




# **Structural Appendix**

-  *Envelope Analysis*
-  *Thin Brick System*
-  *Structural Calculations*

# ***Thin Brick System***

04812/END  
BuyLine 6621

# THIN BRICK



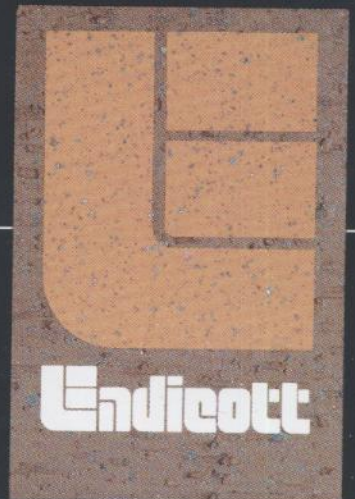
*Sparrow Hospital  
Lansing, MI*



*Arboretum Lakes Building 1  
Carol Stream, IL*



*Target Store  
Brighton, MI*



**Endicott**



# Applications for Endicott thin brick are limited only by the imagination.

Endicott thin brick is ideally suited to year-round commercial, residential and remodeling applications.

Genuine, kiln-fired thin brick possesses all the durability and unparalleled elegance of Endicott face brick, yet when installed maximizes space and weighs considerably less.

## Installation Techniques

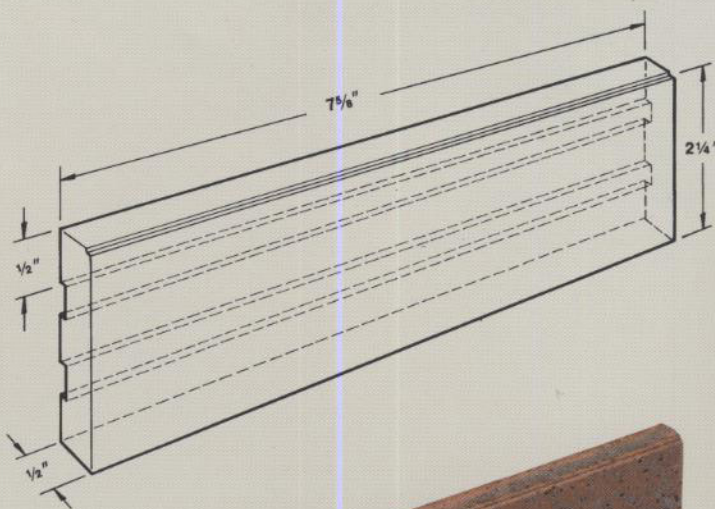
Whether it is a new construction or remodeling project, Endicott thin brick may be applied over any structurally sound substrate. And, because no footings or supports are required, the thin brick may extend all the way to grade.

There are a number of substrate panels and prefabricated wall panel systems available to the industry that can receive the thin brick as factory or job site applied.\*

Reputable installation system suppliers have literature which you may obtain for review regarding project applicability.

The standard Endicott thin brick unit size is 2 1/4" x 7 5/8". Additional unit sizes—3 5/8" x 7 5/8"; 7 5/8" x 7 5/8"; 3 5/8" x 11 5/8"—can, however, be specified for special applications. Endicott thin brick has been tested according to ASTM C1088 specifications and meets Type TBX requirements.

To fully complement the installation process, Endicott also offers all necessary trim units.



Arboretum Lakes Building 2  
Carol Stream, IL



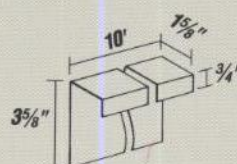
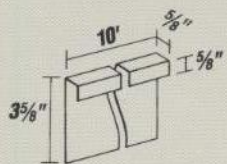
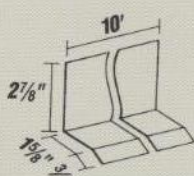
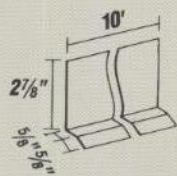
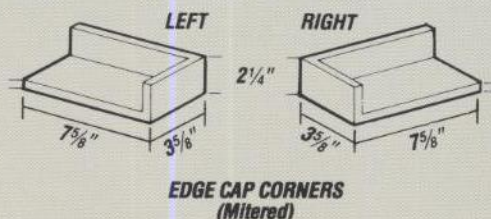
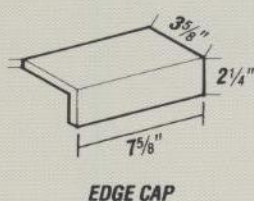
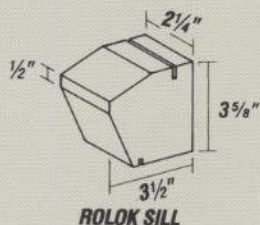
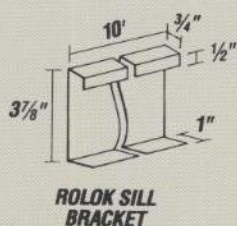
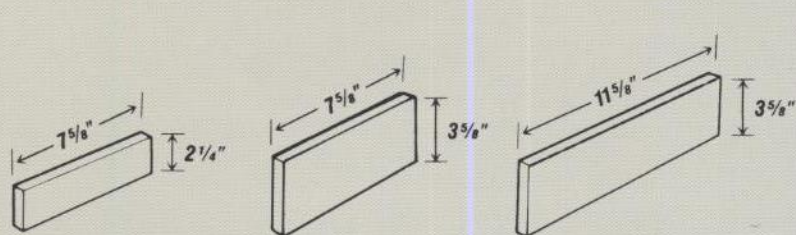
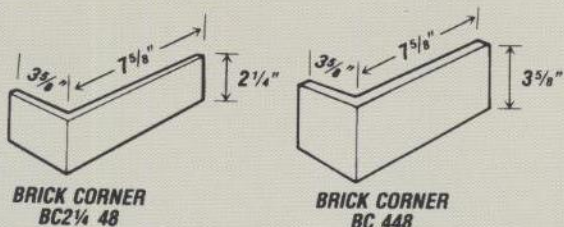
Private Residence  
Central City, NE

\* Code requirements vary from one municipality to the next. Check with your local Code Authority and Engineer for certification of system prior to the start of application.



# THIN BRICK SIZES AND TRIM UNITS

To enhance in-place installation, Endicott thin brick feature a distinct keyback design which provides a mechanical lock into the concrete for maximum durability and permanence. All materials are tested according to ASTM C1088, and meet requirements for Type TBX, Exterior Grade. Testing data is available upon request.



## ESTIMATING DATA

$\frac{1}{2} \times 2\frac{1}{4} \times 7\frac{5}{8}$	- 6.86 pcs./sq. ft.
$\frac{1}{2} \times 3\frac{5}{8} \times 7\frac{5}{8}$	- 4.50 pcs./sq. ft.
$\frac{1}{2} \times 3\frac{5}{8} \times 11\frac{5}{8}$	- 3.00 pcs./sq. ft.
Corners (2 1/4")	- 4.50 pcs./lin. ft.
Corners (3 5/8")	- 3.00 pcs./lin. ft.

Edge Cap	- 1.50 pcs./lin. ft.
Edge Cap - 3 Sided	- 1.00 pc./corner
Rolok Sill	- 4.50 pcs./lin. ft.

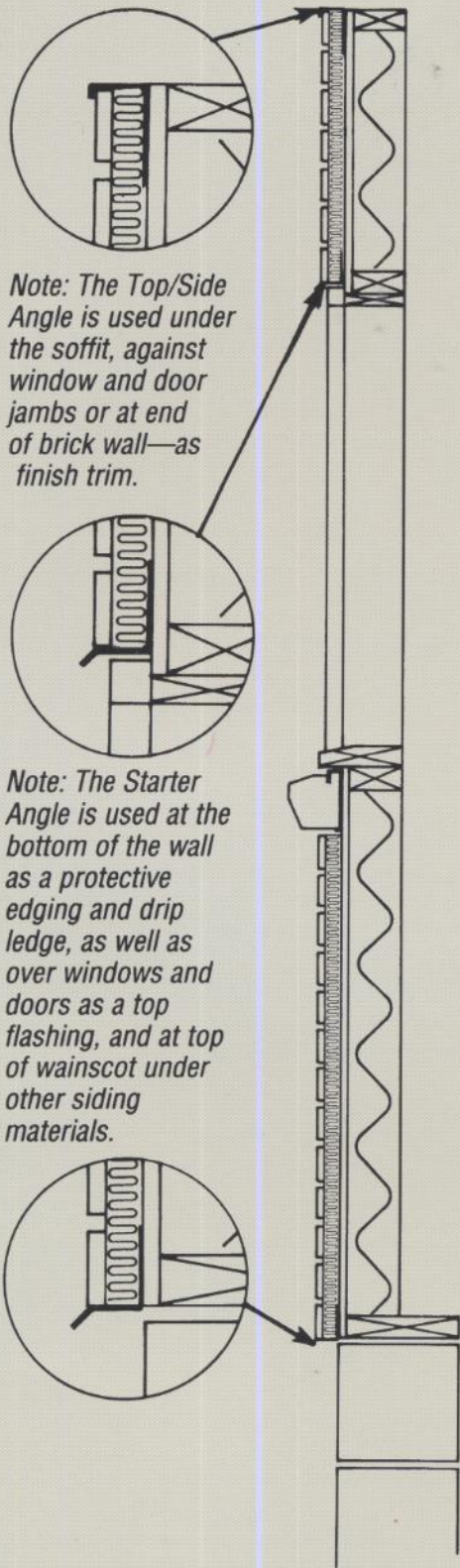
## METRIC CONVERSION

	Imperial	Soft (mm)	Hard (mm)
$\frac{1}{2} \times 2\frac{1}{4} \times 8$	$\frac{1}{2} \times 2\frac{1}{4} \times 7\frac{5}{8}$	12.5 x 57 x 194	12.5 x 57 x 190
$\frac{1}{2} \times 4 \times 8$	$\frac{1}{2} \times 3\frac{5}{8} \times 7\frac{5}{8}$	12.5 x 92 x 194	12.5 x 90 x 190
$\frac{1}{2} \times 4 \times 12$	$\frac{1}{2} \times 3\frac{5}{8} \times 11\frac{5}{8}$	12.5 x 92 x 295	12.5 x 90 x 290

**Soft Conversion:** A simple mathematical calculation (inches x 25.4 = mm) that changes Imperial dimension (inches) to metric (millimeters).  
**Hard Conversion:** Actual physical changes in dies and equipment to produce metric dimensions (millimeters).

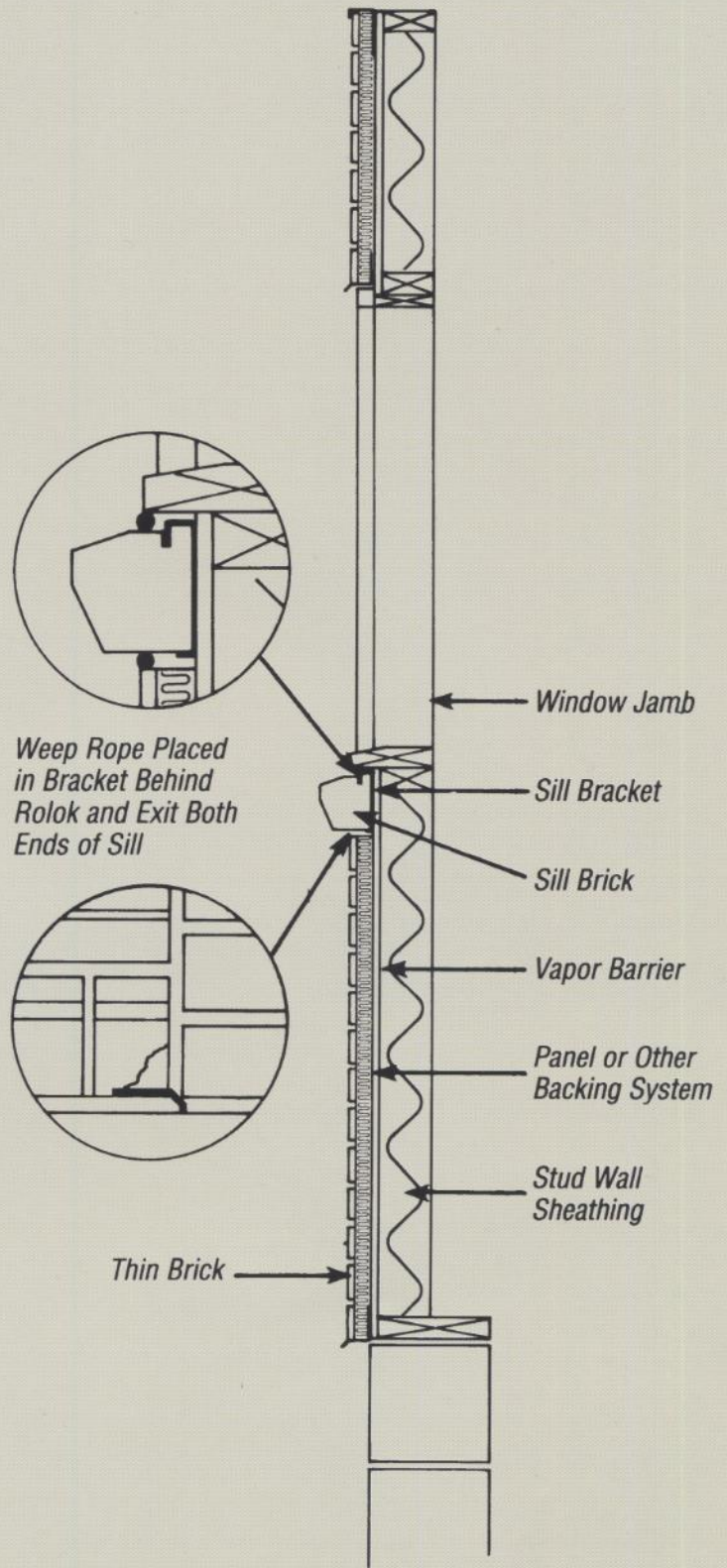


# THIN BRICK CONSTRUCTION DETAILS



*Note: The Top/Side Angle is used under the soffit, against window and door jambs or at end of brick wall—as finish trim.*

*Note: The Starter Angle is used at the bottom of the wall as a protective edging and drip ledge, as well as over windows and doors as a top flashing, and at top of wainscot under other siding materials.*



*Weep Rope Placed in Bracket Behind Sill Brick and Exit Both Ends of Sill*

Window Jamb

Sill Bracket

Sill Brick

Vapor Barrier

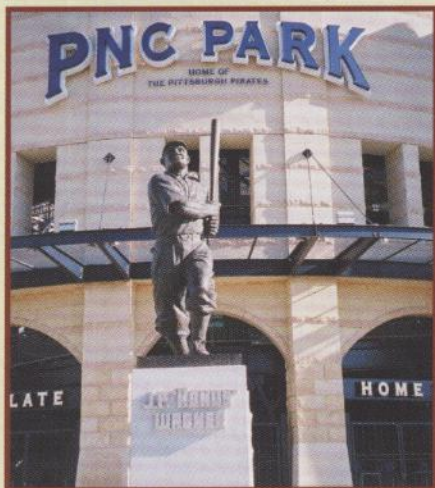
Panel or Other Backing System

Stud Wall Sheathing

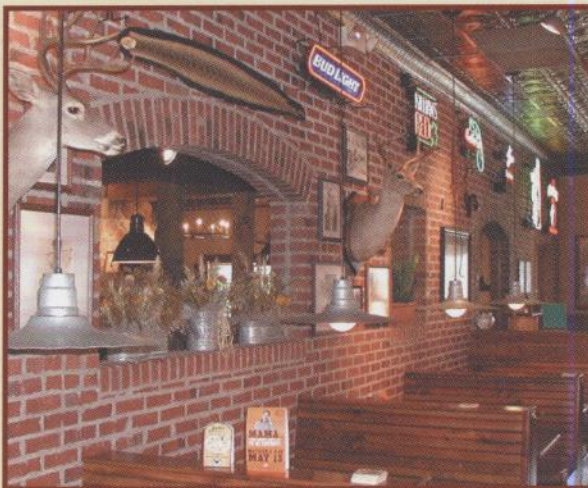
Thin Brick



## THIN BRICK BRICKETTES®



Pittsburgh Pirates - PNC Park



Tumbleweed Restaurant

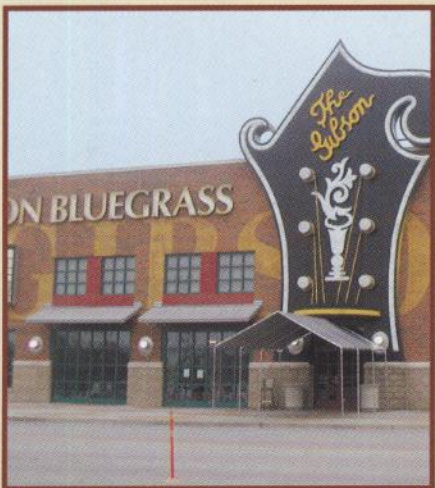


Harley Davidson

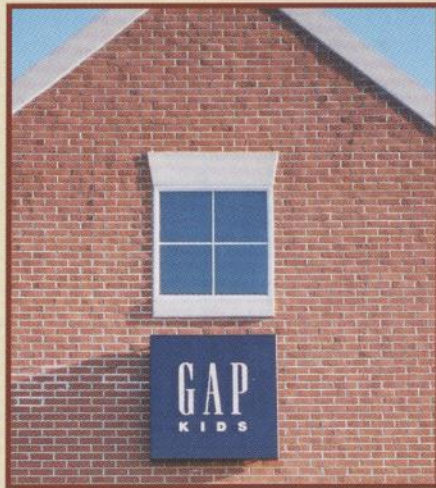
*Quality*

Crafting quality thin brick, panel brick and full-size brick, and delivering it with unsurpassed customer service, have been the hallmarks of our 50+ year history in the brick manufacturing business.

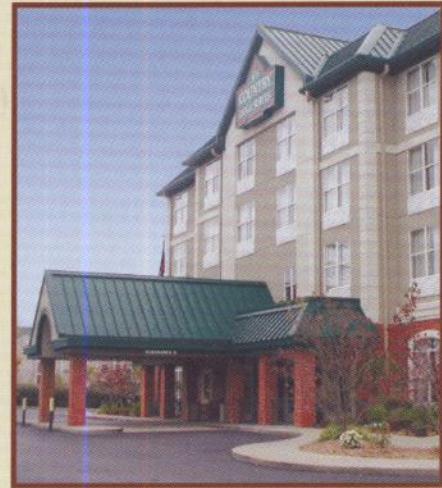
## PANEL BRICK



Gibson Guitar Store



The Gap



Country Inn and Suites



## PANEL BRICK

**Factory Assembled**

Thin Brick Brickette® panels are a factory-assembled system featuring genuine clay kiln 1/2-inch thin brick facing adhered to a rigid insulation fiberboard backer. Panel Brick weighs less than six pounds per square foot, which is 1/5th the weight of full-size brick.

**Materials And Finishes**

Panel Brick is a thin brick veneer system comprised of Brickettes® adhered in running bond to a 16" x 48" backer board.

**Insulation Board**

The rigid backer board used to create Panel Brick is a high density, nail base, asphalt impregnated fiberboard manufactured by Temple-Inland Corporation meeting Federal specification LLL-1-535B, Class E, Style 2 conforms to Industry Standards ANSI/AHA A194, 1-1985 Type IV, Class 2 and ASTM C-208-94.

**Adhesives**

An exterior, waterproof, synthetic rubber base adhesive that complies with APA specification AFG-01 is used to bond Brickettes® to the backer board.

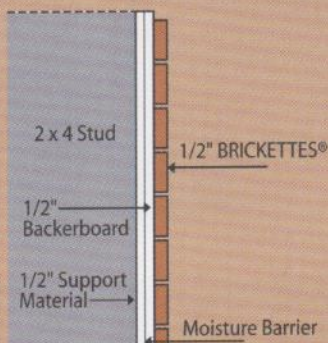
**Assembly And Installation**

Installation of Panel Brick is a straight forward construction procedure for pre-fabricated thin brick systems. Panels are fastened to the supporting construction by driving fasteners into backing material using not less than two fasteners per square foot. A water resistive barrier shall be applied to the substrate behind the Panel Brick. Subsequent panel is interlocked with the first and so on. After all panels are installed, the masonry joints between the Brickettes® are mortared and finished. Panel Brick fabricated with cementations backer board must be used



Shop Rite

where panels are installed below grade to six inches above grade. Detailed installation procedures are available. Please contact us for more information.

**THIN BRICK APPLICATION****Fasteners**

Fasteners must be suitable for the underlying material and of sufficient length to penetrate through the sheathing to insure adequate support for the panels meeting ASTM D-1037-93 testing. Panels shall be mechanically fastened with adequate fasteners to support horizontal and vertical dead loads as listed in BOCA Research Report NO.97-18. Fastener schedule is provided by the manufacturer.

**Channels**

The design of this thin brick veneer system requires the application of a 1" x 3" J or L channel installed below the bottom edge of the lower panel not to extend more than 3/8" below the bottom course of Brickettes® or the Brick Panel bottom. Channels, through wall flashings and approved vapor barriers

will provide adequate system relief in accordance with ASTM E-514.

**Mortaring**

Over fill masonry joints with mortar after all panels have been set and all individual units have had adequate time for adhesive to set, using a tuck pointing tool, metal-tipped mortar bag kit or mortaring machine. Mortar should be a rich mixture of cement and masonry sand mixed to a consistency that flows smoothly through a grout bag. Finish masonry joints with a mortar into the masonry joints. Brickette® grout mix is available from the manufacturer. Grout mixture shall conform to ASTM C270. Application is applied according to manufacturer's recommendations.

**Caulking**

Thoroughly caulk all areas where Panel Brick meets non-Panel Brick surfaces and abutting material. Caulk must be a high performance sealant compatible for conditions and installed per caulk/sealant manufacturer's instructions.

**SIZE**

Panels 16" x 48" x 1" thick

**COVERAGE**

Panels 5.33 square feet per panel  
Approximately 19 panels per square.  
One square covers 100 square ft.

**WEIGHT**

Panels 28 lbs. per blackboard panel  
40 lbs. per cement board panel

**PACKAGING**

Panels 91 panels per pallet (Blackboard)  
70 panels per pallet (Cementboard)

**MORTAR**

Mortar One 80 lb. bag covers approximately 50 square feet of wall space.





*When custom shapes and angles are required, Summitville has the experience and capabilities to satisfy your most demanding specifications.*

From pre-cast concrete panels to traditional tile setting methods, Summitville Thin Brick has performance qualities that can solve installations or engineering and provide results with confidence.

## *The Motivating Force*



Summitville Tiles has evolved over the past 92 years as a producer of premium grade clay products and installation materials that are as diverse as they are useful and long lasting.

In the earliest days of the company's existence highway *paving brick* was produced for streets and roads, such as the Lincoln Highway...America's first transcontinental highway.

From highway paving brick Summitville evolved into a producer of high grade *face brick* used in thousands of residential and commercial properties including the reconstruction of the White House in 1951.

The manufacture of face brick led to the introduction of acid resistant industrial *floor brick* and to ground-edge *quarry tile* which continue to be used in homes, restaurants, commercial and industrial facilities all over the world.

In addition to these products, Summitville is a leading producer of precision-sized *thin brick* used largely in the emerging pre-cast construction market for large commercial properties like hotels, shopping centers and sports arenas.

Most recently *ceramic roof shingles* have been added to our product offering. A whole new line of frost-resistant, highly durable roofing tiles for up-scale residential and commercial properties.

To ensure a quality installation, a complete line of installation materials including latex modified *mortars and grouts*, *chemical resistant epoxies*, *surface preparation materials*, *seamless epoxy floor systems* and an array of *tile care products* are manufactured and offered by Summitville for your one source satisfaction.

From the mining of the raw materials to the manufacture of literally thousands of sizes, shapes and surfaces of clay product, to the materials used to install these clay products, Summitville has withstood the test of time. And it is our commitment to product quality, extraordinary customer service and competitive pricing that has been and will continue to be our motivating force.

Summitville Thin Brick is a product of nature, a mixture of fired shale and clays which results in shade variations from brick to brick and from shipment to shipment. Final selection should be made from actual brick production. Thin Brick should be ordered in quantity sufficient to complete installation.

Thin Brick may vary in size and shade from run to run and within each run. Thin Brick should be blended from numerous cartons on the job site. Do not install any Thin Brick that has not been thoroughly inspected. Do not install without adequate lighting. We will not consider any claims after installation. All Thin Brick shall be installed according to ANSI Standards and the TCA Handbook for Installation. Thin Brick supplied for a particular installation may vary in color tone from samples.





# Summitville Thin Brick

## CUSTOM CAPABILITIES

Summitville is a single source manufacturer that custom produces colors, shapes, sizes and textures to solve installation or engineering problems or to add that "special dimension" to a unique project.

## FLASHED BRICK

Summitville Thin Brick is available in a variety of custom blends: iron spots, light blends, dark blends, vintage blends and mixed blends as shown. Other flashes and custom blends are also available by special order, minimum quantities may be required for all custom flashes or blends. Always check with factory first, inventory may be available.



Multiple angles and curved walls were designed for this U.S. Naval Air Systems Command Facility to resemble a Stealth aircraft when viewed from overhead.



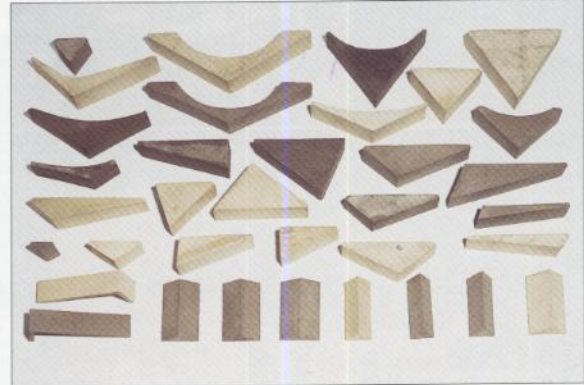
Large panels were constructed off site in a controlled environment. Using cranes to hang the panels allows for quick and efficient installation.



Three custom colors were installed as shown on this curved wall.



Two of the three colors are shown in this panel area with custom size brick (2 1/8" x 1 1/8" x 1/4") produced for this building.



Summitville produced over 135 custom shapes and angles in order to accomplish the necessary profile required to achieve the desired shape of the building.

## SIZES/TRIM/PACKAGING/WEIGHTS

TRIM SHAPES	Item	Color	Pieces Per Tray	Wt. Each
	BTL-248 Left Edge Cap Closed Corner	All Colors	6	2.20
	BTR-248 Right Edge Cap Closed Corner	All Colors	6	2.20
	BC-248-9/16" Corner	All Colors	12	1.13
	BC-248-1" Corner	All Colors	7	2.05
	BT-248 Edge Cap	All Colors	6	1.82

Item	Size	Pieces Per Sq. Ft.	Wt. Per Sq. Ft.	Sq. Ft. Per Tray	Pieces Per Tray	Wt. Per Tray
All Colors	7 5/8" x 2 1/4" x 3/8"	6.87	5.56	3.5	24	19.75

\* Thin Brick Corners are produced to meet 90 degrees (+ or - 2°). A thicker, 1 3/8" corner is available for precast installations which may improve final clean up of the precast panels.



Summitville Thin Brick is installed in numerous ways. It is relatively thin and can be installed by the traditional tile setting and grouting methods or various types of panel systems. Each method of installation has advantages and Summitville does not endorse one method over another. It is always important to use reputable installers, panelized systems with a proven record of performance and installation products formulated for the environmental conditions of the installation.

**TRADITIONAL TILE SETTING & GROUTING PROCEDURES**

All thin brick and ceramic tile should be installed according to ANSI Standards and the Tile Council of America Handbook. Since the wire cut or rustic surface of thin brick is difficult to grout we recommend the following procedure.

Summitville Thin Brick should be set using one of Summitville's latex modified thin-sets such as S-777 / S-810 or epoxy mortars using a 1/4" x 3/4" notched trowel and allowed to cure for 48 hours. Brick should be protected from

rain during the cure period. S-750 Summitville Thin Brick Grout, a specially formulated sanded brick grout, is recommended for grouting. S-750 should be mixed using clean potable water and a slow speed mixer (under 300 RPM).

The S-750 should be installed in the brick joints to a depth of about 1/2 to 3/4 of the brick thickness, using a standard grout bag, mortar gun, pneumatic applicator or motorized grout

applicator with the proper nozzle. Check with factory for additional information regarding sources of supply for grout applicators.

Summitville is the only tile manufacturer that also produces cementitious grouts and mortars, latex formulations, epoxies, furans, membranes and tile care products - for a single source of supply and technical support. Our labs are available to supply a variety of tests, both standard and custom.



Mortar is applied with a 1/4" notched trowel.



Mortar is installed into the brick joints with a grout bag or with mortar dispensing gun.



When mortar is thumb-print hard joints may be tooled.



Brush joints to remove excess mortar before mortar cures.

P A N E L I Z A T I O N M E T H O D S

**PRECAST CONCRETE PANELS**

Precast concrete panels can be produced off site when on site installation can be difficult or expensive. Off site panels can be assembled in a controlled environment and shipped to the job site for installation.



Brick are placed over retarder paper in gasket liner



After steel reinforcing is in place, concrete is poured over the assembly.



Brick precast panel ready to be cleaned.



Panel is cleaned to remove concrete leakage.



Erected panel shows thickness of concrete bonded to thin brick.

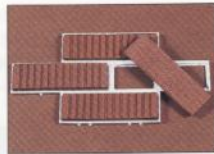


Precast thin brick panels eliminate the need for lintels, sills, weep holes and tie rods.

Panelization system shown and photos supplied by The Scott System.

**BRICK SNAPS SYSTEM**

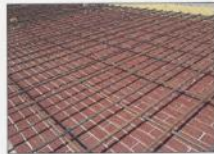
The Brick Snaps were developed by The Scott System specifically for Cast-in-Place and Tilt-Up contractors on projects requiring a brick facade. This is a simple and cost-effective system for brick work with the end result looking just like field-laid masonry.



Thin Brick are pressed into Brick Snaps (plastic carriers), at the factory.



Assembly of Brick Snaps for Tilt-Up is fast at the rate of 2 to 3 square feet per minute, per man.



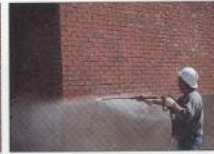
Rebar is placed and panel is ready for concrete.



Concrete is poured and vibrated to insure mortar joints are filled properly.



After the panels are tilted and erected, the snap carriers are removed.



Brick panels are cleaned with hot, high-pressure water.

Panelization system shown and photos supplied by The Scott System. Brick Snaps is a registered trademark of The Scott System, Inc.

**INSULATED BRICK PANELS**

Insulated brick panels offer the advantage of insulation with the beauty of brick. Panels can be assembled off site and shipped or assembled on site year-round under any weather conditions, eliminating costly construction delays.



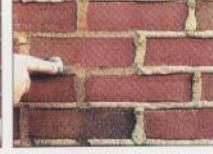
Panels are installed with interlocking clips that mechanically lock the panels and bricks to the structure.



Latex modified mortar bonds to the bricks and clips, creating a permanent mechanical connection to the structure.



After adequate time has been allowed for mortar to set, mortar is applied with a grout bag.



Mortar joints are struck to compress grout and fill joints completely, then tooled to a radius finish.



Installation is cleaned with a brush to remove excess mortar.

Panelization system shown and photos supplied by American Brick Company.

**BRICK INLAY TEMPLATES**

Brick Inlay Templates (BIT's) are used by precast panelizers for Cast-In-Place or Tilt-Up construction. Design flexibility, speed of installation and cost savings are realized with this system.



Thin Brick are factory set into the BIT's.



Assembly of brick templates are done on site for Tilt-Up or in a controlled environment.



Re-bar and clips or anchors are assembled before concrete is placed.



Concrete is placed and vibrated on panels.



After installation, templates are removed and walls are cleaned with high pressure water.

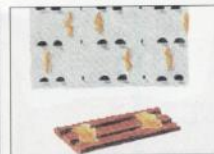
Panelization system shown and photos supplied by Innovative Brick Systems, LLC.

**METAL PANEL SYSTEM**

The EZ-Wall System is a true mechanical support and spacing system using an architectural grade galvanized steel panel for thin brick. Each thin brick is supported and spaced with a custom relief ledge integrated into the steel.



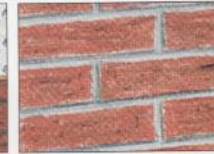
Installation begins with a water infiltration barrier stapled over the substrate. Metal panel is then fastened to the wall.



Thin brick is bonded to the panels by applying adhesive in vertical beads to the panel or dabs on the thin brick.



Metal tabs support the thin brick and assure straight, uniform bed joints.



Mortar or grout is applied into joints with a grout bag, gun or pump system and then struck.

Panelization system shown and photos supplied by EZ-Wall Systems.



# Summitville Thin Brick

Summitville, America's leading floor brick producer, offers Thin Brick in 14 colors. Each color offers a wide range of shades. Thin Brick is made from select clays and shale chosen for their relative purity, fired strength and proven characteristics.

Custom flashed blends such as light flash, dark flash, vintage

flash and mixed blends are available by special order: minimum quantity may be required. Always check with the factory before ordering, some inventory may be available.

Thin Brick standard size is 2 1/4" x 7 5/8" x 9/16". Special order sizes are available minimum quantity required.



## STOCK SIZES

2 1/4" x 7 5/8" x 9/16"

## SPECIAL ORDER SIZES

Summitville Thin Brick

2 1/4" x 3 5/8" x 9/16"

2 1/4" x 11 5/8" x 9/16"

3 5/8" x 7 5/8" x 9/16"

3 5/8" x 11 5/8" x 9/16"

Summitville Face Brick

2 1/4" x 7 5/8" x 3 5/8"

3 5/8" x 7 5/8" x 3 5/8"

3 5/8" x 11 5/8" x 3 5/8"

Other sizes and shapes may be available, depending on color choice and quality. Minimum quantities required - always check factory - inventory may be available.

## INSTALLATION METHODS

Summitville Thin Brick is installed in numerous ways. It is relatively thin and can be installed by the traditional tile setting and grouting methods or various types of panel systems. Each method of installation has advantages and Summitville does not endorse one method over another.

It is always important to use reputable installers, panelized systems with proven record of performance and installation products formulated for the environmental conditions of the installation. All thin brick and ceramic tile should be installed according to ANSI Standards and the Tile Council of America Handbook.



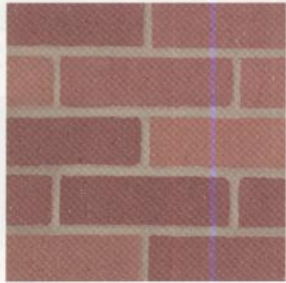
10 Summitville Red  
Range of deep red shades



14 Alexandria  
Range of medium red shades



95 New Bedford  
Range of warm red shades



16 Plymouth  
Range of medium rust brown shades



17 Yorktown  
Range of red tan shades



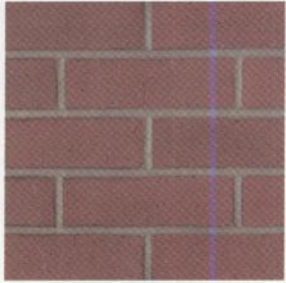
15 Providence  
Range of red brown shades



94 Colony  
Range of light tan shades



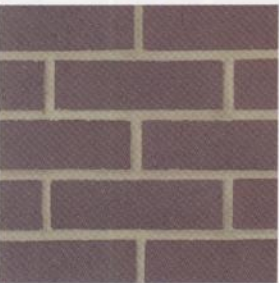
96 Williamstown  
Range of medium tan shades



19 New Amsterdam  
Range of light brown shades



26 Savannah  
Range of light buff shades



97 Valley Forge  
Range of deep warm brown shades



24 Boston  
Range of dark gray shades



21 Raleigh  
Range of light tan gray shades



27 Georgetown  
Range of light red buff shades



# ***Envelope Analysis***



**Envelope Elements**

**Metal Wall Panel Designation**

Type	Product Description	Unit	Unit Cost	Base Cost Quote	Calculated Cost	Calculated Panels	Area	SF Cost	Width	Length	Thickness	(ρ = density) Unit Subweight	
1	Versawall; 2" Thick [26-guage embosed stiad finished]	ea	\$225.00	\$199,800	--	888	0	SF	36.00	in 3.00	lf 2.00	in 0.17	lb/ft <sup>3</sup> 4.7147
2	Versawall; 4-1/2" Thick [26-guage embosed plank finished]	ea	\$185.00	\$198,875	--	1075	0	SF	36.00	in 3.00	lf 4.50	in 0.38	lb/ft <sup>3</sup> 5.2814
3	Foamwall; 2" Thick [26-guage smooth metallic finished]	ea	\$230.00	\$359,950	--	1565	0	SF	36.00	in 3.00	lf 2.00	in 0.17	lb/ft <sup>3</sup> 4.7147
				Versawall; 2" Thick & Foamwall; 2" Thick Base Costs Evaluation			\$559,750						

**CMU Designation**

Type	Product Description	Unit	Unit Cost	Base Cost Quote	Calculated Cost	CMU Totals	Area	SF Cost	Width	Length	Thickness	(ρ = density) Unit Subweight	
1	Burnished Finish w/ integral color	ea	\$13.50	\$0	--		1	SF	8.00	in 0.67	lf 18.00	in 1.50	lb/ft <sup>3</sup> 135.0000
2	Burnished Finish w/ integral color	ea	\$13.50	\$0	--		1	SF	8.00	in 0.67	lf 18.00	in 1.50	lb/ft <sup>3</sup> 135.0000
3	Rock-Split Faced CMU Unit	ea	\$12.00	\$0	--		1	SF	8.00	in 0.67	lf 18.00	in 1.50	lb/ft <sup>3</sup> 125.0000

**Pre-cast Panel Designation**

Type	Product Description	Unit	Unit Cost	Base Cost Quote	Calculated Cost	Pre-cast Panels	Area	SF Cost	Width	Length	Thickness	(ρ = density) Unit Subweight	
8' x 8'	Pre-cast Architectural Panel	ea	\$768.00	\$0	--		64	SF	96.00	in 8.00	lf 96.00	in 8.00	lb/ft <sup>3</sup> 150.0000
8' x 8'	Pre-cast Architectural Panel w/ Form Liner	ea	\$2,240.00	\$0	--		64	SF	96.00	in 8.00	lf 96.00	in 8.00	lb/ft <sup>3</sup> 150.0000

**EZ-Wall Stud System with / Thin Brick**

*Note: Each option accounts for the total area evaluated for the envelope remediation. Cost Comparisons for each option compared to total Base Costs of Type (1) & Type (3) CIM Panels*

Option	Product Description	Unit	Unit Cost	Base Cost Quote	Mat'l Unit Cost	Calculated Panels	Area	SF Cost	Width	Length	Thickness	(ρ = density) Unit Subweight		
1	Edicott Thin Brick System w/ Stud Framing	ea	\$16.95	\$511,188	\$166,788.00	9840	5.333333	SF	\$3.18	16.00	in 1.33	lf 48.00	in 4.00	lb/ft <sup>3</sup> 7.5188
2	Owensboro Thin Brick System/ Stud Framing	ea	\$18.95	\$530,868	\$186,468.00	9840	5.333333	SF	\$3.55	16.00	in 1.33	lf 48.00	in 4.00	lb/ft <sup>3</sup> 7.5188
3	Summittville Thin Brick System/ Stud Framing	ea	\$19.95	\$540,708	\$196,308.00	9840	5.333333	SF	\$3.74	16.00	in 1.33	lf 48.00	in 4.00	lb/ft <sup>3</sup> 7.5188

**Envelope Remediation Elements Scenario**

**1. Option #1**

- ❖ Use pre-manufactured masonry panels or pre-cast panels with veneer in lieu of
  - Pre-cast Form Liner
  - Type (1) – Type (3) Metal Panels
  - Type (1) – Type (3) Architectural CMU(s)
    - ❖ Alternative System Option # 1 – 100 % Pre-manufactured masonry

**2. Option #2**

- ❖ Use pre-manufactured masonry panels or pre-cast panels with veneer in lieu of
  - Type (1) – Type (3) Metal Panels
  - Type (1) – Type (3) Architectural CMU(s)
    - ❖ Alternative System Option # 2 – Pre-manufactured masonry w/ Pre-cast Form Liner

**3. Option #3**

- ❖ Use pre-manufactured masonry panels or pre-cast panels with veneer in lieu of
  - Type (1) – Type (3) Metal Panels
    - ❖ Alternative System Option # 3 – Pre-manufactured masonry w/ Pre-cast Form Liner & Arch CMU units

**4. Option #4**

- ❖ Use an "EZ-Wall" Thin Brick System in lieu of
  - Type (1) – Type (3) Metal Panels
    - ❖ Alternative System Option # 3 – Pre-manufactured masonry w/ Pre-cast Form Liner & Arch CMU units



Note: (66%) of all Architectural CMU(s) used on project are (8") Rock/ Split Face Units  
 (33%) of all Architectural CMU(s) used on project are (8") Burnished Finished integral units

66% Split Face  
 33% Burnished Finis

South Elevation Envelope Analysis

Elevation	Enclosure Mat'l	Width	Length	Total Length	Thickness	Unit Area			
South Elevation	Architectural CMU	8.00 in	0.67 lf	18.00 in	1.50 lf	4321.50 lf	12.00 in	1.00 lf	1.00 SF
South Elevation	Architectural CMU	8.00 in	0.67 lf	18.00 in	1.50 lf	336.00 lf	12.00 in	1.00 lf	1.00 SF
South Elevation	Architectural CMU	8.00 in	0.67 lf	18.00 in	1.50 lf	358.50 lf	12.00 in	1.00 lf	1.00 SF
<b>Column Totals</b>						<b>5016.00 lf</b>			
South Elevation	8'x8' Precast Panels	96.00 in	8.00 lf	96.00 in	8.00 lf	101.38 lf	18.00 in	1.50 lf	64.00 SF
South Elevation	8'x8' Precast Panels	96.00 in	8.00 lf	96.00 in	8.00 lf	12.25 lf	18.00 in	1.50 lf	64.00 SF
South Elevation	8'x8' Precast Panels	96.00 in	8.00 lf	96.00 in	8.00 lf	133.88 lf	18.00 in	1.50 lf	64.00 SF
South Elevation	8'x8' Precast Panels	96.00 in	8.00 lf	96.00 in	8.00 lf	12.25 lf	18.00 in	1.50 lf	64.00 SF
South Elevation	8'x8' Precast Panels	96.00 in	8.00 lf	96.00 in	8.00 lf	59.75 lf	18.00 in	1.50 lf	64.00 SF
South Elevation	8'x8' Precast Panels	96.00 in	8.00 lf	96.00 in	8.00 lf	65.00 lf	18.00 in	1.50 lf	64.00 SF
South Elevation	8'x8' Precast Panels	96.00 in	8.00 lf	96.00 in	8.00 lf	116.00 lf	18.00 in	1.50 lf	64.00 SF
South Elevation	8'x8' Precast Panels	96.00 in	8.00 lf	96.00 in	8.00 lf	307.63 lf	18.00 in	1.50 lf	64.00 SF
South Elevation	8'x8' Precast Panels	96.00 in	8.00 lf	96.00 in	8.00 lf	116.63 lf	18.00 in	1.50 lf	64.00 SF
<b>Column Totals</b>						<b>384.50 lf</b>			
South Elevation	Type (1) Metal Panels	36.00 in	3.00 lf	201.00 in	16.75 lf	186.00 lf	2.00 in	0.17 lf	50.25 SF
South Elevation	Type (1) Metal Panels	36.00 in	3.00 lf	209.00 in	17.42 lf	15.00 lf	2.00 in	0.17 lf	52.25 SF
<b>Column Totals</b>						<b>201.00 lf</b>			
South Elevation	Type (2) Metal Panels	36.00 in	3.00 lf	156.00 in	13.00 lf	216.00 lf	4.50 in	0.38 lf	39.00 SF
South Elevation	Type (2) Metal Panels	36.00 in	3.00 lf	145.00 in	12.08 lf	120.00 lf	4.50 in	0.38 lf	23.93 SF
<b>Column Totals</b>						<b>336.00 lf</b>			
South Elevation	Type (3) Metal Panels	36.00 in	3.00 lf	123.00 in	10.25 lf	183.00 lf	2.00 in	0.17 lf	30.75 SF
South Elevation	Type (3) Metal Panels	36.00 in	3.00 lf	438.00 in	36.50 lf	48.00 lf	2.00 in	0.17 lf	109.50 SF
South Elevation	Type (3) Metal Panels	36.00 in	3.00 lf	438.00 in	36.50 lf	18.00 lf	2.00 in	0.17 lf	109.50 SF
South Elevation	Type (3) Metal Panels	36.00 in	3.00 lf	209.00 in	17.42 lf	15.00 lf	2.00 in	0.17 lf	52.25 SF
South Elevation	Type (3) Metal Panels	36.00 in	3.00 lf	245.00 in	20.42 lf	54.00 lf	2.00 in	0.17 lf	61.25 SF
<b>Column Totals</b>						<b>318.00 lf</b>			



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Unit Volume	Unit Weight	Void Area	Section Area	(#) of Units	Cum Weight	Unit Cost	SF Cost	Section Cost	
1.00 CF	0.0370 CY	127.05 lbs	0.00 SF	2,881.00 SF	2881 ea.	366,031.05 lbs	\$12.38	\$12.38	\$35,652.38
1.00 CF	0.0370 CY	127.05 lbs	64.00 SF	224.00 SF	224 ea.	28,459.20 lbs	\$12.38	\$12.38	\$1,980.00
1.00 CF	0.0370 CY	127.05 lbs	64.00 SF	239.00 SF	239 ea.	30,364.95 lbs	\$12.38	\$12.38	\$2,165.63
			<b>3,344.00 SF</b>	<b>3344 ea.</b>	<b>424,855.20 lbs</b>				<b>\$39,798.00</b>
96.00 CF	3.5556 CY	14,400.00 lbs	0.00 SF	811.00 SF	13 ea.	182,475.00 lbs	\$768.00	\$12.00	\$9,732.00
96.00 CF	3.5556 CY	14,400.00 lbs	0.00 SF	98.00 SF	2 ea.	22,050.00 lbs	\$768.00	\$12.00	\$1,176.00
96.00 CF	3.5556 CY	14,400.00 lbs	0.00 SF	1,071.00 SF	17 ea.	240,975.00 lbs	\$768.00	\$12.00	\$12,852.00
96.00 CF	3.5556 CY	14,400.00 lbs	0.00 SF	98.00 SF	2 ea.	22,050.00 lbs	\$768.00	\$12.00	\$1,176.00
96.00 CF	3.5556 CY	14,400.00 lbs	0.00 SF	478.00 SF	7 ea.	107,550.00 lbs	\$768.00	\$12.00	\$5,736.00
96.00 CF	3.5556 CY	14,400.00 lbs	0.00 SF	520.00 SF	8 ea.	117,000.00 lbs	\$768.00	\$12.00	\$6,240.00
96.00 CF	3.5556 CY	14,400.00 lbs	0.00 SF	928.00 SF	15 ea.	208,800.00 lbs	\$768.00	\$12.00	\$11,136.00
96.00 CF	3.5556 CY	14,400.00 lbs	0.00 SF	2,461.00 SF	38 ea.	553,725.00 lbs	\$768.00	\$12.00	\$29,532.00
96.00 CF	3.5556 CY	14,400.00 lbs	0.00 SF	933.00 SF	15 ea.	209,925.00 lbs	\$768.00	\$12.00	\$11,196.00
			<b>7,398.00 SF</b>	<b>116 ea.</b>	<b>1,664,550.00 lbs</b>				<b>\$88,776.00</b>
8.38 CF	0.0197 ton	39.49 lbs	0.00 SF	3,075.00 SF	62 ea.	2,448.11 lbs	\$225.00	\$0.07	\$13,950.00
8.71 CF	0.0205 ton	41.06 lbs	0.00 SF	215.00 SF	5 ea.	205.29 lbs	\$225.00	\$1.05	\$1,125.00
			<b>3,290.00 SF</b>	<b>67 ea.</b>	<b>2,653.40 lbs</b>				<b>\$15,075.00</b>
14.63 CF	0.0386 ton	77.24 lbs	466.00 SF	3,263.00 SF	72 ea.	5,561.29 lbs	\$185.00	\$0.06	\$13,320.00
13.59 CF	0.0359 ton	71.79 lbs	0.00 SF	939.00 SF	40 ea.	2,871.75 lbs	\$185.00	\$0.20	\$7,400.00
			<b>4,202.00 SF</b>	<b>112 ea.</b>	<b>8,433.04 lbs</b>				<b>\$20,720.00</b>
5.13 CF	0.0121 ton	24.16 lbs	0.00 SF	1,852.00 SF	61 ea.	1,473.94 lbs	\$230.00	\$0.12	\$14,030.00
18.25 CF	0.0430 ton	86.04 lbs	0.00 SF	1,693.00 SF	16 ea.	1,376.70 lbs	\$230.00	\$0.14	\$3,680.00
18.25 CF	0.0430 ton	86.04 lbs	0.00 SF	607.00 SF	6 ea.	516.26 lbs	\$230.00	\$0.38	\$1,380.00
8.71 CF	0.0205 ton	41.06 lbs	0.00 SF	215.00 SF	5 ea.	205.29 lbs	\$230.00	\$1.07	\$1,150.00
10.21 CF	0.0241 ton	48.13 lbs	0.00 SF	1,086.00 SF	18 ea.	866.33 lbs	\$230.00	\$0.21	\$4,140.00
			<b>5,453.00 SF</b>	<b>106 ea.</b>	<b>4,438.51 lbs</b>				<b>\$24,380.00</b>







Note: (66%) of all Architectural CMU(s) used on project are (8") Rock/ Split Face Units 66%  
 (33%) of all Architectural CMU(s) used on project are (8") Burnished Finished integral units 33%

West Elevation Envelope Analysis

<u>Elevation</u>	<u>Enclosure Mat'l</u>	<u>Width</u>		<u>Length</u>		<u>Total Length</u>	<u>Thickness</u>								
West Elevation	Architectural CMU	8.00	in	0.67	If	18.00	in	1.50	If	5325.00	If	12.00	in	1.00	If
<b>Column Totals</b>										<b>5325.00</b>	<b>If</b>				
West Elevation	8'x8' Precast Panels	96.00	in	8.00	If	96.00	in	8.00	If	31.25	If	18.00	in	1.50	If
West Elevation	8'x8' Precast Panels	96.00	in	8.00	If	96.00	in	8.00	If	100.00	If	18.00	in	1.50	If
West Elevation	8'x8' Precast Panels	96.00	in	8.00	If	96.00	in	8.00	If	51.75	If	18.00	in	1.50	If
<b>Column Totals</b>										<b>183.00</b>	<b>If</b>				
West Elevation	Type (1) Metal Panels	36.00	in	3.00	If	201.00	in	16.75	If	240.00	If	2.00	in	0.17	If
West Elevation	Type (1) Metal Panels	36.00	in	3.00	If	430.00	in	35.83	If	36.00	If	2.00	in	0.17	If
<b>Column Totals</b>										<b>183.00</b>	<b>If</b>				
West Elevation	Type (2) Metal Panels	36.00	in	3.00	If	134.00	in	11.17	If	177.00	If	4.50	in	0.38	If
<b>Column Totals</b>										<b>177.00</b>	<b>If</b>				
West Elevation	Type (3) Metal Panels	36.00	in	3.00	If	123.00	in	10.25	If	345.00	If	2.00	in	0.17	If
West Elevation	Type (3) Metal Panels	36.00	in	3.00	If	356.00	in	29.67	If	30.00	If	2.00	in	0.17	If
West Elevation	Type (3) Metal Panels	36.00	in	3.00	If	453.00	in	37.75	If	30.00	If	2.00	in	0.17	If
West Elevation	Type (3) Metal Panels	36.00	in	3.00	If	371.00	in	30.92	If	30.00	If	2.00	in	0.17	If
West Elevation	Type (3) Metal Panels	36.00	in	3.00	If	438.00	in	36.50	If	24.00	If	2.00	in	0.17	If
West Elevation	Type (3) Metal Panels	36.00	in	3.00	If	155.90	in	12.99	If	9.00	If	2.00	in	0.17	If
<b>Column Totals</b>										<b>468.00</b>	<b>If</b>				



Split Face  
Burnished Finished

<u>Unit Area</u>	<u>Unit Volume</u>		<u>Unit Weight</u>	<u>Void Area</u>	<u>Section Area</u>	<u>(#) of Units</u>	<u>Cum Weight</u>	<u>Unit Cost</u>	<u>SF Cost</u>	<u>Section Cost</u>
1.00 SF	1.00 CF	0.0370 CY	127.05 lbs	0.00	3,550.00	3550 ea.	451,027.50 lbs	\$12.38	\$12.38	\$43,931.25
					<b>3,550.00 SF</b>	<b>3550 ea.</b>	<b>451,027.50 lbs</b>			<b>\$43,931.25</b>
64.00 SF	96.00 CF	3.5556 CY	14,400.00 lbs	64.00	250.00	4 ea.	56,250.00 lbs	\$768.00	\$12.00	\$2,232.00
64.00 SF	96.00 CF	3.5556 CY	14,400.00 lbs	0.00	800.00	13 ea.	180,000.00 lbs	\$768.00	\$12.00	\$9,600.00
64.00 SF	96.00 CF	3.5556 CY	14,400.00 lbs	0.00	414.00	6 ea.	93,150.00 lbs	\$768.00	\$12.00	\$4,968.00
					<b>1,464.00 SF</b>	<b>23 ea.</b>	<b>329,400.00 lbs</b>			<b>\$16,800.00</b>
50.25 SF	8.38 CF	0.0197 ton	39.49 lbs	50.25	4,048.00	80 ea.	3,158.86 lbs	\$225.00	\$0.06	\$18,000.00
107.50 SF	17.92 CF	0.0422 ton	84.47 lbs	107.61	1,331.00	12 ea.	1,013.66 lbs	\$225.00	\$0.17	\$2,700.00
					<b>5,379.00 SF</b>	<b>92 ea.</b>	<b>4,172.52 lbs</b>			<b>\$20,700.00</b>
33.50 SF	12.56 CF	0.0332 ton	66.35 lbs	33.50	1,996.00	59 ea.	3,914.49 lbs	\$185.00	\$0.09	\$10,915.00
					<b>1,996.00 SF</b>	<b>59 ea.</b>	<b>3,914.49 lbs</b>			<b>\$10,915.00</b>
30.75 SF	5.13 CF	0.0121 ton	24.16 lbs	33.39	3,552.00	115 ea.	2,778.73 lbs	\$230.00	\$0.06	\$26,450.00
89.00 SF	14.83 CF	0.0350 ton	69.93 lbs	89.04	973.00	10 ea.	699.35 lbs	\$230.00	\$0.24	\$2,300.00
113.25 SF	18.88 CF	0.0445 ton	88.99 lbs	113.16	1,135.00	10 ea.	889.90 lbs	\$230.00	\$0.20	\$2,300.00
92.75 SF	15.46 CF	0.0364 ton	72.88 lbs	92.75	994.00	10 ea.	728.82 lbs	\$230.00	\$0.23	\$2,300.00
109.50 SF	18.25 CF	0.0430 ton	86.04 lbs	109.55	948.00	8 ea.	688.35 lbs	\$230.00	\$0.24	\$1,840.00
38.98 SF	6.50 CF	0.0153 ton	30.63 lbs	38.98	136.50	3 ea.	91.88 lbs	\$230.00	\$1.68	\$690.00
					<b>7,738.50 SF</b>	<b>156 ea.</b>	<b>5,877.03 lbs</b>			<b>\$35,880.00</b>





Note: (66%) of all Architectural CMU(s) used on project are (8") Rock/ Split Face Units  
 (33%) of all Architectural CMU(s) used on project are (8") Burnished Finished integral units

66% Split Face  
 33% Burnished Finis

South Elevation Envelope Analysis

<u>Elevation</u>	<u>Enclosure Mat'l</u>	<u>Width</u>	<u>Length</u>	<u>Total Length</u>	<u>Thickness</u>	<u>Unit Area</u>
North Elevation	Architectural CMU	8.00	18.00	1098.00	12.00	1.00 SF
North Elevation	Architectural CMU	8.00	18.00	145.50	12.00	1.00 SF
North Elevation	Architectural CMU	8.00	18.00	5121.00	12.00	1.00 SF
<b>Column Totals</b>				<b>6364.50</b>		
North Elevation	8'x8' Precast Panels					No.
North Elevation	Type (1) Metal Panels	36.00	208.00	9.00	2.00	52.00 SF
North Elevation	Type (1) Metal Panels	36.00	468.00	33.00	2.00	117.00 SF
North Elevation	Type (1) Metal Panels	36.00	267.00	213.00	2.00	66.75 SF
<b>Column Totals</b>				<b>255.00</b>		
North Elevation	Type (2) Metal Panels	36.00	156.00	216.00	4.50	39.00 SF
North Elevation	Type (2) Metal Panels	36.00	145.00	120.00	4.50	23.93 SF
<b>Column Totals</b>				<b>336.00</b>		
North Elevation	Type (3) Metal Panels	36.00	119.00	375.00	2.00	29.75 SF
North Elevation	Type (3) Metal Panels	36.00	349.00	45.00	2.00	87.25 SF
North Elevation	Type (3) Metal Panels	36.00	468.00	33.00	2.00	117.00 SF
North Elevation	Type (3) Metal Panels	36.00	519.00	12.00	2.00	129.75 SF
North Elevation	Type (3) Metal Panels	36.00	119.00	186.00	2.00	29.75 SF
North Elevation	Type (3) Metal Panels	36.00	468.00	51.00	2.00	117.00 SF
<b>Column Totals</b>				<b>702.00</b>		

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<u>Unit Volume</u>	<u>Unit Weight</u>	<u>Void Area</u>	<u>Section Area</u>	<u>(#) of Units</u>	<u>Cum Weight</u>	<u>Unit Cost</u>	<u>SF Cost</u>	<u>Section Cost</u>			
1.00 CF	0.0370 CY	127.05 lbs	0.00	SF	732.00	SF	732 ea.	93,000.60 lbs	\$12.38	\$12.38	\$9,058.50
1.00 CF	0.0370 CY	127.05 lbs	64.00	SF	97.00	SF	97 ea.	12,323.85 lbs	\$12.38	\$12.38	\$408.38
1.00 CF	0.0370 CY	127.05 lbs	64.00	SF	3,414.00	SF	3414 ea.	433,748.70 lbs	\$12.38	\$12.38	\$41,456.25
					<b>4,243.00 SF</b>		<b>4243 ea.</b>	<b>539,073.15 lbs</b>			<b>\$50,923.13</b>

**8' x 8' Architectural Pre-cast Panels on Elevation:**

8.67 CF	0.0204 ton	40.86 lbs	0.00	SF	118.00	SF	3 ea.	122.58 lbs	\$225.00	\$1.91	\$675.00
19.50 CF	0.0460 ton	91.94 lbs	0.00	SF	1,253.00	SF	11 ea.	1,011.31 lbs	\$225.00	\$0.18	\$2,475.00
11.13 CF	0.0262 ton	52.45 lbs	0.00	SF	4,681.00	SF	71 ea.	3,724.03 lbs	\$225.00	\$0.05	\$15,975.00
					<b>6,052.00 SF</b>		<b>85 ea.</b>	<b>4,857.92 lbs</b>			<b>\$19,125.00</b>
14.63 CF	0.0386 ton	77.24 lbs	466.00	SF	3,263.00	SF	72 ea.	5,561.29 lbs	\$185.00	\$0.06	\$13,320.00
13.59 CF	0.0359 ton	71.79 lbs	0.00	SF	939.00	SF	40 ea.	2,871.75 lbs	\$185.00	\$0.20	\$7,400.00
					<b>4,202.00 SF</b>		<b>112 ea.</b>	<b>8,433.04 lbs</b>			<b>\$20,720.00</b>
4.96 CF	0.0117 ton	23.38 lbs	38.00	SF	3,733.00	SF	125 ea.	2,922.14 lbs	\$230.00	\$0.06	\$28,750.00
14.54 CF	0.0343 ton	68.56 lbs	0.00	SF	1,222.00	SF	15 ea.	1,028.40 lbs	\$230.00	\$0.19	\$3,450.00
19.50 CF	0.0460 ton	91.94 lbs	0.00	SF	1,181.00	SF	11 ea.	1,011.31 lbs	\$230.00	\$0.19	\$2,530.00
21.63 CF	0.0510 ton	101.96 lbs	0.00	SF	510.00	SF	4 ea.	407.82 lbs	\$230.00	\$0.45	\$920.00
4.96 CF	0.0117 ton	23.38 lbs	228.00	SF	2,068.00	SF	62 ea.	1,449.38 lbs	\$230.00	\$0.11	\$14,260.00
19.50 CF	0.0460 ton	91.94 lbs	0.00	SF	1,904.00	SF	17 ea.	1,562.93 lbs	\$230.00	\$0.12	\$3,910.00
					<b>10,618.00 SF</b>		<b>234 ea.</b>	<b>8,381.97 lbs</b>			<b>\$53,820.00</b>



Page Totals

Enclosure Mat'l	Total Area	Enclosure Mat'l Ratio
<b>8"x18"x12" Architectural CMU(s)</b>		
Type (1) Burnished Finished	700 SF	3%
Type (2) Burnished Finished	700 SF	3%
Type (3) Rock/ Split Faced	2,843 SF	11%
<b>Total Arch. CMU(s)</b>	<b>4,243 SF</b>	<b>17%</b>
<b>Cored Insulated Mtl Panels</b>		
Type (1) 26 gauge stl 3'0" (2") Versawall Panel	6,052 SF	24%
Type (2) 26 gauge stl 3'0" (4-1/2") Versawall Panel	4,202 SF	17%
Type (3) 26 gauge stl 3'0" (2") Foamwall Panel	10,618 SF	42%
<b>Total Metal Panels</b>	<b>20,872 SF</b>	<b>83%</b>
<b>8'x8' Architectural Precast Panels</b>		
Architectural Panels w/ Form Liner	0 SF	0%
<b>Total Arch. Precast Panels</b>	<b>0 SF</b>	<b>0%</b>
<b>Interchange Envelope Section</b>	<b>25,115 SF</b>	<b>100%</b>
<b>Enclosure Mat'l System Cost(s)</b>		
8"x18"x12" Architectural CMU(s)	\$50,923	
Cored Insulated Mtl Panels	\$93,665	
8'x8' Architectural Precast Panels	\$0	
<b>Total</b>	<b>\$144,588</b>	

**Total System Wt. 560,746.09 lbs.  
560.75 kips**

**Proposed Wall Remedy (Thin Brick Wall System Set as pre-manufactured panel)**

Panel Area (SF)	Proposed Area		No. of Panels	System Wt.	System Wt.
5	16,670	SF			
$\frac{\text{Proposed Envelope Area}}{\text{Individual Panel Area}} =$			3126	125,353 lb	125.3534 <sup>k</sup>

Weight Adjustments to Current System

Current System Weight	=	560,746 lb	560.75 <sup>k</sup>
(less)	(subtract)		
Type (1) Metal Panels	=	4,858 lb	4.857923 <sup>k</sup>
Type (3) Metal Panels	=	8,382 lb	8.381975 <sup>k</sup>
(plus)	(add)		
Thin Brick System	=	125,353 lb	125.3534 <sup>k</sup>
<b>Adjusted Weight</b>	<b>=</b>	<b>672,860 lb</b>	<b>672.86<sup>k</sup></b>

Note: (66%) of all Architectural CMU(s) used on project are (8") Rock/ Split Face Units  
 (33%) of all Architectural CMU(s) used on project are (8") Burnished Finished integral units

66% Split Face  
 33% Burnished Finished

West Elevation Envelope Analysis

<u>Elevation</u>	<u>Enclosure Mat'l</u>	<u>Width</u>	<u>Length</u>	<u>Total Length</u>	<u>Thickness</u>	<u>Unit Area</u>			
East Elevation	Architectural CMU	8.00 in	0.67 lf	18.00 in	1.50 lf	780.00 lf	12.00 in	1.00 lf	1.00 SF
East Elevation	Architectural CMU	8.00 in	0.67 lf	18.00 in	1.50 lf	189.00 lf	12.00 in	1.00 lf	1.00 SF
<b>Column Totals</b>						<b>969.00 lf</b>			
East Elevation	8'x8' Precast Panels	96.00 in	8.00 lf	96.00 in	8.00 lf	293.63 lf	18.00 in	1.50 lf	64.00 SF
<b>Column Totals</b>						<b>293.63 lf</b>			
East Elevation	Type (1) Metal Panels	36.00 in	3.00 lf	438.00 in	36.50 lf	267.00 lf	2.00 in	0.17 lf	109.50 SF
<b>Column Totals</b>						<b>293.63 lf</b>			
East Elevation	Type (2) Metal Panels	36.00 in	3.00 lf	119.00 in	9.92 lf	144.00 lf	4.50 in	0.38 lf	29.75 SF
East Elevation	Type (2) Metal Panels	36.00 in	3.00 lf	156.00 in	13.00 lf	135.00 lf	4.50 in	0.38 lf	39.00 SF
East Elevation	Type (2) Metal Panels	36.00 in	3.00 lf	356.16 in	29.68 lf	213.00 lf	4.50 in	0.38 lf	89.04 SF
<b>Column Totals</b>						<b>492.00 lf</b>			
East Elevation	Type (3) Metal Panels	36.00 in	3.00 lf	437.90 in	36.49 lf	39.00 lf	2.00 in	0.17 lf	109.48 SF
East Elevation	Type (3) Metal Panels	36.00 in	3.00 lf	460.00 in	38.33 lf	3.00 lf	2.00 in	0.17 lf	115.00 SF
East Elevation	Type (3) Metal Panels	36.00 in	3.00 lf	223.00 in	18.58 lf	6.00 lf	2.00 in	0.17 lf	55.75 SF
East Elevation	Type (3) Metal Panels	36.00 in	3.00 lf	445.00 in	37.08 lf	33.00 lf	2.00 in	0.17 lf	111.25 SF
East Elevation	Type (3) Metal Panels	36.00 in	3.00 lf	430.00 in	35.83 lf	12.00 lf	2.00 in	0.17 lf	107.50 SF
East Elevation	Type (3) Metal Panels	36.00 in	3.00 lf	445.00 in	37.08 lf	18.00 lf	2.00 in	0.17 lf	111.25 SF
East Elevation	Type (3) Metal Panels	36.00 in	3.00 lf	243.00 in	20.25 lf	24.00 lf	2.00 in	0.17 lf	60.75 SF
<b>Column Totals</b>						<b>135.00 lf</b>			



<u>Unit Volume</u>		<u>Unit Weight</u>	<u>Void Area</u>	<u>Section Area</u>	<u>(#) of Units</u>	<u>Cum Weight</u>	<u>Unit Cost</u>	<u>SF Cost</u>	<u>Section Cost</u>
1.00 CF	0.0370 CY	127.05 lbs	0.00 SF	520.00 SF	520 ea.	66,066.00 lbs	\$12.38	\$12.38	\$6,435.00
1.00 CF	0.0370 CY	127.05 lbs	0.00 SF	126.00 SF	126 ea.	16,008.30 lbs	\$12.38	\$12.38	\$1,559.25
				<b>646.00 SF</b>	<b>646 ea.</b>	<b>82,074.30 lbs</b>			<b>\$7,994.25</b>
96.00 CF	3.5556 CY	14,400.00 lbs	0.00 SF	2,349.00 SF	37 ea.	528,525.00 lbs	\$768.00	\$12.00	\$28,188.00
				<b>2,349.00 SF</b>	<b>37 ea.</b>	<b>528,525.00 lbs</b>			<b>\$28,188.00</b>
18.25 CF	0.0430 ton	86.04 lbs	0.00 SF	9,659.00 SF	89 ea.	7,657.87 lbs	\$225.00	\$0.02	\$20,025.00
				<b>9,659.00 SF</b>	<b>89 ea.</b>	<b>7,657.87 lbs</b>			<b>\$20,025.00</b>
11.16 CF	0.0295 ton	58.92 lbs	0.00 SF	1,407.00 SF	48 ea.	2,828.18 lbs	\$185.00	\$0.13	\$8,880.00
14.63 CF	0.0386 ton	77.24 lbs	0.00 SF	1,727.00 SF	45 ea.	3,475.81 lbs	\$185.00	\$0.11	\$8,325.00
33.39 CF	0.0882 ton	176.35 lbs	0.00 SF	6,291.28 SF	71 ea.	12,520.51 lbs	\$185.00	\$0.03	\$13,135.00
				<b>9,425.28 SF</b>	<b>164 ea.</b>	<b>18,824.50 lbs</b>			<b>\$30,340.00</b>
18.25 CF	0.0430 ton	86.02 lbs	0.00 SF	1,376.00 SF	13 ea.	1,118.31 lbs	\$230.00	\$0.17	\$2,990.00
19.17 CF	0.0452 ton	90.37 lbs	0.00 SF	115.00 SF	1 ea.	90.37 lbs	\$230.00	\$2.00	\$230.00
9.29 CF	0.0219 ton	43.81 lbs	0.00 SF	111.00 SF	2 ea.	87.62 lbs	\$230.00	\$2.07	\$460.00
18.54 CF	0.0437 ton	87.42 lbs	0.00 SF	1,216.00 SF	11 ea.	961.61 lbs	\$230.00	\$0.19	\$2,530.00
17.92 CF	0.0422 ton	84.47 lbs	0.00 SF	399.30 SF	4 ea.	337.89 lbs	\$230.00	\$0.58	\$920.00
18.54 CF	0.0437 ton	87.42 lbs	0.00 SF	619.60 SF	6 ea.	524.51 lbs	\$230.00	\$0.37	\$1,380.00
10.13 CF	0.0239 ton	47.74 lbs	0.00 SF	441.73 SF	8 ea.	381.89 lbs	\$230.00	\$0.52	\$1,840.00
				<b>4,278.63 SF</b>	<b>45 ea.</b>	<b>3,502.19 lbs</b>			<b>\$10,350.00</b>





Enclosure Mat'l	Total Area	Enclosure Mat'l Ratio
<b>8"x18"x12" Architectural CMU(s)</b>		
Type (1) Burnished Finished	1,944 SF	2%
Type (2) Burnished Finished	1,944 SF	2%
Type (3) Rock/ Split Faced	7,895 SF	9%
<b>Total Arch. CMU(s)</b>	<b>11,783 SF</b>	<b>13%</b>
<b>Cored Insulated Mtl Panels</b>		
Type (1) 26 gauge stl 3'0" (2") Versawall Panel	14,721 SF	16%
Type (2) 26 gauge stl 3'0" (4-1/2") Versawall Panel	20,059 SF	22%
Type (3) 26 gauge stl 3'0" (2") Foamwall Panel	33,235 SF	37%
<b>Total Arch. CMU(s)</b>	<b>68,015 SF</b>	<b>75%</b>
<b>8'x8' Architectural Precast Panels</b>		
Architectural Panels w/ Form Liner	11,211 SF	12%
<b>Total Arch. CMU(s)</b>	<b>11,211 SF</b>	<b>12%</b>
<b>Interchange Envelope Section</b>	<b>91,009 SF</b>	<b>100%</b>

Enclosure Mat'l	System Cost(s)	Percentage of Cost
8"x18"x12" Architectural CMU(s)	\$142,647	26%
Cored Insulated Mtl Panels (Type 1)	\$74,925	13%
Cored Insulated Mtl Panels (Type 2)	\$82,695	15%
Cored Insulated Mtl Panels (Type 3)	\$124,430	22%
8'x8' Architectural Precast Panels	\$133,764	24%
<b>Total</b>	<b>\$558,461</b>	<b>100%</b>
Total Check	\$558,461	

**Complete Weight** 4100.65 kips

**Weight of Affected Envelope**

Type (1) = 19.42 kips

Type (3) = 22.21 kips

<b>Total Number of Panels</b>	<b>9840 EA.</b>
<b>Additional System Weight</b>	<b>353.05 kips</b>

# ***Structural Calculations***



① Strip Ftg Redesign

② Column Verification

Current Bldg Wt. = 79,246.3<sup>k</sup>  
 w/ Envelope  
 Remediation = 83,700<sup>k</sup>

Total Number of Col(s)  $\Sigma_{col} = 165$

\* Assume Typical Column throughout for analysis condition

$$\bar{P}_{Total D} = 57,300^k \quad \bar{P}_{col D} = \frac{57,300^k}{165} = 347.27^k$$

$$\bar{P}_{Total L} = 26,400^k \quad \bar{P}_{col L} = \frac{26,400^k}{165} = 160^k$$

Length of Affected Areas

Elevation	Ftg. Dimension (Perimeter)
South	167.59'
West	303.65'
North	220.78'
East	253.55'

Existing Exterior Wall Weight

CMU	0.0817 Klf
Pre-cast Panel	4.3291 Klf
CIW Type (1)	0.0132 Klf
CIW Type (2)	0.0251 Klf
CIW Type (3)	0.0140 Klf
<u>Total</u>	<u>4.4661 Klf</u>

Adjusted Exterior Wall Weight (using 16" x 48" Thin Brick Panel System)

CMU	0.0817 Klf
Pre-cast Panel	4.3291 Klf
CIW Type (2)	0.0251 Klf
<u>Thin Brick Sys.</u>	<u>0.1267 Klf</u>
<u>Total</u>	<u>4.5656 Klf</u>

$$\Delta \text{Net Increase} = 0.0995 \text{ Klf}$$

Given: a composite wall composed of 8" x 16" x 12" Split Face / Burnished finish masonry units, 8' x 8' Architectural Pre-cast Panels, 4 1/2" thick Cored Insulated Mt. Panels and 4 3/4" Thin Brick imposes a 4,565/6 PLF load to a concrete strip ftg.

Ftg Strength  $\approx 4,000$  psi  
 Soil Bearing Capacity  $\approx 4,000$  psf  
 Frost Depth  $\approx 48$ "

Step (1): Assume Load Includes Live load

$$P_T = P_D + P_L = 4.5656 \text{ Klf}$$

$$q_a \geq P_T / A \rightarrow (\text{Use unit strip Method})$$

$$\frac{4.5656 \text{ Klf} (1 \text{ ft})}{(1 \text{ ft}) B} \leq 4 \text{ Ksf}$$

$$B = \frac{4.5656 \text{ Ksf}}{4 \text{ Ksf} (1 \text{ ft})} \approx 1.14'$$

$$B \geq 1.14' \rightarrow \text{Use } 1.33'$$

Step (2): Factor Loading

$$P_u = 1.4 P_T = 6.3918 \text{ Klf}$$

$$q_u = \frac{P_u}{A} = \frac{6.3918 \text{ Klf}}{(1') (1.33')} \approx 4.8059 \text{ Ksf}$$

Step (3): Footing Reinforcement Option [Wide Beam Shear]

$$\phi V_c = \phi 2 \sqrt{f'_c} (b)(d) \quad \phi = 0.75$$

$$= (0.75)(2) \sqrt{4,000 \text{ psi}} (12'')(d)$$

↑  
Unit Strip

$$= 1138d$$

$$\phi V_u = (4.8059) \left[ \frac{B - \frac{\text{largest width of wall}}{12}}{2} \right] (\text{Unit Strip})$$



$$V_u = (4.81) \left[ \frac{1.33' - \left(\frac{12}{12}\right)}{2} \right] (1) = 0.7937^k$$

$$= 794 \text{ lbs}$$

$$\phi V_c = V_u$$

$$d = \frac{794 \text{ lbs}}{1138 \text{ lbs}} = 0.6974''$$

$$h = d + 3'' (\text{cover}) + 0.25''$$

$$= 0.6974'' + 3'' + 0.25'' = 3.95'' \rightarrow 4''$$

Use (6'')

$$d = 6'' - (3'' + 0.25'') = 2.75''$$

Step (4): Effective Length - Moment Arm

$$l = \frac{B - W}{2} = \frac{\left(1.33' - \left(\frac{12}{12}\right)\right)}{2}$$

$$l = 0.165' \text{ or } 1.98''$$

$$M_u = \frac{q l^2}{2} = \frac{(4.81)(0.165)^2}{2}$$

$$M_u = 0.0655^k$$

$$a = \frac{A_s f_y}{0.85 f'_c b} \leftarrow \text{Unit Strip}$$

$$a = \frac{60 \text{ ksi} (A_s)}{0.85 (4 \text{ ksi}) (12'')} \approx 1.47 A_s$$

$$M_u = \phi M_n = \phi A_s f_y \left(d - \frac{a}{2}\right)$$

$$\phi = 0.9$$

$$4.81 \text{ k} (12 \text{ in/ft}) = (0.9)(A_s)(60 \text{ ksi}) \left( 2.75 \text{ in} - \frac{1.47 A_s}{2} \right)$$

$$\frac{4.81 \text{ k} (12 \text{ in/ft})}{(0.9)(60 \text{ ksi})} = 2.75 A_s - 0.735 A_s^2$$

$$-0.735 A_s^2 + 2.75 A_s = 1.07$$

$$-0.735 A_s^2 + 2.75 A_s - 1.07$$

$$A_s = 0.455 \text{ in}^2$$

$$\text{Use \#5 @ 6" o.c. } A_s = (2)(0.31 \text{ in}^2) = 0.62 \text{ in}^2$$

Step (5) : Check Spacing

$$\rho = \frac{A_s}{bh} = 0.0018$$

$$\rho = \frac{(0.62 \text{ in}^2)}{(12 \text{ in})(6 \text{ in})} = 0.0086$$

$$\rho = 0.0086 \geq \rho = 0.0018$$

$$a = 1.47 A_s = 1.47 (0.62 \text{ in}^2) = 0.9114$$

$$c = \frac{a}{\beta_1} = \frac{0.9114}{(0.85)} = 1.072 \quad \text{" } \epsilon_s \geq 0.005 \text{ in/in"}$$

$$\epsilon_s = \frac{0.003}{c} (d - c) = \frac{0.003}{1.072} (2.75 - 1.072) = 0.0047$$

To be on safe side / try Using # 4's

$$A_s = (2)(0.20 \text{ in}^2) = 0.40 \text{ in}^2$$

$$\rho = \frac{(0.40 \text{ in}^2)}{(12 \text{ in})(6 \text{ in})} = 0.0055$$

$$a = 1.47 (0.40 \text{ in}^2) \approx 0.588$$

$$c = \frac{a}{\beta_1} = \frac{0.588}{0.85} = 0.6918$$



$$e = \frac{0.003}{c} (d-c) = \frac{0.003}{0.588} (2.75 - 0.588)$$

$$= 0.0110 > 0.005 \text{ Spacing } \therefore \text{ok}$$

w/ #4's  
via inspection

Step (b): Longitudinal shrinkage  
& Temp. Reinforcement

$$A_{s \text{ min}} = 0.0018 bh$$

$$= 0.0018 (1.33 \times (12''/16'') (6''))$$

$$= 0.1723 \text{ in}^2$$

$$\# \text{ of Required Bars} = \frac{A_{s \text{ min}}}{A_{\text{bar \#4}}} = \frac{0.1723 \text{ in}^2}{0.20 \text{ in}^2} = 0.86184$$

# of Required Bars Longitudinal is (1) #4 bar.

$$FTG_T = \text{Width} = 1'-4''$$

$$FTG_D = \text{Depth} = 6''$$

$$\text{Unit Strip } 1'-4'' \times 12'' \times 6''$$

$$\bar{P}_{col} = \bar{P}_{col, DL} + \bar{P}_{col, LL} = 347.27^k (DL) + 160.00^k (LL)$$

Assume  $q_a = 4 \text{ Ksf}$

18" x 18" Pre-cast Column

Step (1)

$$\bar{P}_{Total} = 347.27^k + 160.00^k = 507.27^k$$

$$q_a \geq \frac{P}{A} \rightarrow \frac{P}{B^2}$$

$$B^2 \geq \frac{507.27^k}{4 \text{ Ksf}}$$

$$B^2 \geq 126.82 \text{ sf}$$

$$B \geq 11.26' \rightarrow \text{Use } 11.33'$$

Step (2) Factor Load

$$P_u = 1.2(347.27^k) + 1.6(160.00^k) = 672.72^k$$

$$q = \frac{P_u}{A} \rightarrow \frac{P}{B^2}$$

$$q = \frac{672.72^k}{(11.33')^2} = 5.24 \text{ Ksf}$$

$$= 36.39 \text{ psi}$$

Step (3)

$$V_c = \phi 4 \sqrt{f'_c}$$

$$= (0.75)(4) \sqrt{4,000} = 189.74 \text{ psi}$$

Step (4) Two way Shear

$$d^2(V_c + q/4) + d(V_c + q/2)w = q/4 (B^2 - w^2)$$

$$d^2(189.74 + \frac{(36.39)}{4}) + d(189.74 + \frac{(36.39)}{2})(18) = \frac{(36.39)}{4} ((11.33 \cdot 12)^2 - 18^2)$$

$$198.84d^2 + 3742.83d = 165,220$$

$$.19884d^2 + 3.74283d - 165.221$$

$$d = 20.65''$$

$$h = d + 3'' + d_b$$

$$= 20.65 + 3'' + 0.625$$

$$= 24.275''$$

Use  $\rightarrow$  28''  $\approx$  2'-4''

Step (5)

$$d = h - (3''_{\text{cover}} + 0.625)$$

$$= 28'' - 3.625'' = 24.375''$$

$$l = \frac{B_{FTG} - W_{FTG/PIER}}{2} = \frac{11.33' - (18/12)}{2} = 4.92' \Rightarrow \text{Use } 5'$$

Step (6) Factor Moment

$$M_u = \frac{q l^2}{2} = \frac{5.24 (5)^2}{2} = 65.5' \text{-K}$$

$$a = \frac{A_s f_y}{(0.85) f'_c b} = \frac{A_s (60 \text{ksi})}{(0.85) (4 \text{ksi}) (24.375)} = 0.724 A_s$$

$$M_u = \phi M_n = \phi A_s f_y \left( d - \frac{a}{2} \right)$$

$$65.5' \text{-K} (12) = (0.9) A_s (60) \left( 24.375 - \frac{0.724 A_s}{2} \right)$$

$$\frac{786}{(0.9)(60)} = 24.375 A_s - 0.362 A_s^2$$

$$-0.362 A_s^2 + 24.375 A_s - 14.56$$

$$A_s = 0.615 \text{ in}^2$$

$$\text{Use \#7 @ } 12'' \text{ o.c. } A_s = 0.60 \text{ in}^2$$

$\therefore$  OK if Slightly Under Sized.



Step (7)

$$\rho = \frac{A_s}{bh} = \frac{0.60 \text{ in}^2}{(12")(28")} = 0.00178 \leq 0.0018$$

Try Different Rebar Size or Multiple Levels

Try (2) Levels of #5

$$\rho_{(2)\#5} = \frac{A_s}{bh} = \frac{(2)(0.31 \text{ in}^2)}{(12")(28")} = 0.00185 \geq 0.0018 \therefore \text{OK}$$

$$a = 0.724 A_s$$

$$= 0.724 (2(0.31 \text{ in}^2)) = 0.449$$

$$c = \frac{a}{\beta_1} = \frac{a}{0.85} = \frac{0.449}{0.85} = 0.528$$

$$E_s = \frac{0.003}{c} (d - c) > 0.005$$

$$E_s = \frac{0.003}{0.528} (24.375 - 0.528) = 0.135 > 0.005 \therefore \text{OK}$$

Step (8)

$$\phi B_N = \phi (0.85) f'_c A_1$$

$$= (0.65)(0.85)(4 \text{ ksi})(11.33(12))^2$$

$$= 40,852 \text{ k} > 672.72 \text{ k}$$

$$\phi B_N > P_u$$

FT6

11'-3" x 11'-3" x 2'-8"

What about an 8' x 8' FTG

Step (1)

$$q = \frac{P_u}{A} \rightarrow \frac{P_u}{B^2}$$

$$q = \frac{672.72 \text{ k}}{(8)^2} = 10.51 \text{ KSF}$$

$$= 72.99 \text{ psi}$$

Step (2)

$$V_c = 189.74 \text{ psi}$$

$$d^2 \left( 189.74 + \frac{72.99}{4} \right) + d \left( 189.74 + \frac{72.99}{2} \right) (18) = \frac{72.99}{4} (196^2 - 18^2)$$

$$207.99d^2 + 4072.23d = 162256.77$$

$$0.208d^2 + 4.072d - 162.257$$

$$d = 19.85''$$

$$h = d + 3'' + d_b$$

$$= 19.85'' + 3'' + 0.625''$$

$$= 23.475'' \rightarrow 24$$

Step (3)

$$l = \frac{8' - (18/12)}{2} = 3.25' \quad / \quad d = 24'' - (3 + 0.625)$$

$$= 20.375$$

Step (4)

$$M_u = \frac{q l^2}{2} = \frac{(10.51)(3.25)^2}{2} = 55.51 \text{ k-ft}$$

$$a = \frac{A_s f_y}{(0.85) f'_c b} = \frac{A_s (60 \text{ ksi})}{(0.85)(4)(20.375)} = 0.866 A_s$$

$$M_u = \phi M_n = \phi A_s f_y \left( d - \frac{a}{2} \right)$$

$$55.51 \text{ k-ft} (12) = 0.9 A_s (60) \left( 20.375 - \frac{0.866 A_s}{2} \right)$$

$$\frac{666.12}{(0.9)(60)} = 20.375 A_s - 0.443 A_s^2$$

$$-0.443 A_s^2 + 20.375 A_s - 12.34$$

$$A_s = 0.615 \text{ in}^2$$

Use #7 @ 12"

$$A_s = 0.60 \text{ in}^2$$

Step (5)

$$\rho = \frac{A_s}{bh} = \frac{0.60 \text{ in}^2}{(12")(24")} = 0.0021 > 0.0018$$

$$a = 0.724 A_s$$

$$= 0.724 (0.60)$$

$$a = .4344$$

$$c = \frac{a}{0.85} = \frac{.4344}{0.85} = 0.511$$

$$\beta_1 = 0.85$$

$$E_s = \frac{0.003}{c} (d - c) > 0.005$$

$$E_s = \frac{0.003}{0.511} (19.85 - 0.511) = 0.1135 > 0.005$$

Step (6)

$$\phi B_n = \phi (0.85) f'_c A_c$$

$$= (0.65)(0.85)(4 \text{ ksi}) ((8)(12))^2$$

$$= 20,367.36 \text{ k}$$

$$\phi B_n = 20,367.36 \text{ k} > 507.27 \text{ k o.k.}$$

$$\text{FTG} = 8'-0" \times 8'-0" \times 2'-0"$$