flashing caps significantly increases infiltration into these panels, and the fairly advanced degradation along the bottoms of some panels confirms this. The panel-bottom damage is appreciably accelerated by the absence of drainage provisions. Removal of the roof cornice in the past further increased exposure.

3.7.3 Projected Future Behavior

The damage to a majority of the panels is still pretty limited and largely visual at this stage. Many of these could probably last up to 40 years before beginning to display truly worrisome symptoms, such as recurring dropping of small chunks onto the ground below. On the other hand, a more limited number of panels already show more advanced degradation along their bottom edges, and these are already shedding small flakes, require temporary maintenance now and will need replacement within about two decades.

Probable corrosion of embedded steel anchorage may increase susceptibility to seismic damage.

3.8. North Courtyard Walls, Brick-Clad

3.8.0 General

This subsection pertains to the brick-clad exterior walls wrapping the north courtyard, but excluding the stairwell walls, which intervene between the two areas described in this section.

3.8.1 Summary of Observations

While the public-facing exterior walls of this building are relatively ornate, these courtyard walls are plain and utilitarian in character. Though different in appearance, the basic construction of these walls is basically the same as of the more public walls addressed in section II-3.6, and many of the same observations apply. These can again be divided into structurally-related concerns and general design and resultant condition.

These walls are also multi-wythe brick walls, with up to 3-wythe thickness. In contrast to the “public” walls, these courtyard walls only have a single wythe of brick outward of most of the embedded concrete columns. These walls also have interlocking header courses, though these do not generally align with corresponding courses in the immediately abutting “public” walls, displaying almost wanton disregard for the aesthetic care revealed in the brickwork of the public walls.

Structural securement issues relevant to these walls are basically the same as at the public brickwork. Namely, interlocking header coursing ties parallel wythes together very effectively, but the overall wall assembly relies on mortar bond alone to secure the walls to the supporting floor slabs, and if anchors exist between the brick and columns, many would by now be compromised by corrosion.

With regard to “design and weathering” considerations, these walls are also similar to the more public ones. For example, they also lack flashings or weep holes to drain water out of the brickwork, or above steel window-head lintels, which display variable, and in a few locations moderately-advanced, corrosion.

In contrast to the deeply raked mortar joints in the more public brickwork, the mortar at these walls appears mostly flush-struck, with its outer surface very near the brick face, but not visibly tooled, though surface erosion could have removed tooling indications.

Though we were unable to reach the north-facing walls, examination of the east and west-facing ones proved educational. Namely, the east-facing wall displays significant degradation, such as surface spalling, surface erosion, mortar stress, lintel corrosion, etc. Visible window-head lintel corrosion at this wall affects all of the openings in the upper two levels, and a few near the wall base. In contrast, the west-facing wall is in visibly better condition, with much more limited surface erosion and little spalling, and apparent lintel corrosion occurs only below an entry door.

The east-facing wall also displays cracking in the brick as well as in one pre-cast concrete window sill. Further, it appears that the steel window-head lintel above an upper-level window has sagged, causing a long and significant delamination crack in the brick header above.

Figures II-3.8(1-14) illustrate these observations.

Fig. II-3.8(1): Utility-Grade Design

Fig. II-3.8(2): Spalling, E-Facing Wall

Fig. II-3.8(3): Spalling, E-Facing Wall

Fig. II-3.8(4): Erosion, E-Facing Wall

Fig. II-3.8(5): Better Cond., W-Facing Wall

Fig. II-3.8(6): Absorption Test, E. Wl.

Fig. II-3.8(7): Lintel Corr., E-Wall, Bottom **Fig. II-3.8(8): Lintel Corrosion, E.**

Fig. II-3.8(9): Lintel Corr., E-Wall, Top **Fig. II-3.8(10): Lintel Corrosion, E.**

Fig. II-3.8(11): Sagging Head., E-Wall, Top **Fig. II-3.8(12): Crack Abv. Sag. Hd.**


Fig. II-3.8(13): Sagging Head., E-Wall, Top **Fig. II-3.8(14): Crack @ E. Wall, Top**

3.8.2 Analysis

Though these courtyard walls differ substantially in appearance from their more public counterparts, much the same analysis applies to both, with the one major exception being that these courtyard walls lack the recessed header courses and mortar joints, thus presenting less surface area to the weather. As the analysis for both wall types is quite similar, please refer to subsection II-3.6.2 for a more detailed description, which is repeated here only skeletally.

With regard to securement, adjacent brick wythes are secured to each other via interlocking header courses, but the walls connect to the floor slabs and concrete column edges only via mortar bond. It is not clear whether the brick walls are secured to the columns, but even if they were, the anchors are probably compromised by corrosion, especially at the east-facing wall. Although much of the brickwork is likely to remain in-place, significant localized failures are probable in case of earthquakes, particularly near windows. While this does not threaten the integrity of the entire building, it poses appreciable risk to pedestrians in an earthquake.

Issues related to the cladding's design and its resultant condition are essentially identical to those affecting the more public walls, though the significantly different weather-exposure of these walls has resulted in correspondingly noticeable differences in condition.

The absence of drainage flashings at appropriate locations allows water to drain into lower walls below, exacerbating damage and interior leak risk. Interlocking header courses, though structurally needed, also increase risk of deep water penetration into the walls.

The use of light-colored, probably lower-strength, more absorbent brick, may also have contributed to spalling and surface erosion.

Though these design issues apply to all of the courtyard walls, differences in exposure have produced widely differing results, and the east-facing wall displays much greater degradation, including surface erosion, spalling, lintel corrosion, etc. than its west-facing counterpart.

3.8.3 Projected Future Behavior

In brief, absence of adequate securement of these brick walls to the structure increases seismic risk to pedestrians below.

Infiltration into the brickwork will continue, causing recurring interior leakage, progressive lintel corrosion, continued brickwork degradation, etc. Infiltration into the brickwork can be reduced through a combination of measures, but due to the existing construction, infiltration, and associated brick spalling, cannot be reliably fully stopped with the existing configuration.

These considerations apply much more to the east-facing wall than to the west-facing one, and probably also to the north wall, and degradation will continue to be most rapid at the east wall.

3.9. North Stairwell Walls, Brick & Stucco-Clad

3.9.0 General

This subsection pertains to the brick-clad exterior walls wrapping the stairwell tower in the north courtyard.

3.9.1 Summary of Observations

With regard to their construction, these walls are effectively identical to the other courtyard walls, differing primarily in being taller, protruding a floor level above the roof line, with this upper portion over-clad with directly adhered stucco. The east and west stairwell walls consist of triple-wythe brickwork, while the north wall consists almost entirely of concrete columns wrapped with a single brick wythe. The south wall, which occurs only above the roof, consists of double-wythe brick coated with stucco. The upper stucco band, as well as the entire height of the east-facing wall, is painted with an elastomeric coating. Figures II-3.9(1 & 2) illustrate these observations.

Fig. II-3.9(1): Stairwell's North Wall

Fig. II-3.9(2): Stairwell's North Wall

The east-facing wall suffers significant brick spalling, though partly concealed by the elastomeric coating, which has clearly been applied to address infiltration. The coating has not proved successful in fully precluding moisture entry, and spalling continues, with brick chunks in places hanging by only the coating. The north and west-facing walls are in notably better condition. See Figures II-3.9(3-5).

Indications of ongoing infiltration are also evident at the south-facing wall, whose innermost face manifests the surface pulverization, brick flaking, and white salt deposition characteristic of deep infiltration, as already explained in greater detail in subsection II-3.6.2. See Figures II-3.9(6-8).

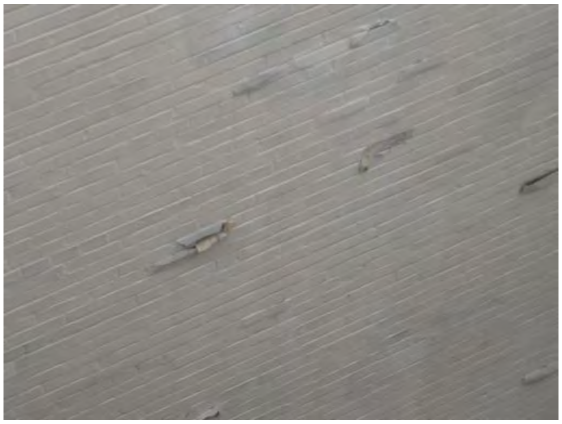


Fig. II-3.9(3): Post-Coating Spallng., East

Fig. II-3.9(4): East Wall Spalling

Fig. II-3.9(5): Post-Coating Spallng., East

Fig. II-3.9(6): Flaking @ Int., S. Wall

Fig. II-3.9(7): Flaking @ Interior, S. Wall

Fig. II-3.9(8): Flaking @ Int., S. Wall

The upper stucco band appears directly adhered to the brick. In places, it bulges outward, and some coating blisters indicate moisture intrusion behind the coating. The stucco's bottom merges into the brick face below, and the elastomeric coating spans across the juncture, precluding any opportunity for drainage. Similarly, the stucco joins the abutting parapets and roof in a non-draining fashion, wherein any water behind the stucco would drain into the roof assembly. See Figures II-3.9(9-12).

Fig. II-3.9(9): Stucco Bulging, W. Wall

Fig. II-3.9(10): Coating Over Junct.

Fig. II-3.9(11): Non-Dr. Stucco-Roof Junct.   Fig. II-3.9(12): Blistered Coating

Brief review of the drawings did not reveal any anchorage of the brick to the concrete columns, and same observations apply to these walls as elsewhere relative to anchorage.

These walls also lack flashings or weep holes to drain water out of the brickwork, or above window-head lintels, which however appear to be in good condition, reflecting their more forgiving northerly exposure.

3.9.2 Analysis

In most respects, the analysis for the courtyard walls, described in subsection II-3.8.2, applies equally well to the stairwell walls, with a few additions.

With regard to securement, the north-facing wall, which in many locations consists of a single wythe of brick over concrete columns, may pose some risk of falling brick in case of earthquakes.

Issues related to the design and resultant condition of these walls are essentially identical to those affecting the courtyard walls.

For example, absence of flashings exacerbates damage and interior leak risk. This is particularly true along the base of the upper stucco band, which drains directly into the brick below, causing accelerated brick spalling, primarily on the east-facing wall.

Similarly, improper, non-draining junctures of the stucco cladding to the parapets and roof along the south side pose inherent risk of interior leakage and damage to the roof.

As with the courtyard walls, differences in exposure have produced widely differing results, and the east-facing wall displays much worse spalling, than any of the other exposed brick walls.

3.9.3 Projected Future Behavior

Questionable securement of the brick, especially at the north stairwell wall may pose seismic risk to pedestrians below.

Infiltration into the brickwork will also continue, which will particularly affect the more weather-exposed west and south walls, causing continued brickwork degradation, and posing risk of recurring interior leakage. Infiltration into the brickwork can be reduced through a combination of measures, but due to the existing construction, infiltration, and associated brick spalling, cannot be reliably fully stopped with the existing configuration.

3.10. Brick Chimney

3.10.0 General

This subsection pertains to the relatively tall brick chimney above the main roof, near the inside corner where the west wing joins the main portion of the building. As the "structural" and "weather-integrity" issues affecting this chimney are intricately related and inseparable, all observations and considerations related to this chimney are addressed holistically in section II-2.5. The sole purpose of section II-3.10 is to refer the reader to section II-2.5 for both "structural" and "weathering" information.

3.11. North Courtyard Walls, Metal-Clad

3.11.0 General

This subsection pertains to two small wall portions on the building's north side, one to each side of the stair tower, at floor level 2. These walls were not part of the building's original construction.

3.11.1 Summary of Observations

These two newer, small walls are reported to consist of standard light-gage steel framing, with steel studs, gypsum exterior sheathing, probably building paper, an exterior metal cladding, and windows and doors. Examination with binoculars did not reveal any drainage provisions along the metal cladding's base. The cladding is lightly warped. Figures II-3.11(1 & 2) show the eastern wall.

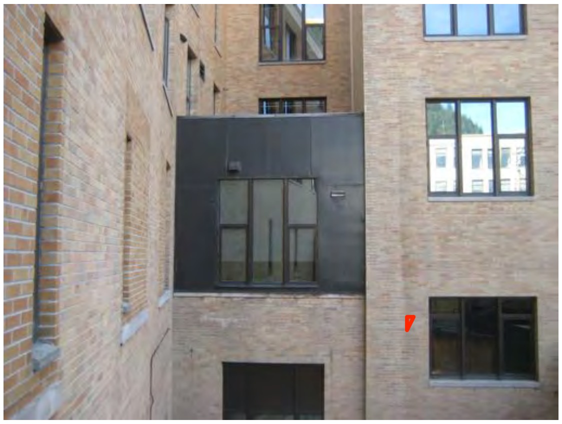


Fig. II-3.11(1): N-Facing, Metal-Clad Wall **Fig. II-3.11(2): Metal Cladding**

3.11.2 Analysis

No structural considerations apply to these lightweight walls.

Absence of cladding drainage provisions, if confirmed, would exacerbate risk of interior leakage and water damage to the lower portions of these walls. This concern is appreciably minimized by the sheltered orientation of both walls.

3.11.3 Projected Future Behavior

In general, these walls are of minor concern, pose no structural issues, and could at worst experience limited infiltration and water damage, which should be minimized by the northerly orientation.

3.12. Windows

3.12.0 General

This subsection pertains to all exterior windows.

3.12.1 Summary of Observations

Most of the building's original steel-sash windows had been replaced some time ago with extruded aluminum units, except at the north ends of the two wings, which retain their original steel ones.

With regard to general configuration, nearly all windows are divided into three equal-width sections, with a large, fixed central panel and two, vertically stacked panels on each side, each containing operable casement sashes below smaller fixed panes. However, a few of the original window openings had been at least partly bricked-in, with either no windows or with narrow units.

At least two variants of aluminum windows exist. In nearly all locations, they have fairly standard frames and mullions with roughly 2" wide profiles. In contrast, the three windows in the governor's conference room have very narrow vertical mullions.

Figures II-3.12(1-4) illustrate these observations.

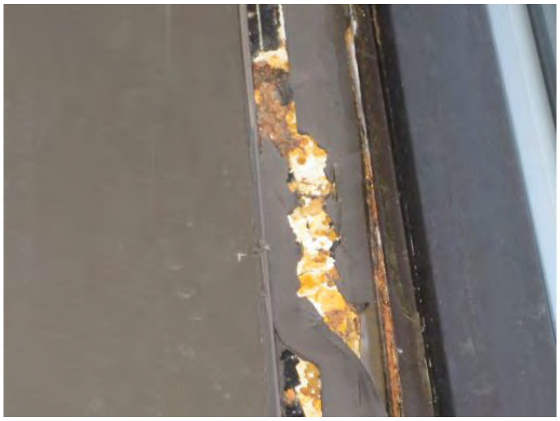
Fig. II-3.12(1): Typ. Window Configuration

Fig. II-3.12(2): Atypical Narrow Units

Fig. II-3.12(3): Typ. Wide-Mullion Config.

Fig. II-3.12(4): Atypical Narrow Mulls.

A few loose and deflected window frames revealed that the new aluminum windows had been installed over the original steel frames, which were corroding. See Figures II-3.12(5 & 6).



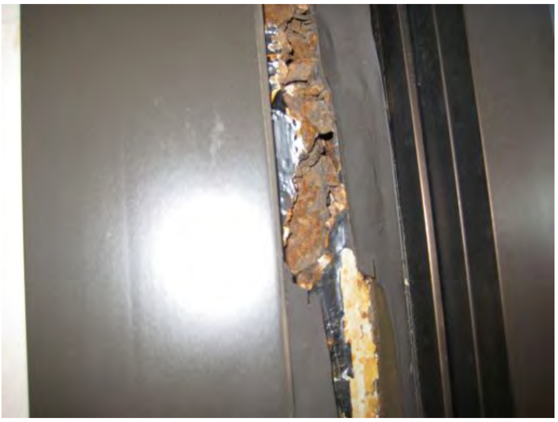


Fig. II-3.12(5): Corroding Steel Frame **Fig. II-3.12(6): Corroding St. Frame**

Although the original steel-sash windows contain rudimentary drainage provisions, such as notches to preclude damming, the newer aluminum units lack any integral drainage. Raised dams along outer sill edges block drainage from the sub-sash channels, whose various screw penetrations and holes clearly allow water into the frame extrusions, but sealant applied along all exterior junctures precludes outward drainage from the frames. The application of sealant over all joints is extremely unusual, and typically, such measures reflect ill-fated efforts to stop leakage. See Figures II-3.12(7-11).

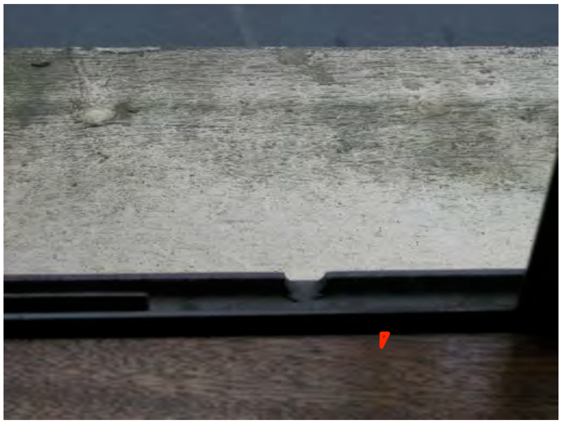


Fig. II-3.12(7): Original Steel-Sash Window **Fig. II-3.12(8): Drain Notch in St. Sill**

- Raised inner sill dam precludes inward spillage of water off sill below operable sash.
- Continuous raised outer lip lacks any notches of holes to allow water atop sill to drain back out.

Figure II-3.12(9): Absence of Drainage Notches or Weeps in Outer Sill Lip

- Hole in sill extrusion drains water off sill into sill extrusion, which appears to be fully sealed and unable to drain.

Figure II-3.12(10): Hole at Sill/Jamb Juncture Allows Water Into Sill Extrusion

- Sealant applied along extrusion joints is very unusual, probably reflects effort to stop leakage.
- Sealant applied below sill extrusion precludes drainage of water out from under sill.

Figure II-3.12(11): Perimeter of Sill Extrusion Sealed with Sealant

Note also that all other joints in aluminum window system are sealed with sealant.

Not surprisingly, my examination also revealed relatively widespread evidence of previous leakage, such as blistered plaster around and below windows, white deposits at many interior joints, elevated moisture content below some window sills, streaks on plaster below sills, and similar manifestations. In a couple of locations, some sort of oily streaks occur on interior mullion faces. While many such symptoms reflect leakage via masonry above these windows, others, such as those below midspans of interior sills and along joints in the aluminum extrusions, are more likely to reflect leakage via the windows themselves. Sealant along interior window frame joints, which is quite unusual, may also reflect an effort to stop leakage. Figures II-3.12(12-23) show some examples of these observed symptoms.

Fig. II-3.12(12): Streaks Bel. Window Sill

Fig. II-3.12(13): Plstr. Dam. Bel. Sill

Fig. II-3.12(14): Plaster Damage Below Sill

Fig. II-3.12(15): Elev. Moist. Bel. Sill

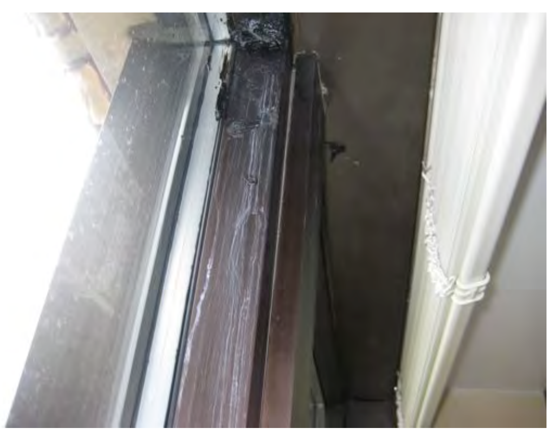


Fig. II-3.12(16): Streaks Bel. Window Head

Fig. II-3.12(17): Streaks on Mullion

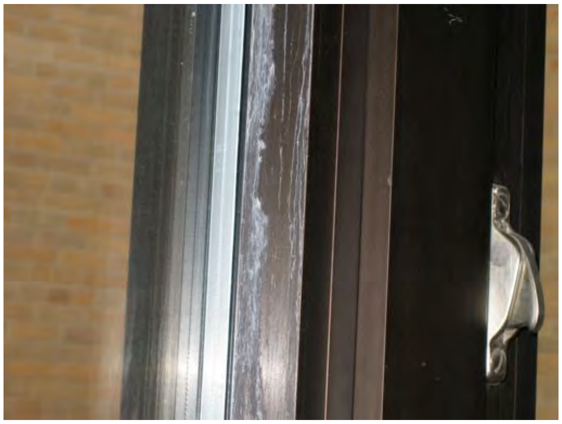


Fig. II-3.12(18): Streaks On Mullion **Fig. II-3.12(19): Oily Streaks on Mull.**

Fig. II-3.12(20): White Dep. At Frame Jts. **Fig. II-3.12(21): White Dep. At Joints**

Fig. II-3.12(22): White Dep. At Frame Jts. **Fig. II-3.12(23): White Dep. At Joints**

In addition, the sills of the three windows above the portico occur quite close to the roof, and occasionally become buried in snow, increasing leak risk. These sills are capped with asphalt-coated copper sill flashings, which could lead to corrosion if copper-aluminum contact occurs. All joints in these windows are also sealed with sealant. See Figures II-3.12(24 & 25).

Fig. II-3.12(24): Sills Near Portico Roof **Fig. II-3.12(25): Cpr. Flshgs. Bel. Al.**

3.12.2 Analysis

The newer aluminum windows are flawed both in their design as well as installation.

The primary design flaw is that the windows lack any sort of integral drainage system. This is a fatal flaw, as it is simply not possible to seal all joints and perimeter conditions perfectly and permanently, and all modern window systems include integral drainage methods to accommodate the inherent infiltration. Various interior symptoms indicate that some of these windows leak, at least under severe weather conditions at highly exposed locations.

Installation issues relate to the securement of the aluminum windows over the steel frames of the original windows, as well as the improper sealing of numerous joints in the window extrusions.

The severely corroded steel frames behind the aluminum extrusions appear to reflect electrolytic corrosion, wherein fastening of the aluminum and steel elements together greatly accelerated corrosion. Water intrusion and condensation within the frames may have exacerbated this effect.

The sealing of the window extrusion joints should not be necessary, and in some locations precludes drainage of water back out of the extrusions. While window perimeters should generally be sealed, sealing at the sills should be executed in a fashion that does not block outward drainage. In these windows, the sill sealing may actually block such drainage.

Placement of three windows only a few inches above the portico roof also increases leak risk, particularly during periods of wet snow accumulation.

3.12.3 Projected Future Behavior

The problems plaguing the windows will persist.

The absence of an integral drainage system will continue to make the windows vulnerable to leakage, which may affect different windows at different times under varying conditions.

To the extent that any of the original steel frames still retain any integrity, continued corrosion will destroy these, and if the aluminum windows are secured to these frames, as appears probable to some degree, such securement will also become compromised.

The sealant applied to the numerous window extrusion joints will continue to fail, and water which enters via these joints will be hindered from draining back out by the same sealant joints below the entry points.

The three windows directly above the portico roof are likely to experience occasional leakage during snowy periods.

3.13. Roofs

3.13.0 General

This subsection pertains to four roof areas, including the large main roof, a small roof atop the stair tower, and two small roof areas atop the metal-clad additions on the building's north side. The portico roof is addressed separately with the portico in subsection II-5.6.

3.13.1 Summary of Observations

Only the large main roof was accessed directly, and concrete pavers atop it precluded examination except along perimeter conditions. The two lower roofs on the north side are also capped with pavers, limiting observations. However, a few germane observations could be made.

First, the assembly of these roofs apparently consists of a single-ply EPDM membrane over the building's concrete roof structure, with rigid polystyrene insulation capped with concrete pavers placed atop this membrane. This configuration represents an Inverted Roof Membrane Assembly, (IRMA), wherein the insulation occurs above the roof membrane.

A second major observation relates to all conditions where the roof membrane joins higher masonry walls above, such as along the base of the brick chimney, where the main roof joins the stair-tower walls and parapets, and where the two lower roofs abut the brick-clad walls. The roof membrane top edges at these junctures are secured with continuous termination bars, with sealant above the bars, but with no through-wall flashings to allow drainage from the masonry or stucco above.

Figures II-3.13(1-10) illustrate these observations.

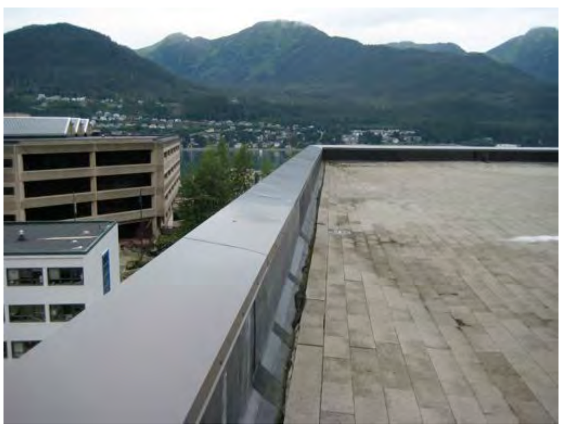


Fig. II-3.13(1): Paver-Capped Main Roof

Fig. II-3.13(2): Paver-Capped Main Rf.

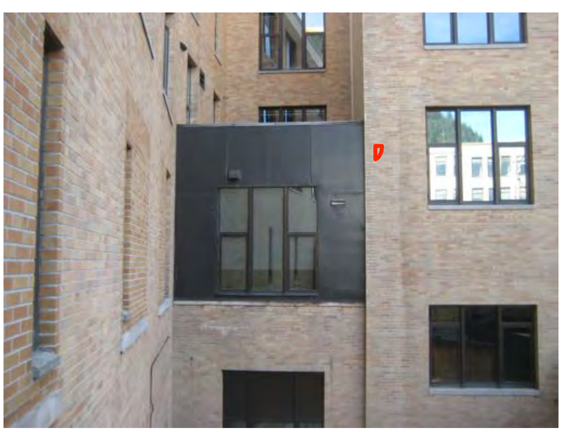


Fig. II-3.13(3): Paver-Capped Low Roof

Fig. II-3.13(4): Paver-Capped Low Rf.

Fig. II-3.13(5): EPDM Roof w/IRMA Config. **Fig. II-3.13(6): Insul. Atop Rf. Membr.**

Fig. II-3.13(7): Non-Drain. Roof-Wall Junct. **Fig. II-3.13(8): Sealed Roof-Wall Jnct.**

Fig. II-3.13(9): Non-Drain. Prpt.-Wall Junct. **Fig. II-3.13(10): Sealed Roof-Wall Jt.**

3.13.2 Analysis

Two primary issues relate to these roof areas.

First, the Inverted Roof Membrane Assembly, (IRMA), wherein the roof membrane is placed below the insulation, is particularly ill suited to a cold, wet climate such as Juneau's. This is because all water reaching these roofs has to percolate through the insulation joints to the membrane, then migrate along the membrane's top to the drains. In the process, this cold water extracts a lot of heat from the building. In a cold, wet climate such as Juneau's, this IRMA configuration effectively negates essentially all value of the insulation, and results in appreciably increased energy consumption.

The non-draining junctures of the roof membrane to abutting walls are quite improper, and substantially increase risk of leakage below such transitions. This may be one reason why the stairwell's east-facing brick wall, as well as several chimney walls, had been painted with an elastomeric coating, probably reflecting an effort to stop infiltration below.

3.13.3 Projected Future Behavior

The ill-suited IRMA roof configuration will continue to drain energy from the affected roof assemblies, resulting in appreciable waste and needless operation costs.

Leak risk will also persist below the various ill-conceived, non-draining roof membrane-wall junctures, requiring vigilant re-coating of the masonry walls above them, and causing recurring leakage below weather-exposed walls.

4. EXTERIOR MASONRY SUB-ELEMENTS

4.0. General

This section of the report addresses issues related to the various exterior masonry sub-elements, such as the stone and terra-cotta water tables, stone window sills, marble panels, etc.

4.1. Lower Stone Water Table at Level 2

4.1.0 General

This subsection pertains to the stone water table that extends at level 2 around the building's more public façades on the west, south, east, and north sides, but not in the north courtyard.

4.1.1 Summary of Observations

A horizontal band consisting of a large, projecting stone water table, with a second, vertically faced stone band above this, extends at level 2 around the building's public façades. Observations related to this band concern its securement, general design, and condition.

With regard to securement, the drawings show the large pieces secured with 5/8" vertical steel rods within the joints below the windows, and with a continuous steel angle where columns occur.

With regard to design, this water table lacks any flashings on top or under it, allowing permeation into the water table and the masonry below. Consequently, it displays appreciable degradation, erosion, cracking, and exfoliation. A large portion east of the south entry has spalled off between my 2006 and 2010 visits, and other sections are in process of spalling. See Figures II-4.1(1-14).

Fig. II-4.1(1): Cracking in Band Abv. W.T.

Fig. II-4.1(2): Crack Above Wtr. Tbl.

Fig. II-4.1(3): Cracking in Band Abv. W.T.

Fig. II-4.1(4): Crack Above Wtr. Tbl.

Fig. II-4.1(5): Cracking in Band Abv. W.T. Fig. II-4.1(6): Crack Abv. & In W.T.

Fig. II-4.1(7): In-Progress Spalling of W.T. Fig. II-4.1(8): Spalling & Degradation

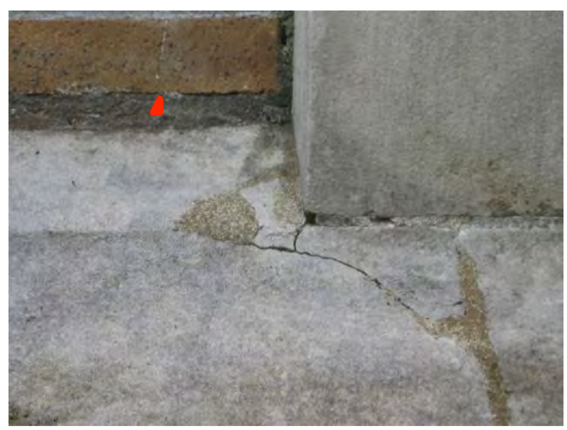


Fig. II-4.1(9): Spalling Near Steel Anchor Fig. II-4.1(10): Spalling Near Anchor

Fig. II-4.1(11): In-Progress Spalling of W.T. **Fig. II-4.1(12): Edge Spalling**

Fig. II-4.1(13): Spalled Water Table Top **Fig. II-4.1(14): Spalled W.T. Top**

4.1.2 Analysis

The water table's securement at the windows appears inadequate to resist lateral loads, though it seems notably beefier where it runs past embedded concrete columns. It is probable that the anchors have begun to corrode, compromising securement to variable degrees, depending on weather exposure.

Absence of flashings atop and below the water table allows infiltration into the water table and masonry below, greatly accelerating degradation, spalling, and risk of interior leakage. However, the current degradation does not yet appear to have irretrievably damaged this water table.

4.1.3 Projected Future Behavior

The water table's securement may pose some risk to pedestrians below in case of earthquake. Continued corrosion of these anchors will compromise securement further, and will contribute to localized spalling near the water table top, which may have already begun.

The water table and to a lesser extent the masonry directly below it will also experience accelerating degradation due to continued infiltration resulting from the absence of flashings atop and under this water table.

4.2. Terra-Cotta Window Bay Surrounds

4.2.0 General

This subsection pertains to the multi-colored terra-cotta border elements that surround all vertical window bays at levels 2-5 around the building's public façades on the west, south, east, and north sides, but not in the north courtyard.

4.2.1 Summary of Observations

Observations related to the window surrounds again concern securement, design, and condition.

The securement was not examined, but the drawings indicate that these surrounds are secured with "non-corroding" metal hooks suspended from steel lintels above the 4^{th} and 5^{th} level window heads. No specific securement method appears called out for the vertical "jamb" pieces, though some hooks may exist there as well. It is not clear whether "non-corroding" metal hooks had been used, and the supporting lintels consist of standard, non-galvanized steel.

The only design-related issue concerns the masonry above the terra-cotta heads. As with the rest of the building, no drainage provisions had been incorporated, and in fact, sealant seals the junctures separating the terra-cotta heads from the brickwork above, precluding drainage.

The condition of these terra-cotta elements varies greatly around the building. In many locations, these elements appear to still be in generally good condition, with no visible weathering symptoms, other than some color fading. See Figures II-4.2(1 & 2).

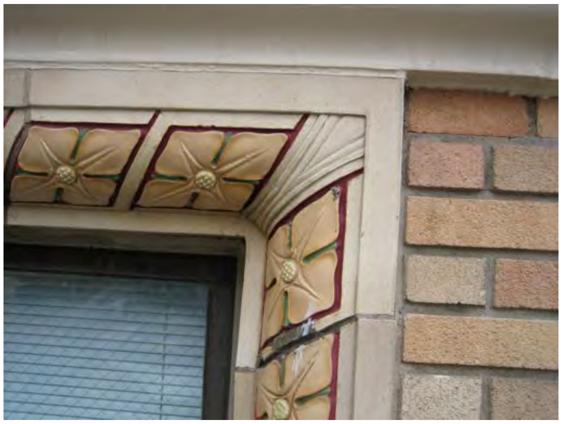


Fig. II-4.2(1): Terra-Cotta in Good Condition **Fig. II-4.2(2): T.-C. in Good Condition**

Elsewhere, many pieces are discolored by what appears to be lime. See Figures II-4.2(3-6).

Fig. II-4.2(3): Terra-Cotta Discoloration **Fig. II-4.2(4): T.-C. Discoloration**

Fig. II-4.2(5): Terra-Cotta Discoloration **Fig. II-4.2(6): Discoloration, Cracking**

Proceeding up the damage scale, a still fairly limited number of pieces have begun to show cracking and spalling of their outer faces, ranging from minor short cracks to complete face spalling. Figures II-4.2(6-12) illustrate the range of this type of damage.

Fig. II-4.2(7): Terra-Cotta Cracking **Fig. II-4.2(8): Terra-Cotta Cracking**

Fig. II-4.2(9): Terra-Cotta Face-Spalling **Fig. II-4.2(10): T.-C. Face-Spalling**

Fig. II-4.2(11): Terra-Cotta Face-Spalling **Fig. II-4.2(12): T.-C. Face-Spalling**

Let me return to the non-draining masonry above the terra-cotta window heads. As noted, the joints directly above these heads had typically been sealed with sealant, precluding drainage from behind the brickwork above. Lime staining below these joints, and moss growth in some mortar joints directly above them, as well as spalling and efflorescence on the underside of these heads clearly indicate that water is trying to drain out of the masonry above the heads. See Figures II-4.2(13 & 14).

Fig. II-4.2(13): Lime Streaks Bel. Sealed Jt. **Fig. II-4.2(14): Lime St., Moss Growth**

Some of these sealed joints near the top of the south elevation had become widened to roughly an inch from their original ½" width. In many such widened locations, the terra-cotta directly below has become cracked, in places quite badly. Such symptoms often indicate corrosive expansion of embedded steel. However, examination of the steel lintel in the location of the worst apparent damage revealed a deeply embedded, non-galvanized, non-flashed steel lintel with very minimal corrosion. This indicates that the observed damage is resulting from freeze-spalling. See Figures II-4.2(15-20).

Fig. II-4.2(15): Widened Joint Abv. T.-C.

Fig. II-4.2(16): T.-C. Cracking Bel. Jt.

Fig. II-4.2(17): Cracking Bel. Sealed Joint

Fig. II-4.2(18): T.-C. Cracking Bel. Jt.

Fig. II-4.2(19): Cracking Bel. Sealed Joint

Fig. II-4.2(20): Minor Lintel Corrosion

4.2.2 Analysis

The condition of these terra-cotta window surrounds is highly variable, depending on weather exposure. Many pieces are minimally degraded, and could probably last another 40 years, perhaps more. On the other hand, a small number are already seriously damaged, and will spall chunks onto the ground below. Perhaps a quarter fall somewhere in-between, and are likely to begin cracking and spalling within a decade or two.

A primary design flaw affecting these terra-cotta surrounds concerns the non-draining brickwork above the heads. As a consequence of the absence of drainage provisions above these heads, water within the brickwork drains directly into the terra-cotta heads, which then direct this water down the terra-cotta jamb surrounds. When the water freezes and expands, it rips the terra-cotta pieces, causing the observed cracking and spalling.

This infiltration is also likely to lead to corrosion of the steel lintels, and probably of the wire hooks securing the terra-cotta heads, although such corrosion does not yet appear to be a significant factor, probably reflecting the fact that the cornice, which had since been removed, had afforded appreciable protection for these heads, and also due to the apparently deep embedment of the lintels.

4.2.3 Projected Future Behavior

The degradation affecting these terra-cotta surrounds will continue and will accelerate, particularly at the upper reaches of the south and east elevations, while such degradation will continue to be slower at the north and west sides and at lower portions. The worst areas near the top of the south elevation may begin dropping threateningly large chunks at any time, and this risk will increase with time.

4.3. Upper Terra-Cotta Water Table at Level 5

4.3.0 General

This subsection pertains to the wide horizontal band that separates the 4th and 5th level windows.

4.3.1 Summary of Observations

This band consists of three different profile types, all composed of terra-cotta, including a projecting water table with a sloping top and a multi-colored "soffit" at the top of this band, a flat-panel middle band, and a smaller rounded, projecting "brow" above the 4th level window heads. The entire band has been painted with an elastomeric coating, precluding direct examination of the outer glazed surfaces. However, valuable observations could be made in spite of this.

With regard to design, the same typical issues affect this band as all other masonry on the building. Namely, no through-wall flashings occur above the upper water table, no flashing caps protect the projecting water table, and no drainage flashings drain water out from the bottom of this band.

This observation provides a good introduction to a discussion of this band's condition, which, though variable, ranges up to seriously degraded in many locations. For example, the uppermost projecting water table band in places appears in reasonably good condition, to the extent one can discern through the elastomeric coating. Elsewhere, in-progress spalling can be seen through the coating on this band, and in various other places, the spalling of this upper band is quite advanced, with chunks of the surface gone. Figures II-4.3(1-16) illustrate these observations.

Fig. II-4.3(1): 3-Part Terra-Cotta Band

Fig. II-4.3(2): Minor Degradation

Fig. II-4.3(3): Minor Degr. of Top W.T. Band

Fig. II-4.3(4): Incipient Spalling

Fig. II-4.3(5): In-Progress Spalling

Fig. II-4.3(6): In-Progress Spalling

Fig. II-4.3(7): In-Progress Spalling

Fig. II-4.3(8): In-Progress Spalling

Fig. II-4.3(9): Serious Spalling of Top Band

Fig. II-4.3(10): Serious Spalling

Fig. II-4.3(11): Serious Spalling of Top Band Fig. II-4.3(12): Serious Spalling

Fig. II-4.3(13): Serious Spalling of Top Band Fig. II-4.3(14): Serious Spalling

Fig. II-4.3(15): Serious Spalling of Top Band Fig. II-4.3(16): Serious Spalling

Similarly, the condition of the flat-panel terra-cotta band below the water table is also variable, though in general, this band displays notably lesser degradation, with only a few areas fully spalled-off and fewer areas of incipient spalling. In one location on the north side of the east wing, rust staining exiting a crack in this band indicates that corrosion is occurring behind this panel. Figures II-4.3(17-20) illustrate these observations.

Fig. II-4.3(17): Middle Band in Decent Cond. Fig. II-4.3(18): Incipient Spalling

Fig. II-4.3(19): Corrosion Exiting Mid. Band Fig. II-4.3(20): Serious Spalling

Finally, with regard to securement, no anchors were directly examined, but a review of the drawings revealed that the uppermost water table band appears to be reasonably secured by embedment within the masonry backing. However, the panels of the middle band are secured via ¼" ø "non-corroding" metal hooks which loop around vertical steel reinforcing bars located at the panel joints. This appears to be rather minimal, and corrosion is likely to have begun compromising these anchors, at least at the steel reinforcing bars.

4.3.2 Analysis

The absence of appropriate through-wall flashings and flashing caps atop the water table, combined with Juneau's challenging climate, has effectively destroyed this band. Though some additional lifespan could be squeezed out through restoration efforts, this does not appear warranted in view of the scope of this project, and the relatively high cost of any retrofit effort compared to the lifespan extension.

4.3.3 Projected Future Behavior

This element will continue degrading at an accelerating rate, and small pieces will continue to fall off, posing some hazard to people below. Continued corrosion of the anchors will also begin compromising integrity, which could lead to larger chunks falling off, especially in earthquakes.

4.4. Marble Panels at Level 5

4.4.0 General

This subsection pertains to four flat marble panels embedded within the level 5 brickwork.

4.4.1 Summary of Observations

Four marble panels occur within the level 5 brickwork. Two are roughly 3 ½ feet wide and 6 ½ feet tall, and two are the same height but only about a foot wide. The drawings show these as consisting of 2 ½" thick marble, indicating that the larger panels weigh roughly 700 pounds each, while the smaller ones should weigh near 200 pounds. My drawing review did not reveal any specific method for securing these panels, and instrument detection revealed only tenuous and seemingly random signals, implying that these panels may be secured only with mortar bond. Tapping on these panels also revealed many apparently hollow areas, implying only partial mortar bond.

The outer surfaces of these panels are quite rough and eroded, indicating fairly heavy sandblasting, which appears to reflect natural and serious weathering. Some of the marble's veins appear to be possibly cracked. The panel bottom edges are stained dark, resembling mildew staining. Figures II-4.4(1-6) depict these observations.

Fig. II-4.4(1): Marble Panels

Fig. II-4.4(2): Surface Erosion

Fig. II-4.4(3): Poss. Anchor Loc., Erosion

Fig. II-4.4(4): Erosion, Poss. Cracking

Fig. II-4.4(5): Black Staining at Panel Bott. **Fig. II-4.4(6): Staining, Spalled Brick**

4.4.2 Analysis

Though these panels are affected both by weathering and possibly inadequate anchorage, it appears that at least at this stage, the questionable securement represents the primary possible concern.

The weathering degradation is largely a visual distraction, and not much of that, since these panels are so high above any viewing point that the surface erosion is not apparent. The surface erosion may tend to increase moisture absorption, but this can be largely addressed with application of appropriate penetrating repellents. The possible short cracks along veins can also exacerbate infiltration and subsequent freeze-spalling, so this could be a more serious consideration.

The questionable securement could pose a risk to pedestrians below in case of earthquake, as well as possibly due to freeze-spalling.

4.4.3 Projected Future Behavior

The weathering degradation and surface erosion will continue, producing ever-coarsening roughness, which could increase moisture absorption, thus accelerating degradation further. Freezing of water that may penetrate the surface cracks could also lead to spalling.

However, the questionable securement appears to be the primary concern, which could pose a risk to pedestrians below.

4.5. Cornice-Parapet Band at Roof Level

4.5.0 General

This subsection pertains to the entire height of the multi-part band above the level 5 windows and brickwork.

4.5.1 Summary of Observations

The entire band has been painted with an elastomeric coating, precluding direct examination of its composition. However, valuable observations could be made in spite of this.

This horizontal band consists of five different sub-elements. A narrow, protruding rounded terra-cotta band extends along the bottom, with flat terra-cotta panels above this. A protruding narrow band occurs above this. This element is at variance from the construction drawings, and its composition was not tested, but it could be a sedimentary stone, such as sandstone or limestone. Above this is a flat-surfaced band that probably consists of stucco. The parapet cap sits on top of this.

Three primary considerations apply to this band. First, the current configuration does not reflect the building's design or original construction, in that the design included a significant, protruding terra-cotta cornice, which was built, but as a consequence of its ill-advised design, was removed after about three decades due to its degradation.

The second issue concerns this band's securement to the structure, which primarily applies to the flat terra-cotta panels near the bottom. Per the drawings, these panels secure with ¼" ø wires of "non-corroding" metal looped around vertical steel rods within recessed channels in the concrete back-up wall. Checking for embedded steel with instruments revealed only very random and weak signals, casting some uncertainty about this securement.

Another securement concern reflects the fact that tapping on the assumed stucco band above the protruding band produced many hollow sounds, indicating that the stucco may be delaminating in places. In at least one location on the north side, this assumed stucco band appears to bow out, again implying possible delamination.

The third consideration relates to the condition of this band, most notably to the protruding band about 3 feet from the wall top, which is in extremely poor condition. It is in fact disintegrating, dropping up to fist-sized chunks onto the portico roof and ground below. During one visit to the roof, I personally observed one such chunk fall off and shatter on the portico roof below.

Another noteworthy condition-related observation concerns a steel lintel embedded deep within the brickwork directly below this band, which somewhat surprisingly suffered only minor surface corrosion. Figures II-4.5(1-10) illustrate these observations.

Fig. II-4.5(1): Cornice-Parapet Band

Fig. II-4.5(2): Disintegration

Fig. II-4.5(3): Disintegration

Fig. II-4.5(4): Disintegration

Fig. II-4.5(5): Disintegration

Fig. II-4.5(6): Disintegration

Fig. II-4.5(7): Disintegration

Fig. II-4.5(8): Disintegration

Fig. II-4.5(9): Disintegration **Fig. II-4.5(10): Minor Lintel Corrosion**

4.5.2 Analysis

Three primary considerations apply to this band.

The most obvious relates to the severe degradation of its protruding mid-band, which will continue to seemingly randomly shed stone chunks ranging up to about fist-sized, posing an ongoing and immediate risk to pedestrians. During my most recent 2012 visit, I pointed out some “ready-to-go” pieces directly above a walkway on the building’s north side, which were removed the next day. <u>However, ongoing degradation will continue to produce possibly dangerous chunks, so ongoing vigilance and removal of loose pieces are critically important.</u>

A much less apparent issue may relate to the securement of the large flat panels, which appears questionable. This could also pose risk to pedestrians below, primarily during earthquakes. I venture a hunch that appreciable additional freeze-spalling damage would need to occur before weathering issues alone would pose a risk of entire panels becoming displaced, though some limited surface spalling has begun to affect these panels.

The yet-more subtle issue concerns the cornice, which no longer exists, having been removed due to its degradation resulting from its ill-advised, though not atypical design. While subtle, this issue is quite significant, and warrants some explanation.

Let me begin by reiterating that the primary killers of masonry include one-way passage of water through it, and water-absorption followed by freezing. Both lead to spalling and pulverization of the masonry’s outer surfaces, though water’s one-way transport typically affects the innermost surfaces, while freeze-spalling affects the outermost ones. My investigations revealed both interior and exterior face degradation, unambiguously indicating that both factors are at work on this building. This is not surprising, as Juneau’s climate provides near-ideal conditions for masonry destruction, with 220 rainy days annually and 5-months of daily sub-freezing temperatures. To combat this destructive climate, the masonry should ideally be kept as warm and dry as often and for as long as possible.

A projecting cornice can actually help maintain marginally, but helpfully higher temperatures, as well as limit the frequency, duration, and severity of wetting. Not wishing to write a chapter on these subjects, let me at least quickly touch upon both the temperature and wetting issues, as these claims are often met with initial incredulity.

With regard to temperature elevation, the coldest conditions are typically reached on clear winter nights, when all matter radiates infrared heat into the cold Universe. Any projection that limits exposure to the sky also limits this outward radiation, thus helping keep the temperature of any material somewhat higher. One can see this shadowing effect on grass below trees on cold clear mornings, for example, where the grass not overhung with the tree crowns is covered with frost, while the grass “shaded” by the crowns is frost-free. Similar observations can be made regarding dew-formation on car surfaces facing away from such “radiant shadows”, etc.

In short, the building itself raises its own ambient temperature by shadowing itself, and any projecting roof overhang, cornice, or similar features only help enhance this warming effect. The masonry does not need to be kept toasty warm, but any temperature elevation can appreciably reduce the severity of freeze-spalling.

Now, let me proceed to the wetting-reduction effect of a properly designed cornice. Although many may hold the impression that since rain typically falls at an angle, a projecting cornice can only shelter the uppermost portions of the wall below it, as one might naturally project the falling angle to assume that rain will strike the building face below this line. Figure II-4.5(11) illustrates this common, though mistaken, assumption.

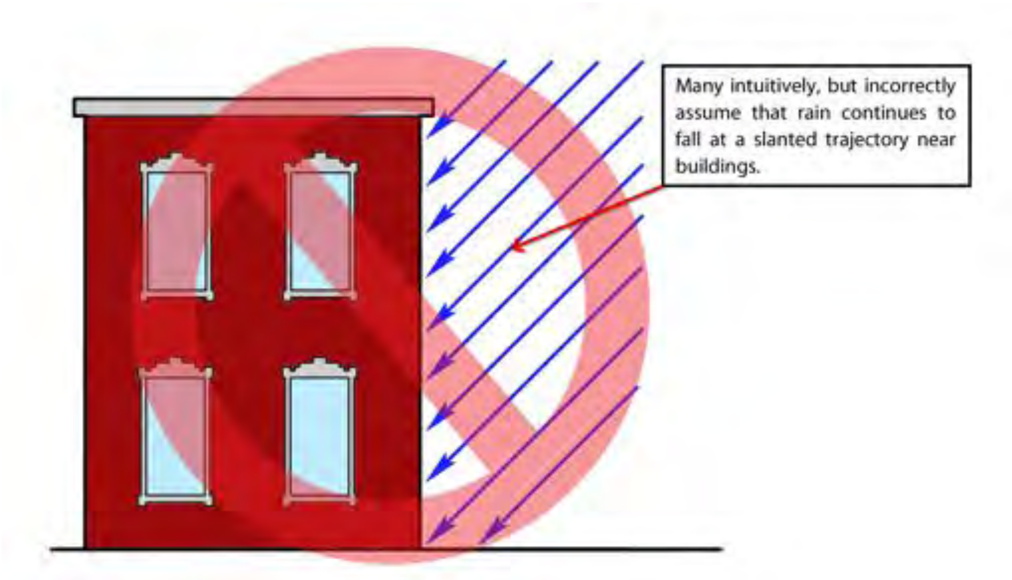


Fig. II-4.5(11): Incorrectly Assumed Rain Trajectory Near Building Faces

In reality, the reason why rain typically falls at an angle is that much of the time, some minor wind pushes the droplets sideways, producing the sloped fall-line, which otherwise would be straight down. This lateral wind force needs to be continually applied near the bottom of the falling trajectory, for if this wind is somehow removed, the droplets would fall along a curved, steepening path.

Since wind cannot blow through a building, it is deflected around it. The airflow near its top is deflected upward over its roof, and the airflow below splits and travels around the corners or falls down before hitting the wall. This removes the lateral force on the droplets, causing them to fall along steepening arcs, rather than wetting the building. Under most conditions, this effect will cause only the uppermost bands of building walls to become wet, even if not sheltered by a cornice or roof overhang. The outer vertical building corners also typically receive more rain exposure than mid-faces. Figure II-4.5(12) illustrates this wind effect. As this claim has often met with disbelief, Figures II-4.5(13-18) show actual buildings during rains or showing stain evidence of this phenomenon. More specifically, Figure II-4.5(13) shows the lee face of a short building, with a narrow wet band along its top, Figures II-4.5(14-16) show the lee and windward faces of three different buildings after three days of heavy and windy rains, and Figures II-4.5(17 & 18) show two stained faces of a building near the Alaska Capitol. All of these photos clearly show that most water reaching the wall surfaces drains down from the uppermost band, rather than resulting from direct rain strikes. This, in turn, should illustrate the benefit afforded by a projecting cornice, which can help deflect away from the building the vast majority of water that would otherwise drain down the walls to damage the masonry.

The surprisingly limited corrosion found at the top lintel also implies that it had benefited from this sheltering effect when the cornice was in place, causing its corrosion to be delayed, though some of this can also be ascribed to the lintel's deep embedment within the masonry.

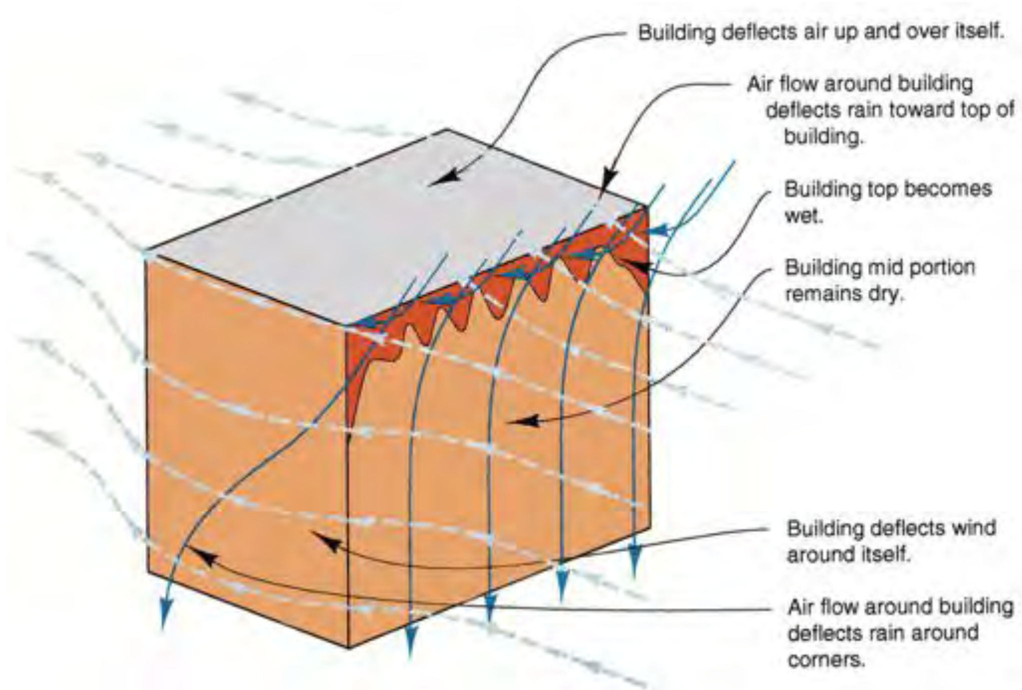


Fig. II-4.5(12): Typical Wind-Flow and Rain Trajectory Near Buildings

Fig. II-4.5(13): Wetting Pattern on Lee Side

Fig. II-4.5(14): 3rd Rain Day Wetting

Fig. II-4.5(15): 3rd Rain Day Wetting Pattern

Fig. II-4.5(16): 3rd Rain Day Wetting

Fig. II-4.5(17): Stain Pattern, Juneau **Fig. II-4.5(18): Stain Pattern, Juneau**

4.5.3 Projected Future Behavior

The severe degradation of the protruding mid-band will continue to pose a hazard to pedestrians below.

The questionable securement of the flat terra-cotta panels could also pose risk to pedestrians below, primarily during earthquakes.

The absence of a protective cornice substantially increases the frequency, duration, and severity of wetting of the exterior masonry. This, combined with the many ledges and absorption surfaces resulting from the recessed brick headers and mortar joints, Juneau's destructive climate, among other factors, will continue to subject this building's masonry to appreciably accelerated weathering degradation.

4.6. Stone Window Sills

4.6.0 General

This subsection pertains to the stone sills which occur along the full height of three vertical window bands at the building's SE corner, along levels 0 and 1 on the east and west elevations, at level 1 of the north ends of both wings, and at nearly all windows facing the courtyard.

4.6.1 Summary of Observations

As with many other elements of this building, relevant observations can be divided into issues of securement, design, and condition.

With regard to securement, these sills appear to rely entirely on mortar bond, with no mechanical anchors. Further, the mortar under most of these sills is degraded and largely delaminated. Thus, these sills appear to be held in place primarily via friction.

With regard to design, these sills, like essentially all other elements on this building, lack any flashings under them or flashing caps atop them. Some interior plaster damage below window sills may indicate infiltration via these un-flashed sills.

In general, the condition of these sills is variable, but for the most part degradation is limited. Various sills have chipped corners and edges, some surface erosion, and one sill on the east face of the west wing is seismically cracked.

Figures II-4.6(1-6) illustrate these observations.

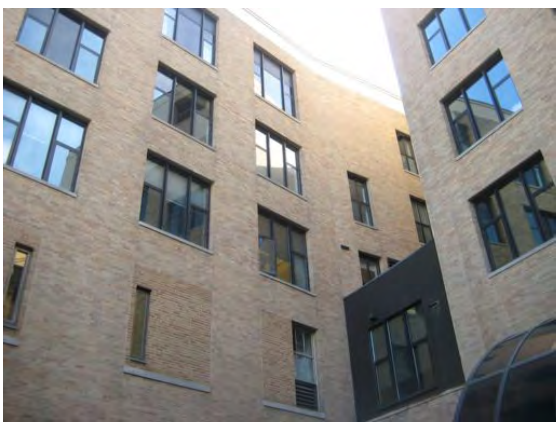


Fig. II-4.6(1): Stone Sills, Courtyard Area

Fig. II-4.6(2): Sill in Good Condition

Fig. II-4.6(3): Minor Chipping & Erosion

Fig. II-4.6(4): Minor Surface Erosion

Fig. II-4.6(5): Moderate Surface Erosion **Fig. II-4.6(6): Cracked Stone Sill**

4.6.2 Analysis

Three primary considerations apply to these sills.

First, lack of mechanical securement poses some increased risk of dislocation during earthquakes, which may present a hazard to pedestrians below. However, compared to similar risks posed by several other elements, this appears to be a relatively moderate risk at most. The one cracked sill on the east side of the west wing poses increased risk, as its outer portion is fully cracked-off.

The absence of flashings below and/or atop these sills exposes the stone to weathering degradation, and also increases risk of interior infiltration.

In general, the condition of these sills is reasonably good, given their age and climate. To a fair degree, this probably reflects the fact that most, though not all, such sills are not fully weather-exposed, being either low on the building and below the protruding, sheltering level 2 water table, or by being on the building's north side.

4.6.3 Projected Future Behavior

Lack of mechanical securement will continue to pose relatively minor-to-moderate risk to pedestrians in case of earthquake.

The absence of flashings will continue to cause relatively slow degradation of most of these sills, and of the brickwork directly below them, except at higher portions of the SE corner, where more rapid degradation should be expected. Infiltration and plaster damage may also result from this flaw, again especially at the SE corner.

4.7. Steel Window-Head Lintels

4.7.0 General

This subsection pertains to the steel lintels above windows that do not have terra-cotta panels above them. These occur along the full height of three vertical window bands at the SE corner, at levels 0 and 1 on the east and west elevations, at level 1 of the north ends of both wings, and at all windows facing the courtyard.

4.7.1 Summary of Observations

Relevant observations pertain to the lintel design and their resultant condition.

With regard to design, these lintels typically consist of doubled-up steel angles that support the brickwork above. They are plagued by several flaws that may be ascribed to design. First, like essentially all other elements, they lack any flashings. Many are also sealed to the brickwork directly above them, thus precluding drainage. Further, these lintels consist of standard steel.

These design-related flaws have resulted in the expected symptoms. The lintels display varying degrees of corrosion. Many in relatively sheltered locations, such as those near wall bases, or located on the west face of the east wing, are still in good condition, with only minor surface corrosion. In contrast, lintels in more exposed locations, such as those at the building's SE corner or on the east face of the west wing, display more advanced corrosion, which, however, still appears moderate and is less advanced than one might expect, given the building's age and climate. Some elevated moisture readings and interior plaster damage near window heads may also relate to the absence of lintel flashings. Figures II-4.7(1-10) illustrate these observations.

Fig. II-4.7(1): Very Minor Lintel Corrosion

Fig. II-4.7(2): Minor Lintel Corrosion

Fig. II-4.7(3): Moderate Lintel Corrosion

Fig. II-4.7(4): Sealed Gap Abv. Lintel

Fig. II-4.7(5): Moderate Lintel Corrosion

Fig. II-4.7(6): Moderate Corrosion

Fig. II-4.7(7): Moderate Lintel Corrosion

Fig. II-4.7(8): Moderate Corrosion

Fig. II-4.7(9): Corrosion Stain on Sealant

Fig. II-4.7(10): Moderate Corrosion

In addition, one lintel on the east face of the west wing appears to have sagged, as have the two brick courses above this lintel, causing a relatively wide gap and mortar delamination above the full width of the window. The lintel at this location is among the most corroded on the building. See Figures II-4.7(11 & 12).

Fig. II-4.7(11): Sagging Brick Above Lintel

Fig. II-4.7(12): Gap Abv. Sag. Lintel

4.7.2 Analysis

The absence of end-dammed flashings atop these lintels contributes to lintel corrosion and also to some of the interior plaster damage near window heads.

The sealing of the lintels to the brick above is counter-productive, as it entraps moisture atop these lintels, accelerating corrosion and exacerbating leak risk.

Use of standard steel for these lintels, with no corrosion protection such as galvanizing, greatly exacerbates corrosion. In fact, the relatively good condition of most lintels is somewhat surprising, given Juneau's climate and the building's age.

The one sagging lintel may be beginning to fail due to corrosion.

4.7.3 Projected Future Behavior

The lintels will continue to corrode, and leakage may persist above some of the weather-exposed windows as a result of the absence of flashings and drainage provisions. This will lead to laminar corrosion, wherein the steel corrodes in distinct layers, causing the brick above to become lifted, which also often causes the supporting brick below the lintels to spall. Figures II-4.7(13 & 14) depict the eventual fate of these lintels, as photographed on another project.

Fig. II-4.7(13): Severe Lintel Corrosion

Fig. II-4.7(14): Spalling Bel. Lintel

5. ENTRY PORTICO

5.0. General

This section pertains to all elements that comprise the entry portico. It is subdivided into subsections, each of which addresses the portico's various components, such as its support base, stairs, columns, etc.

5.1. Support Base For Portico Entry and Stairs

5.1.0 General

This subsection pertains to the portico's support base, including its support structure, granite paving, granite stairs, and granite-clad column plinths.

5.1.1 Summary of Observations

The base structure consists of a series of concrete and brick walls protruding southward from the building. Granite paving, about 9" thick, spans across the tops of these closely spaced walls.

My 2010 field examination revealed signs of stress and deflection that had affected this portion of the portico, as well as other parts of the building. Observed symptoms included obvious differential movement between portions of the entry stairs and the portico floor, as well as cracking of the granite paving and elements above it. The entry stairs and portico floor varied by up to about 3/4" from their original installation elevations, with those portions located below the marble columns typically having been deflected downward.

Much of this differential deflection had been corrected by my 2012 visit, by which time the stairs and paving had been re-leveled, though not entirely.

Figures II-5.1(1-8) depict these observations.

Fig. II-5.1(1): Portico Sub-Structure

Fig. II-5.1(2): Condens. @ Granite


Fig. II-5.1(3): Granite Stair Deflection

Fig. II-5.1(4): Paving Deflection


Fig. II-5.1(5): Re-Leveling of Granite Stairs

Fig. II-5.1(6): Paving Crack


Fig. II-5.1(7): Cracked Portico Roof Support

Fig. II-5.1(8): Cracked Support Stone

5.1.2 Analysis

With regard to the genesis of the observed deflections and cracking, a variety of causes could possibly have contributed to some of these symptoms. However, these symptoms, especially when considered together with relatively widespread manifestations of similar stresses and deflections affecting other portions of the building, are most consistent with seismically induced deflections dating back to some past earthquake(s). To be more specific, the symptoms imply that the columns had swayed in the E-W direction parallel to the building face. This caused the serious cracking of the stone beams supported by these columns. These beams moved E-W with the column tops, but rotated at the building face, which remained mostly in place. The stone cladding supporting these beam ends also rotated with these beams, as its minimal wire anchors allow free rotation of this cladding. This rotation caused the closely spaced cracking of the stone support cladding's bottom pieces, as well as the large, though short crack in the nearby granite paving. This same mechanism caused the cracking observed in the supporting pilaster capitals and adjacent stone window head.

These seismically induced stresses may also have deflected the supporting walls under the portico and caused these to settle down differentially, causing the uneven paving and stairs.

No specific analysis is offered concerning the portico base structure's structural adequacy, as the drawings offer limited information. However, review by the structural engineer did not reveal any major concerns with this base.

5.1.3 Projected Future Behavior

Based on the conclusion that the observed deflections reflect damage from a past earthquake, it appears unlikely that the differential settlement will progress in the absence of subsequent earthquakes.

However, future earthquakes may exacerbate the damage already sustained. The deflections that had already taken place may have weakened the elements supporting the portico, and if this is the case, the portico base could have increased susceptibility to the progression of such damage during subsequent earthquakes.

5.2. Marble Columns

5.2.0 General

This subsection pertains to the portico's four marble columns and associated capitals.

5.2.1 Summary of Observations

Each of these four columns consists of three round marble sections that taper toward their tops, with ornamental stone capitals atop these.

The large marble column sections are laid atop each other, with "cube dowels" within the joints.

My field investigation uncovered several distinct observations.

First, as already noted in section II-5.1.1, the bases supporting these columns have become deflected downward, causing portions to be up to 3/4" lower than adjacent portions.

The marble columns had become weathered and seriously eroded on their SW, SE, and NE exposures. Reddish-brown oxide staining was also observed on some columns. Many cracks, some hairline in width while others appreciably wider, affect the column surfaces. Very high water absorption at such cracks indicates that the cracks are deep.

Figures II-5.2(1-12) illustrate these observations.

Fig. II-5.2(1): Marble Portico Columns

Fig. II-5.2(2): Portico Beams & Cols.

Fig. II-5.2(3): Deep Cracking in Columns **Fig. II-5.2(4): Deep Cracking**

Fig. II-5.2(5): Erosion & Cracking in Cols. **Fig. II-5.2(6): Deep Cracking**

Fig. II-5.2(7): Deep Cracking in Columns **Fig. II-5.2(8): Deep Cracking**

Fig. II-5.2(9): Erosion & Cracking in Cols. **Fig. II-5.2(10): Oxide Staining**

Fig. II-5.2(11): High Moist. Absorp. @ Crack **Fig. II-5.2(12): High Absorption**

5.2.2 Analysis

Several salient issues pertain to these columns.

First, their structural design is clearly inadequate in the sense that the three primary marble sections comprising each column are only "aligned" with each other via the "cube dowels" within the mortar joints between the adjacent sections, but are not really fastened together in any effective fashion. This makes them potentially susceptible to failure in a significant earthquake.

Second, marble may not have been the optimal material to use for these exterior columns. Marble is sensitive to acidic solutions, and over time, slightly acidic rains will etch and erode the surface, which was already observed. Further, marble is characterized by veins, which can lead to differential erosion, which was also observed. Perhaps more significantly, such veins often represent lines of structural weakness, which are susceptible to cracking if subjected to seismic forces. The many relatively wide, and possibly deep cracks along such veins may indicate that some seismic cracking along these veins had already occurred, though it is difficult to discern to what degree this may have compromised the structural integrity of these columns.

Such cracks, once formed, allow subsequent infiltration of water, and when this is combined with freezing temperatures, the expansion of the entrapped ice leads to progressive pushing apart of the stone. Conditions when these columns are both wet and freezing occur frequently in Juneau, and in view of the building's 80 years of existence, this phenomenon is likely to have already begun compromising the integrity of these columns. Appreciable water infiltration into even the minutest hairline cracks was confirmed by testing.

Another concern relates to the stone column capitals, and how the stone beams sit atop these. The issues related to these capitals pertain to the lack of connection between the columns and the capitals as well as between the capitals and the stone beam sections above, the specific configuration of these capitals, the composition of the capitals, and the specific configuration in which the stone beams bear on these capitals. These considerations are outlined in greater detail in section IV-5.2.2 of my 12/31/10 report, and are repeated here only skeletally.

With regard to the connections between the capitals and the columns below and stone beams above, only "cube dowels" occur between the top of the marble columns and the stone capitals, and no mechanical connection of any sort exists between the top of the capital and the stone beam above. This implies that these connections rely primarily on mortar bond. This lack of mechanical connections is worrisome, as extremely heavy and brittle elements are stacked atop each other right above the main entry with little holding these together and in place. As my investigation also revealed significant cracking and loss of mortar bond, it is certain that the bond had been compromised, in places completely, and cannot be relied upon. Many of these stones may be merely stacked like blocks, with no interconnection to adjacent pieces at all. This consideration appears to pose potentially significant risk in case of an earthquake.

The other three issues about these capitals, concerning their configuration, composition, and how they support the beams above, are so intertwined that they need to be discussed together.

Concerning their configuration, these capitals project roughly 9" past the column faces. This creates relatively weather-exposed horizontal ledges that become wet during windy rains. This typically leads to greatly accelerated degradation.

This concern is exacerbated by how the beams sit atop these capitals. In brief, the sections of the E-W beam spanning across the tops of the four columns bear only on the cantilevered edges of the stone capitals, and do not extend above the marble columns at all.

Although the E-W beam sections as well as the south ends of the N-S crossbeams are tied together with an embedded concrete-and-steel beam above the beam sections, I believe that there are grounds for some concern related to the bearing configuration atop these columns, particularly in view of the seismic damage observed at some of these beam ends.

5.2.3 Projected Future Behavior

Two basic considerations relate these columns, including weathering degradation and potential seismic risk. These two phenomena act synergistically. For example, the seismic cracking in the columns allowed deep water infiltration into these cracks, and upon freezing, the expanding entrapped ice pulled these cracks farther apart, leading to yet-accelerated water infiltration.

With regard to the fate of the marble portions of these columns, the above-described processes will continue, leading eventually to their crumbling into distinct pieces. Future earthquakes can greatly accelerate this process by causing deep cracks, thus exacerbating weathering. The presence of seemingly significant cracks in these columns raises particular concerns with respect to possible future seismic events.

The lack of "inter-connectedness" between the column sections, and in particular between the column tops and the roof structure above, combined with the beam loading configuration which concentrates stresses onto the cantilevered portions of the stone capitals, raise serious concern about future seismic stability of these columns and the entire portico. This concern is aggravated by the observed damage and cracking within these columns and supported roof structure.

5.3. Stone Cladding on Exterior Building Wall

5.3.0 General

This section pertains to the stone cladding along the building's exterior wall, but only where it occurs under the portico roof. While this cladding wraps the entire base of the south façade, it forms the structural support for the N-S stone beams that support the portico roof. Consequently, at the portico, this cladding is used in a structural fashion, although this cladding's components are identical at both the portico and beyond it.

5.3.1 Summary of Observations

Relevant observations pertain to structural securement of the cladding elements and to their condition.

With regard to basic configuration and securement, this cladding consists of very large stone pilasters, which align with the four marble columns, along with smaller peripheral pieces. The large pilaster pieces and the abutting larger stone pieces are secured to the embedded concrete columns with 3/8" ø ties which wrap around the concrete columns, then enter into the horizontal mortar joints between the larger pieces, and turn down 2" into holes drilled into the tops of each pilaster piece. In one location, below the second window west of the portico, one such embedded metal tie had corroded sufficiently to spall the stone.

Two primary observations relate to this cladding's condition. The first pertains to widespread and, in places, severe cracking of the structural cladding pieces as well as in the portico base below this cladding and in the portico roof structure supported by this cladding. Wide, sometimes closely spaced cracks occur in the granite paving directly below the cladding pilasters, in the pilaster pieces, at the stone window heads below the portico roof, and in the stone capitals as well as in the stone beams supporting the portico roof. While I found relatively minor symptoms of such stress in the stone cladding away from the portico, major cracks were observed at the bases of the jambs of all three entry doors below the portico. These also occur below the large, short stone crossbeams at the portico ceiling. Figures II-5.3(1-8) depict such cracking, generally starting at the top and proceeding downward.

Fig. II-5.3(1): Cracks in Head, Capital, Beam

Fig. II-5.3(2): Cracked Roof Beam

Fig. II-5.3(3): Beam-Building Separation **Fig. II-5.3(4): Cracked Str. Cladding**

Fig. II-5.3(5): Cracked Structural Cladding **Fig. II-5.3(6): Cracked Str. Cladding**

Fig. II-5.3(7): Cracked Structural Cladding **Fig. II-5.3(8): Cracked Fl. Bel. Pilaster**

Other "condition-related" observations pertain to widespread, severe moisture infiltration, which is much more pronounced in the sheltered location below the portico roof than at the adjacent, weather-exposed locations. For example, severe staining and efflorescence affect the cladding's upper reaches and the adjacent ceiling. Moderate corrosion affects the steel window lintels below the portico's ceiling, and infiltration is apparent inside these sheltered windows. Highly elevated moisture and reddish staining on the interior marble tile imply that anchor corrosion is occurring. Highly elevated moisture near the cladding's bottom also indicates moisture intrusion. Further, the bottoms of all metal doorjambs display serious corrosion. See Figures II-5.3(9-16).

Fig. II-5.3(9): Staining Below Portico Roof

Fig. II-5.3(10): Staining Below Roof

Fig. II-5.3(11): Sheltered Lintel Corrosion

Fig. II-5.3(12): Interior Window Leaks

Fig. II-5.3(13): Interior Oxide Staining

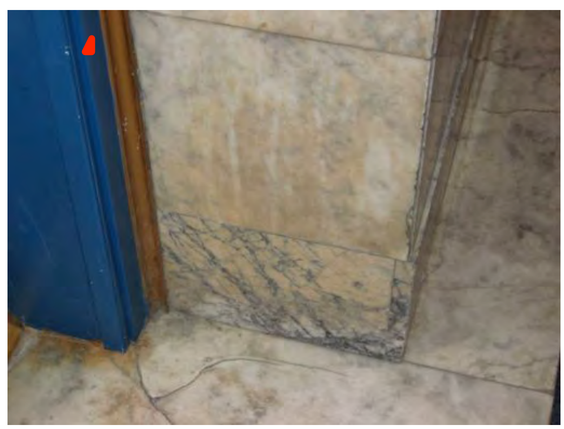


Fig. II-5.3(14): Int. Oxide Staining

Fig. II-5.3(15): Moisture @ Sheltered Cldng. Fig. II-5.3(16): Shltrd. Jamb Corr.

5.3.2 Analysis

Many problems affecting the “portico” portion of the stone-clad walls are similar to those affecting these same walls away from the portico. These are not repeated here in detail.

The problems plaguing these walls fall into two broad categories. The first relates to structural integrity, while the latter concerns water-infiltration and long-term integrity. These are closely intertwined, as the long-term infiltration has exacerbated issues of structural integrity.

As with all other exterior wall types on this building, this wall does not provide much lateral force-resisting capacity, with non-structural brick infill between relatively slender concrete columns.

As with the weather-exposed portions of the stone-clad walls, the stone’s securement to the structure is inadequate at the portico, providing nearly inconsequential wire anchors spaced with an approximate density of one anchor per 15 square feet of stone cladding. Further, the long-term and relatively severe moisture infiltration that has been draining into this wall has almost certainly compromised the integrity of even this minimal securement.

Concern regarding the stone’s securement is severely heightened by the support of the stone crossbeams by the cladding pilasters, which are seriously damaged by seismic cracking, as well as by displacement and cracking affecting the pilaster capitals and the ends of the crossbeams. The combination of these factors poses serious risk in future earthquakes.

The second broad category of issues pertains to water infiltration and resultant degradation. This cladding lacks through-wall flashings, weep provisions, and other features desirable in masonry-clad walls. However, of greatest concern is the long-term severe infiltration draining into this wall from the masonry above the portico roof. This infiltration has detrimentally affected essentially all parts of this wall. This has by now almost certainly compromised the steel wire ties securing the stone, has begun corroding steel lintels above windows, and damaged the stone.

5.3.3 Projected Future Behavior

The problems plaguing this stone-clad wall pose serious risks.

This wall is vulnerable to significant seismic damage. Inadequate spacing of anchors, combined with eight decades of degradation, corrosion, and seismic damage, significantly increase susceptibility to damage and collapse during earthquakes. This concern is particularly exacerbated by the apparently compromised support of the portico roof’s crossbeams by the pilasters, due to cracking and dislocation affecting both tops and bottoms of these pilasters.

Infiltration from masonry above the portico roof, and perhaps from the roof itself, will continue to degrade the cladding, window lintels, doorjambs, and interior surfaces at scattered locations.

5.4. Portico Roof Structure

5.4.0 General

This section pertains to the elements comprising the portico's roof structure, including the entablature beam, embedded concrete beam above the entablature, stone crossbeams, steel lintels, stone water table, concrete roof slab, stone ceiling panels, and related elements.

5.4.1 Summary of Observations

Relevant observations pertain to structural support of the roof structure and its securement to the building, and to the roof structure's condition.

With regard to basic configuration, the roof structure consists of four short stone N-S crossbeams. Their north ends sit atop the stone pilasters along the building's exterior face, while their south ends rest on the marble columns. Three similar stone beams span in the E-W direction over the column capitals, and are tied together with a small concrete and steel beam atop them. This concrete beam is tied back to the building's brick walls with very small steel straps spaced roughly 6'-0" apart. Ornate stone ceiling panels are placed across the tops of the stone beams, but are not mechanically secured. A horizontal stone water table sits atop the concrete beam over the marble columns and continues around the corners to the building face. These stone water table sections are also not mechanically secured to the portico roof. Short brick cripple walls are laid atop the stone ceiling panels and the stone beams to support a 3 ½" thick sloping roof slab.

My investigation uncovered worrisome manifestations affecting this roof structure. As many of these also relate to other components, some are outlined in greater detail elsewhere, and are only repeated here in a cursory fashion. As with nearly all other elements on this building, my findings concerning the roof structure fall into the two broad and interrelated categories of structural adequacy and water infiltration and resultant damage.

In brief, the field findings of direct structural concern are as follows. First, the large stone N-S crossbeams are supported by the stone pilaster capitals and by the marble columns. However, there are no mechanical connections, other than questionable mortar bond, between these crossbeams and their supporting columns, pilasters, and capitals.

Further, the supporting marble columns display possibly structurally significant cracking, and the three sections comprising these columns are secured to each other only with "cube dowels", which provide very limited attachment between these sections.

Also, the pilasters supporting the north ends of these crossbeams are cracked in many locations at their very tops and very bottoms, and such cracking appears to have appreciably compromised the integrity of these pilasters.

The crossbeams also display relatively severe cracking at the south ends of the far west and far east beams, and additional cracking occurs at both their north and south ends. Seismic displacement has separated the ends of these beams from the structure at some of their north ends. In places, the observed cracking and displacement have greatly reduced the effective bearing surface supporting these beams.

Structurally-related observations pertaining to the three E-W entablature beam sections spanning across the tops of the marble columns concern the absence of any direct mechanical connections between these beams and the column tops, as well as apparently limited bearing surfaces afforded by the stone column capitals. In brief, no mechanical connections secure these beam sections to the columns or capitals below, although a composite concrete-steel beam spanning in the E-W direction above the beam at least connects the various sections together. Further, the E-W beam sections bear mostly on the cantilevered portions of the column capitals.

In short, it appears that the roof structure was inadequate to begin with, and has been appreciably compromised by seismic damage. Figures II-5.4(1-12) illustrate these observations.

Fig. II-5.4(1): Cracks in Head, Capital, Beam **Fig. II-5.4(2): Cracked Crossbeam**

Fig. II-5.4(3): Cracked Beam End **Fig. II-5.4(4): Cracked Beam End**

Fig. II-5.4(5): Cracked Beam End **Fig. II-5.4(6): Cracked Beam End**

Fig. II-5.4(7): Cracked Beam End

Fig. II-5.4(8): Cracked Beam End

Fig. II-5.4(9): Cracked, Hanging Bm. Chunk

Fig. II-5.4(10): Cracked-Off Chunk

Fig. II-5.4(11): Cracked Support Pilaster

Fig. II-5.4(12): Cracked Column

A further observation concerns both structural and water-infiltration issues. Namely, profuse signs of long-term infiltration are apparent at the portico ceiling, and such infiltration can be traced fully down within the stone wall cladding. These signs include efflorescence, lime, and brownish as well as reddish staining. Tapping on the stone ceiling indicates that the moisture degradation may by now have caused internal, concealed delamination within the stone. The reddish staining may be an indication that the minimal steel straps securing the four marble column tops to the building have been compromised by corrosion. Further, the large, projecting stone water table pieces had become moderately degraded, with surface erosion, some spalling, loss of mortar, lichens growth, and similar manifestations. No through-wall flashings were found anywhere in the portico roof structure, or anywhere else on the building. See Figures II-5.4(13-18).

Fig. II-5.4(13): Leakage at Ceiling

Fig. II-5.4(14): Ceiling Leakage

Fig. II-5.4(15): Leakage at Ceiling

Fig. II-5.4(16): Ceiling Leakage

Fig. II-5.4(17): Leakage at Ceiling

Fig. II-5.4(18): Water Table Degrad.

5.4.2 Analysis

As with many other portions of this building, the portico roof structure is affected by the intertwined factors of structural and water-degradation issues.

Perhaps the most concise way to summarize the structural issues is to clarify that I would run, with a great deal of motivation, away from this portico in the event of even a moderate seismic tremor. Essentially all parts of the portico roof, and of the elements supporting it, appear inadequate in their initial design to begin with, and many of these have since been compromised further by seismic damage and water degradation.

Starting at the bottom of the roof-supporting structure, the marble columns and their stone capitals consist of separate sections with no connections between these, and cracking of possible structural significance has affected these columns.

Similarly, the stone pilasters supporting the portico roof's crossbeams are inadequately secured to the building structure as designed, and the metal ties which secure these have probably been damaged by seismic events, and have almost certainly been compromised by corrosion resulting from long-term infiltration. Cracking at both the tops and bottoms of these stone pilasters has further compromised the integrity of the structure supporting the portico roof.

Cracking and separation at the portico roof's N-S crossbeams appear to reflect additional seismic damage and further threaten the integrity of the roof structure.

Absence of any mechanical connections securing the stone ceiling panels, combined with apparent damage from long-term infiltration, poses additional hazards to pedestrians below.

The minimal steel straps securing the portico roof to the building walls were also never adequate to begin with, and these have by now almost certainly been compromised by corrosion.

The wide stone water table is ill conceived in its weather exposure, causing accelerated degradation. Absence of through-wall flashings allows infiltration into the roof structure, which may by now have also begun to corrode the steel channels within the concrete beam embedded within the roof structure.

5.4.3 Projected Future Behavior

In the absence of earthquakes, the portico roof structure will continue to experience accelerating degradation, which will pose an increasing safety risk.

Pieces of stone, ranging from very small to potentially life-threatening, are likely to fall off the ceiling panels and surrounding stone trim at seemingly random times, and freezing water within the ceiling panels may exacerbate this risk.

Cracking in the marble columns may progress deeper, again largely through the action of freezing expansion of entrapped moisture within these cracks.

Continued infiltration into the stone water table will cause accelerating degradation, particularly along the top outer surfaces, which may begin shedding pieces along the outer edge. Such infiltration is also likely to exacerbate corrosion of the steel channels and fasteners at the embedded concrete beam, which will eventually lead to cracking and spalling of the E-W sandstone entablature beam, especially along its outer face.

In the event of a moderate or greater earthquake, a wide range of possibilities appears plausible. The generally inadequate design, combined with past seismic damage and serious water degradation of many elements, makes serious, life-threatening failures entirely plausible.

5.5. Stone Railing

5.5.0 General

This section pertains to the stone elements comprising the portico roof's perimeter railing.

5.5.1 Summary of Observations

The railing consists of a horizontal base atop the water table, with railing "posts" above each column and at the building face. Spaced balusters sit atop the base, and are capped with a horizontal rail cap. The railing posts are capped with stone caps.

Primary observations again pertain to structural, general design, and condition considerations. With regard to structural issues, many of the stone railing pieces are not mechanically connected to any other elements, and rely entirely on mortar bond to stay in place. I was actually able to move a large cap piece directly above the stairs below, weighing roughly 200 pounds, back and forth, indicating this absence of connections as well as loss of mortar bond.

With respect to general design, this railing exposes all of its stone elements directly to the weather, with no flashing caps to limit infiltration into the stone, and no through-wall flashings to limit water intrusion into the water table and roof structure below.

This leads suitably to a discussion of the railing's general condition, which has been partly compromised by both seismic damage and weathering. In terms of weathering, the railing displays appreciable degradation, including extensive surface erosion, spalling, and loss of mortar bond and integrity, which in turn exacerbates water infiltration into the masonry below. Figures II-5.5(1-6) illustrate the weathering damage.

Fig. II-5.5(1): Railing Weathering

Fig. II-5.5(2): Railing Weathering

Fig. II-5.5(3): Railing Spalling

Fig. II-5.5(4): Railing Spalling

Fig. II-5.5(5): Railing Spalling

Fig. II-5.5(6): Loss of Mortar Bond

Cap can be moved freely.

The railing also displays seismic stress, including cracking and dislocation, which is most evident at its juncture to the building face at the portico's NW corner. See Figures II-5.5(7-10).

Fig. II-5.5(7): Seismic Cracking of Railing

Fig. II-5.5(8): Seismic Cracking

Fig. II-5.5(9): Seismic Dislocation

Fig. II-5.5(10): Seismic Cracking

5.5.2 Analysis

The railing suffers from some ill-advised design and material choices and structural deficiencies.

The absence of mechanical connections between the railing's various pieces and abutting elements poses significant hazard in case of earthquake. This risk is greatly exacerbated by the significant loss of mortar bond observed at various locations, as well as by the seismic damage that already affects it.

With regard to design and materials, stone generally does not perform well if placed in weather-exposed locations with any skyward-facing surfaces. It absorbs water, which with subsequent freezing causes it to spall, exfoliate, and erode, and these symptoms are apparent on this railing. Flashing caps and through-wall flashings should have been incorporated to limit water intrusion and protect the stone from weathering.

5.5.3 Projected Future Behavior

From a weathering perspective alone, the factors that already affect this railing will continue to do so, though at an accelerating rate. Small pieces will continue to flake off, surface erosion will continue, and what little mortar bond still remains will also degrade. In the absence of future earthquakes, the condition of this railing will become unacceptable to the casual observer, probably within about 30 years.

However, the degradation and damage already suffered by this railing, if combined with even a relatively moderate earthquake, will pose major safety risks to pedestrians below.

5.6. Portico Roof, Drains, and Associated Flashings

5.6.0 General

This section pertains to the portico's roof membrane, drains, and associated flashings.

5.6.1 Summary of Observations

The roof slopes inward, toward the building, as well as east and west from a central ridge toward two drains. These drains are recessed within deep sumps. No overflow drains are provided.

The drawings show this roof as consisting of copper. However, my examination revealed that it consists of an asphaltic built-up roof membrane. Along the edges, the built-up roof laps over copper, which I initially took as flashings. However, the drawings, combined with my field examination, imply that perhaps copper sheet roofing had been installed originally, but due to leakage, a built-up roof may have been installed over the copper in an unsuccessful effort to address the leakage.

Along the roof's perimeter, copper counter-flashings are inserted about an inch into reveals in the stone along the portico's perimeter. Where this roof abuts the masonry building walls, the copper roof extends up the walls, and a copper flashing, inserted about 1" into the mortar joint, counter-flashes over this. No through-wall flashings occur at this juncture.

My field examination of the built-up roof revealed that it is quite degraded, and that it has largely delaminated from the copper at the interface to the building, allowing water to drain under the roof membrane. This may be a factor contributing to severe leakage apparent at the ceiling below.

Three window sills occur very close to the roof surface. Their sill flashings turn up along their edges and tuck under separate copper flashings inserted about an inch into the horizontal mortar joint below a stone band at the base of the masonry wall. These sill flashings penetrate under the aluminum windows, whose sills are sealed to these flashings, with no weep provisions. Figures II-5.6(1-8) illustrate these observations.

Fig. II-5.6(1): Portico Roof Configuration

Fig. II-5.6(2): Roof Drain in Sump

Fig. II-5.6(3): Roof Delamination

Fig. II-5.6(4): Roof Delamination

Fig. II-5.6(5): Roof Alligatoring

Fig. II-5.6(6): Ceiling Leakage

Fig. II-5.6(7): Roof-Building Juncture

Fig. II-5.6(8): Roof-Bldg. Juncture

5.6.2 Analysis

Relevant issues pertain to this roof's design and condition.

The roof's design is improper in several respects.

The primary flaw is that no through-wall flashings occur along the roof-wall junctures. As a result of this intrinsic flaw, water within the masonry walls above this roof migrates down within the masonry, and upon reaching the portico roof-wall juncture, it continues its downward migration into the roof below. Through-wall flashings should have been incorporated along this roof-wall juncture to capture this water and drain it back out of the wall, onto the portico roof. Correction of this flaw is severely complicated by the header courses in the brick walls, wherein the brick is turned 90 degrees to span across two adjacent wythes. These header courses, which occur at every 7^{th} brick course, create ledges, upon which water may accumulate and drain deeper inward into the wall. Thus, while retrofitting of through-wall flashings, though costly, is typically feasible and effective in solving these types of infiltration problems, it does not appear possible to correct this infiltration problem with absolute certainty by retrofitting such flashings in this case.

A generally similar flaw occurs at the portico's outer perimeter, where no through-wall flashings occur below the railing base, thus allowing water to permeate into the water table and beams below, causing leakage and degradation.

The absence of overflow drains is counter to typical code requirements, and can lead to overloading the roof in case the primary drains clog. However, in this case, this risk appears quite limited, so I don't believe this is a significant issue from any realistic perspective.

Several flaws also occur at the roof-window sill junctures. First, the close proximity of the roof surface to the sills is problematic, and increases leak risk, particularly during wet snow periods.

The fact that the copper sill flashings are sealed to the aluminum windows above them, combined with the absence of weep provisions in these windows, further exacerbates leak risk. Water inherently enters the aluminum window sills, and as these windows lack weeps and the copper flashings are sealed to the window extrusions, drainage is precluded from under the window sills, which probably contributes to the leakage.

The close proximity of copper flashings to aluminum windows may also pose added risk of electrolytic corrosion, as these two metals are not compatible, and must be isolated.

With regard to the roof's condition, the built-up membrane is quite deteriorated, and its delamination from the underlying copper along the building juncture makes this roof ineffective.

5.6.3 Projected Future Behavior

Ongoing infiltration into the roof structure and into the stone cladding below will persist unless some through-wall flashings are retrofitted along the roof/wall junctures. This will continue the already severe degradation of the stone ceiling and wall cladding. Corrosive degradation of the window lintels below the portico roof will also continue, and this may compromise the structural integrity of these lintels within perhaps forty years. Corrosion of the steel straps which secure the portico to the building, and of the steel ties which secure the stone pilasters and cladding to the building below the portico roof, will also continue, though it is quite plausible that the integrity of these elements may already have been effectively compromised in various locations by the long-term corrosion which has already occurred.

Occasional leakage may occur below the window sills, especially during periods of wet snow, due to the proximity of the sills to the roof. Infiltration is also likely to continue due to the absence of weeps in the aluminum window sills and the sealing of these sills to the copper flashings.

The absence of overflow drains poses some risk of overloading and possibly increased leak risk if either of the two primary drains clogs. In this case, the risk of overloading appears improbable.

6. INTERIOR ARCHITECTURAL ELEMENTS

6.0. General

This section addresses issues related to the interior architectural elements including the wall, floor, and ceiling construction and finishes.

6.1. Interior Faces of Exterior Building Walls

6.1.0 General

This subsection pertains to the portions of the interior architectural elements affected by the seismic retrofit and exterior wall renovation, primarily the interior faces of the exterior walls.

6.1.1 Summary of Observations

The interior faces of the exterior walls consist mostly of hollow clay tile surfaced with painted plaster. The Governor’s Office, the House and Senate Chambers, the House Speaker’s Office and the House and Senate Finance Committee Rooms and a few other rooms have wood paneling. The restrooms have ceramic wall tile finishes.

Most of the flooring is carpeting and most of the ceilings are suspended acoustical panel systems.

6.1.2 Analysis

No analysis applies to these aspects, other than to note that the interior finishes along the exterior walls will need to be removed to accommodate the structural and masonry work outlined elsewhere in this report.

6.1.3 Projected Future Behavior

This subsection does not apply to this aspect.

7. MECHANICAL SYSTEMS

7.0. General

This section addresses issues related to the building's mechanical systems, including heating, ventilation, plumbing, and fire sprinkler systems.

7.1. General Mechanical Systems

7.1.0 General

This subsection pertains to the mechanical systems affected by the work on the exterior walls, and mechanical systems affected by other seismic retrofit work.

7.1.1 Summary of Observations

The heating system for the building consists of oil-fired steam boilers located on the ground floor, steel steam distribution and condensate piping and cast iron registers. The registers are located primarily on the exterior walls and are fed by vertical risers from the crawl space. The piping is insulated with asbestos-containing insulation. The boilers were replaced in 2010 along with the associated piping. The vertical risers and cast iron registers are mostly original dating to the construction of the building.

Most of the building is not served by a mechanical ventilation system. The areas that are served include the east wing of the ground floor, the first floor, the House and Senate Chambers on the second floor and the Governor's office on the SE corner of the third floor. In addition there are exhaust systems serving the restrooms and the Legislative Lounge on the second floor.

The plumbing systems consist of domestic water supply piping and waste and vent piping. The piping is a mixture of original galvanized steel and more modern copper piping.

The fire sprinkler system was installed in 2009 and consists of steel piping.

7.1.2 Analysis

No analysis applies to these aspects, other than to note that some elements of the mechanical systems will need to be removed or relocated to accommodate the structural and masonry work outlined elsewhere in this report.

For example, the heating system piping and registers will need to be removed as part of the seismic retrofit and exterior renovation. The system will be converted to hot water from the existing steam heating.

The ventilation, plumbing and fire sprinkler systems will be unaffected by the retrofit and renovation and will remain, except where there may be a conflict in the crawl space or in interior walls that are retrofitted.

7.1.3 Projected Future Behavior

This subsection does not apply to this aspect.

8. ELECTRICAL SYSTEMS

8.0. General

This section addresses issues related to the building's electrical systems, including power, lighting and communication systems.

8.1. General Electrical Systems

8.1.0 General

This subsection pertains to the electrical systems affected by the work on the exterior walls and electrical systems affected by other seismic retrofit work.

8.1.1 Summary of Observations

The exterior walls generally contain very little in terms of electrical systems as most of the power, lighting and communication distribution is through the ceiling space and interior walls.

8.1.2 Analysis

Where the interior portion of the exterior walls is replaced allowing electrical devices to be added this will be done in coordination with the use of the interior spaces.

8.1.3 Projected Future Behavior

This subsection does not apply to this aspect.

III. GENERAL DISCUSSION OF CORRECTIVE OPTIONS

1. GENERAL INTRODUCTION

1.0. General

This report describes the building's various deficiencies in Part II, then presents three different corrective options in some detail, in Parts IV, V, and VI. This Part III provides a more integrated and holistic discussion of the relative advantages and inherent limitations of these three corrective approaches. The prime intent of this part is to afford the State of Alaska the opportunity to make the most technically informed corrective selections from the possible options.

1.1. Overall Summary of Deficiencies

In the case of this particular building, it is essential to understand the inherent limitations of the existing exterior masonry cladding elements as a basis for informed corrective decisions. Let me outline some of these considerations.

First, the building is deficient structurally, in that it is excessively vulnerable to seismic damage, and displays past earthquake damage, particularly at the entry portico, but scattered elsewhere as well. This poses safety hazards to occupants and pedestrians, as well as risks of costly damage. This issue can be addressed in a vaguely similar way in all three corrective approaches, and involves, among other things, addition of new concrete shear walls and foundations. In general, new concrete shear walls are proposed along the exterior building walls in all three corrective options. Similarly, the defects and extant damage to the entry portico warrant complete replacement of the portico roof structure in all three corrective options. This structurally-related work is quite major, with inherent disturbance of use, and with appreciable impacts on rooms abutting the exterior walls. Among other aspects, this work involves removal of interior plaster and hollow clay tile walls from the exterior walls, thus also exposing much mechanical and electrical work, such as piping and electrical conduits, etc., which will need to be relocated to accommodate the structural work. In short, this is a major project with large costs and substantial disturbance of occupants in all three options, even in the seemingly least disruptive Option 1, which attempts to maintain as much of the existing building as is feasible. At the same time, a project of this scope allows, and in many cases logically dictates, that other affected existing systems be upgraded to enhance performance, energy efficiency, comfort, safety, etc.

The building also suffers some interior leakage and moisture damage in its sub-grade floors and walls. These issues can also be addressed in the same fashion in all three primary corrective approaches.

The differences and underlying reasons for the three corrective approaches become apparent when the building's exterior masonry walls and related elements begin to be considered. Significant flaws affect these exterior masonry assemblies, requiring extensive work even in the seemingly least-disruptive Option 1 approach.

The deficiencies of the exterior masonry walls can be divided into the three categories of Structural Concerns, Water-Resistance Vulnerabilities, and Energy-Efficiency limitations.

Structurally, essentially all of the exterior masonry lacks adequate capacity to resist lateral loads, the masonry walls lack anchorage to the concrete structure, and most masonry elements, such as the large level 2 water table, lack adequate anchorage to the exterior walls. As outlined in paragraph 2 of this subsection, lateral load resisting capacity is enhanced in all three approaches by adding concrete shear walls. In addition, the Option 1 Restoration approach requires very significant re-anchoring of the exterior brick and stone elements. In the Option 2 and 3 approaches, such anchorage would be achieved in the process of replacing the brick cladding.

The existing exterior walls suffer a variety of fundamental water-resistance vulnerabilities, many of which are intricately interrelated. As all masonry is inherently absorbent, exterior masonry walls should incorporate drainage cavities, through-wall flashings, and weep provisions to limit the depth of water penetration, and capture and drain any water entering the walls back out. None of the existing exterior walls contain any such features. Further, the existing brick walls contain deeply recessed header courses and mortar joints, which greatly increase permeation and allow water to enter deeply into the wall assemblies. This has already caused appreciable degradation of the masonry, which in turn exacerbates yet greater permeation, resulting in a vicious cycle. The exterior faces of the brick have been deeply eroded, as if sandblasted, and this has removed the brick's most weather-resistant and most durable outer skin, making the brick walls yet more susceptible to further permeation and degradation.

From an energy-efficiency perspective, the existing exterior walls lack any insulation, and consequently, the building requires significant energy use to maintain thermal comfort through Juneau's prolonged cold season, which seems to extend from January 1st through December's end.

1.2. Inherent Limitations of Retrofit Approach

The building's structural, water-infiltration, and energy-efficiency issues should be addressed in all corrective options to the greatest feasible extent.

All three options described in this report address the structural concerns, although even in this respect, the Option 1 retrofit approach yields less satisfactory results than either of the other two options. This largely reflects the fact that Option 1 results in the heaviest structure of the three options, thus increasing lateral seismic loads and reducing seismic safety.

However, it is critical to understand that the Option 1 retrofit approach has very significant limitations when it comes to the water-infiltration and energy-efficiency considerations, which are so intertwined that they cannot be discussed entirely separately.

Let me begin with a brief discussion of masonry's twin mortal enemies of moisture saturation combined with freezing, and persistent one-directional moisture migration.

With regard to freezing of wet masonry, when water-saturated masonry freezes, the embedded water turns to ice and begins to expand. On the other hand, the masonry, like nearly all materials, shrinks with cooling, and the expansion of the embedded ice combined with the shrinkage of the masonry causes internal stresses, especially near the masonry's outermost faces, which leads to spalling of the outer masonry layers.

One-way moisture transport through masonry causes the masonry's integral salts to dissolve into the migrating water, which then transports these salts inward. At the masonry's inner faces, the water evaporates and leaves the salts behind, causing it to crystallize. Much like expanding water ice, the recrystallizing salts produce expansion stresses along the inner masonry faces, causing these to spall and pulverize.

Both of the exterior-face freeze-spalling and the inner-face crystallization-spalling were observed on this building, indicating that both phenomena are occurring.

Now, let me quickly jump to a brief discussion of Juneau's climate. In skeletal form, Juneau experiences roughly 220 rainy days annually, and freezing temperatures occur on every average day during the 5-month duration of the cold season. In short, Juneau's climate provides both ample water and freezing temperatures, and is inherently very challenging for all masonry.

In view of these considerations, it is important to keep the exterior masonry of this building as warm and as dry as dry as possible, and to limit the frequency of its wetting and freezing as much as possible. All three approaches attempt to limit the frequency and severity of wetting by reconstructing a roof-level cornice. However, in view of the existing serious damage to the outer brick faces, the many water-catching ledges, and the header courses in the existing brickwork, it is particularly important to limit water absorption and freezing.

Although a major project such as this can afford the opportunity to enhance energy efficiency by adding insulation, with the Option 1 retrofit approach, the addition of insulation will by definition lower the temperature of the outer masonry, thus causing higher moisture levels and greater frequency, severity, and duration of freezing temperatures. In other words, the currently energy-inefficient exterior walls actually help protect the masonry from degradation, as the escaping heat helps to dry and warm-up the masonry. Figure III-1.2(1) illustrates this effect. In view of this consideration, I do not recommend adding any more than roughly 2" of rigid insulation to the walls in the Option 1 retrofit approach, and even this should be done only in combination with the addition of the cornice to help reduce wetting frequency and severity. In short, one of the prime limitations of the Option 1 approach is that the energy efficiency of the exterior walls cannot be significantly enhanced without risking an acceleration of the already serious weathering degradation of the masonry. This consideration is a much lesser concern with either of the reconstruction approaches, as these would replace the seriously damaged, surface-eroded brick with new brick which still has its water-resistant fired outer skin, and infiltration into it can be further reduced by eliminating or greatly reducing the recessed header courses and mortar joints.

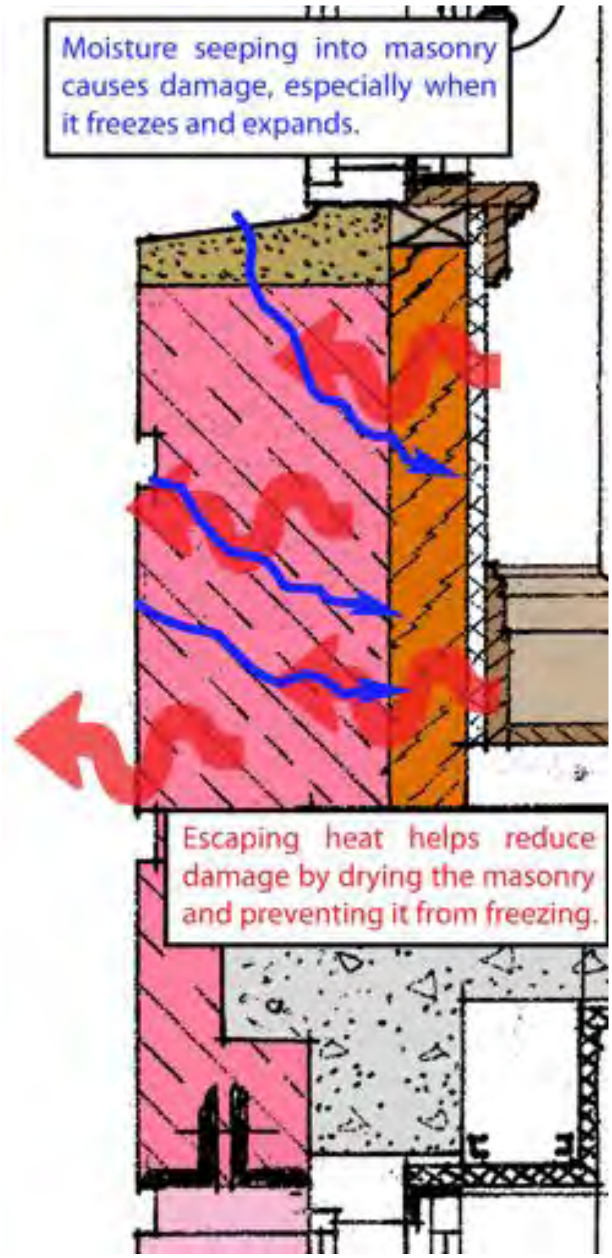


Figure III-1.2(1): Drying & Warming Effect of Current Energy-Inefficient Walls

The existing masonry walls are also inherently susceptible to continued degradation and interior leakage, as these lack any drainage cavities, through-wall flashings, or weeps, and the deeply recessed header courses and mortar joints, as well as the extant surface erosion, appreciably exacerbate moisture absorption and allow its deep penetration into the walls. While the recommended corrective actions for Option 1 include retrofitting of through-wall flashings at certain locations to reduce infiltration into the walls and into the portico roof in particular, the complete effectiveness of such retrofitted flashings cannot be guaranteed, as the many recessed header courses can allow water to penetrate inward of any retrofitted flashings. In short, while execution of the Option 1 retrofit option should appreciably slow-down further degradation and reduce interior infiltration, the brick will continue to degrade, and some degree of infiltration may also persist.

In short, the existing building's design is rather ill suited to Juneau's persistently wet and cold climate, and while the Option 1 retrofit approach attempts to alleviate the building's inherent vulnerabilities, it will only slow but not stop further degradation of the brick, and some interior leakage may also persist. In view of these considerations, I cannot recommend this retrofit approach, as the state will end up spending tens of millions of dollars to still have a relatively energy-consumptive building that will continue to visibly degrade with time, may still suffer some interior leakage, will require costly ongoing maintenance, and will not provide the same level of seismic safety of Options 2 or 3. This logic formed the basis for developing and evaluating the Option 2 and 3 approaches, for though these may seem like rather drastic cures, they both largely address the inherent limitations of the Option 1 retrofit approach.

1.3. Outline of Corrective Approaches

1.3.0 General

This subsection summarizes the three primary corrective approaches described in this report.

1.3.1 Approach 1: Retrofit Existing Masonry & Structure

This approach strives to retain existing elements to the greatest reasonable degree. All existing masonry which can be salvaged without incurring needlessly large costs, relative to other options, and which can provide adequate safety, performance, and projected lifespan, are generally kept in this approach. However, some elements, such as the front portico, terra-cotta panels, or windows, are so damaged or ill suited that replacement is warranted even within this "retrofit" option. This approach does not significantly alter the existing exterior wall assemblies, and thus retains their inherent vulnerabilities, as described in the preceding section III-1.2.

PL:BECS does not recommend this approach, as its projected construction cost of 18.1 million dollars represents roughly 83% of the projected cost of Option 2, while providing an exterior cladding which will continue to degrade, will require significant ongoing maintenance, is likely to require additional significant work within perhaps 40 years, produces a building which will need much higher ongoing heating expenses, will not yield quite comparable levels of seismic safety, provides somewhat less useable interior space, and which may continue to suffer some degree of ongoing interior leakage. In short, this approach costs nearly as much as Option 2, while providing a vastly inferior building whose exterior cladding may have 1/3 the lifespan of Option 2.

Figures III-1.3(1-7) illustrate this approach at several typical locations. Please see Part IV for a more detailed description of this approach.

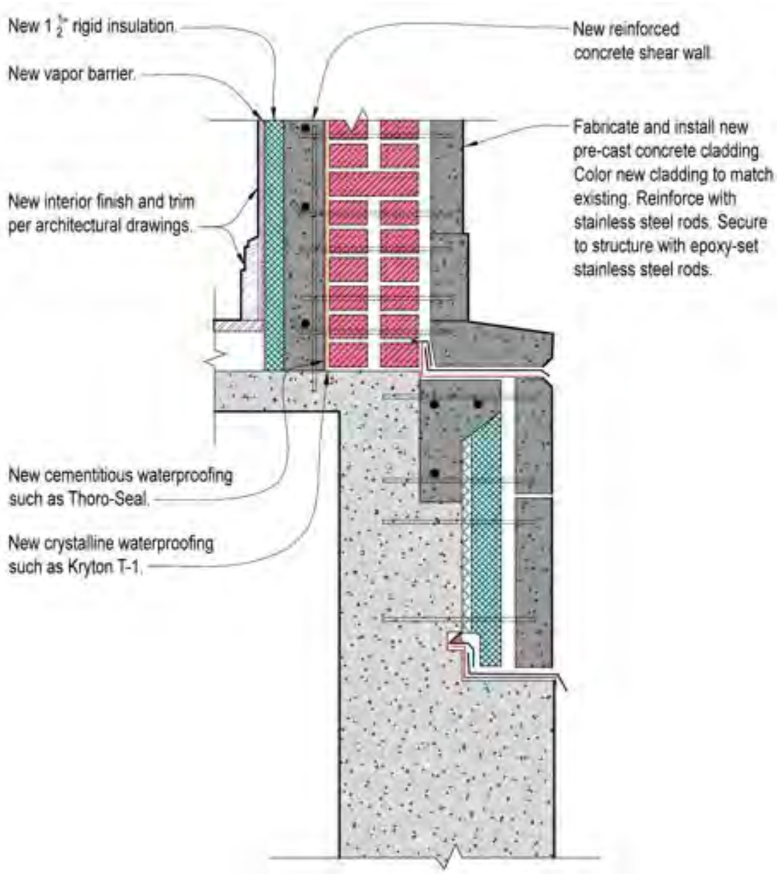


Fig. III-1.3(1): Option 1 Restoration Approach at Stone Wall Base, South Side

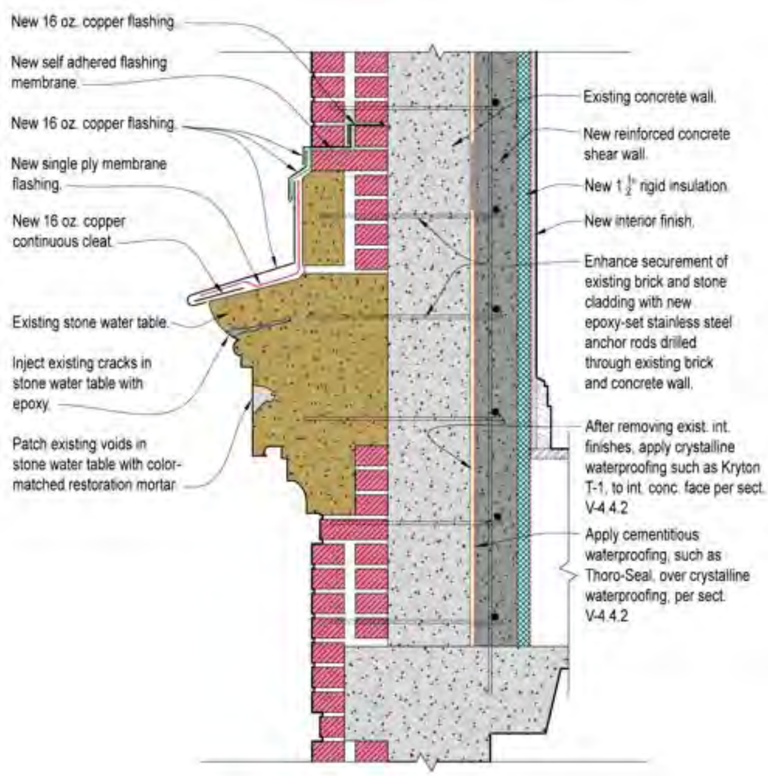


Fig. III-1.3(2): Option 1 Restoration Approach at Level 2 Stone Water Table

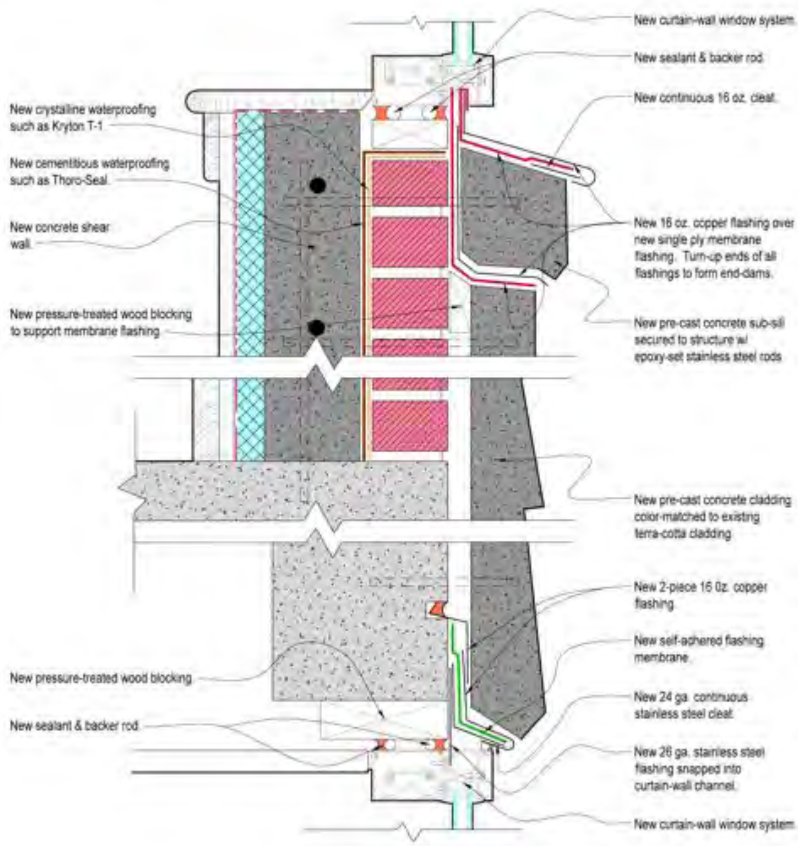


Fig. III-1.3(3): Option 1 Restoration Approach at Typical Public Façade Windows

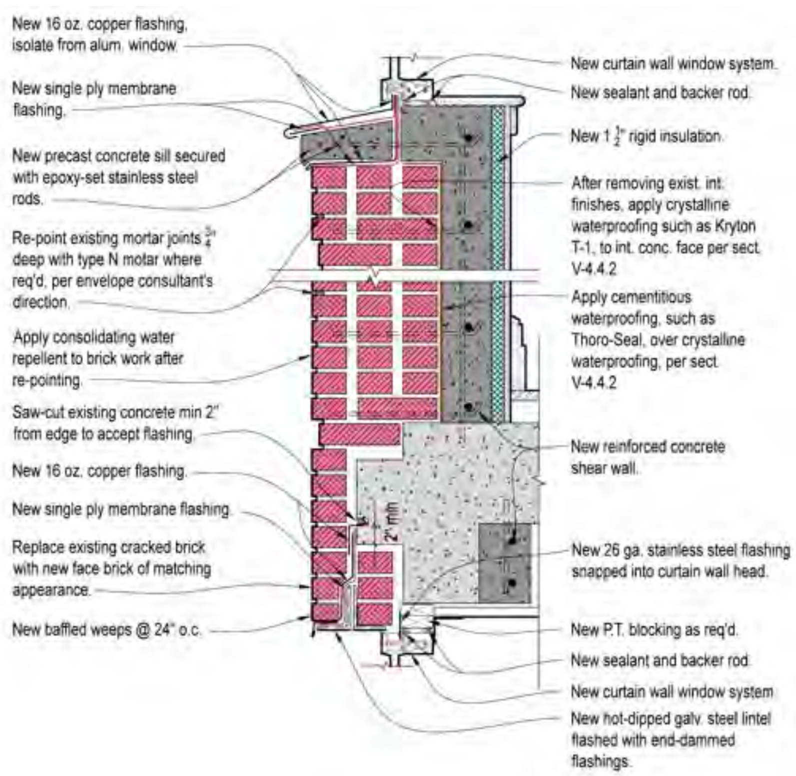


Fig. III-1.3(4): Option 1 Restoration Approach at Typical Stone-Sill Windows

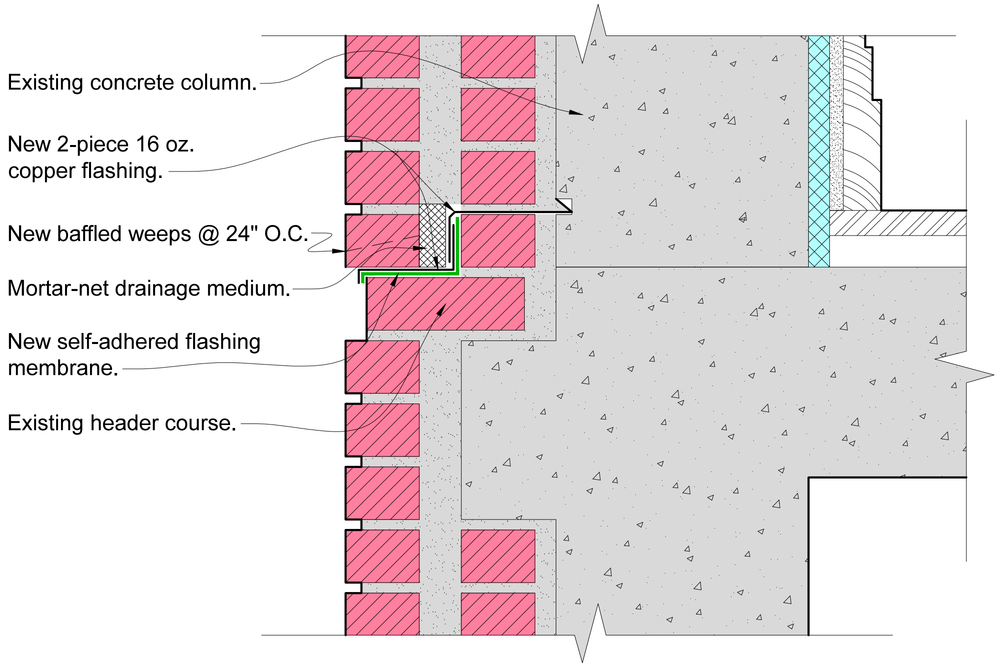


Fig. III-1.3(5): Option 1 Restoration Approach Through-Wall Flashing Retrofit

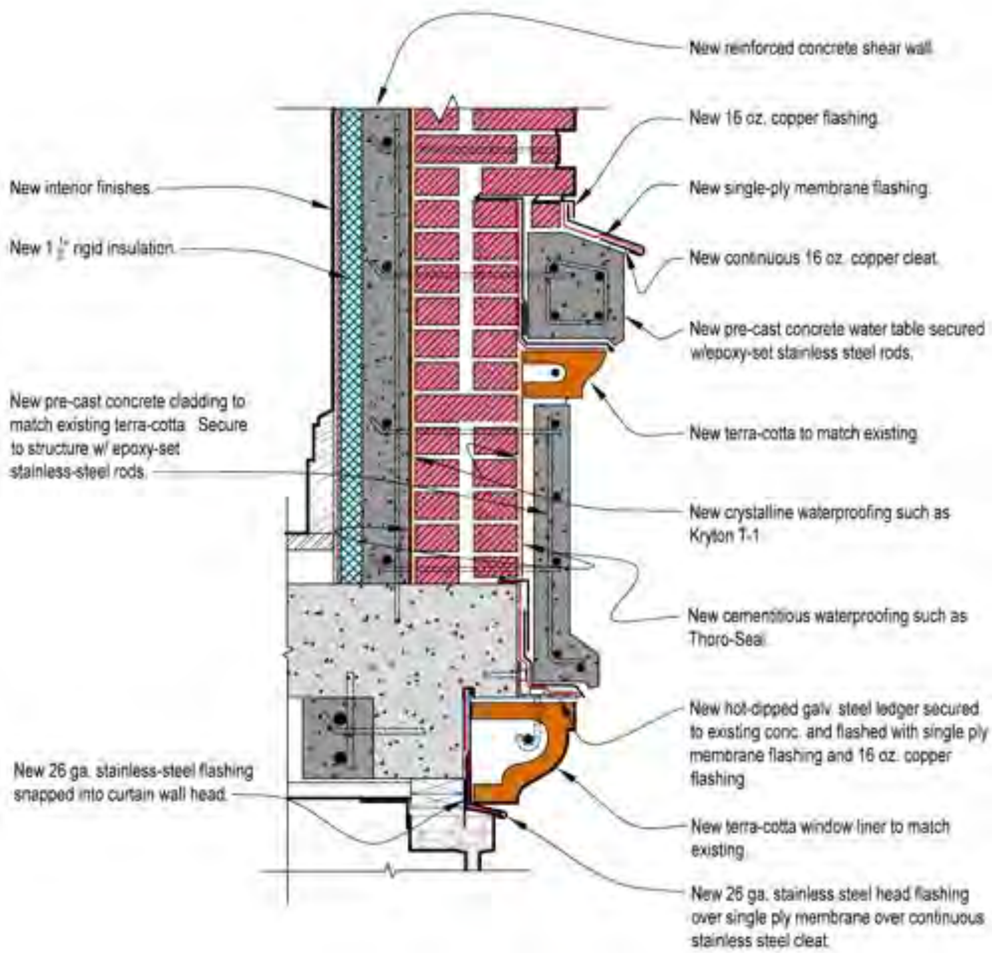


Fig. III-1.3(6): Option 1 Restoration Approach Above Level 4 Windows

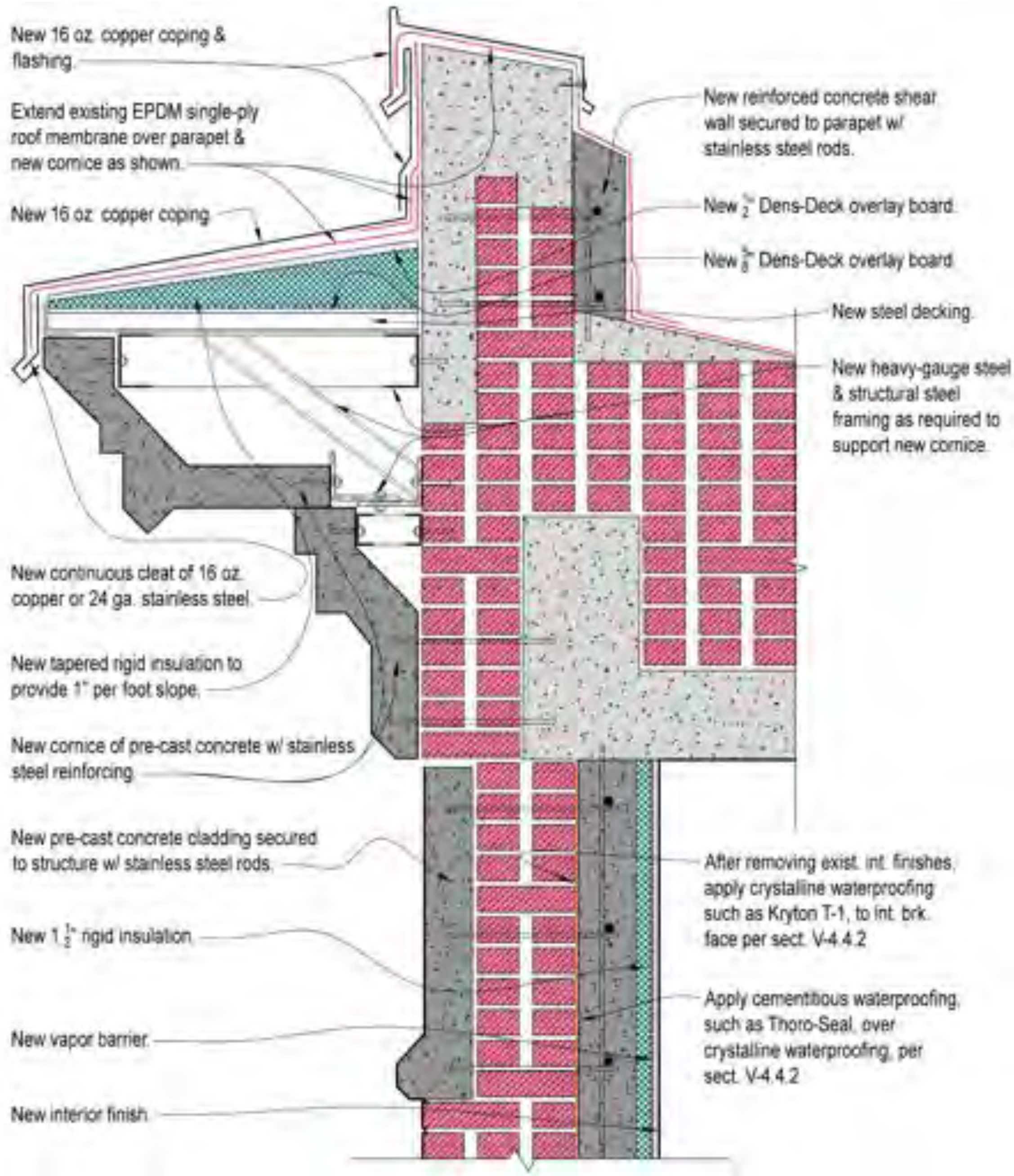


Fig. III-1.3(7): Option 1 Restoration Approach at Roof-Level Cornice-Parapet

1.3.2 Approach 2: New Masonry Veneer & Concrete Walls

This approach recognizes the inherent limitations of the Option 1 approach, and rather than recommending that millions of dollars be spent to still produce a flawed building whose masonry continued to erode away, it is technically much preferable to reconstruct its outer cladding system as a masonry veneer. As it initially appeared plausible that this approach may not actually be more costly, PL:BECS recommended that such an approach be evaluated for cost as a first step.

This approach also strives to retain the existing appearance to the greatest reasonable degree. However, it does so by removing essentially all exterior masonry, beefing up the existing concrete structure, casting new concrete back-up exterior walls, and re-cladding the building with a masonry veneer resembling the existing building, as originally designed.

This "Reconstruction" Option 2 represents the technically ideal approach, and is strongly recommended by PL:BECS. In fact, in view of its relatively limited added cost relative to Option 1, PL:BECS considers this the only reasonable approach. This reflects the fact that the projected construction cost of 18.1 million dollars for Option 1 represents roughly 83% of the projected construction cost of Option 2, so Option 1 is nearly as costly as Option 2, while Option 2 produces a building which is seismically safer, accommodates substantial added insulation to the exterior walls, and should appreciably enhance energy efficiency, yielding cost savings and greater comfort. Compared to the restoration approach of Option 1, it also results in a somewhat lighter structure with a thinner exterior wall profile, yielding added interior space, which is roughly in the range of 2,000 SF for the entire building. Properly executed, this approach should yield a low-maintenance cladding with a likely lifespan exceeding 120 years even in Juneau's masonry-challenging climate. Further, with proper execution, Option 2 can be guaranteed to avoid interior leakage. In short, this Option 2 approach yields a technically vastly better building with only limited additional cost.

In general, the work consists of the removal of all existing interior finishes, the hollow clay tile, and all exterior masonry to expose the existing concrete building frame.

New concrete walls, piers, and headers are cast between existing concrete columns per subsection IV-2.1.1. The exterior concrete faces are then coated with an asphaltic damp-proofing.

Galvanized steel ledgers are secured along all floor lines where needed to support the new brick veneer along each floor level.

The ledgers and the existing protruding concrete lugs are flashed with a double-layer flashing assembly of self-adhered flashing membrane capped with 26-gage stainless steel flashings where fully concealed, and with 16 oz. copper flashings where these become exposed to view.

New stainless steel veneer anchor channels, such as Dur-O-Wal DA904, are fastened to the concrete walls, spaced 16" apart horizontally, and vertically continuous.

A thin vent mat, such as Enka-Drain 9714, is placed against the damp-proofed concrete walls, with 4" thick extruded polystyrene insulation, such as Dow Board, is placed against this. Stainless steel veneer anchors, such as Dur-O-Wal DA931, are clipped into the channel slots, spaced 18" apart vertically. A thicker drain mat, such as Enka-Drain 9120, is placed over the insulation, fabric-side facing outward, to limit mortar clogging.

A new masonry veneer, consisting of ASTM C-216 face brick, Grade SW, at brick areas, or pre-cast concrete cladding at stone locations, is installed over this, largely to match the existing appearance, but with greatly reduced offsets and with concave-tooled mortar joints to limit water infiltration into the masonry. Horizontal 9-gage stainless steel wire seismic joint reinforcing is embedded within the horizontal joints spaced 18" apart vertically.

The new masonry should be cleaned and sealed with a penetrating water repellent, such as ProSoCo Weather-Seal Siloxane.

Figures III-1.3(8-14) illustrate this approach at several typical locations.

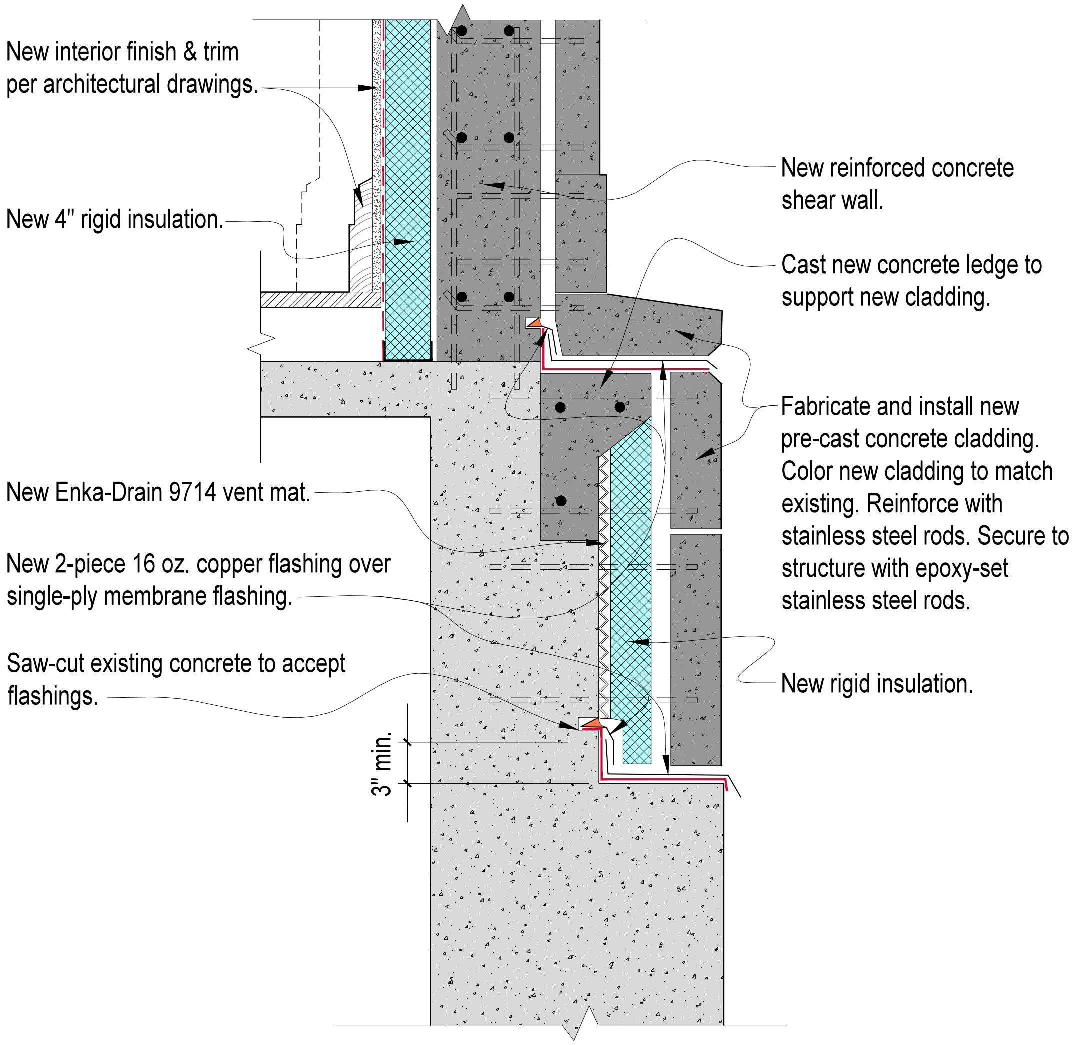


Fig. III-1.3(8): Option 2 New Masonry Veneer Appr. at Stone Wall Base, S. Side

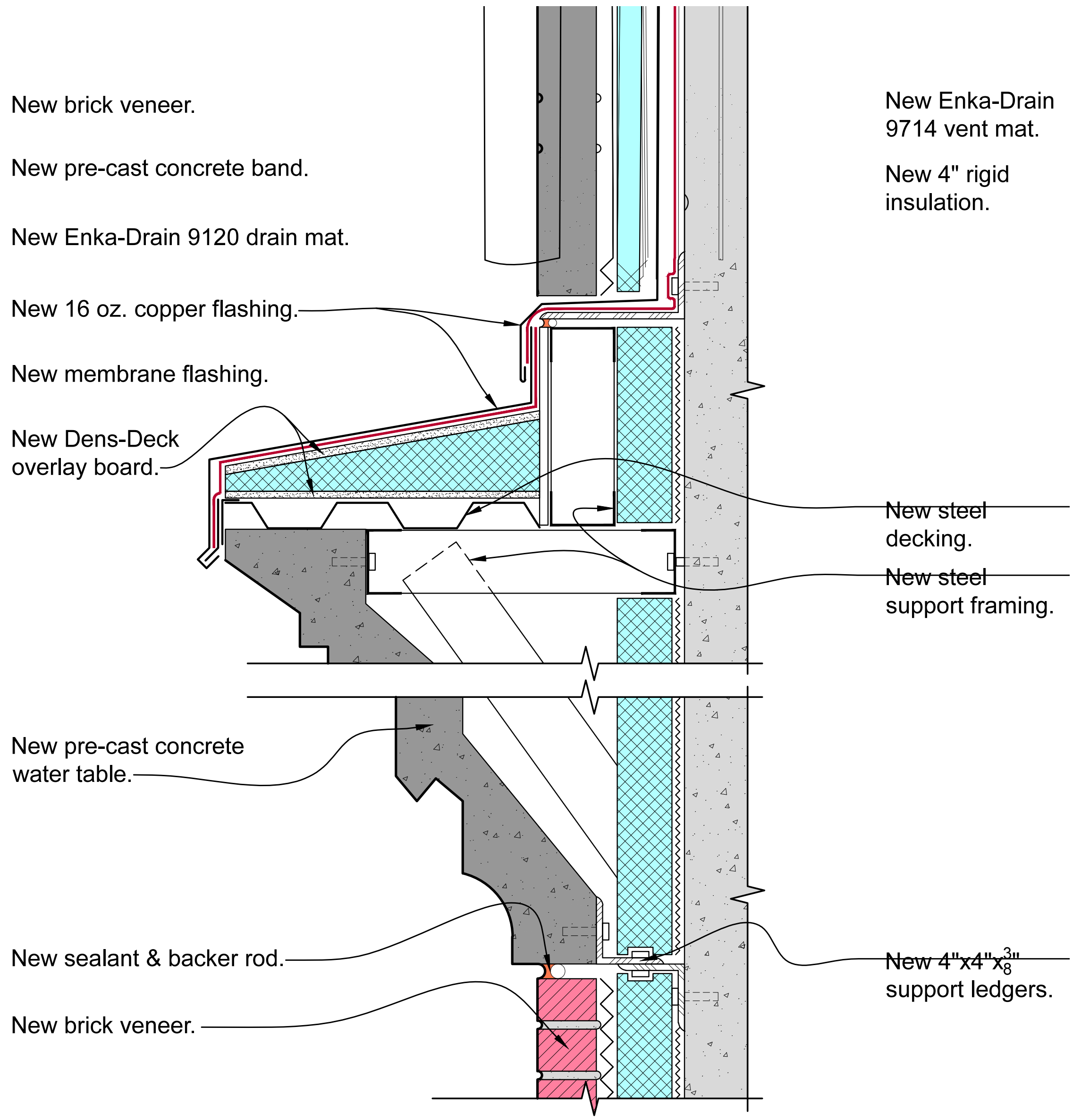


Fig. III-1.3(9): Option 2 New Masonry Veneer Appr. at Level 2 Stone Water Table

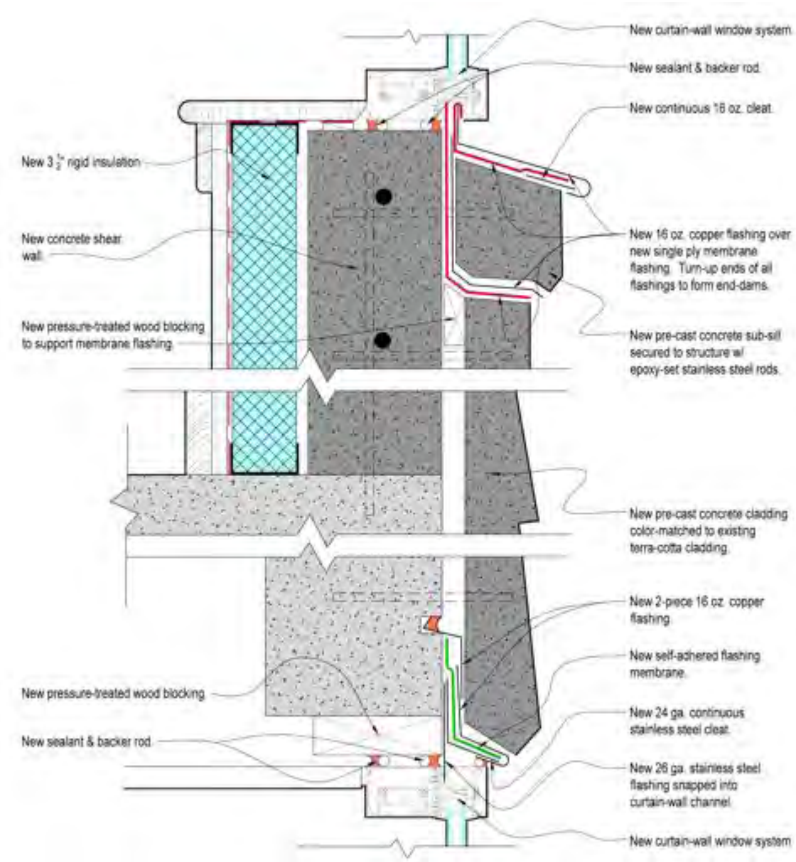


Fig. III-1.3(10): Option 2 New Mas. Veneer Appr. at Typ. Public Façade Windows

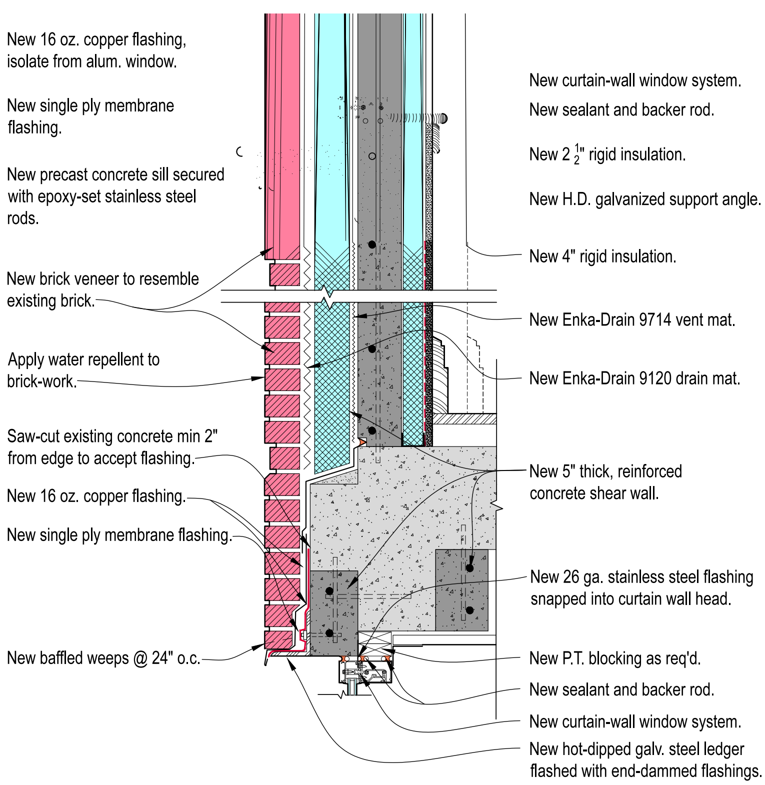


Fig. III-1.3(11): Option 2 New Masonry Veneer Appr. at Typ. Stone-Sill Windows

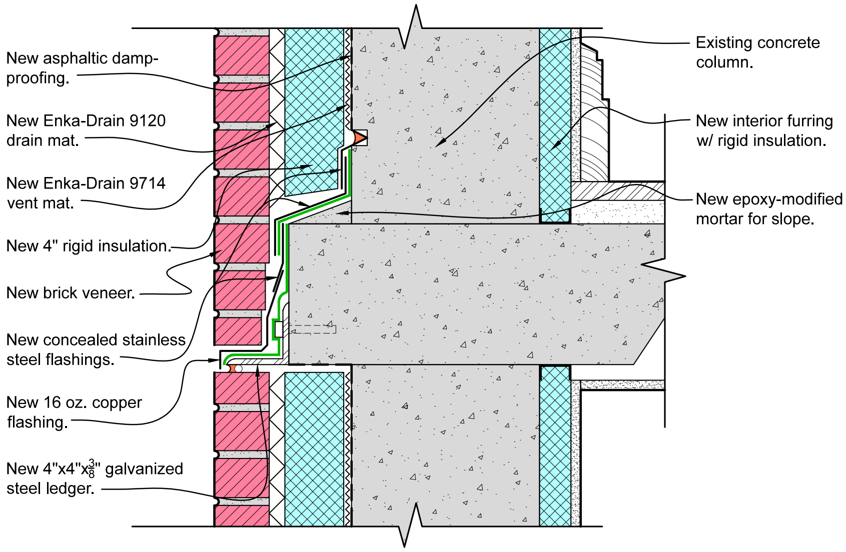


Fig. III-1.3(12): Option 2 New Masonry Veneer Appr. at Typ. Floor-Level Ledger

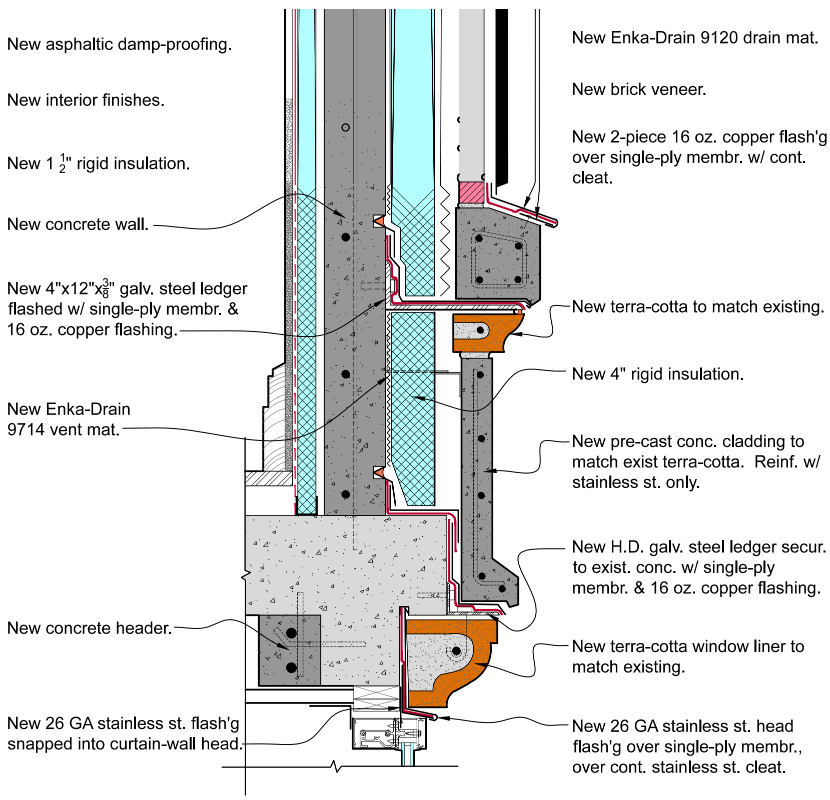


Fig. III-1.3(13): Option 2 New Masonry Veneer Appr. Above Level 4 Windows

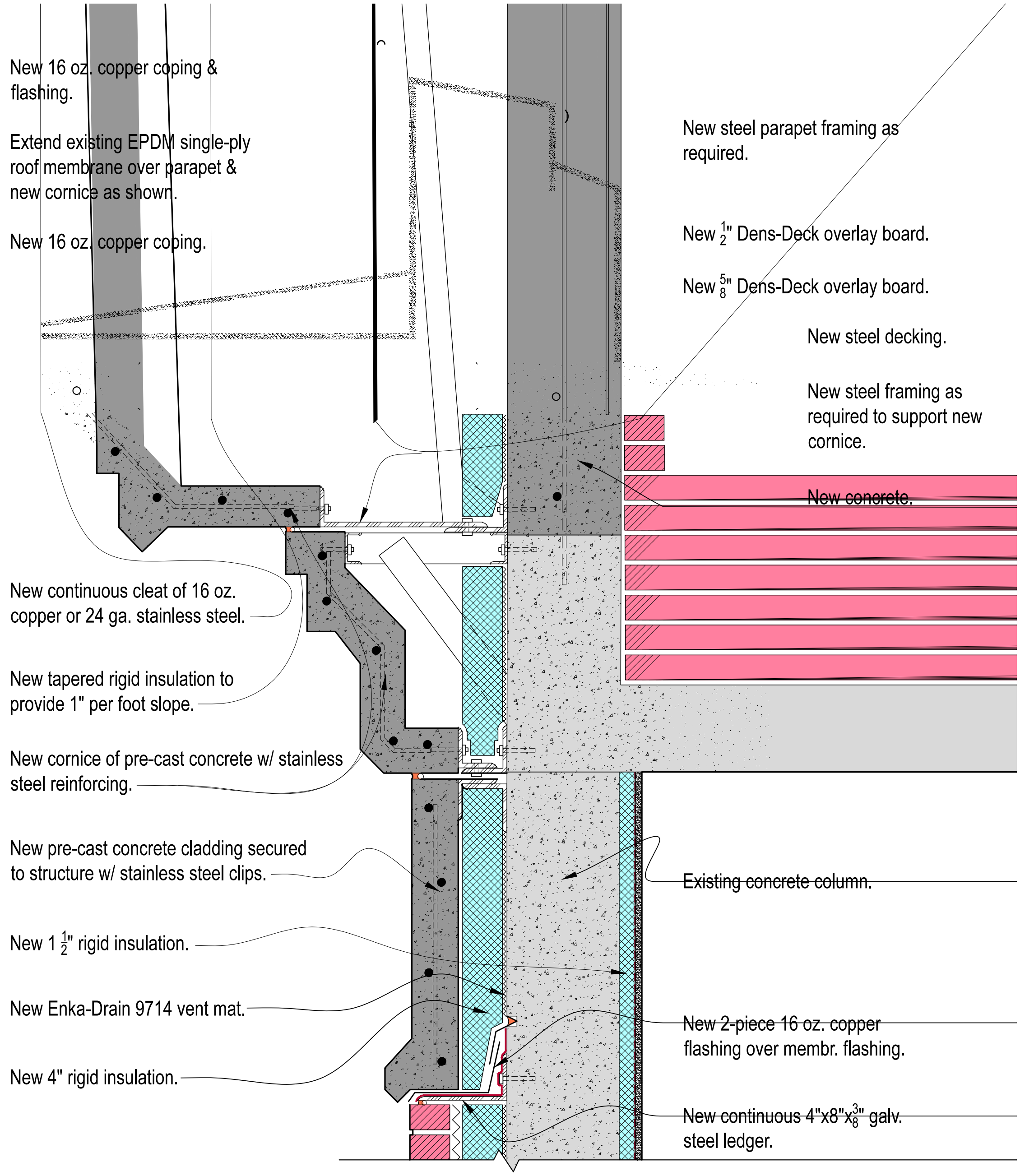


Fig. III-1.3(14): Option 2 New Mas. Veneer Appr. at Roof-Level Cornice-Parapet

1.3.3 Approach 3: New Masonry Veneer & Concrete & Steel-Framed Walls

This approach also recognizes the inherent limitations of Option 1, and also recommends replacement of the exterior cladding with a new masonry veneer. It differs from Option 2 only in that while Option 2 placed cast-in-place concrete walls inward of the masonry veneer at essentially all locations, Option 3 adds such concrete shear walls only where needed to resist lateral loads, and uses standards steel-framed walls elsewhere. In essentially all other respects, Option 3 mimics Option 2.

Where such framed walls occur, the assembly, exterior-to-interior, consists of the masonry veneer placed over a ¾" drain mat, such as Enka-Drain 9120, over 4" rigid insulation, over 3/16" vent-mat, such as Enka-Drain 9714, over 2-layer building wrap, over 5/8" exterior gypsum sheathing, over 6" deep, 16-gage steel studs spaced 16" apart. Batt or rigid insulation can be used within the framing cavities. Over the framing's interior face would be a 6-mil cross-laminated vapor barrier, and 5/8" gypsum wallboard.

This Option 3 was evaluated because it initially appeared to possibly represent a less-costly approach than Option 2. However, this approach should not be viewed as technically equal to Option 2, and was not recommended by PL:BECS for a major institutional building in Juneau's climate. Interestingly, the evaluation revealed that this Option 3 approach actually costs a bit more than Option 2, with a projected construction cost of 22.5 million dollars, compared to 21.9 million dollars for the technically preferable Option 2. In view of its higher cost and lesser qualities, Option 3 can readily be discarded.

However, for sake of completeness, let me also briefly outline the reasons for why this Option 3 yields an inferior building. My reservations about this approach include both technical and architectural considerations.

Technical concerns with this approach center on the certainty of recurring internal condensation and associated risks of corrosion, as well as possible risk of fungal infestation.

More specifically, the corrosion concern reflects the vulnerability to losing effective anchorage of the masonry veneer. The stainless steel ties that secure the masonry veneer to the walls are screwed through the gypsum sheathing to the steel stud flanges. If stainless steel screws are used, there remains a risk of corrosion right where the one or two screw threads engage the galvanized steel studs, where even very localized corrosion of the stud flanges around the screw threads can negate the veneer tie securement. I don't think this risk should be underestimated in Juneau's perpetually wet and cool climate.

The fungal concern relates to the use of gypsum sheathing in such a damp climate, especially for a major institutional building with a hopefully longer lifespan than most. Although the recommended Dens-Glass Gold sheathing is silicone-treated to resist absorption, having observed mildew growth even on vertical glass, I would not entirely dismiss the risk of at least localized fungal colonization.

An additional draw-back of this approach is that ironically, it requires appreciably more foundation work, as well as thicker concrete shear walls extending up the building's full height near its corners, to make up for the loss of the new thin concrete walls under and above the windows which are included in Options 1 and 2, but not 3. As a consequence of these thicker concrete walls, the office spaces near the building corners at all floor levels lose some floor space.

For these reasons, I do not consider the Option 3 approach technically equal to Option 2, and strongly recommend Option 2.

As this approach is otherwise essentially identical to Option 2, it is not described in detail here. Please see subsections III-1.3.2 and Part VI for more detailed descriptions.

Also, since Options 2 and 3 are very similar, many of the same drawings describe both options. Thus, Figures III-1.3(15 & 16) illustrate only a couple of typical locations where these differ from Option 2.

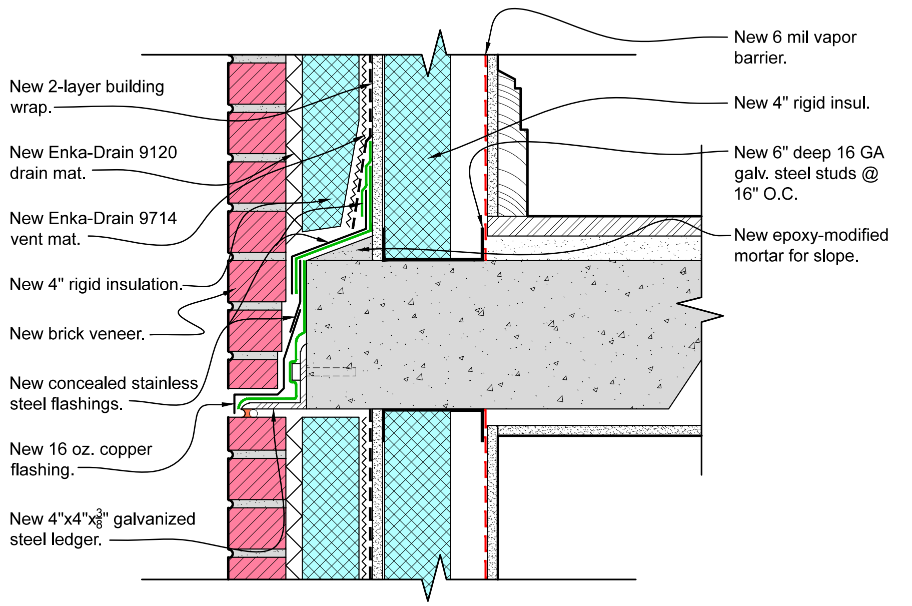


Fig. III-1.3(15): Option 3 New Masonry Veneer Appr. at Typ. Floor-Level Ledger

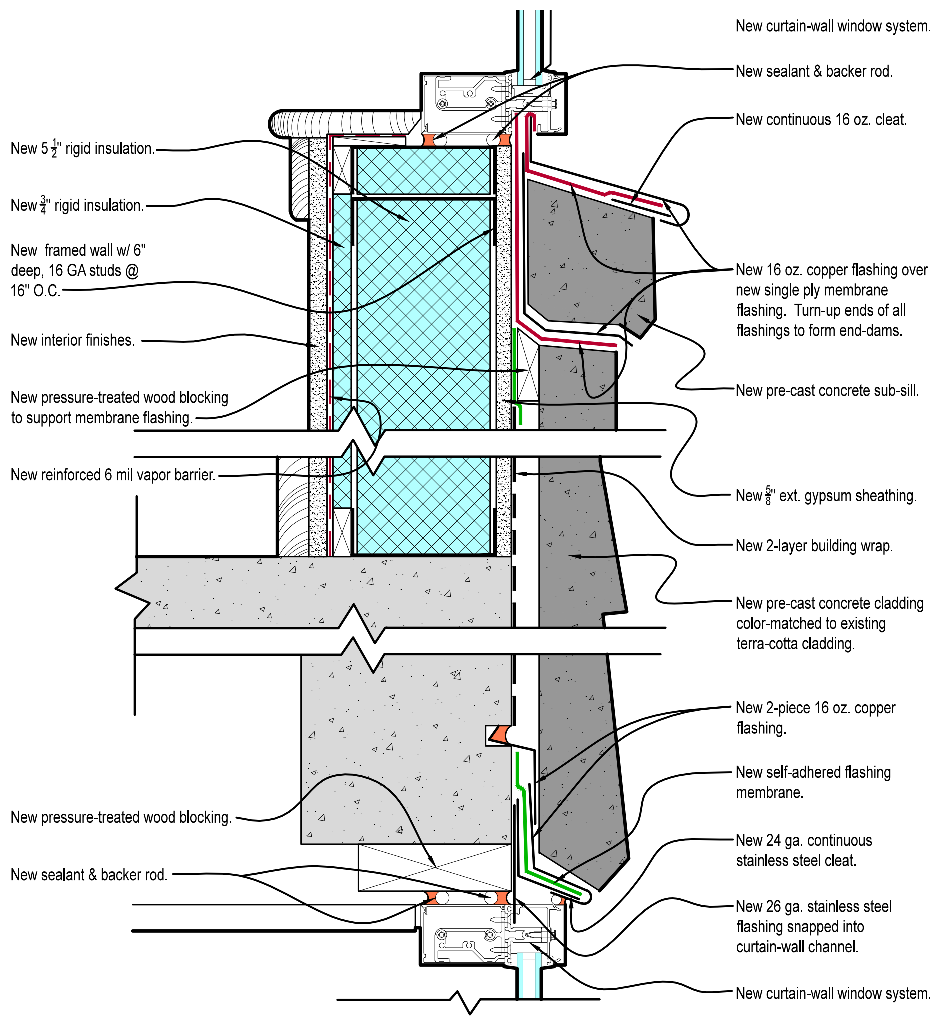


Fig. III-1.3(16): Option 3 New Mas. Veneer Appr. at Typ. Public Façade Windows

IV. OPTION 1: RETROFIT EXISTING STRUCTURE AND MASONRY

1. GENERAL INTRODUCTION

1.0. General

This section addresses issues of general applicability to Part IV: Option 1: Retrofit Existing Structure and Masonry.

Subsection 1.1 includes General Format Notes, which describe the general formatting.

Subsection 1.2, Introductory Notes, outlines some general considerations.

Finally, subsection 1.3, Overall Description of the Option 1 Corrective Approach and its Limitations, provides a summary description of the overall approach and its limitations.

1.1. General Format Notes

This Part outlines general Option 1 corrective recommendations for the various elements. For clarity, individual recommendations are provided for the various systems within Primary Sections, and are formatted same as Part II: Summary of Observations & Analysis, as follows:

1. General Introduction
2. Structure
3. Primary Exterior Enclosure Assemblies & Elements
4. Exterior Masonry Sub-Elements
5. Entry Portico
6. Interior Architectural Elements
7. Mechanical Systems
8. Electrical Systems

Each primary section is divided into subsections, each addressing individual sub-components, for optimal clarity. For example, section 2 is further subdivided into the following subsections:

2.0 General
2.1 Basic Structure of Building
2.2 Foundations
2.3 Lowest-Level Concrete Floor Framing
2.4 Level 1 Concrete Floor Slab
2.5 Brick Chimney
2.6 Securement of Large Masonry Cladding Elements
2.7 Interior Hollow Clay Tile Walls
2.8 Large Mechanical Equipment

Each primary subsection is yet further divided into three secondary subsections. For example, subsection 2.1, which pertains to the building's basic structure, is divided as follows:

2.1.0 General
2.1.1 Basis of Recommendations
2.1.2 Recommended Corrective Actions

The first subsection describes the element to which the section applies, and provides any other general background information.

The second subsection, Basis of Recommendations, summarizes problems affecting the existing construction, and explains the reasoning for the recommended corrective course.

The third constitutes the Recommended Corrective Actions. Where yet-greater level of detail is required, each subsection may be further subdivided as appropriate.

1.2. Introductory Notes

This report's primary intent is to evaluate the building's major problems to a sufficient degree to develop generally feasible corrective approaches, and to also determine the general ranges of possible construction costs for the different approaches. It is beyond this report's scope to develop highly detailed construction detailing for all of the conditions. Rather, the scope of this report is to identify corrective approaches sufficiently for rough cost estimates to be prepared, thus assisting in the selection of appropriate approaches.

While recommendations are provided individually for each major element for optimal clarity, this should not be misconstrued as representing some sort of "menu", wherein some recommendations are executed while others are not. In many cases, recommendations pertaining to several elements must be executed to solve a particular problem, and doing only some of the work would not suffice. For example, the severe infiltration observed at the portico ceiling, which may partly originate at the portico roof, certainly also reflects infiltration from the wall above the portico, and correcting only the portico roof would not solve this particular problem.

In some cases, several possible corrective options appear feasible even within this basic "retrofit" approach described in this Part. In such cases, such possible approaches are also described.

While the recommendations represent appropriate approaches for solving the problems plaguing this building, they do not constitute any sort of construction documents describing the work in sufficient detail. A separate set of construction drawings and specifications must be prepared, on the basis of these recommendations, to optimize the opportunity that the problems are corrected.

It is also critical to stress the absolute importance of adequate construction supervision by qualified personnel during the corrective work to assure that the actual construction follows the design. As but one example, in my own career, which now spans over a quarter century and includes roughly 600-800 projects in the field of the exterior envelopes, I have not yet observed one single project which completely followed the design with respect to the exterior envelope.

1.3. Overall Description of the Option 1 Corrective Approach and Its Limitations

The recommendations are divided into numerous subsections, each of which addresses a particular element. While this approach provides specific information in a highly retrievable format, the resulting fragmentation may obscure the overall context from which the individual recommendations spring. This section attempts to provide the more holistic explanation.

In brief, this approach strives to retain existing elements to the greatest reasonable degree. All existing masonry that can be salvaged without incurring needlessly large costs, relative to other options, and that can provide adequate safety, performance, and projected lifespan, are generally kept in this approach. However, some elements, such as the front portico or windows, are so damaged or ill suited that replacement is warranted even within this "retrofit" option.

It is critical to note that this "retrofit" option is not technically ideal. In fact, it possesses some inherent vulnerabilities that can at best be minimized, but not fully corrected. For example, the existing exterior wall assemblies are deficient both structurally and from a water-infiltration perspective. Execution of the structural recommendations described in this Part should greatly enhance the building's structural integrity, though the existing building will retain a degree of vulnerability compared to Option 2. With regard to water infiltration, the masonry walls are inherently moisture absorbent and completely lack any flashings or barrier system to drain water back out of the masonry, causing interior infiltration symptoms scattered around the building's perimeter. The recommended work in this approach should limit, but may not entirely eliminate, interior leakage. A further problem is that the exterior brick is in many locations seriously damaged and is spalling. While such spalling can be slowed with consolidating agents, it cannot be effectively stopped, and the brick cladding will continue to shed its outer face over the longer-term. It is critical to understand that this approach may not completely solve all problems at all locations, and that the current spalling and weather degradation will continue, though more slowly. For these reasons, PL:BECS does not recommend this approach.

2. STRUCTURE

2.0. General

This section addresses larger-scale structural considerations. It is divided into nine subsections, each of which pertains to a specific sub-element of the structure.

2.1. Basic Structure of Building

2.1.0 General

This subsection pertains to the building's basic structural design in the most general terms.

2.1.1 Basis of Recommendations

This building's structural frame consists of a grid-work of reinforced concrete columns supporting a series of reinforced concrete beams, which in turn support reinforced concrete slabs with integrally cast concrete joists. In addition, structural steel frames occur on the 3rd and 4th levels of the east wing. Along exterior walls, the concrete beams and columns are embedded within longer wall sections comprised of brick masonry, with 4" thick, non-structural terra-cotta along the interior faces of these exterior masonry walls, and plaster or other interior finish applied over this.

A structural evaluation report by the engineering firm of Berger/Abam, dated 7/29/2002, titled "Seismic Assessment and Retrofit Concept Study", concludes that many of the building's primary structural elements, including its columns, beams, floor and roof diaphragms, and foundation pedestals, are structurally deficient and could experience significant damage in a seismic event.

A structural analysis performed as part of this report's scope by the engineering firm of Swenson Say Fagét confirmed that this building possesses excessive vulnerability to seismic damage. This concern is exacerbated by my field investigation, which revealed some previous seismically induced damage, which may have weakened some sub-elements of the building.

2.1.2 Recommended Corrective Actions

With regard to the building's overall structural frame, recommended corrective work largely aligns with recommendations of the 12/31/10 PL:BECS report, and consists of the replacement of much of the existing interior non-structural terra-cotta, or hollow clay tile, along the building's exterior walls with reinforced concrete piers and shear walls.

These added shear walls and piers occur on all floor levels, though they become progressively less extensive toward the upper floor levels, as one would expect. They vary in thickness, with new concrete piers generally near the building's outer corners being 12" thick, while in most other locations, only 4" thick concrete walls replace the hollow clay tile wall finish. At the northern portions of both wings at the ground floor level, 6" thick concrete shear walls are added. Large concrete grade beams are also added to the foundation system, as described in section IV-2.2.2. In contrast to the 12/31/10 PL:BECS report, which also assumed that the new concrete shear walls would extend along inner faces of the existing concrete columns, the analysis by Swenson Say Fagét concluded that these would not be of much help, and consequently, interior concrete shear walls are generally not being added along inner faces of the existing concrete columns.

In general, the work consists of the removal of existing interior finishes and the hollow clay tile to expose underlying brick construction. The inner brick and mortar faces are then coated with a crystalline waterproofing agent, such as Kryton T-1, followed by a cementitious waterproofing agent, such as Thoro-Seal. A grid-work of either Heli-Fix helical anchors, or epoxy-set, 5/8" ø stainless steel all-thread rods is then drilled into the inner faces of the brick, extending to about 2" short of the exterior wall face. These rods should be spaced about 16" apart in both directions, and should be tied to the new wall's reinforcing steel. Finally, new concrete shear walls are placed, either via the shot-crete method or with one-sided forms. Steel furring, rigid insulation, vapor barrier, and interior finishes are then installed over the new concrete.

Figure IV-2.1(1) shows a typical detail with the interior shear wall added to the existing brick walls, and Figure IV-2.1(2) shows a photo of generally similar work being executed to stabilize an existing concrete wall. Figures IV-2.1(3-8) then show each of the building's floor plans with specific locations and thicknesses of the new shear walls and piers indicated. See also Figure IV-2.2(1), which shows the related structural work at the foundation level.

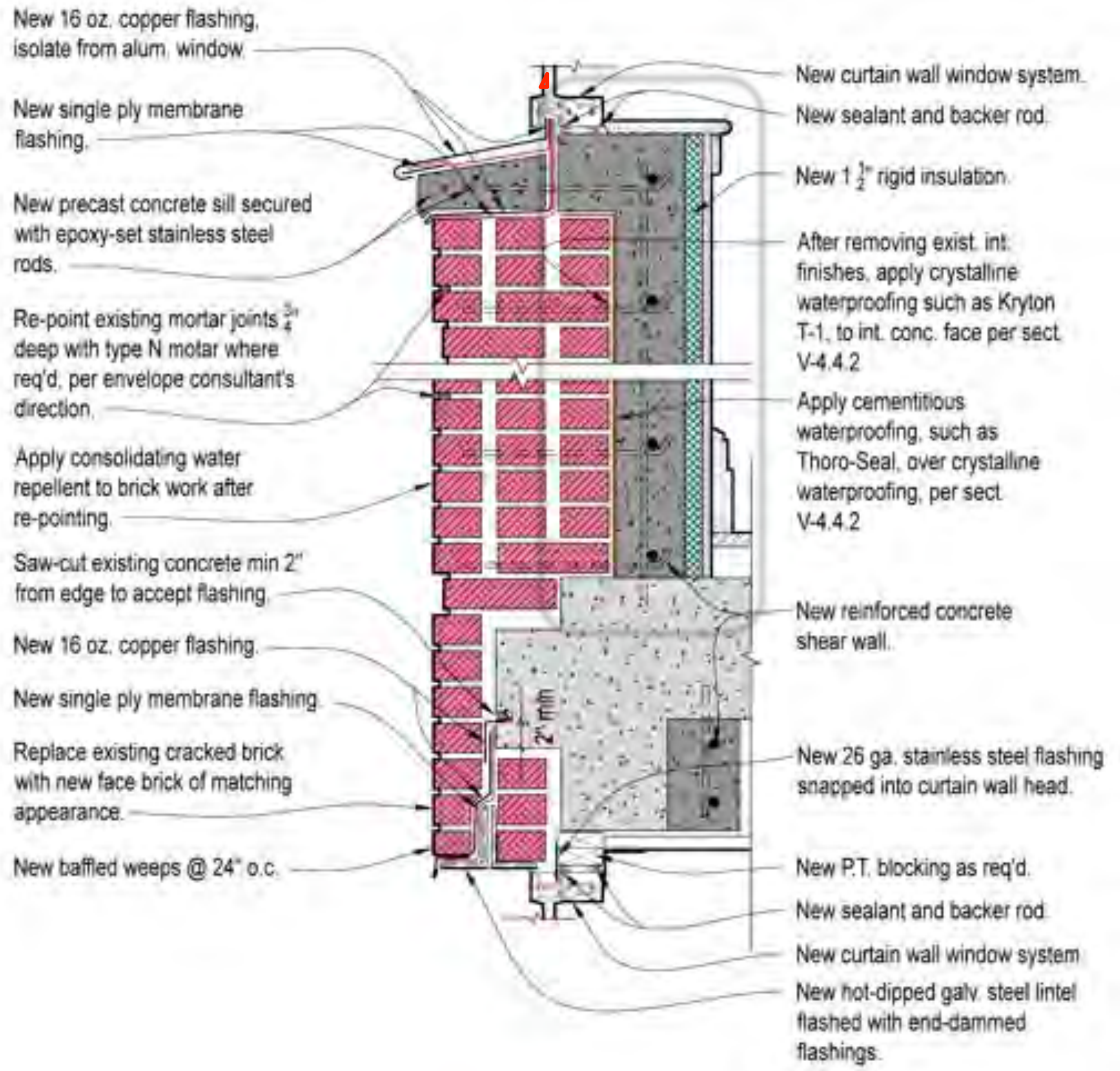


Figure IV-2.1(1): Typical Interior Concrete Shear Wall

Figure IV-2.1(2): In-Progress Installation of Interior Concrete Shear Wall

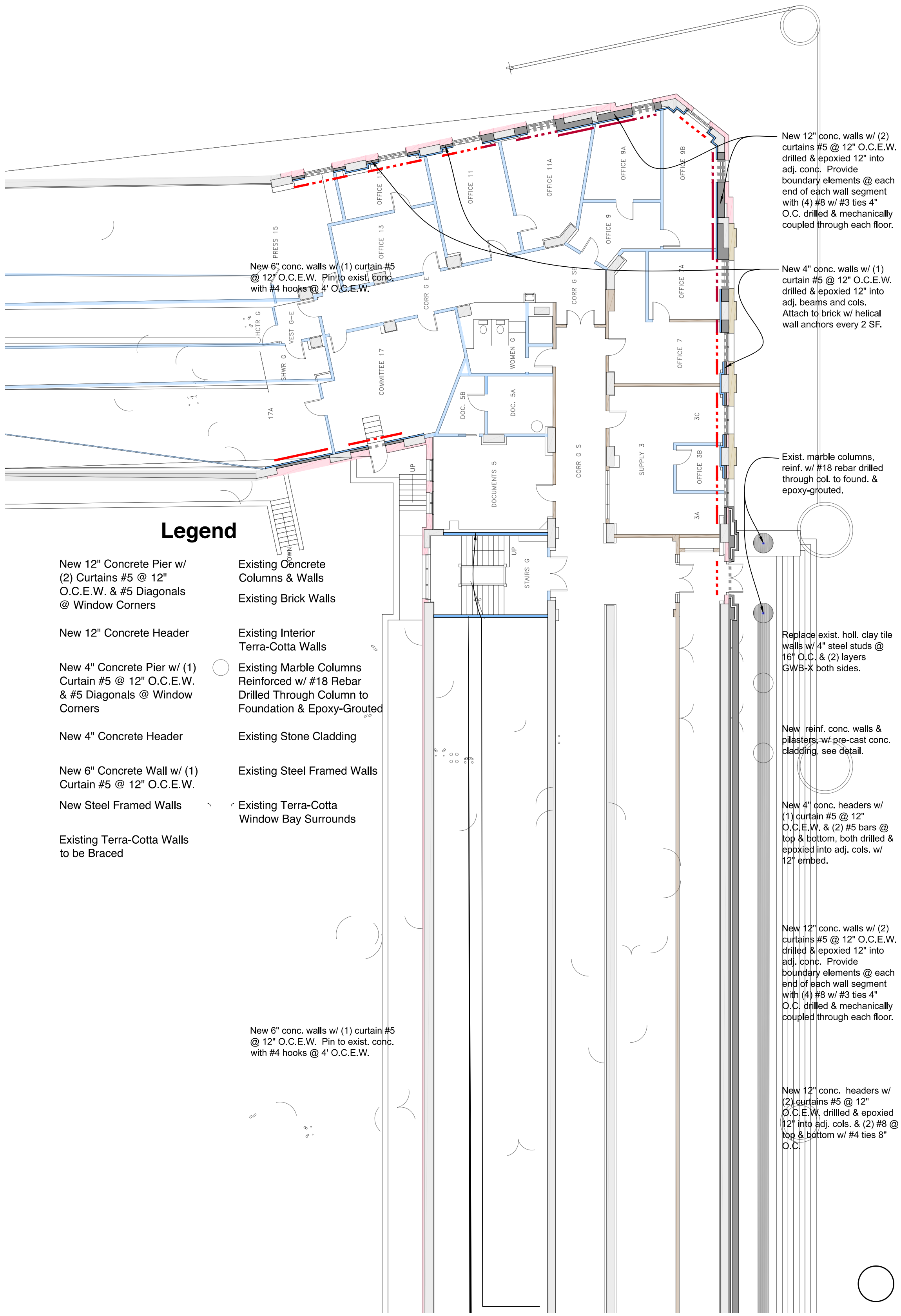


Figure IV-2.1(3): Structural Reinforcing of Building Frame - Ground Floor Level

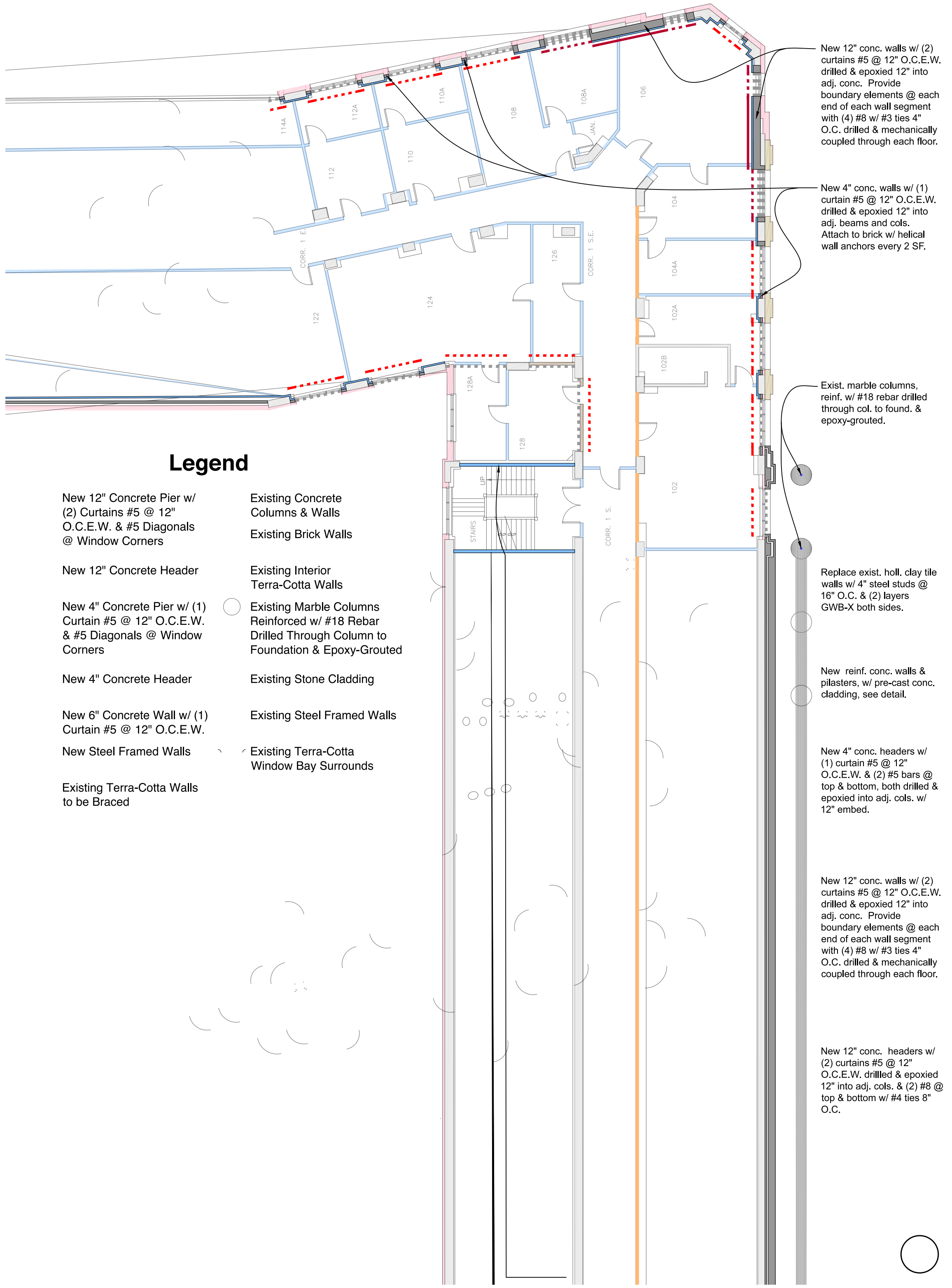


Figure IV-2.1(4): Structural Reinforcing of Building Frame - Floor Level 1

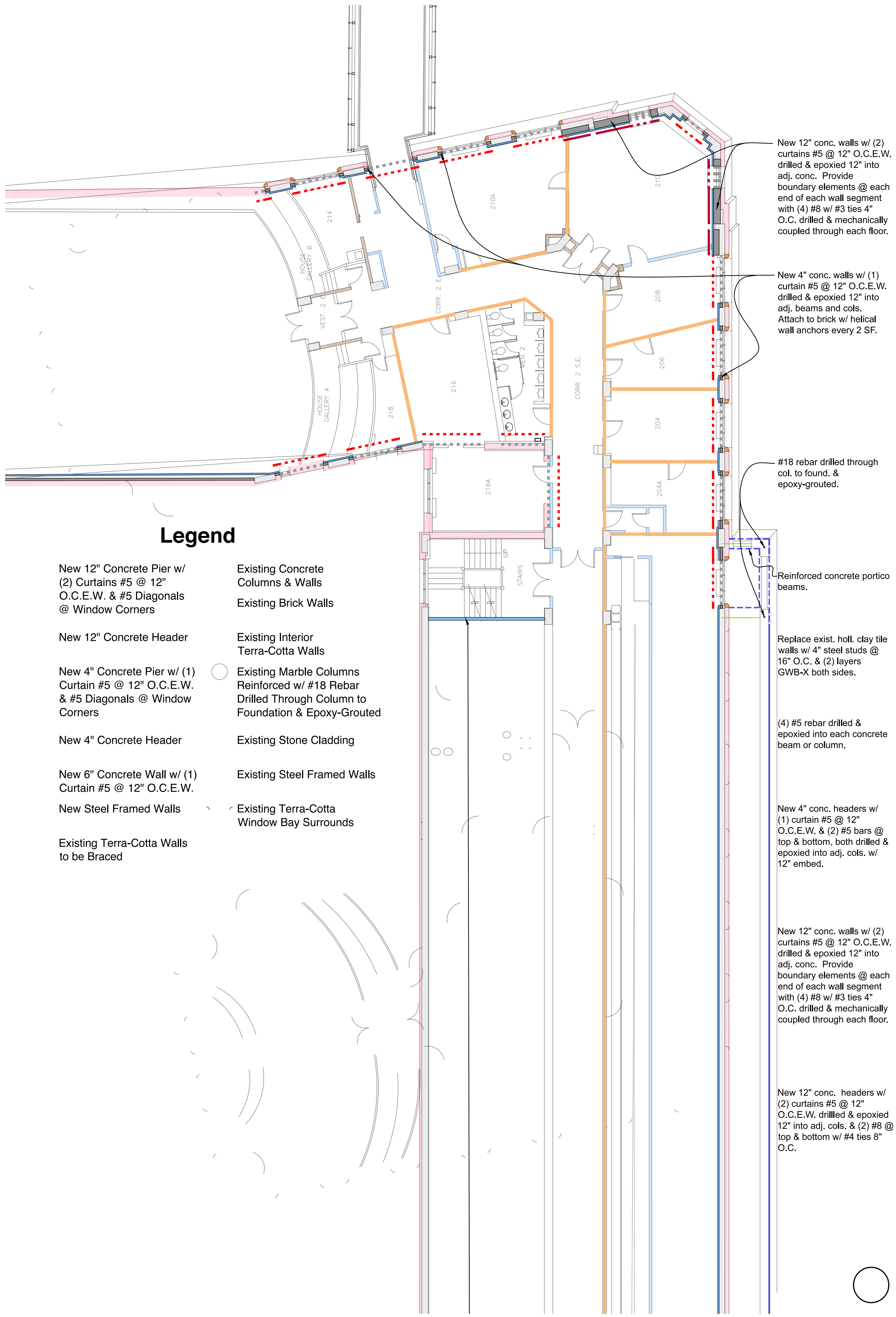


Figure IV-2.1(5): Structural Reinforcing of Building Frame - Floor Level 2

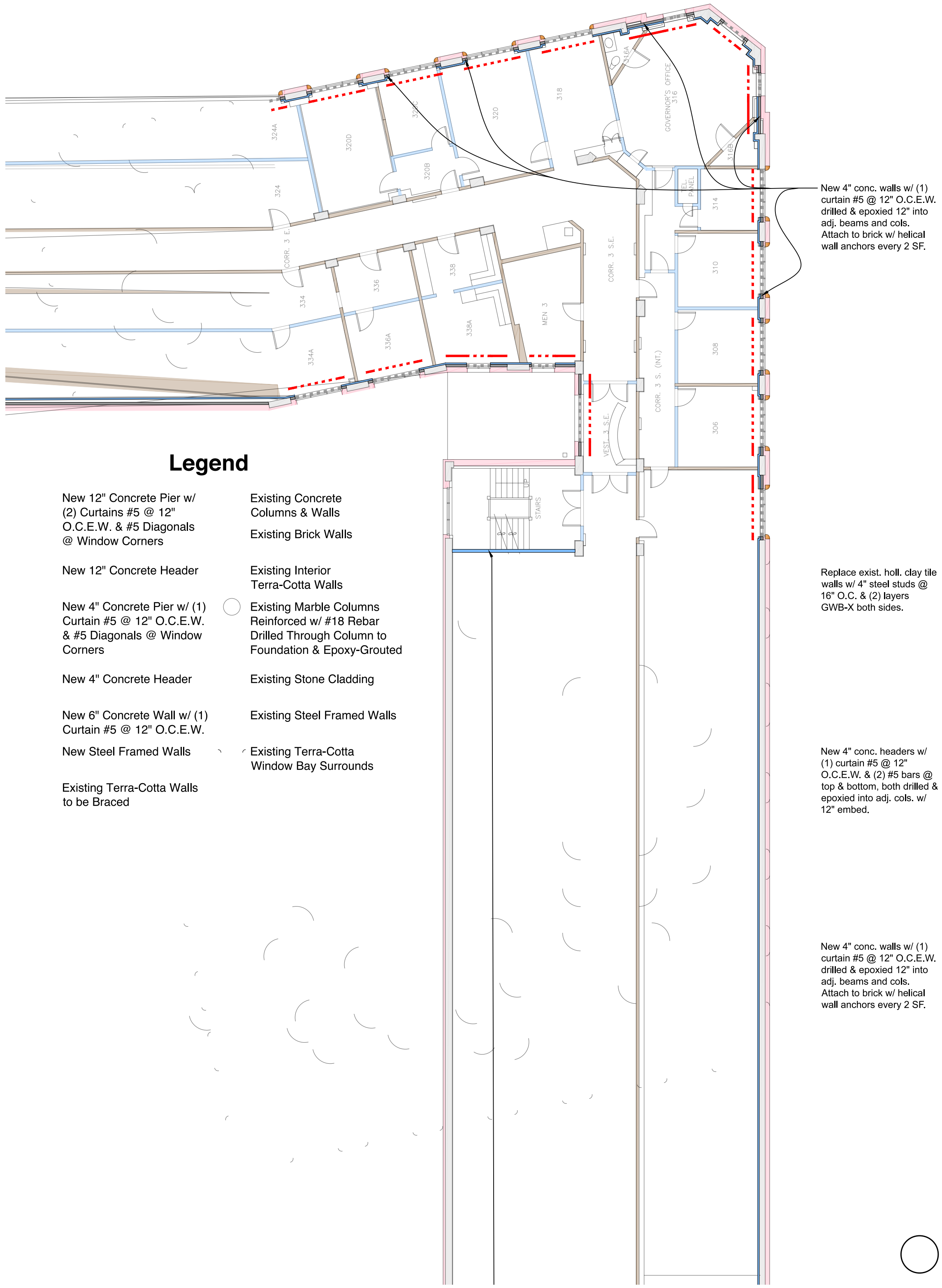


Figure IV-2.1(6): Structural Reinforcing of Building Frame - Floor Level 3

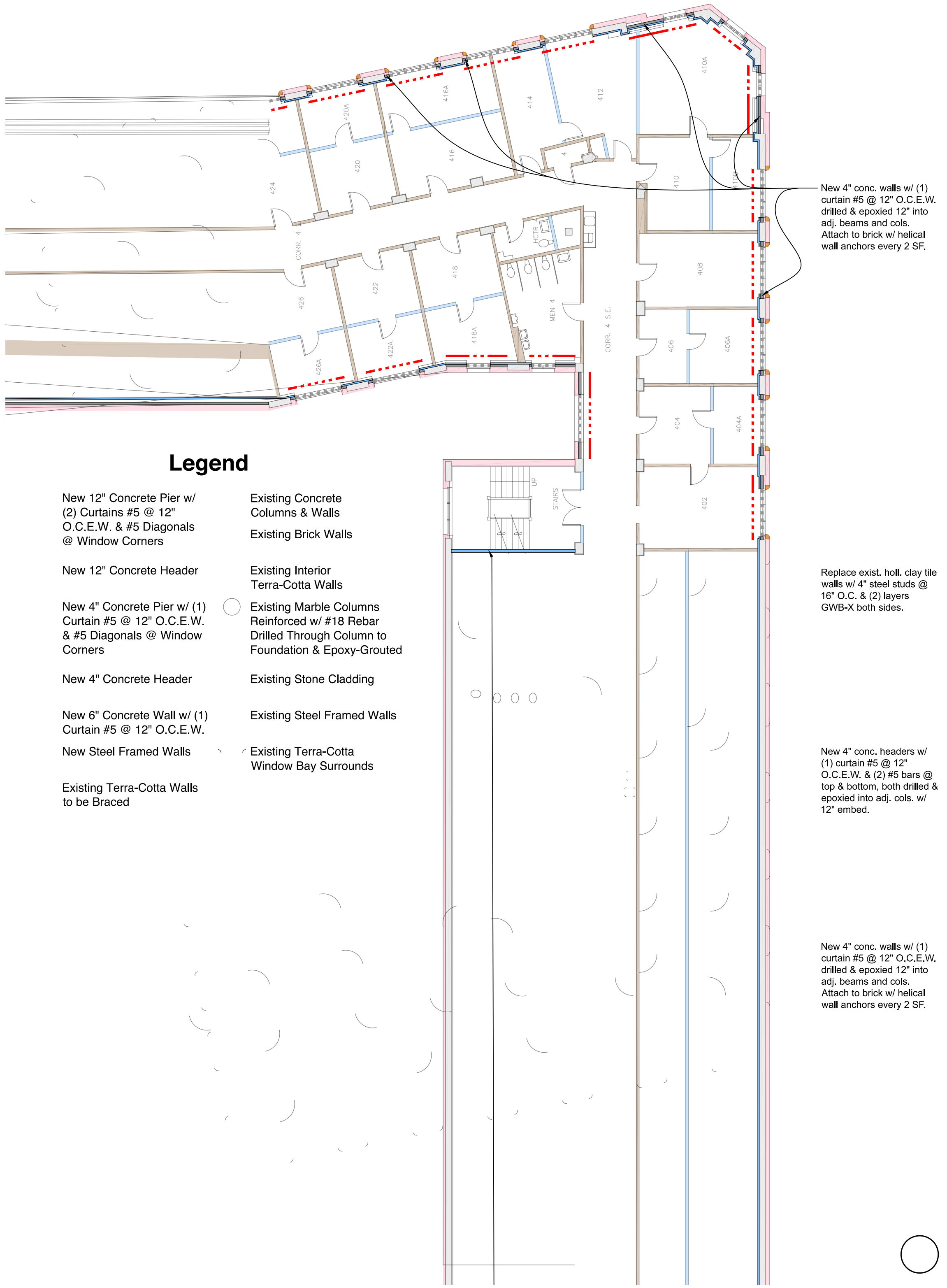


Figure IV-2.1(7): Structural Reinforcing of Building Frame - Floor Level 4

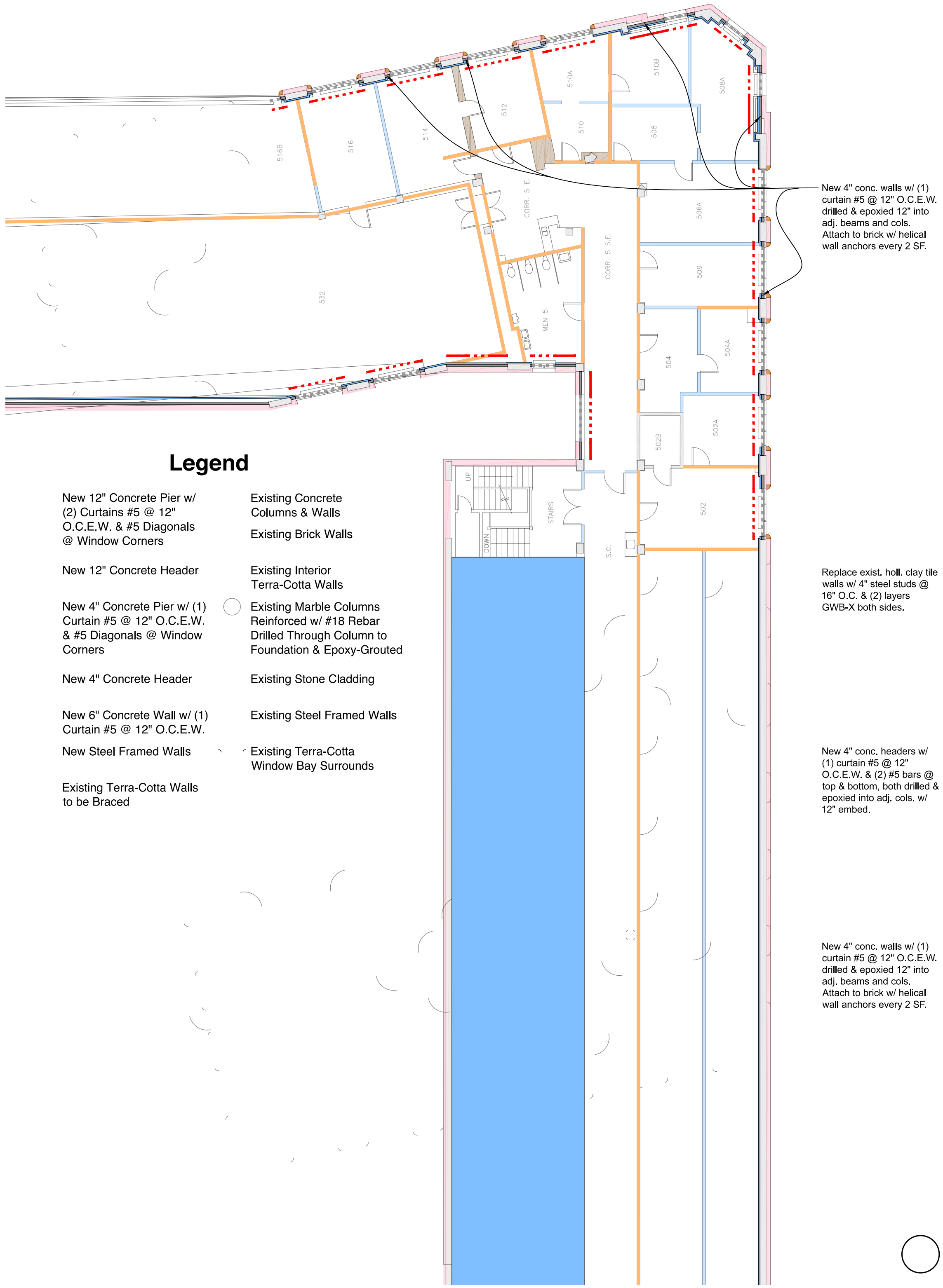


Figure IV-2.1(8): Structural Reinforcing of Building Frame - Floor Level 5

2.2. Foundations

2.2.0 General

This subsection pertains to the building's basic foundation system in general terms. See also section IV-3.1: Lowest-Level Crawl Space for related information.

2.2.1 Basis of Recommendations

The foundation consists of a grid-work of many individual, mostly square footings of reinforced concrete. This is true even along the building's outer perimeter, and the only continuous footing occurs along the north wall of the west wing.

Very wet soils occur in the crawl space under the building, with a small, continuous stream running through this space. Consequently, the foundations suffer variable degrees of corrosive spalling and efflorescence, indicating moisture absorption into the concrete.

Issues germane to the foundations relate to structural adequacy and degradation.

With regard to structural adequacy, analysis indicates that the foundation system is generally adequate for resisting vertical gravity loads, but does not suffice to resist lateral loads. Consequently, some beefing-up is warranted. In brief, this consists of the addition of several large grade beams, as described in greater detail in subsection IV-2.2.2.

From a degradation perspective, the existing foundations are not in too bad a condition, but are experiencing variable degrees of corrosive spalling and efflorescence, which in itself can also lead to spalling as the salts recrystallize near the concrete's surface. In the longer-term, this process would lead to the destruction of these foundations. Therefore, some corrective measures are also advisable to limit this intrusion of water into the concrete.

However, the conditions affecting these foundations pose some inherent challenges, which may limit the effectiveness of many possible corrective measures, so a bit of discussion is warranted.

The minimum course, which should be applied in any case, would be to correct the existing damage, by removing loose concrete, cleaning the exposed steel, and restoring the concrete with new shot-crete, as described in greater detail in subsection IV-2.2.2. This should be combined with measures to limit atmospheric humidity and enhance crawl space drainage per subsection IV-3.1.2. The limitation of this approach is that it will repair existing damage, but will do little to slow-down further degradation, as water will continue to be sucked into the concrete from the wet soils. Thus, this approach alone represents a maintenance program that would need to be continued indefinitely, though probably at 10-year intervals, perhaps even longer.

The effort to actually slow-down the degradation is greatly complicated by the site's conditions, including its perpetually wet, densely compacted soils and deep burial of the foundations within the soils, which effectively precludes access to these foundations. These conditions mean that the concrete foundations may be very difficult to dry out, and dampness of the concrete will limit the effectiveness of many possible corrective measures, which typically involve permeating the concrete with different products to retard corrosion or reduce absorptivity. Another possible approach would be to try waterproofing the soils underlying the foundations, but again, this involves permeating the soils with chemical grouts, and while this works very well in dry sand, it may prove of little benefit with permanently wet, dense glacial till. Yet another possible approach would be to apply crystalline waterproofing to the exposed concrete surfaces, but again, the crystalline waterproofing is not likely to be able to permeate through the very thick concrete to have much effect on the footing bottoms, thus limiting the effectiveness of this approach.

Let me touch upon these considerations in greater detail, starting with application of a corrosion-retarder, such as Sika FerroGard 903. This fluid coating is applied to exposed concrete surfaces, then permeates the concrete to its reinforcing steel, which it coats and retards further corrosion. The problem is that the product may not permeate the concrete very well if it is already saturated with water, which it is and this is difficult to avoid since the soils never dry out in Juneau.

Another possible approach would be to permeate the concrete with absorption-reducing agents, such as ProSoCo Conservare Damp-Course Fluid. This is more typically used to permeate stone masonry, but the work consists of drilling accessible faces of the concrete with a pattern of holes, then injecting this fluid to permeate the concrete. The challenge with this again relates to the existing wetness of the concrete, which may limit effectiveness of this approach.

Yet another possible approach would be to inject the underlying soils with a chemical grout, such as Avanti AV-315 or AV-330, to create a waterproof soil blanket under each footing. However, while this would be a fine approach if the soils consisted of dry sand which would readily accept this grout, saturated dense glacial till may prove much less suitable for this approach. Further, the very deeply buried footings effectively make this approach unfeasible in this case.

Application of crystalline waterproofing, such as Kryton T-1, also appears to pose some limitations in this case. This is typically applied as a water-borne slurry to damp concrete, and the product permeates into the concrete matrix, then crystallizes to reduce porosity and absorption. This can work very well in stopping infiltration into a space through concrete, but in this case, the accessible concrete surfaces are often separated by many feet from the footing bottoms where the waterproofing agent is most needed.

In short, while a number of different approaches can be tried, alone or in combination, to limit moisture absorption and resultant corrosive spalling, due to the conditions affecting this building, many approaches are effectively precluded, and all of these measures should be considered experimental, and should be field-tested on a small number of footings to help evaluate their effectiveness prior to wholesale application. These considerations drive the following recommendations.

2.2.2 Recommended Corrective Actions

Primary corrective measures include addition of new grade beams at strategic locations, repairing existing damaged foundations, enhancing drainage, and controlling humidity. As the purpose of this phase of this project is to roughly determine probable construction cost ranges for various approaches, I further recommend that a budget be allowed for testing some possible additional measures to help retard further degradation.

Drainage enhancements and humidity measures are described in greater detail in subsection IV-3.1.2.

The structural enhancement of these foundations consists of adding new concrete grade beams at the building's SW and SE corners, as well as near the entry portico, as shown in Figure IV-2.2(1). The new grade beams should be 12" thick and 84" tall, extending downward 7'-0" from the undersides of the ground-level concrete floor beams.

To limit the destruction of the new grade beams by moisture absorption, as is occurring with the existing foundations, the grade beams should incorporate several measures. First, any reinforcing should be of stainless steel, or hot-dipped galvanized steel as a minimum, to control corrosion. To limit shrinkage cracks and resultant moisture entry, a low shrinkage, low-water concrete mix with polypropylene fiber reinforcing and Kryton KIM admixture should be used.

See Figure IV-2.2(1) for the configuration of these new grade beams.

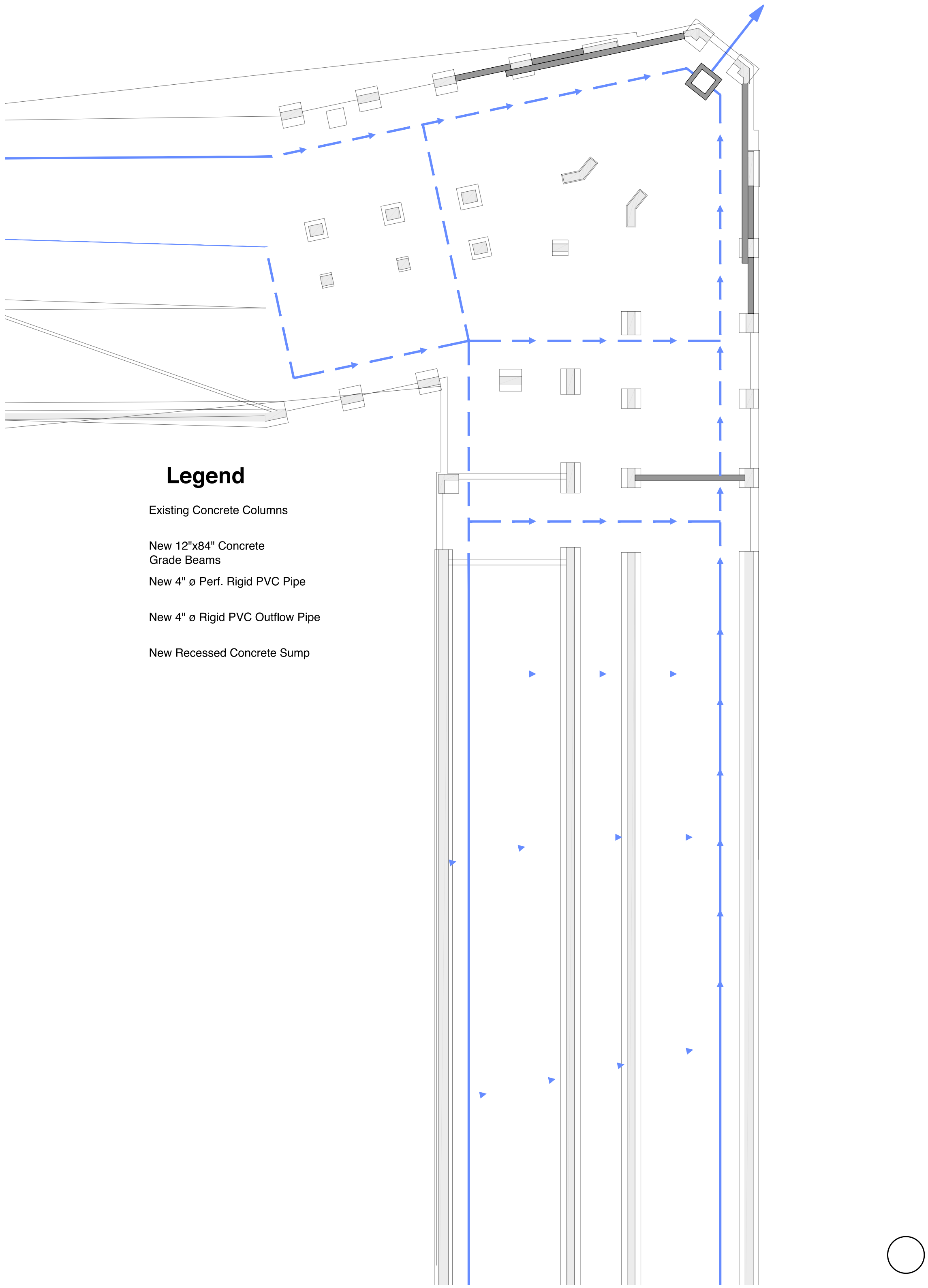


Figure IV-2.2(1): Structural Reinforcing of Foundation System

Now, let me tackle the degradation issue. The basic recommendations include enhancing drainage and controlling humidity per subsection IV-3.1.2, repairing existing foundation damage, and testing possible measures for retarding further degradation.

Correcting the existing damage consists of removal of all loose concrete to expose corroding steel, blasting the exposed steel to bare, bright steel, coating this steel with a zinc-rich primer such as Tnemec 90-97 Tneme-Zinc, and then restoring the original concrete shape with fiber-reinforced shot-crete. Any steel that becomes exposed and that has become seriously corroded should be cut out and replaced with new stainless steel rods before embedding with new shot-crete. To enhance the new shot-crete's resistance to infiltration, admixtures such as Kryton KIM can be added per the manufacturer's recommendations. This work represents the Option 1 "Base Bid" for the foundation repair, and should be executed at all locations. This work should repair existing accessible damage, and should restore the foundation system's integrity for at least 10 years. The owner is advised to check the foundations every 5 years or so, and to perform this same repair work as the need arises. I would venture a guess that this may not need to be repeated any more frequently than about 10 years apart, probably notably longer.

In addition, I believe that in spite of the aforementioned challenges, a combination of measures may help retard further degradation, and should at least be tested. This work includes the following steps, listed in order of execution, which in this case is quite important.

1. Expose Foundation Pier Sides & Clean & Repair Concrete

   Excavate about 6" of soil away from foundation pier sides to expose the uppermost portions to view. Brush and rinse off efflorescence and dirt, and remove any spalled concrete to create sound, clean concrete surfaces. Clean and repair steel and concrete as outlined in the previous paragraph describing Base Bid work.

2. Inject Damp-Course Fluid Into Exposed Parts of Piers

   Drill downward-sloping, 1" diameter holes, about 6" deep and spaced about 12" apart, into the exposed piers directly above the excavated soils. Inject ProSoCo Conservare Damp-Course Fluid per the manufacturer's directions, into these holes. Upon completion, fill drilled holes with grout with Kryton KIM or T-1 admixture.

3. Apply Corrosion Inhibitor

   Apply Sika FerroGard 903 to tops and sides of concrete piers above drilled holes per manufacturer's directions, then rinse all residue and allow to penetrate. This product should permeate the concrete, coat the reinforcing, and help retard further corrosion.

4. Apply Crystalline Waterproofing to All Exposed Concrete Surfaces

   After fully rinsing the corrosion inhibitor and allowing it to permeate the concrete per manufacturer's directions, apply Kryton T-1 to the sides and tops of the exposed foundation piers. This will permeate the concrete and reduce infiltration.

5. Backfill Around Footings

   Replace soils removed to expose foundation pier sides with concrete lean-mix, Controlled-Density-Fill, (CDF), or similar backfill.

2.3. Lowest-Level Concrete Floor Framing

2.3.0 General

This subsection pertains to the raised, concrete-framed floor directly above the crawl space. See also section IV-3.1: Lowest-Level Crawl Space for related information.

2.3.1 Basis of Recommendations

This floor consists of a concrete slab integrally poured with concrete floor beams and joists. Issues germane to this floor system relate to structural adequacy and degradation.

With regard to structural adequacy, analysis by Swenson Say Fagét did not uncover any major deficiencies, thus requiring no “beefing-up”.

On the other hand, degradation is an issue, as many, perhaps most, of the concrete joists display widespread, fairly serious corrosive spalling, particularly near their midspans. The bottoms of these joists had in most locations spalled off, exposing corroding reinforcing steel, resulting from moisture intrusion. However, in contrast to the spalling affecting the foundations, the only moisture source reaching these joists consists of atmospheric humidity in the wet crawl space. Left uncorrected, this degradation will continue, and will eventually compromise the structural integrity of the entire floor system.

2.3.2 Recommended Corrective Actions

Primary corrective measures include repairing existing damaged floor joists, enhancing drainage, and controlling humidity.

Drainage enhancements and humidity measures are described in greater detail in subsection IV-3.1.2.

Correcting the existing joist damage consists of removal of all loose concrete to expose corroding steel, blasting the exposed steel to bare, bright steel, coating this steel with a zinc-rich primer such as Tnemec 90-97 Tneme-Zinc, and then restoring the original concrete shape with fiber-reinforced shot-crete. Any steel which becomes exposed and which has become seriously corroded should be cut out and replaced with new stainless steel rods before embedding with new shot-crete. This work represents the Option 1 “Base Bid” for the floor repair, and should be executed at all locations. This work should repair existing accessible damage, and should restore the floor system’s integrity for at least 10 years. The owner is advised to check the floor system every 5 years or so, and to perform this same repair work as the need arises. I would venture a guess that this may not need to be repeated any more frequently than about 10 years apart, probably notably longer.

In addition, I believe that coating the underside of the entire floor system, especially the joists and beams, with a penetrating corrosion inhibitor may help retard further degradation. This work includes the following steps, listed in order of execution, which in this case is quite important.

1. Clean & Repair Concrete

   Brush and rinse off efflorescence and dirt, and remove any spalled concrete to create sound, clean concrete surfaces. Clean and repair steel and concrete as outlined in the previous paragraph describing Base Bid work.

2. Apply Corrosion Inhibitor

   Apply Sika FerroGard 903 to all sides of joists, beams, and floor slab per manufacturer’s directions. This product should permeate the concrete, coat the reinforcing, and help retard further corrosion.

2.4. Level 1 Concrete Floor Slab

2.4.0 General

This subsection pertains to the raised, concrete-framed floor directly above the ground floor level.

2.4.1 Basis of Recommendations

This floor consists of a concrete slab integrally poured with concrete floor beams and joists.

Where visible, significant cracking was observed very near the building's outer corners, where typically fairly wide, often closely spaced cracks were located. Due to their size, locations, and spacing, these cracks appear seismically induced.

In addition, one continuous, straight crack was observed running a few feet south of the wall separating the boiler room from the shop. This crack parallels this wall, and probably occurs along a pour joint, which has also probably been widened by seismic activity.

These cracks may slightly weaken this floor slab, mildly increasing future seismic risk. The floor system in general appears structurally adequate.

2.4.2 Recommended Corrective Actions

No structural beefing-up appears needed at this floor system. Recommended corrective measures include injecting all accessible floor cracks with epoxy, such as Sika Sikadur Injection Gel, Sikadur 35, etc., as appropriate for specific conditions.

2.5. Brick Chimney

2.5.0 General

This subsection pertains to the relatively tall brick chimney above the main roof, near the inside corner where the west wing joins the main portion of the building.

2.5.1 Basis of Recommendations

This chimney consists of 2-wythe, 9” wide brick walls, lined with 4 ½” thick firebrick spaced 3” from the brick structure. It is capped with two stone rings that appear to be secured to the chimney only with mortar bond.

The chimney brick and stone caps are largely painted with an elastomeric coating, apparently to limit moisture intrusion into the brickwork, which is degraded, with extensive surface erosion, mortar cracking, etc. The coating is delaminating in various locations, indicating moisture intrusion behind it.

In addition, the chimney’s junctures to the roof and parapets are not executed properly, with no through-wall flashings to drain water out from behind the outer brick wythe.

Visually, this chimney is a utilitarian structure, visible only to a limited extent from the building’s north side, which itself is rather utilitarian. In other words, from an architectural perspective, it would generally be best for this chimney to be invisible.

Technical issues relate to structural considerations as well as to moisture infiltration.

Structural concerns relate to overall stability as well as to its stone cap securement. Analysis by Swenson Say Fagét confirmed my suspicion that as constructed, it lacks adequate seismic resistance. The absence of any mechanical securement of its heavy capstones, combined with its degraded mortar, increase vulnerability to seismic displacement, posing risk to people below.

From a water-infiltration perspective, the chimney suffers from ill-conceived, though for its time typical design, especially for Juneau’s climate, whose 220 rainy days and roughly 150 days with sub-freezing temperatures each year pose a deadly combination for all forms of masonry. The basic flaws are that it lacks any flashing caps to preclude water entry, and similarly lacks any flashings to drain water out from behind the brick above the roof. Consequently, moisture within the masonry drains into the roof assembly, which may explain why it has been painted with an elastomeric coating. As expected, spalling, mortar erosion, and similar symptoms are evident, and the chimney is fairly degraded. Left uncorrected, the degradation will accelerate, and occasional leakage into the roof assembly will also occur, as the elastomeric coating cannot reliably preclude water entry into the masonry.

2.5.2 Recommended Corrective Actions

As this chimney is neither very visible nor particularly attractive, I recommend the easiest and least-costly approach for addressing the structural and infiltration issues affecting it. In brief, this consists of dismantling its top to lower it to 8 feet above the roof, cleaning and parge-coating the brick, then over-cladding with a metal cladding with a drainage cavity.

Lowering the chimney height alone allows the remaining portion to have adequate seismic stability. This is unlikely to cause any detrimental effects, and if odors became problematic, the chimney could be extended with a sheet-metal flue and housing. Parge-coating the brick will enhance integrity further by surface-bonding the brickwork, and will also help protect against moisture intrusion. The recommended metal over-cladding will have very limited visibility, and can easily improve on the chimney’s current appearance.

Specific chimney recommendations are as follows, and as depicted in Figure IV-2.5(1):

1. Dismantle Existing Chimney Top Portion & Clean Remaining Part

   Dismantle brickwork and stone caps to lower chimney to roughly 7'-6" above adjacent roof. Remove all elastomeric coatings, loose mortar, spalled brick, and any other loose or foreign matter to expose sound clean brick and mortar.

2. Drill Cap Anchors Into Top of Brick Cap

   Drill Helifix anchors or ½"ø epoxy-set stainless steel threaded rods about 4" into the tops of the outermost and innermost brick wythes, spaced about 24" apart in a staggered fashion. Leave rods protruding up about 3".

3. Cast New Concrete Cap Ring Atop Chimney

   Cast new concrete cap with an outward sloping top atop the brick. Make inner cap thickness about 8", outer about 5". Cast outer cap edge minimum 2 ½" past outer brick face.

4. Retrofit Reglet Base Flashing Above Roof Membrane Termination

   Saw-cut mortar joint about 4" above top of existing roof membrane and install upper portion of 2-piece, 24-gage stainless steel or 16 oz. copper flashing into saw-cut, then insert backer-rod and sealant.

5. Apply Parge Coat to Chimney Brick

   As repointing of the existing seriously degraded chimney mortar would be recommended in any case, it would probably be less costly to simply apply a cementitious parging coat, and this is my recommendation, as this can also enhance the chimney's integrity and infiltration resistance. Specifically, I recommend that a 3/8"-1/2" thick parge coat of type S mortar, reinforced with polypropylene fibers, be applied and troweled smooth over the cleaned outer brickwork. To limit absorptivity, I also recommend addition of Kryton KIM or a similar admixture to the parge coat.

6. Install Lower Portion of 2-Piece Reglet Base Flashing Begun in Step 4

   Snap-in lower portion of 24-gage stainless steel or 16 oz. copper flashing to fully cap top of roof membrane or parapet-top flashing.

7. Over-Clad Chimney with Metal Cladding

   After parge coat is fully cured, install galvanized steel vertical hat channels near chimney corners and spaced 16" on center in-between, then secure new sheet-metal cladding over this, along with corner trim, etc. as needed. The new cladding can consist of 24-gage pre-finished galvanized or stainless steel, or 16 oz. copper. Dissimilar metals, if any, should be isolated from each other.

8. Install Flashing Cap Atop Chimney

   Install continuous cleat of 24-gage galvanized or stainless steel or 16 oz. copper along outer-lower portion of new concrete cap, then apply high-temperature self-adhered flashing membrane, such as Grace Vycor Ultra, over top of concrete cap and over cleat and into chimney flue. Make sure to terminate the membrane at the bottom of the concrete cap, before reaching brick, to allow gasses to vent from behind the firebrick. Then, cap the chimney top with a sheet metal cap of 24-gage galvanized or stainless steel or 16 oz. copper.

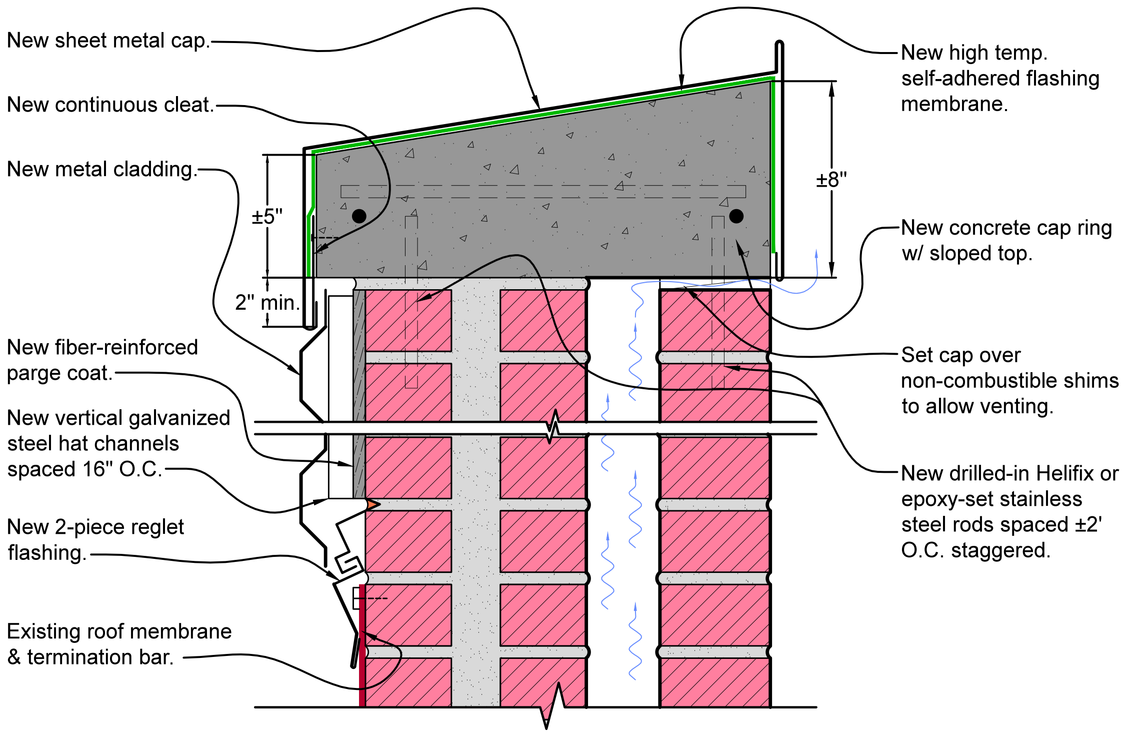


Figure IV-2.5(1): Recommended Chimney Modifications

2.6. Securement of Large Masonry Cladding Elements

2.6.0 General

This subsection pertains to the securement of the various masonry cladding elements to the primary building structure and to each other. Such elements include the stone cladding along the building base, stone and terra-cotta water tables, terra-cotta wall panels, chimney caps, window sills, essentially all of the portico's sub-components, etc. These are also discussed in subsequent subsections in greater detail, and this subsection focuses on the "securement issues" applicable to all of these elements in general.

2.6.1 Basis of Recommendations

Various of the building's large masonry elements are either not secured to the primary construction in any fashion other than with mortar bond, or where various steel anchors had been used, they appear widely spaced and minimal in many locations.

Further, the mortar bond securing some of these elements has generally degraded, and in some cases has been fully compromised. Some of these elements had also become cracked, further compromising their securement. In addition, corrosion has begun to compromise many of these anchors.

In short, the building appears lacking with respect to the securement of many large masonry elements to the structure and to each other. While this does not threaten the integrity of the building as a whole, it poses risk to pedestrians below in case of an earthquake. This risk will only increase with ongoing loss of mortar bond and corrosion of steel anchors.

2.6.2 Recommended Corrective Actions

In general, recommended corrective actions for this securement issue vary substantially between the different elements, and are thus outlined in greater detail in the subsections addressing these elements individually.

This subsection only provides a "catch-all" recommendation that any larger masonry elements that may not be addressed individually elsewhere be anchored. For clarity, the term "larger elements" refers to masonry blocks whose total volume exceeds about 1.5 CF and whose weight exceeds about 200 pounds. Any such elements not addressed elsewhere should be anchored to the back-up walls and primary structure with a minimum of two Helifix or ½" ø stainless steel threaded rods, and such anchors should be spaced as needed to equal an approximate anchor density of 1 anchor per 2 SF.

2.7. Interior Hollow Clay Tile Walls

2.7.0 General

This subsection pertains to the interior partition walls comprised of hollow clay tile, referred to in the drawings as terra-cotta walls.

2.7.1 Basis of Recommendations

Many interior partition walls consist of 4” hollow clay tile, with plaster or other finishes applied over these. In many locations on floor levels 1, 2, and 5, these heavy walls stop above the ceilings, with no connections to the upper floor slabs. These partition walls pose a risk of collapsing in earthquakes.

2.7.2 Recommended Corrective Actions

The tops of the typical partition walls should be braced to the concrete floor system above them. In general, the bracing consists of installing a steel channel to capture the tops of the hollow clay tile walls, with steel angles bolted or welded onto this channel, spaced roughly 4 feet apart, and extending up at an approximate slope of 45 degrees to the undersides of the concrete beams or floor joists above, to which these should be secured.

Where these hollow clay tile walls occur around elevator and stair shafts, they cannot be easily braced, and at these locations, it is simpler to just replace these walls with steel-framed walls with two layers 5/8” type X GWB both sides to maintain the needed fire rating.

Figure IV-2.7(1) depicts a typical bracing method for the partition walls, while Figures IV-2.7(2-7) indicate the locations where the bracing or replacement with metal stud walls is recommended.

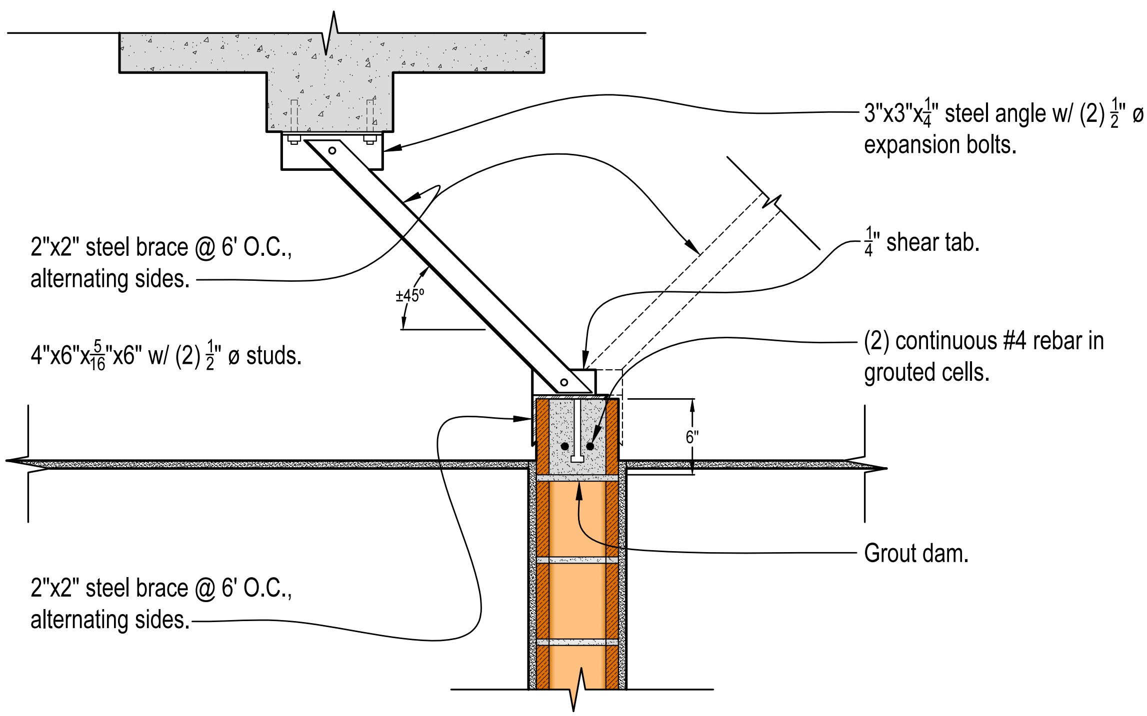


Figure IV-2.7(1): Recommended Hollow Clay Tile Wall Top Bracing

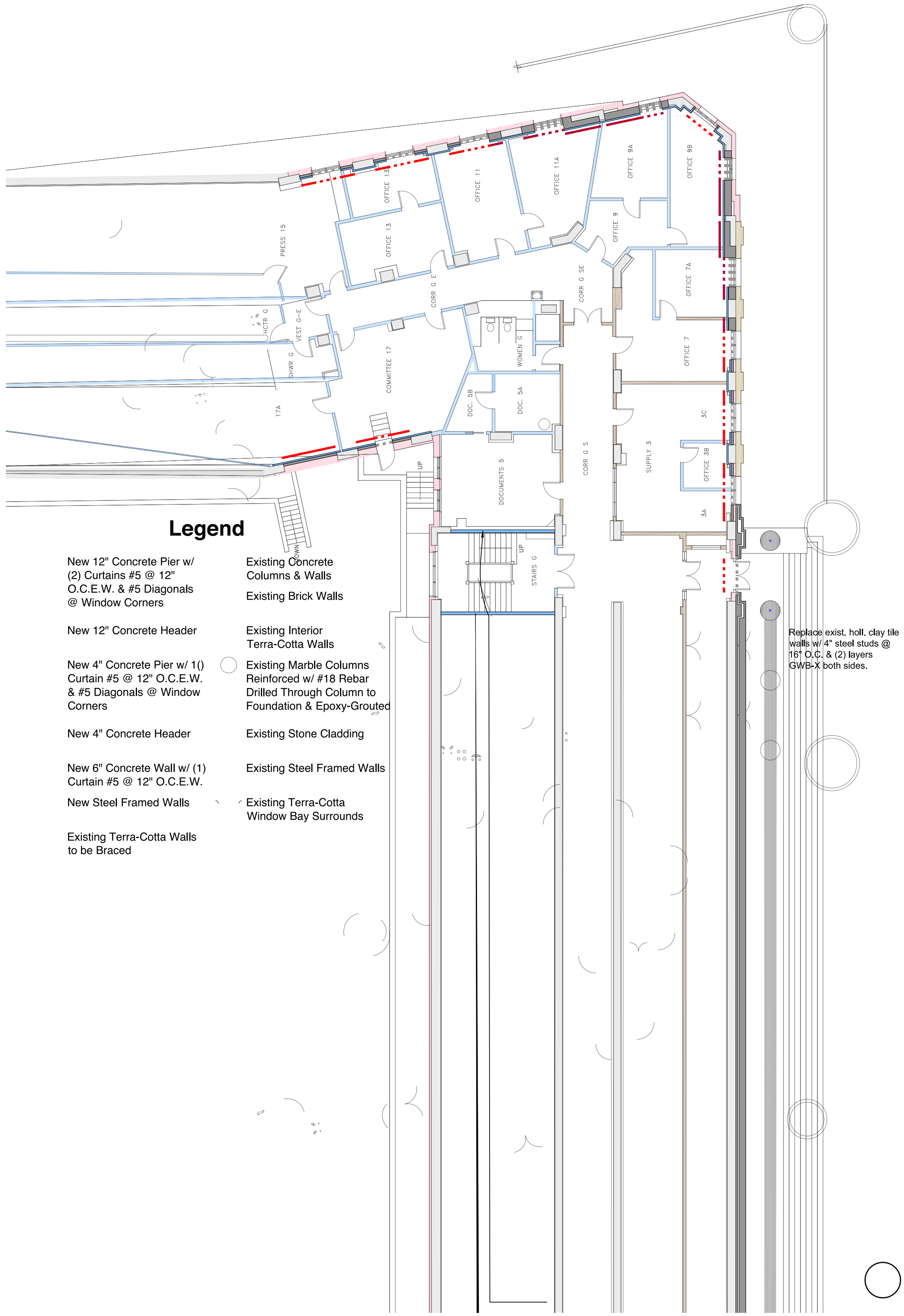


Figure IV-2.7(2): Recom. HCT Wall Bracing/Replacement Locations-Floor Level 0

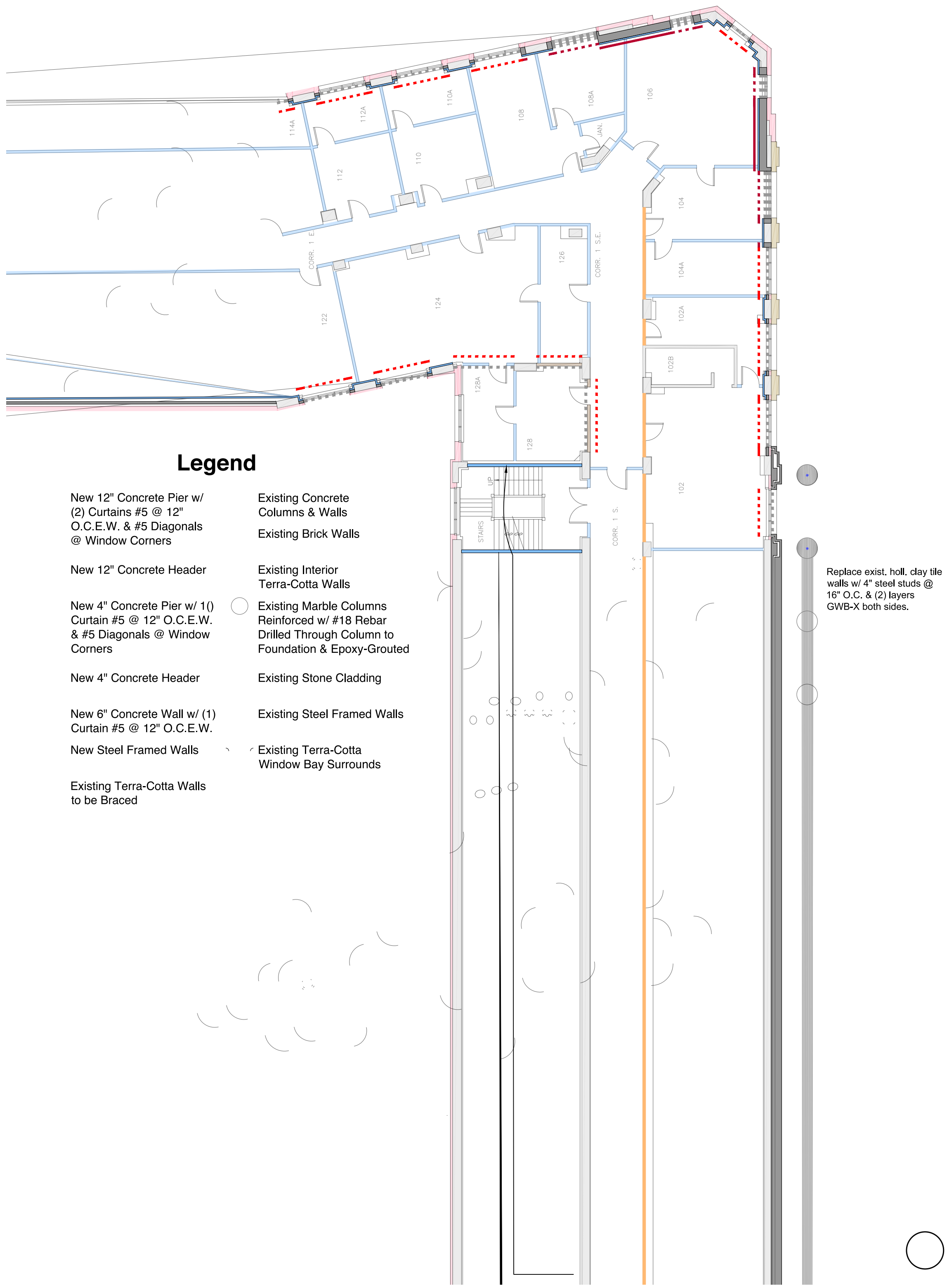


Figure IV-2.7(3): Recom. HCT Wall Bracing/Replacement Locations-Floor Level 1

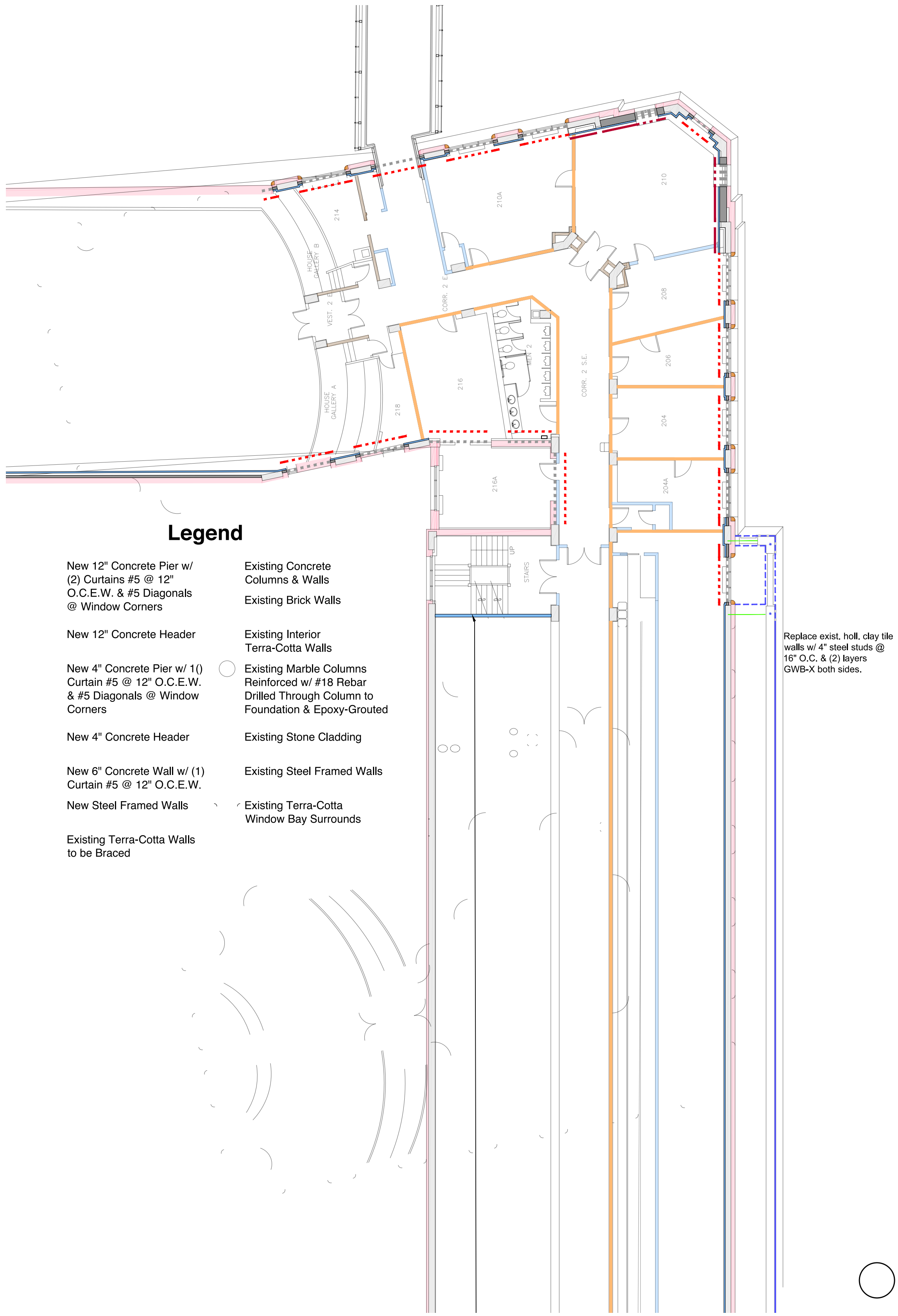


Figure IV-2.7(4): Recom. HCT Wall Bracing/Replacement Locations-Floor Level 2

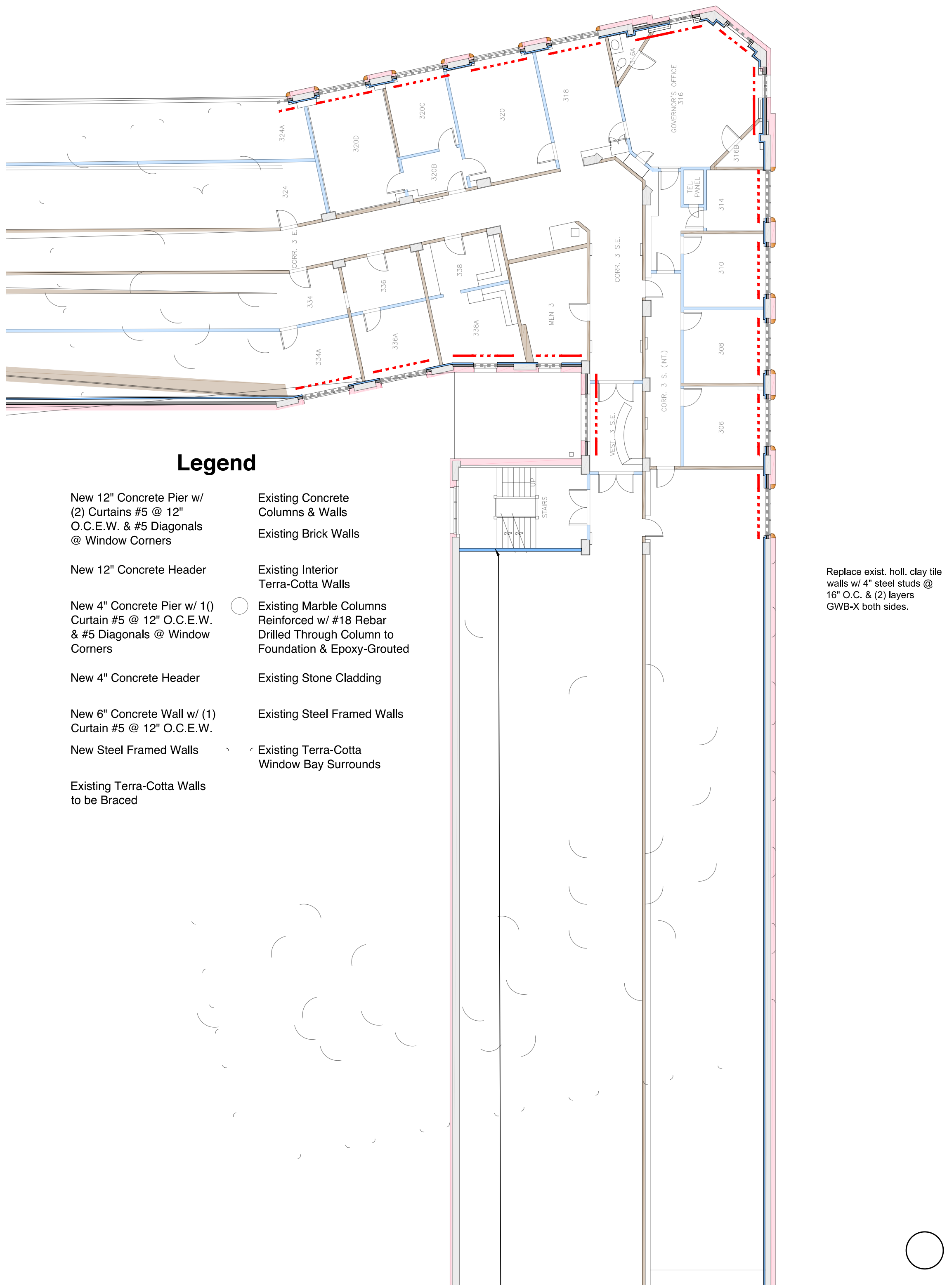


Figure IV-2.7(5): Recom. HCT Wall Bracing/Replacement Locations-Floor Level 3

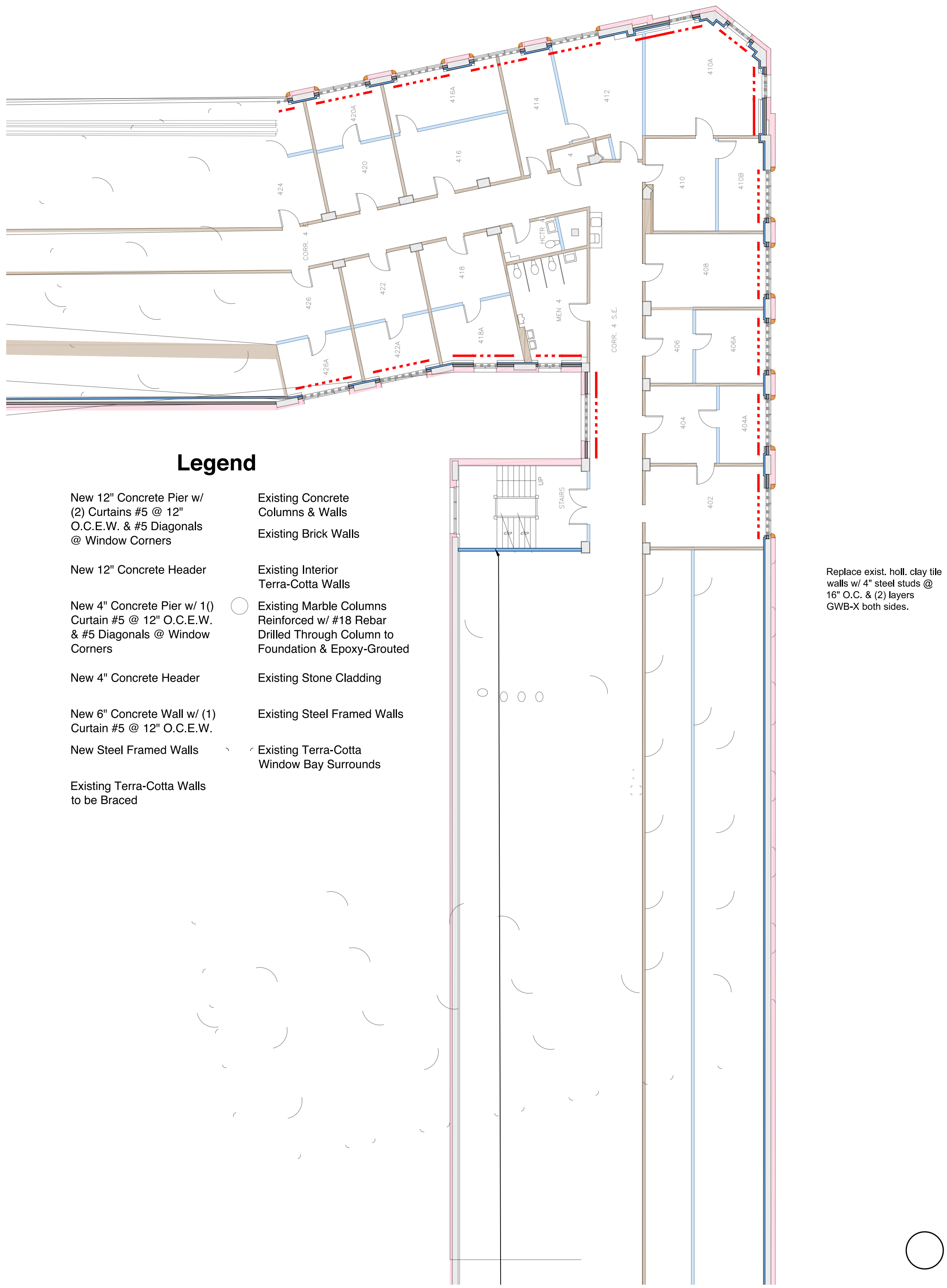


Figure IV-2.7(6): Recom. HCT Wall Bracing/Replacement Locations-Floor Level 4

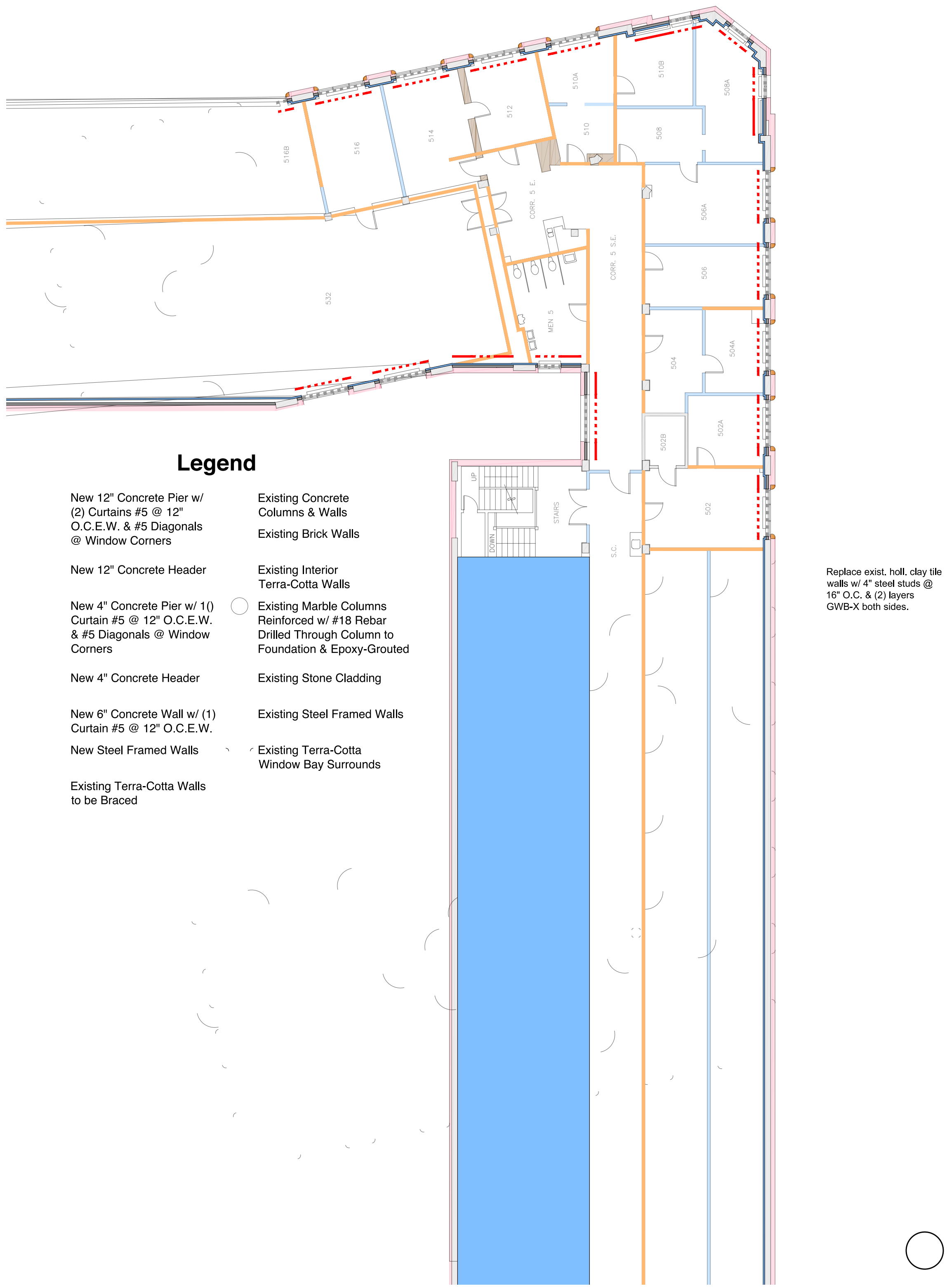


Figure IV-2.7(7): Recom. HCT Wall Bracing/Replacement Locations-Floor Level 5

2.8. Large Mechanical Equipment

2.8.0 General

This subsection pertains to various pieces of large mechanical equipment, such as the boiler, within the building.

2.8.1 Basis of Recommendations

The building contains various large mechanical equipment units, such as the boiler, ductwork, piping, and similar elements that are not secured or braced in any fashion. These unsecured elements are quite heavy, and pose a risk of overturning or falling in earthquakes.

2.8.2 Recommended Corrective Actions

These heavy elements should be secured to the floors under them, in the case of floor-mounted equipment such as the boiler, and should be braced to the concrete floor system above them where suspended, such as large ducts and piping.

In general, floor-mounted equipment should be bolted to the floors.

Suspended ducting, plumbing, and similar elements can be braced with steel straps spaced roughly 12 feet apart, and extending up at an approximate slope of 45 degrees to the undersides of the concrete beams or floor joists above, to which these should be secured.

3. PRIMARY EXTERIOR ENCLOSURE ASSEMBLIES & ELEMENTS

3.0. General

This section of the report addresses issues related to the building's primary exterior elements, such as wall assemblies, ground-level floor slabs, windows, roofs, and similar major components. It is divided into 14 subsections, each of which pertains to a specific primary element. Where appropriate, each subsection contains preliminary drawings depicting the described work. In addition, Figures IV-3.0(1-7) show the exterior elevations which reference the locations of specific details in the various subsections.

Fig. IV-3.0(1): South Elevation

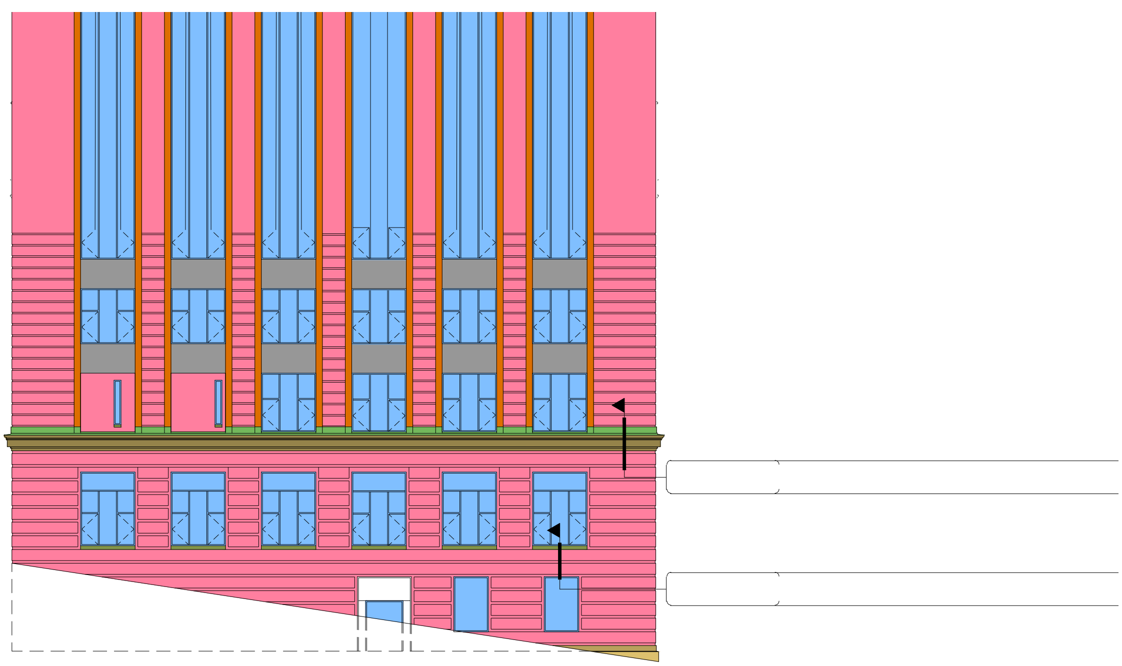


Fig. IV-3.0(2): West Elevation

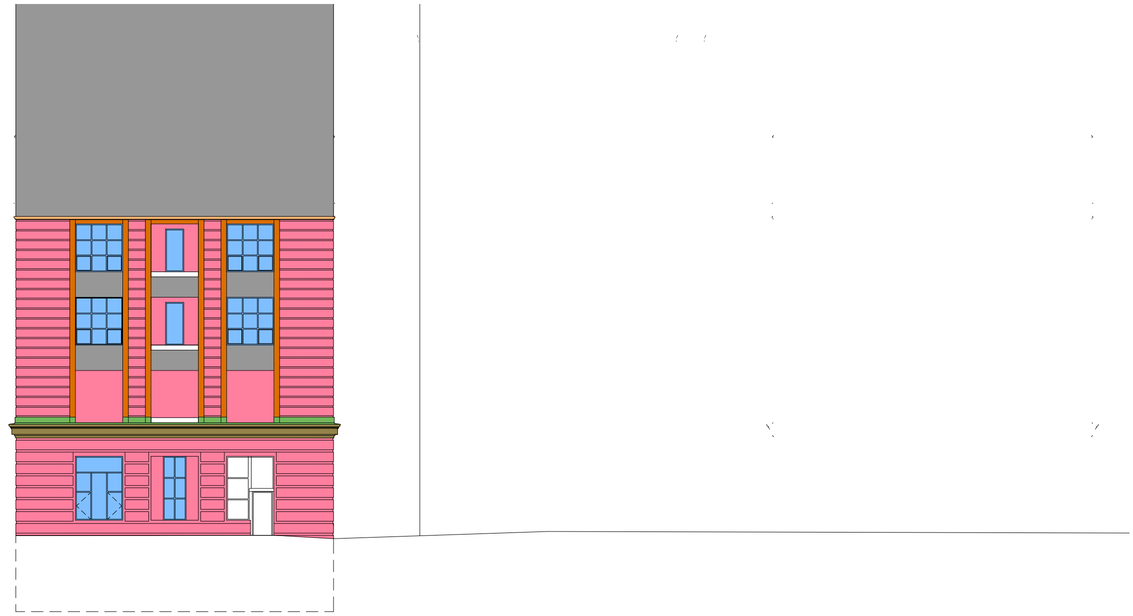


Fig. IV-3.0(3): North Elevation

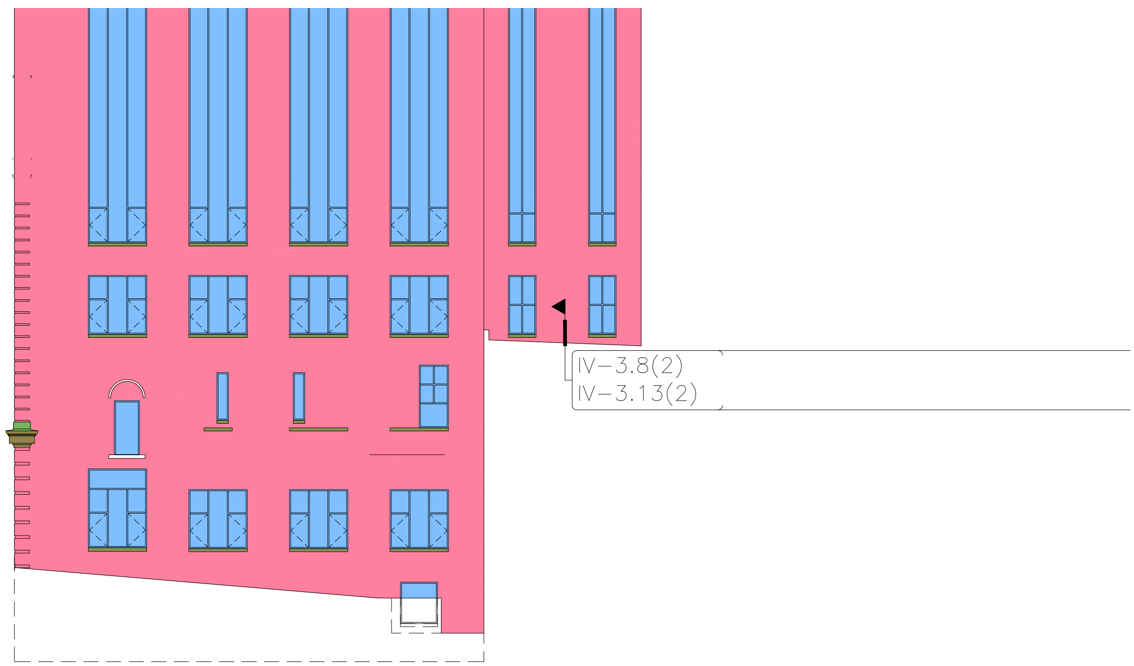


Fig. IV-3.0(4): North Courtyard: West-Facing Wall

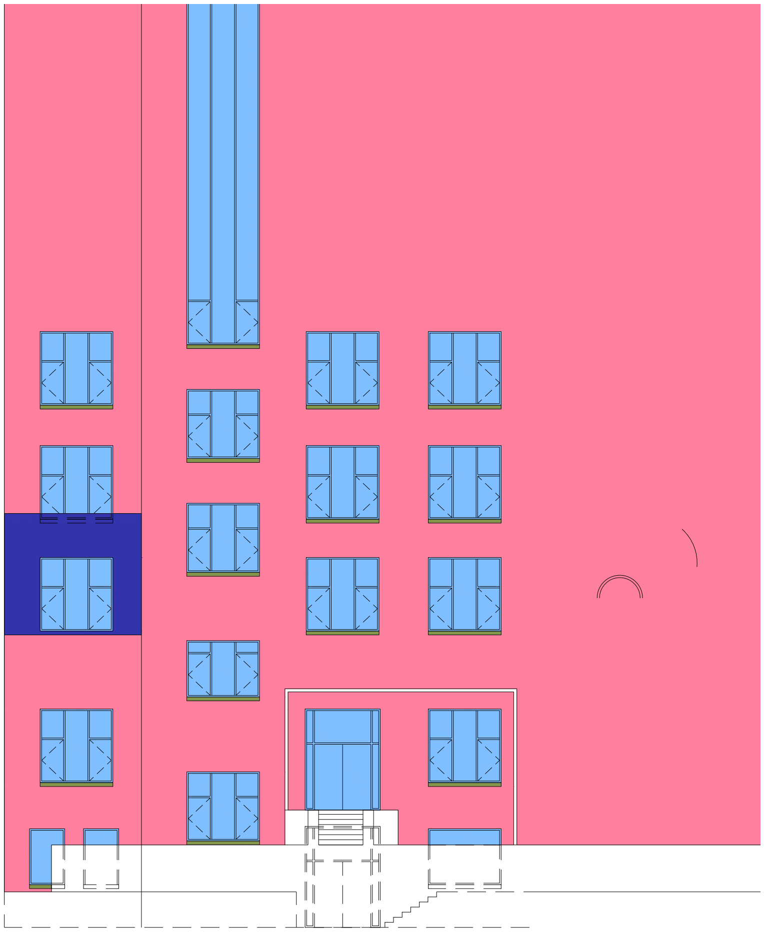


Fig. IV-3.0(5): North Courtyard: North-Facing Wall

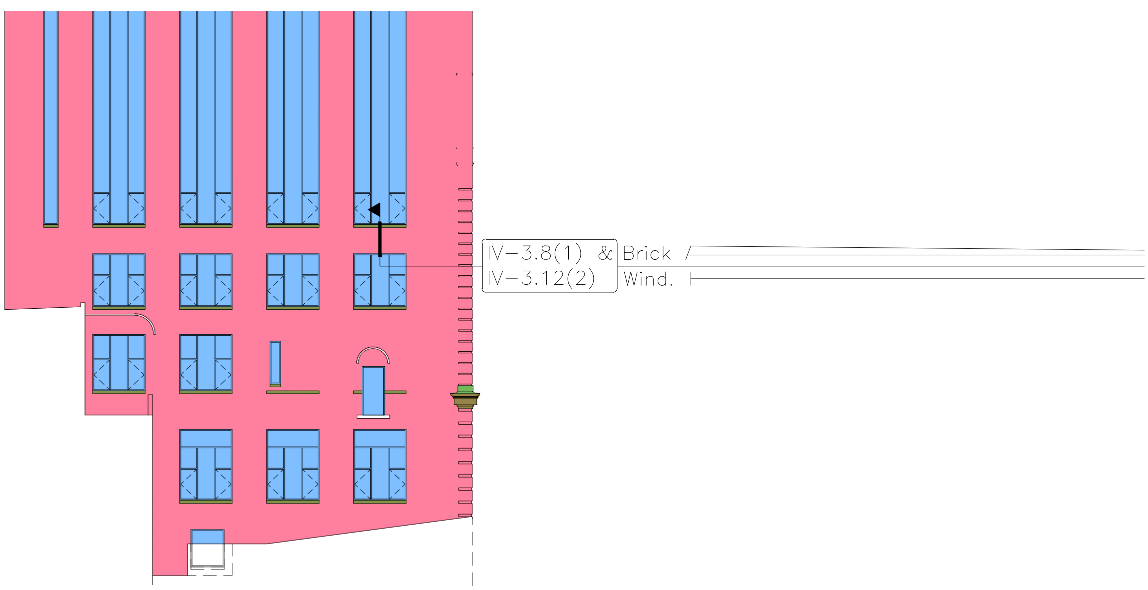


Fig. IV-3.0(6): North Courtyard: East-Facing Wall

Fig. IV-3.0(7): East Elevation

3.1. Lowest-Level Crawl Space

3.1.0 General

This subsection pertains to the crawl space located under the building's main body and under the southerly portions of both north-extending wings, in general terms.

3.1.1 Basis of Recommendations

Exposed sloping soil forms the crawl space floor, and the underside of the concrete-framed level-1 floor comprises its ceiling. The crawl space is characterized by very wet and humid conditions, with a small continuous stream running through this space. Consequently, many concrete elements, such as the foundations and floor joists, display corrosive spalling and efflorescence.

The exposed, water-saturated soils are having a very detrimental effect on the integrity of all exposed concrete. Water is being absorbed directly from soil into the foundations, but atmospheric moisture alone is causing the concrete floor joists to spall.

3.1.2 Recommended Corrective Actions

Please see subsections IV-2.2 and IV-2.3 for additional related corrective measures not described here. Recommended corrective measures within this section are two-fold, and include the installation of a gravity-fed drainage system and soil-capping with a cross-laminated vapor-barrier, as well as optional capping with a 2" thick, fiber-reinforced shot-crete "slab" to help protect the vapor barrier and further reduce humidity.

The recommended drainage system consists of excavating a grid-work of roughly 12" square trenches throughout the crawl space, as generally shown in Figure IV-3.1(1). To the extent feasible, these trenches should slope about 2% toward the SE corner, where a recessed, concrete-lined sump, about 3'-0" square and 2'-0" deep, should be installed. This sump should gravity-feed into the storm-drain via a 4" ø non-perforated rigid PVC pipe.

The trenches should be lined with a geotextile fabric, such as Mirafi 140 N, then filled with about 3" of gravel. This gravel base should be overlaid with 4" ø, perforated rigid PVC pipes wrapped with geotextile fabric. Gravel should then fill the remainder of the trench, and the geotextile fabric should wrap over the top.

A heavy-duty, reinforced or cross-laminated vapor barrier, such as Griffolyn T-85, should then be placed over the entire crawl space floor. All laps and rips should be taped with the manufacturer's vapor-barrier tape, and the perimeters should also be taped to the perimeter foundations.

Figures IV-3.1(1 & 2) describe the work recommended in this subsection.

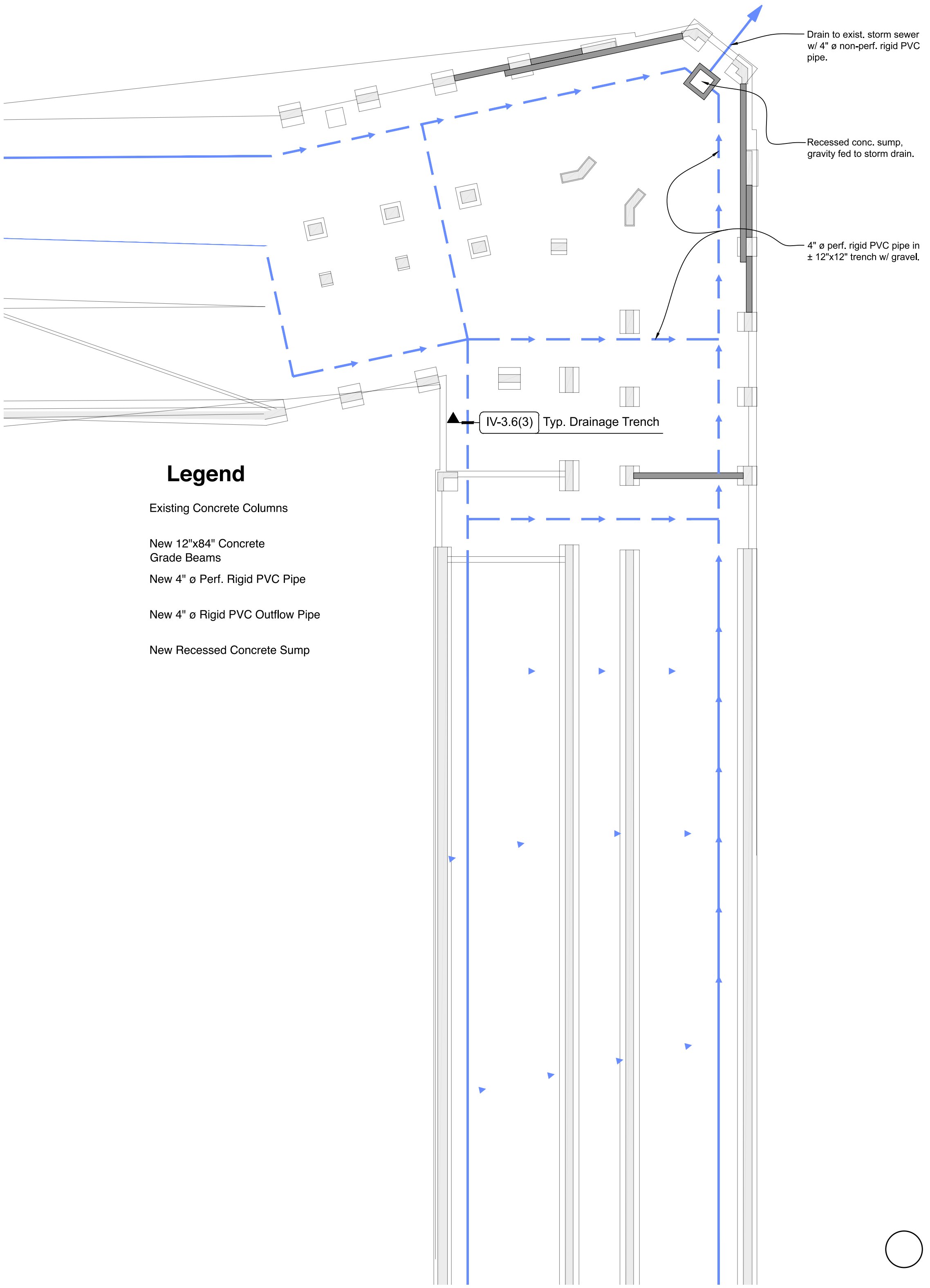


Fig. IV-3.1(1): General Configuration of Recommended Drainage System

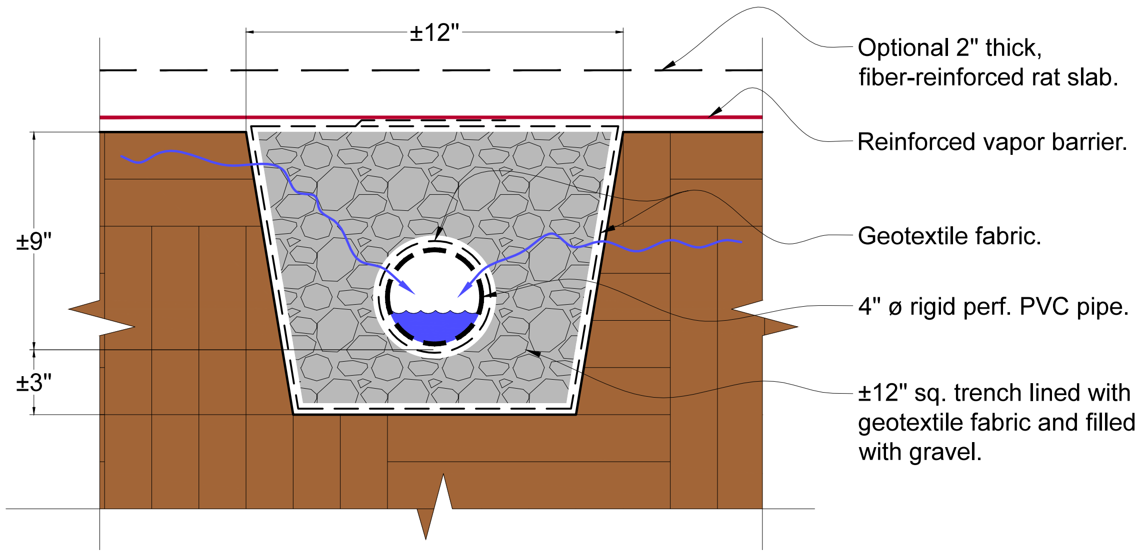


Fig. IV-3.1(2): Typical Drainage Trench

3.2. Concrete On-Grade Floor Slabs

3.2.0 General

This subsection pertains to the on-grade concrete floor slabs that occur at the base of the northern portions of both north-extending wings.

3.2.1 Basis of Recommendations

These floor slabs were examined only in the west wing, where elevated moisture levels were detected within this slab in the shop area, and occupant-staff reported occasional leakage via a slab crack and along the slab-floor juncture, both near the west wing's NW corner. No leakage was reported at the east-wing floor slab during a brief visit to this restricted-access space.

The drawings indicate that the boiler-room slab may incorporate waterproofing between two slabs, but this waterproofed sandwich-slab does not extend under the shop area, which has no waterproofing, and occasional limited leakage occurs there.

A wide spectrum of possible corrective approaches could be applied to control the slab infiltration, with a correspondingly wide spectrum of costs. At the extreme end, one could remove the existing floor slab, install sub-slab drainage and waterproofing systems, and replace the floor slab. This would be a very costly approach, which does not appear warranted by the shop-use of this area, which can generally accommodate some occasional limited dampness, unlike a carpeted office space, for example.

In view of these considerations, recommended corrective work is quite limited, and consists of injecting the leaky floor crack and floor-wall cold joints with epoxy. It should be understood that this may not prove entirely effective, but is recommended as a first approach due to its vastly lower cost and general moisture-tolerance of the affected spatial use. More robust, and costlier, measures can be retrofitted if the epoxy injection fails to solve the infiltration and the owner wishes to expend the funds for beefier measures.

3.2.2 Recommended Corrective Actions

Recommended corrective measures include injecting all accessible floor cracks and the perimeter of the shop slab where it joins the basement walls with epoxy, such as Sika Sikadur 35 Hi-Mod LV LPL, Sikadur 52, etc., as appropriate for specific conditions.

3.3. Concrete Sub-Grade Walls

3.3.0 General

This subsection pertains to several sub-grade concrete walls that occur primarily at the base of the northern portions of both north-extending wings.

3.3.1 Basis of Recommendations

A brief examination of accessible interior wall portions at the west wing revealed some floor staining near this wing's NW corner, and occupant-staff reported occasional water accumulation along this floor-wall juncture. No other locations of leakage were observed below the west wing.

In contrast, the newer sub-grade walls below the east wing displayed various leak symptoms, though I was told that no current leakage affects this east-wing basement, in spite of the symptoms, which imply otherwise. In view of this, it appears prudent to assume that leakage is affecting the east wing walls, via shrinkage cracks, cold-joints, and possibly rock-pockets. Over the long term, this could begin affecting the walls' integrity through reinforcing corrosion.

3.3.2 Recommended Corrective Actions

No corrective work is recommended for the west wing's sub-grade walls, other than those outlined for the wall-floor junctures in subsection IV-3.2.2.

Recommended corrective measures at the east wing are as follows:

1. Remove Interior Finishes from Locations Displaying Moisture Damage

   Remove interior finishes to expose interior concrete surfaces to view. Brush and clean off efflorescence and dirt, and remove any spalled concrete to create sound, clean concrete surfaces.

2. Inject Epoxy Into All Exposed Concrete Cracks and Cold Joints

   Where removal of interior finishes reveals cracks or cold joints, inject these with appropriate epoxy resins, such as Sika Sikadur 35 Hi-Mod LV, etc.

3. Repair Rock Pockets, Voids, and Similar Flaws

   Where rock pockets and similar flaws are found upon removal of the interior finishes, remove all loose concrete to sound concrete. Depending on conditions, fill all voids with Kryton Krystol Plug for actively leaking areas, or coat dry but flawed areas with Kryton Krystol T-1. Cap over this with Kryton Bari-Cote, then coat entire exposed concrete surface with Kryton Krystol T-1.

4. Reinstall Interior Finishes

   Reinstall new interior finishes to match adjacent.

3.4. Stone-Clad Exterior Wall Base

3.4.0 General

This subsection pertains to the lowest-level stone base along the building's south elevation. This stone base extends from grade up to a projecting stone water table, which separates it from the stone cladding above.

3.4.1 Basis of Recommendations

This stone base, especially along the very bottom, has effectively been destroyed by moisture absorption and freeze-spalling. The securement of the stone to the structure is minimal to begin with, and the steel wire anchors have been further compromised by corrosion.

While the stone's appearance could temporarily be restored with restoration mortars, this would not last very long, and the same symptoms would continue to manifest. Further, continued corrosion will also compromise the stone anchors, leading to instability of this stone base.

3.4.2 Recommended Corrective Actions

In view of the advanced degradation of this stone base, replacement with a pre-cast concrete cladding is advised.

The new cladding should be integrally colored and textured to match the existing stone cladding's appearance, and it should be reinforced only with stainless steel reinforcing to avoid future corrosion spalling. For cost estimating purposes, the cladding should be assumed 4" thick.

It can be anchored to the structure with epoxy-set stainless steel threaded rods, or with stainless steel embedded clips, etc.

Figure IV-3.4(1) depicts replacement of this stone base.

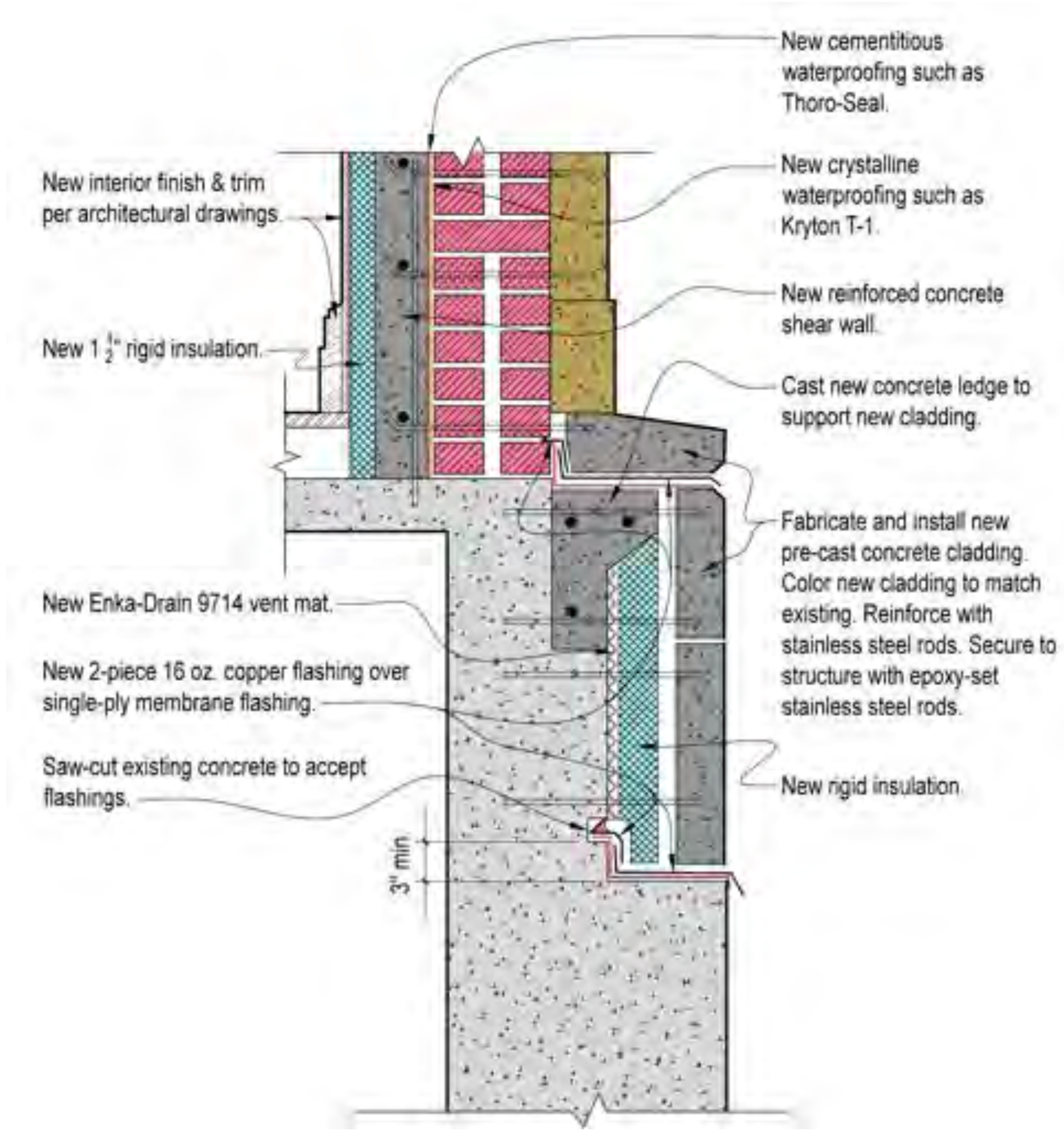


Fig. IV-3.4(1): Stone Base Replacement with Restoration of Exist. Cladding Abv.

In broad terms, the recommended corrective measures are as follows:

1. Stabilize Stone Cladding Above Stone Base

   Stabilize the stone cladding above to allow removal of the stone base. In brief, stabilization would require drilling stainless steel anchor rods through the brick walls into the cladding, then casting interior concrete walls, as generally described in subsection IV-2.1. Once this upper cladding has been secured, the stone base can be removed.

2. Cast New Concrete Ledger Below Stone Base Water Table

   A new reinforced concrete ledger should be cast directly below the projecting water table to support the new water table.

3. Install New Membrane and Copper Base Flashings

   Saw-cut a continuous horizontal reveal at least 3" above the existing concrete ledge to accept a new, double-layer base flashing consisting of a single-ply membrane capped with a 2-piece, 16-ounce copper flashing. The single-ply membrane can consist of Cetco Core-Flash 60. Figures IV-3.4(3 & 4) illustrate similar work at a different project.

Fig. IV-3.4(3): Adhered Single-Ply Membrane Flashing & Saw-Cut Reveal

Fig. IV-3.4(4): 2-Piece Copper Flashing Over Single-Ply Membrane Flashing

4. Install Anchors For New Cladding

   Quite a variety of anchoring methods can be used to secure the new cladding, and detailed analysis of optimal methods is beyond this cost-focused report's scope. In brief, anchor methods can include standard masonry veneer ties, embedded clips, as well as drilled-in, epoxy-set rods. The rod-method is described as a basis for cost estimating, though the specific method will probably have limited cost impact.

   Regardless of specific anchoring method, all anchors should be type 304 stainless steel to avoid corrosion. The number of anchors per cladding piece will vary, depending on size of cladding piece being secured, but no fewer than two anchors should secure each piece, and at least one anchor should occur for every 2 SF.

   With the rod method, the existing concrete wall should be drilled at least 4" deep, and roughly ½" ø stainless steel threaded rods should be epoxy-set into these holes. The rods should be of sufficient length to penetrate into the cladding to within 1 ½" of its outer surface.

5. Install New Vent Mat and Rigid Insulation Over Existing Concrete Wall

   Spot-adhere with sealant or otherwise secure new thin vent mat, Colbond Enka-Drain 9714 over the existing concrete wall face to facilitate drainage behind new insulation. Install vent-mat with fabric side facing outward.

   Install rigid, 2" thick, extruded polystyrene insulation, such as Dow Board, over the vent mat and anchors.

6. Install New Color-Matched Pre-Cast Concrete Cladding Over Lower Wall Portion

   Drill or cast-in oversized holes into back side of pre-cast concrete cladding pieces to accept stainless steel rods. Drill holes to within about 1 ½" of outer cladding surface. Inject holes with epoxy, set over anchor rods, and brace in place till epoxy sets.

7. Install New Membrane and Copper Flashings Under Projecting Water Table

   Saw-cut a continuous horizontal reveal along existing mortar bed joint in brick wall behind water table to accept a new, double-layer base flashing consisting of a single-ply membrane capped with a 2-piece, 16-ounce copper flashing. The single-ply membrane can consist of Cetco Core-Flash 60. Figures IV-3.4(3 & 4) illustrate similar work at a different project.

8. Install New Color-Matched Pre-Cast Concrete Water Table Pieces

   Drill or cast-in oversized holes into back side of pre-cast concrete water table pieces to accept stainless steel rods. Drill holes about 4" deep. Apply blobs of type S mortar over copper flashings, with gaps between blobs to allow drainage from under water table pieces. Inject holes in pieces with epoxy, set over anchor rods, and shim in place till mortar and epoxy set.

3.5. Stone-Clad Exterior Walls Along Bottom 2 Levels

3.5.0 General

This subsection pertains to the stone-clad walls directly above the stone base addressed in subsection IV-3.4. The stone cladding extends from this base upward to a projecting stone water table above the first floor windows, and clads most of the building's south elevation. While this base is contiguous with and similar to the stone cladding below the portico, the portico-related cladding is addressed separately in subsection IV-5.3.

3.5.1 Basis of Recommendations

The primary factor relating to the design of these walls is the fact that they completely lack any flashings or other means to limit water intrusion and to drain any water back out the cladding. This exacerbates moisture intrusion and interior leak risk, and accelerates degradation of the cladding and its metal anchors. Consequently, the cladding displays scattered erosion, cracking, mortar delamination, and similar symptoms. In addition, all ground-level stone sills in this cladding are cracked at one side.

The stone cladding pieces are secured with a single 3/8" ø steel wire drilled 2" into each of the larger stones. In some cases, this yields a single point of marginal attachment for stones with a 13 SF face area, 20 CF volume, and over 3,000 lb. weight. Further, these minimal anchors have begun to corrode, in a few locations causing spalling. Though this does not threaten the integrity of the building, it poses risk to pedestrians below in case of an earthquake.

The cladding degradation will accelerate, and pieces may fall off from time to time. Risk of interior leakage, especially below window sills and above the lower window heads will also persist, as will risk of seismic displacement with continued anchor corrosion.

However, unlike the stone base directly below, this cladding is not yet entirely destroyed, and its restoration appears feasible, though this will only yield a limited lifespan of perhaps another 40 years before corrosion of the existing anchors will bring about unsustainable spalling.

Another relevant consideration is the fact that this cladding must be replaced where it occurs under the portico roof, where it is seismically damaged and also serves the structural function of supporting the heavy portico roof. This is addressed in greater detail in subsection IV-5.3. This consideration argues for the replacement of this cladding even where not under the portico roof.

Similarly, as outlined in subsection IV-3.4, the stone base directly below this cladding also needs to be replaced, as it is essentially destroyed. This also argues in favor of wholesale replacement of this stone cladding, even though its life can be extended with lesser measures.

In short, the technically optimal corrective approach would be to replace the existing cladding, as this would better match the appearance of the adjacent portions which need to be replaced, and would provide a much longer-lived and better-secured cladding. Thus, I recommend the Cladding Replacement approach in Options 2 & 3 (Parts V & VI). Option 1 includes the Cladding Restoration approach, which would be to re-anchor and restore the existing cladding to harvest its remaining lifespan more fully, and to give the state some sort of cost comparison.

3.5.2 Recommended Corrective Actions

In general terms, the Cladding Restoration approach is depicted in Figure IV-3.5(1), and the verbal description of the work follows the drawing.

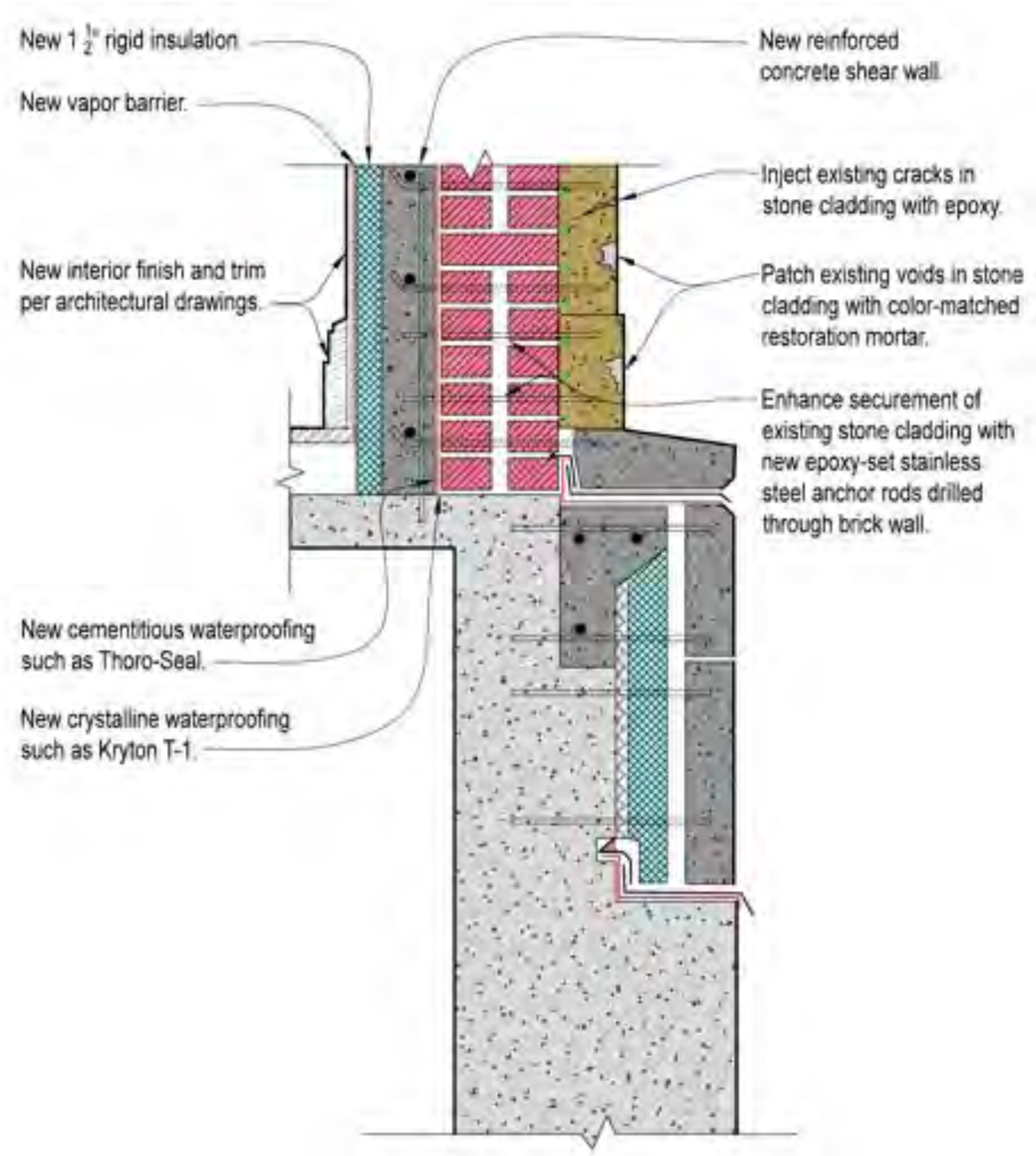


Fig. IV-3.5(1): Stone Cladding Restoration

The Cladding Restoration approach consists of the following steps:

1. Remove Int. Hollow Clay Tile and Install New Int. Concrete Walls and Pins at Levels 0 & 1

   This work is described in greater detail in subsection IV-2.1.2.

   The number of anchors per cladding piece will vary, depending on size of cladding piece being secured, but no fewer than two anchors should secure each piece, and at least one anchor should occur for every 2 SF.

   Stainless steel, ½” ø rods would be drilled through the brick walls or concrete columns to penetrate the cladding to within 1 ½” of its outer surface, and should be epoxy-set in both the cladding and walls or columns.

2. Replace Stone Base Below Stone Cladding

   This work is described in greater detail in subsection IV-3.4.2.

3. Inject Cracks in Stone Cladding with Epoxy

   Major cracks in the cladding pieces should be injected with appropriate epoxy resins, such as Sika Sikadur 35 Hi-Mod LV, etc.

4. Restore Surface Voids, Spalled Areas, etc. with Appropriate Restoration Mortar

   Surface voids, spalled areas, and similar surface flaws should be patched with appropriate restoration mortars, such as Jahn Restoration Mortar by Cathedral Stone Products Inc.

5. Repoint Eroded, Cracked, or Damaged Mortar Joints with New Mortar

   Where existing mortar joints are cracked, eroded, or otherwise damaged, selectively repoint such joints to a minimum depth of ¾” with color-matched, type N mortar, and tool joints to match existing ones.

6. Clean Masonry Surfaces

   Clean exposed masonry surfaces with appropriate cleaners, such as ProSoCo Sure-Klean 766 Limestone & Masonry Pre-Wash followed by Limestone & Masonry After-Wash, etc.

7. Consolidate and Seal Stone Cladding

   Apply appropriate consolidating & repellent agent, such as ProSoCo Conservare H-100, etc.

3.6. Brick-Clad Exterior Public Façade Walls, All Levels

3.6.0 General

This subsection pertains to the brick-clad exterior walls at all floor levels and at all of the building's "public" façades, including its south, east, and west elevations, and the north elevations of its east and west wings. Elements integral to these walls, such as steel lintels above the windows, are also addressed here.

3.6.1 Basis of Recommendations

Issues affecting these brick-clad walls relate to their general design and the resultant cladding condition, and the walls' and cladding's anchorage to the primary structure.

In general, the design of these walls is not well suited to Juneau's cold, wet climate in several ways.

First, none of these walls incorporate any flashings or weep holes to drain any water back out of the brickwork. This contributes to interior leakage in various locations, exacerbates degradation, and is largely responsible for severe damage at the portico roof structure and ceiling.

Header courses, though structurally needed, encourage water penetration deep into the wall assemblies, and complicate retrofitting of effective drainage flashings.

Recessed header courses and deeply raked mortar joints also increase moisture intrusion and associated degradation of the brick and mortar.

As a consequence of these design issues, symptoms of infiltration are scattered around the building, such as interior plaster damage near windows, elevated moisture levels within the stone cladding below these brick walls, extreme infiltration into the portico roof structure and stone cladding below, variable degrees of lintel corrosion, widespread brick spalling, etc.

The brickwork also displays scattered, probably seismically induced cracks in some locations.

The mortar condition varies greatly between locations, with some areas displaying largely sound, well-bonded mortar, while eroded, cracked, and delaminated mortar typifies other locations.

With regard to anchorage, the brick wythes are well interconnected via many header courses. However, the brick walls themselves appear to rely primarily on mortar bond to the floor slabs that support them, and it is not clear whether the brick walls are connected to the concrete columns. This may pose a risk to pedestrians below in case of an earthquake.

The use of light-colored brick, which is often an indicator of lower-strength, more absorbent brick, may also have contributed to the fairly widespread spalling and surface erosion.

Unfortunately, Juneau's challenging climate, the specific configuration of the brickwork, and the already advanced erosion of the outermost brick faces, will lead to ongoing spalling, which can be slowed down, but cannot be effectively stopped, by treating with consolidating agents. This consideration, and the infiltration-prone wall assemblies, pose inherent limitations of this "retrofit" approach. With this approach, it appears prudent to plan on an ongoing maintenance program of re-sealing as well as replacement of spalling brick. Based on the degradation observed to date, I venture a guesstimate that after the initial replacement of presently spalled brick is executed as part of this work if this approach is pursued, roughly 0.5% of the brick in weather-exposed locations will continue to spall annually. Another way of saying that is that every 10 years, about 5% of the exterior brick wythe in weather-exposed locations may need to be replaced.

3.6.2 Recommended Corrective Actions

The recommended work is divided into three general categories, including structural anchorage, water-integrity enhancements, and restoration work. These often overlap in various locations. It is also critical for the work to be properly sequenced to maintain stability during the installation. For example, before brick can be removed to retrofit flashings, the brickwork above has to be re-anchored. However, a detailed discussion of sequencing considerations falls outside the scope of this phase of the work.

Let me begin with anchorage work, which itself can be divided into two categories, including anchoring brickwork where it occurs over concrete columns as well as where multi-wythe brick represents the entire wall assembly, with no existing concrete columns.

Where the brickwork occurs over existing concrete columns, which represents the large majority of the "public" façades, the brickwork can be anchored per conventional retrofit methods, using stainless steel helical "Helifix" anchors, shown in Figure IV-3.6(1).

Fig. IV-3.6(1): Helical Helifix Masonry Anchors

These anchors should be drilled from the exterior through mortar T-joints at least 4" into the concrete columns. As the brickwork in most column locations includes two spaced wythes with a thickness of 9", plus another joint between the brick and concrete, this will require 14"-16" drilled holes. After the drilled holes are cleaned out, the anchors should be installed and be recessed about 1" from the outer mortar face. The anchors should be spaced to provide at least 1 anchor per 2 SF of area. With the typical header coursing in this building's brickwork, I recommend that the anchors be drilled into T-joints just above each header course, spaced 16" apart horizontally. This will yield a spacing of 16" horizontally and 18" vertically, which produces the desired 2 SF per anchor. A vertical line of anchors should be placed about 4" away from each vertical brick panel edge.

In locations where mortar joints are to be repointed, the repointing can be used to cap over the anchors. Where no repointing is needed, the anchors can be capped with an appropriate sealant, such as Dow 790, with sand added to the surface to mimic mortar.

Where the outer brick occurs over brick walls, which occurs only in some limited portions of the "public" façades, new interior concrete walls are also to be added, as described in subsection IV-2.1, and this affords an opportunity to drill the anchors from the interior and integrate these into the new concrete walls. This also allows the anchors to be drilled into the brick units, rather than into the mortar joints. The same "Helifix" anchors can be used for this, as well as epoxy-set stainless steel threaded rods, among others. Spacing should again be 16" apart horizontally and 18" apart vertically. Figure IV-3.6(2) shows this method at these brick walls.

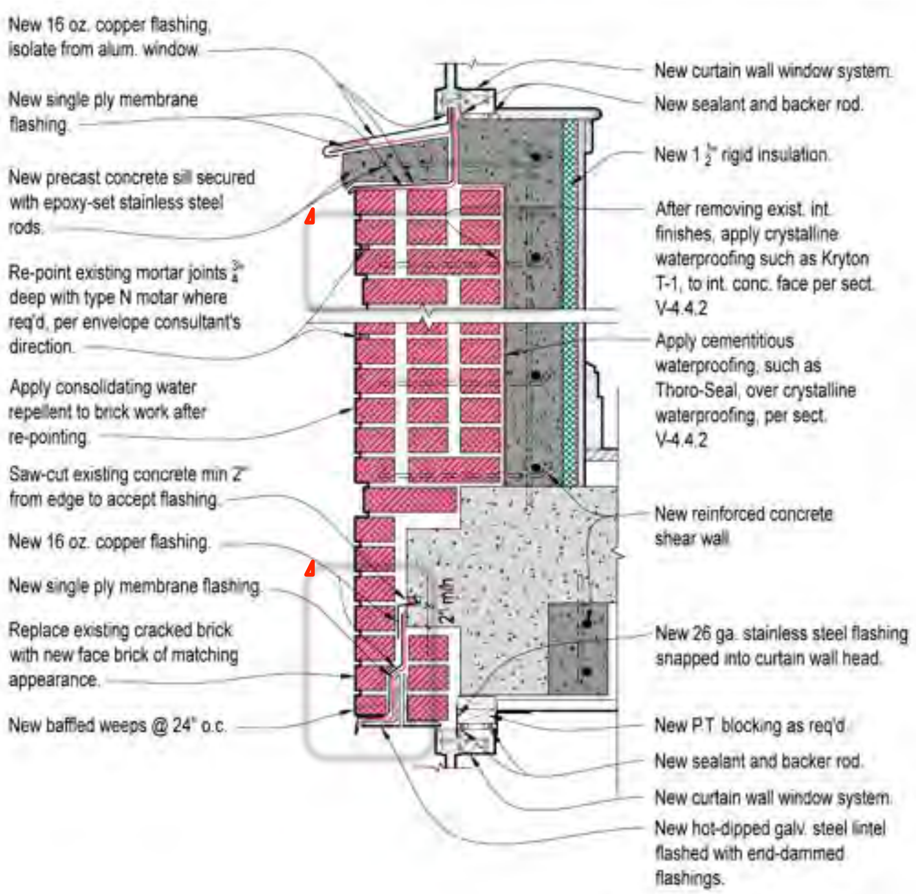


Fig. IV-3.6(2): Brick Anchorage and Lintel Flashings at Brick Walls

The water-integrity enhancement work consists of retrofitting of interceptor flashings at strategic locations to drain water back out of the brickwork and avoid its excessive accumulation within the wall assemblies. Four different types of locations appear suitable for retrofit flashings, including:

1. Above All Accessible Steel Window-Head Lintels

   Where head lintels are exposed, such as at the SE corner, the existing lintels are corroding to varying degrees, and should be replaced. Figure IV-3.6(2) shows the basic method, which must begin by placing the interior concrete walls and brick anchors above, and will also probably require temporary bracing to maintain stability. About 5 brick courses above the lintel need to be removed to access the steel double-lintel. The outer of these should be replaced with a new, hot-dipped galvanized steel lintel. A saw cut should be made into the concrete lug above the heads to receive the upper portion of a 2-piece flashing. A membrane flashing, consisting either of a single-ply membrane such as Cetco Core-Flash 60, or a self-adhered membrane, such as Grace Vycor Plus, should then be adhered over the lintel and up the inner brick and concrete to the saw-cut. A 2-piece copper flashing should then be installed as shown in Figure IV-3.6(2), and the brick should be reinstalled, using type N mortar. Baffled weeps spaced 24" apart should be included for drainage.

2. Above the Level 2 Stone Water Table

The stone water table is degrading and needs to be capped with a flashing to retard further degradation. These water table flashings can be integrated with retrofitted through-wall flashings. Work related to the water table, including restoration, anchorage, and flashings, is described in section IV-4.1.

The through-wall flashings above the water table can be retrofitted by first re-anchoring the brick above, then removing two brick courses above the stone, saw-cutting the existing concrete column behind the brick to receive the upper portion of a 2-piece copper flashing. A membrane flashing, consisting either of a single-ply membrane such as Cetco Core-Flash 60, or a self-adhered membrane, such as Grace Vycor Plus, should then be adhered over the inner brick and concrete to the saw-cut. A 2-piece copper flashing should then be installed as shown in Figure IV-3.6(3), and the brick should be reinstalled, using type N mortar. Baffled weeps spaced 24" apart should be included for drainage.

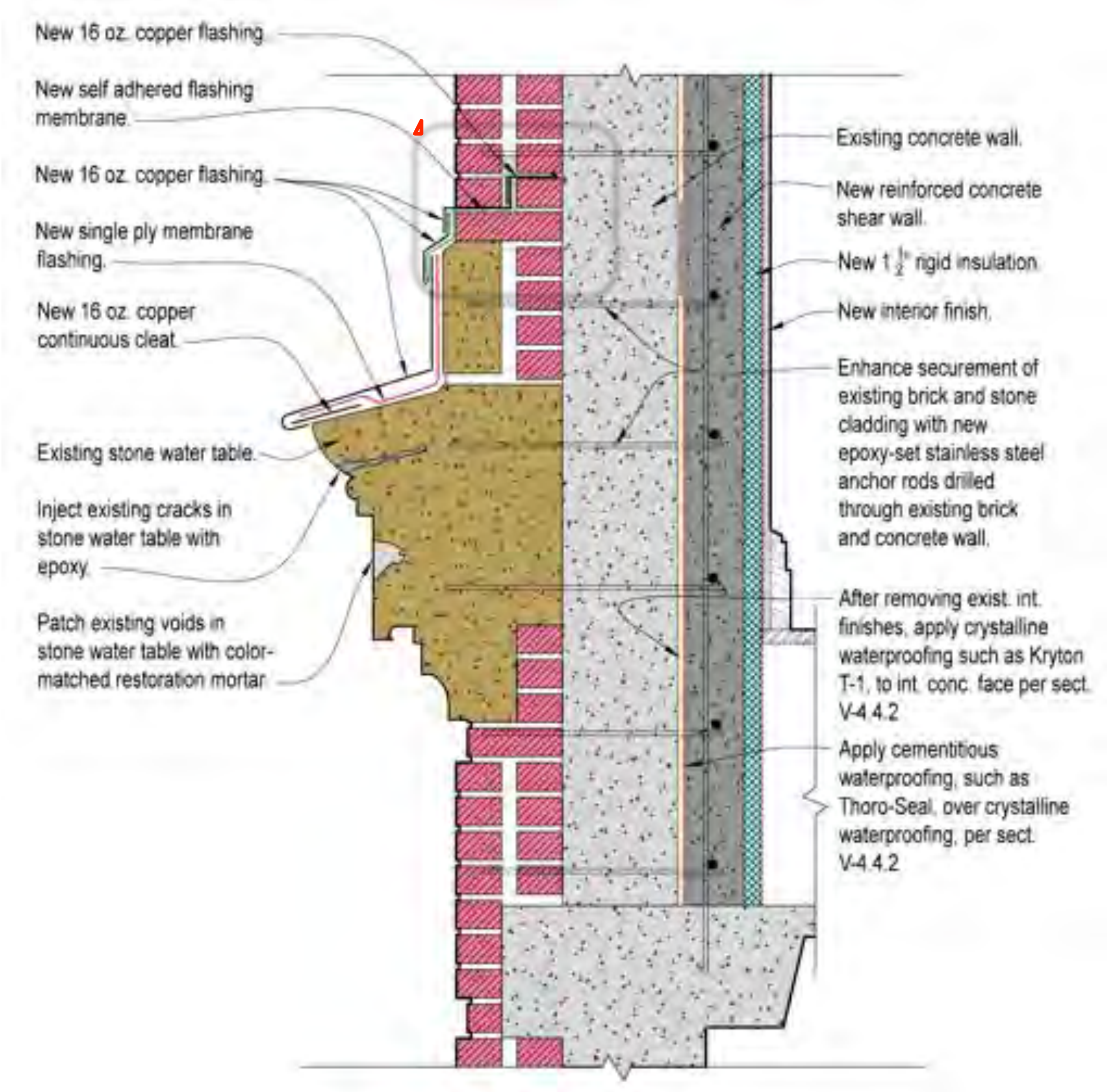


Fig. IV-3.6(3): Retrofitting of Through-Wall Flashings Above Water Table

3. Above the Portico Roof

To limit the presently severe infiltration and damage to the portico roof structure, interceptor flashings should be retrofitted directly above the portico roof. The work is essentially very similar to the flashing retrofit above the water table, described in item 2 of this subsection and is not described in detail. Figure IV-3.6(4) shows the basic method where it occurs over brick walls. The work must begin by placing the interior concrete walls and brick anchors above, and will also probably require temporary bracing to maintain stability. The work also involves retrofitting of membrane flashings overlaid with copper flashings. After the flashings are installed, the removed brick should be reinstalled, using type N mortar. Baffled weeps spaced 24" apart should be included for drainage.

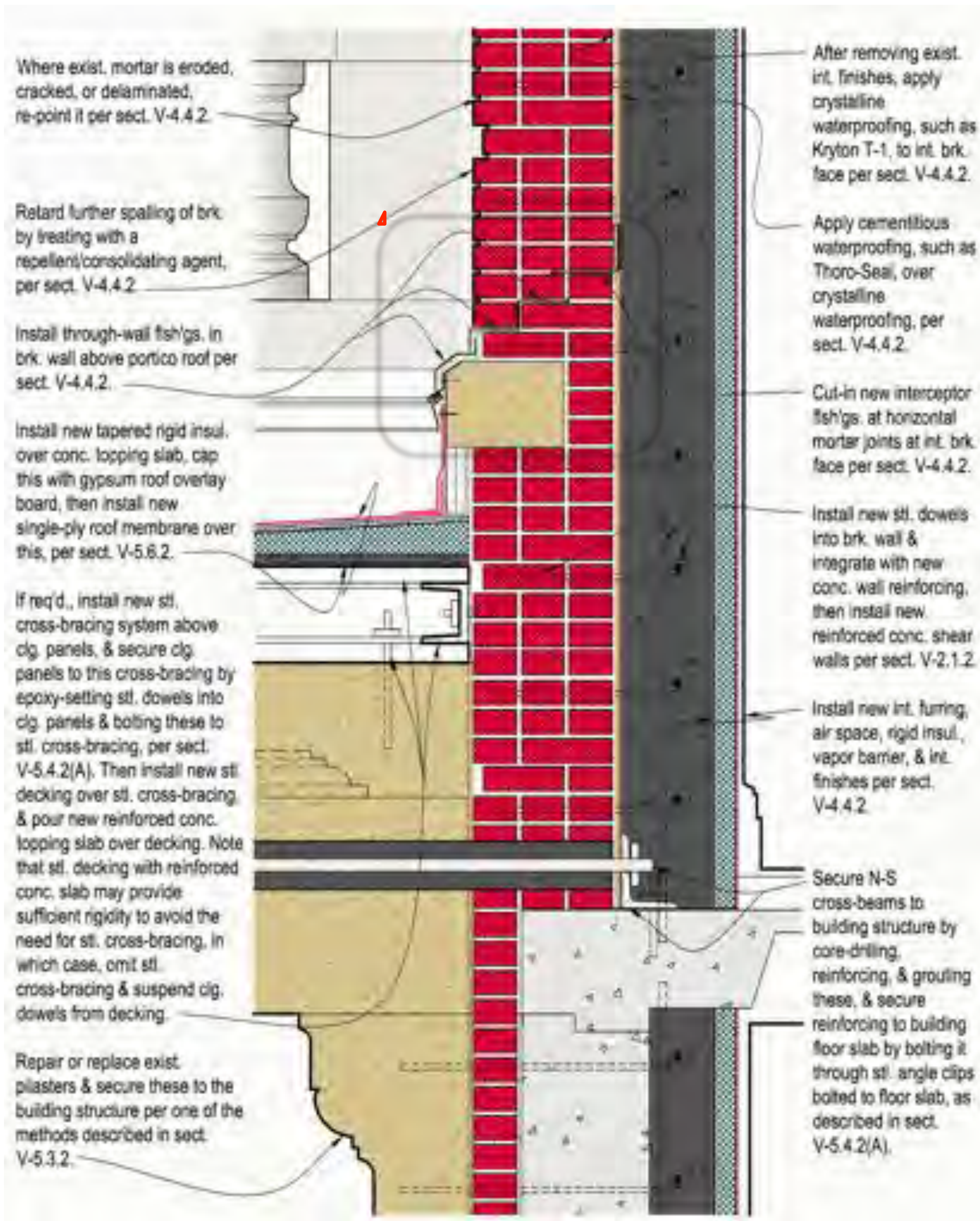


Fig. IV-3.6(4): Retrofitting of Through-Wall Flashings Above Portico Roof

4. Along Level 3 & 4 Floor Slab Edges Directly Above the Portico

As explained in greater detail in subsection II-3.6.2, the header courses in the brickwork tend to exacerbate water penetration deeply into the brick walls, which limits the effectiveness of retrofitted flashings, as water may be able to bypass inward of these flashings. As it is critical to limit intrusion into the portico roof structure in particular, I also recommend that interceptor flashings be retrofitted along the edges of the level 3 and 4 floor slabs, but only in the four brick pilasters located above the portico. These flashings should preclude accumulation of water within these brick pilasters, thus limiting intrusion into the portico roof as well.

The work is essentially very similar to the flashing retrofit above the water table, described in item 2 of this subsection and is not described in detail. Figure IV-3.6(5) shows the basic method where it occurs over the concrete columns. The work must begin by anchoring the brick anchors above, and will also probably require temporary bracing to maintain stability. The work also involves retrofitting of membrane flashings overlaid with copper flashings. After the flashings are installed, the removed brick should be reinstalled, using type N mortar. Baffled weeps spaced 24" apart should be included for drainage.

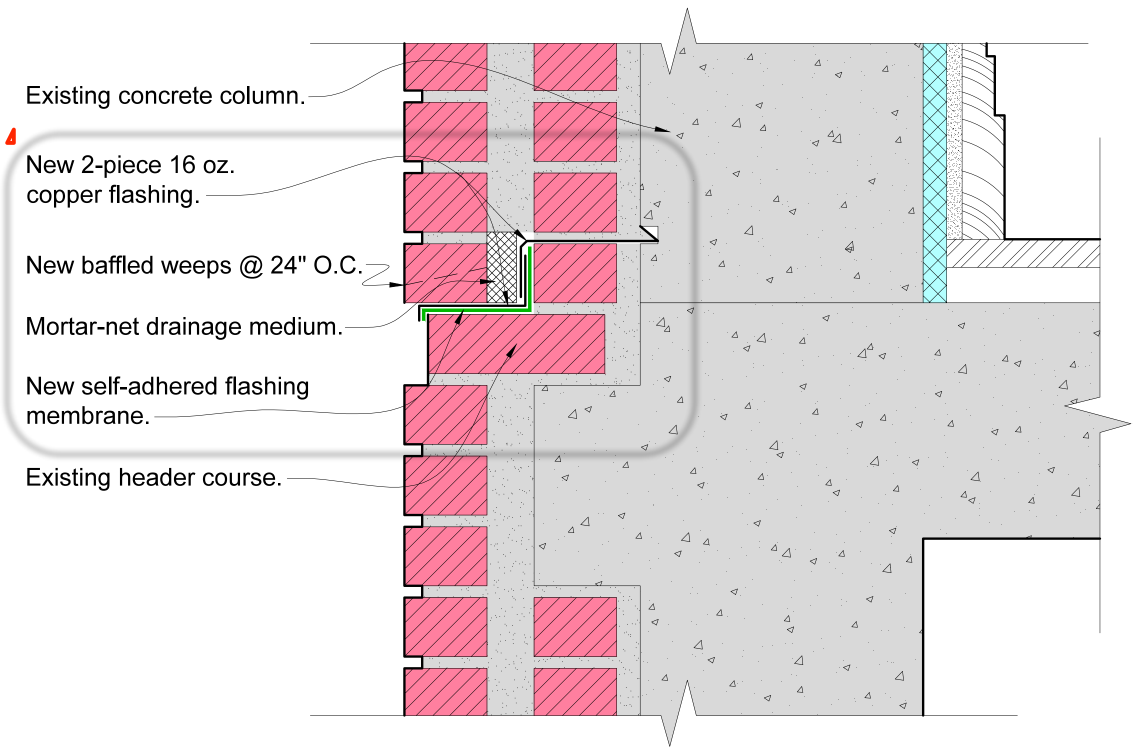


Fig. IV-3.6(5): Through-Wall Flsh'gs. @ Lvl. 3 & 4 Slab Edges Abv. Portico Roof

The brick restoration work consists of replacing corroded accessible window-head lintels, replacement of spalled and cracked brick, repointing of eroded, cracked, and delaminated mortar, and application of a penetrating water repellent/consolidating agent.

Replacement of corroded accessible window-head lintels in these “public” brick-clad walls applies only to the 18 windows within the three vertical bands nearest to the SE corner. This work is already described in item 1 and Figure IV-3.6(2) of this subsection pertaining to the flashing retrofitting above such lintels.

Existing spalled or cracked brick should be replaced with new face brick of similar color and texture to closely resemble the existing brick. The new brick should be ASTM C-216 face brick, Grade SW, Type FBS. To the extent achievable with brick of similar color, the new brick should strive to exceed these standards in having a total 5-hour boiling water absorption of 13% maximum, a maximum 24-hour cold water absorption of 9%, maximum C/B ratio of 0.70, and an Initial Rate of Absorption, (IRA) in the range of 10-20 grams/30 sq. in./minute. As the only way to match the existing brick’s texture would be to sandblast the new brick, which is very damaging, I recommend that the new brick have a Mission texture, which is not too different in appearance, without having the detrimental effect of sandblasting. The new brick should be laid with a type N mortar. For cost estimating purposes, I would assume that roughly 5% of the brickwork at these public façades will need replacing.

Existing cracked, eroded, delaminated, or otherwise damaged mortar should be repointed to a minimum depth of ¾”, using type N mortar, which should be recessed to match the existing mortar joints, but should be tooled to at least densify the surface. For cost estimating purposes, I would assume that roughly 20% of the brickwork at these public façades will need repointing.

The brickwork will then need to be treated to remove the existing penetrating repellent to allow new consolidating repellent to absorb into it. The cleaned brick should then be treated with a consolidating repellent agent, such as ProSoCo H-100, per the manufacturer’s directions.

3.7. Terra-Cotta-Clad Exterior Walls at Levels 2-4

3.7.0 General

This subsection pertains to the terra-cotta exterior wall panels that occur between windows at floor levels 2-4 at the building's south, east, west, and north "public" façades.

3.7.1 Basis of Recommendations

The apparent condition of these elements varies appreciably between different locations. Many appear to still be in reasonably good condition, with relatively minor surface spalling.

However, these elements lack any drainage provisions, and consequently, the bottoms of many panels in weather-exposed locations are degrading, with spalling and efflorescence evident.

In addition, various panels display both vertical and horizontal hairline cracking, which often coincides with locations of embedded steel, and can be an early indication of corrosive expansion. Such corrosion appears probable at the more exposed panels, and this may increase seismic displacement risk, posing a hazard to pedestrians below.

Above the entry portico, several panels have sloping mortar-wash sills, which are degrading seriously. Several nearby panels also have some grille penetrations with moss growth.

The damage to a majority of the panels is still pretty limited and largely visual at this stage. Many could probably last up to 40 years before beginning to display truly worrisome symptoms, such as recurring dropping of small chunks onto the ground below. On the other hand, a few show more advanced degradation along their bottom edges, are already shedding small flakes, and require temporary maintenance now and will need replacement within about two decades.

Although most of these panels do not yet appear to require urgent attention, it does not seem to make much sense to perform extensive restoration work at most other elements on this building's exterior and leave these terra-cotta panels in place, to be dealt with on a more urgent basis 20 years later. In other words, these panels are doomed to a lifespan ranging from 20 years for some panels to perhaps 40 years elsewhere, and the large-scale restoration project affecting many other elements provides a good opportunity to also address these panels to avoid the need for doing so fairly soon in any case.

3.7.2 Recommended Corrective Actions

In view of the reasoning outlined above, it seems prudent to include wholesale replacement of these panels as part of this major restoration effort. These panels could be replaced with new terra-cotta panels, pre-cast concrete panels, or Glass-Fiber-Reinforced-Concrete, (GFRC). Terra-cotta would obviously be closest in appearance, but would likely be more costly. Also, as these panels are one color, pre-cast concrete or GFRC can be integrally colored to match the existing terra-cotta.

For cost-estimating purposes, replacement with integrally colored pre-cast concrete panels reinforced with stainless steel should be assumed. The panels can be secured with embedded stainless steel clips, epoxy-set threaded rods, or similar methods.

To slow degradation, I recommend that these replacement panels consist of two pieces, one consisting of a sill piece directly below the windows, and the other below this, with a double-layer flashing of adhered single-ply membrane capped with 16 oz. copper installed between these two as well as atop the sill. The upper sill flashing should integrate with the new curtain-wall windows recommended in subsection IV-3.12.2. The single-ply membrane flashing should wrap over the top of the copper flashing to avoid contact between the aluminum window frame and the copper flashing. Figure IV-3.7(1) shows a generic detail for this work.

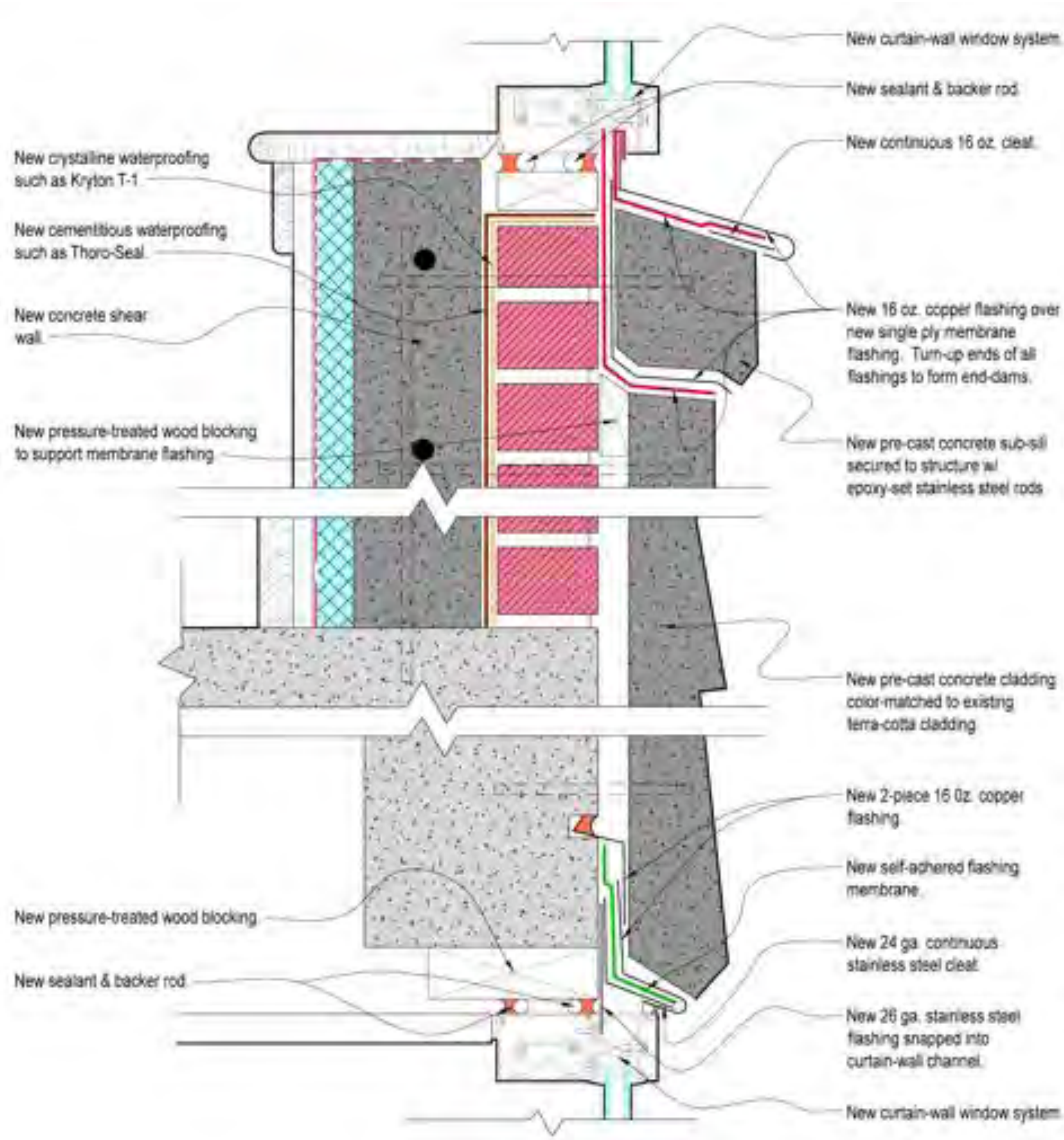


Fig. IV-3.7(1): Replacement of Terra-Cotta Panels With Pre-Cast Concrete Panels

3.8. North Courtyard Walls, Brick-Clad

3.8.0 General

This subsection pertains to the brick-clad exterior walls wrapping the north courtyard, but excludes the stairwell walls. Elements integral to these walls, such as steel lintels above the windows, are also addressed here.

3.8.1 Basis of Recommendations

These courtyard walls are plain in character, but though different in appearance, their construction is basically the same as of the more public walls addressed in section IV-3.6, and many of the same structural and design issues apply.

These walls are also multi-wythe brick walls, with up to 3-wythe thickness. In contrast to the "public" walls, these courtyard walls only have a single brick wythe outward of most embedded concrete columns. These walls also have interlocking header courses, which do not align with header courses in adjacent "public" walls.

Structural securement issues are basically the same as at the public brickwork. Namely, interlocking header courses tie parallel wythes together, but the overall assembly relies on mortar bond alone to secure the walls to the supporting floor slabs, and if anchors exist between the brick and columns, many would by now be compromised by corrosion, especially on the east-facing wall. This does not threaten overall integrity, but poses seismic risk to pedestrians below.

With regard to "weathering" considerations, the design of these walls is not well suited to Juneau's cold, wet climate in several ways. For example, they also lack flashings or weep holes to drain water out of the brickwork, or above steel window-head lintels, which display variable, and in a few locations moderately-advanced corrosion, especially at upper reaches of the east-facing wall. The absence of flashings exacerbates damage and interior leak risk. Interlocking header courses, though structurally needed, also increase risk of deep water penetration.

Where these courtyard walls occur above the two small roof areas, the existing roofing terminates at the outer brick face, with no through-wall flashings. This is improper, and poses risk of interior leakage, though this risk is somewhat mitigated by the relatively sheltered locations of these transitions.

In contrast to the deeply raked mortar joints in the more public brickwork, the mortar at these walls appears mostly flush-struck, with its outer surface very near the brick face.

Due to different weather orientations, the east-facing wall displays significant degradation, such as spalling, surface erosion, mortar stress, lintel corrosion, etc., while the west-facing wall is in visibly better condition, with much more limited surface erosion and little spalling, and apparent lintel corrosion occurs only below an entry door.

The east-facing wall also displays cracking in the brick as well as in one pre-cast concrete window sill. Further, it appears that the steel window-head lintel above an upper-level window has sagged, causing a long and significant delamination crack in the brick header above.

The use of light-colored, probably lower-strength, more absorbent brick, may also have contributed to spalling and surface erosion.

Unfortunately, Juneau's challenging climate, the specific configuration of the brickwork, and the already advanced erosion of the outermost brick faces, especially at the east-facing wall, will lead to ongoing spalling, which can be slowed down, but cannot be effectively stopped, by treating with consolidating agents. This consideration, and the infiltration-prone wall assemblies, pose inherent limitations of this "retrofit" approach. With this approach, it appears prudent to plan on an ongoing maintenance program of re-sealing as well as replacement of spalling brick. Every 10 years, about 5% of the exterior brick wythe in weather-exposed locations may need to be replaced on the east-facing wall.

3.8.2 Recommended Corrective Actions

Recommended work at these walls is in many ways quite similar to the recommended work for the more public brick walls addressed in subsection IV-3.6.2, and is thus described in a more cursory fashion. Please see subsection IV-3.6.2 for more detailed information.

As with the public walls, recommended work is divided into three general categories, including structural anchorage, water-integrity enhancements, and restoration work. These often overlap in various locations. It is also critical for the work to be properly sequenced to maintain stability during the installation.

The anchorage work can be divided into three categories, including anchoring brickwork where it occurs over concrete columns, anchoring brickwork where multi-wythe brick represents the entire wall assembly, with no existing concrete columns, and also anchoring of window sills.

Where the brickwork occurs over existing concrete columns, which represents the majority of these wall areas, the brickwork can be anchored per conventional retrofit methods, using stainless steel helical “Helifix” anchors. These should be drilled from the exterior through mortar T-joints at least 4” into the concrete columns. As the brickwork in most column locations consists of a single brick wythe, plus another joint between the brick and concrete, this will require 8”-9” drilled holes. After the holes are cleaned out, the anchors should be installed and be recessed about 1” from the outer mortar face. The anchors should be spaced to provide at least 1 anchor per 2 SF of area. I recommend that the anchors be drilled into T-joints just above each header course, spaced 16” apart horizontally. This will yield a spacing near the desired 2 SF per anchor. A vertical line of anchors should be placed about 4” away from each vertical brick panel edge.

In locations where mortar joints are to be repointed, the repointing can be used to cap over the anchors. Where no repointing is needed, the anchors can be capped with an appropriate sealant, such as Dow 790, with sand added to the surface to mimic mortar.

Where the outer brick occurs over brick walls, which occurs mostly above and below windows, new interior concrete walls are also to be added, as described in subsection IV-2.1, and this affords an opportunity to drill the anchors from the interior and integrate these into the new concrete walls. This also allows the anchors to be drilled into the brick units, rather than into the mortar joints. The same “Helifix” anchors can be used for this, as well as epoxy-set stainless steel threaded rods, among others. Spacing should again be 16” apart horizontally and 18” apart vertically. Figure IV-3.8(1) shows this method at these brick walls.

With respect to anchoring of the window sills, the existing stone sills are mostly in reasonable condition, and can be reused. However, these sills will need to be removed at least temporarily to retrofit flashings under them, so it may be reasonable to also replace these sills with new pre-cast concrete ones, as recommended for Options 2 & 3. In either case, each sill should be anchored with two anchors drilled from the interior as shown in Figure IV-3.8(1). These can be helical “Helifix” type, epoxy-set threaded rods, or similar. They should consist of stainless steel to avoid corrosion.

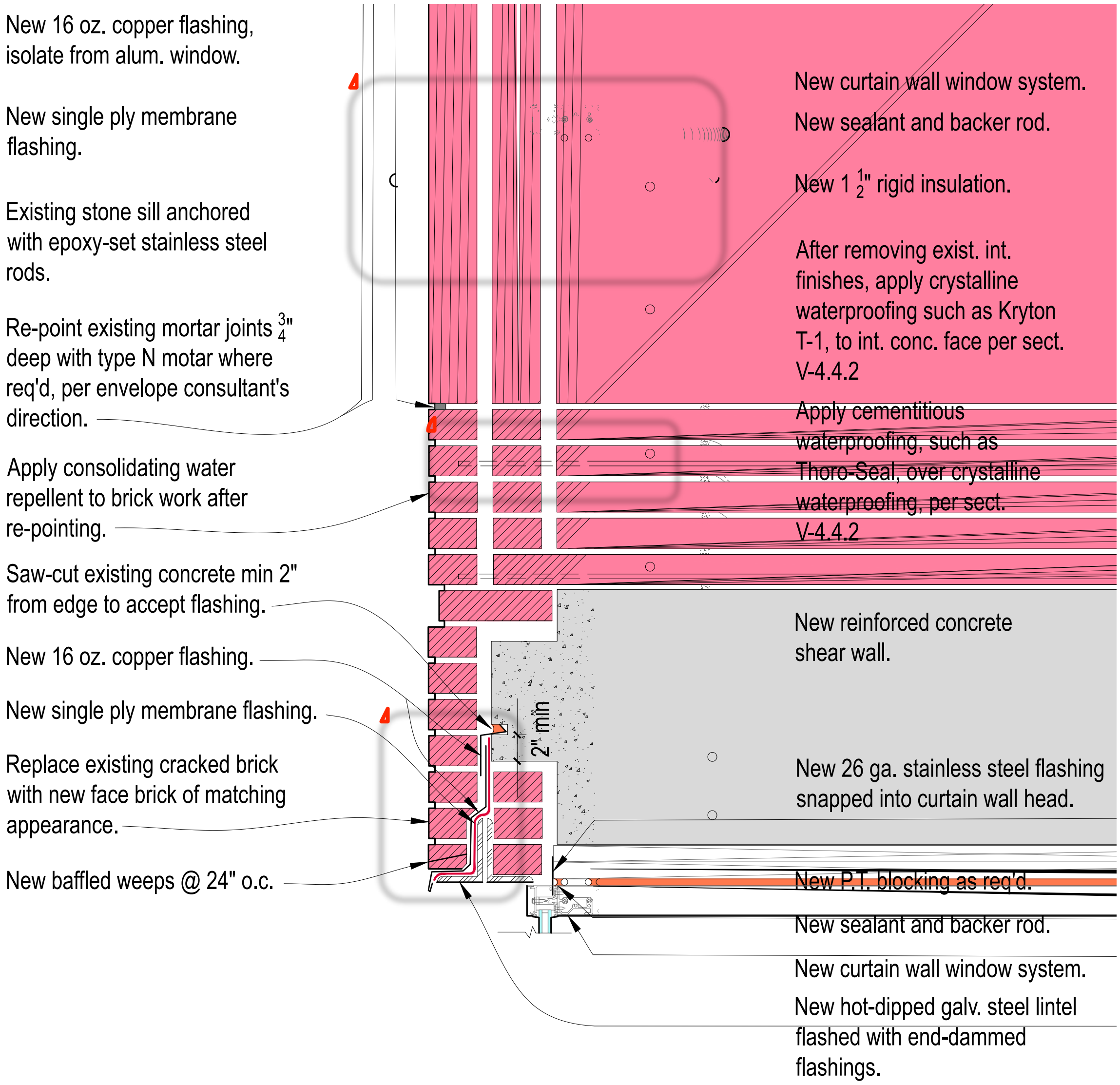


Fig. IV-3.8(1): Brick Anchorage and Lintel and Sill Flashings at Brick Walls

The water-integrity enhancement work consists of retrofitting of interceptor flashings at strategic locations to drain water back out of the brickwork and avoid its excessive accumulation within the wall assemblies. Three different types of locations appear suitable for four types of retrofit flashings, as follows:

1. Above All Accessible Steel Window-Head Lintels

   The existing lintels are corroding to varying degrees, and should be replaced, especially at the east-facing wall. Figure IV-3.8(1) shows the basic method, which must begin by placing the interior concrete walls and brick anchors above, and will also probably require temporary bracing to maintain stability. About 5 brick courses above the lintel need to be removed to access the steel double-lintel. The outer of these should be replaced with a new, hot-dipped galvanized steel lintel. A saw cut should be made into the concrete lug above the heads to receive the upper portion of a 2-piece flashing. A membrane flashing, consisting either of a single-ply membrane such as Cetco Core-Flash 60, or a self-adhered membrane, such as Grace Vycor Plus, should then be adhered over the lintel and up the inner brick and concrete to the saw-cut. A 2-piece copper flashing should then be installed as shown in Figure IV-3.8(1), and the brick should be reinstalled, using type N mortar. Baffled weeps spaced 24” apart should be included for drainage.

2. Under and Atop the New Pre-Cast Concrete Window Sills

To retard further degradation and limit infiltration, new double-layer flashings should be installed both under and atop the masonry window sills, which should be replaced with new pre-cast concrete sills.

After the existing interior terra-cotta finish, windows, and stone sills are removed, new interior concrete walls should be placed against the interior faces of the brick walls as outlined in subsection IV-2.1.2. Two anchor pins should be installed to protrude into each new pre-cast concrete sills as shown in Figure IV-3.8(1).

New, double-layer sub-sill flashings should then be installed under the new pre-cast concrete sills. These should consist of a membrane flashing, such as either a single-ply membrane such as Cetco Core-Flash 60, or a self-adhered membrane, such as Grace Vycor Plus, capped with a 16 oz. copper flashing, installed as shown in Figure IV-3.8(1).

The new pre-cast concrete sills should then be epoxy-set over the anchor pins. These should also be capped with double-layer flashing caps of membrane flashings with copper flashings atop these. The copper flashings should be isolated from the new aluminum windows by wrapping the membrane flashings over the copper at the windows.

3. Above the Two Low Roof Areas

The two low roof areas do not terminate properly along their junctures to the brick-clad walls, as the roof membrane extends up the brick walls and is secured to the outer brick faces with termination bars, with no through-wall flashings above to drain water from within the brick over the roofs. This poses a leak risk.

To limit this risk, interceptor flashings should be retrofitted directly above the two roof areas wherever these join with the brick-clad walls. The work is essentially very similar to the flashing retrofit above the water table, described in item 2 of subsection IV-3.6.2, and is not described in detail. Figure IV-3.8(2) shows the basic method where it occurs over brick walls. The work must begin by placing the interior concrete walls and brick anchors above, and will also probably require temporary bracing to maintain stability. The work also involves retrofitting of membrane flashings overlaid with copper flashings. After the flashings are installed, the removed brick should be reinstalled, using type N mortar. Baffled weeps spaced 24” apart should be included for drainage.

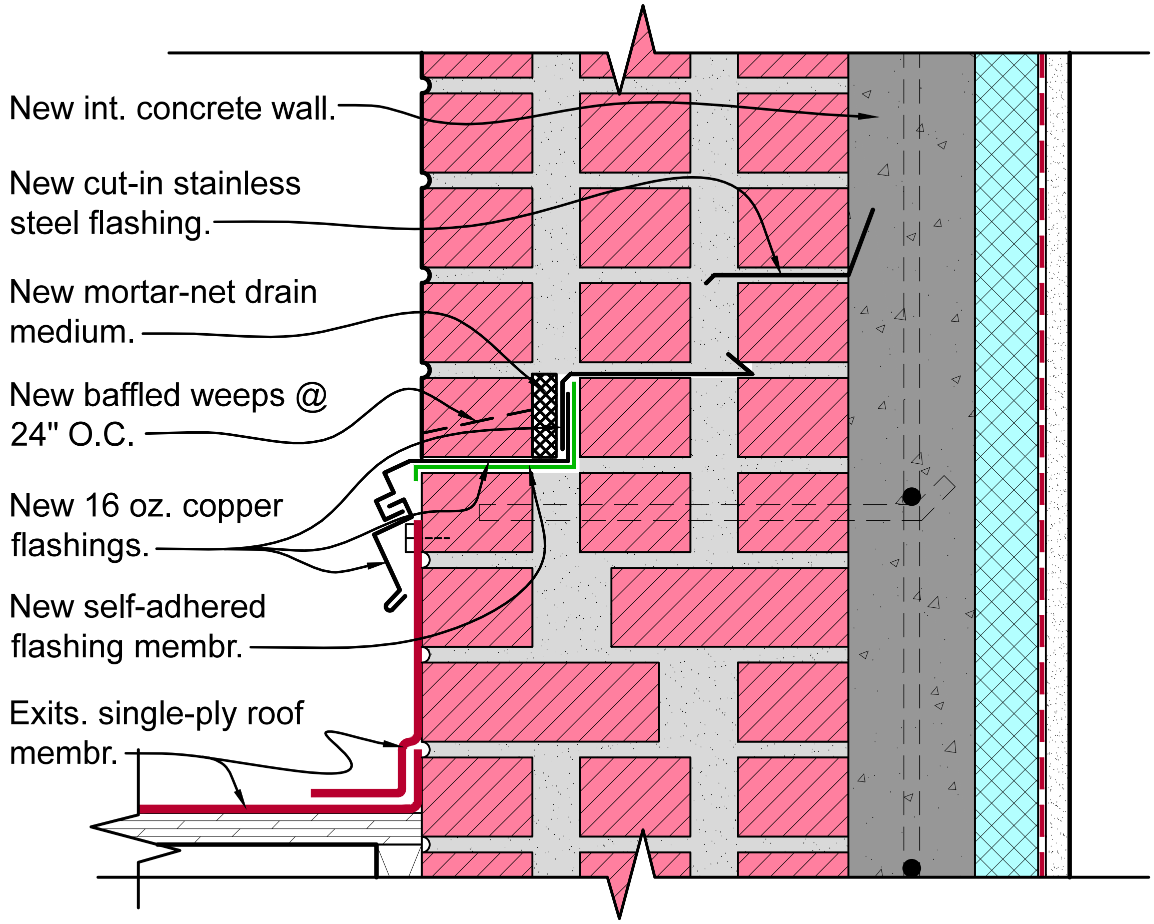


Fig. IV-3.8(2): Through-Wall Flashings Above Low Roofs

The brick restoration work consists of replacing corroded accessible window-head lintels, replacement of spalled and cracked brick, repointing of eroded, cracked, and delaminated mortar, and application of a penetrating water repellent/consolidating agent.

Replacement of corroded accessible window-head lintels is already described in item 1 and Figure IV-3.8(1) of this subsection pertaining to the flashing retrofitting above such lintels.

Existing spalled or cracked brick should be replaced with new face brick of similar color and texture to closely resemble the existing brick, using brick, mortar, and methods described in detail in section IV-3.6.2 for the public walls. For cost estimating purposes, I would assume that roughly 5% of the brickwork at the east-facing wall, and 1% at the west and north-facing walls will need replacing.

Existing cracked, eroded, delaminated, or otherwise damaged mortar should be repointed to a minimum depth of ¾", using type N mortar, which should match the existing mortar joints, but should be tooled to at least densify the surface. For cost estimating purposes, I would assume that roughly 80% of the brickwork at the east-facing wall, and 20% at the west and north-facing walls will need repointing.

The brickwork will then need to be treated to remove the existing penetrating repellent to allow new consolidating repellent to absorb into it. The cleaned brick should then be treated with a consolidating repellent agent, such as ProSoCo H-100, per the manufacturer's directions.

3.9. North Stairwell Walls, Brick & Stucco-Clad

3.9.0 General

This subsection pertains to the brick-clad exterior walls wrapping the stairwell in the courtyard.

3.9.1 Basis of Recommendations

These walls are nearly identical to the courtyard walls, differing primarily in being taller, with the above-roof portion clad with stucco. The east and west walls consist of triple-wythe brickwork, while the north wall consists mostly of concrete columns wrapped with a single brick wythe. The south wall occurs only above the roof, and consists of double-wythe, stucco-clad brickwork.

The east-facing wall has been painted with an elastomeric coating, and suffers significant brick spalling. The coating has not proved successful in precluding moisture entry, and spalling continues, with brick chunks in places hanging by only the coating. The north and west-facing walls are in notably better condition. Indications of ongoing infiltration are also evident at the south-facing wall, whose innermost face manifests the surface pulverization, brick flaking, and white salt deposition characteristic of deep infiltration.

The upper stucco band bulges outward in places, and some coating blisters indicate moisture intrusion behind the coating. The elastomeric coating spans across the stucco bottom onto the brick, precluding drainage. Similarly, the stucco joins the abutting parapets and roof in a non-draining fashion, wherein any water behind the stucco would drain into the roof assembly.

Brief review of the drawings did not reveal any anchorage of the brick to the concrete columns, and same observations apply to these walls as elsewhere relative to anchorage. The north-facing wall, which in many locations consists of a single wythe of brick over concrete columns, may pose some risk of falling brick in case of earthquakes.

These walls also lack flashings or weep holes to drain water out of the brickwork above window-head lintels, which however appear to be in good condition, reflecting their more forgiving northerly exposure. No through-wall flashings occur where these walls join the two low roofs below, posing appreciable leak risk, particularly below the east-facing wall.

Similarly, improper, non-draining junctures of the stucco cladding to the parapets and roof along the south side pose inherent risk of interior leakage and damage to the roof.

As with the courtyard walls, differences in exposure have produced widely differing results, and the east-facing wall displays much worse spalling, than any of the other exposed brick walls.

Infiltration into the brickwork can be reduced through a combination of measures, but cannot be reliably fully stopped with the existing configuration.

3.9.2 Recommended Corrective Actions

In most respects, recommended work at these walls is identical to the work recommended for the other courtyard walls, as described in subsection IV-3.8.2, and is not repeated here. Please follow recommendations of subsection IV-3.8.2, except as noted here.

One difference between the stairwell walls and the other courtyard walls is that the interior terra-cotta finish is thinner, thus precluding the opportunity to add interior concrete walls, as is recommended for essentially all other exterior walls. Consequently, no new anchorage of the brickwork can take place at the stairwell's east, west, and south walls, or above or below any windows. However, where the brickwork occurs over existing concrete columns, which represents the majority of the north wall, the brickwork can be anchored per conventional retrofit methods, using stainless steel helical "Helifix" anchors. Please follow recommendations of subsection IV-3.8.2 for this re-anchoring work.

The new pre-cast concrete window sills should also be anchored per subsection IV-3.8.2.

Water-integrity enhancement work at the brick walls is identical to the work recommended in subsection IV-3.8.2 for the other courtyard walls, and includes retrofitting of flashings above window-head lintels, below and over the window sills, and above the two abutting low roof areas. Please follow recommendations of subsection IV-3.8.2 precisely for these flashings.

The brick restoration work at these stairwell walls is also identical to the courtyard walls, and recommendations of subsection IV-3.8.2 should be followed. Primary differences relate to different area percentages of brick replacement and mortar-repointing. In addition, the east-facing wall will need to have its elastomeric coating removed.

For cost estimating purposes, I would assume that roughly 10% of the exposed brickwork at the east-facing wall, and 1% at the west and north-facing walls will need replacing.

Similarly, I would assume that roughly 100% of the brickwork at the east-facing wall, and 20% at the west and north-facing walls will need repointing.

The brickwork will then need to be treated to remove the existing penetrating repellent to allow new consolidating repellent to absorb into it. The cleaned brick should then be treated with a consolidating repellent agent, such as ProSoCo H-100, per the manufacturer's directions.

With respect to the uppermost stucco-clad walls, which have limited visibility, I recommend the easiest and least-costly approach, which consists of over-cladding with a metal cladding with a drainage cavity, as also recommended for the chimney in subsection IV-2.5.2. Specific recommendations are as follows:

1. Retrofit Reglet Base Flashing Above New Cornice

   Saw-cut mortar joint about 4" above top of new cornice, described in subsection IV-4.5.2, and install upper portion of 2-piece, 24-gage stainless steel or 16 oz. copper flashing into saw-cut, then insert back-rod and sealant.

2. Install Lower Portion of 2-Piece Reglet Base Flashing Begun in Step 1

   Snap-in lower portion of 24-gage stainless steel or 16 oz. copper flashing to fully cap top of cornice-top flashing.

3. Over-Clad Stucco with Metal Cladding

   Install galvanized steel vertical hat channels near corners and spaced 16" on center in-between, then secure new sheet-metal cladding over this, along with corner trim, etc. as needed. The new cladding can consist of 24-gage pre-finished galvanized or stainless steel, or 16 oz. copper. Dissimilar metals, if any, should be isolated from each other.

4. Install Flashing Cap Atop Parapet

   Install continuous cleat of 24-gage galvanized or stainless steel or 16 oz. copper along outer-lower portion of parapet cap, then install strips of new EPDM roof membrane over top of parapet and over cleat and adhere to existing EPDM roof membrane. Then cap the parapet top with a sheet metal cap of 16 oz. copper.

3.10. Brick Chimney

3.10.0 General

This subsection pertains to the relatively tall brick chimney above the main roof, near the inside corner where the west wing joins the main portion of the building. As the "structural" and "weather-integrity" issues affecting this chimney are intricately related and inseparable, all recommendations related to this chimney are addressed holistically in section IV-2.5. The sole purpose of section IV-3.10 is to refer the reader to section IV-2.5 for both "structural" and "weathering" information.

3.11. North Courtyard Walls, Metal-Clad

3.11.0 General

This subsection pertains to two small wall portions on the building's north side, one to each side of the stair tower, at floor level 2. These walls were not part of the building's original construction.

3.11.1 Basis of Recommendations

These two newer, small walls consist of standard light-gage steel framing, with steel studs, gypsum exterior sheathing, probably building paper, an exterior metal cladding, and windows and doors. No drainage provisions were observed along the metal cladding's base. If drainage is not accommodated along the base, this would exacerbate risk of interior leakage and water damage to the lower portions of these walls. This concern is minimized by the walls' sheltered orientation. However, although these walls may not currently pose any actual problems, their cladding appears somewhat warped, and in view of the major project envisioned in this report, combined with the very small size of these walls, it appears advisable to include replacement of the cladding on these walls for cost estimating purposes.

3.11.2 Recommended Corrective Actions

For cost estimating reasons, replacement of the cladding on both of these small walls should be anticipated. This work would consist of removing the existing cladding and the assumed underlying building wraps as a first step. Following this, a drainage flashing would be installed along the cladding's base, and a 2-layer building wrap assembly would be placed over the gypsum sheathing. Perforated, 2" wide galvanized steel "Z" girts would then be installed horizontally over this spaced 16" apart and screwed to the underlying steel stud framing. A thin vent-mat, such as Enka-Drain 9714, would be fitted between the girts, fabric side facing outward, followed by 1 ½" rigid extruded polystyrene insulation. A new metal cladding would then be installed over the girts.

3.12. Windows

3.12.0 General

This subsection pertains to all exterior windows.

3.12.1 Basis of Recommendations

Most of the original steel-sash windows had been replaced with extruded aluminum units, except at the north ends of the two wings, which retain the original steel ones. In addition, a few of the original openings had been at least partly bricked-in, with either no windows or with narrow units.

The aluminum windows appear to have been installed over the original steel frames, and at least some of the underlying steel frames are corroding severely, which probably reflects electrolysis, as contact between aluminum and steel should be avoided. Continued corrosion may compromise the securement of the aluminum windows.

The newer aluminum windows lack any integral drainage provisions. Not surprisingly, relatively widespread leakage evidence is associated with windows in scattered locations, such as blistered plaster, white deposits at many interior joints, elevated moisture content and streaks below some sills, etc. Sealant along both exterior and interior window frame joints, which is quite unusual, may also reflect efforts to stop leakage. The absence of a drainage system is a fatal flaw, as it is not possible to seal all joints and perimeter conditions perfectly and permanently, and the various interior symptoms indicate that some of the exposed windows leak.

In addition, the sills of the three windows above the portico occur quite close to the roof, and occasionally become buried in snow, increasing leak risk.

In short, the existing windows are exceedingly ill conceived, and doomed to recurring leakage.

3.12.2 Recommended Corrective Actions

In view of the poor design and general condition of the existing window system, combined with ample evidence of leakage associated with these windows, I recommend that the existing aluminum windows be replaced with a high-performance curtain-wall system, such as Kawneer's 1600 Wall, with operable sashes of Kawneer's AA-900 window system glazed into the curtain-wall where such operable sashes are desired. In contrast to the existing system, the 1600 curtain-wall system incorporates a highly effective integral drainage system, with all panes individually drained for optimal performance.

Where operable sashes are desired to match the current configuration, Kawneer's AA-900 operable windows can be glazed into the curtain-wall, making these windows well suited for incorporation into this curtain-wall system.

I further recommend that sheet metal sill flashings be installed to cap the exposed masonry sills under the windows. Such sheet metal sill flashings should be integrated into the curtain-wall glass channels in the bottoms of the extrusions. These flashings must either be galvanically compatible with the aluminum windows, or must be electrically isolated from them. For example, aluminum or stainless steel flashings can contact the aluminum window system, but copper flashings must be isolated from the windows by wrapping with either a single-ply roof membrane, such as Cetco Core-Flash 60, or a self-adhered flashing membrane, such as Grace Vycor Ultra.

I also recommend that twin flashings be installed above the window heads to help drain water away from the heads. The first should be a flat piece of stainless steel or aluminum that should snap into the head glass channel, which has an integral drainage system, and can thus drain any water that enters it. A second head flashing system should be installed over this, consisting of a stainless steel cleat, which should be capped with a self-adhered flashing membrane, and a copper flashing should snap over this.

Figures IV-3.12(1-4) illustrate recommended installation detailing at sills and heads at several typical conditions at this building. Please note that these drawings also show different options for adjacent masonry work, some of which may not apply, so only the window installation methods should be followed. Further, some of the drawings are excerpted from the 12/31/10 PL:BECS report, so section references noted in these drawings pertain to that earlier report.

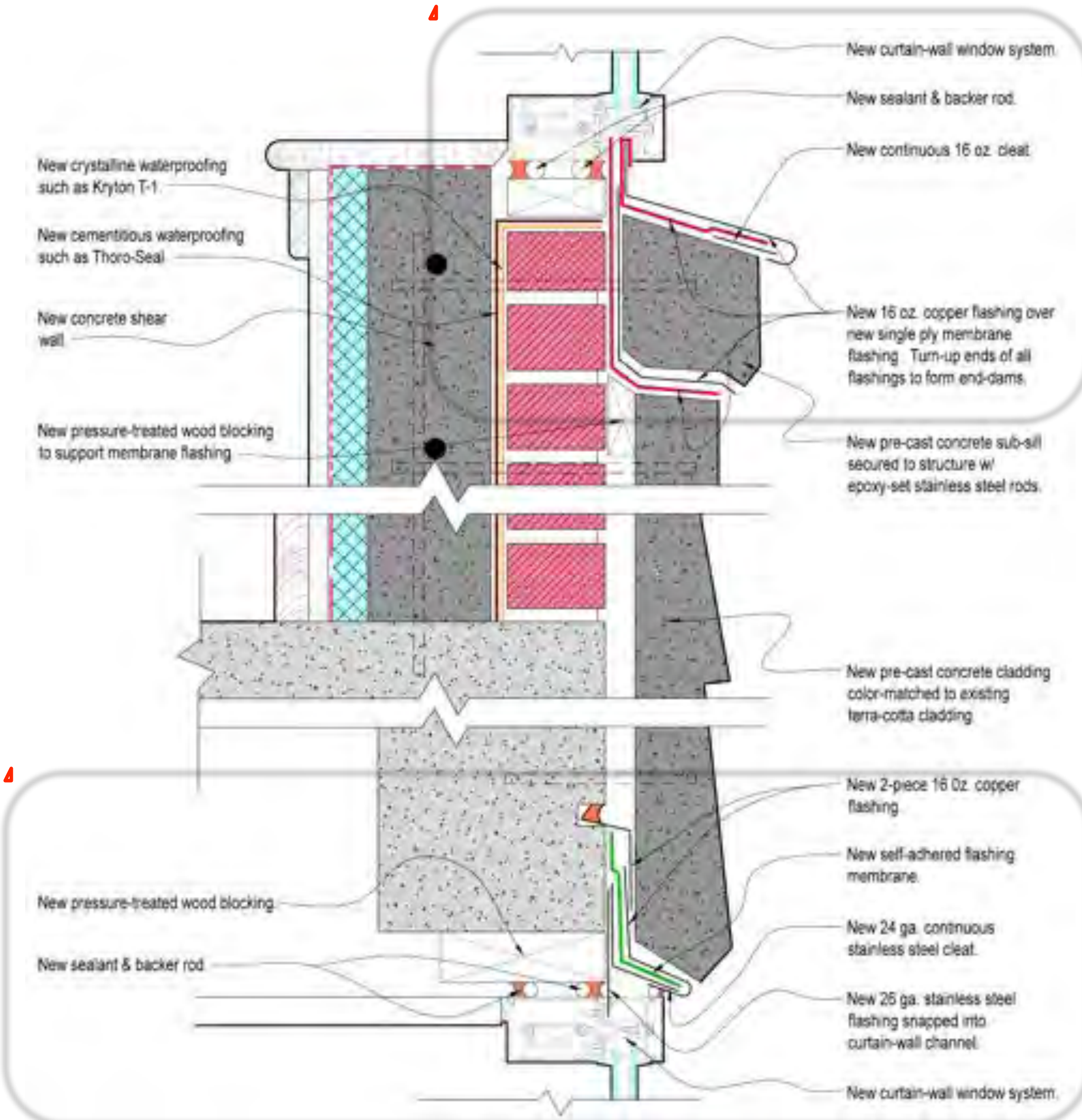


Fig. IV-3.12(1): Window Head & Sill Installation at Typical Cladding Panel Loc.

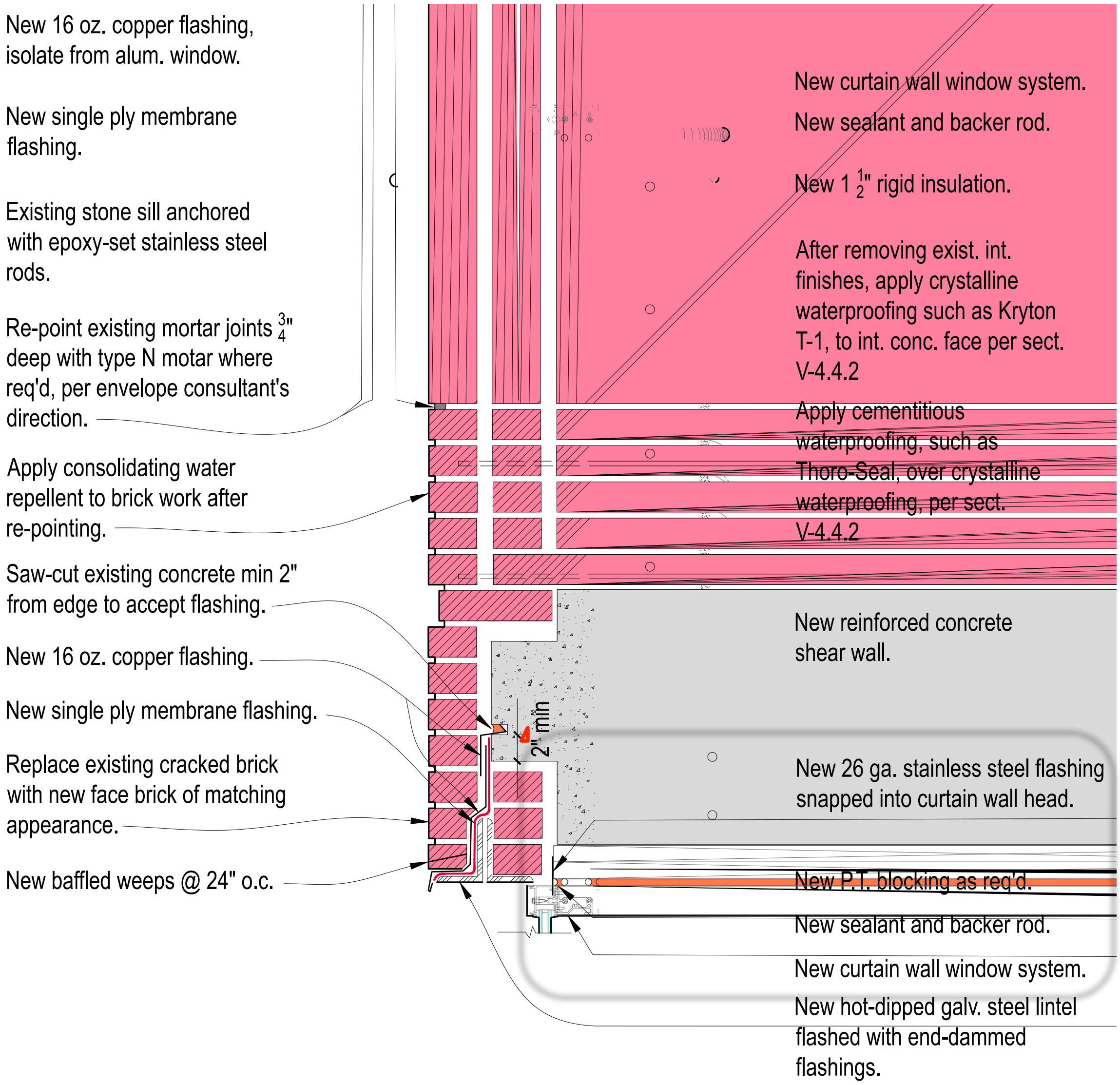


Fig. IV-3.12(2): Window Head & Sill Installation at Typical Brick Wall Loc.

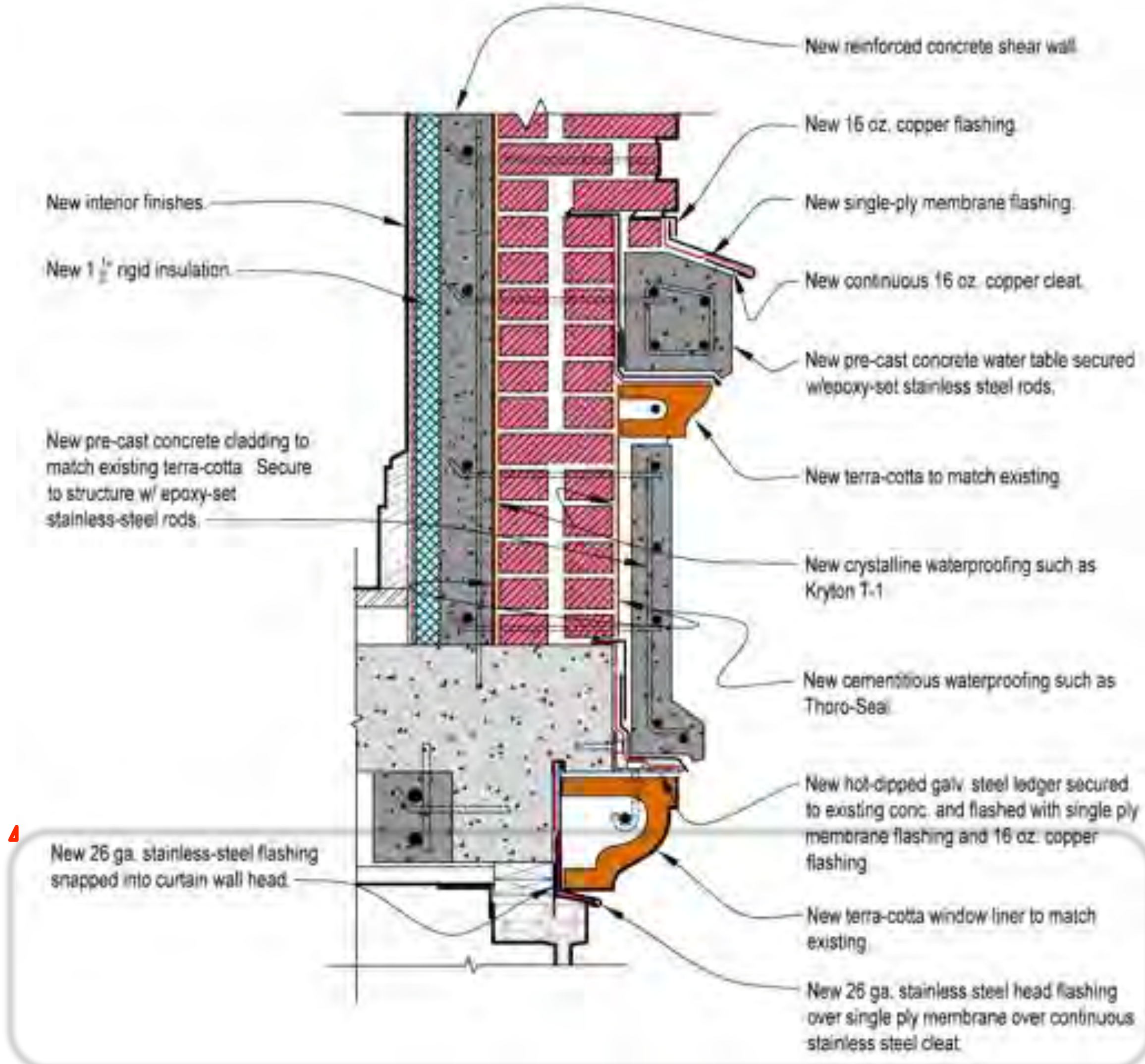


Fig. IV-3.12(3): Window Head Installation at Level 4 "Public" Façade Locations

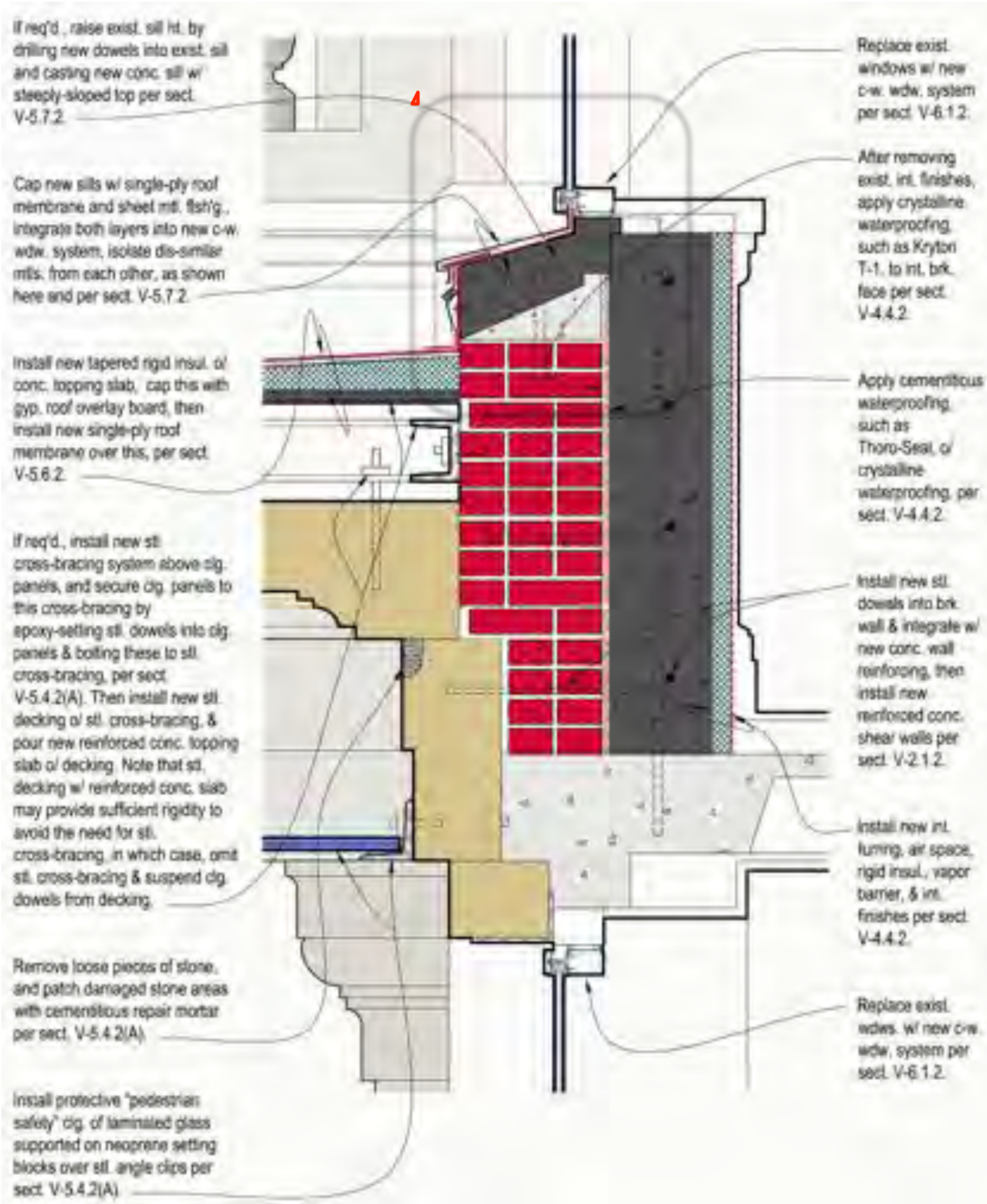


Fig. IV-3.12(4): Window Sill Installation Above Portico Roof

Note that this drawing is excerpted from 12/31/10 report, and section references pertain to that report. Also, aspects of the adjacent masonry work do not reflect updated recommendations of this report.

3.13. Roofs

3.13.0 General

This subsection pertains to four roof areas, including the large main roof, a small roof atop the stair-tower, and two small roof areas atop the metal-clad additions on the building's north side. The portico roof is addressed separately with the Portico in subsection IV-5.6.

3.13.1 Basis of Recommendations

Concrete pavers atop the roofs precluded examination except along perimeter conditions. However, a few germane observations could be made.

First, the assembly of these roofs consists of a single-ply EPDM membrane over the building's concrete roof structure, with rigid polystyrene insulation capped with concrete pavers placed atop this membrane. This configuration represents an Inverted Roof Membrane Assembly, (IRMA), wherein the insulation occurs above the roof membrane. This type of assembly is particularly ill suited to a cold, wet climate such as Juneau's, since all water has to percolate through the insulation joints to the membrane, then migrate along the membrane's top to the drains. In the process, this cold water extracts a lot of heat from the building. In a cold, wet climate, this IRMA configuration effectively negates essentially all value of the insulation, and results in appreciably increased energy consumption.

A second major observation relates to all conditions where the roof membrane joins higher masonry walls above, such as along the base of the brick chimney, where the main roof joins the stair-tower walls and parapets, and where the two lower roofs abut the brick-clad walls. The roof membrane top edges are secured with continuous termination bars, with sealant above the bars, but with no through-wall flashings to allow drainage from the masonry or stucco above. This non-draining configuration is quite improper, and substantially increases risk of leakage below such transitions, as moisture within the masonry drains into the roof assembly. This may be one reason why the stairwell's east-facing brick wall, as well as several chimney walls, had been painted with an elastomeric coating, probably reflecting an effort to stop infiltration below.

3.13.2 Recommended Corrective Actions

Although the Inverted Roof Membrane Assembly is exceedingly ill suited to Juneau's cold, wet climate, the EPDM membrane, where it could be examined, appeared to be in relatively new condition, with perhaps another two decades of lifespan. In view of this, it may be reasonable to wait till replacement is required before modifying the assembly type. Unfortunately, this implies that the building's energy usage will be needlessly high till the assembly can be altered. However, no work is recommended with respect to this replacement as part of this project.

However, when the time comes to replace the membrane on these roofs, I strongly recommend that the assembly be altered to place the membrane atop the rigid insulation, rather than under it.

The only aspects that need to be altered as part of this current project are the perimeter conditions where the roofs abut adjacent masonry or stucco-clad walls. This includes junctures of the roofs to the existing brick chimney, to the stucco-clad walls, and to brick walls where the lower roofs on the north side have brick walls on three sides.

Recommended modifications to the roof-chimney junctures are described in subsection IV-2.5.2, and are shown in Figure IV-2.5(1), which is shown again here as Figure IV-3.13(1). In brief, the improper junctures of the roof to the chimney will be addressed by installing a reglet flashing above the roof membrane termination and over-cladding the chimney with a metal cladding. See Figure IV-3.13(1).

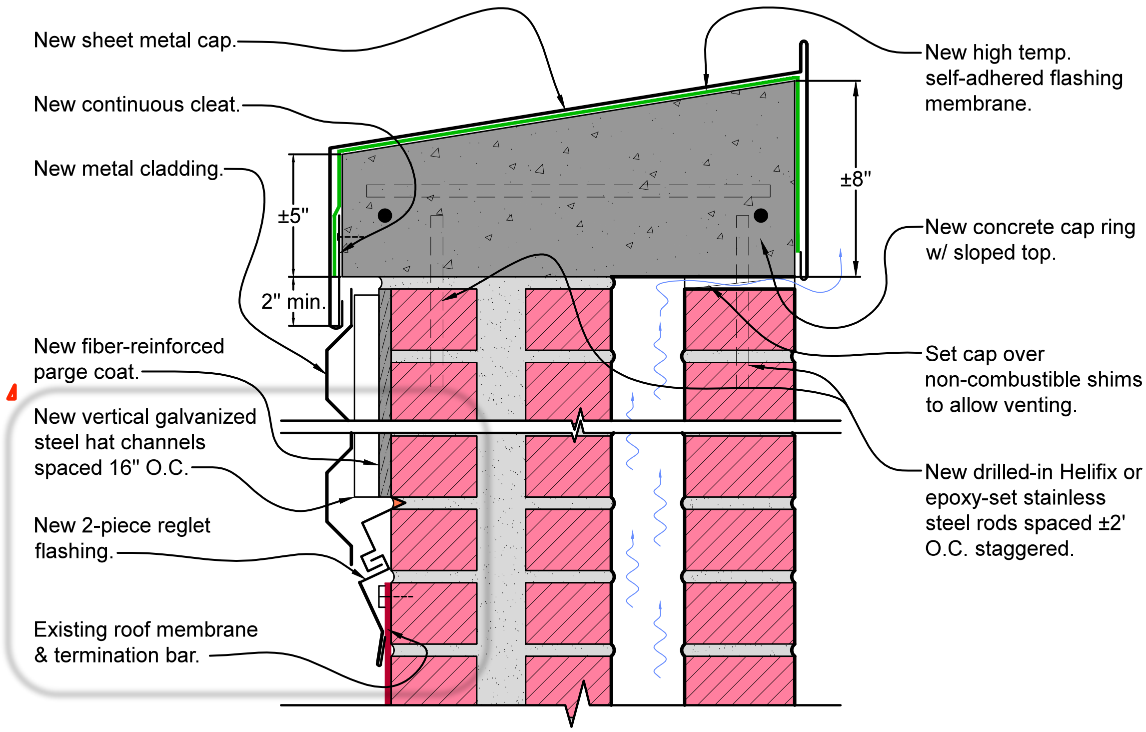


Figure IV-3.13(1): Recommended Modifications at Chimney-Roof Junctures

Recommended modifications to the roof-stucco wall junctures are described in subsection IV-3.9.2, and are fundamentally similar to the roof-chimney junctures depicted in Figure IV-3.13(1).

Recommended modifications to the roof-brick wall junctures are described in subsection IV-3.8.2, and involve retrofitting of through-wall flashings. They are shown in Figure IV-3.8(2), repeated here for the reader's convenience as Figure IV-3.13(2.).

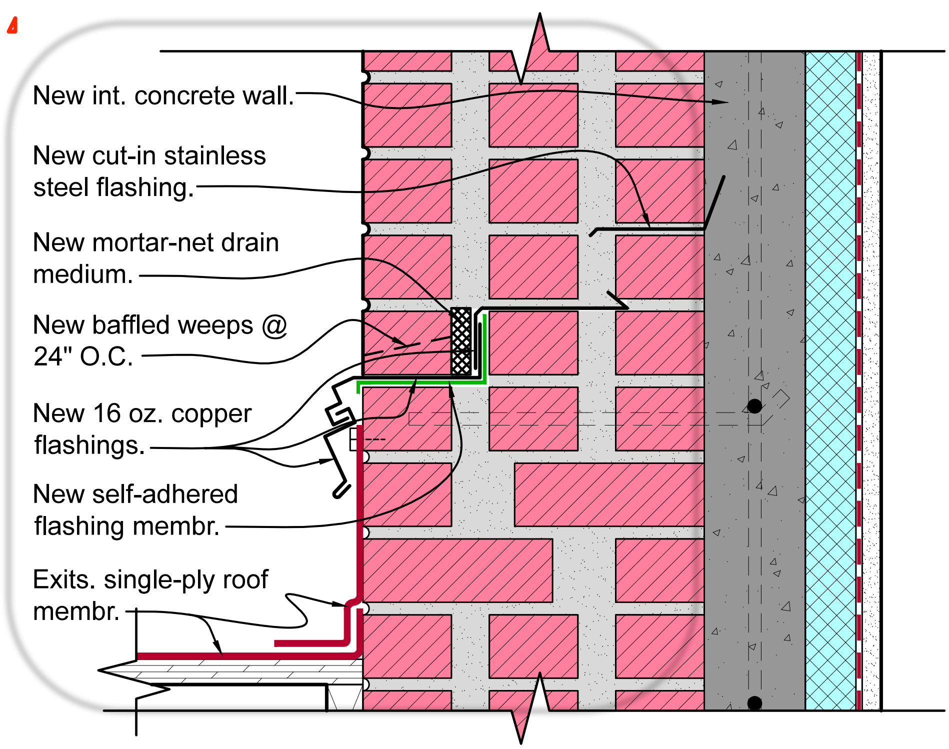


Fig. IV-3.13(2): Recommended Modifications at Roof-Brick Wall Junctures

4. EXTERIOR MASONRY SUB-ELEMENTS

4.0. General

This section of the report addresses issues related to the various exterior masonry sub-elements, such as the stone and terra-cotta water tables, stone window sills, marble panels, etc. It is divided into 8 subsections, each of which pertains to a specific primary element. Where appropriate, each subsection contains preliminary drawings depicting the described work. In addition, Figures IV-4.0(1-7) show the exterior elevations which reference the locations of specific details in the various subsections.

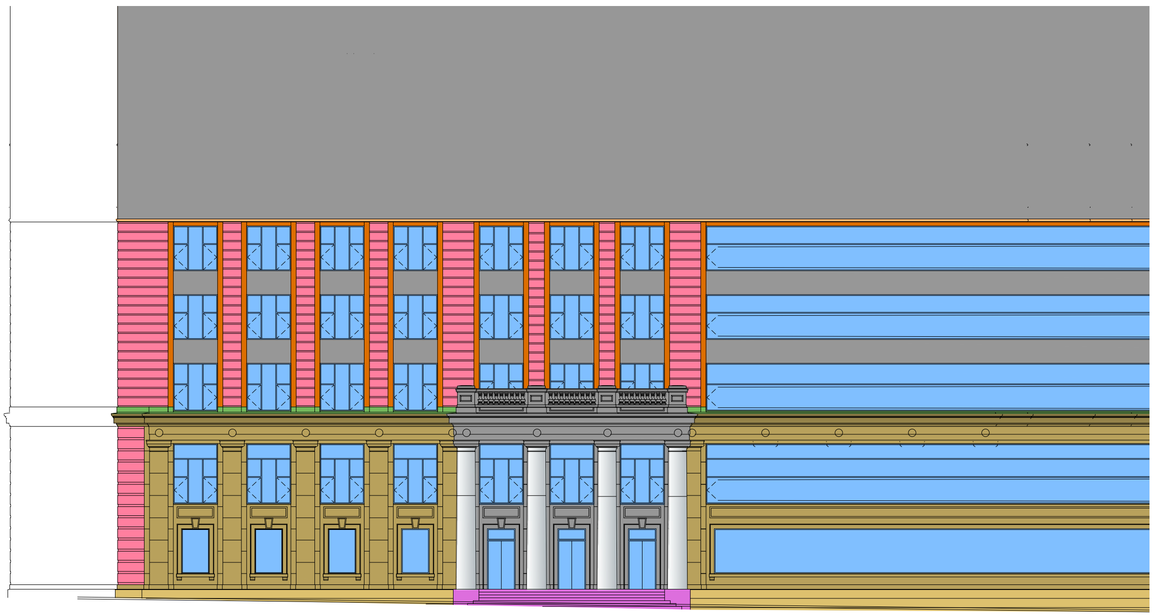


Fig. IV-4.0(1): South Elevation

Fig. IV-4.0(2): West Elevation

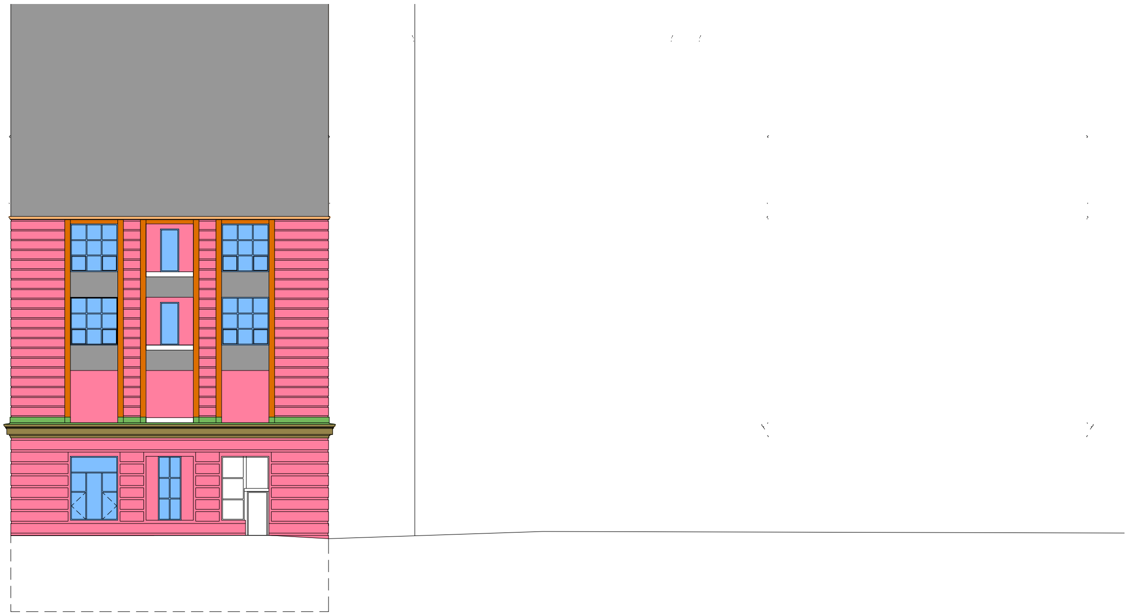


Fig. IV-4.0(3): North Elevation

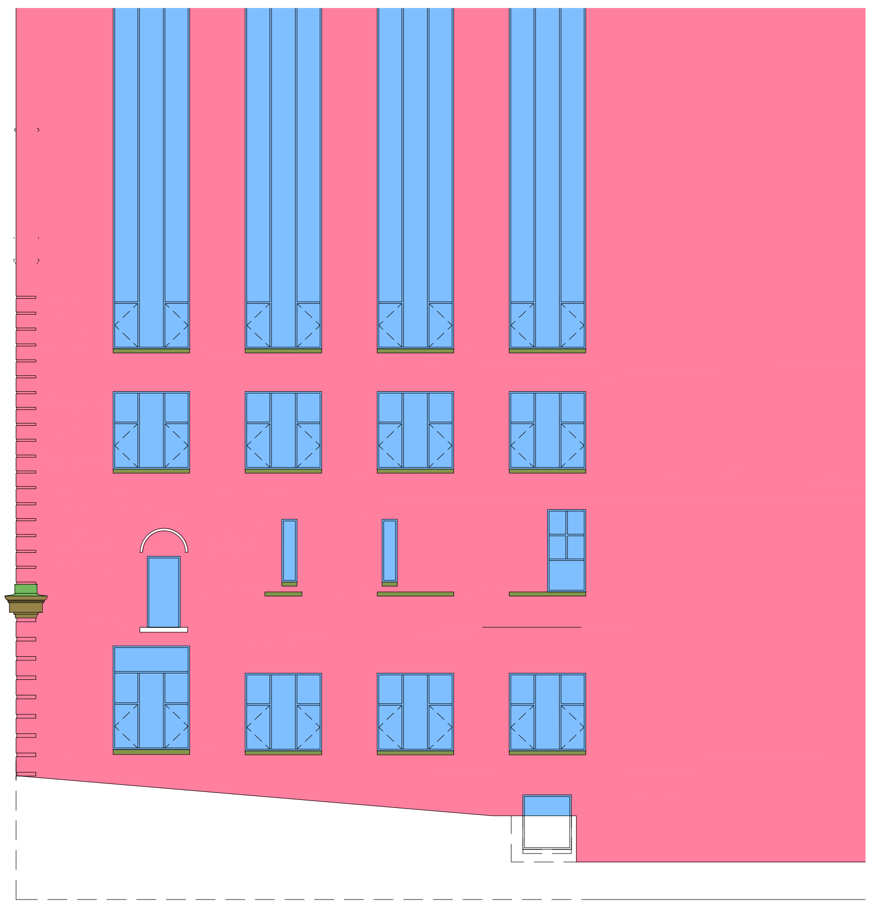


Fig. IV-4.0(4): North Courtyard: West-Facing Wall

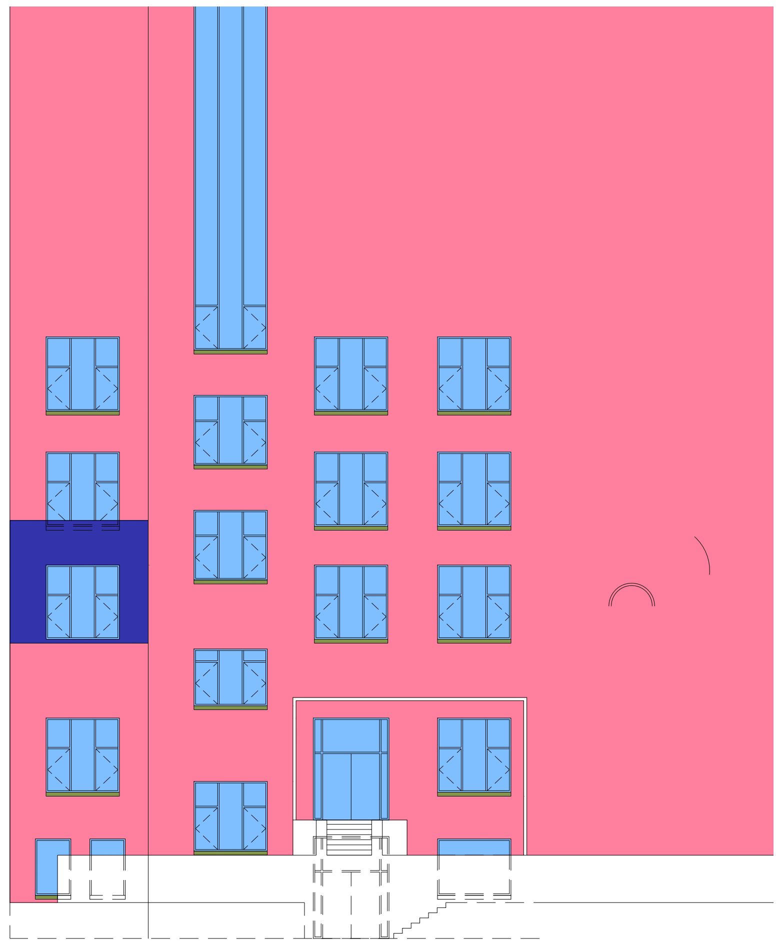


Fig. IV-4.0(5): North Courtyard: North-Facing Wall

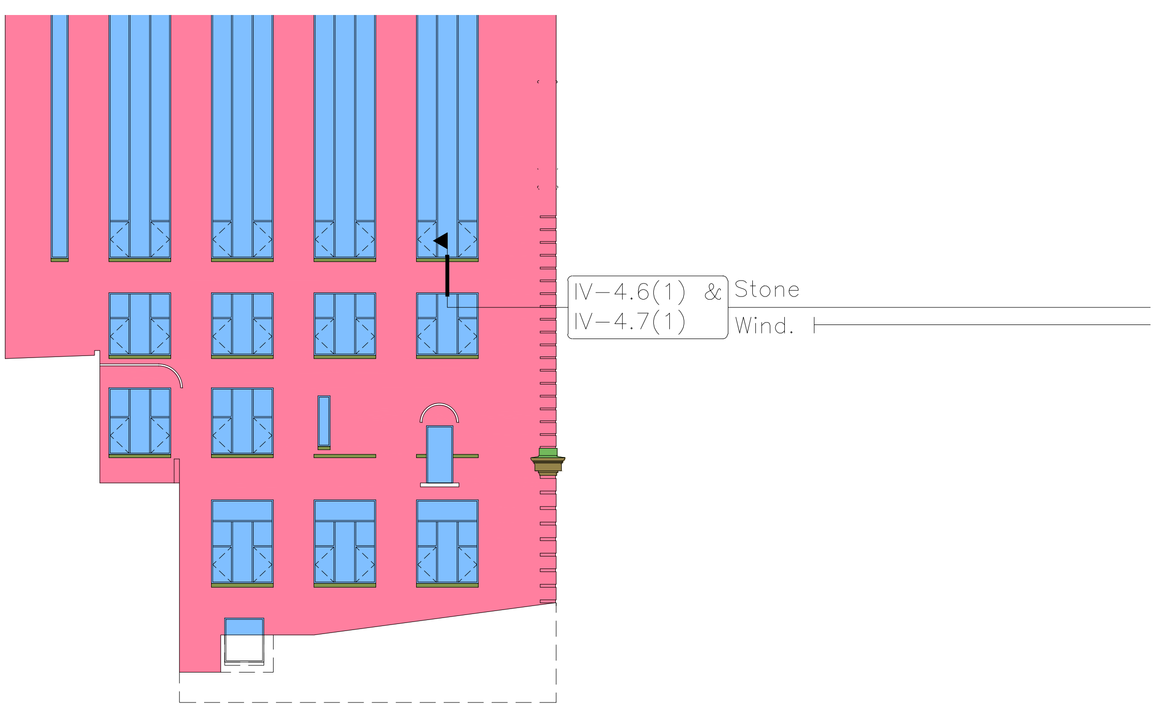


Fig. IV-4.0(6): North Courtyard: East-Facing Wall

Fig. IV-4.0(7): East Elevation

4.1. Lower Stone Water Table at Level 2

4.1.0 General

This subsection pertains to the stone water table that extends at level 2 around the building's more public façades on the west, south, east, and north sides, but not in the north courtyard.

4.1.1 Basis of Recommendations

The water table's securement at the windows appears inadequate for lateral loads, though it is notably beefier where it runs past embedded concrete columns. It is probable that the anchors have begun to corrode, compromising securement to variable degrees, depending on exposure. This may pose some risk to pedestrians below in case of earthquake.

With regard to design, this water table lacks any flashings on top or under it, allowing permeation into the water table and the masonry below. Consequently, it displays appreciable degradation, erosion, cracking, and exfoliation. Although the degradation does not yet appear to have irretrievably damaged this water table, it will only accelerate if left unprotected.

4.1.2 Recommended Corrective Actions

The recommended corrective work for this water table includes three primary components, including enhancing anchorage, restoration, and retrofitting of flashings. Figure IV-4.1(1) depicts most of the corrective steps described here, though it does not show all design changes.

Anchorage enhancements should take place first. In brief, this involves drilling through the existing brick or concrete walls from the interior at least 6" into the inner face of the stone pieces, then epoxy-setting ½" ø stainless steel threaded rods into these holes. Where this work occurs at the concrete walls, the holes will be drilled through the concrete walls and epoxy-set into these as well. Where the water table runs past brick walls, new interior concrete walls will be placed against these, so the rods can be tied to the new concrete wall reinforcing and become embedded in the concrete. The rods should be placed in two horizontal rows spaced 16" apart vertically, and the rods should also be spaced about 16" apart within each row, but not fewer than two anchors should be drilled into each water table piece in each row.

The flashing retrofit work consists of several integrated flashing pieces. This work must be properly sequenced with the restoration work, and is not necessarily listed in installation order. It includes installation of through-wall flashings in the brickwork directly above the water table band, as well as capping of the top surface of the water table with flashing caps. The through-wall flashing's purpose is to intercept water draining down within the brick above and drain it out of the wall. The flashing caps will help protect the water table from degrading further.

Installation of the through-wall flashings should be done after the brick walls above have been re-anchored and may require some temporary bracing. This work consists of removing one or perhaps two courses of the outer brick wythe above the upper water table band, saw-cutting through the horizontal mortar joint in the inner brick wythe, adhering a self-adhered flashing membrane over the brick below this saw-cut, installing a 16-oz. copper flashing over the self-adhered flashing, then insertion of a copper or stainless steel flashing in the previously-made saw-cut in the inner wythe. The saw-cut should then be packed with type N mortar, and the removed brick should then be reinstalled, with baffled weeps spaced 24" O. C. placed in every third head joint to allow water to drain out.

Capping of the water table should take place after at least the top surfaces had been cleaned, rebuilt with restoration mortar, etc. This work begins by installing a continuous, 3”-4” wide cleat of 16 oz. copper or 24-gage stainless steel along the outer edge to protrude at least ½” past the water table edge. This cleat should be secured to the stone with appropriate stainless steel or copper stone fasteners. The top of the water table should then be capped with an adhered single-ply membrane flashing, such as Cetco Core-Flash 60, which should adhere over the cleat at the outer edge, cover the water table top, and extend vertically up the upper stone face. A 16-oz. copper flashing should then be clipped over the continuous cleat and be secured to the upper stone band with stainless steel or copper stone fasteners along its uppermost edge. Another 16-oz. copper flashing should cap over the top edge of the water table flashing and tuck under the through-wall flashing above.

Restoration work includes the following steps, which need to be sequenced properly with the flashing retrofit work, and are not necessarily listed in installation order:

1. Inject Cracks in Stone with Epoxy

   Major cracks in the water table pieces should be injected with appropriate epoxy resins, such as Sika Sikadur 35 Hi-Mod LV, etc.

2. Restore Surface Voids, Spalled Areas, etc. with Appropriate Restoration Mortar

   Surface voids, spalled areas, and similar surface flaws should be patched with appropriate restoration mortars, such as Jahn Restoration Mortar by Cathedral Stone Products Inc.

3. Rout and Seal Vertical Mortar Joints Between Pieces

   Rout all vertical mortar joints between water table pieces to a depth of about ¾”, insert closed-cell backer rod, such as Dow Ethafoam, into these reveals, and install appropriate silicone sealant, such as Dow 790, over the backer rod. Apply sand to wet sealant to mimic mortar. Test sealant-stone compatibility prior to installing to ascertain that sealant will not stain stone.

4. Repoint Damaged Horizontal Mortar Joints

   Where existing horizontal mortar joints are cracked, eroded, or otherwise damaged, selectively repoint such joints to a minimum depth of ¾” with color-matched, type N mortar, and tool joints to match existing ones.

5. Clean Masonry Surfaces

   Clean exposed masonry surfaces with appropriate cleaners, such as ProSoCo Sure-Klean 766 Limestone & Masonry Pre-Wash followed by Limestone & Masonry After-Wash, etc.

6. Consolidate and Seal Stone Cladding

   Apply appropriate consolidating & repellent agent, such as ProSoCo Conservare H-100, etc.

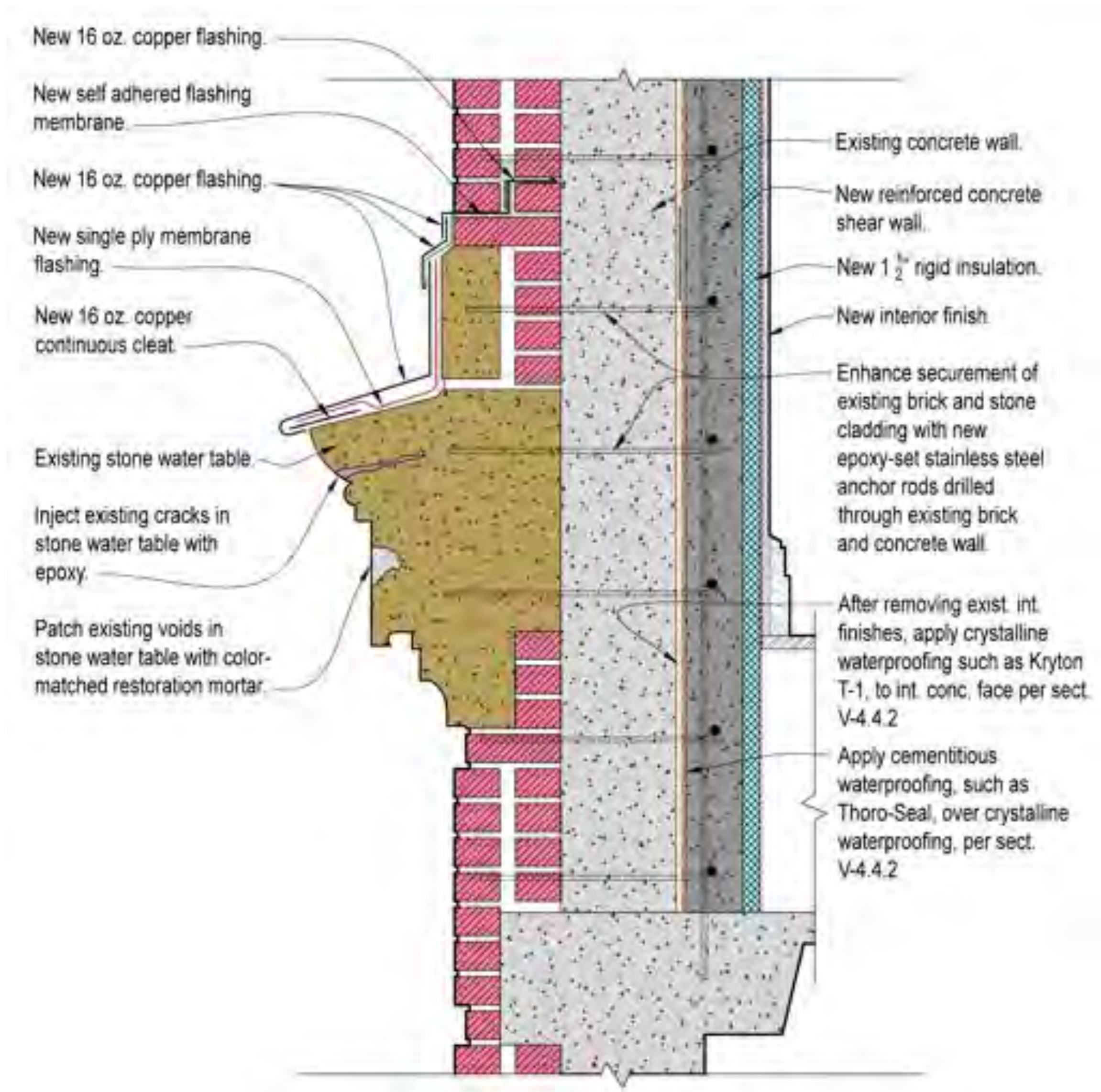


Fig. IV-4.1(1): Water Table Flashing, Anchorage, and Restoration Work

Note that interior concrete walls occur only at brick walls and not at concrete columns. See subsection IV-2.1.2 for interior concrete wall locations, thicknesses, & reinforcing.

4.2. Terra-Cotta Window Bay Surrounds

4.2.0 General

This subsection pertains to the multi-colored terra-cotta border elements that surround all vertical window bays at levels 2-5 around the building's public façades on the west, south, east, and north sides, but not in the north courtyard.

4.2.1 Basis of Recommendations

Issues related to the window surrounds concern securement, design, and condition.

A primary design flaw affecting these terra-cotta surrounds concerns the non-draining brickwork above the heads. Due to the absence of drainage provisions above these heads, water within the brickwork drains directly into the terra-cotta heads, which then direct this water down the terra-cotta jamb surrounds. When the water freezes and expands, it rips the terra-cotta pieces, causing cracking and spalling.

This infiltration is also likely to lead to corrosion of the steel lintels, and probably of the wire hooks securing the terra-cotta heads.

The condition of these terra-cotta elements ranges from generally good to notably damaged by cracking and face-spalling. Many pieces are minimally degraded, and could probably last another 40 years, perhaps more. On the other hand, a small number are already seriously damaged, and will spall chunks onto the ground below. Perhaps a quarter fall somewhere in-between, and are likely to begin cracking and spalling within a decade or two.

Although one could wait a decade or more before needing to address these elements, it makes no sense to try squeezing more life from these pieces in view of the major masonry restoration work about to take place, so replacement of these pieces is advised at this stage.

4.2.2 Recommended Corrective Actions

The recommended corrective work consists of replacing all existing terra-cotta window bay surrounds with new terra-cotta pieces. Figure IV-4.2(1) depicts the corrective work at the level 4 window heads, which must be coordinated with the work recommended for the upper water table band above this, as described in subsection IV-4.3.2.

Since these elements are multi-colored and highly repetitious, they should be replaced with new terra-cotta pieces of matching design. They should be mortar-set and secured with stainless steel wire anchors.

New hot-dipped galvanized steel lintels should be installed and flashed above the level 4 window heads, as described in more detail in subsection IV-4.3.2.

Although similar replacement and flashing of steel lintels above the level 5 window heads would be optimal, such work would be difficult to achieve at that location, and it appears feasible to leave the existing lintels in place at this location, as the recommended new cornice directly above this will help shelter these and limit corrosion. In view of this, the accessible faces of these level 5 lintels should be blasted to remove all rust, new stainless steel hooks should be secured to these, and the lintel faces should be painted with a zinc-rich primer, such as Tnemec 90-97 Tneme-Zinc. All reinforcing and anchorage embedded within the new terra-cotta should be of stainless steel to avoid corrosion.

New stainless steel and single-ply membrane flashings should be installed above the level 4 and 5 window heads, behind the new terra-cotta, as described in more detail in subsection IV-3.12.2.

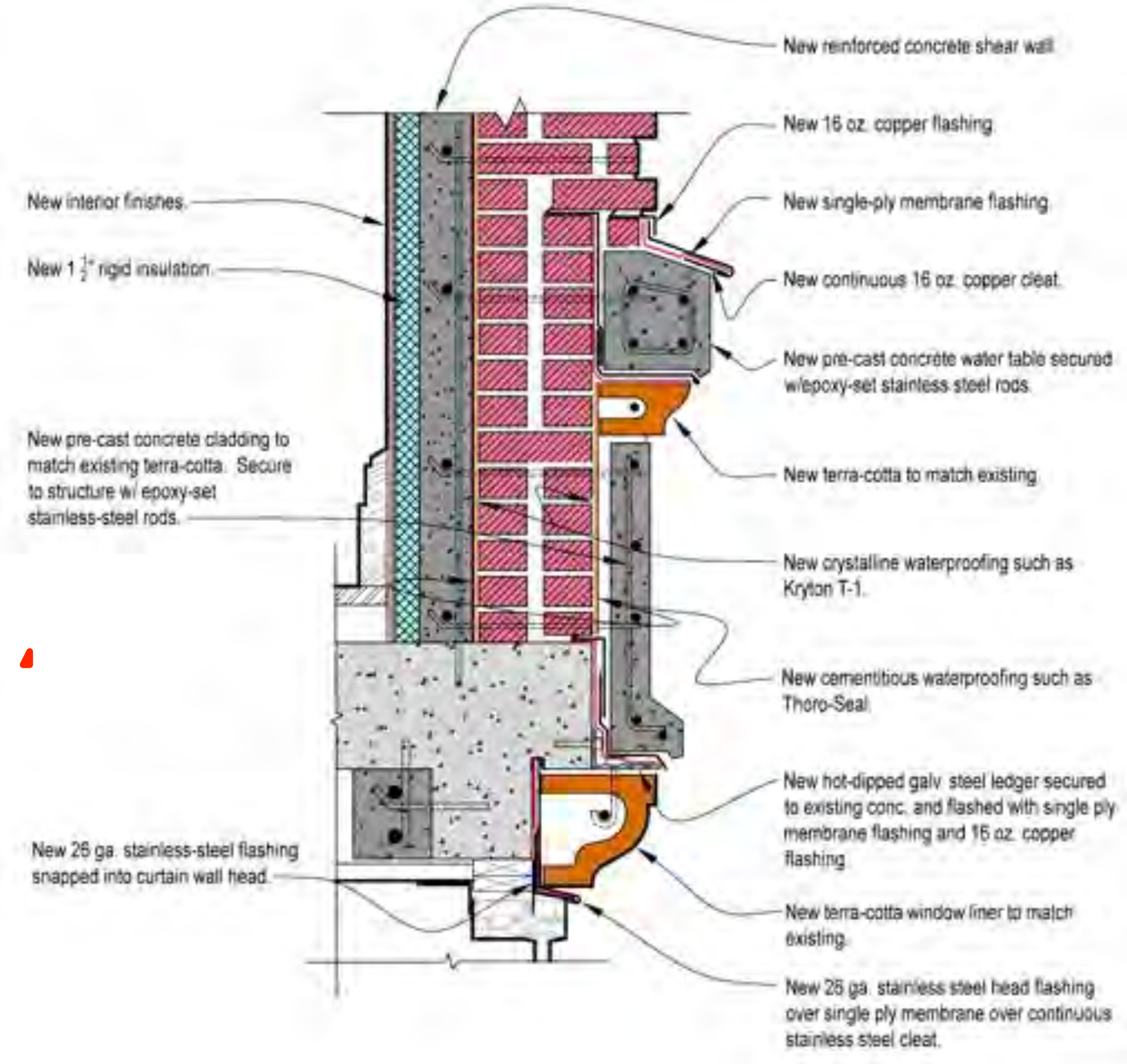


Fig. IV-4.2(1): Terra-Cotta window Bay Surround Replacement at Level 4 Heads

4.3. Upper Terra-Cotta Water Table at Level 5

4.3.0 General

This subsection pertains to the wide horizontal band that separates the 4th and 5th level windows.

4.3.1 Basis of Recommendations

This multi-part band suffers from a lack of flashing caps and through-wall flashings, and the mechanical securement of the flat panels in its mid-portion may be marginal and possibly partly compromised by corrosion.

The absence of appropriate through-wall flashings and flashing caps atop the water table has effectively destroyed significant portions of this band, with widespread and severe spalling affecting weather-exposed locations. Though some additional lifespan could be squeezed out through restoration efforts, this does not appear warranted in view of the scope of this project, and the relatively high cost of any retrofit effort compared to the lifespan extension.

In view of this, wholesale replacement of this band appears most suitable.

4.3.2 Recommended Corrective Actions

The recommended corrective work consists of replacing the entire band with new pre-cast concrete and terra-cotta pieces, along with installation of new, continuous steel support ledgers above the level 4 windows and above the adjacent brick, as well as installation of new flashing caps and through-wall flashings. Figure IV-4.3(1) depicts the corrective work at this band, which must be coordinated with the work recommended in subsection IV-2.1.2 related to the addition of interior concrete walls, subsection IV-3.6.2 for the brick wall corrections, and subsection IV-4.2.2 for the level 4 window heads.

While the monochromatic projecting water table and the flat panels below can be replaced with pre-cast concrete, the multi-colored terra-cotta “soffit” under the water table should be replaced with terra-cotta to match the existing pieces.

The replacement work includes the following steps, which need to be sequenced properly, and are not necessarily listed in installation order:

1. Stabilize Existing Brick Walls & Remove Existing Terra-Cotta Band

   After the interior concrete walls are added and the brickwork above this band is anchored, the existing terra-cotta band elements should be removed to expose the underlying concrete and brick walls, which should be cleaned of all mortar and debris. This work may require additional temporary bracing to support the brickwork above.

2. Install Continuous Support Ledgers Along Band Bottom

   Install Hot-Dip galvanized steel ledgers continuously along bottom of band. The ledgers’ bottom legs should be sufficiently wide to essentially fully support the future pre-cast concrete band to be installed above this. Secure these to the edges of the concrete floors with expansion bolts or epoxy-set stainless steel threaded rods. Incorporate attachment hooks for terra-cotta window heads below the ledgers.

3. Flash New Support Ledgers

   Saw-cut horizontal mortar joint in brick or concrete wall behind band directly above the floor slab top to create ¾” deep reveal. Adhere new single-ply membrane flashing, such as Cetco Core-Flash 60, over ledger and up back-up wall to saw-cut. Cap over this with 2-piece, 16-oz. copper flashing. Insert top of upper flashing into saw-cut, then insert closed-cell backer rod, such as Dow Ethafoam, and fill remaining reveal with sealant.

4. Apply Crystalline and Cementitious Waterproofing to Brick and Concrete Back-Up Walls

   Apply crystalline waterproofing, such as Kryton Krystol T-1 to exposed faces of brick and concrete back-up walls and allow to permeate per manufacturer's directions. Apply cementitious waterproofing, such as Thoro Thoroseal, over treated brick and concrete back-up walls.

5. Install New Pre-Cast Concrete and Terra-Cotta Bands

   Where anchors had not yet been installed as part of the work described in subsection IV-2.1.2, install new stainless steel anchors for pre-cast concrete panels and terra-cotta pieces. Different types of anchors can be used, including bolted clips, epoxy-set threaded rods, etc. Install 4 anchors per pre-cast concrete panel.

   Fabricate and install new pre-cast concrete panels with stainless steel reinforcing.

   Fabricate and install new multi-colored terra-cotta pieces to match existing ones atop the pre-cast concrete panels. Secure with stainless steel hooks and bars and set in mortar.

6. Flash Over New Terra-Cotta Band

   Saw-cut horizontal mortar joint in brick or concrete wall behind band one course above the projecting water table to create 3 ½" deep reveal. Adhere new single-ply membrane flashing, such as Cetco Core-Flash 60, over terra-cotta band and up back-up wall to saw-cut. Cap over this with 2-piece, 16-oz. copper flashing. Insert top of upper flashing into saw-cut, then pack joint with type N mortar.

7. Install New Pre-Cast Concrete Water Table and Brick Course Above It

   Where anchors had not yet been installed as part of the work described in subsection IV-2.1.2, install new stainless steel anchors for pre-cast concrete water table pieces. Different types of anchors can be used, including bolted clips, epoxy-set threaded rods, etc. Install anchors spaced roughly 16" apart, but not fewer than 3 anchors per piece.

   Fabricate and install new pre-cast concrete water table pieces with stainless steel reinforcing to match profiles of existing water table.

   Reinstall one brick course directly above water table, but leave horizontal bed joint above this free of mortar.

8. Flash Over New Terra-Cotta Band

   Secure 3"-4" wide continuous strip of either 16 oz. copper or 24 gage stainless steel along top outer edge of water table to serve as a continuous cleat. Adhere new single-ply membrane flashing, such as Cetco Core-Flash 60, over water table band and one course up brick wall to empty mortar joint. Cap over this with 2-piece, 16-oz. copper flashing. Insert top of upper flashing into empty mortar joint, then pack joint with type N mortar.

9. Fill Vertical Joints Between Pieces with Backer Rod and Sealant

   Install baffled weeps, such as Dur-O-Wal Cell-Vent, at bottoms of vertical joints in flat panels directly above flashings, then fill all remaining vertical joints between pieces with closed cell backer rod, such as Dow Ethafoam, leaving a 3/8" deep reveal. Fill reveal with appropriate sealant, such as Dow 790, and apply sand to outer sealant faces to mimic mortar.

10. Seal New Pre-Cast Concrete Elements

    Apply appropriate water repellent, such as ProSoCo Weather-Seal Siloxane PD or SL-100 to pre-cast concrete surfaces. Protect other surfaces from the sealer.

Figure IV-4.3(1) illustrates this work.

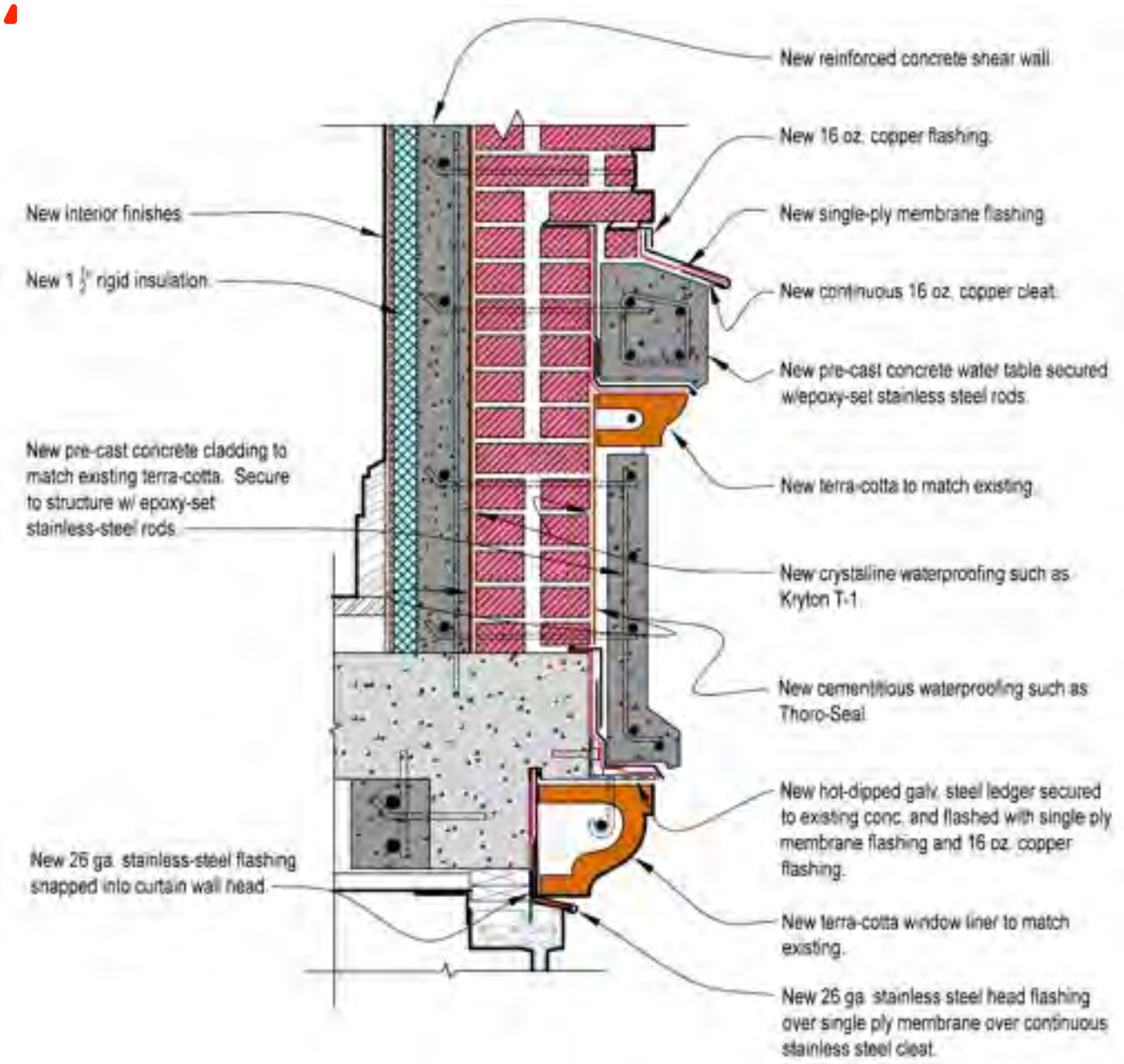


Fig. IV-4.3(1): Terra-Cotta Water Table Band Replacement Abv. Level 4 Windows

4.4. Marble Panels at Level 5

4.4.0 General

This subsection pertains to four flat marble panels embedded within the level 5 brickwork.

4.4.1 Basis of Recommendations

Four marble panels occur within the level 5 brickwork. Two are relatively large, with about 23 SF of area and weighing roughly 700 pounds, while two smaller panels have about 7 SF of exposed area and weigh about 200 pounds each. Two issues pertain to these panels.

First, it is not clear whether any mechanical anchors secure them, and they may rely primarily on mortar bond for securement. Further, the mortar appears to be significantly delaminated, based on random tapping. The questionable securement represents the primary concern, which could pose a hazard to pedestrians below, particularly in earthquakes.

Second, the outer surfaces are seriously weathered and eroded. Some of the marble's veins appear to be possibly cracked. The panel bottom edges are stained. This degradation is largely a minor visual distraction, since these panels are so high above the street level. The surface erosion may increase moisture absorption, but this can be largely addressed with appropriate repellents. The possible short cracks along veins can also exacerbate infiltration and subsequent freeze-spalling, which could be a more serious consideration.

4.4.2 Recommended Corrective Actions

The recommended corrective work consists of enhancing anchorage, injecting apparent cracks with epoxy, and cleaning and sealing the surfaces.

The panels can be anchored by drilling either helical Helifix pins or epoxy-set threaded rods through the stone panels and back-up brick into the existing concrete walls. Only stainless steel anchors should be used, and should be set into the back-up concrete walls at least 4". They should be recessed about ¾" from the outer panel faces, with the remaining holes filled with appropriate sealant with sand embedded to mimic the stone. Dow 790 may be an appropriate sealant for this, but it should be tested for compatibility with this marble to assure that it will not stain the stone. The two larger panels should be anchored with 9 anchors, consisting of 3 rows of 3 anchors each, while the two smaller panels can be secured with 3 anchors.

The apparent cracks in the panels can be injected with a low viscosity epoxy, such as Sika Sikadur 35 Hi-Mod LV to re-glue the panels. However, this method should first be tested to assure that the epoxy does not stain the stone.

Although the surface erosion could be addressed by re-polishing, this would be costly and would provide very little benefit, as it cannot be seen from the street level. Therefore, no polishing is recommended.

However, the panels should be cleaned and sealed to limit infiltration and slow-down further degradation. Cleaning can be achieved with products such as ProSoCo Limestone Restorer or 766 Limestone & Masonry Pre-Wash and Limestone After-Wash. Sealing can be achieved with ProSoCo NST 400, NST-600, or Weather-Seal H40, which will also help consolidate the stone surface.

4.5. Cornice-Parapet Band at Roof Level

4.5.0 General

This subsection pertains to the entire height of the multi-part band above the level 5 windows and brickwork.

4.5.1 Basis of Recommendations

Three primary considerations apply to this band.

First, the current configuration does not reflect the building's original design, which included a significant, protruding terra-cotta cornice. This was built, but was removed after about three decades due to its degradation. As noted in subsection II-4.5.2, though the original cornice was improperly designed and required removal, a properly designed cornice can provide very beneficial weather protection for all elements below. In view of the inherent vulnerability of these masonry elements, reconstruction of a properly designed cornice of similar appearance to the original one should be considered mandatory.

The second issue concerns this band's securement to the structure, which primarily applies to the flat terra-cotta panels near the bottom. In brief, securement of these panels appears questionable, and has probably been somewhat compromised by corrosion. A lesser securement concern is that the stucco portion of this band may be delaminating in places. Both may pose risks to pedestrians below, especially in earthquakes.

The third consideration relates to the condition of the protruding band within this element, which is in extremely poor condition. It is in fact disintegrating, dropping up to fist-sized chunks onto the portico roof and ground below. This poses a serious, ongoing risk to pedestrians below.

4.5.2 Recommended Corrective Actions

The combination of problems affecting this band can best be addressed by removal of what remains of its original construction, and replacement with a new, projecting cornice of similar appearance to the original one, but made of pre-cast concrete elements supported by steel framing. Figure IV-4.5(1) depicts the general nature of the recommended replacement cornice.

In brief, the recommended work begins by removing all remnants of this cornice band. The bottom projecting terra-cotta band and the flat terra-cotta panels above would then be replaced with a single band of pre-cast concrete, which can be secured to the structure with stainless steel clips or epoxy-set threaded rods, with a minimum of 4 anchors per panel piece.

Above this, a new structural support framework of hot-dipped galvanized steel would be constructed, capped with galvanized steel decking. Pre-cast concrete soffit panels, fabricated to mimic the original cornice and reinforced with stainless steel, would then be secured to this steel support structure.

New 5/8" gypsum overlay board, such as Georgia Pacific Dens-Deck, would be secured over the decking, and would be capped with tapered rigid insulation, sloped at ½" per foot as a minimum, to provide slope. Another layer of 5/8" gypsum overlay board would be secured over this.

A continuous 24-gage stainless steel cleat would be secured along the outer edge. A single-ply membrane, such as Cetco Core-Flash 60, TPO roofing membrane, or a similar membrane, would cap over this cleat and extend over the cornice top and up the parapet wall to its top.

Finally, a 16 oz. copper cap flashing would be secured over this, and would be counter-flashed along the parapet face with another 16 oz. copper flashing. This counter-flashing could be fabricated to interlock with a new 16 oz. copper parapet coping, though this could also be secured with a separate cleat.

Figure IV-4.5(1) illustrates the general construction of the recommended cornice.

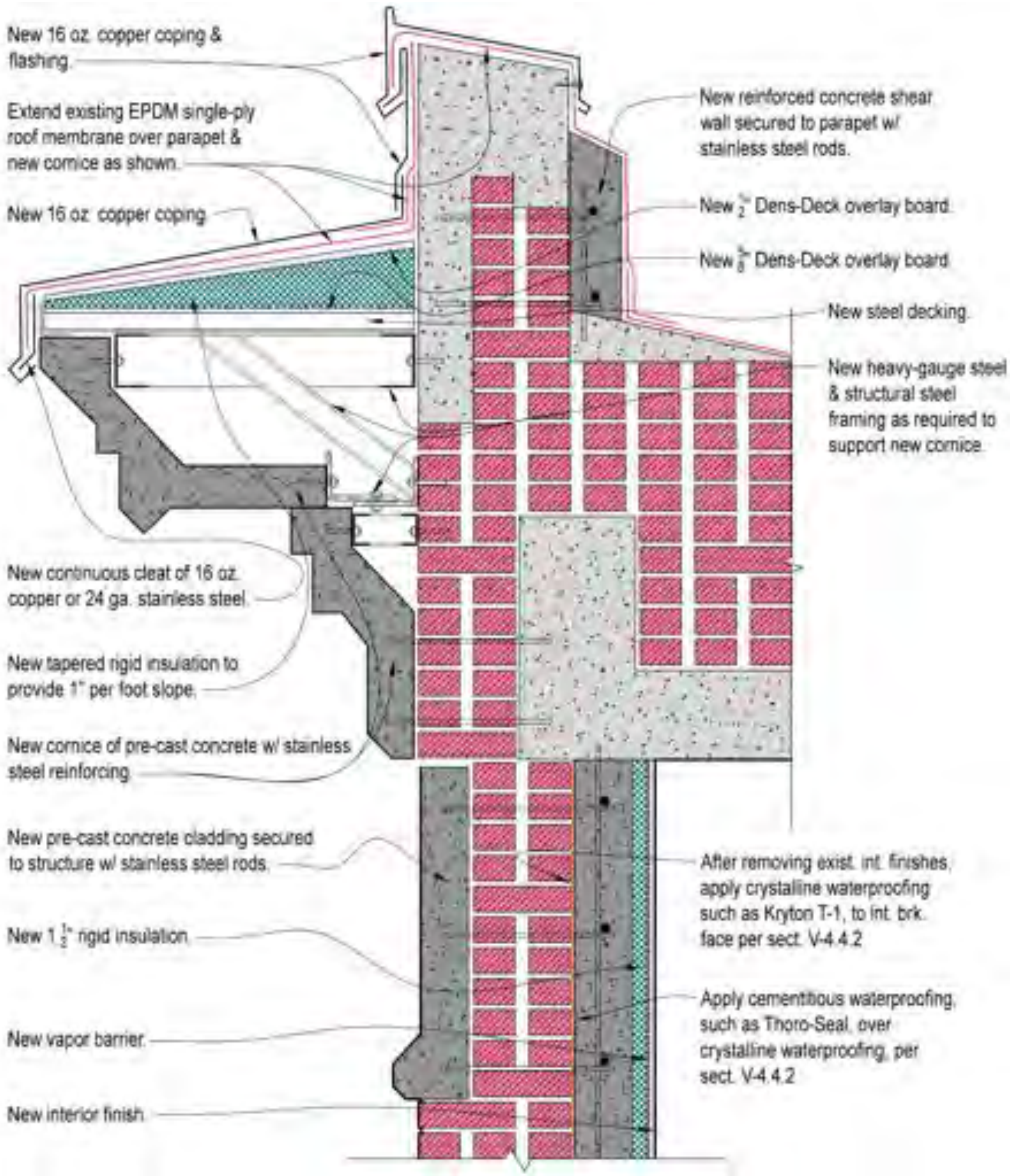


Fig. IV-4.5(1): General Configuration of New Cornice

4.6. Stone Window Sills

4.6.0 General

This subsection pertains to the stone sills which occur along the full height of three vertical window bands at the building's SE corner, along levels 0 and 1 on the east and west elevations, at level 1 of the north ends of both wings, and at nearly all windows facing the courtyard.

4.6.1 Basis of Recommendations

As with many other elements of this building, relevant observations can be divided into issues of securement, design, and condition.

With regard to securement, these sills rely entirely on mortar bond, with no mechanical anchors. Further, the mortar under most sills is largely delaminated. Thus, these sills appear to be held in place primarily via friction. Lack of mechanical securement poses some increased risk of dislocation during earthquakes. However, this appears to be a relatively moderate risk.

With regard to design, these sills lack any flashings under or atop them. Some interior plaster damage below the sills indicates infiltration via these sills. The absence of flashings below and/or atop these sills exposes the stone to weathering degradation, and also increases infiltration risk.

In general, the condition of these sills is variable, but for the most part degradation is limited. Various sills have chipped corners and edges, some surface erosion, and one sill on the east face of the west wing is seismically cracked.

4.6.2 Recommended Corrective Actions

In view of the reasonably decent condition of most of these sills, two options appear feasible.

The first would be to patch and anchor the existing stone sills, and cap over their top surfaces with flashing caps. This is described here as part of Option 1, depicted in Figure IV-4.6(1).

A somewhat technically preferable approach, though a notably costlier one, would be to replace the existing sills with pre-cast concrete ones. This would allow installation of flashings under the sills as well as over them, thus limiting interior infiltration risk to a minimum. This is described in Option 2 & 3 (Parts V & VI).

In the restoration approach, the existing stone sills would be anchored to the new interior concrete walls with either stainless steel helical Helifix anchors, or epoxy-set threaded rods. Each sill should be anchored with at least two rods.

The one seriously cracked sill on the east side of the west wing should be re-glued with epoxy injection, using an appropriate epoxy resin, such as Sika Sikadur 35 Hi-Mod LV, etc.

Surface voids, spalled areas, and similar surface flaws should be patched with appropriate restoration mortars, such as Jahn Restoration Mortar by Cathedral Stone Products Inc.

The exposed sill surfaces should be cleaned with appropriate cleaners, such as ProSoCo Sure-Klean 766 Limestone & Masonry Pre-Wash followed by Limestone & Masonry After-Wash, etc.

Prior to capping, the sills should be treated with an appropriate consolidating & repellent agent, such as ProSoCo Conservare H-100, etc.

The stone sills should then be capped with a single-ply membrane flashing capped with 16 oz. copper flashings. This should be done by first securing continuous cleats of 16 oz. copper or 24-gage stainless steel along the outer sill edges, then adhering a single-ply membrane such as Cetco Core-Flash 60 over the cleats and sills, and integrating this membrane into the channels in the bottoms of the new curtain-wall windows. Finally, 16 oz. copper flashing caps with up-turned ends should clip over these cleats and into the curtain-wall window channels. The up-turned ends should be counter-flashed with copper flashings cut into the jamb brick joints.

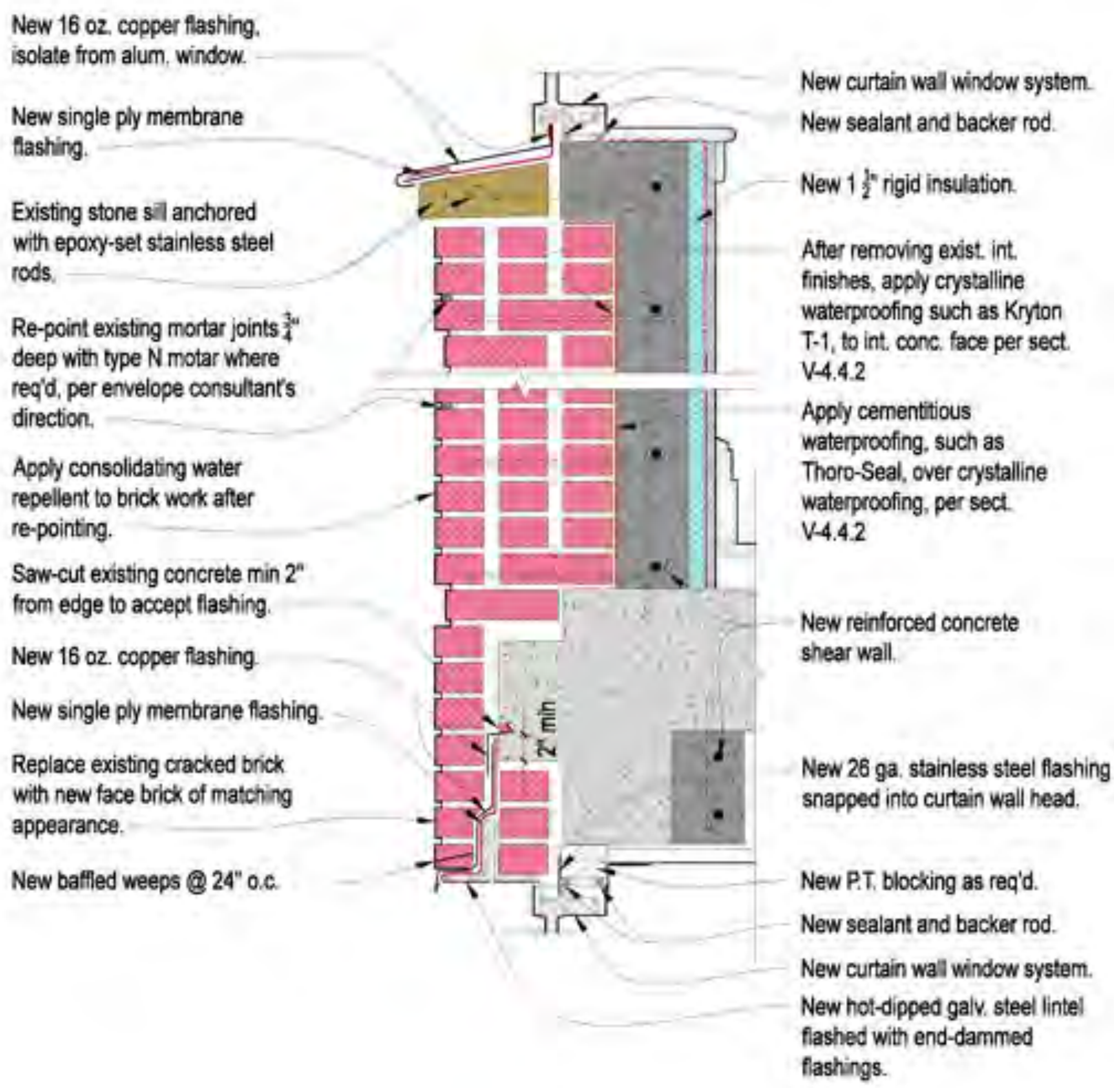


Fig. IV-4.6(1): Restoration, Anchorage, and Flashing of Existing Sills

4.7. Steel Window-Head Lintels

4.7.0 General

This subsection pertains to the steel lintels above windows that do not have terra-cotta panels above them. These occur along the full height of three vertical window bands at the SE corner, at levels 0 and 1 on the east and west elevations, at level 1 of the north ends of both wings, and at all windows facing the courtyard.

4.7.1 Basis of Recommendations

Relevant observations pertain to the lintel design and their resultant condition.

With regard to design, these lintels typically consist of doubled-up steel angles that support the brickwork above. They are plagued by several flaws that may be ascribed to design. First, like essentially all other elements, they lack any flashings. Many are also sealed to the brickwork directly above them, thus precluding drainage. Further, these lintels consist of standard steel.

Consequently, the lintels display varying degrees of corrosion, ranging from minor in many sheltered locations to moderate where more weather-exposed. Some elevated moisture readings and interior plaster damage near window heads may also relate to the absence of lintel flashings.

In addition, one lintel on the east face of the west wing appears to have sagged, as have the two brick courses above this lintel, causing a relatively wide gap and mortar delamination above the full width of the window. The lintel at this location is among the most corroded on the building.

The lintels will continue to corrode, and leakage may persist above some of the weather-exposed windows as a result of the absence of flashings and drainage provisions.

4.7.2 Recommended Corrective Actions

Although many of the existing lintels are still in decent condition and could provide several decades of additional life, their current un-flashed configuration contributes to scattered interior leakage, and the scope of this retrofit project warrants replacement of the outer, accessible lintels as part of this approach. This work is depicted in Figure IV-4.7(1).

In brief, this work must begin by placing the interior concrete walls and brick anchors above, and will also probably require temporary bracing to maintain stability. About 5 brick courses above the lintels need to be removed to access the steel double-lintels. The outer of these should be replaced with a new, hot-dipped galvanized steel lintel. A saw cut should be made into the concrete lug above the heads to receive the upper portion of a 2-piece flashing. A membrane flashing, consisting either of a single-ply membrane such as Cetco Core-Flash 60, or a self-adhered membrane, such as Grace Vycor Plus, should then be adhered over the lintel and up the inner brick and concrete to the saw-cut. A 2-piece copper flashing should then be installed as shown in Figure IV-4.7(1), and the brick should be reinstalled, using type N mortar. Baffled weeps spaced 24” apart should be included for drainage.

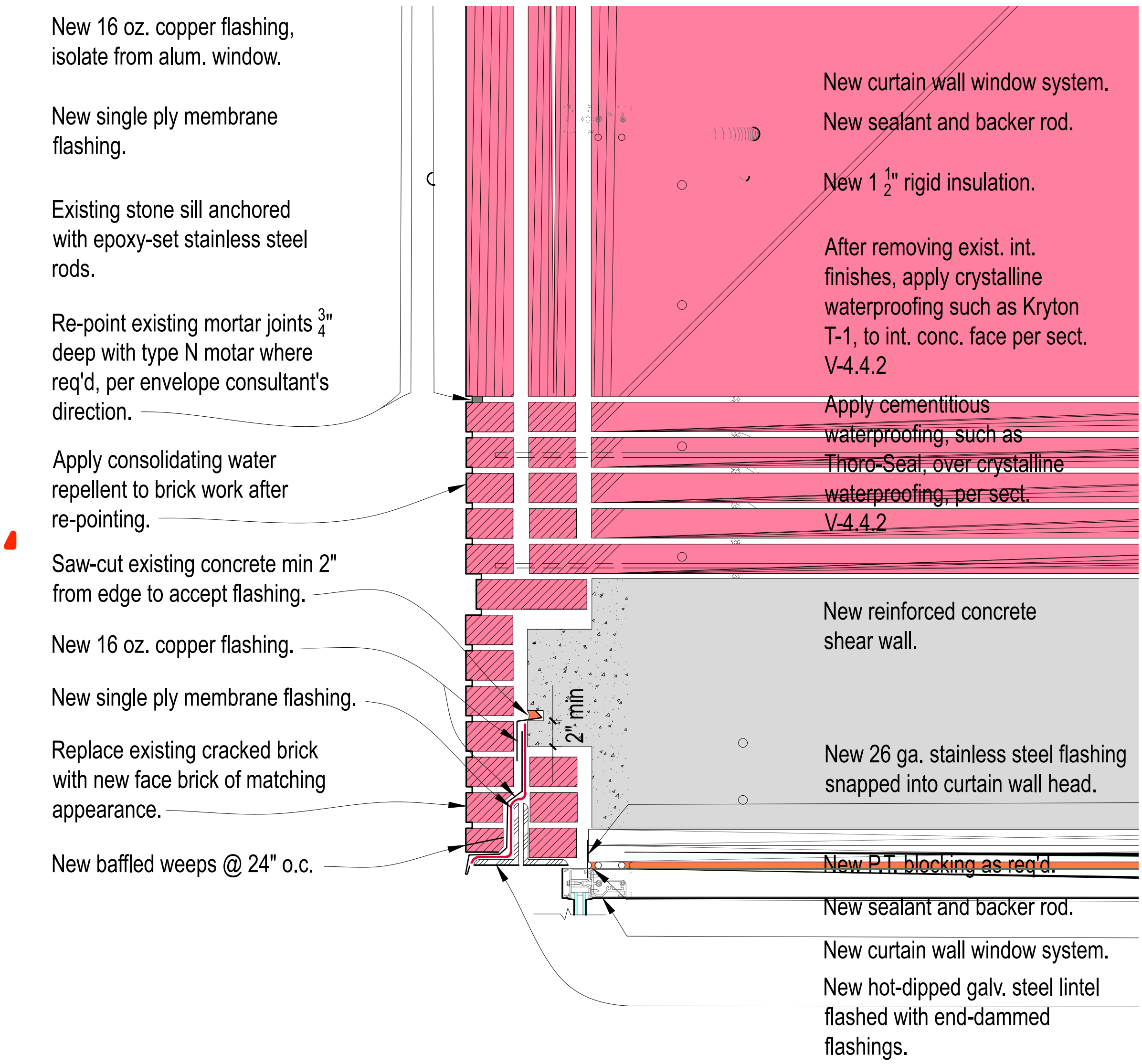


Fig. IV-4.7(1): Window-Head Lintel Replacement and Flashing

5. ENTRY PORTICO

5.0. General

This section pertains to all elements that comprise the entry portico. It is subdivided into 7 subsections, each of which addresses the portico's various components, such as its support base, stairs, columns, etc. Where appropriate, each subsection contains preliminary drawings depicting the described work. For clarity, Figure IV-5.0(1) shows the locations of specific details in the various subsections.

Figure IV-5.0(1): Portico South Elevation

5.1. Support Base for Portico Entry and Stairs

5.1.0 General

This subsection pertains to the portico's support base, including its support structure, granite paving, granite stairs, and granite-clad column plinths.

5.1.1 Basis of Recommendations

The base structure consists of a series of concrete and brick walls protruding southward from the building. Granite paving, about 9" thick, spans across the tops of these closely spaced walls.

My 2010 field examination revealed signs of stress and deflection that had affected this portion of the portico, as well as other parts of the building. Symptoms included differential movement between portions of the entry stairs and the portico floor, as well as cracking of the granite paving and elements above it. The entry stairs and portico floor varied by up to about 3/4" from their original installation elevations, with those portions located below the marble columns typically having been deflected downward. Much of this differential deflection had been corrected by my 2012 visit, by which time the stairs and paving had been re-leveled, though not entirely.

Although a variety of causes could have contributed to these deflection symptoms, they are most consistent with seismically induced deflections dating back to some past earthquake(s). No specific analysis is offered concerning this element's structural adequacy, as the drawings offer limited information. However, review by the structural engineer did not reveal any major concerns with this base.

Based on the conclusion that the observed deflections reflect damage from a past earthquake, it is unlikely that the differential settlement will progress in the absence of subsequent earthquakes. However, future earthquakes may exacerbate the damage already sustained. The deflections that had already taken place may have weakened the elements supporting the portico, and if so, the base could have increased susceptibility to further damage in subsequent earthquakes.

5.1.2 Recommended Corrective Actions

This section provides guidance for corrective work related to the portico base structure, including the stairs, exterior paving, and related elements.

Unfortunately, insufficient available information precludes specific guidance on what repairs are needed, as I was unable to examine the underlying structure which supports the columns, stairs, and portico floor, and thus do not know what damage may exist, if any.

In view of this limitation, my primary recommendation concerning this aspect is that additional evaluation should be performed as part of the next phase of corrective work, which will hopefully allow examination of the concealed portions below the portico entry paving.

5.2. Marble Columns

5.2.0 General

This subsection pertains to the portico's four marble columns and associated capitals.

5.2.1 Basis of Recommendations

Several salient issues pertain to these columns.

First, their structural design is clearly inadequate, as in the three primary marble sections comprising each column are only "aligned" with each other via "cube dowels" within the mortar joints between the adjacent sections, but are not really fastened together in any effective fashion. This makes them potentially susceptible to failure in a significant earthquake.

Second, marble was not the optimal material for these exterior columns, as it is sensitive to acids, and over time, slightly acidic rains will etch and erode the surface, as has already occurred on three sides of each column. Further, marble veins can experience differential erosion, which was also observed. These veins often represent lines of weakness, and are susceptible to seismic cracking. A fair bit of apparently significant, deep cracking along these veins has already occurred, which may have somewhat compromised the structural integrity of these columns.

Such cracks also allow appreciable water infiltration. When combined with freezing temperatures, the expansion of the entrapped ice leads to progressive pushing apart of the stone. These columns are both wet and freezing very frequently, and in view of the building's 80-years of existence, this is likely to have already begun compromising the integrity of these columns.

Another concern relates to the stone capitals, and how the stone beams sit atop these. The issues related to these capitals are outlined in greater detail in section IV-5.2.2 of my 12/31/10 report, and are repeated here only skeletally. In brief, various beam sections bear only on the cantilevered portions of the capitals, which are not mechanically secured to the marble columns, nor are the beams connected to the capitals. This lack of mechanical connections is worrisome, as extremely heavy and brittle elements are stacked atop each other right above the main entry with little holding these together and in place. This poses significant risk in an earthquake.

5.2.2 Recommended Corrective Actions

This section provides guidance for corrective work related to the portico columns.

A significant clarification needs to precede the corrective work description. Namely, due to the serious damage to the portico roof structure and supporting stone cladding, and the extensive scope of this overall project, I strongly recommend complete reconstruction of the roof structure and supporting cladding, as described in other sections. In view of this complete reconstruction approach, it would also be technically best to replace these columns with reinforced concrete columns clad with 2"-3" thick marble, which would produce nearly identical appearance with a more reliable structural system, possibly at comparable or even lower cost. The marble would have some vertical joints, which could be visually minimized. However, it is my understanding that the marble columns came from an Alaskan quarry, and are of historical significance to the state. In respect of this, the described approach keeps the existing columns, but reinforces and restores them to enhance safety and longevity.

To interconnect the column sections, capitals, roof beams, and foundations, the existing columns should be core-drilled full-height and into the foundations, followed by epoxy-grouting steel reinforcing from the foundations to the tops of the new concrete roof beams described in subsection IV-5.4.2. The reinforcing should either be stainless steel or hot-dipped galvanized steel if at all possible, as use of standard steel would doom the columns to eventual corrosive destruction, though this could take a century to manifest. The reinforcing should be equivalent to #18 bars. Alternately, Dywidag Systems International, (DSI), Cintec, and perhaps others, provide special reinforcing bars for this precise application. Figure IV-5.2(1), excerpted from my 12/31/10 report, depicts the general configuration of this reinforcing work.

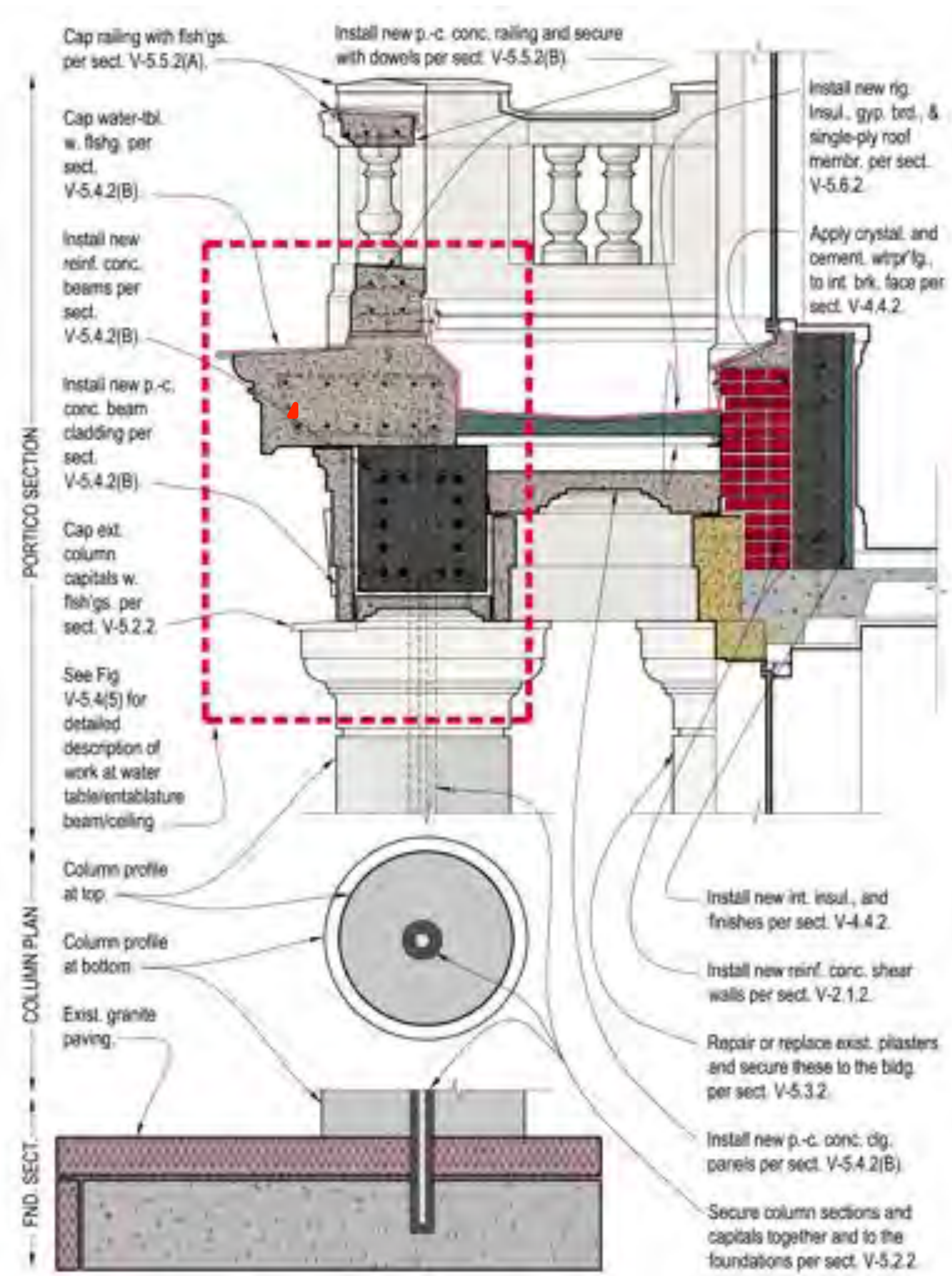


Figure IV-5.2(1): Portico Column Reinforcing

This is excerpted from PL:BECS 12/31/10 report and notes reference that report.

To restore the columns' integrity, the various larger cracks should be injected with appropriate epoxy pastes and/or low-viscosity epoxies. To limit risk of discoloration, materials and methods should first be tested in small, least-visible locations. Epoxy Paste products include Flexi-Fill 530 by Edison Coatings Inc., Sika Sikadur Injection Gel-Standard Set, among others. Low viscosity epoxies include Edison Coatings Flexi-Weld 520, Sika Sikadur 35 Hi-Mod LV, among others.

The somewhat weathered and damaged stone capitals can either be replaced with matching new pre-cast concrete ones, or the existing ones can be cleaned and restored.

If new concrete capitals are used, they should consist of low-shrinkage, integrally colored, pre-cast concrete with stainless steel reinforcing. They should be color-matched to the existing stone. This approach would fully address any weakening and damage which has affected the existing capitals, and would provide sound connections between the columns and the beams.

Alternately, the existing capitals can be patched where needed with a color-matched restoration mortar, such as Cathedral Stone Products Jahn Restoration Mortar. This approach would not fully restore integrity, and would not be appropriate if structurally-significant cracks affect them.

With either approach, the weather-exposed, upward-facing tops of these capitals should be protected by appropriate flashings, which should consist of a non-corroding sheet metal, such as 16 oz. copper, underlain with a membrane flashing, such as Cetco Core-Flash 60, or a similar membrane. Such flashings should fully cap the outer, weather-exposed top surfaces, and turn-up and integrate with the beam faces above.

To restore the eroded, etched, and stained surfaces, the marble columns can be cleaned and polished. The iron oxide staining affecting primarily the westernmost column can be removed with a combination of ProSoCo's T-1087 stain remover mixed with Stand-Off Poultice Powder, applied over the stained areas, then removed by rinsing. Re-polishing of the marble columns can be achieved by machine grinding with ultra-fine grit. However, this is a costly effort, and will require great care to avoid surface undulations from uneven polishing.

5.3. Stone Cladding on Exterior Building Wall

5.3.0 General

This section pertains to the stone cladding along the building's exterior wall, but only where it occurs under the portico roof. While this cladding wraps the entire base of the south façade, it forms the structural support for the N-S stone beams of the portico roof. Consequently, at the portico, this cladding is used in a structural fashion.

5.3.1 Basis of Recommendations

This cladding consists of large, mortar-set stone pilasters, aligned with the four marble columns, as well as smaller pieces. The pilasters support the stone roof beams above. Thus, this cladding is a structural element at the portico.

With regard to basic configuration and securement, this cladding consists of large stone pilasters aligned with the marble columns, along with smaller peripheral pieces. The large pilaster pieces are minimally secured to the embedded concrete columns, and it is probable that corrosion has largely compromised these ties, as a result of water intrusion from above.

Further, widespread and significant cracking affects these stone pilasters at their bases as well as at their tops, and the stone beam-ends atop these pilasters have in places moved away from the building face. Some of these beam-ends are supported by pilaster capitals that have cracked, compromising these beam supports yet further.

Additional cracking affects various other pieces of this stone cladding, including some of the stone lintels above windows.

Water infiltration from above the portico roof has also begun to corrode the steel lintels above some of the windows below the portico roof. Moisture permeates the full height of the cladding, causing corrosion staining on the interior marble tile in the entry vestibule, corroding the bottoms of the entry doorjambs, and compromising the steel ties securing the stone to the building.

In addition to these cladding-related concerns, this wall does not provide much lateral force-resisting capacity, with non-structural brick infill walls between slender concrete columns.

This stone cladding also lacks any flashings or weep provisions to contain and drain water.

In short, the stone-clad wall below the portico roof presents major concerns. The basic wall assembly lacks lateral load-resisting capacity, posing risk of major damage in an earthquake. The stone cladding, which supports the portico roof, is seriously damaged by widespread cracking, dislocation, and corrosion of the inadequate ties which secure it to the concrete columns, posing serious risk of collapse during an earthquake. Embedded steel lintels above some windows have also begun to corrode.

5.3.2 Recommended Corrective Actions

This section provides guidance for corrective work related to the stone-clad wall at the portico.

In brief, the issues needing corrective work include the following:

1. Inadequate lateral load-resisting capacity of the wall assembly.
2. Widespread, and in places structurally significant cracking and displacement of the roof-supporting stone pilasters and adjacent stone elements.
3. Inadequate connection of the stone cladding to the wall structure.
4. Corrosion of steel lintels above windows.
5. Absence of flashings and drainage provisions in the stone cladding at appropriate locations.

The severity of damage to the portico roof-supporting structural cladding, and the extensive scope of the overall project, makes replacement of this cladding the most viable option. Removal of the existing cladding will also make it feasible to address this wall's other issues from the exterior, in contrast to other walls on this building. This will avoid the need to impact the interior of the entry vestibule.

In view of this, the recommended work consists of the following steps, which are depicted in Figure IV-5.3(1):

1. Remove Existing Stone Cladding

   After removing the portico roof structure, the stone cladding in the portico area should be removed.

2. Install Anchors to Secure Existing Interior Terra-Cotta and New Concrete Walls

   Drill new stainless steel helical Helifix or epoxy-set threaded rods through existing brick and concrete into interior terra-cotta walls to help secure these. Place anchors 16" O. C. horizontally and 18" O. C. vertically to produce an anchor density of 2 SF/Anchor. Leave outer ends of anchors protruding about 3" from existing brick or concrete at future concrete walls and 8" at future concrete columns.

3. Install New Steel Reinforcing for Future Concrete Columns and Walls

   For cost-estimating purposes, assume that the thicker piers will be reinforced with two curtains of #5 reinforcing @ 12" O. C. E. W., and that the abutting thinner concrete walls will be reinforced with one curtain of #5 bars @ 12" O. C. E. W. In addition, (2) #5 hooked dowels spaced 48" O. C. should be drilled and epoxy-set into the existing concrete columns.

4. Install New Concrete Columns and Walls

   Cast new concrete piers and walls against the outer faces of the existing walls. For cost-estimating purposes, assume that the piers will be 12" thick and the thinner abutting walls will be 5" thick.

5. Apply Asphaltic Emulsion Coating Over Exterior Faces of New Concrete Columns and Walls

   Spray asphaltic emulsion coating over exterior faces of new concrete walls and columns.

6. Install New Galvanized Steel Ledgers Above Window and Door Heads

   Install new hot-dipped galvanized steel ledgers above window and door openings; secure these to new concrete walls with stainless steel expansion or epoxy-set bolts. For cost estimating purposes, assume that 4" x 4" x 3/8" steel ledgers would be secured with 5/8" ø expansion bolts spaced 24" O. C.

7. Install New Membrane and Sheet Metal Flashings Along Wall Bases and Over All Ledgers

   Install new Cetco Core-Flash 60 membrane flashings over all ledgers and along all wall bases, and cap over these with 16 oz. copper flashings.

8. Install New Anchorage for New Pre-Cast Concrete Cladding

   Install new stainless steel clips as needed to secure new pre-cast concrete cladding. Install 4 anchors per large cladding piece.

9. Install New Thin Vent Mat and Rigid Insulation Against Outer Face of New Concrete Walls

   Install new Enka-Drain 9714 vent-mat, fabric side outward, against new concrete walls, then secure new extruded polystyrene insulation over this. Vary insulation thickness as needed to maintain a 1" free air space separating insulation from new pre-cast concrete cladding.

10. Install New Color and Texture-Matched Pre-Cast Concrete Cladding

Fabricate and install new pre-cast concrete cladding, matching existing stone cladding in specific configuration, color, and texture. Reinforce new cladding with stainless steel, and embed stainless steel anchors.

Install baffled weeps, such as Dur-O-Wal Cell-Vent at bottom of cladding, spaced roughly 24" apart, but located at bottoms of vertical joints.

Seal joints between pieces with closed-cell backer rods, such as Dow Ethafoam, and Dow 790 silicone sealant. Embed color-matched sand into sealant surfaces to mimic mortar joints.

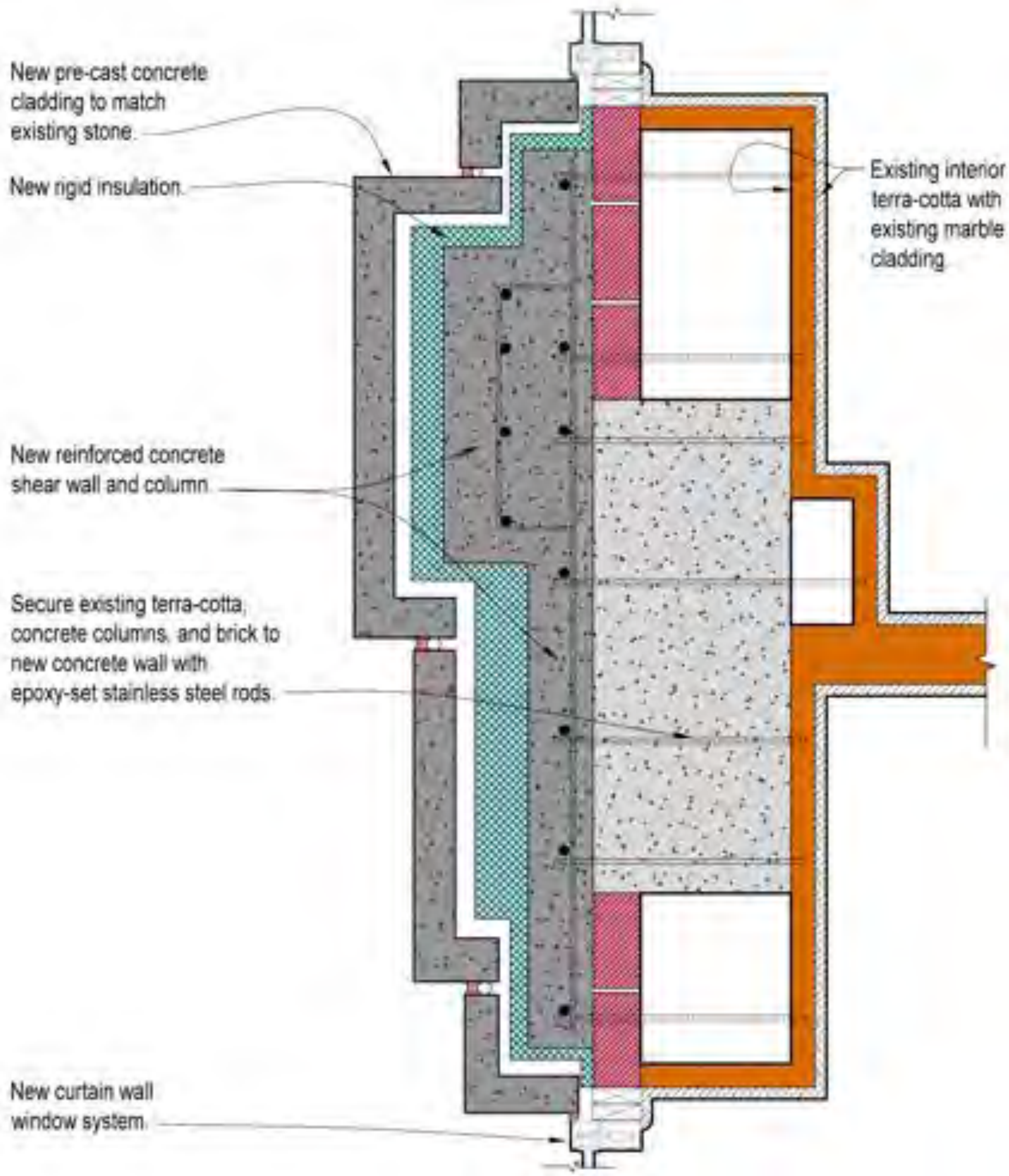


Figure IV-5.3(1): Typical Portico Stone-Clad Wall Corrections

5.4. Portico Roof Structure

5.4.0 General

This section pertains to the elements comprising the portico's roof structure, including the entablature beam, embedded concrete beam above the entablature, stone crossbeams, steel lintels, stone water table, concrete roof slab, stone ceiling panels, and related elements.

5.4.1 Basis of Recommendations

Relevant issues pertain to structural support of the roof structure and its securement to the building, and to the roof structure's condition.

The roof structure consists of four short stone N-S crossbeams and three similar E-W beams which span over the column capitals, and are tied together with a small concrete and steel beam atop them. This concrete beam is tied back to the building's brick walls with very small steel straps spaced roughly 6'-0" apart. Ornate stone ceiling panels are loosely placed across the tops of the stone beams with no connections. A horizontal stone water table sits atop the concrete beam over the marble columns and continues to the building face. These stone water table sections are also not mechanically secured to the portico roof. Short brick cripple walls atop the stone ceiling panels support a 3 ½" thick sloping roof slab.

Many worrisome manifestations affect this roof structure. Many also relate to other components and are outlined elsewhere. Findings concerning the roof structure fall into the two interrelated categories of structural adequacy and water infiltration and resultant damage.

In brief, structural concerns are as follows. First, the large stone N-S crossbeams are supported by the stone pilaster capitals and by the marble columns. However, there are no mechanical connections, other than questionable mortar bond, between these crossbeams and their supporting columns, pilasters, and capitals.

Further, the supporting marble columns display possibly structurally significant cracking, and the three sections comprising these columns are not secured to each other.

Also, the pilasters supporting the crossbeams are appreciably compromised by cracking.

The crossbeams also display relatively severe cracking. Seismic displacement has separated the ends of these beams from the structure at some locations. In places, the observed cracking and displacement have greatly reduced the effective bearing surface supporting these beams.

Structurally-related observations pertaining to the three E-W entablature beam sections spanning across the tops of the marble columns concern the absence of any direct mechanical connections between these beams and the column tops, as well as apparently limited bearing surfaces afforded by the stone column capitals. In brief, no mechanical connections secure these beam sections to the columns or capitals below, although a composite concrete-steel beam above the stone beams at least connects the various sections together. Further, the E-W beam sections bear mostly on the cantilevered portions of the column capitals.

In short, it appears that the roof structure was inadequate to begin with, and has been appreciably compromised by seismic damage.

A further observation concerns both structural and water-infiltration issues. Namely, profuse, long-term infiltration has damaged many elements of this roof structure, including its stone ceiling, beams, and the inadequate steel straps which secure the portico to the structure, which are by now probably compromised by corrosion.

The combination of inadequate securement and significant weather degradation has made the entire portico roof structure susceptible to seismic failure, and even in the absence of earthquakes, the damaged portico poses a hazard to pedestrians below.

5.4.2 Recommended Corrective Actions

This section provides guidance for corrective work related to the portico roof structure.

In brief, the issues needing corrective work include the following:

1. Absence of connections between the roof-supporting stone beams and the building.

2. Structurally significant cracking and displacement of the roof-supporting stone beams.

3. Woefully inadequate connection of the overall portico roof to the building structure, which has been further compromised by corrosion due to long-term water infiltration.

4. Absence of mechanical securement of the heavy stone ceiling panels, combined with possibly significant degradation of these panels due to long-term water infiltration.

5. Absence of any structural elements, such as cross-bracing, to resist lateral loads.

6. Absence of connections between the stone beams and the supporting columns.

7. Absence of flashings at appropriate locations in the roof structure to preclude water infiltration and associated damage to structural elements.

In short, as with most other elements of this building, the portico roof structure suffers from twin, interrelated issues of structural inadequacy and water infiltration and associated damage. My 12/31/10 report outlined two possible approaches for addressing these issues, which could be described as “restoration” and “replacement”. However, these were based on the assumption that only the portico would be retrofitted. In view of the much-expanded corrective scope of the current project, the “restoration” approach is not appropriate, and only the “replacement” approach is described here. Figures IV-5.4(1 & 2) depict this general approach.

This approach would begin with the installation of scaffolding and safety measures as needed.

Following this, the entire roof structure above the stone column capitals would be removed, leaving only the marble columns and their capitals in place. The capitals could also be replaced if found too damaged, which however does not appear to be the case.

Shafts would be drilled through the marble columns to secure the sections together, per subsection IV-5.2.2. The new column reinforcing would extend through each column into its concrete foundation.

If it were deemed preferable to replace the stone capitals, new ones of color-matched, low-shrinkage concrete with stainless steel reinforcing, would be secured atop the columns with additional stainless steel dowels per the structural engineer’s design, in addition to the central reinforcing bars. It would also be helpful to incorporate crystalline waterproofing, such as Kryton KIM admixture, into the concrete mix to limit water intrusion into these capitals. However, it appears feasible to keep the existing stone capitals, in which case, these should also be drilled-through to allow enhanced securement to the marble columns with epoxy-set dowels.

Reinforced concrete beams would be cast-in-place atop the column capitals. These beams should be roughly 8”-10” narrower than the existing stone beams to allow for new pre-cast concrete cladding panels to match the existing appearance. The beam tops should extend to the bottom of the water table.

New ceiling panels, matching the appearance of the existing ones, but composed of color-matched, reinforced, pre-cast concrete, would be installed between the concrete beams. These panels could be substantially thinner and lighter than the existing ones, and could be supported on steel angles secured to the sides of the beams and to the building’s brick wall.

The roof drain lines would be extended to relocate the roof drains along the centerline of the roof.

The existing stone water table pieces could be reinstalled atop the concrete beams. However, since these have to be removed to allow the other work to be installed, it would probably be less costly to fabricate and install new, color-matched water table pieces of pre-cast concrete, reinforced with stainless steel. These new pieces would be secured to the new concrete beams with epoxy-set dowels or via another method. If pre-cast concrete water table pieces are used, incorporation of crystalline waterproofing, such as Kryton KIM admixture, is advisable.

Steel decking would be secured atop the new concrete beams, or on continuous steel angles. If needed for added rigidity, a concrete slab could be cast atop this. If not needed, a gypsum roofing board, such as Georgia-Pacific Dens-Deck, could be installed over the decking. Tapered rigid insulation would be installed atop the slab or gypsum roof board to provide roof slope toward the centrally located roof drains.

The top surfaces of the water table would be capped with a double-layer flashing system, consisting of a membrane, capped with a non-corroding sheet metal flashing. Both layers would cap the exposed surface, and extend under the railing base and turn-up the inner edges. Both layers would also form up-turned sleeves around the dowels used to secure the stone railing base. The membrane flashing should ideally be compatible with the roofing membrane. Materials such as TPO roofing, Cetco Core-Flash, Sarnafil PVC roofing membrane, or similar membranes, would be well suited to this application, depending on the roof membrane used. The sheet metal flashing could consist of 16 oz. copper. Due to the large exposed surfaces, the outer edges of the sheet metal flashings would be secured with continuous cleats, and would also need to be fairly heavy-gage, such as 16-20 oz. copper or 24-22 gage stainless steel.

New double-layer flashings, as generally described for the water table pieces and in subsection IV-5.2.2, would be installed to cap over the outer, weather-exposed tops of the column capitals. These flashings would extend roughly 3” up the concrete beam faces and be inserted into saw-cut or integrally cast reglet reveals. These flashings would integrate with similar flashings running along the full length of the outer concrete beams.

The new concrete beams would be clad with pre-cast concrete panels to match the existing appearance. These panels could be secured to the concrete beams with epoxy-set stainless steel dowels or clips.

The work described in this subsection would produce a vastly enhanced portico roof structure, which would be essentially indistinguishable from the existing portico’s appearance.

That is a general summary of the work recommended within this approach. As it is nearly impossible to describe such work adequately in text alone, Figures IV-5.4(1 & 2) depict this approach. Figure IV-5.4(4) is a section through the portico roof between the columns, while Figure IV-5.4(2) shows the portico’s outer edge, including the entablature beam and water table, in greater detail. Please note that both drawings are excerpted from my 12/31/10 report, and the notes reference sections of that report, rather than this one.

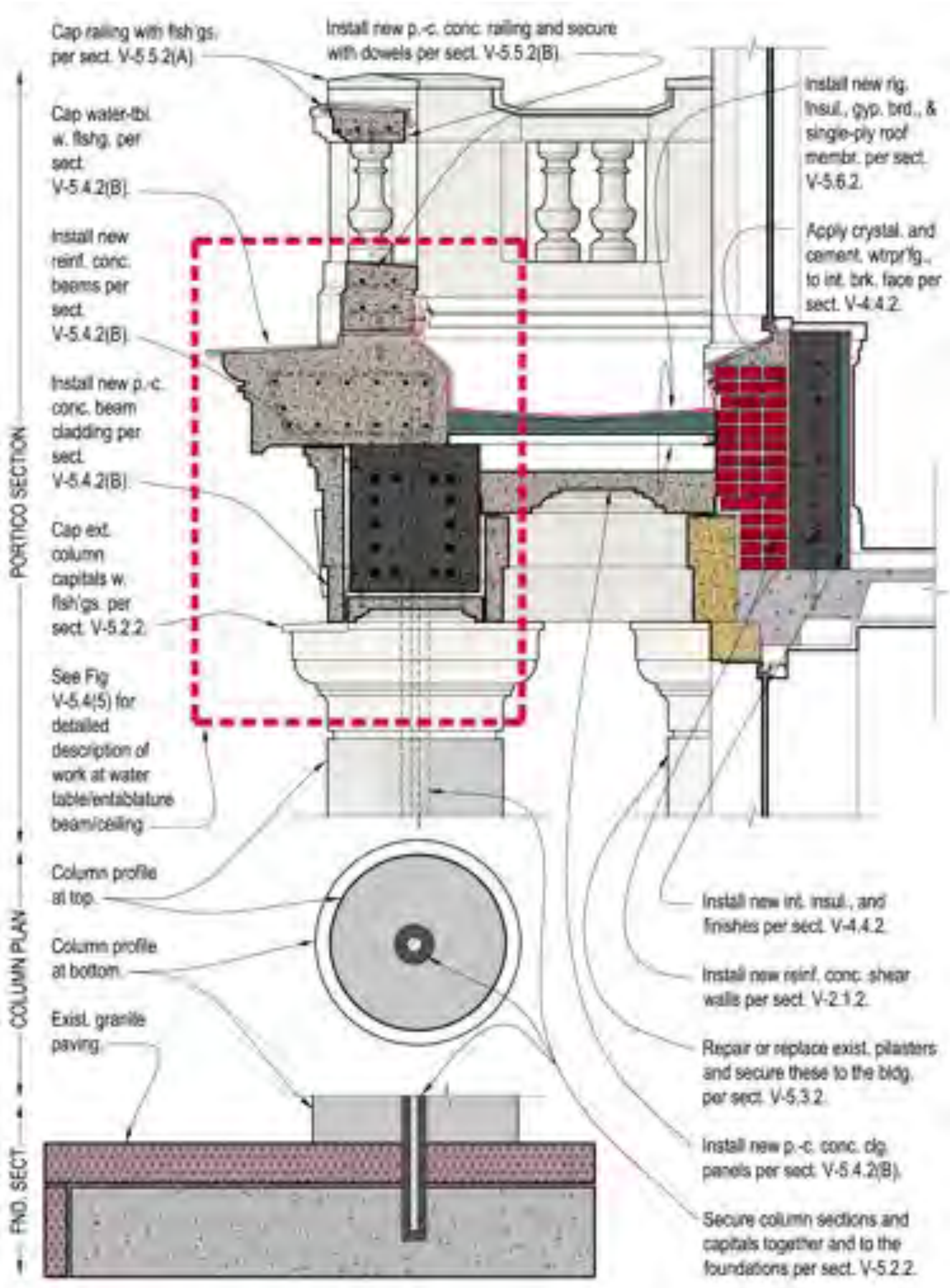


Figure IV-5.4(1): Recommended Portico Roof Structure Reconstruction

Note that this drawing is excerpted from the 12/31/10 report, and its notes reference sections of that report. Further, this drawing does not entirely align with the work described here. For example, the stone cladding shown at the building face should be changed to pre-cast concrete cladding.

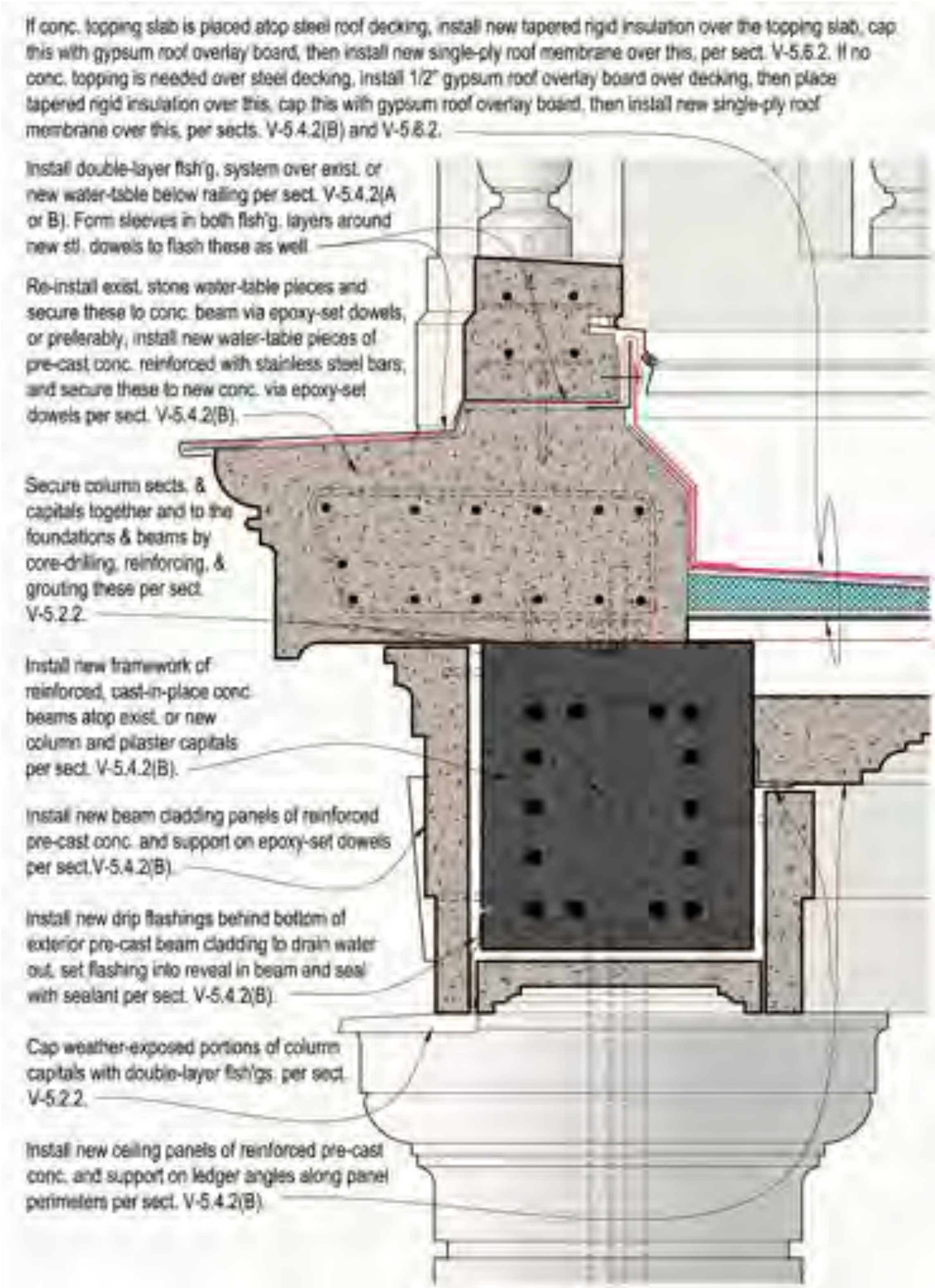


Figure IV-5.4(2): Recommended Portico Roof Structure Reconstruction

Note that this drawing is excerpted from the 12/31/10 report, and its notes reference sections of that report. Further, this drawing does not entirely align with the work described here.

5.5. Stone Railing

5.5.0 General

This section pertains to the stone elements comprising the portico roof's perimeter railing.

5.5.1 Basis of Recommendations

The railing consists of a horizontal base atop the water table, with railing "posts" above each column and at the building face. Spaced balusters sit atop the base, and are capped with a horizontal rail cap.

Primary observations pertain to structural, general design, and condition considerations. With regard to structural issues, none of the stone railing pieces are mechanically connected to any other elements, and rely entirely on mortar bond to stay in place. Mortar bond has been largely compromised, and I could move a 200-pound piece directly above the stairs, illustrating the obvious seismic risk to pedestrians below.

With respect to general design, this railing exposes all of its stone elements directly to the weather, with no flashing caps to limit infiltration into the stone, and no through-wall flashings to limit water intrusion into the water table and roof structure below. Consequently, elements below are exposed to infiltration and damage, which are amply evident.

The railing has also been partly compromised by seismic damage and weathering, displaying cracks, displacement, surface erosion, some spalling, and loss of mortar bond and integrity.

5.5.2 Recommended Corrective Actions

In brief, the issues needing corrective work include the following:

1. Absence of mechanical connections between the various railing elements.
2. Absence of mechanical connections between the railing elements and adjacent structure.
3. Greatly deteriorated, and in places completely destroyed, mortar bond.
4. Seismic damage, such as cracking, affecting a number of the railing pieces.
5. Variable surface erosion, spalling, and other weather-degradation of the railing pieces.

Two approaches, "restoration" or "replacement", were outlined in my 12/31/10 report. However, that report was based on a work scope to include only the portico. In view of the much larger scope of this project, only the technically preferable "replacement" approach is described here.

This work would begin by complete disassembly of the railing and supporting roof structure. After reconstruction and flashing of the roof-structure, per subsection IV-5.4.2, new pre-cast concrete pieces, reinforced with stainless steel and with an integral crystalline waterproofing, such as Kryton KIM admixture, matching the existing stone in configuration, color, and texture, would be epoxy-set over stainless steel dowels drilled and epoxy-set into the water table pieces.

A minimum of two dowels would be installed for each railing base piece. The double-layer flashing system atop the water table would be formed with up-turned sleeves to flash these penetrations, as described in subsection IV-5.4.2. The bottoms of the railing base pieces would be drilled with holes to receive these flashed dowels, and epoxy would be injected into these holes. The railing base pieces would then be set over a mortar bed.

The railing pieces against the building would be installed similarly. However, to limit infiltration, a double-layer flashing, consisting of a membrane capped with a copper flashing, would first be extended up the building wall to essentially isolate the vertical railing piece from the building face. Two stainless steel dowels per railing piece would be epoxy-set into the wall. The railing pieces would then be epoxy-set over these dowels.

The large railing "post" pieces would be installed over the base pieces in the same fashion, with a minimum of two stainless steel dowels epoxy-set into the base piece for each "post" piece, and the "post" pieces would be set in mortar over this base piece, with epoxy injected into receiving holes for the dowels. These "posts" would be rebuilt using this same method, with all pieces secured to underlying ones with two epoxy-set dowels in addition to a mortar bed.

The baluster pieces would then be installed in the same fashion, but with only one dowel per baluster piece.

The tops of these baluster pieces would then be drilled to receive epoxy-set dowels, one per baluster piece.

The railing cap would then be epoxy-set over the baluster pieces in the same fashion.

To limit weather degradation, the tops of the railing "posts" and the caps would be capped with double-layer flashings consisting of a membrane capped with a copper flashing. At least the outer edges of these cap flashings should be secured with continuous cleats. The inner edges may be secured with exposed fasteners, or with concealed cleats. The membrane flashings can consist of TPO or PVC roofing membrane, Cetco Core-Flash, or a self-adhered flashing, such as Grace Vycor Ultra. Due to the large exposed surfaces, the metal flashings would need to be fairly heavy-gage, such as 16 oz. copper.

Please refer to Figures IV-5.4(1 & 2) of the previous section for drawings depicting this work.

5.6. Portico Roof, Drains, and Associated Flashings

5.6.0 General

This section pertains to the portico's roof membrane, drains, and associated flashings.

5.6.1 Basis of Recommendations

The roof slopes toward the building, as well as east and west from a central ridge toward two drains, which are recessed within deep sumps. No overflow drains are provided. The absence of overflow drains is counter to typical code requirements, and can lead to overloading, though this risk is quite limited in this case.

No through-wall flashings occur along the roof's junctures with the building face and with the outer portico edge. This is a major flaw, which allows any water within the masonry walls above this roof to migrate down into the roof below. Major degradation affects the entire underlying roof structure due largely to this problem. Through-wall flashings should have been incorporated along this roof-wall juncture to capture and drain this water back out onto the portico roof. Retrofitting of such flashings is inherently complicated by the header coursing in the brick, which may allow water to bypass even retrofitted flashings.

Three window sills occur very close to the roof surface. Their copper sill flashings penetrate under the aluminum windows, whose sills are sealed to these flashings, with no weep provisions. The proximity of the roof to the sills increases leak risk, particularly during wet snow periods.

The sealing of the copper sill flashings to the aluminum windows, and the absence of weep provisions, exacerbates leak risk, as drainage is precluded from under the window sills. The close proximity of copper flashings to aluminum windows may also pose added risk of corrosion.

The built-up roof is badly degraded, and is nearly completely delaminated from underlying copper along the building face. Consequently, this roof is ineffective.

5.6.2 Recommended Corrective Actions

This section provides guidance for corrective work at the roof, drains, and associated flashings.

In brief, the issues needing corrective work include the following:

1. Absence of through-wall flashings along roof-wall junctures.

2. Inadequate vertical clearance between roof top and adjacent window sills.

3. Inward roof slope toward the building, which increases snow build-up along the building face.

4. Absence of emergency overflow drains.

5. Degraded, failed roof membrane.

Recommendations to address these problems are depicted in Figures IV-5.6(2-4), and include:

1. Retrofit Through-Wall Flashings Along Roof-Wall Junctures

   This work is described in greater detail in subsection IV-3.6.2, and is not repeated here. In brief, this involves retrofitting of through-wall flashings into the brick walls abutting the roof to intercept and drain water migrating downward within the masonry. See Figure IV-5.6(4).

2. Retrofit Through-Wall Flashings Below Perimeter Railings

   This work is described in greater detail in subsection IV-5.4.2, and is not repeated here. In brief, this involves retrofitting of through-wall flashings atop the perimeter water table, to intercept and drain water migrating downward within the masonry railing and to protect the water table. See Figures IV-5.6(2 & 3).

3. Increase Vertical Clearance to Window Sills

   This goal should be achieved by lowering the roof structure as recommended in subsection IV-5.4.2. If needed, the vertical clearance can be further increased by raising the window sills. If this becomes necessary, I recommend that these window sills be raised per subsection V-5.7.2 of my 12/31/10 report.

4. Modify the Roof Slope to Eliminate Slope Toward Building

   Per subsection IV-5.4.2, the new roof slope would be provided with tapered rigid insulation. I recommend that this tapered rigid insulation slope from the north and south edges toward the roof centerline, at a slope of 3/8" per foot.

   A shallow cricket should also be installed along this centerline to drain water toward the drains, which would occur near the roof's east and west edges. Due to the portico roof's long, narrow configuration, this cricket would need to be quite shallow, near 1/16" per foot. This is less than ideal, but would work. A preferable approach would be to add a drain at the center of the roof, which would allow two roof crickets, each sloping at roughly 1/8" per foot. This would require adding a new drain line within the ceiling cavity. This appears feasible.

5. Add Overflow Drains

   I recommend that one new overflow drain be added adjacent to each primary drain. These overflow drains should be essentially identical to the roof drains, but with a 2" tall stand-pipe screwed into the drain body to force the water level to rise 2" before these would begin draining water. Such overflow drains are readily available from J. R. Smith, Wade, Josam, and others.

   The primary and overflow drains should be recessed within sumps, created by reducing the thickness of rigid insulation by at least 3/4" relative to adjacent roof surfaces. The sumps should be roughly 18"-24" wide and 36"-42" long. Figure IV-5.6(1) shows a possible overflow drain type.

Raised stand-pipe within overflow drain precludes drainage until water level rises to pipe top.

Figure IV-5.6(1): Generally Appropriate Overflow Drain Type

6. Replace Roof Membrane Assembly

The corrective work described in subsection IV-5.4.2 for the roof structure would result in the placement of tapered rigid insulation atop the portico roof to provide slope toward the portico centerline, away from the building, along with a shallow cricket along the centerline to direct water flow toward the roof drains.

Over this sloped insulation, install gypsum overlay roof board, such as ½" thick Georgia Pacific Dens-Deck. This can be screwed to the steel decking or it can be adhered to the insulation. Alternately, one could also loose-lay a non-woven polypropylene fabric, such as Sarnafil NWP, over the rigid insulation, in which case the membrane would need to be mechanically fastened.

A new single-ply roof membrane should then be installed over this. This could be an EPDM membrane, as had been used elsewhere on this building, a TPO membrane, or a good quality PVC membrane, such as Sarnafil. Although there is some logic to using an EPDM membrane, to maintain consistency with other parts of the building, my tendency is to recommend either TPO or PVC. The basis for this recommendation is that TPO and PVC membrane laps are heat-welded, which is in my opinion a preferable, more-durable method than gluing, as is done with EPDM. Further, both TPO and PVC membranes have compatible membrane-coated sheet metal flashings, which appear to have some uses on this project. Suitable TPO membranes are made by Carlisle, Firestone, and others. Sarnafil, Cetco, and others make suitable PVC membranes. Regardless of specific membrane type, the membrane should be 60 mils thick.

The membrane can be secured with mechanical fasteners or by adhesion. If adhesion is used, the underlayment would need to be a board type, such as Georgia Pacific Dens-Deck, rather than a loose-laid fabric.

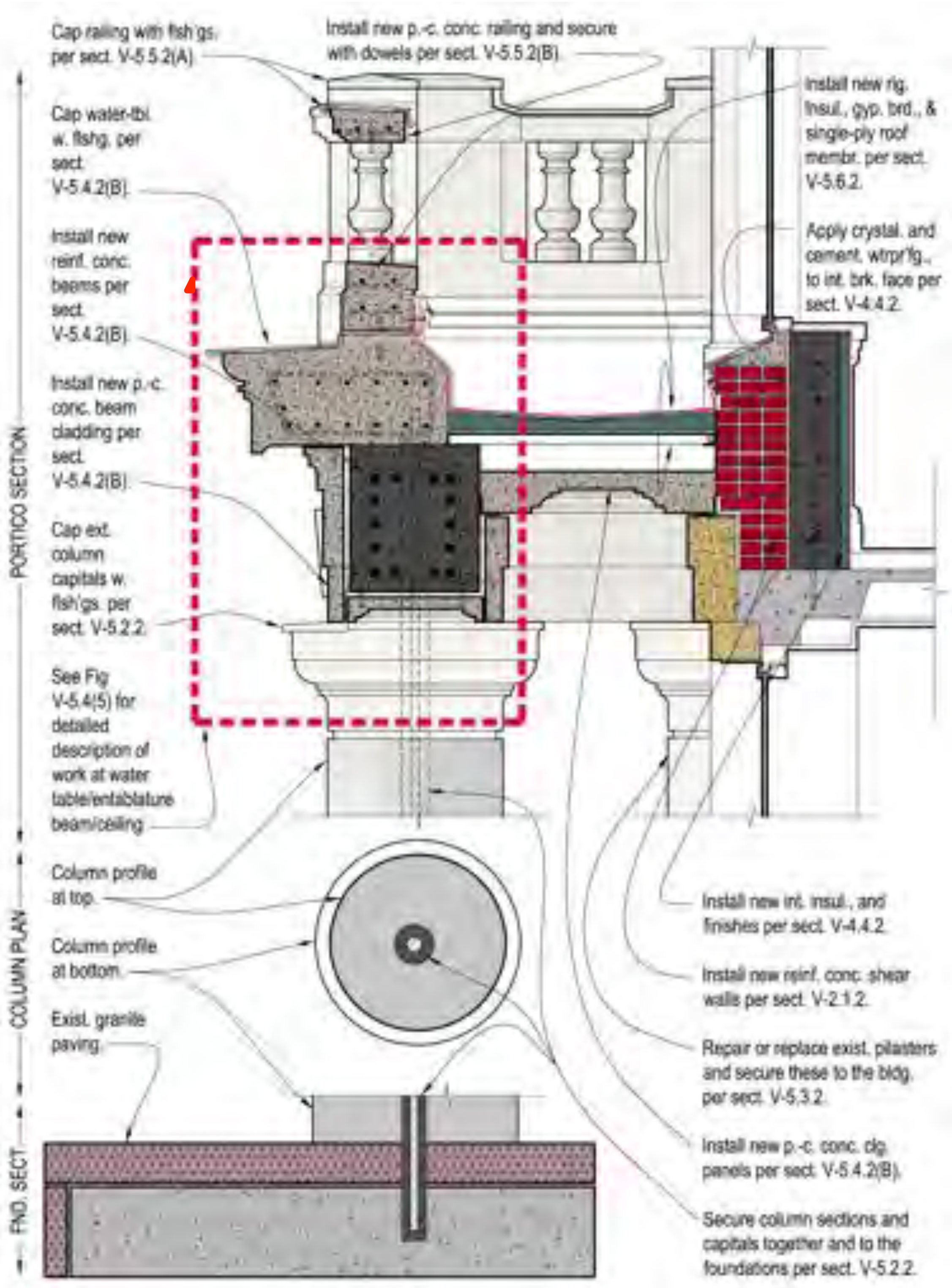


Figure IV-5.6(2): Recommended Portico Roof Modifications

Note that this drawing is excerpted from the 12/31/10 report, and its notes reference sections of that report. Further, this drawing does not entirely align with the work described here. For example, the stone cladding shown at the building face should be changed to pre-cast concrete cladding.

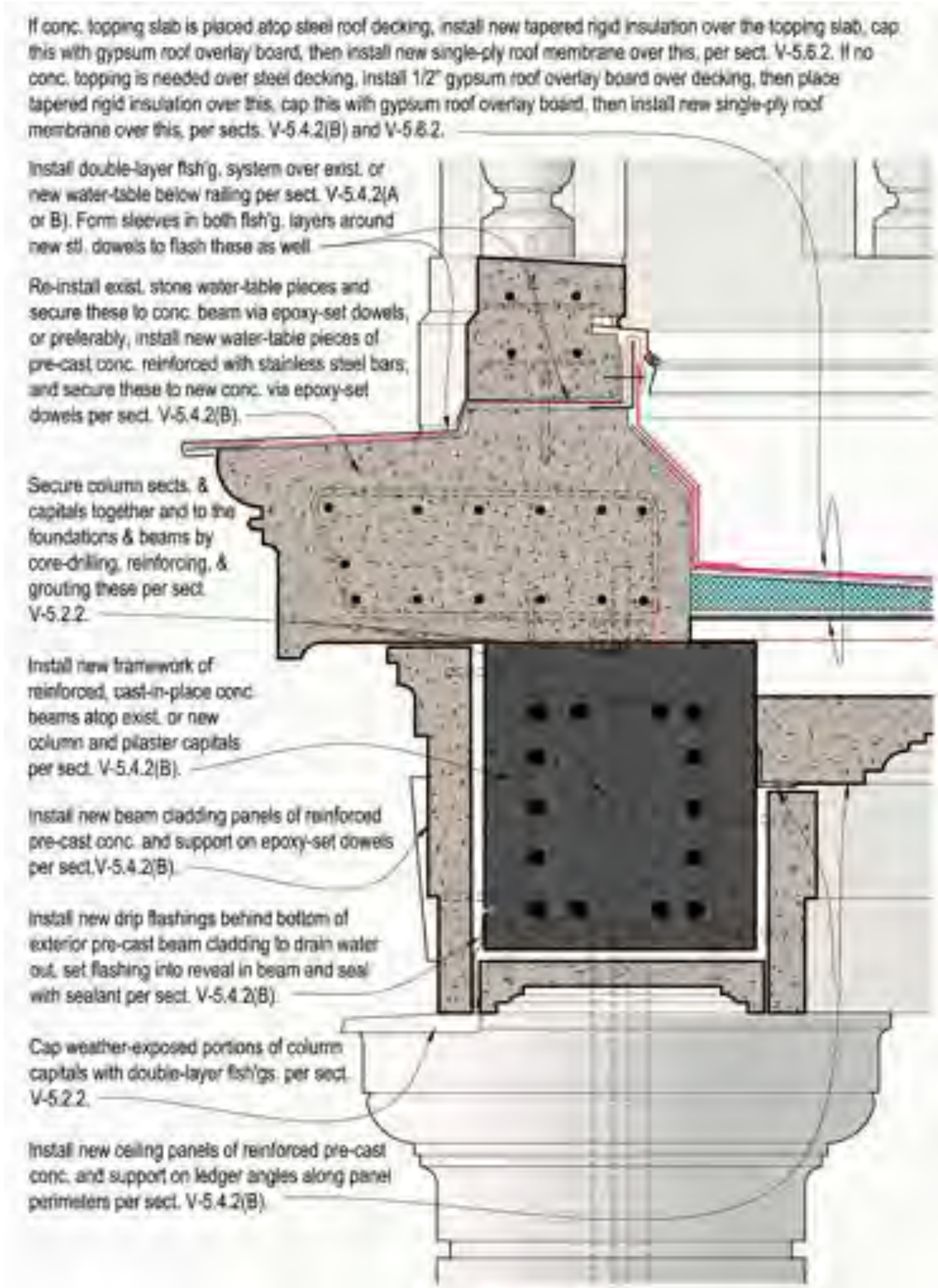


Figure IV-5.6(3): Recommended Portico Roof Modifications

Note that this drawing is excerpted from the 12/31/10 report, and its notes reference sections of that report. Further, this drawing does not entirely align with the work described here.

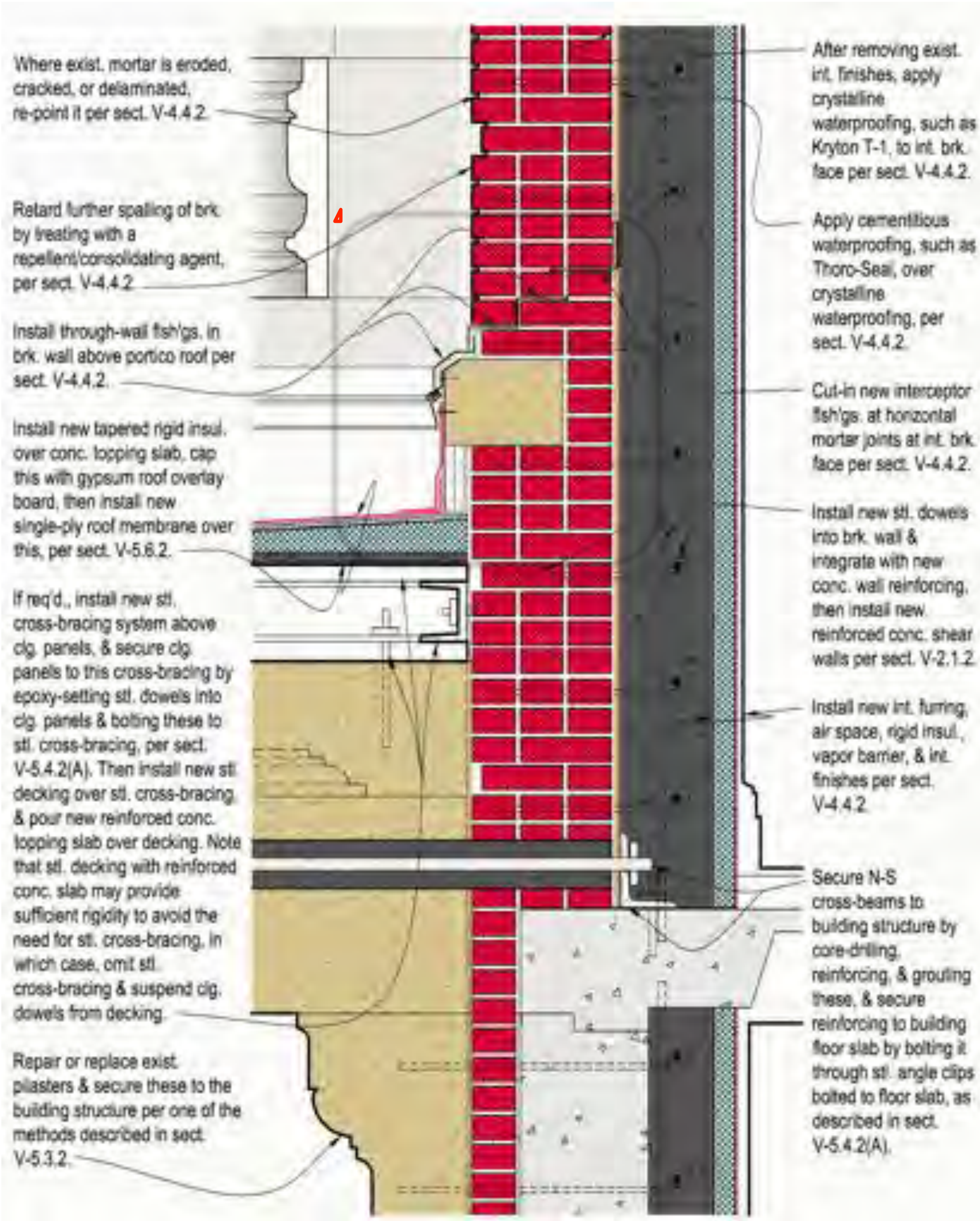


Figure IV-5.6(4): Retrofitting of Through-Wall Flashings Above Portico Roof

Note that this drawing is excerpted from the 12/31/10 report, and its notes reference sections of that report. Further, this drawing does not entirely align with the work described here. For example, the stone portico elements shown should be changed to pre-cast concrete.

6. INTERIOR ARCHITECTURAL ELEMENTS

6.0. General

This section addresses issues related to the interior architectural elements including the wall, floor and ceiling construction and finishes.

6.1. Interior Faces of Exterior Building Walls

6.1.0 General

This subsection pertains to the interior architectural elements affected by the seismic retrofit and exterior wall renovation, which primarily impacts interior faces of exterior walls.

6.1.1 Basis of Recommendations

The needed structural work will require removal of interior finishes of exterior walls, which will impact the interior wall finishes and abutting floors and ceilings. This will necessitate restoration of the interior finishes.

6.1.2 Recommended Corrective Actions

The interior faces of the exterior walls will be replaced with gypsum board assemblies as illustrated elsewhere in Part IV. The finishes for the walls will match the existing finishes.

Where removal of adjacent walls, flooring and ceiling finishes is required as part of the seismic retrofit and exterior renovation they will be reinstalled, patched or repaired to match the existing finishes.

The retrofit and renovation will affect adjacent walls, flooring and ceilings to a limited extent; patching and repair of these areas will be included.

7. MECHANICAL SYSTEMS

7.0. General

This section addresses issues related to the building's mechanical systems, including heating, ventilation, plumbing and fire sprinkler systems.

7.1. General Mechanical Systems

7.1.0 General

This subsection pertains to the mechanical systems affected by the work on the exterior walls and mechanical systems affected by other seismic retrofit work.

7.1.1 Basis of Recommendations

The needed structural work will require removal of interior finishes of exterior walls, which will also expose and impact embedded mechanical systems. This will necessitate some mechanical work, as well as allowing upgrades to mechanical systems where these become exposed.

7.1.2 Recommended Corrective Actions

The heating system piping and registers will be replaced per a 1998 design. The system will be converted to hot water from the existing steam heating. The new system will allow for a change from the cast iron radiators that heat with steam to hot water convectors. The 2010 boilers will be converted to hot water when all the devices are replaced.

The ventilation, plumbing and fire sprinkler systems will be unaffected by the retrofit and renovation and will remain, except where there may be a conflict in the crawl space or in interior walls that are retrofitted.

The plumbing systems will not be affected except in minor instances where plumbing is located on an exterior walls or an interior wall that is required to be retrofitted.

The fire sprinkler system will not be affected by the new work.

8. ELECTRICAL SYSTEMS

8.0. General

This section addresses issues related to the building's electrical systems, including power, lighting and communication systems.

8.1. General Electrical Systems

8.1.0 General

This subsection pertains to the electrical systems affected by the work on the exterior walls and by other seismic retrofit work.

8.1.1 Basis of Recommendations

The exterior walls generally contain very little in terms of electrical systems as most of the power, lighting and communication distribution is through the ceiling space and interior walls.

8.1.2 Recommended Corrective Actions

Where the interior portion of the exterior walls is replaced, allowing electrical devices to be added, this will be done in coordination with the use of the interior spaces.

9. ESTIMATED CONSTRUCTION COST OF OPTION 1

9.0. General

This section presents the summarized construction cost estimate for Option 1, which is based on the full cost estimate prepared by HMS, Inc., with subsequent modifications by Jensen Yorba Lott Inc., and PL:BECS.

As this Option 1 attempts to retain as much of the existing masonry as possible, it possesses an inherently higher degree of uncertainty concerning possible costs. For example, while Options 2 and 3 would replace 100% of all existing brick cladding, Option 1 may need to replace 5%, or perhaps 10%, of the existing brick at different locations, and this uncertainty precludes a high degree of precision. For this reason, the assumed contingency for phases 2 and 3 of the Option 1 approach is 33% higher than the corresponding contingencies for Options 2 and 3.

It should further be noted that this preliminary evaluation obviously did not attempt to design in detail every aspect of each option, but rather attempted to define each approach to a schematic level, sufficient to allow only very rough construction cost estimates to be prepared. The primary intent of this evaluation was to help determine the relative construction costs of each of the three approaches. For this reason, the costs of each phase of each option are rounded to the nearest $ 100,000, and realistically, even this level of precision implies a higher degree of certainty than can be justified by the schematically-defined work scope descriptions. The reader is encouraged to round these estimates to the nearest $ 1,000,000.

Finally, it should also be clarified that these estimates relate only to the projected construction costs, and that in any case and with any approach, appreciable additional costs should be anticipated to cover temporary relocation of occupants, design and engineering fees, possible soil studies, and other, non-construction related expenses. These additional non-construction costs apply to all options.

9.1. Estimated Construction Cost of Option 1

The estimate is broken down by the 3 construction phases

Construction Phase 1 is scheduled for May to December 2013. This phase will consist of seismic reinforcing and renovation of the Portico along with repairs to the ground floor structure in the crawl space and providing drainage in the crawl space.

Construction Phase 2 is schedule for May to December 2014. This phase will consist of seismic reinforcing of the south wall from the foundations to the roof along with restoration of the exterior south wall assembly. The work will also include replacing the steam heating system on the south wall with a hydronic heating system.

Construction Phase 3 is schedule for May to December 2015 and May to December 2016. This phase will consist of seismic reinforcing of the east, west and north walls from the foundations to the roof along with restoration of the remaining exterior wall assemblies. The work will also include replacing the steam heating system in the remainder of the building with a hydronic heating system.

The cost of the three construction phases follows:

Construction Phase 1: $ 1.1 million.

Construction Phase 2: $ 4.8 million.

Construction Phase 3: $ 12.2 million.

Total: $ 18.1 million.

V. OPTION 2: NEW MASONRY VENEER OVER CONCRETE WALLS

1. GENERAL INTRODUCTION

1.0. General

This section addresses issues of general applicability to Part V: Option 2: New Brick Veneer Over Concrete Walls.

Subsection 1.1 includes General Format Notes, which describe the general formatting.

Subsection 1.2, Introductory Notes, outlines some general considerations.

Finally, subsection 1.3, Overall Description of the Option 2 Reconstruction Approach, provides a summary description of the overall approach.

1.1. General Format Notes

Please see section IV-1.1, which applies fully to this Option 2 approach as well.

1.2. Introductory Notes

Please see section IV-1.2, which applies fully to this Option 2 approach as well.

1.3. Overall Description of the Option 2 Reconstruction Approach

The recommendations are divided into numerous subsections, each of which addresses a particular element. While this approach provides specific information in a highly retrievable format, the resulting fragmentation may obscure the overall context from which the individual recommendations spring. This section attempts to provide the more holistic explanation.

This approach recognizes the inherent limitations of the Option 1 approach, and rather than recommending that millions of dollars be spent to still produce a flawed building whose masonry continued to erode away, it is technically much preferable to reconstruct its outer cladding system as a masonry veneer. As it appeared plausible that such an approach may not actually be much more costly than Option 1, PL:BECS recommended that this Option 2 approach be evaluated for cost as a first step.

This approach also strives to retain the existing appearance to the greatest reasonable degree. However, it does so by removing essentially all exterior masonry, beefing up the existing concrete structure, casting new concrete back-up exterior walls, and re-cladding the building with a masonry veneer resembling the existing building, as originally designed.

Please note that this “Reconstruction” Option 2 represents the technically ideal approach, and is most recommended by PL:BECS if its costs prove anywhere near comparable. This approach provides concrete back-up walls with a new brick veneer, which is likely to perform best in Juneau’s climate. It accommodates substantial added insulation to the exterior walls, and should appreciably enhance energy efficiency, yielding cost savings and greater comfort. Compared to the restoration approach of Option 1, it also results in a somewhat lighter structure with a thinner exterior wall profile, yielding added interior space, which is roughly in the range of 2,000 SF for the entire building. As it produces a lighter structure, it also reduces possible seismic forces, and yields a seismically safer building. Properly executed, this approach should yield a low-maintenance cladding with a likely lifespan exceeding 120 years even in Juneau’s masonry-challenging climate.

In short, this Option 2 is the technically optimal approach, which is well worth paying extra for. As the cost estimate for this option is only about 21% higher than for Option 1, PL:BECS considers Option 2 as the only truly viable approach, as it yields at least 3 times the likely projected cladding lifespan, lower energy and maintenance costs, larger interior space, among many other benefits, for only a small cost premium.

In general, the work consists of the removal of all existing interior finishes, the hollow clay tile, and all exterior masonry to expose the existing concrete building frame.

New concrete walls, piers, and headers are cast between existing columns per subsection IV-2.1.1. The exterior concrete faces are then coated with an asphaltic damp-proofing.

Galvanized steel ledgers are secured along all floor lines where needed to support the new brick veneer along each floor level.

The ledgers and the existing protruding concrete lugs are flashed with a double-layer flashing assembly of self-adhered flashing membrane capped with 26-gage stainless steel flashings where fully concealed, and with 16 oz. copper flashings where these become exposed to view.

New stainless steel veneer anchor channels, such as Dur-O-Wal DA904, are fastened to the concrete walls, spaced 16" apart horizontally, and vertically continuous.

A thin vent mat, such as Enka-Drain 9714, is placed against the damp-proofed concrete walls, with 4" thick extruded polystyrene insulation, such as Dow Board, placed against this. Stainless steel veneer anchors, such as Dur-O-Wal DA931, are clipped into the channel slots, spaced 18" apart vertically. A thicker drain mat, such as Enka-Drain 9120, is placed over the insulation, fabric-side facing outward, to limit mortar clogging.

A new masonry veneer, consisting of ASTM C-216 face brick, Grade SW, at brick areas, or pre-cast concrete cladding at stone locations, is installed over this, largely to match the existing appearance, but with greatly reduced offsets and with concave-tooled mortar joints to limit water infiltration into the masonry. Horizontal 9-gage stainless steel wire seismic joint reinforcing is embedded within the horizontal joints spaced 18" apart vertically.

The new masonry should be cleaned and sealed with a penetrating water repellent, such as ProSoCo Weather-Seal Siloxane.

Figure V-1.3(1) shows a typical exterior detail where it occurs over the existing embedded concrete columns.

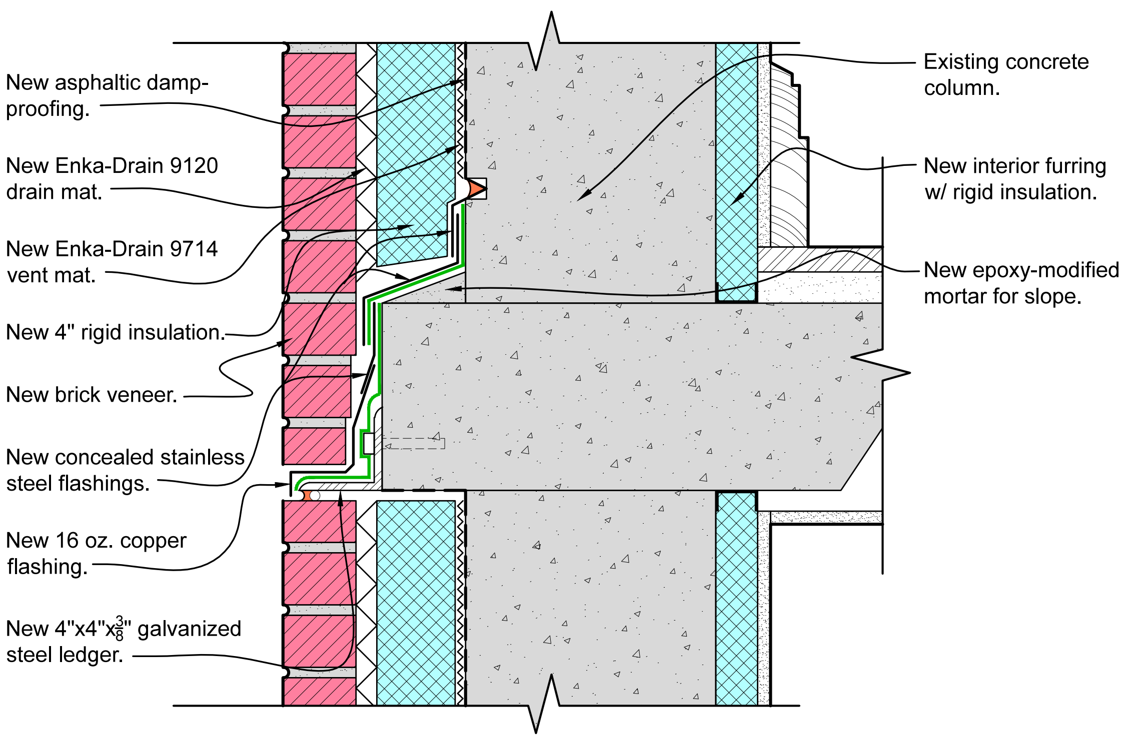


Figure V-1.3(1): Typical New Brick Veneer Over Existing Concrete Column

2. STRUCTURE

2.0. General

This section addresses larger-scale structural considerations. It is divided into nine subsections, each of which pertains to a specific sub-element of the structure.

2.1. Basic Structure of Building

2.1.0 General

This subsection pertains to the building's basic structural design in the most general terms.

2.1.1 Basis of Recommendations

Please see subsection IV-2.1.1, which applies fully to this Option 2 approach as well.

2.1.2 Recommended Corrective Actions

With regard to the building's overall structural frame, recommended corrective work is similar to Option 1, and is not described here in detail. Please refer to subsection IV-2.1.2 and the floor plans therein for the work description.

In brief, this work consists of adding concrete shear walls, headers, piers, and grade beams with thicknesses and reinforcing remaining mostly same as for Option 1.

The structural work in this approach diverges from the corresponding Option 1 work in two aspects.

First, where 4" thick walls are shown in Option 1, those should be changed to 5" thick walls. Further, while Option 1 places those walls against the inner face of the existing brickwork, these would be stand-alone cast-in-place concrete walls. Steel reinforcing in all walls remains the same as shown for Option 1.

The second modification is that in contrast to the Option 1 approach, Option 2 replaces the exterior walls of the north stair tower with a brick veneer placed over 8" thick concrete walls reinforced with #5 bars spaced 12" O, C. each way.

2.2. Foundations

2.2.0 General

This subsection pertains to the building's basic foundation system in general terms. See also section V-3.1: Lowest-Level Crawl Space for related information.

2.2.1 Basis of Recommendations

Please see subsection IV-2.2.1, which applies fully to this Option 2 approach as well.

2.2.2 Recommended Corrective Actions

Please see subsection IV-2.2.2, which applies fully to this Option 2 approach as well. In brief, this work consists of adding new grade beams per subsection IV-2.2.2 and Figure IV-2.2(1).

In addition, the existing foundations should be restored as outlined in subsection IV-2.2.2. An experimental, corrosion-retarding treatment is also suggested in that subsection.

2.3. Lowest-Level Concrete Floor Framing

2.3.0 General

This subsection pertains to the concrete-framed floor directly above the crawl space.

2.3.1 Basis of Recommendations

Please see subsection IV-2.3.1, which applies fully to this Option 2 approach as well.

2.3.2 Recommended Corrective Actions

Please see subsection IV-2.3.2, which applies fully to this Option 2 approach as well. In brief, this work consists of repairing existing damaged concrete floor joists per subsection IV-2.3.2.

2.4. Level 1 Concrete Floor Slab

2.4.0 General

This subsection pertains to the raised, concrete-framed floor directly above the ground floor level.

2.4.1 Basis of Recommendations

Please see subsection IV-2.4.1, which applies fully to this Option 2 approach as well.

2.4.2 Recommended Corrective Actions

Please see subsection IV-2.4.2, which applies fully to this Option 2 approach as well. In brief, this work consists of injecting existing floor slabs with epoxy per subsection IV-2.4.2.

2.5. Brick Chimney

2.5.0 General

This subsection pertains to the relatively tall brick chimney above the main roof, near the inside corner where the west wing joins the main portion of the building.

2.5.1 Basis of Recommendations

Please see subsection IV-2.5.1, which applies fully to this Option 2 approach as well.

2.5.2 Recommended Corrective Actions

Please see subsection IV-2.5.2, which applies fully to this Option 2 approach as well. In brief, this work consists of shortening the chimney, casting a new concrete cap atop it, installing new flashings, and over-cladding the chimney with a new metal cladding, per subsection IV-2.5.2.

2.6. Securement of Large Masonry Cladding Elements

2.6.0 General

This subsection pertains to the securement of the various masonry elements to the primary structure. These are also discussed in subsequent subsections in greater detail.

2.6.1 Basis of Recommendations

Please see subsection IV-2.6.1, which applies fully to this Option 2 approach as well.

2.6.2 Recommended Corrective Actions

In general, this Option 2 approach involves construction of a new masonry veneer, so essentially all exterior elements will be new, and will be anchored as outlined in other subsections of this part. No specific work is included in this subsection for this Option 2 approach.

2.7. Interior Hollow Clay Tile Walls

2.7.0 General

This subsection pertains to the interior partition walls comprised of hollow clay tile.

2.7.1 Basis of Recommendations

Please see subsection IV-2.7.1, which applies fully to this Option 2 approach as well.

2.7.2 Recommended Corrective Actions

Please see subsection IV-2.7.2, which applies fully to this Option 2 approach as well. In brief, this work consists of bracing the existing walls per subsection IV-2.7.2 and Figures IV-2.7(1-7).

2.8. Large Mechanical Equipment

2.8.0 General

This subsection pertains to various pieces of large mechanical equipment, such as the boiler.

2.8.1 Basis of Recommendations

Please see subsection IV-2.8.1, which applies fully to this Option 2 approach as well.

2.8.2 Recommended Corrective Actions

Please see subsection IV-2.8.2, which applies fully to this Option 2 approach as well. In brief, this work consists of bolting floor-mounted equipment to the floor slabs and bracing large suspended plumbing lines, per subsection IV-2.8.2.

3. PRIMARY EXTERIOR ENCLOSURE ASSEMBLIES & ELEMENTS

3.0. General

This section of the report addresses issues related to the building's primary exterior elements, such as wall assemblies, ground-level floor slabs, windows, roofs, and similar major components. It is divided into 14 subsections, each of which pertains to a specific primary element. Where appropriate, each subsection contains preliminary drawings depicting the described work. In addition, Figures V-3.0(1-7) show the exterior elevations which reference the locations of specific details in the various subsections.

Fig. V-3.0(1): South Elevation

Fig. V-3.0(2): West Elevation

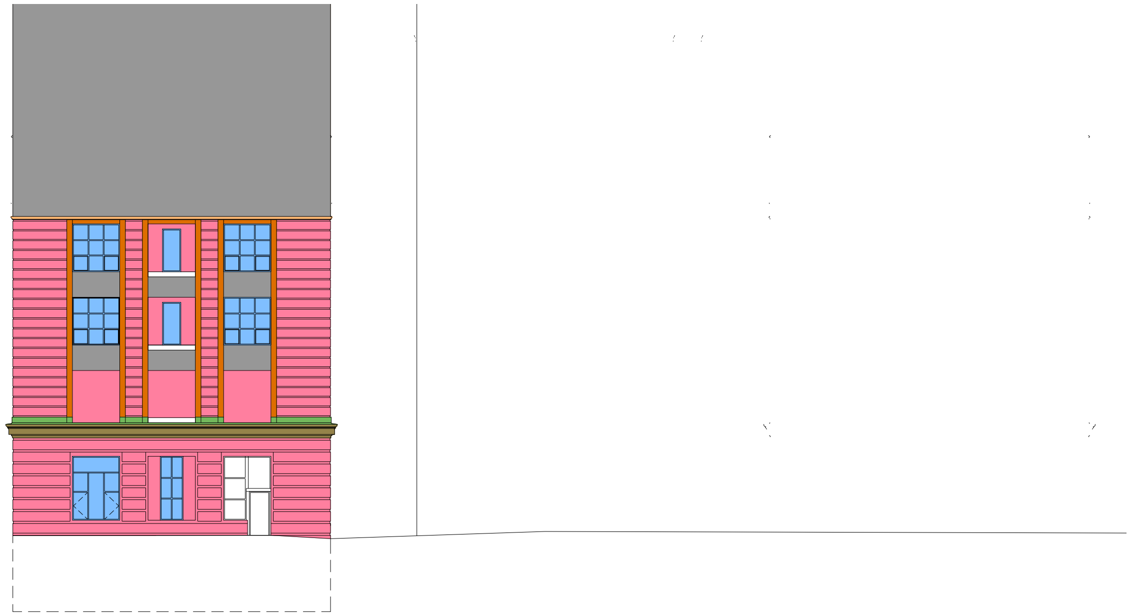


Fig. V-3.0(3): North Elevation

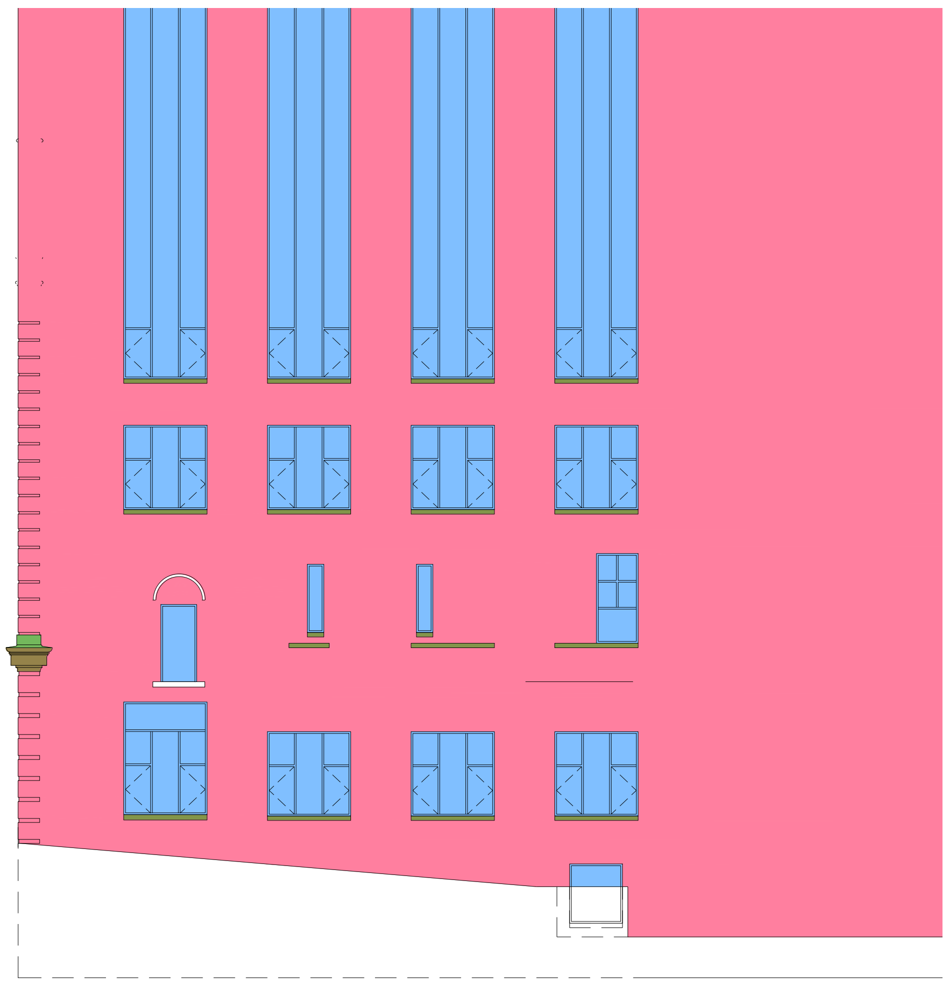


Fig. V-3.0(4): North Courtyard: West-Facing Wall

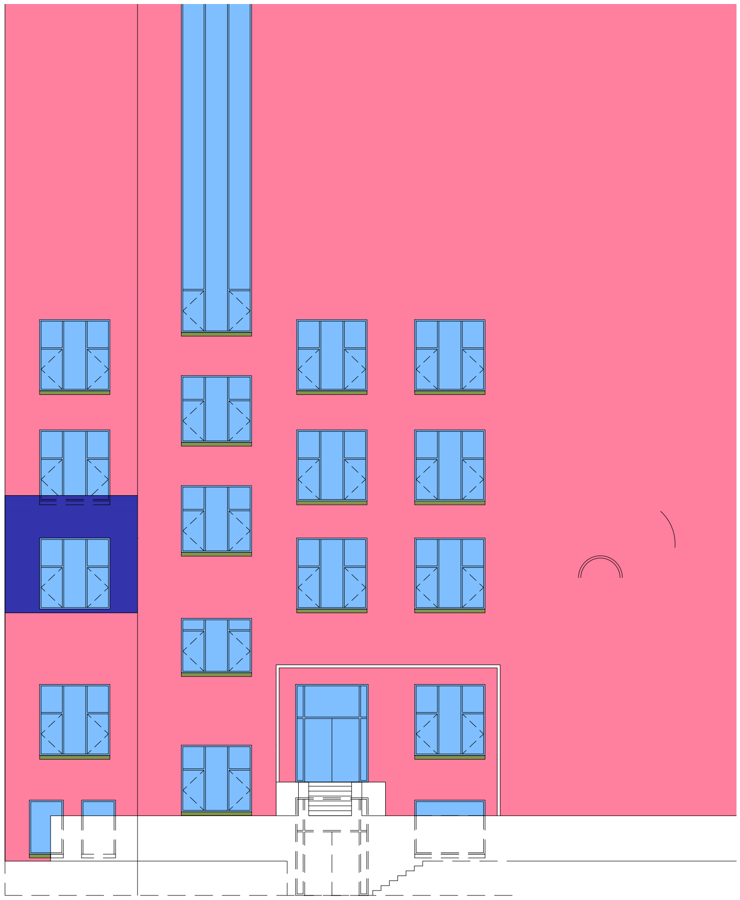


Fig. V-3.0(5): North Courtyard: North-Facing Wall

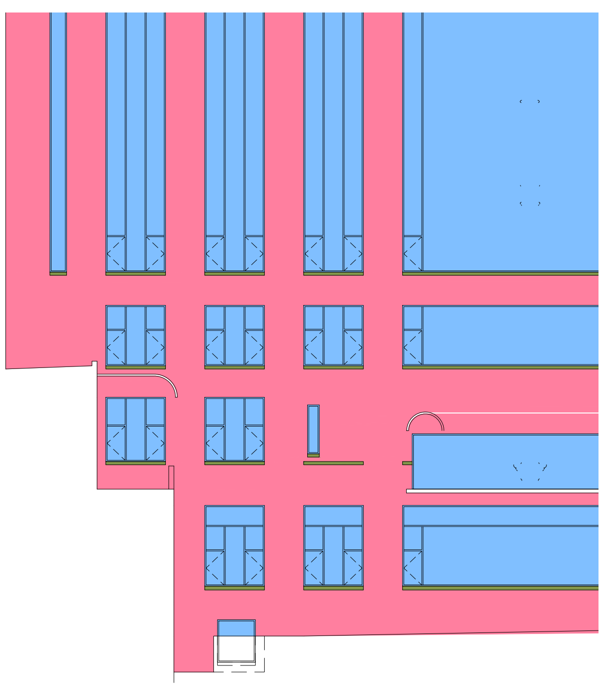


Fig. V-3.0(6): North Courtyard: East-Facing Wall

Fig. V-3.0(7): East Elevation

3.1. Lowest-Level Crawl Space

3.1.0 General

This subsection pertains to the crawl space located under the building's main body and under the southerly portions of both north-extending wings, in general terms.

3.1.1 Basis of Recommendations

Please see subsection IV-3.1.1, which applies fully to this Option 2 approach as well.

3.1.2 Recommended Corrective Actions

Please see subsection IV-3.1.2, which applies fully to this Option 2 approach as well. Please see also subsections IV-2.2 and IV-2.3 for related corrective measures not described here.

In brief, this work consists of the installation of a gravity-fed drainage system and soil-capping with a cross-laminated vapor-barrier, as well as optional capping with a 2" thick, fiber-reinforced shot-crete "slab" to help protect the vapor barrier and further reduce humidity. See Figures IV-3.1(1 & 2).

3.2. Concrete On-Grade Floor Slabs

3.2.0 General

This subsection pertains to the on-grade concrete floor slabs that occur at the base of the northern portions of both north-extending wings.

3.2.1 Basis of Recommendations

Please see subsection IV-3.2.1, which applies fully to this Option 2 approach as well.

3.2.2 Recommended Corrective Actions

Please see subsection IV-3.2.2, which applies fully to this Option 2 approach as well.

In brief, this work consists of injecting all accessible floor cracks and the perimeter of the shop slab where it joins the basement walls with epoxy.

3.3. Concrete Sub-Grade Walls

3.3.0 General

This subsection pertains to several sub-grade concrete walls that occur primarily at the base of the northern portions of both north-extending wings.

3.3.1 Basis of Recommendations

Please see subsection IV-3.3.1, which applies fully to this Option 2 approach as well.

3.3.2 Recommended Corrective Actions

Please see subsection IV-3.3.2, which applies fully to this Option 2 approach as well.

In brief, no work related to these walls is recommended at the west wing's sub-grade walls.

At the east wing's sub-grade walls, this work consists of selective removal of interior finishes at locations of apparent leakage, injecting all wall cracks and cold joints with epoxy, treatment of rock pockets and similar flaws with crystalline waterproofing, and replacement of finishes.

3.4. Stone-Clad Exterior Wall Base

3.4.0 General

This subsection pertains to the lowest-level stone base along the south elevation, which extends from grade up to a projecting stone water table, which separates it from the cladding above.

3.4.1 Basis of Recommendations

Please see subsection IV-3.4.1, which applies fully to this Option 2 approach as well.

3.4.2 Recommended Corrective Actions

Please see subsection IV-3.4.2, which applies fully to this Option 2 approach, except that the stone cladding above the base will be removed in Option 2, rather than stabilized as in Option 1.

In brief, the work consists of replacement of this band with a pre-cast concrete cladding per subsection IV-3.4.2. As subsection IV-3.4.2 described the stabilization of the stone cladding above this, rather than its removal, Figure V-3.4(1) depicts the Option 2 work.

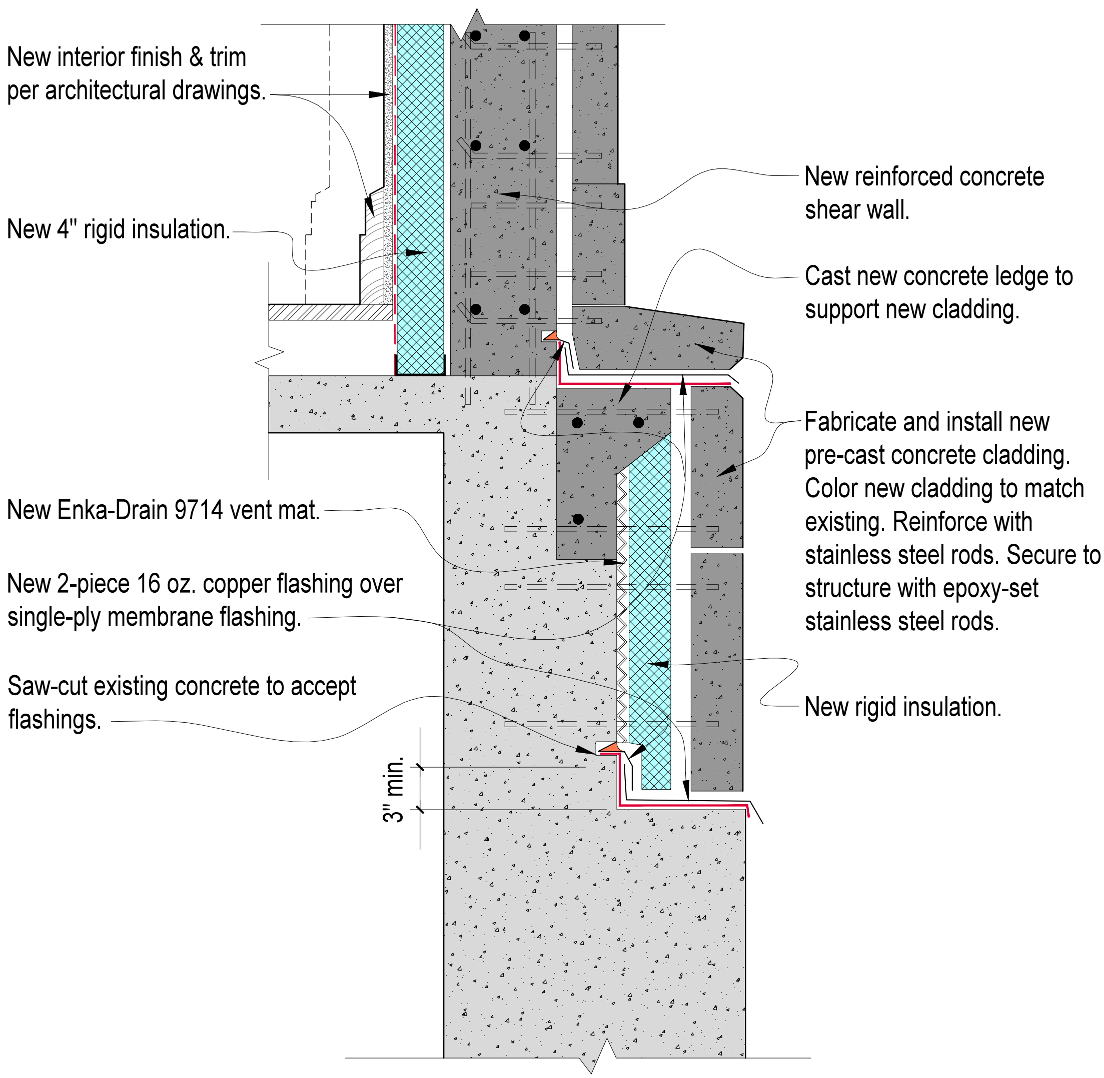


Fig. V-3.4(1): Stone Base Replacement with Replacement of Cladding Above

3.5. Stone-Clad Exterior Walls Along Bottom 2 Levels

3.5.0 General

This subsection pertains to the stone-clad walls directly above the stone base addressed in subsection V-3.4. While this cladding is contiguous with and similar to the cladding below the portico, the portico-related cladding is addressed separately in subsection V-5.3.

3.5.1 Basis of Recommendations

Please see subsection IV-3.5.1, which applies fully to this Option 2 approach as well.

3.5.2 Recommended Corrective Actions

In general terms, the Cladding Replacement approach is depicted in Figure IV-3.5(1), and the verbal description of the work follows the drawing.

The new cladding should be integrally colored and textured to match the existing stone cladding's appearance, and it should be reinforced only with stainless steel reinforcing to avoid future corrosion spalling. For cost estimating purposes, the cladding should be assumed 4" thick.

It can be anchored to the structure with epoxy-set stainless steel threaded rods, or with stainless steel embedded clips, etc.

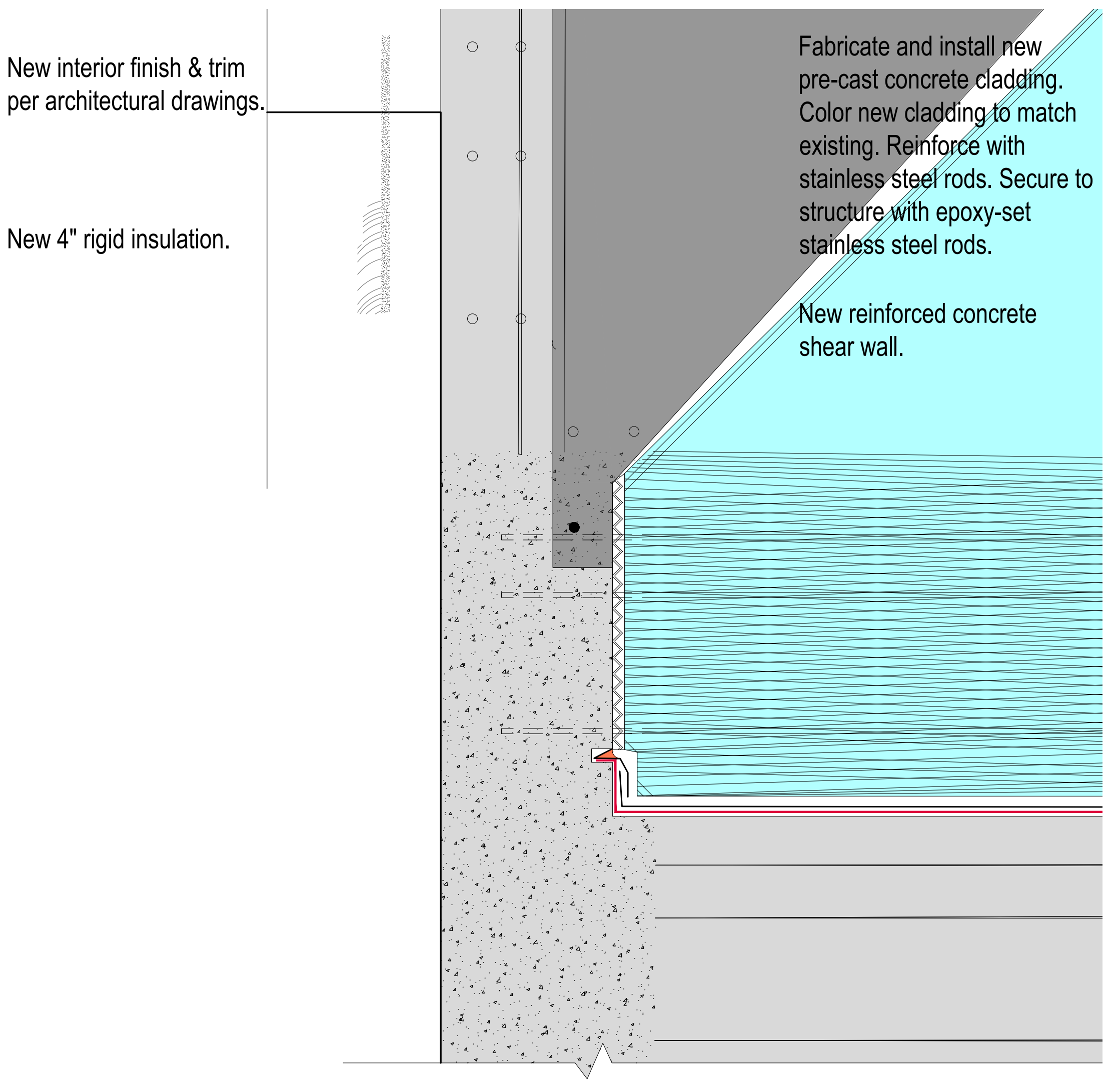


Fig. V-3.5(1): Stone Cladding Replacement

The Cladding Replacement approach consists of the following general steps:

1. Remove Interior Hollow Clay Tile and Install New Interior Concrete Walls and Pins at Level 2

   This work is described in greater detail in subsection IV-2.1.2. It can be executed at level 2 near the top of this cladding as part of helping secure the stone water table, which is partly supported by this cladding.

2. Remove Existing Stone Cladding Above Stone Base

   As the stone cladding helps support the stone water table above it, the water table would first need to be supported, as generally described in subsection IV-4.1.2. Once this element has been secured, the stone base can be removed.

3. Replace Stone Base Below Stone Cladding

   This work is described in greater detail in subsection IV-3.4.2.

4. Remove Int. Hollow Clay Tile and Install New Int. Concrete Walls and Pins at Levels 0 & 1.

   This work is described in greater detail in subsection IV-2.1.2. It can be executed after the outer cladding is removed to allow new anchor pins to be installed.

5. Install Anchors For New Cladding

   Please see item 4 in subsection IV-3.4.2 for a more detailed explanation of possible anchor methods. For cost-estimating purposes only, the “rod method” is described.

   Regardless of specific anchoring method, all anchors should be type 304 stainless steel to avoid corrosion. The number of anchors per cladding piece will vary, depending on size of cladding piece being secured, but no fewer than two anchors should secure each piece, and at least one anchor should occur for every 2 SF.

   Where the cladding occurs over brick walls, the rods would be drilled through the brick from the interior. Stainless steel, ½” ø rods would be drilled through the brick to penetrate the cladding to within 1 ½” of its outer surface.

   However, most of the cladding occurs over existing concrete columns, which would be drilled from the exterior. The existing concrete walls should be drilled at least 4” deep, and roughly ½” ø stainless steel threaded rods should be epoxy-set into these holes. The rods should be of sufficient length to penetrate into the cladding to within 1 ½” of its outer surface.

6. Install New Color-Matched Pre-Cast Concrete Cladding

   Drill or cast-in oversized holes into back side of pre-cast concrete cladding pieces to accept stainless steel rods. Drill holes to within about 1 ½” of outer cladding surface. Inject holes with epoxy, set over anchor rods, and brace in place till epoxy sets.

3.6. Brick-Clad Exterior Public Façade Walls, All Levels

3.6.0 General

This subsection pertains to the brick-clad exterior walls at all floor levels and at all of the building's "public" façades, including its south, east, and west elevations, and the north elevations of its east and west wings. Some elements integral to these walls are also addressed here.

3.6.1 Basis of Recommendations

Please see subsection IV-3.6.1, which applies fully to this Option 2 approach as well.

3.6.2 Recommended Corrective Actions

In general, the work consists of the removal of all existing interior finishes, the hollow clay tile, and all exterior masonry to expose the existing concrete building frame.

New concrete walls, piers, and headers are cast between existing concrete columns per subsection IV-2.1.1. The exterior concrete faces are then coated with an asphaltic damp-proofing.

Galvanized ledgers are secured at all floor lines to support the new brick veneer at each level.

The ledgers and the existing protruding concrete lugs are flashed with a double-layer flashing assembly of self-adhered flashing membrane capped with 26-gage stainless steel flashings where fully concealed, and with 16 oz. copper flashings where these become exposed to view.

New stainless steel veneer anchor channels, such as Dur-O-Wal DA904, are fastened to the concrete walls, spaced 16" apart horizontally, and vertically continuous.

A thin vent mat, such as Enka-Drain 9714, is placed against the damp-proofed concrete walls, and 4" thick extruded polystyrene insulation, such as Dow Board, is placed against this. Stainless steel veneer anchors, such as Dur-O-Wal DA931, are clipped into the channel slots, spaced 18" apart vertically. A thicker drain mat, such as Enka-Drain 9120, is placed over the insulation, fabric-side facing outward, to limit mortar clogging.

A new brick veneer is installed over this, largely to match the existing appearance, but with greatly reduced offsets and with concave-tooled mortar joints to limit water infiltration into the masonry. Horizontal 9-gage stainless steel wire seismic joint reinforcing is embedded within the horizontal joints spaced 18" apart vertically.

The new masonry should be cleaned and sealed with a penetrating water repellent, such as ProSoCo Weather-Seal Siloxane.

With respect to configuration, the existing brickwork contains many recessed header courses and deeply raked joints, which are recessed about 1" from the brick face. These help create visual interest, but are technically counter-productive, as both greatly increase exposed surface area and moisture absorption, contributing to the severe degradation affecting the existing brickwork. It would be best to avoid these aspects, while still maintaining the desired visual appearance. I believe that the recessed header coursing can be successfully mimicked by using somewhat darker brick in the header courses. Similarly, I believe the recessed mortar joints can also be simulated by using integral pigments to darken the mortar. Therefore, my specific recommendations are to use a darker brick type along the header courses, and recess these only about ¼" and to use a darker mortar and recess it also only ¼", with a concave-tooled profile.

Concerning specific brick types to use, given Juneau's masonry-challenging climate, in addition to complying with ASTM C-216, Grade SW requirements, I also recommend that, to the greatest feasible extent, technically optimal brick types should comply with having maximum 5-hour boiling absorption of 13%, maximum 24-hour cold absorption of 9%, Initial Rate of Absorption (IRA) values near the range of 10-20 grams/30 sq. in./minute, and minimum compressive strength of 4,000 psi. These requirements may limit color selection to the darker range.

Figure V-3.6(1) shows a typical exterior detail where it occurs over the existing embedded concrete columns. Figure V-3.6(2) shows a comparable detail at the windows. Figures V-3.6(3 & 4) show a very similar in-progress stone veneer assembly.

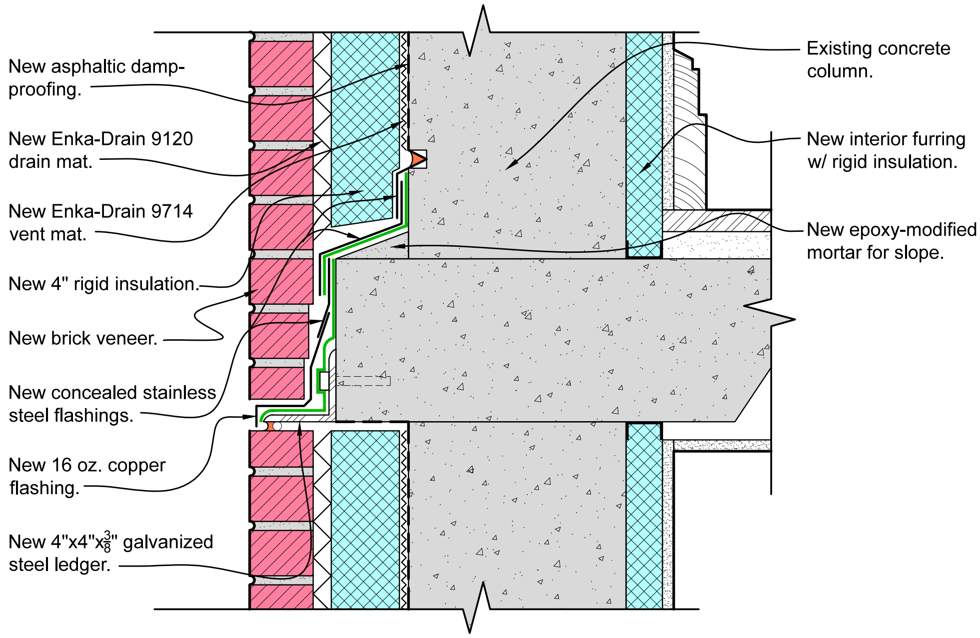


Figure V-3.6(1): Typical New Brick Veneer Over Existing Concrete Column

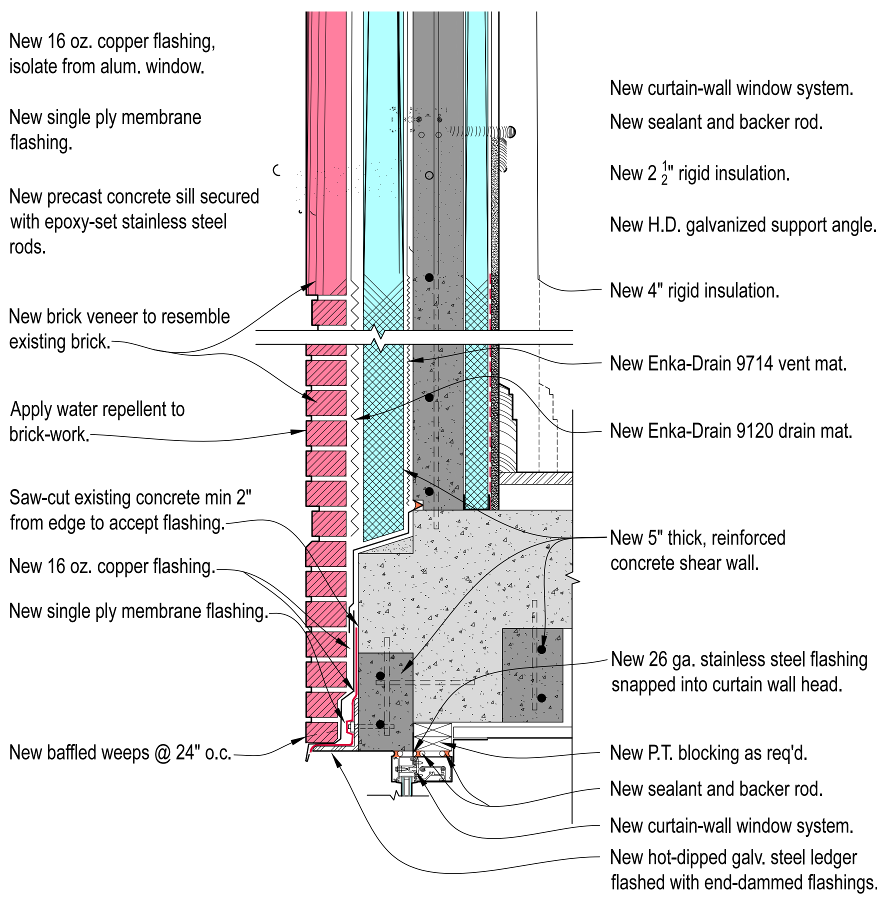


Figure V-3.6(2): Typical New Brick Veneer at Windows

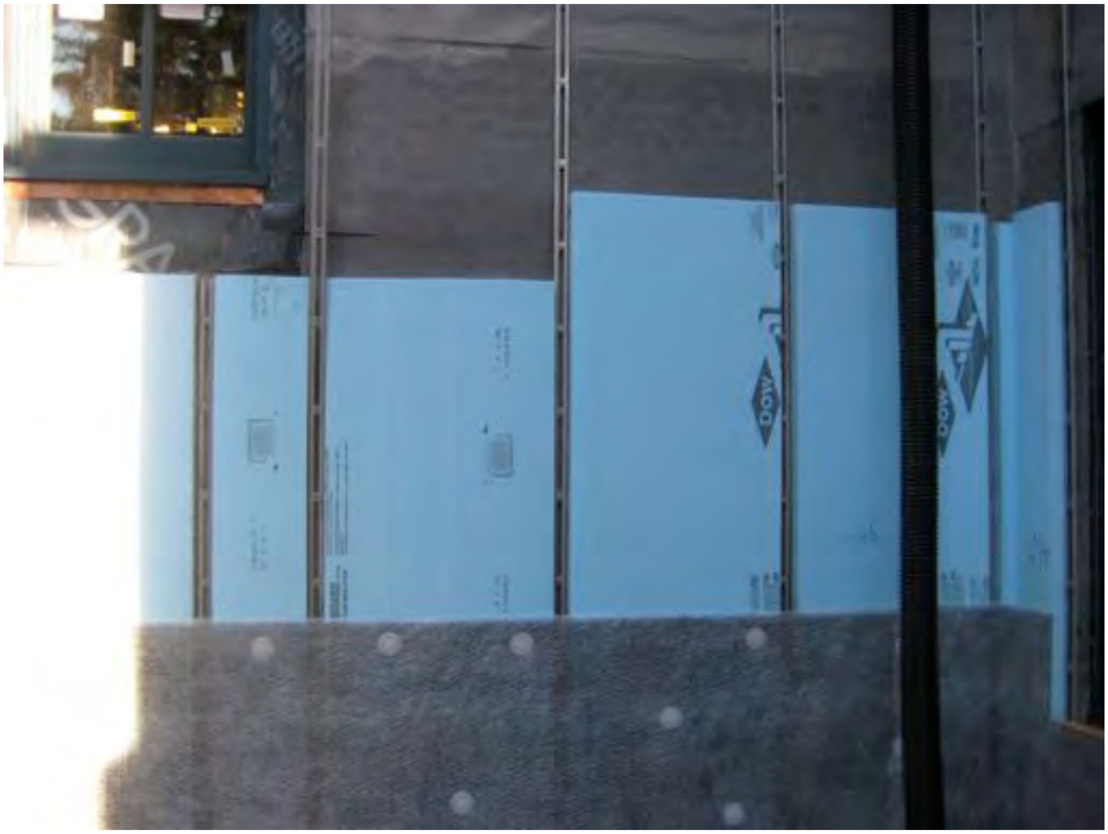


Figure V-3.6(3): Similar In-Progress Work

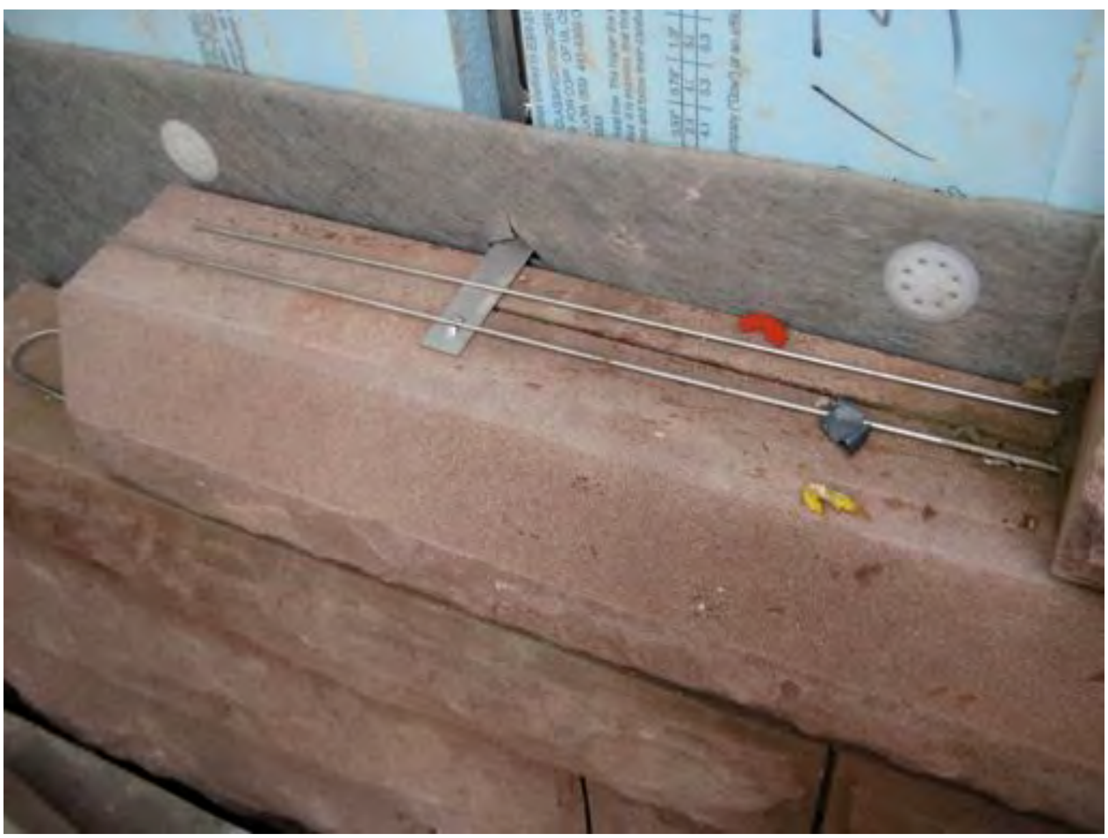


Figure V-3.6(4): Similar In-Progress Work

3.7. Terra-Cotta-Clad Exterior Walls at Levels 2-4

3.7.0 General

This subsection pertains to the terra-cotta exterior wall panels that occur between windows at floor levels 2-4 at the building's south, east, west, and north "public" façades.

3.7.1 Basis of Recommendations

Please see subsection IV-3.7.1, which applies fully to this Option 2 approach as well.

3.7.2 Recommended Corrective Actions

The work includes wholesale replacement of these panels, either with pre-cast concrete, or Glass-Fiber-Reinforced-Concrete, (GFRC). Terra-cotta would obviously be closest in appearance, but would likely be more costly. Also, as these panels are one color, pre-cast concrete or GFRC can be integrally colored to match the existing terra-cotta. The panels can be secured with embedded stainless steel clips, epoxy-set threaded rods, or similar methods.

To slow degradation, I recommend that these replacement panels consist of two pieces, one consisting of a sill piece directly below the windows, and the other below this, with a double-layer flashing of adhered single-ply membrane capped with 16 oz. copper installed between these two as well as atop the sill. The upper sill flashing should integrate with the new curtain-wall windows recommended in subsection V-3.12.2. The single-ply membrane flashing should wrap over the top of the copper flashing to avoid contact between the aluminum window frame and the copper flashing. Figure V-3.7(1) shows a generic detail for this work.

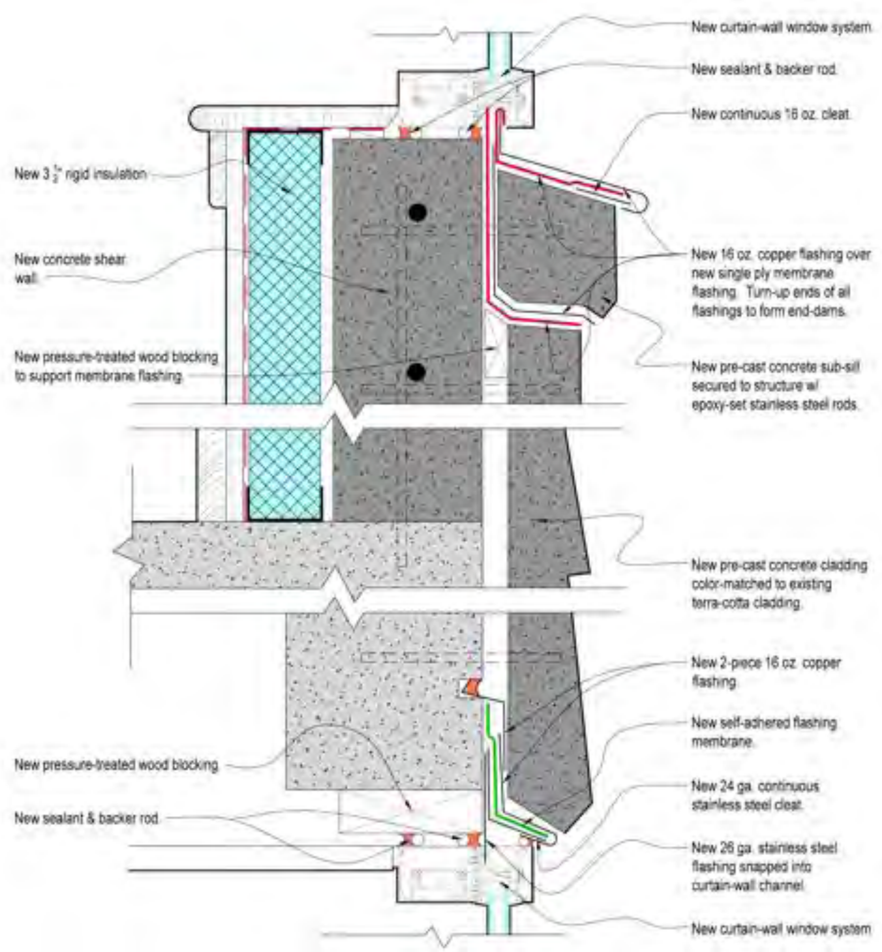


Fig. V-3.7(1): Replacement of Terra-Cotta Panels With Pre-Cast Concrete Panels

3.8. North Courtyard Walls, Brick-Clad

3.8.0 General

This subsection pertains to the brick-clad exterior walls wrapping the north courtyard, but excludes the stairwell walls. Elements integral to these walls, such as steel lintels above the windows, are also addressed here.

3.8.1 Basis of Recommendations

Please see subsection IV-3.8.1, which applies fully to this Option 2 approach as well.

3.8.2 Recommended Corrective Actions

Recommended work at these walls is in most ways quite similar to the recommended work for the more public brick walls addressed in subsection V-3.6.2, and is thus described in a more cursory fashion. Please see subsection V-3.6.2 for more detailed information.

However, there is one significant difference between these courtyard walls and the more public ones, in that the courtyard walls only have a single brick wythe outward of the concrete columns, and the windows are presently recessed farther inward to maintain a similar sill depth to the other walls. To maintain a similar appearance, the new interior concrete shear walls above and below windows would be cast about 4” inward of the outer concrete column faces. However, in other regards, the work is very similar to that described in subsection V-3.6.2, and is repeated here only skeletally. Please see subsection V-3.6.2 for additional information.

This work also begins with the removal of all existing interior finishes, the hollow clay tile, and all exterior masonry to expose the existing concrete building frame.

New concrete walls, piers, and headers are cast between existing concrete columns per subsection IV-2.1.1, but about 4” inward of the outer concrete column faces. All exterior concrete faces are then coated with an asphaltic damp-proofing.

Galvanized steel ledgers are secured along all floor lines where needed to support the new brick veneer along each floor level.

The ledgers are flashed with a double-layer flashing assembly of self-adhered flashing membrane capped with 26-gage stainless steel flashings where fully concealed, and with 16 oz. copper flashings where these become exposed to view.

New stainless steel veneer anchor channels, such as Dur-O-Wal DA904, are fastened to the concrete walls, spaced 16” apart horizontally, and vertically continuous.

A thin vent mat, such as Enka-Drain 9714, is placed against the damp-proofed concrete walls, and 4” thick extruded polystyrene insulation, such as Dow Board, is placed against this. Stainless steel veneer anchors, such as Dur-O-Wal DA931, are clipped into the channel slots, spaced 18” apart vertically. A thicker drain mat, such as Enka-Drain 9120, is placed over the insulation, fabric-side facing outward, to limit mortar clogging.

A new masonry veneer, consisting of ASTM C-216 face brick, Grade SW, is installed over this, largely to match the existing appearance. Horizontal 9-gage stainless steel wire seismic joint reinforcing is embedded within the horizontal joints spaced 18” apart vertically.

The new masonry should be cleaned and sealed with a penetrating water repellent, such as ProSoCo Weather-Seal Siloxane.

Figure V-3.8(1) shows a similar exterior detail where it occurs at the windows. This detail pertains specifically to the more public walls addressed in subsection V-3.6.2, and does not represent the condition at the courtyard walls with complete accuracy. However, it should be close enough for cost-estimating purposes.

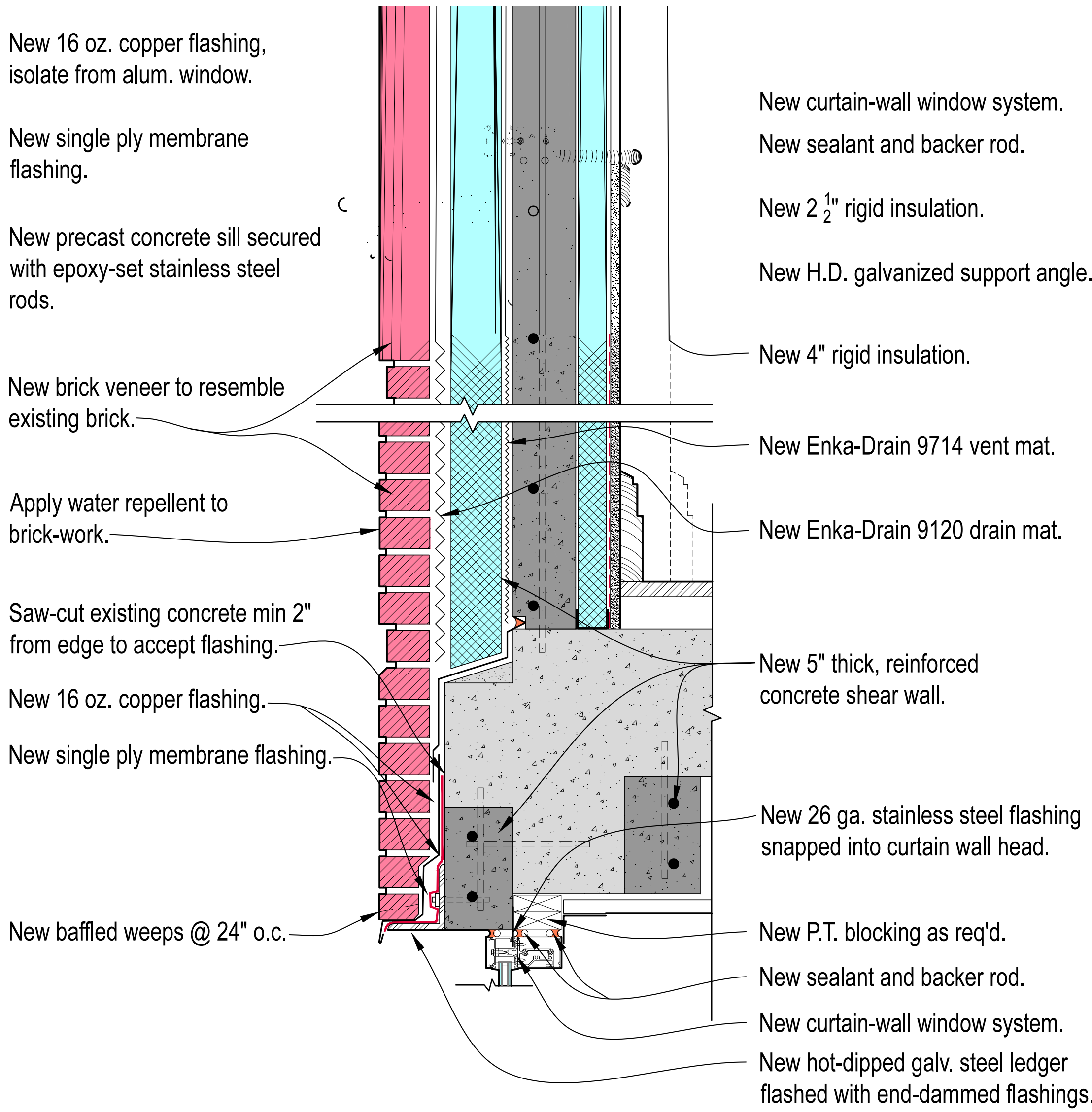


Figure V-3.8(1): Typical New Brick Veneer at Windows

3.9. North Stairwell Walls, Brick & Stucco-Clad

3.9.0 General

This subsection pertains to the brick-clad exterior walls wrapping the stairwell in the courtyard.

3.9.1 Basis of Recommendations

Please see subsection IV-3.9.1, which applies fully to this Option 2 approach as well.

3.9.2 Recommended Corrective Actions

In most respects, recommended work at these walls is identical to the work recommended for the other Courtyard walls, as described in subsection V-3.8.2, and is not repeated here in detail.

This work also begins with the removal of all existing interior finishes, the hollow clay tile, and all exterior masonry to expose the existing concrete building frame.

New concrete walls, piers, and headers are cast between existing concrete columns per subsection IV-2.1.1, flush with the outer concrete column faces. All exterior concrete faces are then coated with an asphaltic damp-proofing. For cost-estimating purposes, 8" thick concrete walls reinforced with #5 bars at 12" O. C. Each Way should be assumed.

Galvanized steel ledgers are secured along all floor lines where needed to support the new brick veneer along each floor level.

The ledgers are flashed with a double-layer flashing assembly of self-adhered flashing membrane capped with 26-gage stainless steel flashings where fully concealed, and with 16 oz. copper flashings where these become exposed to view.

New stainless steel veneer anchor channels, such as Dur-O-Wal DA904, are fastened to the concrete walls, spaced 16" apart horizontally, and vertically continuous.

A thin vent mat, such as Enka-Drain 9714, is placed against the damp-proofed concrete walls, and 4" thick extruded polystyrene insulation, such as Dow Board, is placed against this. Stainless steel veneer anchors, such as Dur-O-Wal DA931, are clipped into the channel slots, spaced 18" apart vertically. A thicker drain mat, such as Enka-Drain 9120, is placed over the insulation, fabric-side facing outward, to limit mortar clogging.

A new masonry veneer, consisting of ASTM C-216 face brick, Grade SW, is installed over this, largely to match the existing appearance. Horizontal 9-gage stainless steel wire seismic joint reinforcing is embedded within the horizontal joints spaced 18" apart vertically.

The new masonry should be cleaned and sealed with a penetrating water repellent, such as ProSoCo Weather-Seal Siloxane.

In contrast to the Option 1 approach, the uppermost, stucco-clad wall band would also be replaced with this new brick veneer, rather than a metal cladding.

This approach would also require new galvanized-steel ledgers directly above the abutting low roofs, with through-wall flashings, to drain water from behind the brick veneer over these roofs.

Similarly, new galvanized-steel ledgers would be needed to support the brick veneer above the newly retrofitted cornice. These ledgers would also be flashed with a double-layer through-wall flashing to drain water from behind the brick veneer over the cornice cap.

Finally, this work would also require new sheet metal copings at the stairwell roof parapets. The existing EPDM membrane would be extended over the new parapet tops over continuous 24-gage stainless steel cleats, and new 16 oz. copper copings would secure over this.

Detailing around windows would be similar to Figure V-3.8(1).

3.10. Brick Chimney

3.10.0 General

This subsection pertains to the relatively tall brick chimney above the main roof, near the inside corner where the west wing joins the main portion of the building. As the “structural” and “weather-integrity” issues affecting this chimney are intricately related and inseparable, all recommendations related to this chimney are addressed holistically in section V-2.5. The sole purpose of section V-3.10 is to refer the reader to section V-2.5 for both “structural” and “weathering” information.

3.11. North Courtyard Walls, Metal-Clad

3.11.0 General

This subsection pertains to two small wall portions on the building’s north side, one to each side of the stair tower, at floor level 2. These walls were not part of the building’s original construction.

3.11.1 Basis of Recommendations

Please see subsection IV-3.11.1, which applies fully to this Option 2 approach as well.

3.11.2 Recommended Corrective Actions

Please follow recommendations of subsection IV-3.11.2, which apply fully to this Option 2 approach as well.

3.12. Windows

3.12.0 General

This subsection pertains to all exterior windows.

3.12.1 Basis of Recommendations

Please see subsection IV-3.12.1, which applies fully to this Option 2 approach as well.

3.12.2 Recommended Corrective Actions

Please follow recommendations of subsection IV-3.12.2, which apply to this Option 2 approach as well.

In brief, the work consists of complete replacement of all windows with a new curtain-wall system with operable sashes integrated as needed to match the current window configurations.

Figures V-3.12(1 & 2) depict typical window installation details for most conditions on this building.

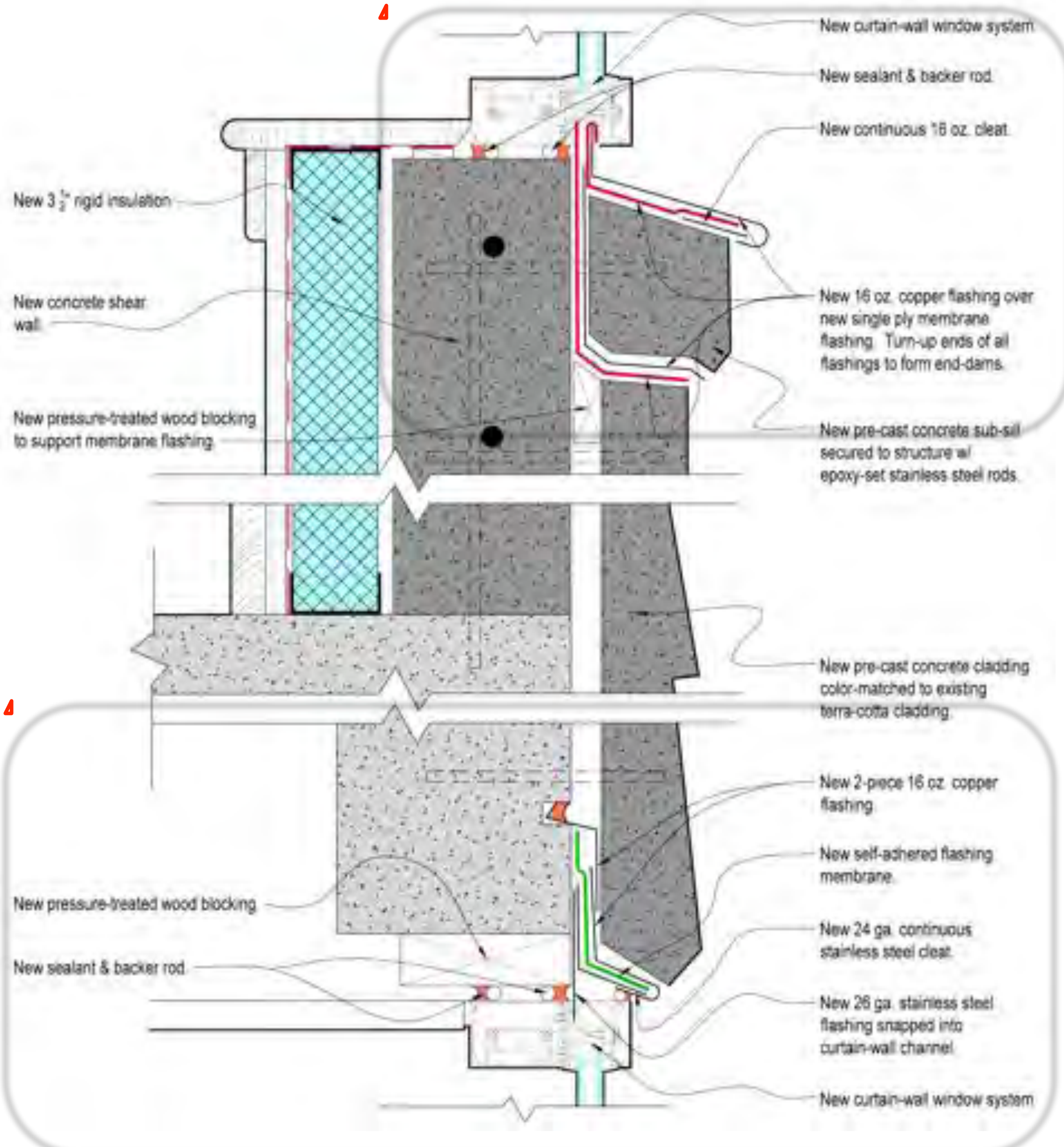


Fig. V-3.12(1): Window Head & Sill Installation at Typical Cladding Panel Loc.

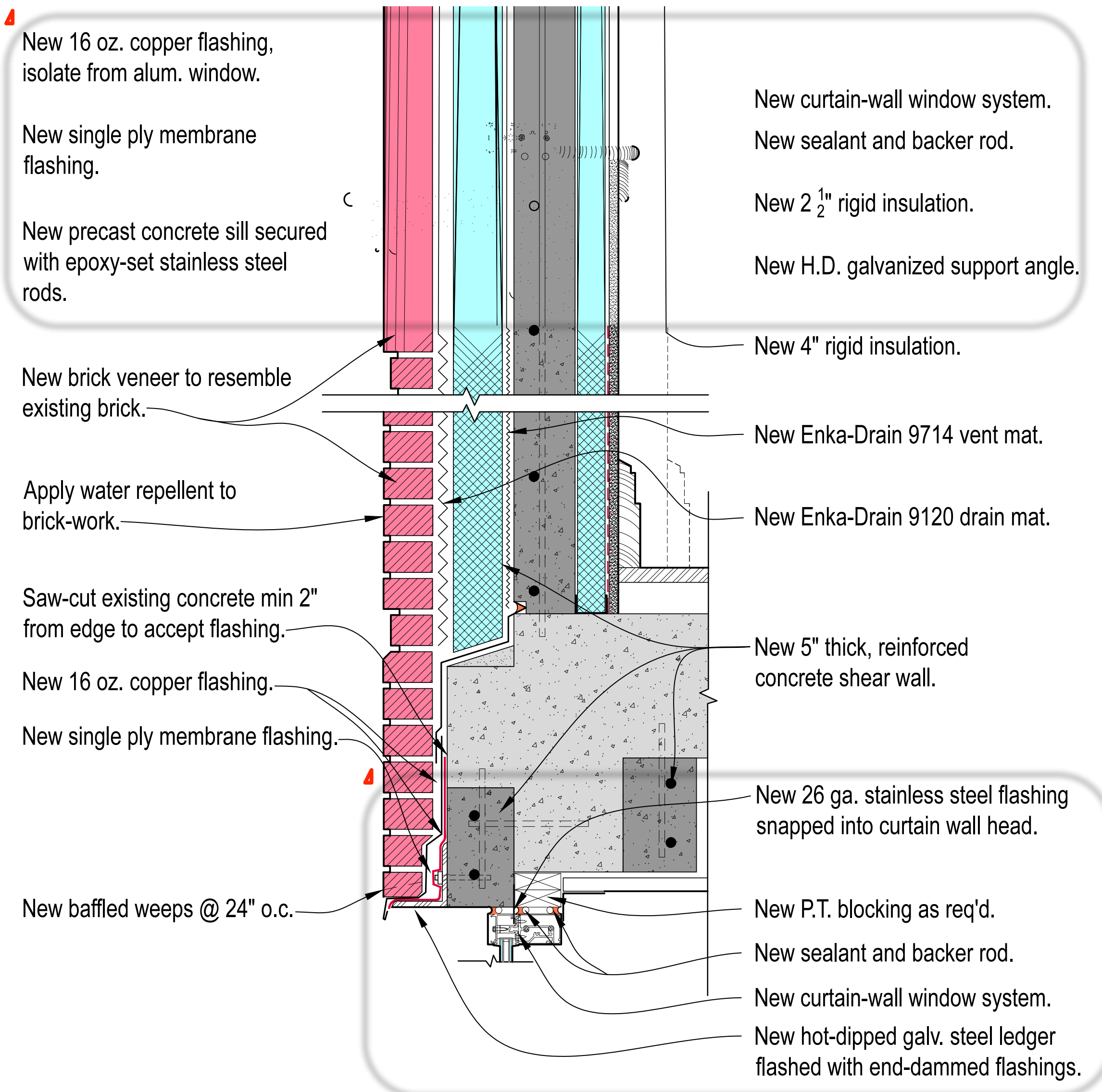


Fig. V-3.12(2): Window Head & Sill Installation at Typical Brick Wall Loc.

3.13. Roofs

3.13.0 General

This subsection pertains to four roof areas, including the large main roof, a small roof atop the stair-tower, and two small roof areas atop the metal-clad additions on the building's north side. The portico roof is addressed separately with the portico in subsection V-5.6.

3.13.1 Basis of Recommendations

Please see subsection IV-3.13.1, which applies fully to this Option 2 approach as well.

3.13.2 Recommended Corrective Actions

Please follow recommendations of subsection IV-3.13.2, which apply to this Option 2 approach as well.

4. EXTERIOR MASONRY SUB-ELEMENTS

4.0. General

This section of the report addresses issues related to the various exterior masonry sub-elements, such as the stone and terra-cotta water tables, stone window sills, marble panels, etc. It is divided into 8 subsections, each of which pertains to a specific primary element. Where appropriate, each subsection contains preliminary drawings depicting the described work. In addition, Figures V-4.0(1-7) show the exterior elevations which reference the locations of specific details in the various subsections.

Fig. V-4.0(1): South Elevation

Fig. V-4.0(2): West Elevation

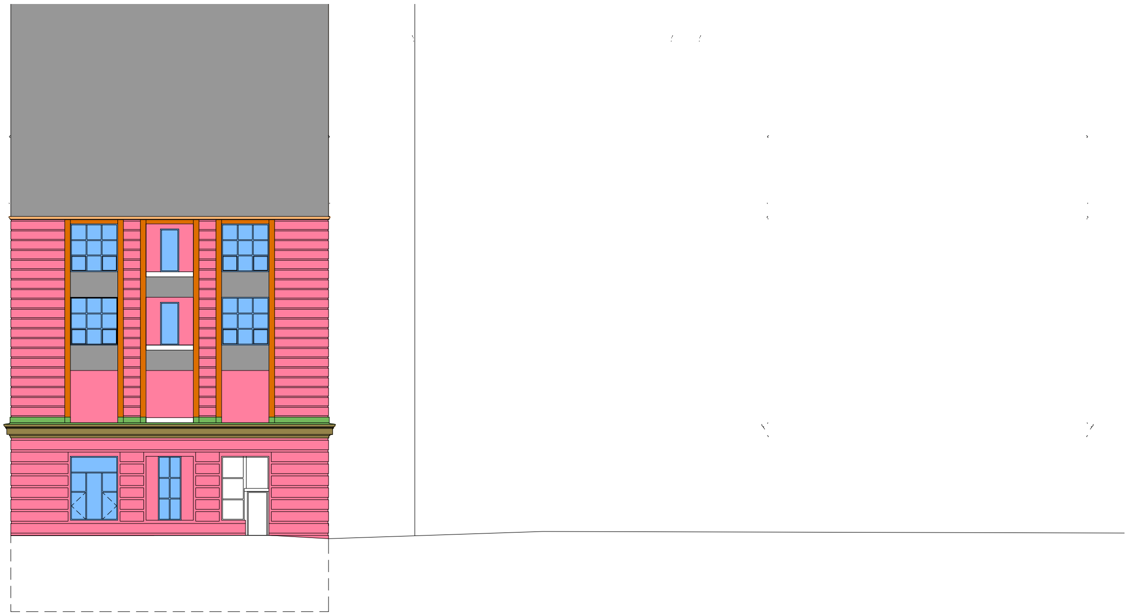


Fig. V-4.0(3): North Elevation

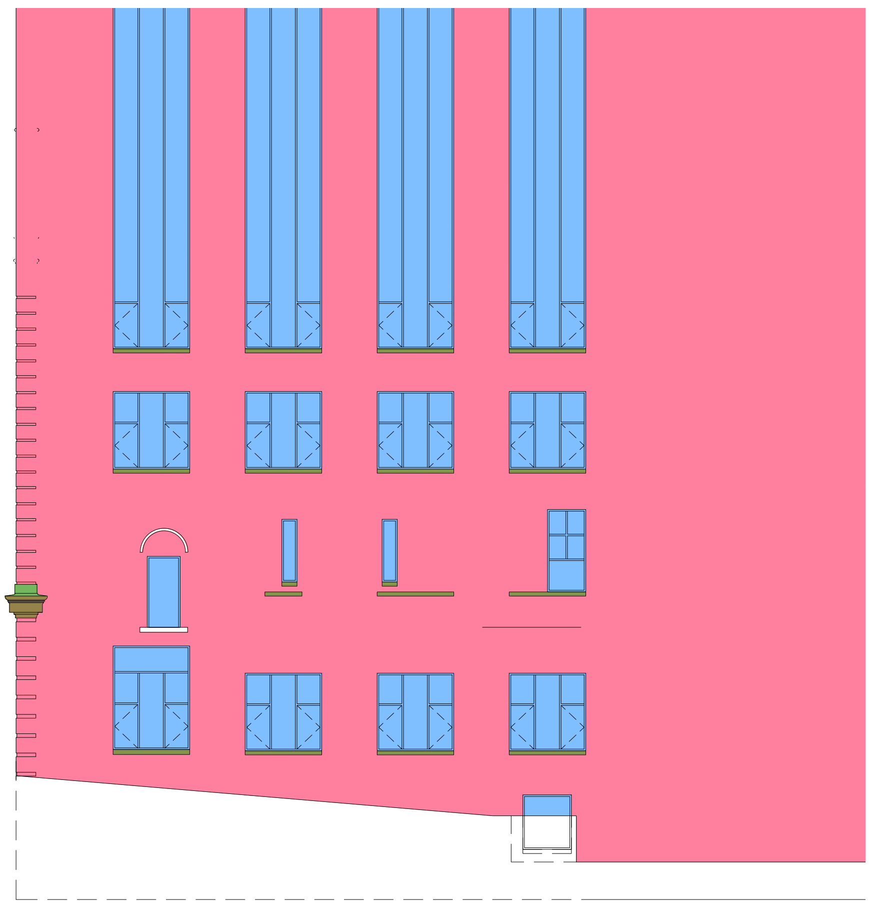


Fig. V-4.0(4): North Courtyard: West-Facing Wall

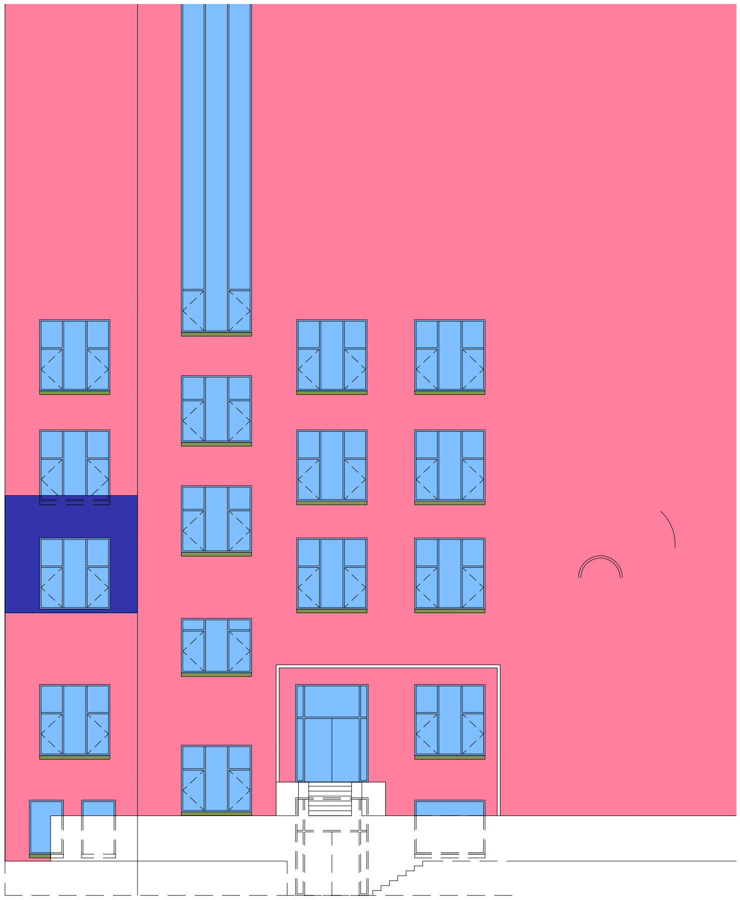


Fig. V-4.0(5): North Courtyard: North-Facing Wall

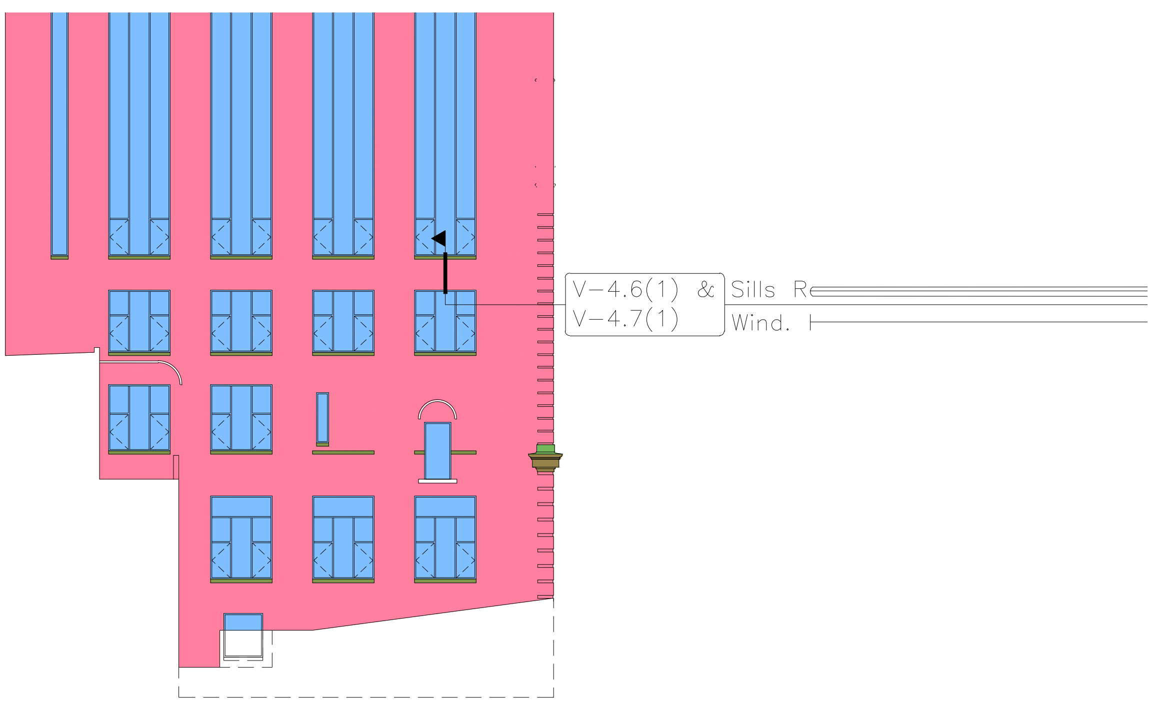


Fig. V-4.0(6): North Courtyard: East-Facing Wall

Fig. V-4.0(7): East Elevation

4.1. Lower Stone Water Table at Level 2

4.1.0 General

This subsection pertains to the stone water table that extends at level 2 around the building's more public façades on the west, south, east, and north sides, but not in the north courtyard.

4.1.1 Basis of Recommendations

Please see subsection IV-4.1.1, which applies fully to this Option 2 approach as well.

In addition, please note that although the existing water table could be restored and reused in this approach, it would need to be removed to allow other work to proceed, and it would probably be less costly, as well as technically preferable, to replace this water table with a new, pre-cast concrete one, generally similar to the proposed new cornice.

4.1.2 Recommended Corrective Actions

Replacement of this water table with a pre-cast concrete one is recommended. Figure V-4.1(1) depicts the general scope of this work.

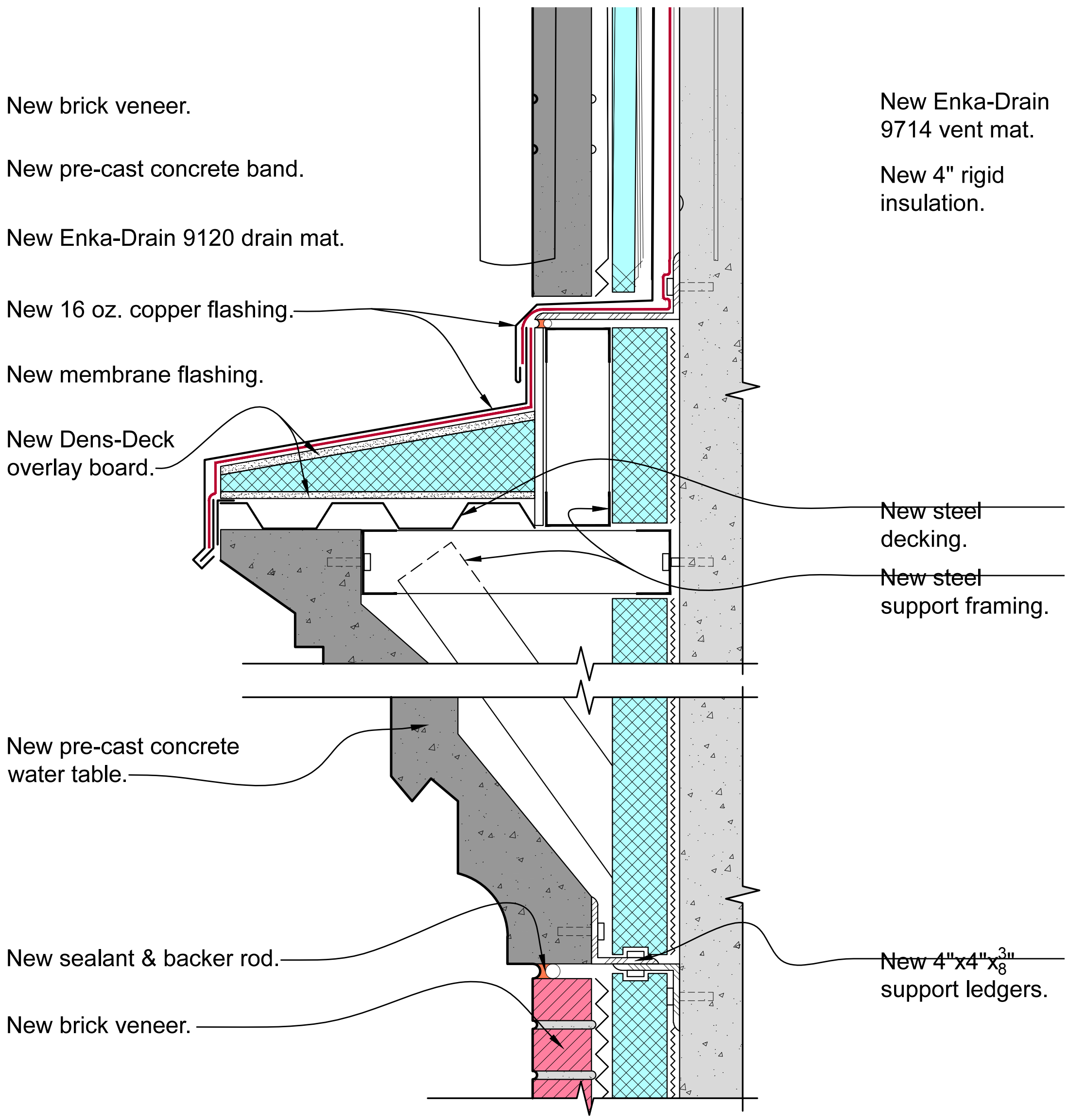


Fig. V-4.1(1): Water Table Reconstruction

4.2. Terra-Cotta Window Bay Surrounds

4.2.0 General

This subsection pertains to the multi-colored terra-cotta border elements that surround all vertical window bays at levels 2-5 around the building's public façades on the west, south, east, and north sides, but not in the north courtyard.

4.2.1 Basis of Recommendations

Please see subsection IV-4.2.1, which applies fully to this Option 2 approach as well.

4.2.2 Recommended Corrective Actions

Please see subsection IV-4.2.2, which applies fully to this Option 2 approach as well.

In brief, this work consists of replacing all existing terra-cotta window bay surrounds with new terra-cotta pieces.

4.3. Upper Terra-Cotta Water Table at Level 5

4.3.0 General

This subsection pertains to the wide horizontal band that separates the 4th and 5th level windows.

4.3.1 Basis of Recommendations

Please see subsection IV-4.3.1, which applies fully to this Option 2 approach as well.

4.3.2 Recommended Corrective Actions

Recommended work of this section is similar to the corresponding work in the Option 1 Restoration approach, as described in subsection IV-4.3.2.

In brief, the work consists of replacing the entire band with new pre-cast concrete and terra-cotta pieces, along with installation of new, continuous steel support ledgers above the level 4 windows and above the adjacent brick, and below the new pre-cast concrete water table, as well as installation of new flashing caps and through-wall flashings. Figure V-4.3(1) depicts this work.

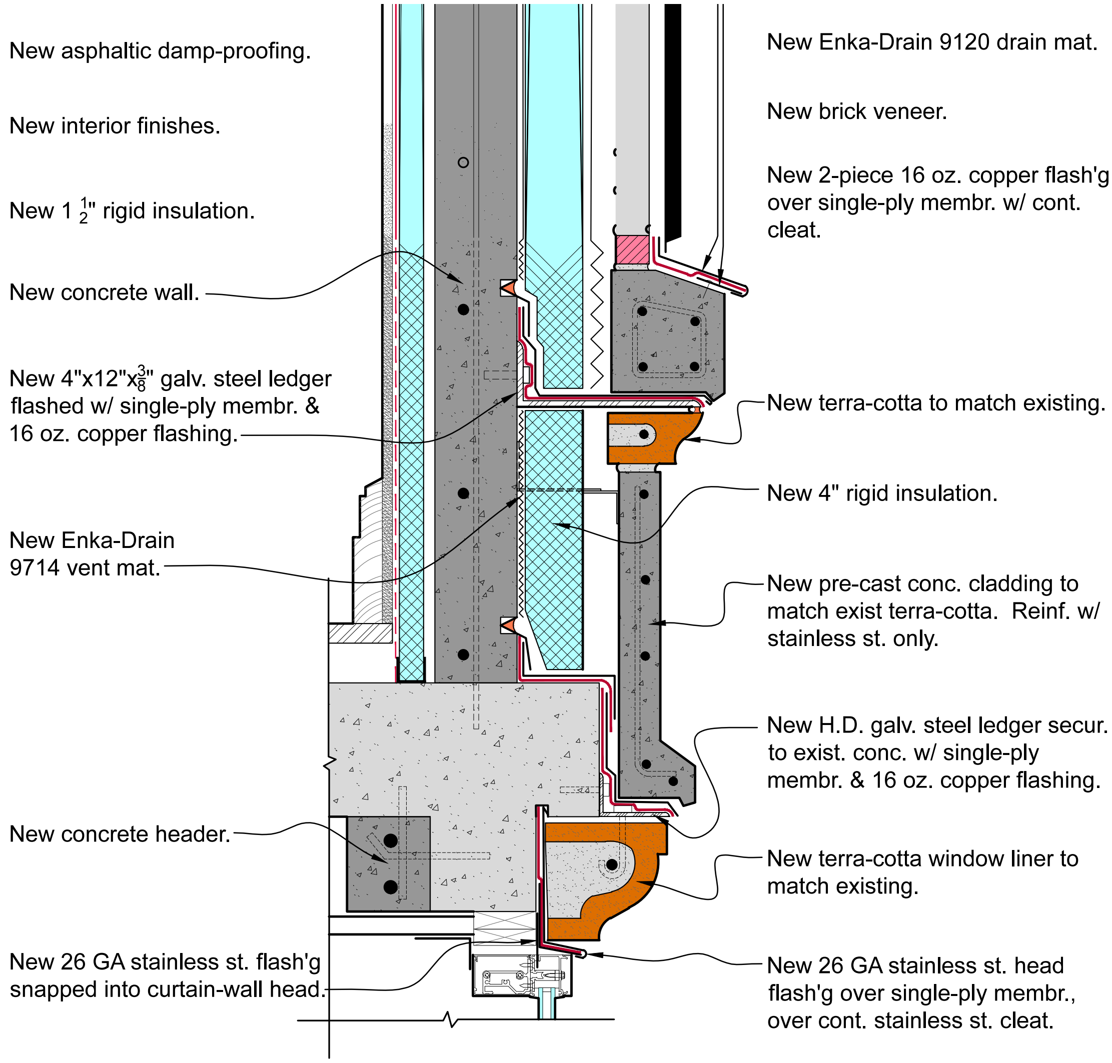


Fig. V-4.3(1): Terra-Cotta Water Table Band Replacement Abv. Level 4 Windows

4.4. Marble Panels at Level 5

4.4.0 General

This subsection pertains to four flat marble panels embedded within the level 5 brickwork.

4.4.1 Basis of Recommendations

Please see subsection IV-4.4.1, which applies fully to this Option 2 approach as well.

4.4.2 Recommended Corrective Actions

In contrast to the Option 1 approach, these marble panels will not be backed-up with another wythe of brick, and will need to be fitted within the thickness of the brick veneer. As these panels are 2 ½" thick, they should not support any brick above them, though they can rest upon the brick below them.

In view of this consideration, the existing panels should be restored and anchored in place, but the steel ledgers above the adjacent windows should run continuously to support the brick above the panels. These ledgers should be flashed with a membrane flashing capped with 16 oz. copper as recommended for all ledgers. The gaps separating the tops of the marble panels from the ledgers should be filled with closed-cell backer rods and sealant.

The panels can be anchored by drilling epoxy-set threaded rods into the existing concrete walls behind them. Only stainless steel anchors should be used, and should be set into the back-up concrete walls at least 4". The back side of the panels should be drilled with slightly over-sized holes which stop about ¾" short of the outer panel faces. These drilled holes should be filled with epoxy, then set over the threaded rods. The two larger panels should be anchored with 9 anchors, consisting of 3 rows of 3 anchors each, while the two smaller panels can be secured with 3 anchors.

The apparent cracks in the panels can be injected with a low viscosity epoxy, such as Sika Sikadur 35 Hi-Mod LV to re-glue the panels. However, this method should first be tested to assure that the epoxy does not stain the stone.

Although the surface erosion could be addressed by re-polishing, this would be costly and would provide very little benefit, as it cannot be seen from the street level. Therefore, no polishing is recommended.

However, the panels should be cleaned and sealed to limit infiltration and slow-down further degradation. Cleaning can be achieved with products such as ProSoCo Limestone Restorer or 766 Limestone & Masonry Pre-Wash and Limestone After-Wash. Sealing can be achieved with ProSoCo NST 400, NST-600, or Weather-Seal H40, which will also help consolidate the stone surface.

4.5. Cornice-Parapet Band at Roof Level

4.5.0 General

This subsection pertains to the entire height of the multi-part band above the level 5 windows and brickwork.

4.5.1 Basis of Recommendations

Please see subsection IV-4.5.1, which applies fully to this Option 2 approach as well.

4.5.2 Recommended Corrective Actions

The recommended work for this band in this approach is very similar to the work recommended for the Option 1 approach, and also includes complete replacement of this band with a new pre-cast concrete cornice and cladding supported with new steel framing. It differs from the option 1 approach only in the specifics of its construction to reflect the different cladding approach. Figure V-4.5(1) depicts the general nature of the recommended replacement cornice.

In brief, the recommended work in this approach also begins by removing all remnants of this cornice band. The bottom projecting terra-cotta band and the flat terra-cotta panels above would then be replaced with a single band of pre-cast concrete, which can be secured to the structure with stainless steel clips, with a minimum of 4 anchors per panel piece.

Above this, a new structural support framework of hot-dipped galvanized steel would be constructed, capped with galvanized steel decking. Pre-cast concrete soffit panels, fabricated to mimic the original cornice and reinforced with stainless steel, would then be secured to this steel support structure.

New 5/8" gypsum overlay board, such as Georgia Pacific Dens-Deck, would be secured over the decking, and would be capped with tapered rigid insulation, sloped at 1" per foot as a minimum, to provide slope. Another layer of 1/2" gypsum overlay board would be secured over this.

A continuous 24-gage stainless steel cleat would be secured along the outer edge. A single-ply membrane, such as the existing EPDM roof membrane, Cetco Core-Flash 60, TPO roofing membrane, or a similar membrane, would cap over this cleat and extend over the cornice top and up the parapet wall to its top.

Finally, a 16 oz. copper cap flashing would be secured over this, and would be counter-flashed along the parapet face with another 16 oz. copper flashing. This counter-flashing could be fabricated to interlock with a new 16 oz. copper parapet coping, though this could also be secured with a separate cleat.

Figure V-4.5(1) illustrates the general construction of the recommended cornice.

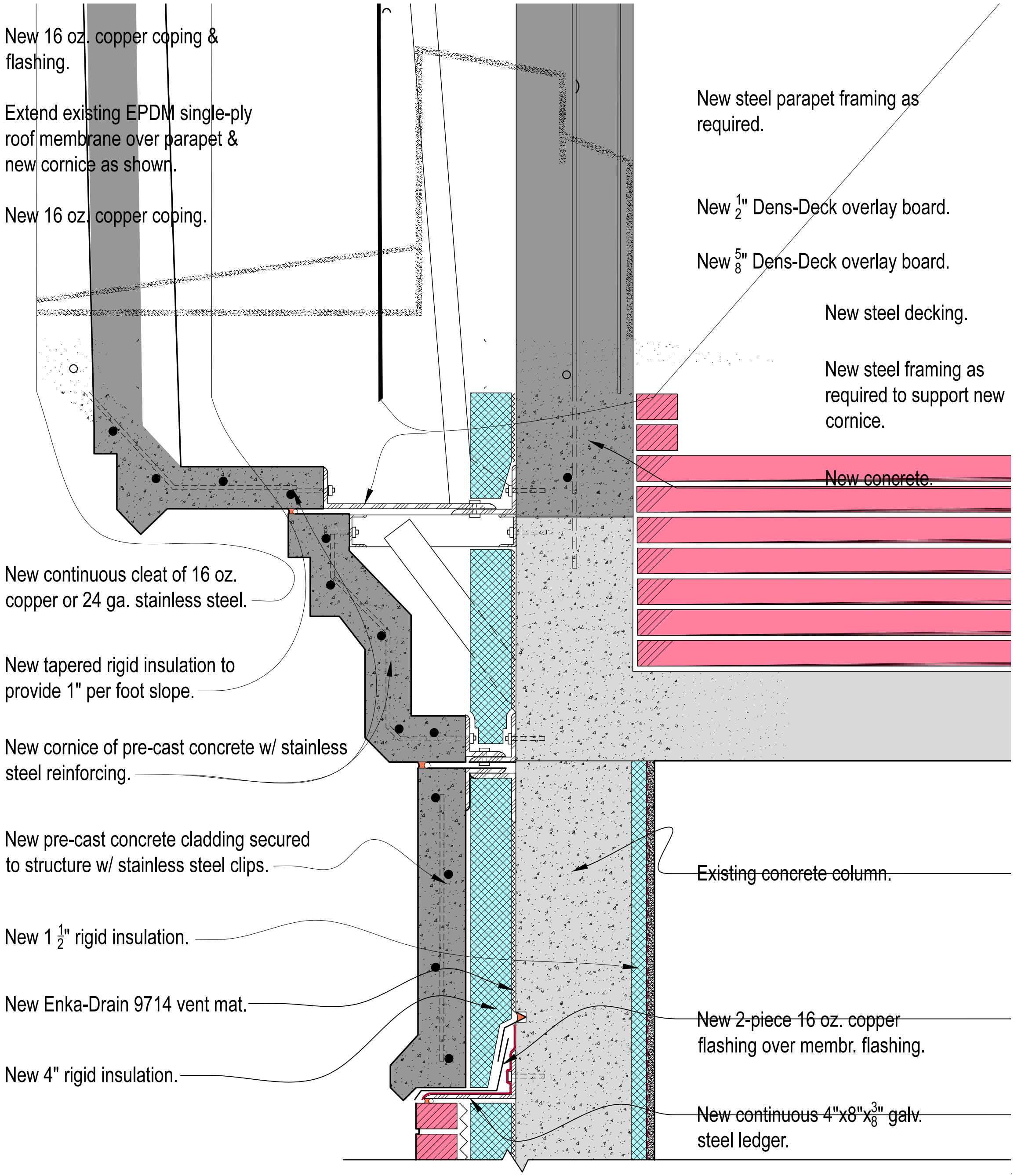


Fig. V-4.5(1): General Configuration of New Cornice

4.6. Stone Window Sills

4.6.0 General

This subsection pertains to the stone sills which occur along the full height of three vertical window bands at the building's SE corner, along levels 0 and 1 on the east and west elevations, at level 1 of the north ends of both wings, and at nearly all windows facing the courtyard.

4.6.1 Basis of Recommendations

Please see subsection IV-4.6.1, which applies fully to this Option 2 approach as well. In addition, this Option 2 approach envisions removing all existing exterior cladding. Consequently, it would probably be less costly to fabricate new pre-cast concrete sills, rather than trying to save the existing stone sills.

4.6.2 Recommended Corrective Actions

The recommended work consists of replacing these sills with new pre-cast concrete sills with membrane and copper flashings atop and below these as shown in Figure V-4.6(1).

The new pre-cast concrete sills should be supported on new 4" x 10" x 3/8" hot-dipped galvanized steel ledgers secured to the new concrete walls, and should also be anchored to the new interior concrete walls with either stainless steel helical Helifix anchors, or epoxy-set threaded rods. Each sill should be anchored with at least two rods.

The new sills should be underlain as well as capped with a single-ply membrane flashing and 16 oz. copper flashings. Prior to installing the sills, new single-ply membrane flashings, such as Cetco Core-Flash 60, should be adhered over the supporting steel ledger and extended up the vertical concrete face under the windows, and new 16 oz. copper flashings with up-turned end-dams should secure over this. The new sills should then be mortar-set over this, with gaps left in the mortar to allow drainage.

New flashing caps should be installed over these sills. This work consists of securing continuous cleats of 16 oz. copper or 24-gage stainless steel along the outer edges, adhering a single-ply membrane over the cleats and sills, and integrating this membrane into the curtain-wall channels. Finally, 16 oz. copper flashing caps with up-turned ends should clip over these cleats and into the curtain-wall window channels. The up-turned ends should be counter-flashed with copper flashings cut into the jamb brick joints.

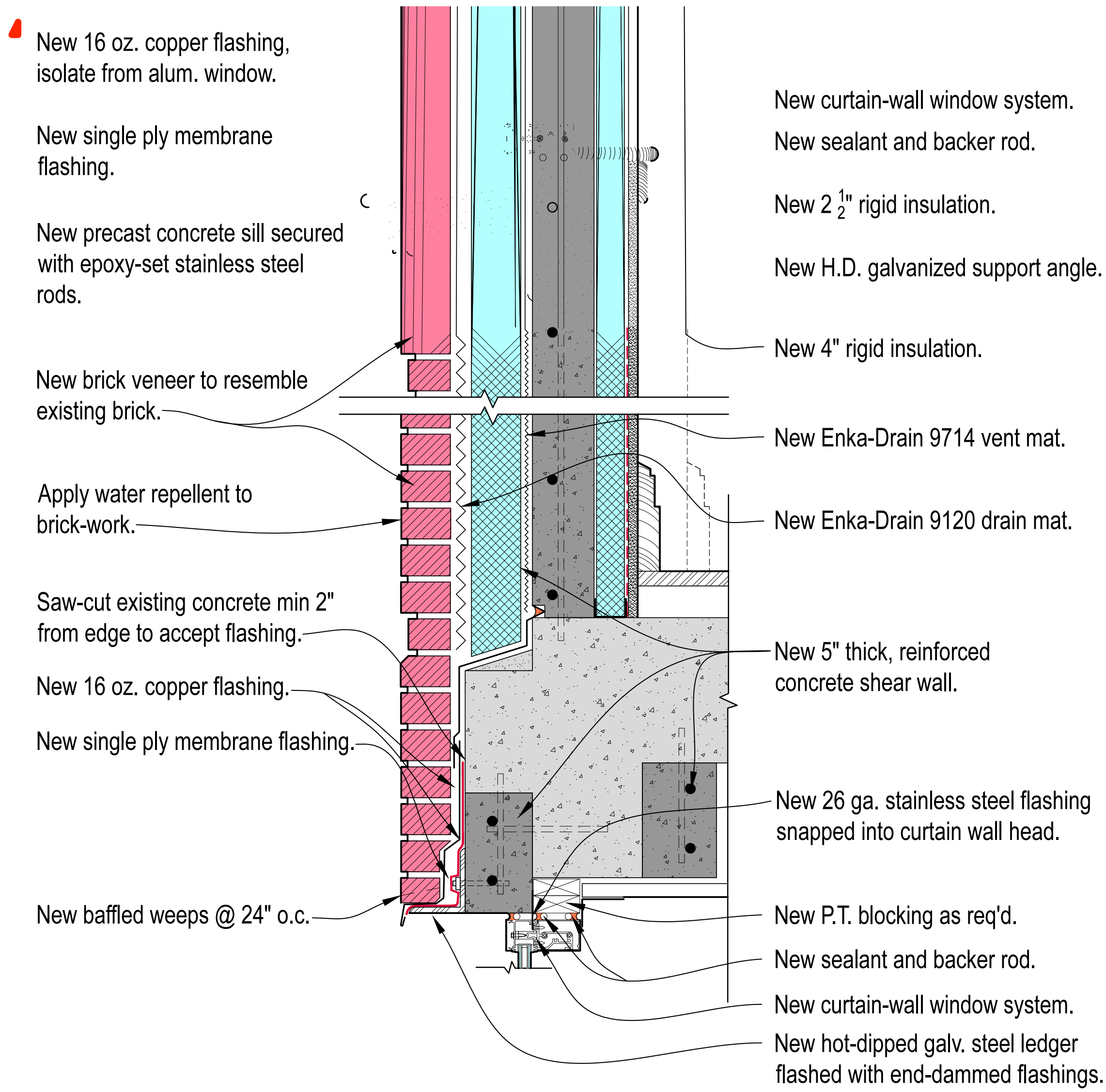


Fig. V-4.6(1): Sill Replacement With Pre-Cast Concrete

4.7. Steel Window-Head Lintels

4.7.0 General

This subsection pertains to the steel lintels above windows that do not have terra-cotta panels above them. These occur along the full height of three vertical window bands at the SE corner, at levels 0 and 1 on the east and west elevations, at level 1 of the north ends of both wings, and at all windows facing the courtyard.

4.7.1 Basis of Recommendations

Please see subsection IV-4.7.1, which applies fully to this Option 2 approach as well. In addition, this Option 2 approach envisions removing all existing exterior cladding. Consequently, the window-head lintels would be replaced with galvanized steel ledgers.

4.7.2 Recommended Corrective Actions

Although many of the existing lintels are still in decent condition and could provide several decades of additional life, their current un-flashed configuration contributes to scattered interior leakage, and the scope of this retrofit project warrants replacement of the outer, accessible lintels as part of this approach. This work is depicted in Figure IV-4.7(1).

In brief, this work consists of replacing these lintels with new, hot-dipped galvanized steel ledgers. These should be flashed with 2-layer flashings consisting of membrane flashings, such as Cetco Core-Flash 60, capped with 3-piece copper flashings, as shown in Figure V-4.7(1). Baffled weeps spaced 24" apart should be included for drainage.

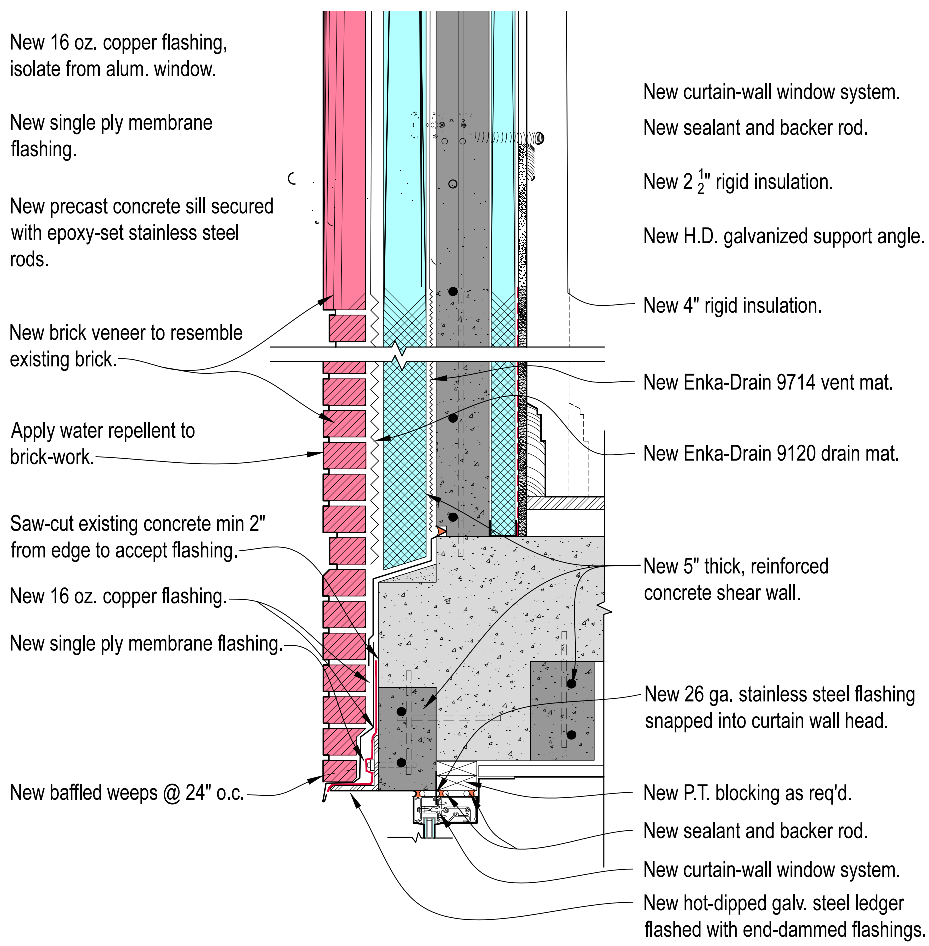


Fig. V-4.7(1): Window-Head Lintel Replacement and Flashing

5. ENTRY PORTICO

5.0. General

This section pertains to all elements that comprise the entry portico. It is subdivided into 7 subsections, each of which addresses the portico's various components, such as its support base, stairs, columns, etc. As the Option 2 work at the portico is essentially identical in nearly all regards to the Option 1 portico work, no new details are needed, and Figure V-5.0(1) references specific details from the Option 1 approach without repeating them in this section.

Figure V-5.0(1): Portico South Elevation

5.1. Support Base for Portico Entry and Stairs

5.1.0 General

This subsection pertains to the portico's support base, including its support structure, granite paving, granite stairs, and granite-clad column plinths.

5.1.1 Basis of Recommendations

Please see subsection IV-5.1.1, which applies fully to this Option 2 approach as well.

5.1.2 Recommended Corrective Actions

Please see subsection IV-5.1.2, which applies fully to this Option 2 approach as well.

In brief, this work consists of performing additional evaluation as part of the next phase of corrective work, which will hopefully allow examination of the concealed portions below the portico entry paving.

5.2. Marble Columns

5.2.0 General

This subsection pertains to the portico's four marble columns and associated capitals.

5.2.1 Basis of Recommendations

Please see subsection IV-5.2.1, which applies fully to this Option 2 approach as well.

5.2.2 Recommended Corrective Actions

Please see subsection IV-5.2.2, which applies fully to this Option 2 approach as well.

In brief, this work consists of core-drilling and reinforcing the columns, injecting cracks with epoxy, restoring or replacing the stone column capitals and capping them with 2-layer flashing caps, and cleaning and polishing the eroded column surfaces.

5.3. Stone Cladding on Exterior Building Wall

5.3.0 General

This section pertains to the stone cladding along the building's exterior wall, but only where it occurs under the portico roof. While this cladding wraps the entire base of the south façade, it forms the structural support for the N-S stone beams of the portico roof. Consequently, at the portico, this cladding is used in a structural fashion.

5.3.1 Basis of Recommendations

Please see subsection IV-5.3.1, which applies fully to this Option 2 approach as well.

5.3.2 Recommended Corrective Actions

Please see subsection IV-5.3.2, which applies fully to this Option 2 approach as well.

In brief, this work consists of replacing the existing damaged cladding with a new, color-matched, pre-cast concrete cladding over new reinforced concrete support columns and walls, along with new flashings, sealant joints, etc., as described in subsection IV-5.3.2.

5.4. Portico Roof Structure

5.4.0 General

This section pertains to the elements comprising the portico's roof structure, including the entablature beam, embedded concrete beam above the entablature, stone crossbeams, steel lintels, stone water table, concrete roof slab, stone ceiling panels, and related elements.

5.4.1 Basis of Recommendations

Please see subsection IV-5.4.1, which applies fully to this Option 2 approach as well.

5.4.2 Recommended Corrective Actions

Please see subsection IV-5.4.2, which applies fully to this Option 2 approach as well.

In brief, this work consists of replacing the entire portico roof structure with a new structure of cast-in-place concrete beams, steel decking and framing, pre-cast concrete cladding, new flashings, etc. as described in subsection IV-5.4.2.

5.5. Stone Railing

5.5.0 General

This section pertains to the stone elements comprising the portico roof's perimeter railing.

5.5.1 Basis of Recommendations

Please see subsection IV-5.5.1, which applies fully to this Option 2 approach as well.

5.5.2 Recommended Corrective Actions

Please see subsection IV-5.5.2, which applies fully to this Option 2 approach as well.

In brief, this work consists of replacing the entire railing with a new one of pre-cast concrete capped with new flashings, etc. as described in subsection IV-5.5.2.

5.6. Portico Roof, Drains, and Associated Flashings

5.6.0 General

This section pertains to the portico's roof membrane, drains, and associated flashings.

5.6.1 Basis of Recommendations

Please see subsection IV-5.6.1, which applies fully to this Option 2 approach as well.

5.6.2 Recommended Corrective Actions

Please see subsection IV-5.6.2, which applies <u>nearly fully</u> to Option 2 as well. It differs only in that rather than retrofitting through-wall flashings in the existing brick above the portico roof, such flashings, consisting of single-ply membrane capped with 16 oz. copper, would cap over new steel ledgers supporting the new brick veneer. In all other respects, the work would be identical.

In brief, this work consists of replacing the existing portico roof membrane, installing through-wall flashings under the railings, adding two new overflow drains, etc. per subsection IV-5.6.2.

6. INTERIOR ARCHITECTURAL ELEMENTS

6.0. General

This section addresses issues related to the interior architectural elements including the wall, floor and ceiling construction and finishes.

6.1. Interior Faces of Exterior Building Walls

6.1.0 General

This subsection pertains to the interior architectural elements affected by the seismic retrofit and exterior wall renovation, which primarily impacts interior faces of exterior walls.

6.1.1 Basis of Recommendations

Please see subsection IV-6.1.1, which applies fully to this Option 2 approach as well.

6.1.2 Recommended Corrective Actions

Please see subsection IV-6.1.2, which applies fully to this Option 2 approach as well.

7. MECHANICAL SYSTEMS

7.0. General

This section addresses issues related to the building's mechanical systems, including heating, ventilation, plumbing and fire sprinkler systems.

7.1. General Mechanical Systems

7.1.0 General

This subsection pertains to the mechanical systems affected by the work on the exterior walls and mechanical systems affected by other seismic retrofit work.

7.1.1 Basis of Recommendations

Please see subsection IV-7.1.1, which applies fully to this Option 2 approach as well.

7.1.2 Recommended Corrective Actions

Please see subsection IV-7.1.2, which applies fully to this Option 2 approach as well.

8. ELECTRICAL SYSTEMS

8.0. General

This section addresses issues related to the building's electrical systems, including power, lighting and communication systems.

8.1. General Electrical Systems

8.1.0 General

This subsection pertains to the electrical systems affected by the work on the exterior walls and by other seismic retrofit work.

8.1.1 Basis of Recommendations

Please see subsection IV-8.1.1, which applies fully to this Option 2 approach as well.

8.1.2 Recommended Corrective Actions

Please see subsection IV-8.1.2, which applies fully to this Option 2 approach as well.

9. ESTIMATED CONSTRUCTION COST OF OPTION 2

9.0. General

This section presents the summarized construction cost estimate for Option 2, which is based on the full cost estimate prepared by HMS, Inc., with subsequent modifications by Jensen Yorba Lott Inc., and PL:BECS.

As this Option 2 replaces all exterior cladding elements, a higher level of certainty is assumed concerning its likely costs, compared to Option 1. For this reason, the assumed contingency for phases 2 and 3 of Option 2 is 25% lower than the corresponding contingencies for Option 1.

It should further be noted that this preliminary evaluation obviously did not attempt to design in detail every aspect of each option, but rather attempted to define each approach to a schematic level, sufficient to allow only very rough construction cost estimates to be prepared. For this reason, the costs of each phase of each option are rounded to the nearest $ 100,000, and realistically, even this level of precision implies a higher degree of certainty than can be justified by the schematically-defined work scope descriptions. The reader is encouraged to round these estimates to the nearest $ 1,000,000.

It should also be clarified that these estimates relate only to the projected construction costs, and that in any case and with any approach, appreciable additional costs should be anticipated to cover temporary relocation of occupants, design and engineering fees, possible soil studies, and other, non-construction related expenses.

9.1. Estimated Construction Cost of Option 2

The estimate is broken down by the 3 construction phases

Construction Phase 1 is scheduled for May to December 2013. This phase will consist of seismic reinforcing and renovation of the Portico along with repairs to the ground floor structure in the crawl space and providing drainage in the crawl space.

Construction Phase 2 is schedule for May to December 2014. This phase will consist of seismic reinforcing of the south wall from the foundations to the roof along with renovation of the exterior south wall assembly. The work will also include replacing the steam heating system on the south wall with a hydronic heating system.

Construction Phase 3 is schedule for May to December 2015 and May to December 2016. This phase will consist of seismic reinforcing of the east, west and north walls from the foundations to the roof along with renovation of the remaining exterior wall assemblies. The work will also include replacing the steam heating system in the remainder of the building with a hydronic heating system.

The cost of the three construction phases follows:

Construction Phase 1:	$ 1.1 million.
Construction Phase 2:	$ 6.7 million.
Construction Phase 3:	$ 14.1 million.
Total	**$ 21.9 million.**

VI. OPTION 3: NEW MASONRY VENEER OVER CONC. & ST. WALLS

1. GENERAL INTRODUCTION

1.0. General

This section addresses issues of general applicability to Part VI: Option 3: New Brick Veneer Over Concrete & Steel-Framed Walls.

Subsection 1.1 includes General Format Notes, which describe the general formatting.

Subsection 1.2, Introductory Notes, outlines some general considerations.

Finally, subsection 1.3, Overall Description of the Option 3 Reconstruction Approach, provides a summary description of the overall approach and its limitations.

1.1. General Format Notes

Please see section IV-1.1, which applies fully to this Option 3 approach as well.

1.2. Introductory Notes

Please see section IV-1.2, which applies fully to this Option 3 approach as well.

1.3. Overall Description of the Option 3 Reconstruction Approach

The recommendations are divided into numerous subsections, each of which addresses a particular element. While this approach provides specific information in a highly retrievable format, the resulting fragmentation may obscure the overall context from which the individual recommendations spring. This section attempts to provide the more holistic explanation.

In brief, like Option 2, this approach recognizes the inherent limitations of Option 1, and also recommends replacement of the exterior cladding with a new masonry veneer. It differs from Option 2 only in that while Option 2 placed cast-in-place concrete walls inward of the masonry veneer at essentially all locations, Option 3 adds such concrete shear walls only where needed to resist lateral loads, and uses standards steel-framed walls elsewhere. In essentially all other respects, Option 3 mimics Option 2.

Where such framed walls occur, the assembly, exterior-to-interior, consists of the masonry veneer placed over a ¾” drain mat, such as Enka-Drain 9120, over 4” rigid insulation, over 3/16” vent-mat, such as Enka-Drain 9714, over 2-layer building wrap, over 5/8” exterior gypsum sheathing, over 6” deep, 16-gage steel studs spaced 16” apart. Batt or rigid insulation can be used within the framing cavities. Over the framing’s interior face would be a 6-mil cross-laminated vapor barrier, and 5/8” gypsum wallboard.

The only possible advantage of Option 3, compared to Option 2, appeared to be one of cost, which is also the only reason why this option was evaluated. Option 3 is not technically equal to Option 2. Further, this Option 3 approach somewhat ironically requires significantly more concrete work at the foundations and at the building corners at all floor levels. Consequently, it actually ends up a bit more costly than Option 2. In short, this approach produces a lesser building at higher cost than Option 2, and is thus not recommended by PL:BECS for a major institutional building in Juneau’s climate.

My reservations include technical and architectural considerations.

Technical concerns with this approach center on the certainty of recurring internal condensation and associated risks of corrosion, as well as possible risk of fungal infestation.

More specifically, the corrosion concern reflects the vulnerability to losing effective anchorage of the masonry veneer. The stainless steel ties that secure the masonry veneer to the walls are screwed through the gypsum sheathing to the steel stud flanges. If stainless steel screws are used, there remains a risk of corrosion right where the one or two screw threads engage the galvanized steel studs, where even very localized corrosion of the stud flanges around the screw threads can negate the veneer tie securement. I don't think this risk should be underestimated in Juneau's perpetually wet and cool climate.

The fungal concern relates to the use of gypsum sheathing in such a damp climate, especially for a major institutional building with a hopefully longer lifespan than most. Although the recommended Dens-Glass Gold sheathing is silicone-treated to resist absorption, having observed mildew growth even on vertical glass, I would not entirely dismiss the risk of at least localized fungal colonization.

An additional draw-back of this approach is that ironically, it requires appreciably more foundation work, as well as thicker concrete shear walls extending up the building's full height near its corners, to make up for the loss of the new thin concrete walls under and above the windows which are included in Options 1 and 2, but not 3. As a consequence of these thicker concrete walls, the office spaces near the building corners at all floor levels lose some floor space.

For these reasons, I do not consider the Option 3 approach technically equal to Option 2, and strongly recommend Option 2, which is both technically superior and less costly than Option 3.

As this approach is otherwise essentially identical to Option 2, it is not described in detail here. Please see subsections III-1.3.2 and III-1.3.3 and Part V for more detailed descriptions. Also, since Options 2 and 3 are very similar, many of the same drawings describe both options. Thus, Figures III-1.3(15 & 16) illustrate only two typical locations where these differ from Option 2.

Proceeding to the description, this approach is identical to Option 2 where new concrete shear walls are to be added, and this portion is not repeated here. Please see section V-1.3 for this.

Galvanized steel ledgers are secured along all floor lines where needed to support the new brick veneer along each floor level.

The ledgers and the existing protruding concrete lugs are flashed with a double-layer flashing assembly of self-adhered flashing membrane capped with 26-gage stainless steel flashings where fully concealed, and with 16 oz. copper flashings where these become exposed to view.

Where new framed walls are to replace the existing hollow clay tile walls, the work also begins with the removal of all existing interior finishes, the hollow clay tile, and all exterior masonry to expose the existing concrete building frame.

New concrete walls, piers, and headers are cast between existing concrete columns where needed for shear capacity, per subsection VI-2.1.1. New framed walls are installed between these concrete elements, consisting of 6" deep, 16-gage galvanized steel studs spaced 16" apart. Over the exterior wall face, 5/8" exterior gypsum sheathing is screwed to the studs, and is overlaid with a 2-layer building wrap assembly, such as Tyvek Stucco-Wrap overlaid with 60-Minute Grade D paper.

New stainless steel veneer anchor channels, such as Dur-O-Wal DA904, are screwed through the gypsum wall sheathing to the wall framing studs, thus spaced 16" apart horizontally, and vertically continuous.

A thin vent mat, such as Enka-Drain 9714, is placed against the building wrap, and 4" thick extruded polystyrene insulation, such as Dow Board, is placed against this. Stainless steel veneer anchors, such as Dur-O-Wal DA931, are clipped into the channel slots, spaced 18" apart vertically. A thicker drain mat, such as Enka-Drain 9120, is placed over the insulation, fabric-side facing outward, to limit mortar clogging.

A new masonry veneer, consisting of ASTM C-216 face brick, Grade SW, at brick areas, or pre-cast concrete cladding at stone locations, is installed over this, largely to match the existing appearance, but with greatly reduced offsets and with concave-tooled mortar joints to limit water infiltration into the masonry. Horizontal 9-gage stainless steel wire seismic joint reinforcing is embedded within the horizontal joints spaced 18” apart vertically.

The new masonry should be cleaned and sealed with a penetrating water repellent, such as ProSoCo Weather-Seal Siloxane.

As this Option 3 approach contains both the concrete-backed and framed-wall portions, depending on location, Figure VI-1.3(1) shows a typical exterior detail where it occurs over the existing embedded concrete columns, while Figure VI-1.3(2) shows the corresponding wall assembly where steel-framed walls occur.

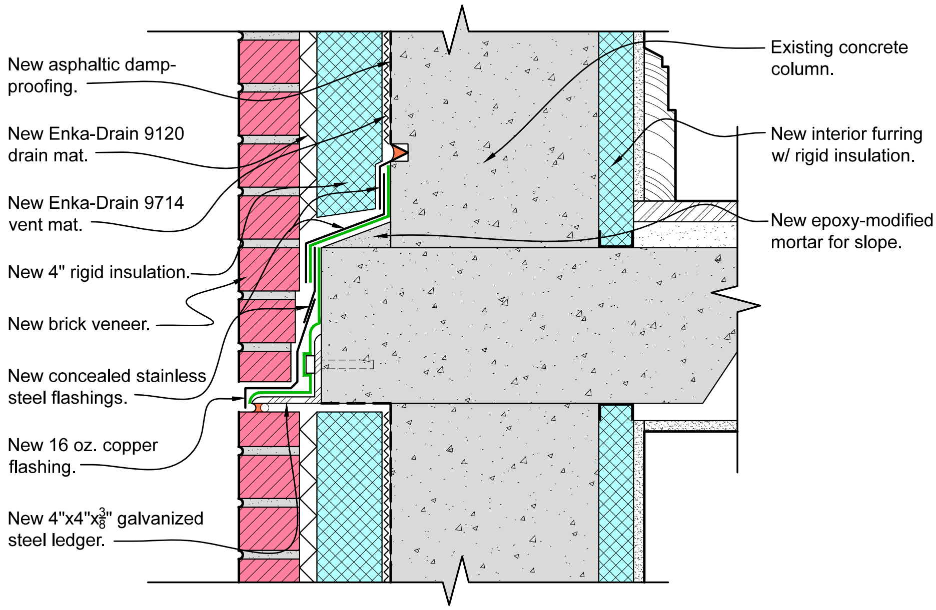


Figure VI-1.3(1): Typ. New Brick Veneer Over Exist. Concrete Column-Opt. 2 & 3

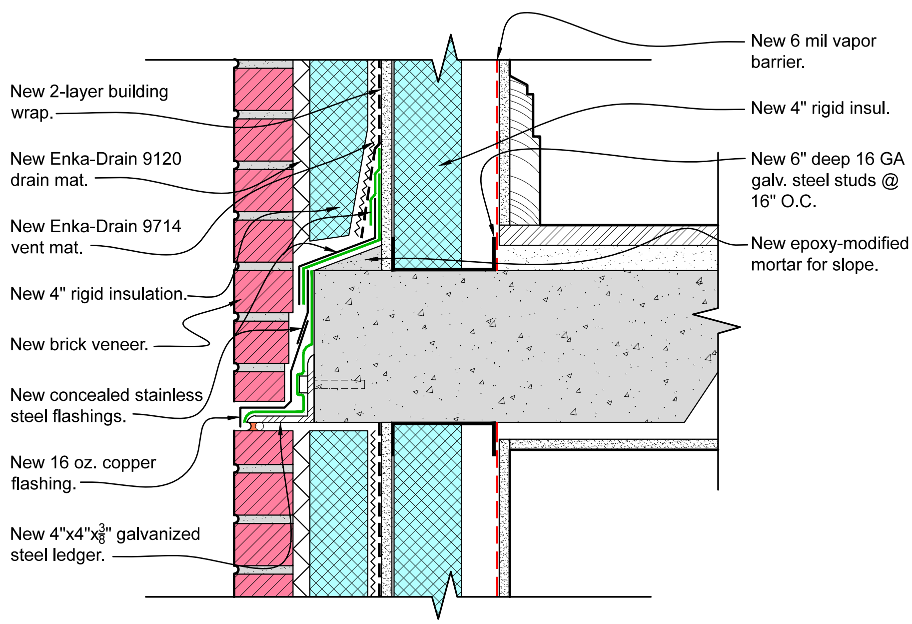


Figure VI-1.3(2): Typ. New Brick Veneer Over New Steel-Framed Wall-Opt. 3 Only

2. STRUCTURE

2.0. General

This section addresses larger-scale structural considerations. It is divided into nine subsections, each of which pertains to a specific sub-element of the structure.

2.1. Basic Structure of Building

2.1.0 General

This subsection pertains to the building's basic structural design in the most general terms.

2.1.1 Basis of Recommendations

Please see subsection IV-2.1.1, which applies fully to this Option 3 approach as well.

2.1.2 Recommended Corrective Actions

With regard to the building's overall structural frame, recommended corrective work is similar to Option 2, and is not described here in detail. It diverges from Option 2 primarily in that rather than adding concrete back-up walls at all locations, Option 3 adds such concrete walls only where needed to provide lateral load resistance, and places metal-framed back-up walls where concrete shear walls are not needed. Consequently, new concrete shear walls are typically added near all building corners, but mid-portions of the exterior walls only receive the metal-framed walls above and below the windows.

Somewhat ironically, the elimination of the concrete shear walls in the wall mid-portions reduces the building's overall shear capacity, and thus requires beefier concrete shear walls near the corners extending the full building height, while Option 2 only requires the thicker concrete shear walls from the foundation level up to level 2, and 5" thick walls extend above this. Thus, Option 3 reduces interior floor space near the building corners at all floor levels.

As outlined in more detail in subsection VI-2.2.2, Option 3 also requires addition of significantly more concrete work to the foundations.

Figures VI-2.1(1-6) show the building's floor plans with specific locations and thicknesses of the new shear walls and piers indicated. See also Figure VI-2.2(1), which shows the related structural work at the foundation level.

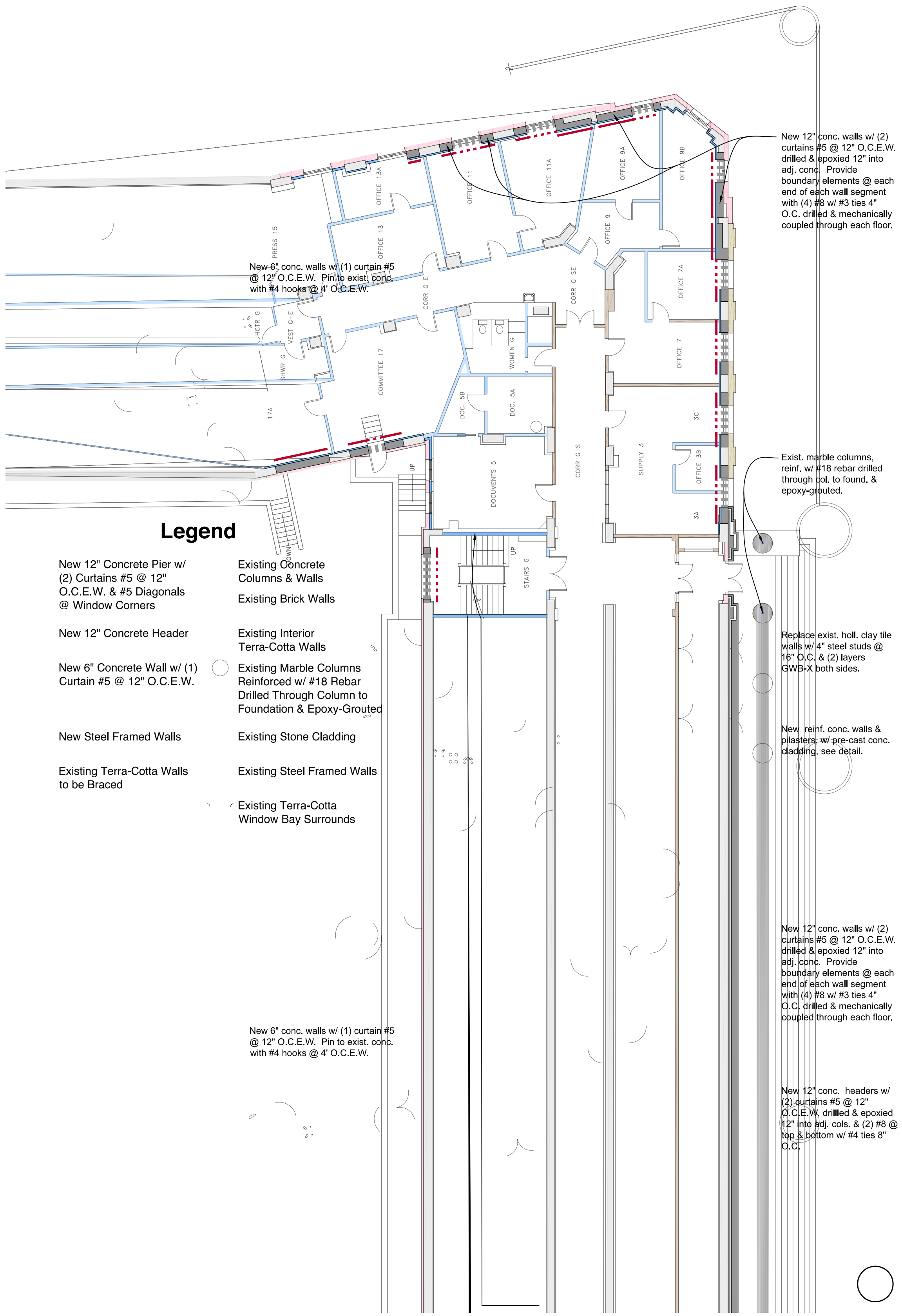


Figure VI-2.1(1): Structural Reinforcing of Building Frame - Ground Floor Level

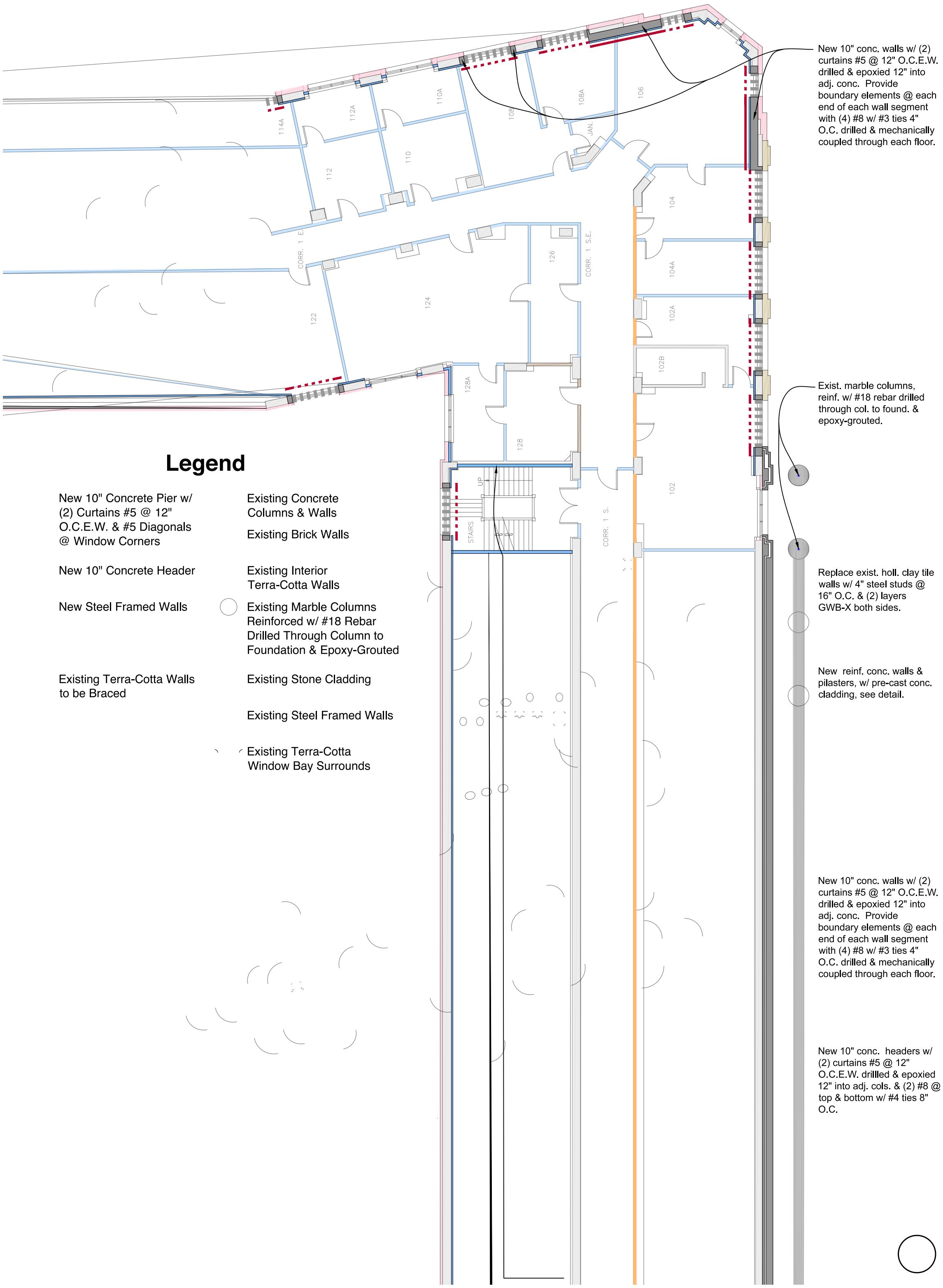


Figure VI-2.1(2): Structural Reinforcing of Building Frame - Floor Level 1

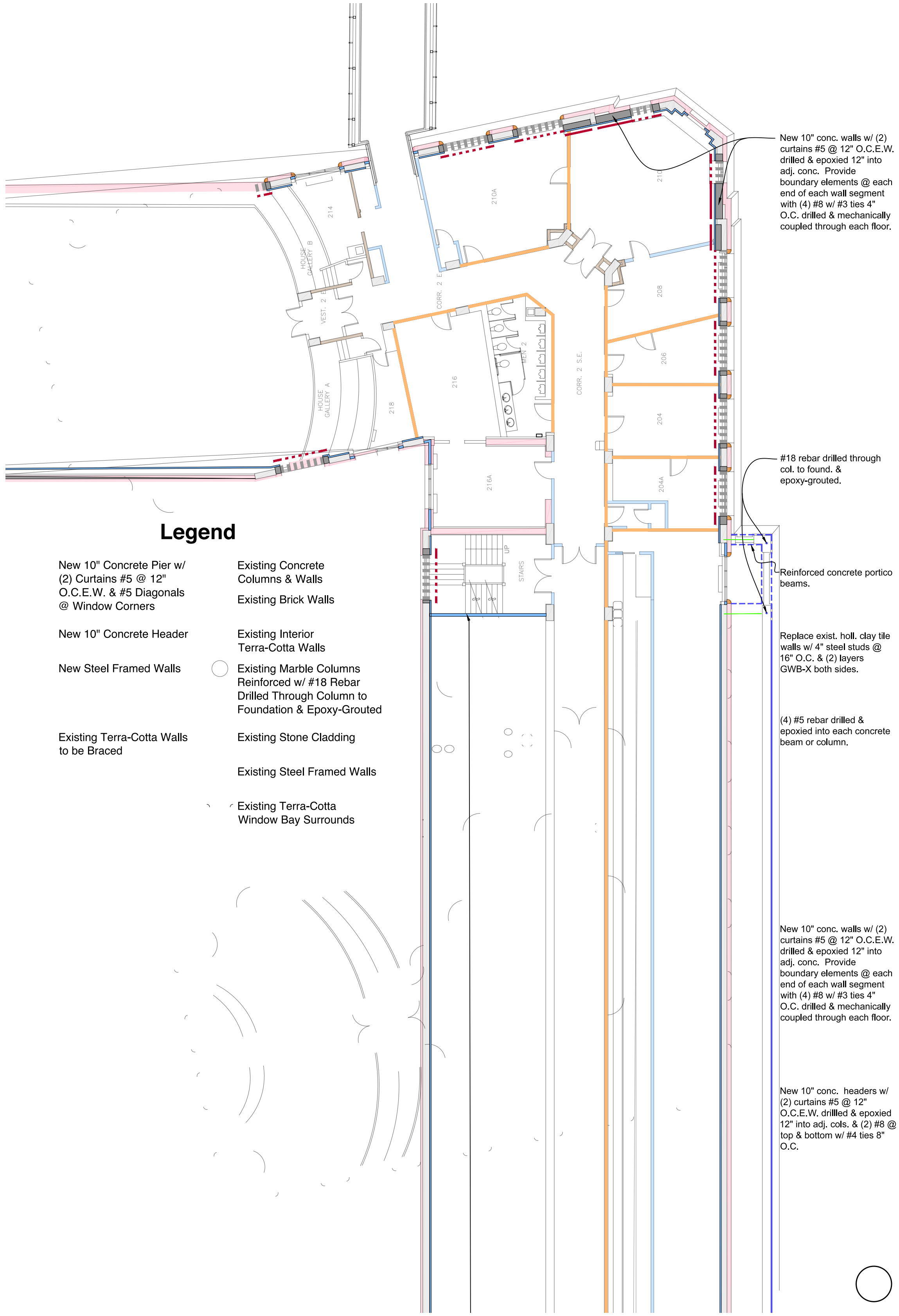


Figure VI-2.1(3): Structural Reinforcing of Building Frame - Floor Level 2

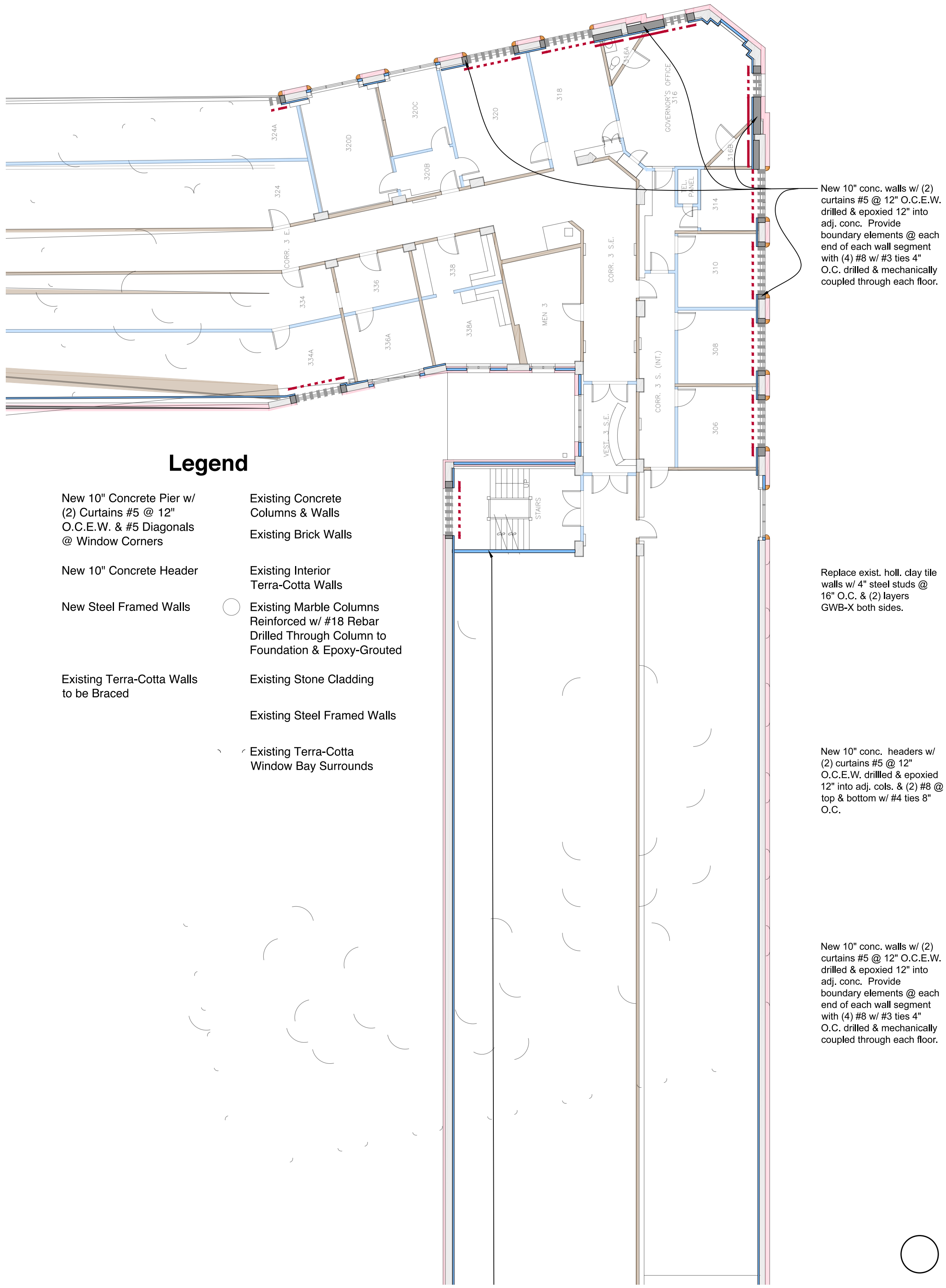


Figure VI-2.1(4): Structural Reinforcing of Building Frame - Floor Level 3

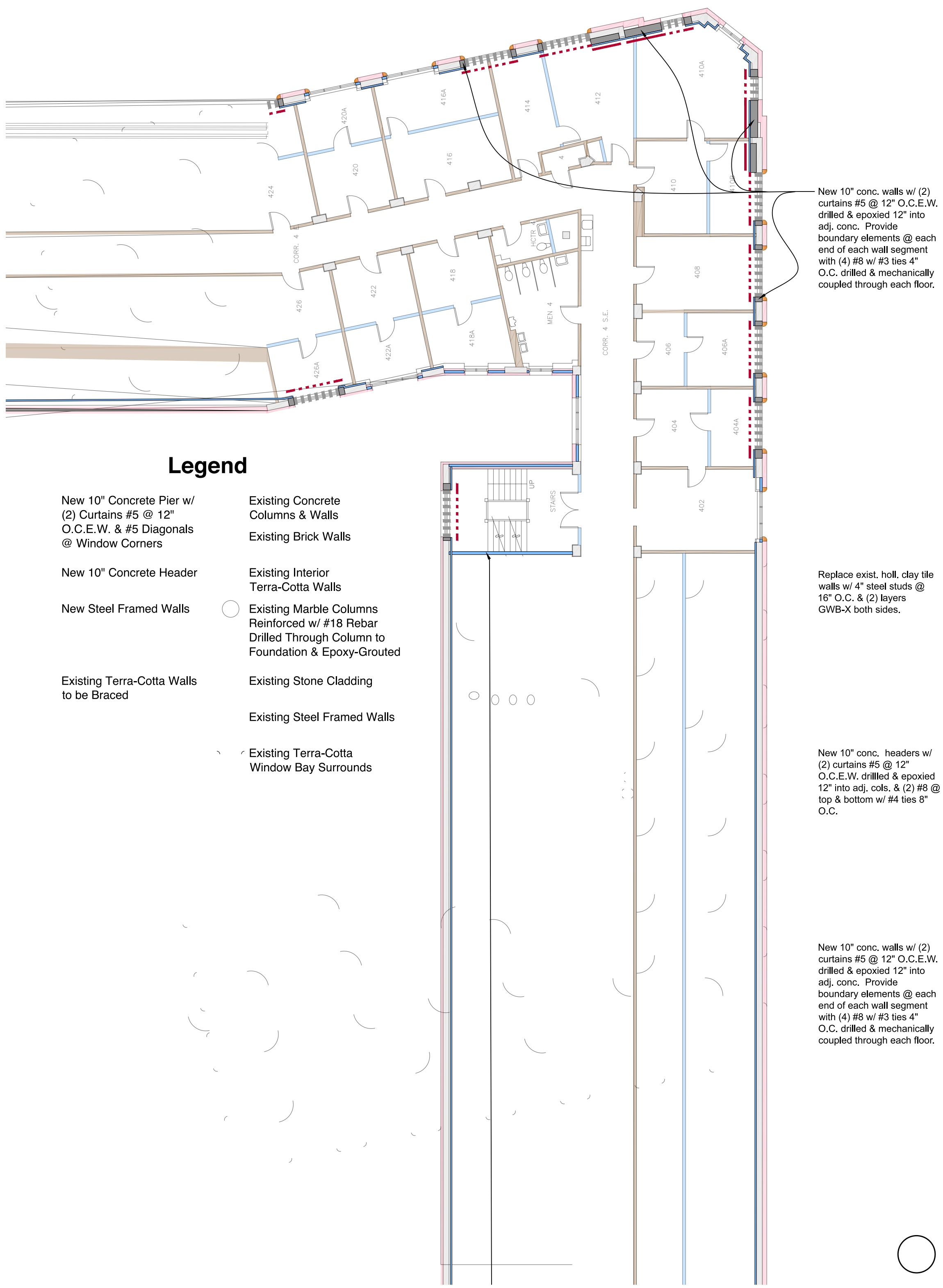


Figure VI-2.1(5): Structural Reinforcing of Building Frame - Floor Level 4

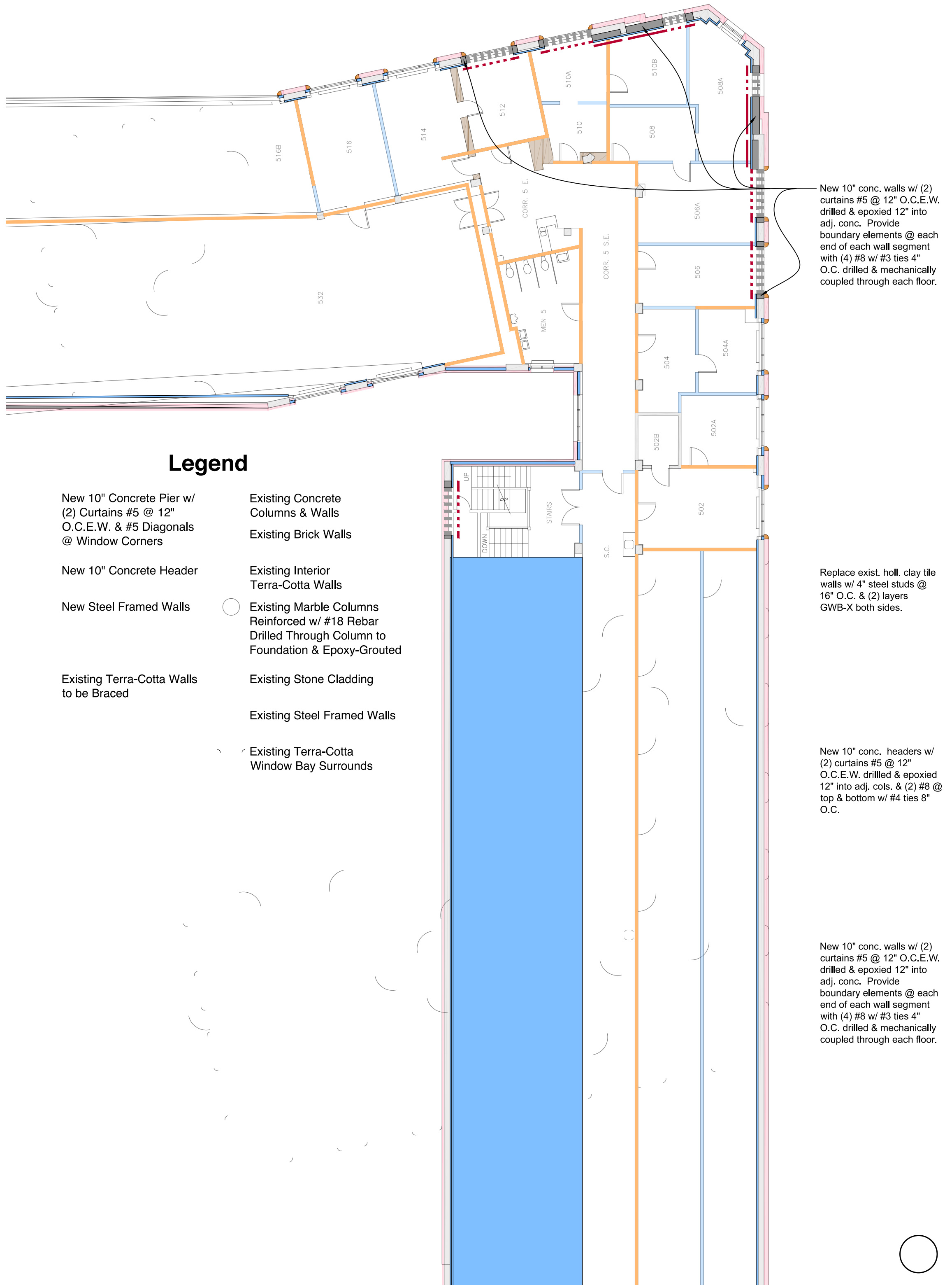


Figure VI-2.1(6): Structural Reinforcing of Building Frame - Floor Level 5

2.2. Foundations

2.2.0 General

This subsection pertains to the building's basic foundation system in general terms. See also section V-3.1: Lowest-Level Crawl Space for related information.

2.2.1 Basis of Recommendations

Please see subsection IV-2.2.1, which applies fully to this Option 3 approach as well.

2.2.2 Recommended Corrective Actions

In most respects, recommended corrective work is very similar to the Option 1 approach, described in greater detail in subsection IV-2.2.2, which applies nearly fully to this Option 3 approach as well.

In brief, the work consists of adding new concrete grade beams and restoring the existing damaged foundations.

In addition, the "experimental" extra corrective approach for the existing damaged foundations, described in detail in subsection IV-2.2.2, consists of several chemical treatments that may prevent or substantially slow further degradation of the foundations.

The existing foundations should be restored as outlined in subsection IV-2.2.2.

The Option 3 work related to the addition of new concrete grade beams is very similar to the corresponding work described for Options 1 and 2. However, as this Option 3 approach reduces concrete shear walls at the upper levels, it ironically requires appreciably more extensive concrete grade beams at the foundation level. Consequently, the new grade beams extend along the entire length of the south wall and also extend farther northward along the building's east and west walls than Options 1 and 2.

The new concrete grade beams should be 12" thick and 84" tall, extending downward 7'-0" from the undersides of the ground-level concrete floor beams.

To limit the destruction of the new grade beams by moisture absorption, as is occurring with the existing foundations, the grade beams should incorporate several measures. First, any reinforcing should be of stainless steel, or hot-dipped galvanized steel as a minimum, to control corrosion. To limit shrinkage cracks and resultant moisture entry, a low shrinkage, low-water concrete mix with polypropylene fiber reinforcing and Kryton KIM admixture should be used.

See Figure VI-2.2(1) for the configuration of these new grade beams.

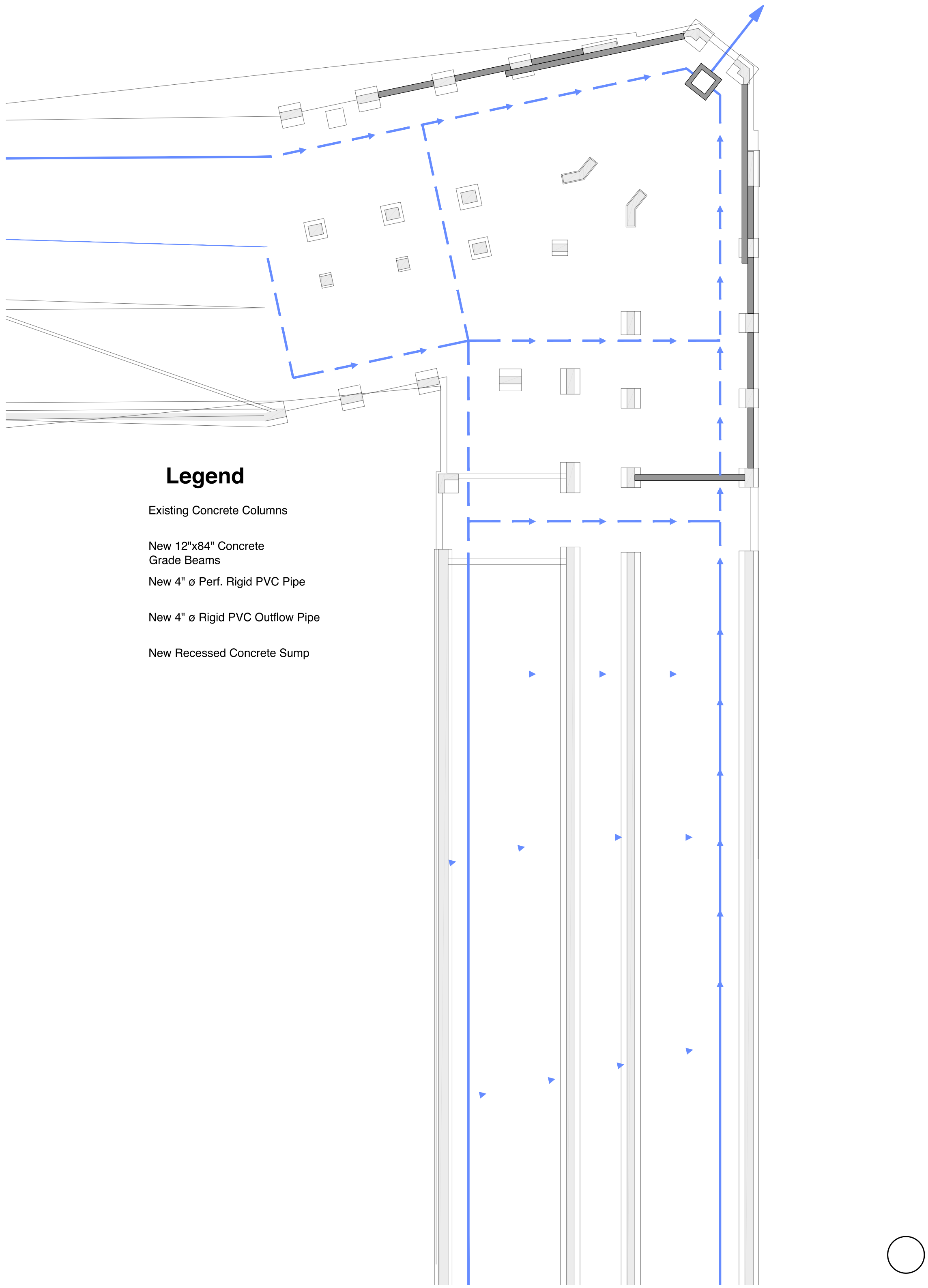


Figure VI-2.2(1): Structural Reinforcing of Foundation System

2.3. Lowest-Level Concrete Floor Framing

2.3.0 General

This subsection pertains to the concrete-framed floor directly above the crawl space.

2.3.1 Basis of Recommendations

Please see subsection IV-2.3.1, which applies fully to this Option 3 approach as well.

2.3.2 Recommended Corrective Actions

Please see subsection IV-2.3.2, which applies fully to this Option 3 approach as well. In brief, this work consists of repairing existing damaged concrete floor joists per subsection IV-2.3.2.

2.4. Level 1 Concrete Floor Slab

2.4.0 General

This subsection pertains to the raised, concrete-framed floor directly above the ground floor level.

2.4.1 Basis of Recommendations

Please see subsection IV-2.4.1, which applies fully to this Option 3 approach as well.

2.4.2 Recommended Corrective Actions

Please see subsection IV-2.4.2, which applies fully to this Option 3 approach as well. In brief, this work consists of injecting existing floor slabs with epoxy per subsection IV-2.4.2.

2.5. Brick Chimney

2.5.0 General

This subsection pertains to the relatively tall brick chimney above the main roof, near the inside corner where the west wing joins the main portion of the building.

2.5.1 Basis of Recommendations

Please see subsection IV-2.5.1, which applies fully to this Option 3 approach as well.

2.5.2 Recommended Corrective Actions

Please see subsection IV-2.5.2, which applies fully to this Option 3 approach as well. In brief, this work consists of shortening the chimney, casting a new concrete cap atop it, installing new flashings, and over-cladding the chimney with a new metal cladding, per subsection IV-2.5.2.

2.6. Securement of Large Masonry Cladding Elements

2.6.0 General

This subsection pertains to the securement of the various masonry elements to the primary structure. These are also discussed in subsequent subsections in greater detail.

2.6.1 Basis of Recommendations

Please see subsection IV-2.6.1, which applies fully to this Option 3 approach as well.

2.6.2 Recommended Corrective Actions

In general, this Option 3 approach involves construction of a new masonry veneer, so essentially all exterior elements will be new, and will be anchored as outlined in other subsections of this Part. No specific work is included in this subsection for this Option 3 approach.

2.7. Interior Hollow Clay Tile Walls

2.7.0 General

This subsection pertains to the interior partition walls comprised of hollow clay tile.

2.7.1 Basis of Recommendations

Please see subsection IV-2.7.1, which applies fully to this Option 3 approach as well.

2.7.2 Recommended Corrective Actions

Please see subsection IV-2.7.2, which applies fully to this Option 3 approach as well. In brief, this work consists of bracing the existing walls per subsection IV-2.7.2 and Figures IV-2.7(1-7).

2.8. Large Mechanical Equipment

2.8.0 General

This subsection pertains to various pieces of large mechanical equipment, such as the boiler.

2.8.1 Basis of Recommendations

Please see subsection IV-2.8.1, which applies fully to this Option 3 approach as well.

2.8.2 Recommended Corrective Actions

Please see subsection IV-2.8.2, which applies fully to this Option 3 approach as well. In brief, this work consists of bolting floor-mounted equipment to the floor slabs and bracing large suspended plumbing lines, per subsection IV-2.8.2.

3. PRIMARY EXTERIOR ENCLOSURE ASSEMBLIES & ELEMENTS

3.0. General

This section of the report addresses issues related to the building's primary exterior elements, such as wall assemblies, ground-level floor slabs, windows, roofs, and similar major components. It is divided into 14 subsections, each of which pertains to a specific primary element. Where appropriate, each subsection contains preliminary drawings depicting the described work. In addition, Figures VI-3.0(1-7) show the exterior elevations which reference the locations of specific details in the various subsections.

Fig. VI-3.0(1): South Elevation

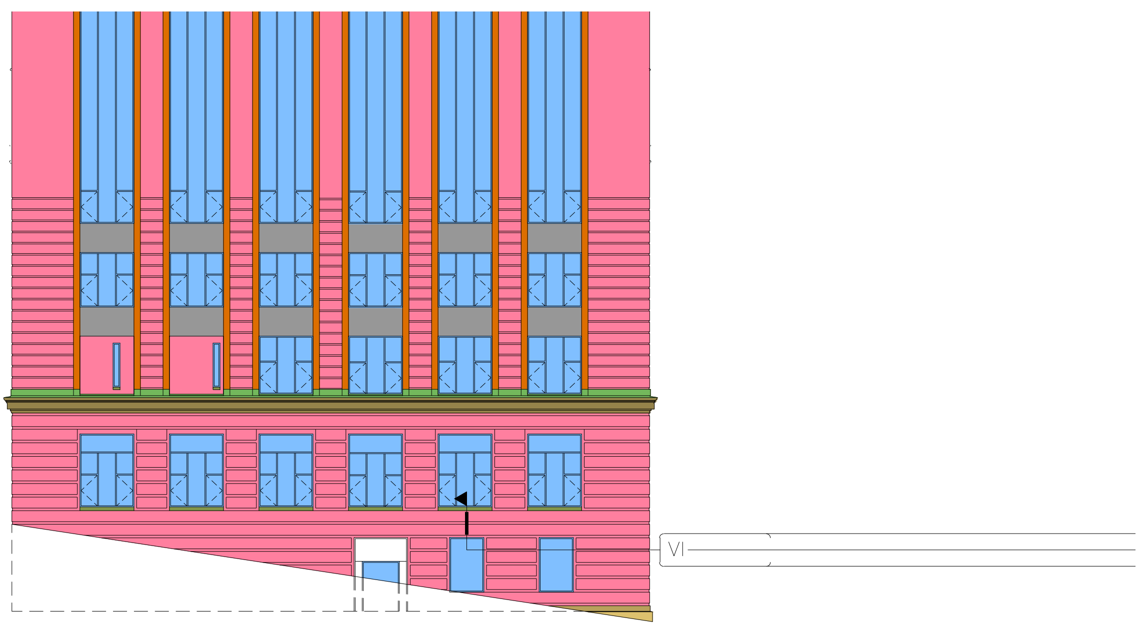


Fig. VI-3.0(2): West Elevation

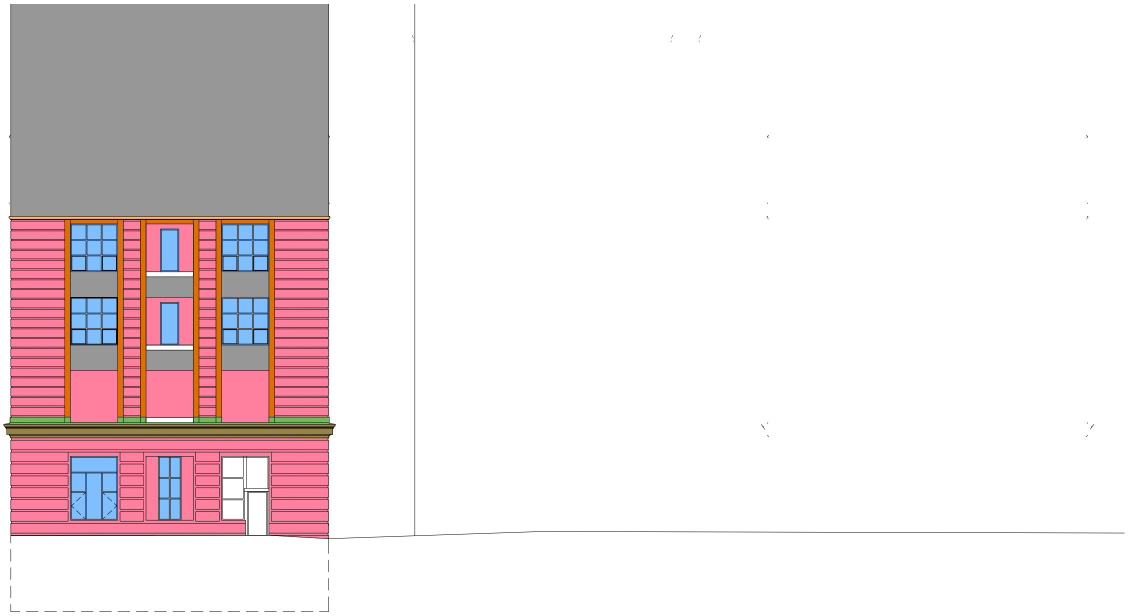


Fig. VI-3.0(3): North Elevation

Fig. VI-3.0(4): North Courtyard: West-Facing Wall

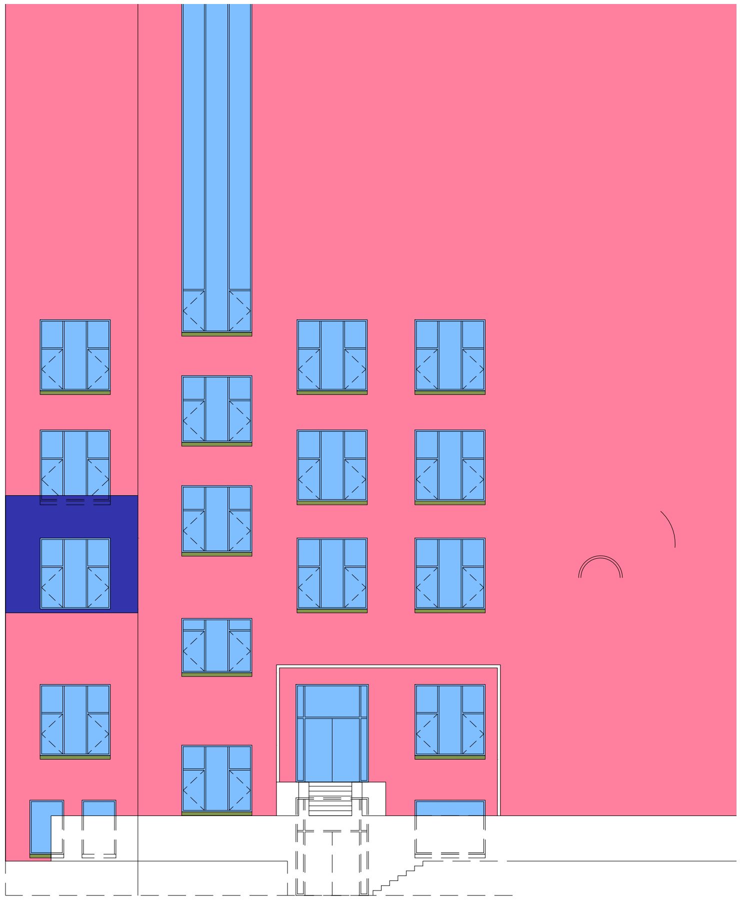


Fig. VI-3.0(5): North Courtyard: North-Facing Wall

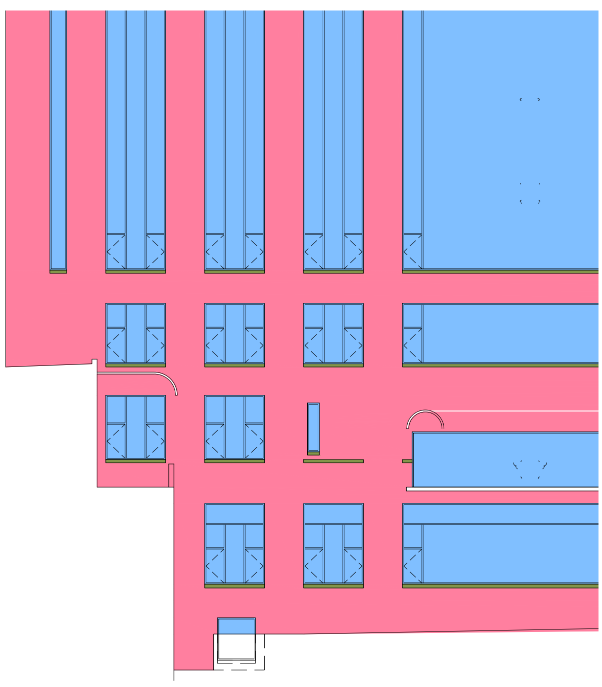


Fig. VI-3.0(6): North Courtyard: East-Facing Wall

Fig. VI-3.0(7): East Elevation

3.1. Lowest-Level Crawl Space

3.1.0 General

This subsection pertains to the crawl space located under the building's main body and under the southerly portions of both north-extending wings, in general terms.

3.1.1 Basis of Recommendations

Please see subsection IV-3.1.1, which applies fully to this Option 3 approach as well.

3.1.2 Recommended Corrective Actions

Please see subsection IV-3.1.2, which applies fully to this Option 3 approach as well. Please see also subsections IV-2.2 and IV-2.3 for related corrective measures not described here.

In brief, this work consists of the installation of a gravity-fed drainage system and soil-capping with a cross-laminated vapor-barrier as part of the Base Bid, as well as optional capping with a 2" thick, fiber-reinforced shot-crete "slab" to help protect the vapor barrier and further reduce humidity. See Figures IV-3.1(1 & 2).

3.2. Concrete On-Grade Floor Slabs

3.2.0 General

This subsection pertains to the on-grade concrete floor slabs that occur at the base of the northern portions of both north-extending wings.

3.2.1 Basis of Recommendations

Please see subsection IV-3.2.1, which applies fully to this Option 3 approach as well.

3.2.2 Recommended Corrective Actions

Please see subsection IV-3.2.2, which applies fully to this Option 3 approach as well.

In brief, this work consists of injecting all accessible floor cracks and the perimeter of the shop slab where it joins the basement walls with epoxy.

3.3. Concrete Sub-Grade Walls

3.3.0 General

This subsection pertains to several sub-grade concrete walls that occur primarily at the base of the northern portions of both north-extending wings.

3.3.1 Basis of Recommendations

Please see subsection IV-3.3.1, which applies fully to this Option 3 approach as well.

3.3.2 Recommended Corrective Actions

Please see subsection IV-3.3.2, which applies fully to this Option 3 approach as well.

In brief, no work related to these walls is recommended at the west wing's sub-grade walls.

At the east wing's sub-grade walls, this work consists of selective removal of interior finishes at locations of apparent leakage, injecting all wall cracks and cold joints with epoxy, treatment of rock pockets and similar flaws with crystalline waterproofing, and replacement of finishes.

3.4. Stone-Clad Exterior Wall Base

3.4.0 General

This subsection pertains to the lowest-level stone base along the south elevation, which extends from grade up to a projecting stone water table, which separates it from the cladding above.

3.4.1 Basis of Recommendations

Please see subsection IV-3.4.1, which applies fully to this Option 3 approach as well.

3.4.2 Recommended Corrective Actions

Please see subsection IV-3.4.2, which applies fully to this Option 3 approach, except that the stone cladding above the base will be removed in Option 3, rather than stabilized as in Option 1.

In brief, the work consists of replacement of this band with a pre-cast concrete cladding per subsection IV-3.4.2. As subsection IV-3.4.2 described the stabilization of the stone cladding above this, rather than its removal, Figure VI-3.4(1) depicts the Option 3 work.

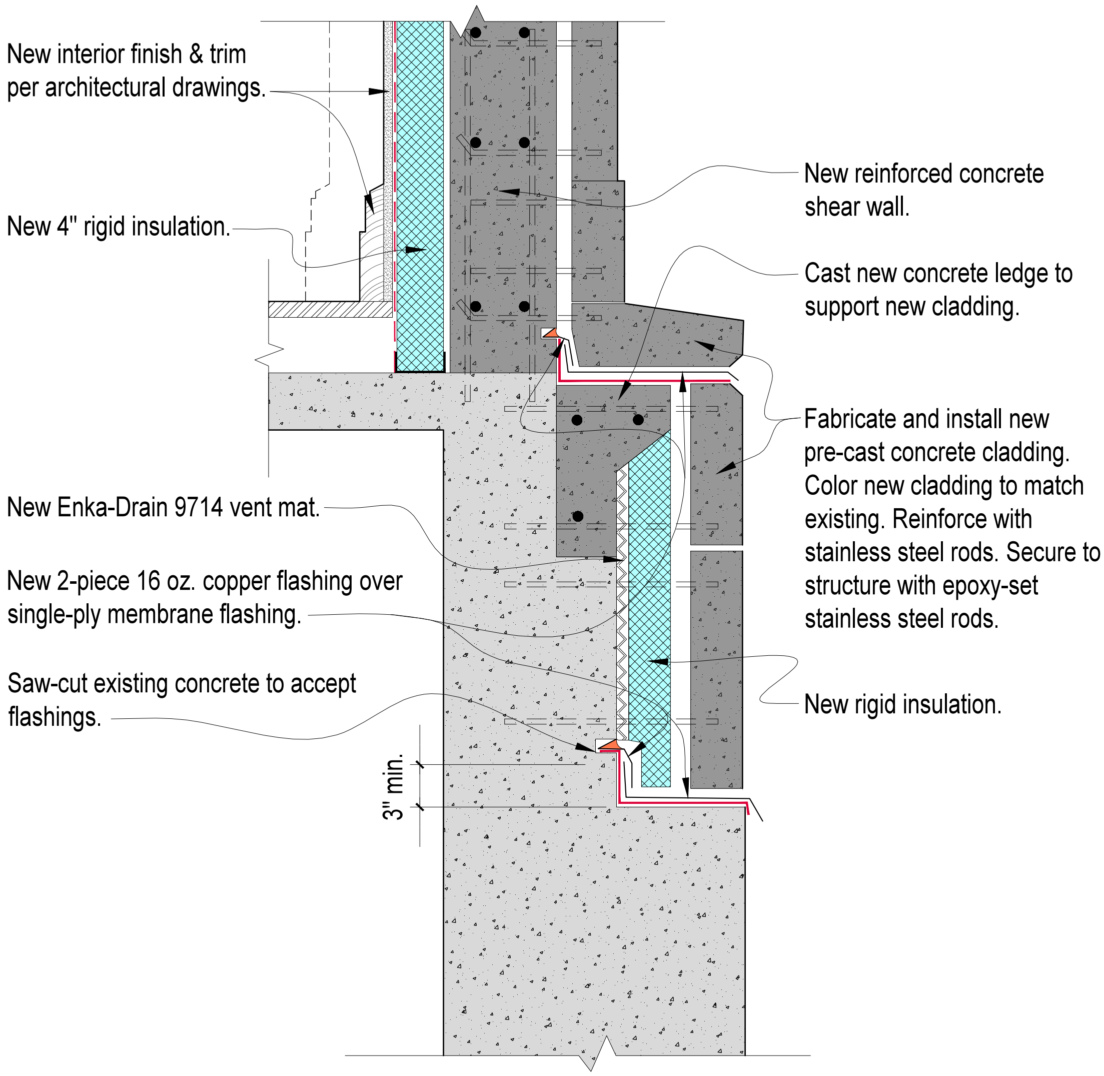


Fig. VI-3.4(1): Stone Base Replacement with Replacement of Cladding Above

3.5. Stone-Clad Exterior Walls Along Bottom 2 Levels

3.5.0 General

This subsection pertains to the stone-clad walls directly above the stone base addressed in subsection VI-3.4. While this cladding is contiguous with and similar to the cladding below the portico, the portico-related cladding is addressed separately in subsection VI-5.3.

3.5.1 Basis of Recommendations

Please see subsection IV-3.5.1, which applies fully to this Option 3 approach as well.

3.5.2 Recommended Corrective Actions

Please see subsection V-3.5.2, which largely applies to this Option 3 approach as well.

In brief, the work consists of replacement of this cladding with a pre-cast concrete cladding per subsection V-3.5.2. See Figure V-3.5(1), which is repeated below for convenience as Figure VI-3.5(1).

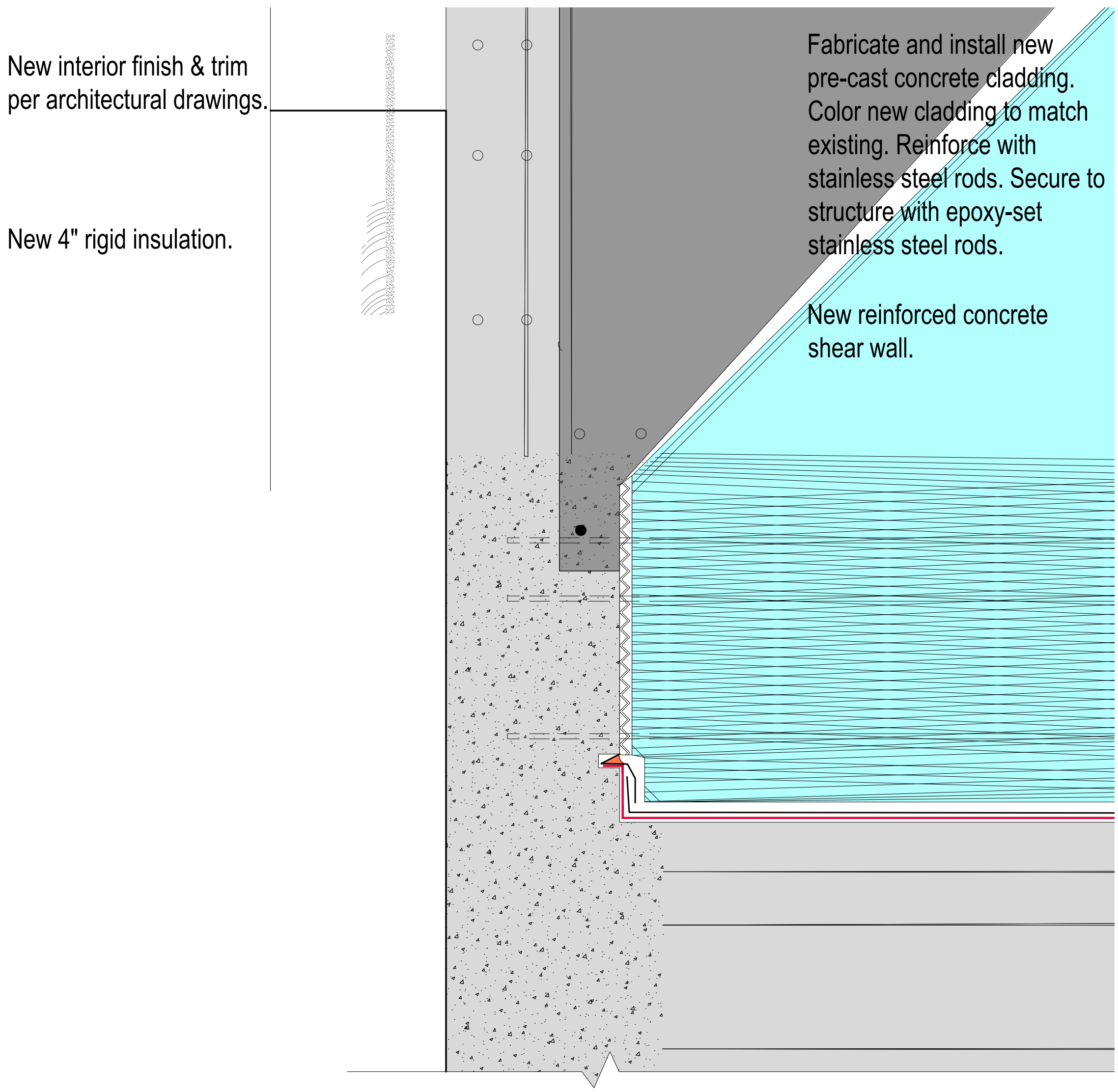


Fig. VI-3.5(1): Stone Cladding Replacement

3.6. Brick-Clad Exterior Public Façade Walls, All Levels

3.6.0 General

This subsection pertains to the brick-clad exterior walls at all floor levels and at all of the building's "public" façades, including its south, east, and west elevations, and the north elevations of its east and west wings. Elements integral to these walls, such as steel lintels above the windows, are also addressed here.

3.6.1 Basis of Recommendations

Please see subsection IV-3.6.1, which applies fully to this Option 3 approach as well.

3.6.2 Recommended Corrective Actions

In general, the work is exactly per the Option 2 approach where concrete back-up walls occur, and is not repeated here for these walls. Please follow recommendations of subsection V-3.6.2.

Where steel-framed interior walls are to occur, the work also begins with removal of all existing interior finishes, the hollow clay tile, and all exterior masonry to expose the existing concrete building frame.

After the new concrete walls, piers, and headers are cast per subsection IV-2.1.1, new framed walls are built between the concrete wall elements. Specifically, the assembly, exterior-to-interior, consists of the brick veneer placed over a ¾" drain mat, such as Enka-Drain 9120, over 4" rigid insulation, over 3/16" vent-mat, such as Enka-Drain 9714, over 2-layer building wrap, over 5/8" exterior gypsum sheathing, over 6" deep, 16-gage steel studs spaced 16" apart. Batt or rigid insulation can be used within the framing cavities. The interior face of the framing would receive a 6-mil cross-laminated vapor barrier, and 5/8" gypsum wallboard.

Galvanized steel ledgers are secured along all floor lines where needed to support the new brick veneer along each floor level.

The ledgers and the existing protruding concrete lugs are flashed with a double-layer flashing assembly of self-adhered flashing membrane capped with 26-gage stainless steel flashings where fully concealed, and with 16 oz. copper flashings where these become exposed to view.

New stainless steel veneer anchor channels, such as Dur-O-Wal DA904, are fastened to the framed walls, located over and secured to the wall studs, thus spaced 16" apart horizontally. Stainless steel veneer anchors, such as Dur-O-Wal DA931, are clipped into the channel slots, spaced 18" apart vertically. A thicker drain mat, such as Enka-Drain 9120, is placed over the insulation, fabric-side facing outward, to limit mortar clogging.

A new brick veneer is installed over this, largely to match the existing appearance, but with greatly reduced offsets and with concave-tooled mortar joints to limit water infiltration into the masonry. Horizontal 9-gage stainless steel wire seismic joint reinforcing is embedded within the horizontal joints spaced 18" apart vertically.

With respect to the veneer's specific configuration and brick types, recommendations of subsection V-3.6 should be followed, to limit water-catching recesses, and use a robust brick type.

The new masonry should be cleaned and sealed with a penetrating water repellent, such as ProSoCo Weather-Seal Siloxane.

Figure VI-3.6(1) shows a typical exterior detail where it occurs over the existing embedded concrete columns. Figure VI-3.6(2) shows a comparable detail at the framed walls.

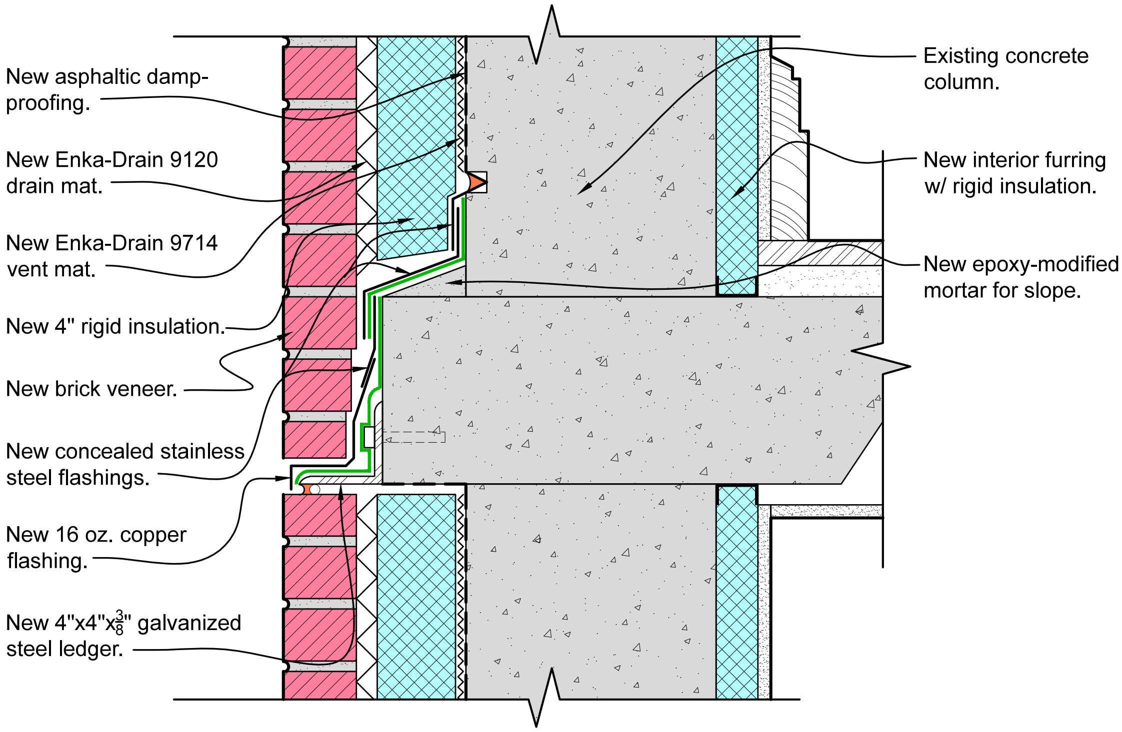


Figure VI-3.6(1): Typ. New Brick Veneer Over Exist. Concrete Column- Opt. 2 & 3

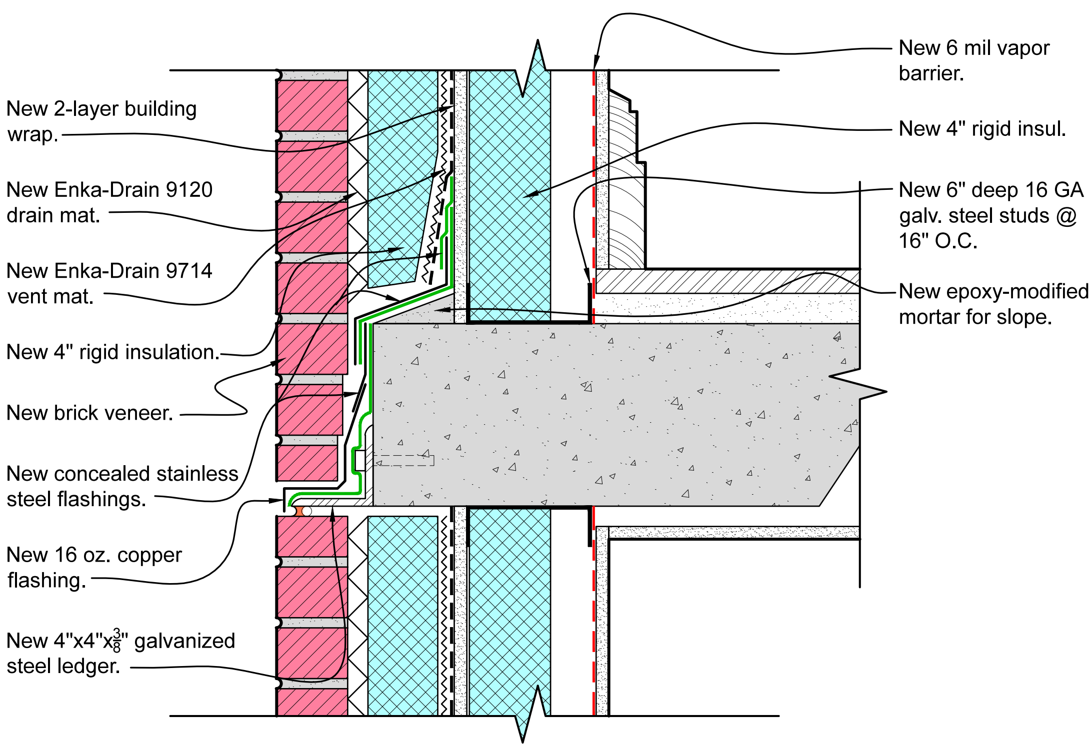


Figure VI-3.6(2): Typ. New Brick Veneer Over New Steel-Framed Wall- Opt. 3 Only

3.7. Terra-Cotta-Clad Exterior Walls at Levels 2-4

3.7.0 General

This subsection pertains to the terra-cotta exterior wall panels that occur between windows at floor levels 2-4 at the building's south, east, west, and north "public" façades.

3.7.1 Basis of Recommendations

Please see subsection IV-3.7.1, which applies fully to this Option 3 approach as well.

3.7.2 Recommended Corrective Actions

To a very large extent, the work is identical to the work of Option 2, as described in subsection V-3.7.2, and is not repeated here in detail. This approach differs from Option 2 in that rather than having concrete back-up walls behind the terra-cotta, these would typically consist of steel stud-framed walls with gypsum sheathing. This approach also replaces the terra-cotta panels with color-matched pre-cast concrete ones.

Since the existing terra-cotta wall panels are recessed inward of the abutting brick, the exterior cavity behind the new pre-cast concrete wall panels does not accommodate exterior rigid insulation, and most of the wall insulation is placed within the framing cavities. However, to both limit the shadowing effect, wherein studs become visible through the wallboard over time, and slow rapid heat loss via the metal studs, I recommend that horizontal furring, spaced 16" O. C., be applied over the interior faces of the steel studs to allow at least ¾" of rigid insulation to be fitted between them. This can be achieved with wood 1 x 3 furring, Z-girts, etc.

Figure VI-3.7(1) shows a generic detail for these steel-framed wall portions.

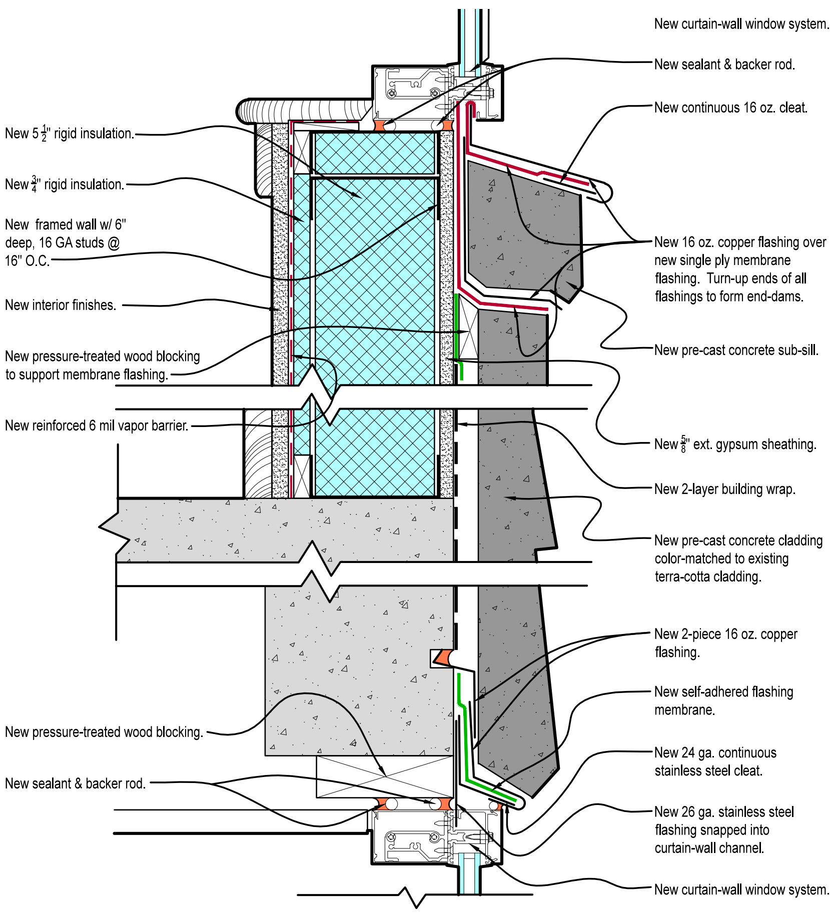


Fig. VI-3.7(1): Replacement of Terra-Cotta Panels With Pre-Cast Concrete Panels

3.8. North Courtyard Walls, Brick-Clad

3.8.0 General

This subsection pertains to the brick-clad exterior walls wrapping the north courtyard, but excludes the stairwell walls. Elements integral to these walls, such as steel lintels above the windows, are also addressed here.

3.8.1 Basis of Recommendations

Please see subsection IV-3.8.1, which applies fully to this Option 3 approach as well.

3.8.2 Recommended Corrective Actions

Recommended work at these walls is essentially identical to the corresponding work of subsection V-3.8.2, and is not repeated here. Please see subsection V-3.8.2 for most information.

The Option 3 approach for these walls differs from Option 2 only in that where new concrete walls are not needed for shear capacity, new back-up walls consisting of 6" deep, 16-gage steel studs spaced 16" O. C. are installed, also 4" inward of the outer concrete faces. These framed walls would have 5/8" exterior gypsum sheathing installed on the exterior stud faces, with a 2-layer building wrap over this. Enka-Drain 9714 vent mat is applied over this, followed by 4" rigid insulation. Over this, Enka-Drain 9120 drain mat is placed, fabric side facing outward. The brick veneer, per subsection V-3.6.2, is installed over this. To minimize heat loss and risk of shadowing, horizontal 1 x 3 wood or similar furring, spaced 16" O. C., is screwed to the interior framing faces, and ¾" rigid insulation is fitted between the furring. Finally, a reinforced, 6-mil vapor barrier and interior finishes are installed over this.

In all other regards, the work should follow recommendations of subsection V-3.8.2.

3.9. North Stairwell Walls, Brick & Stucco-Clad

3.9.0 General

This subsection pertains to the brick-clad exterior walls wrapping the stairwell in the courtyard.

3.9.1 Basis of Recommendations

Please see subsection IV-3.9.1, which applies fully to this Option 3 approach as well.

3.9.2 Recommended Corrective Actions

In most respects, recommended work at these walls is identical to the work recommended for the other courtyard walls, as described in subsection VI-3.8.2, and is not repeated here in detail.

This work also begins with the removal of all existing interior finishes, the hollow clay tile, and all exterior masonry to expose the existing concrete building frame.

New 10" thick concrete walls, piers, and headers are cast between existing concrete columns at the stairwell's north wall, per subsection VI-2.1.2, flush with the outer concrete column faces. At the stairwell's east and west exterior walls, new steel-framed walls of 16-gage steel studs spaced 16" O. C. with 5/8" exterior gypsum sheathing are constructed between the existing concrete columns. All exterior concrete faces are then coated with an asphaltic damp-proofing, while the steel-framed walls are covered with a 2-layer building wrap.

Galvanized steel ledgers are secured along all floor lines where needed to support the new brick veneer along each floor level.

The ledgers are flashed with a double-layer flashing assembly of self-adhered flashing membrane capped with 26-gage stainless steel flashings where fully concealed, and with 16 oz. copper flashings where these become exposed to view.

New stainless steel veneer anchor channels, such as Dur-O-Wal DA904, are fastened to the concrete or framed walls, spaced 16” apart horizontally, and vertically continuous.

A thin vent mat, such as Enka-Drain 9714, is placed against the damp-proofed concrete walls and over the exterior building wraps on the framed walls, and 4” thick extruded polystyrene insulation, such as Dow Board, is placed against this. Stainless steel veneer anchors, such as Dur-O-Wal DA931, are clipped into the channel slots, spaced 18” apart vertically. A thicker drain mat, such as Enka-Drain 9120, is placed over the insulation, fabric-side facing outward, to limit mortar clogging.

A new masonry veneer, consisting of ASTM C-216 face brick, Grade SW, is installed over this, largely to match the existing appearance. Horizontal 9-gage stainless steel wire seismic joint reinforcing is embedded within the horizontal joints spaced 18” apart vertically.

The new masonry should be cleaned and sealed with a penetrating water repellent, such as ProSoCo Weather-Seal Siloxane.

In contrast to the Option 1 approach, the uppermost, stucco-clad wall band would also be replaced with this new brick veneer, rather than a metal cladding.

This approach would also require new galvanized steel ledgers directly above the abutting low roofs, with through-wall flashings, to drain water from behind the brick veneer over these roofs.

Similarly, new galvanized steel ledgers would be needed to support the brick veneer above the newly retrofitted cornice. These ledgers would also be flashed with a double-layer through-wall flashing to drain water from behind the brick veneer over the cornice cap.

Finally, this work would also require new sheet metal copings at the stairwell roof parapets. The existing EPDM membrane would be extended over the new parapet tops over continuous 24-gage stainless steel cleats, and new 16 oz. copper copings would secure over this.

Detailing around windows would be similar to Figure V-3.8(1).

3.10. Brick Chimney

3.10.0 General

This subsection pertains to the relatively tall brick chimney above the main roof, near the inside corner where the west wing joins the main portion of the building. As the “structural” and “weather-integrity” issues affecting this chimney are intricately related and inseparable, all recommendations related to this chimney are addressed holistically in section VI-2.5. The sole purpose of section VI-3.10 is to refer the reader to section VI-2.5 for both “structural” and “weathering” information.

3.11. North Courtyard Walls, Metal-Clad

3.11.0 General

This subsection pertains to two small wall portions on the building’s north side, one to each side of the stair tower, at floor level 2. These walls were not part of the building’s original construction.

3.11.1 Basis of Recommendations

Please see subsection IV-3.11.1, which applies fully to this Option 3 approach as well.

3.11.2 Recommended Corrective Actions

Please follow recommendations of subsection IV-3.11.2, which apply fully to this Option 3 approach as well.

3.12. Windows

3.12.0 General

This subsection pertains to all exterior windows.

3.12.1 Basis of Recommendations

Please see subsection IV-3.12.1, which applies fully to this Option 3 approach as well.

3.12.2 Recommended Corrective Actions

Please follow recommendations of subsection IV-3.12.2, which apply to this Option 3 approach as well.

In brief, the work consists of complete replacement of all windows with a new curtain-wall system with operable sashes integrated as needed to match the current window configurations.

Figure VI-3.12(1) depicts typical window installation details above and below the new pre-cast concrete panels, and represents most conditions on this building.

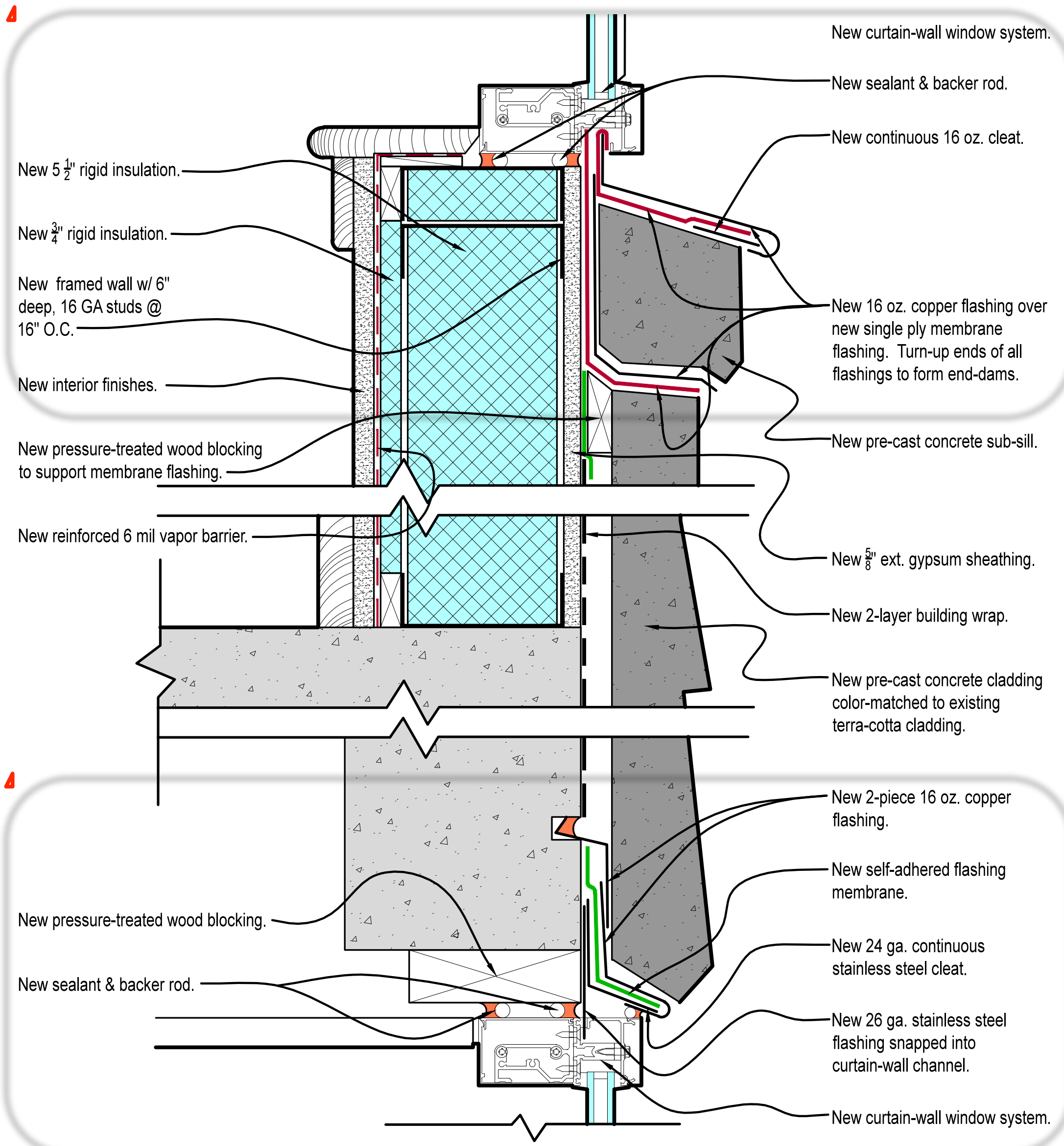


Fig. VI-3.12(1): Window Head & Sill Installation at Typical Cladding Panel Loc.

3.13. Roofs

3.13.0 General

This subsection pertains to four roof areas, including the large main roof, a small roof atop the stair-tower, and two small roof areas atop the metal-clad additions on the building's north side. The portico roof is addressed separately with the portico in subsection V-5.6.

3.13.1 Basis of Recommendations

Please see subsection IV-3.13.1, which applies fully to this Option 3 approach as well.

3.13.2 Recommended Corrective Actions

Please follow recommendations of subsection IV-3.13.2, which apply to this Option 3 approach as well.

4. EXTERIOR MASONRY SUB-ELEMENTS

4.0. General

This section of the report addresses issues related to the various exterior masonry sub-elements, such as the stone and terra-cotta water tables, stone window sills, marble panels, etc. It is divided into 8 subsections, each of which pertains to a specific primary element. Where appropriate, each subsection contains preliminary drawings depicting the described work. In addition, Figures VI-4.0(1-7) show the exterior elevations which reference the locations of specific details in the various subsections.

Fig. VI-4.0(1): South Elevation

Fig. VI-4.0(2): West Elevation

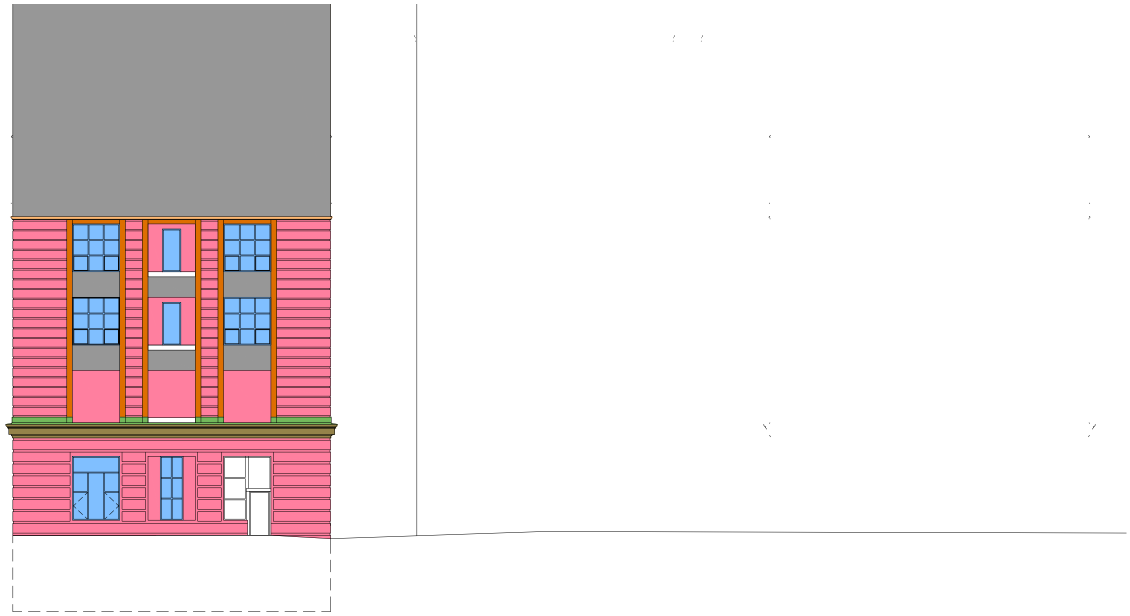


Fig. VI-4.0(3): North Elevation

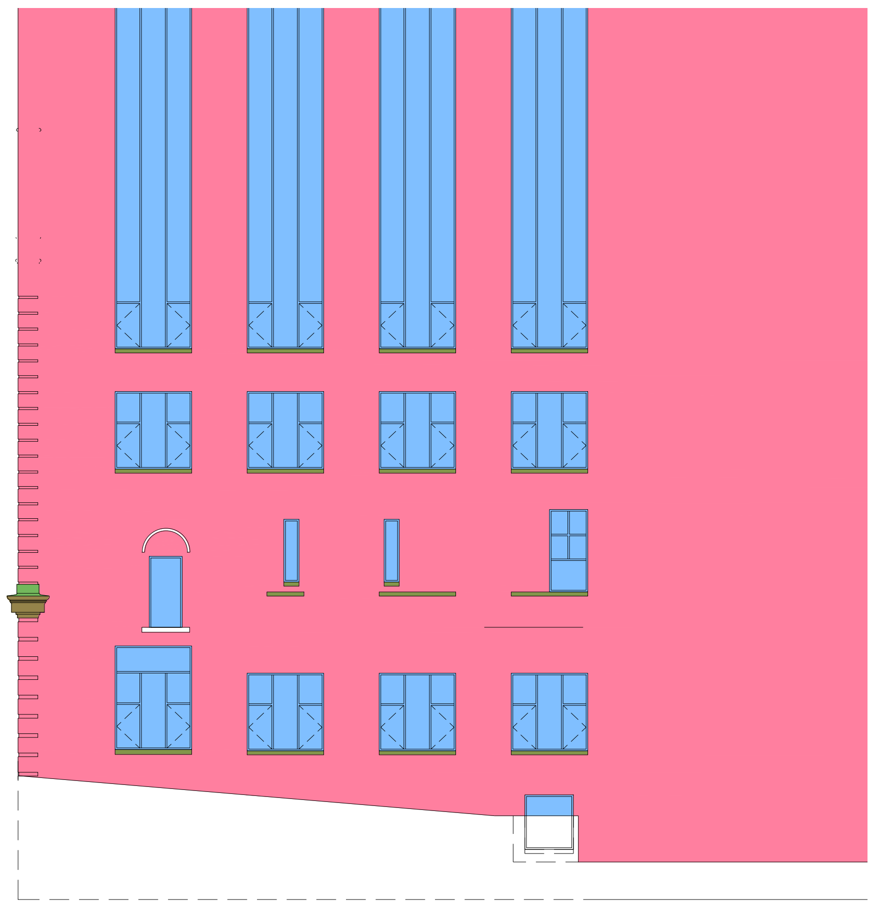


Fig. VI-4.0(4): North Courtyard: West-Facing Wall

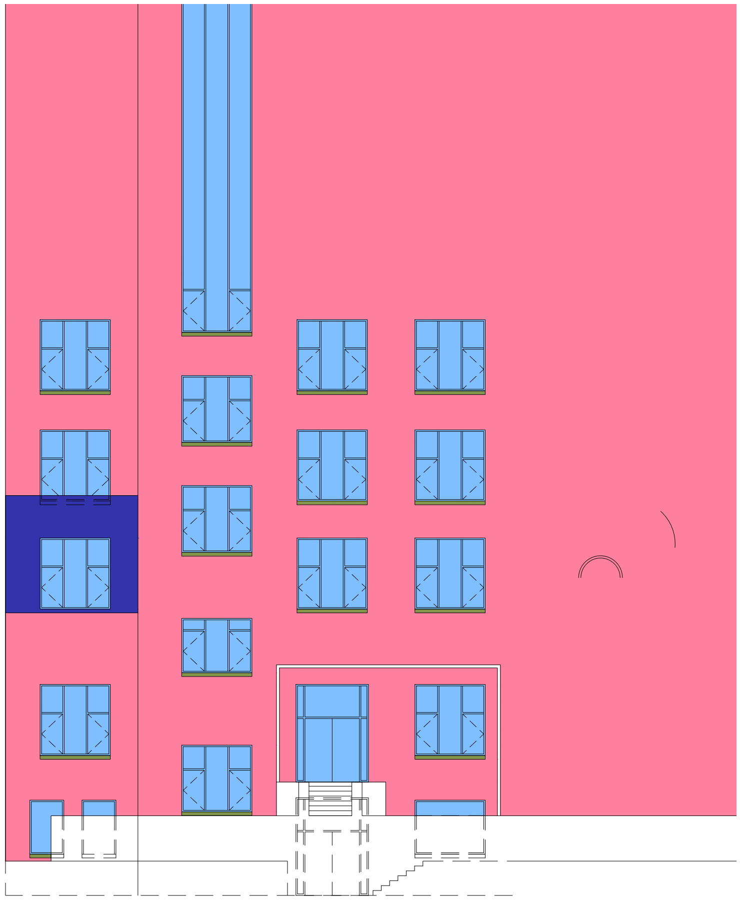


Fig. VI-4.0(5): North Courtyard: North-Facing Wall

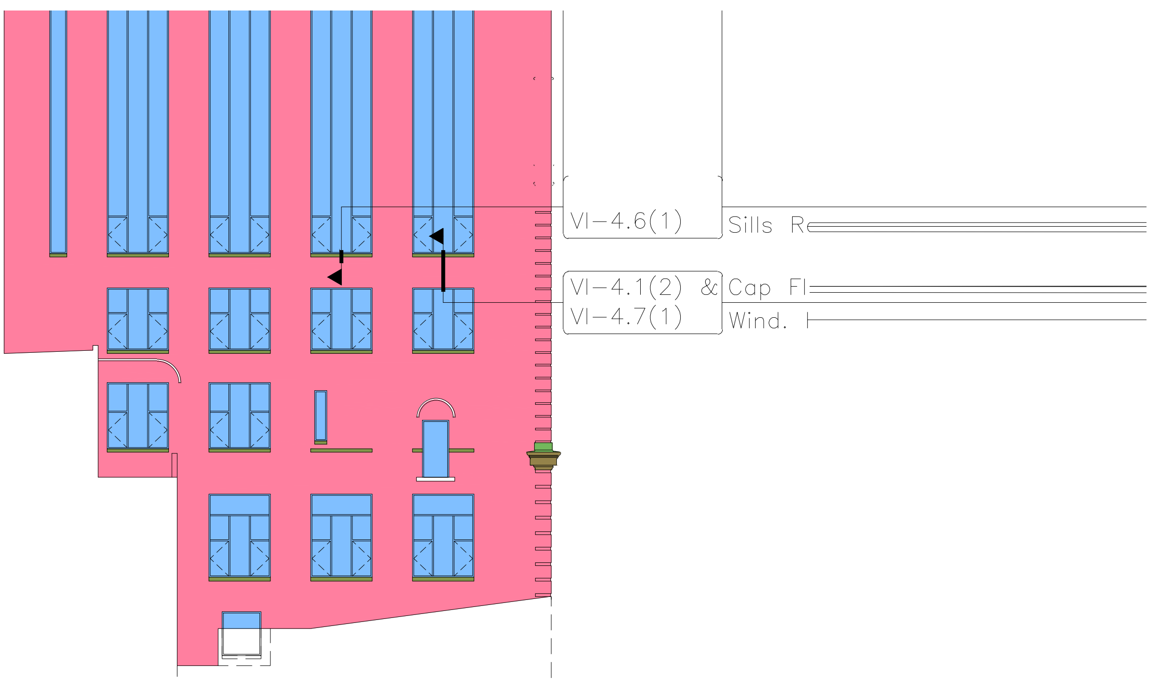


Fig. VI-4.0(6): North Courtyard: East-Facing Wall

Fig. VI-4.0(7): East Elevation

4.1. Lower Stone Water Table at Level 2

4.1.0 General

This subsection pertains to the stone water table that extends at level 2 around the building's more public façades on the west, south, east, and north sides, but not in the north courtyard.

4.1.1 Basis of Recommendations

Please see subsection IV-4.1.1, which applies fully to this Option 3 approach as well.

In addition, please note that although the existing water table could be restored and reused in this approach, it would need to be removed to allow other work to proceed, and it would probably be less costly, as well as technically preferable, to replace this water table with a new, pre-cast concrete one, generally similar to the proposed new cornice.

4.1.2 Recommended Corrective Actions

Replacement of this water table with a pre-cast concrete one is recommended. Figure VI-4.1(1) depicts the general scope of this work where the water table occurs by an existing or new concrete column or wall, which represents most conditions on the building. The work would be nearly identical where new steel-framed walls occur, except the specific integration of the through-wall flashing with the back-up wall would be slightly different, and this flashing would lap under the 2-layer building wrap over the exterior gypsum sheathing. Where window sills occur, the flashing cap atop the water table would integrate with the new curtain-wall window system, generally as shown in Figure VI-4.1(2).

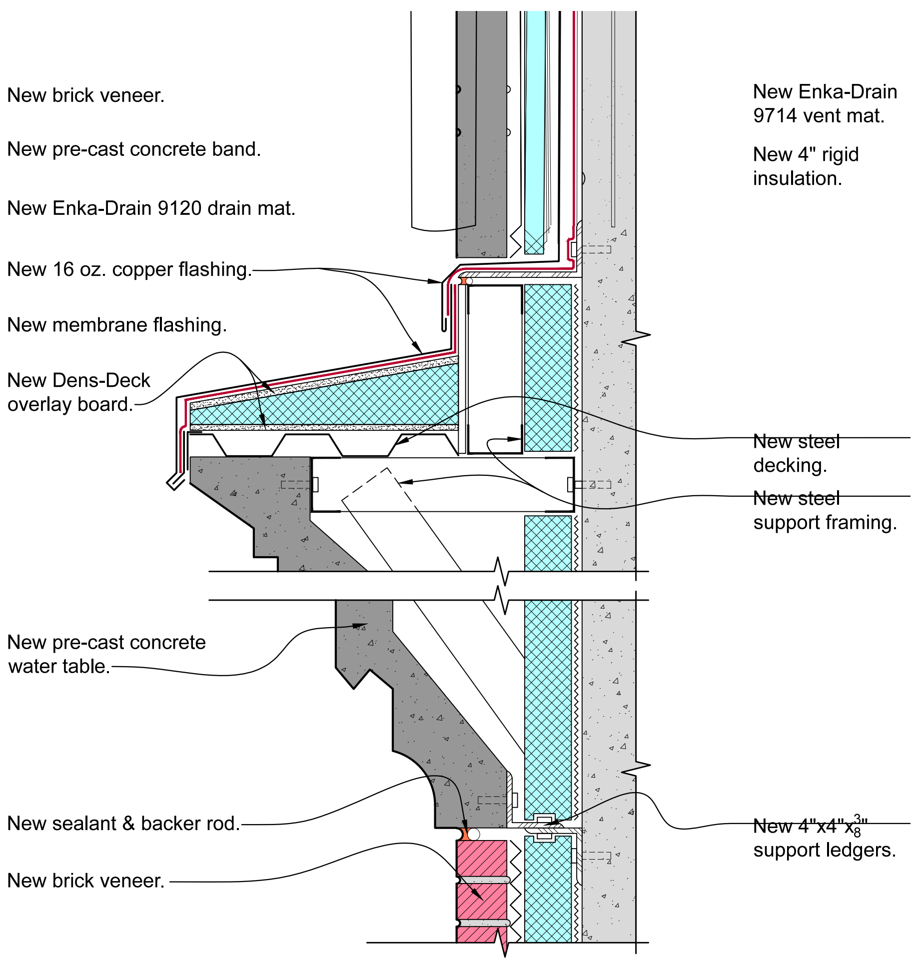


Fig. VI-4.1(1): Water Table Reconstruction

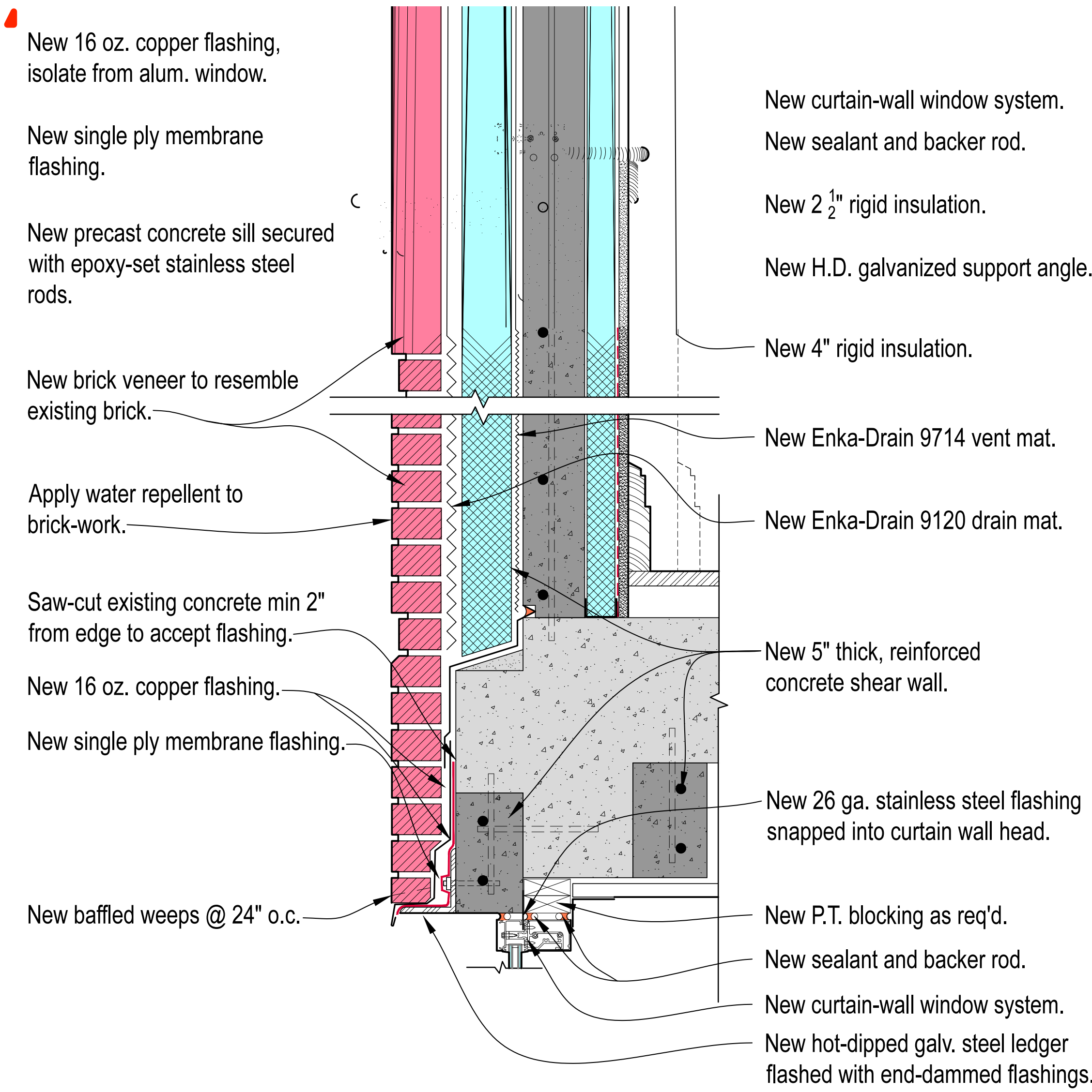


Fig. VI-4.1(2): Integration of Water Table Cap Flashing with Window Sills

4.2. Terra-Cotta Window Bay Surrounds

4.2.0 General

This subsection pertains to the multi-colored terra-cotta border elements that surround all vertical window bays at levels 2-5 around the building's public façades on the west, south, east, and north sides, but not in the north courtyard.

4.2.1 Basis of Recommendations

Please see subsection IV-4.2.1, which applies fully to this Option 3 approach as well.

4.2.2 Recommended Corrective Actions

Please see subsection IV-4.2.2, which applies fully to this Option 3 approach as well.

In brief, this work consists of replacing all existing terra-cotta window bay surrounds with new terra-cotta pieces.

4.3. Upper Terra-Cotta Water Table at Level 5

4.3.0 General

This subsection pertains to the wide horizontal band that separates the 4th and 5th level windows.

4.3.1 Basis of Recommendations

Please see subsection IV-4.3.1, which applies fully to this Option 3 approach as well.

4.3.2 Recommended Corrective Actions

Recommended work of this section is similar to the corresponding work in the Option 1 Restoration approach, as described in subsection IV-4.3.2.

In brief, the work consists of replacing the entire band with new pre-cast concrete and terra-cotta pieces, along with installation of new, continuous steel support ledgers above the level 4 windows and above the adjacent brick, and below the new pre-cast concrete water table, as well as installation of new flashing caps and through-wall flashings.

Figure VI-4.3(1) depicts the general scope of this work where this water table occurs by an existing or new concrete column or wall, which represents most conditions on the building.

The work would be nearly identical where new steel-framed walls occur, except the specific integration of the through-wall flashing with the back-up wall would be slightly different, and this flashing would lap under the 2-layer building wrap over the exterior gypsum sheathing.

Where window sills occur, the flashing cap atop the water table would integrate with the new curtain-wall window system, generally as shown in Figure VI-4.3(2).

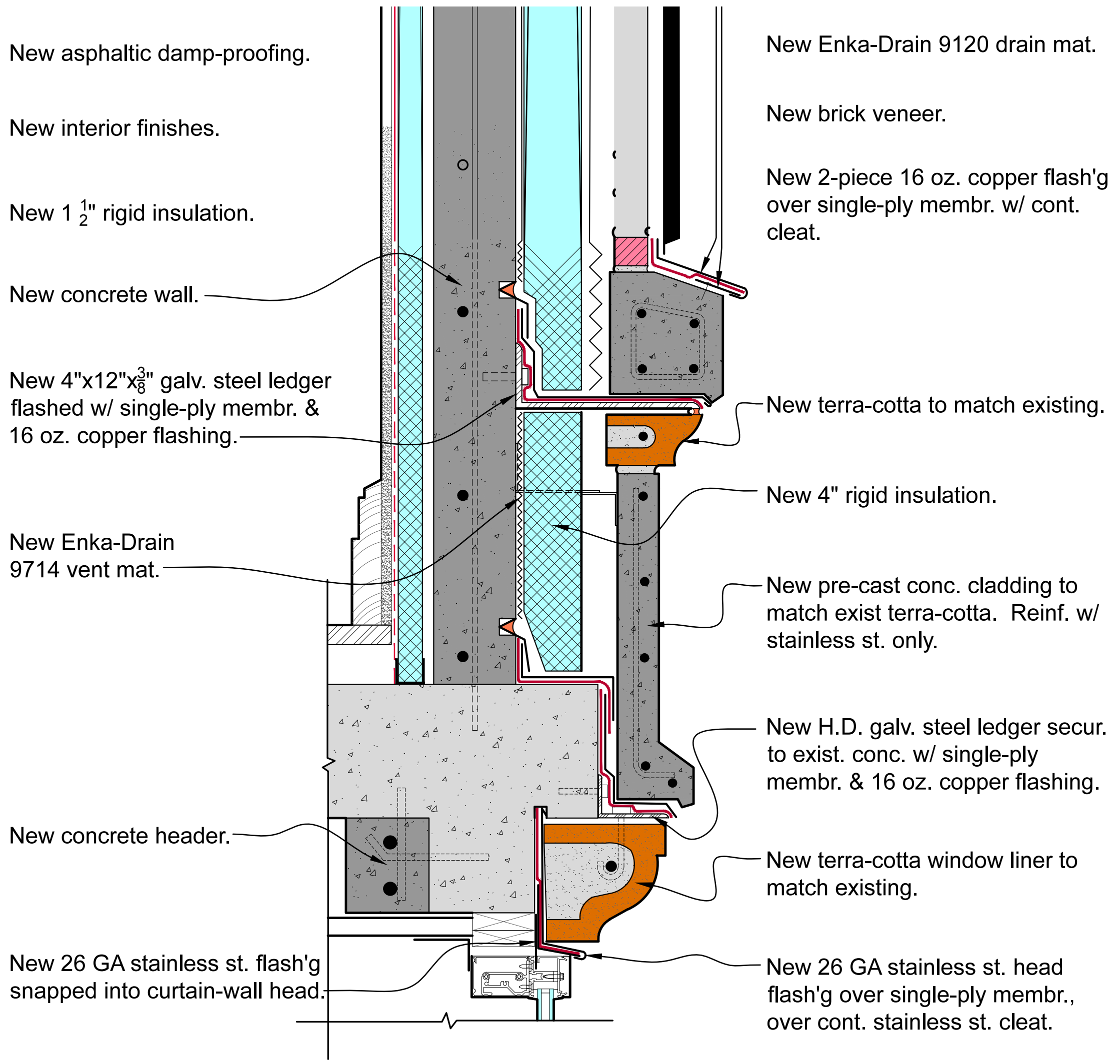


Fig. VI-4.3(1): Terra-Cotta Water Table Band Replacement Abv. Level 4 Windows

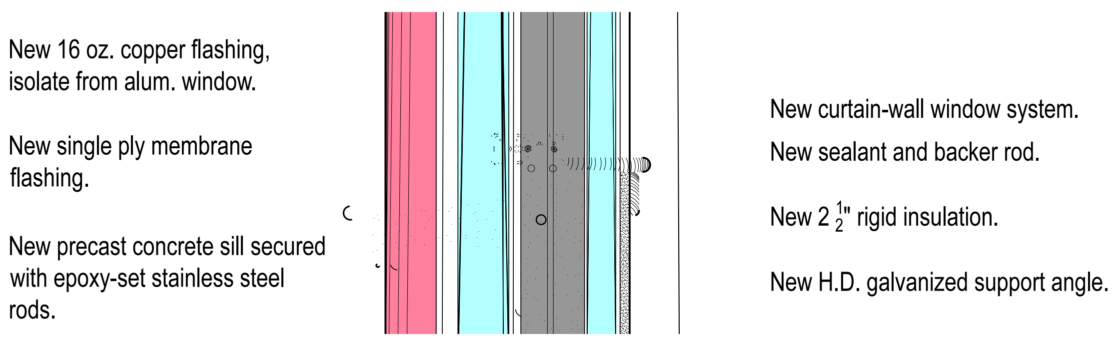


Fig. VI-4.3(2): Integration of Water Table Cap Flashing with Window Sills

4.4. Marble Panels at Level 5

4.4.0 General

This subsection pertains to four flat marble panels embedded within the level 5 brickwork.

4.4.1 Basis of Recommendations

Please see subsection IV-4.4.1, which applies fully to this Option 3 approach as well.

4.4.2 Recommended Corrective Actions

Please see subsection V-4.4.2, which applies fully to this Option 3 approach as well.

In brief, this work consists of removing, restoring, and reinstallation of the existing marble panels, all of which occur over existing concrete columns.

4.5. Cornice-Parapet Band at Roof Level

4.5.0 General

This subsection pertains to the entire height of the multi-part band above the level 5 windows and brickwork.

4.5.1 Basis of Recommendations

Please see subsection IV-4.5.1, which applies fully to this Option 3 approach as well.

4.5.2 Recommended Corrective Actions

Please see subsection V-4.5.2, which applies nearly fully to this Option 3 approach as well.

In brief, the work consists of complete replacement of this band with a new pre-cast concrete cornice and cladding supported with new steel framing. It differs from the Option 2 approach only where it occurs over steel-framed walls, which only exist in small areas. In other regards, the work would be essentially identical to Option 2.

Figure VI-4.5(1) depicts the general nature of the recommended replacement cornice, where it occurs over existing concrete columns, which represents the majority of the building's perimeter.

The work would be nearly identical where new steel-framed walls occur, except the specific integration of the through-wall flashing with the back-up wall would be slightly different, and this flashing would lap under the 2-layer building wrap over the exterior gypsum sheathing.

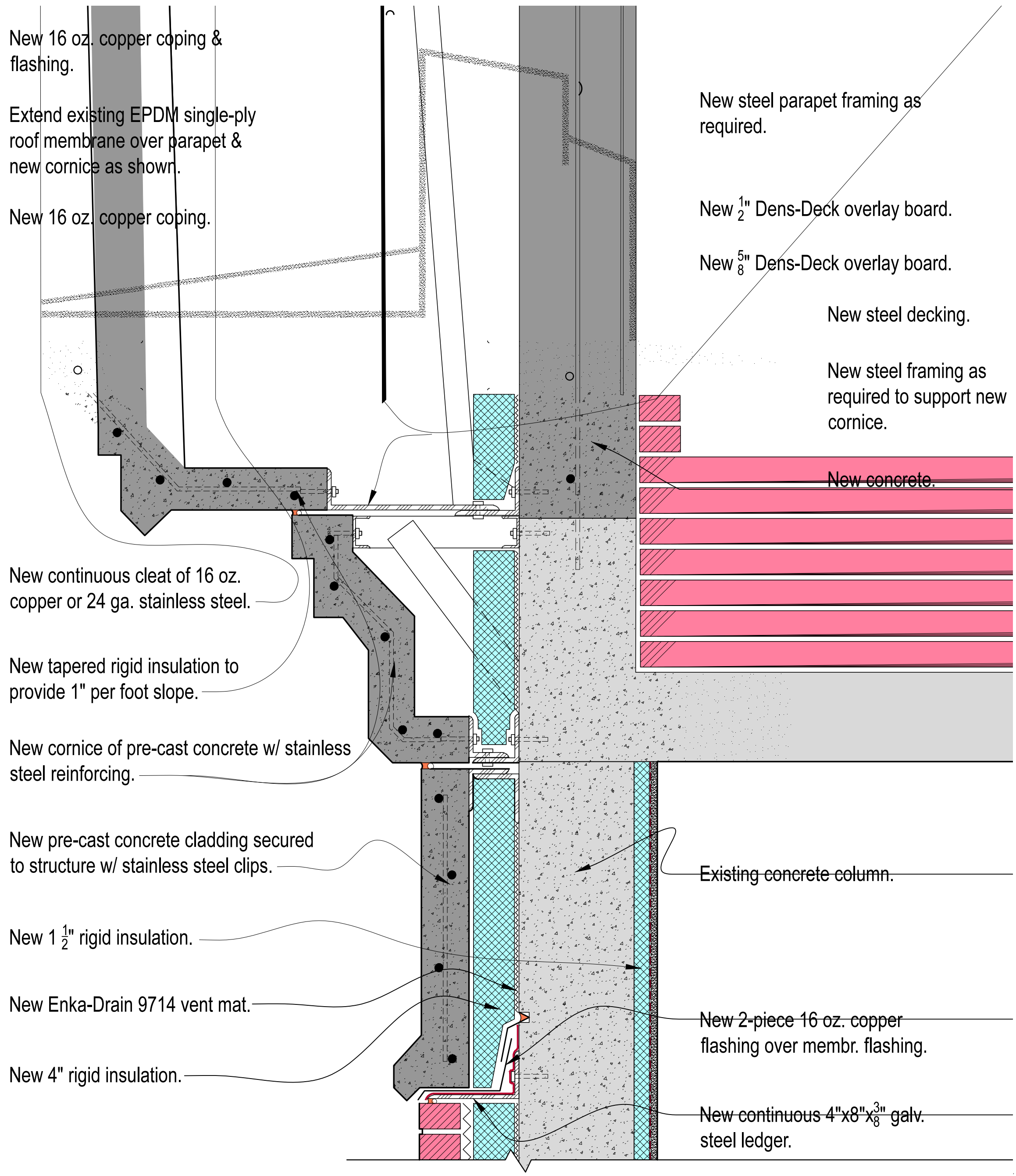


Fig. VI-4.5(1): General Configuration of New Cornice Over Existing Conc. Col's.

4.6. Stone Window Sills

4.6.0 General

This subsection pertains to the stone sills which occur along the full height of three vertical window bands at the building's SE corner, along levels 0 and 1 on the east and west elevations, at level 1 of the north ends of both wings, and at nearly all windows facing the courtyard.

4.6.1 Basis of Recommendations

Please see subsection IV-4.6.1, which applies fully to this Option 3 approach as well. In addition, this Option 3 approach envisions removing all existing exterior cladding. Consequently, it would probably be less costly to fabricate new pre-cast concrete sills, rather than trying to save the existing stone sills.

4.6.2 Recommended Corrective Actions

Please see subsection V-4.6.2, which applies nearly fully to this Option 3 approach as well.

In brief, the work consists of replacing these sills with new pre-cast concrete sills with membrane and copper flashings atop and below these.

Figure VI-4.6(1) depicts the general nature of the recommended work, as it would occur per Option 2. Option 3 differs from this only in that the new concrete wall shown below the window sill would in most locations be replaced with a steel-framed wall with exterior gypsum sheathing.

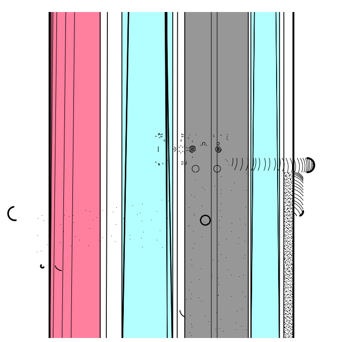


Fig. VI-4.6(1): Replacement of Window Sills

4.7. Steel Window-Head Lintels

4.7.0 General

This subsection pertains to the steel lintels above windows that do not have terra-cotta panels above them. These occur along the full height of three vertical window bands at the SE corner, at levels 0 and 1 on the east and west elevations, at level 1 of the north ends of both wings, and at all windows facing the courtyard.

4.7.1 Basis of Recommendations

Please see subsection IV-4.7.1, which applies fully to this Option 3 approach as well. In addition, this Option 3 approach envisions removing all existing exterior cladding. Consequently, the window-head lintels would be replaced with galvanized steel ledgers.

4.7.2 Recommended Corrective Actions

Please see subsection V-4.7.2, which applies fully to this Option 3 approach as well.

In brief, this work consists of replacing these lintels with new, hot-dipped galvanized steel ledgers flashed with 2-layer flashings, generally as shown in Figure VI-4.7(1). Baffled weeps spaced 24" apart should be included for drainage above the ledgers.

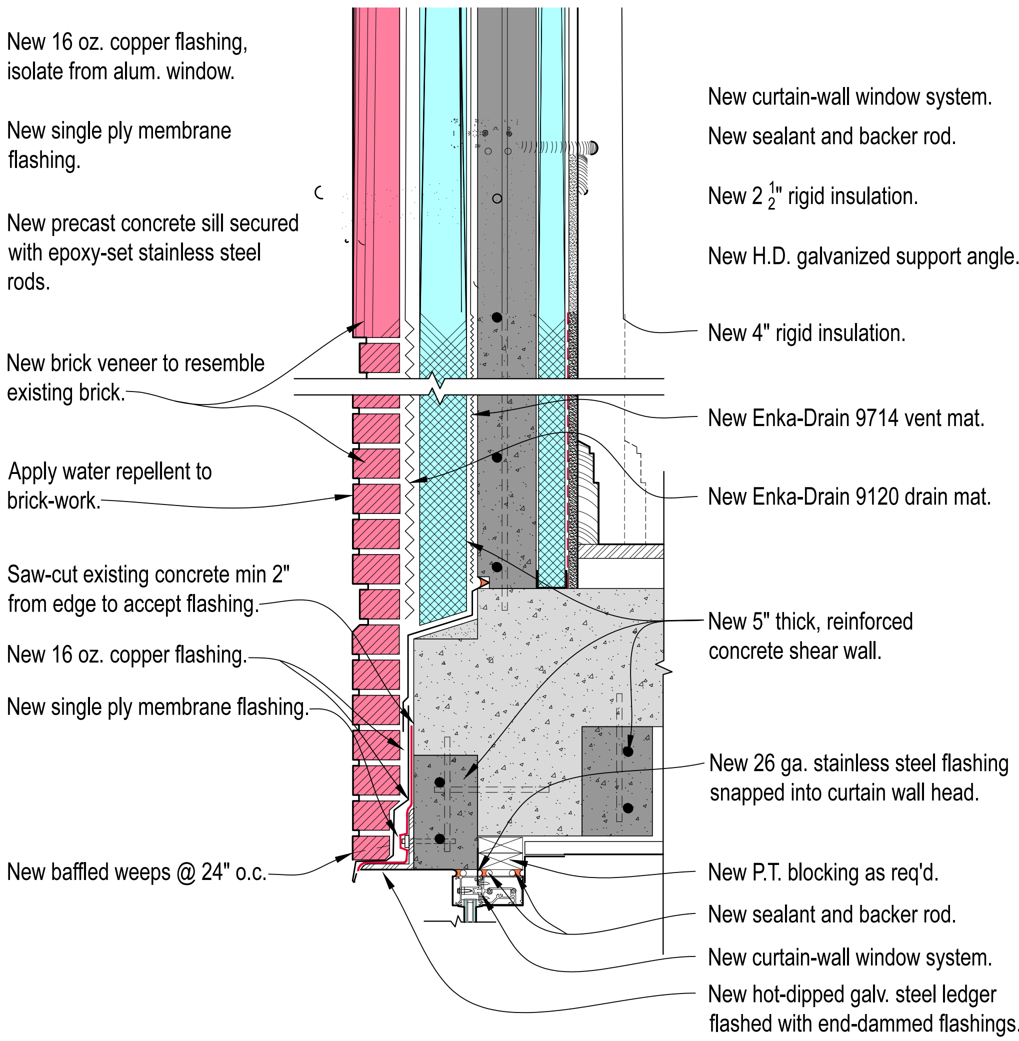


Fig. VI-4.7(1): Window-Head Lintel Replacement and Flashing

5. ENTRY PORTICO

5.0. General

This section pertains to all elements that comprise the entry portico. It is subdivided into 7 subsections, each of which addresses the portico's various components, such as its support base, stairs, columns, etc. As the Option 3 work at the portico is essentially identical in nearly all regards to the Option 1 portico work, no new details are needed, and Figure VI-5.0(1) references specific details from the Option 1 approach without repeating them in this section.

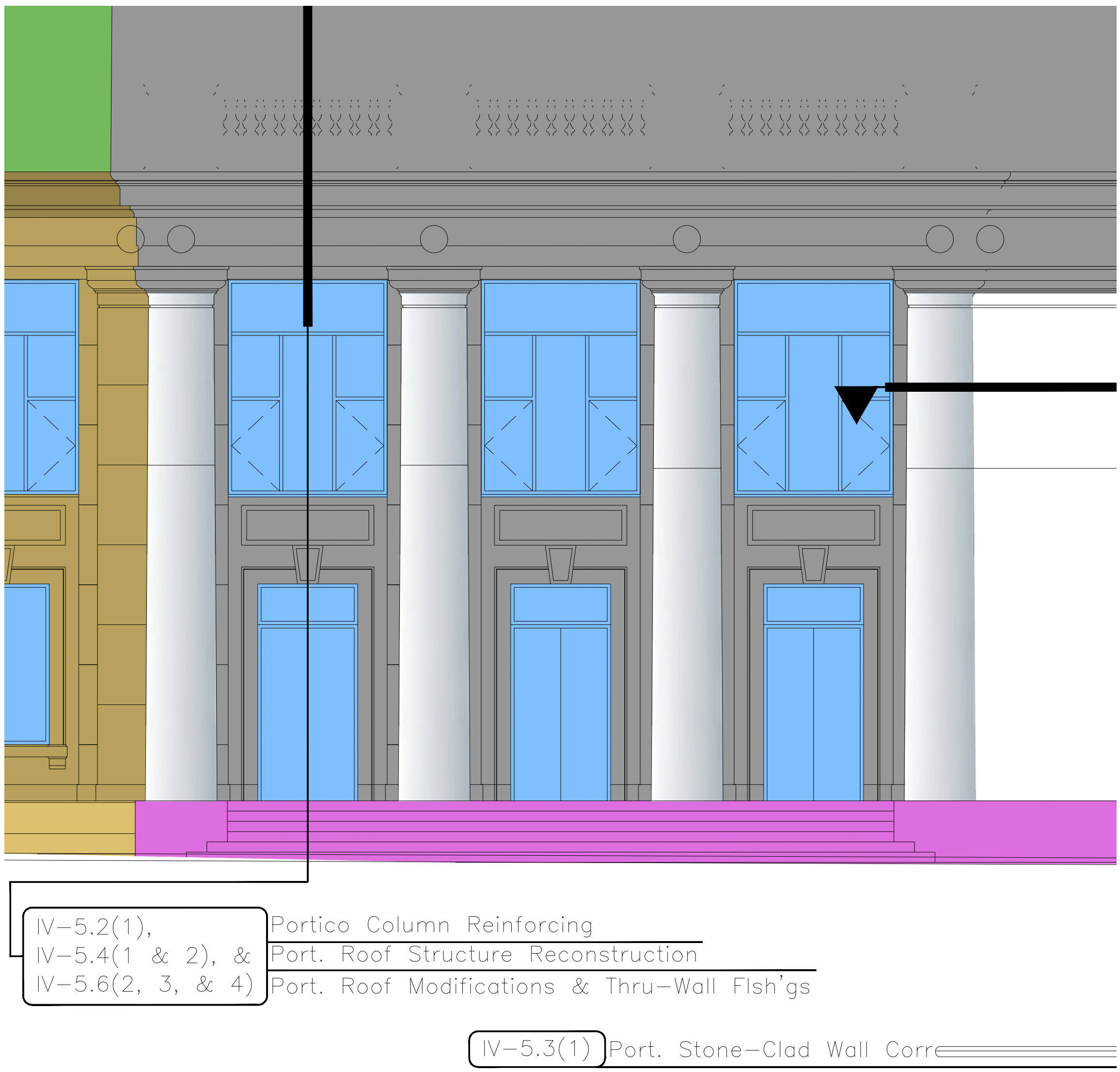


Figure VI-5.0(1): Portico South Elevation

5.1. Support Base For Portico Entry and Stairs

5.1.0 General

This subsection pertains to the portico's support base, including its support structure, granite paving, granite stairs, and granite-clad column plinths.

5.1.1 Basis of Recommendations

Please see subsection IV-5.1.1, which applies fully to this Option 3 approach as well.

5.1.2 Recommended Corrective Actions

Please see subsection IV-5.1.2, which applies fully to this Option 3 approach as well.

In brief, this work consists of performing additional evaluation as part of the next phase of corrective work, which will hopefully allow examination of the concealed portions below the portico entry paving.

5.2. Marble Columns

5.2.0 General

This subsection pertains to the portico's four marble columns and associated capitals.

5.2.1 Basis of Recommendations

Please see subsection IV-5.2.1, which applies fully to this Option 3 approach as well.

5.2.2 Recommended Corrective Actions

Please see subsection IV-5.2.2, which applies fully to this Option 3 approach as well.

In brief, this work consists of core-drilling and reinforcing the columns, injecting cracks with epoxy, restoring or replacing the stone column capitals and capping them with 2-layer flashing caps, and cleaning and polishing the eroded column surfaces.

5.3. Stone Cladding on Exterior Building Wall

5.3.0 General

This section pertains to the stone cladding along the building's exterior wall, but only where it occurs under the portico roof. While this cladding wraps the entire base of the south façade, it forms the structural support for the N-S stone beams of the portico roof. Consequently, at the portico, this cladding is used in a structural fashion.

5.3.1 Basis of Recommendations

Please see subsection IV-5.3.1, which applies fully to this Option 3 approach as well.

5.3.2 Recommended Corrective Actions

Please see subsection IV-5.3.2, which applies fully to this Option 3 approach as well.

In brief, this work consists of replacing the existing damaged cladding with a new, color-matched, pre-cast concrete cladding over new reinforced concrete support columns and walls, along with new flashings, sealant joints, etc., as described in subsection IV-5.3.2.

5.4. Portico Roof Structure

5.4.0 General

This section pertains to the elements comprising the portico's roof structure, including the entablature beam, embedded concrete beam above the entablature, stone crossbeams, steel lintels, stone water table, concrete roof slab, stone ceiling panels, and related elements.

5.4.1 Basis of Recommendations

Please see subsection IV-5.4.1, which applies fully to this Option 3 approach as well.

5.4.2 Recommended Corrective Actions

Please see subsection IV-5.4.2, which applies fully to this Option 3 approach as well.

In brief, this work consists of replacing the entire portico roof structure with a new structure of cast-in-place concrete beams, steel decking and framing, pre-cast concrete cladding, new flashings, etc. as described in subsection IV-5.4.2.

5.5. Stone Railing

5.5.0 General

This section pertains to the stone elements comprising the portico roof's perimeter railing.

5.5.1 Basis of Recommendations

Please see subsection IV-5.5.1, which applies fully to this Option 3 approach as well.

5.5.2 Recommended Corrective Actions

Please see subsection IV-5.5.2, which applies fully to this Option 3 approach as well.

In brief, this work consists of replacing the entire railing with a new one of pre-cast concrete capped with new flashings, etc. as described in subsection IV-5.5.2.

5.6. Portico Roof, Drains, and Associated Flashings

5.6.0 General

This section pertains to the portico's roof membrane, drains, and associated flashings.

5.6.1 Basis of Recommendations

Please see subsection IV-5.6.1, which applies fully to this Option 3 approach as well.

5.6.2 Recommended Corrective Actions

Please see subsection IV-5.6.2, which applies nearly fully to Option 3 as well. It differs only in that rather than retrofitting through-wall flashings in the existing brick above the portico roof, such flashings, consisting of single-ply membrane capped with 16 oz. copper, would cap over new steel ledgers supporting the new brick veneer. In all other respects, the work would be identical.

In brief, this work consists of replacing the existing portico roof membrane, installing through-wall flashings under the railings, adding two new overflow drains, etc. per subsection IV-5.6.2.

6. INTERIOR ARCHITECTURAL ELEMENTS

6.0. General

This section addresses issues related to the interior architectural elements including the wall, floor and ceiling construction and finishes.

6.1. Interior Faces of Exterior Building Walls

6.1.0 General

This subsection pertains to the interior architectural elements affected by the seismic retrofit and exterior wall renovation, which primarily impacts interior faces of exterior walls.

6.1.1 Basis of Recommendations

Please see subsection IV-6.1.1, which applies fully to this Option 3 approach as well.

6.1.2 Recommended Corrective Actions

Please see subsection IV-6.1.2, which applies fully to this Option 3 approach as well.

7. MECHANICAL SYSTEMS

7.0. General

This section addresses issues related to the building's mechanical systems, including heating, ventilation, plumbing and fire sprinkler systems.

7.1. General Mechanical Systems

7.1.0 General

This subsection pertains to the mechanical systems affected by the work on the exterior walls and mechanical systems affected by other seismic retrofit work.

7.1.1 Basis of Recommendations

Please see subsection IV-7.1.1, which applies fully to this Option 3 approach as well.

7.1.2 Recommended Corrective Actions

Please see subsection IV-7.1.2, which applies fully to this Option 3 approach as well.

8. ELECTRICAL SYSTEMS

8.0. General

This section addresses issues related to the building's electrical systems, including power, lighting and communication systems.

8.1. General Electrical Systems

8.1.0 General

This subsection pertains to the electrical systems affected by the work on the exterior walls and by other seismic retrofit work.

8.1.1 Basis of Recommendations

Please see subsection IV-8.1.1, which applies fully to this Option 3 approach as well.

8.1.2 Recommended Corrective Actions

Please see subsection IV-8.1.2, which applies fully to this Option 3 approach as well.

9. ESTIMATED CONSTRUCTION COST OF OPTION 3

9.0. General

This section presents the summarized construction cost estimate for Option 3, which is based on the full cost estimate prepared by HMS, Inc., with subsequent modifications by Jensen Yorba Lott Inc., and PL:BECS.

As this Option 3 replaces all exterior cladding elements, a higher level of certainty is assumed concerning its likely costs, compared to Option 1. For this reason, the assumed contingency for phases 2 and 3 of Option 3 is 25% lower than the corresponding contingencies for Option 1.

It should further be noted that this preliminary evaluation obviously did not attempt to design in detail every aspect of each option, but rather attempted to define each approach to a schematic level, sufficient to allow only very rough construction cost estimates to be prepared. For this reason, the costs of each phase of each option are rounded to the nearest $ 100,000, and realistically, even this level of precision implies a higher degree of certainty than can be justified by the schematically-defined work scope descriptions. The reader is encouraged to round these estimates to the nearest $ 1,000,000.

It should also be clarified that these estimates relate only to the projected construction costs, and that in any case and with any approach, appreciable additional costs should be anticipated to cover temporary relocation of occupants, design and engineering fees, possible soil studies, and other, non-construction related expenses.

9.1. Estimated Construction Cost of Option 3

The estimate is broken down by the 3 construction phases

Construction Phase 1 is scheduled for May to December 2013. This phase will consist of seismic reinforcing and renovation of the Portico along with repairs to the ground floor structure in the crawl space and providing drainage in the crawl space.

Construction Phase 2 is schedule for May to December 2014. This phase will consist of seismic reinforcing of the south wall from the foundations to the roof along with renovation of the exterior south wall assembly. The work will also include replacing the steam heating system on the south wall with a hydronic heating system.

Construction Phase 3 is schedule for May to December 2015 and May to December 2016. This phase will consist of seismic reinforcing of the east, west and north walls from the foundations to the roof along with renovation of the remaining exterior wall assemblies. The work will also include replacing the steam heating system in the remainder of the building with a hydronic heating system.

The cost of the three construction phases follows:

Construction Phase 1:	$ 1.1 million.
Construction Phase 2:	$ 6.9 million.
Construction Phase 3:	$ 14.5 million.
Total	**$ 22.5 million.**