

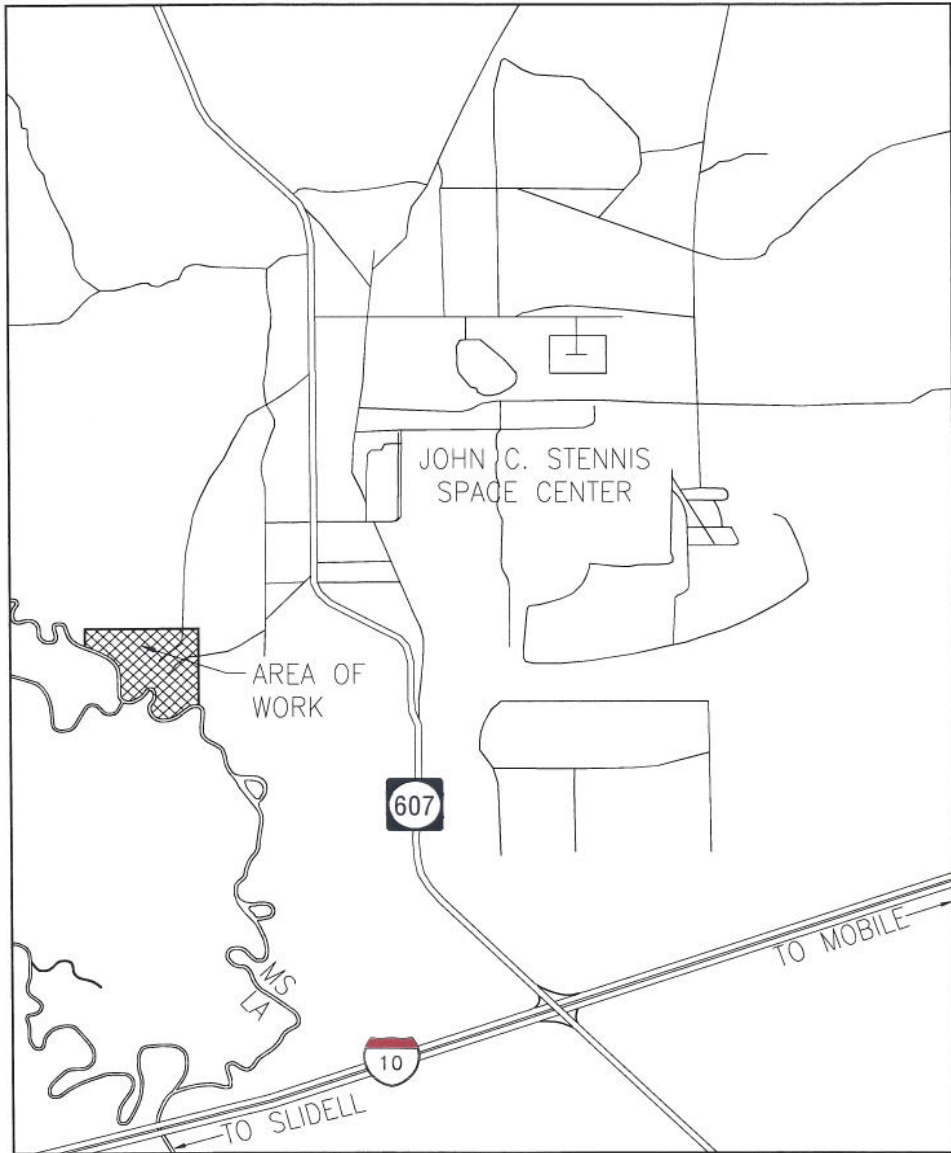
***SOV RIVERINE AND COMBATANT  
CRAFT OPERATIONS FACILITY***

*Located at  
John C. Stennis Space Center  
Hancock County Mississippi*

***BDLG. 2440 / 2441  
MASONRY DESIGN  
CALCULATIONS***

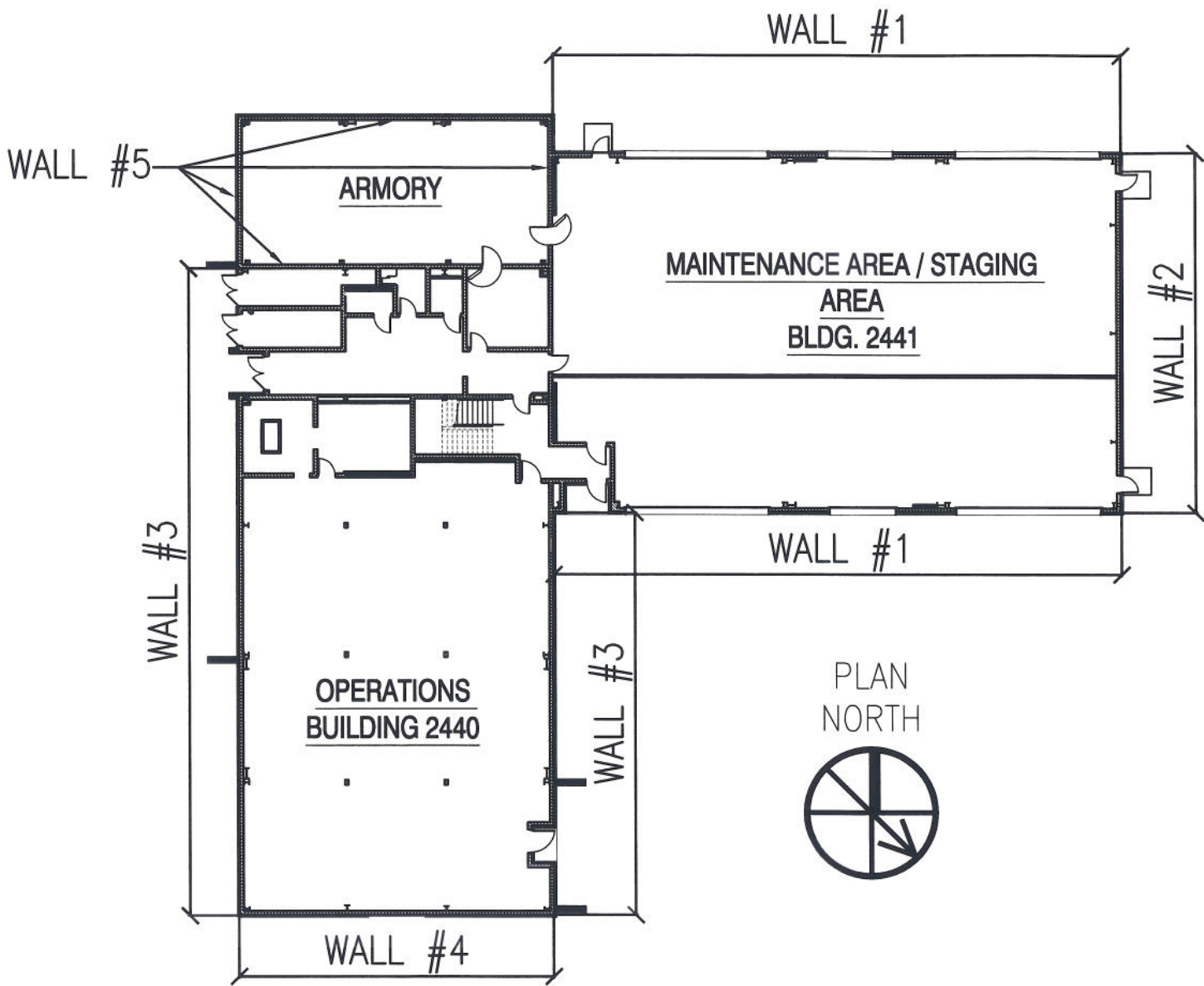
April 30, 2009

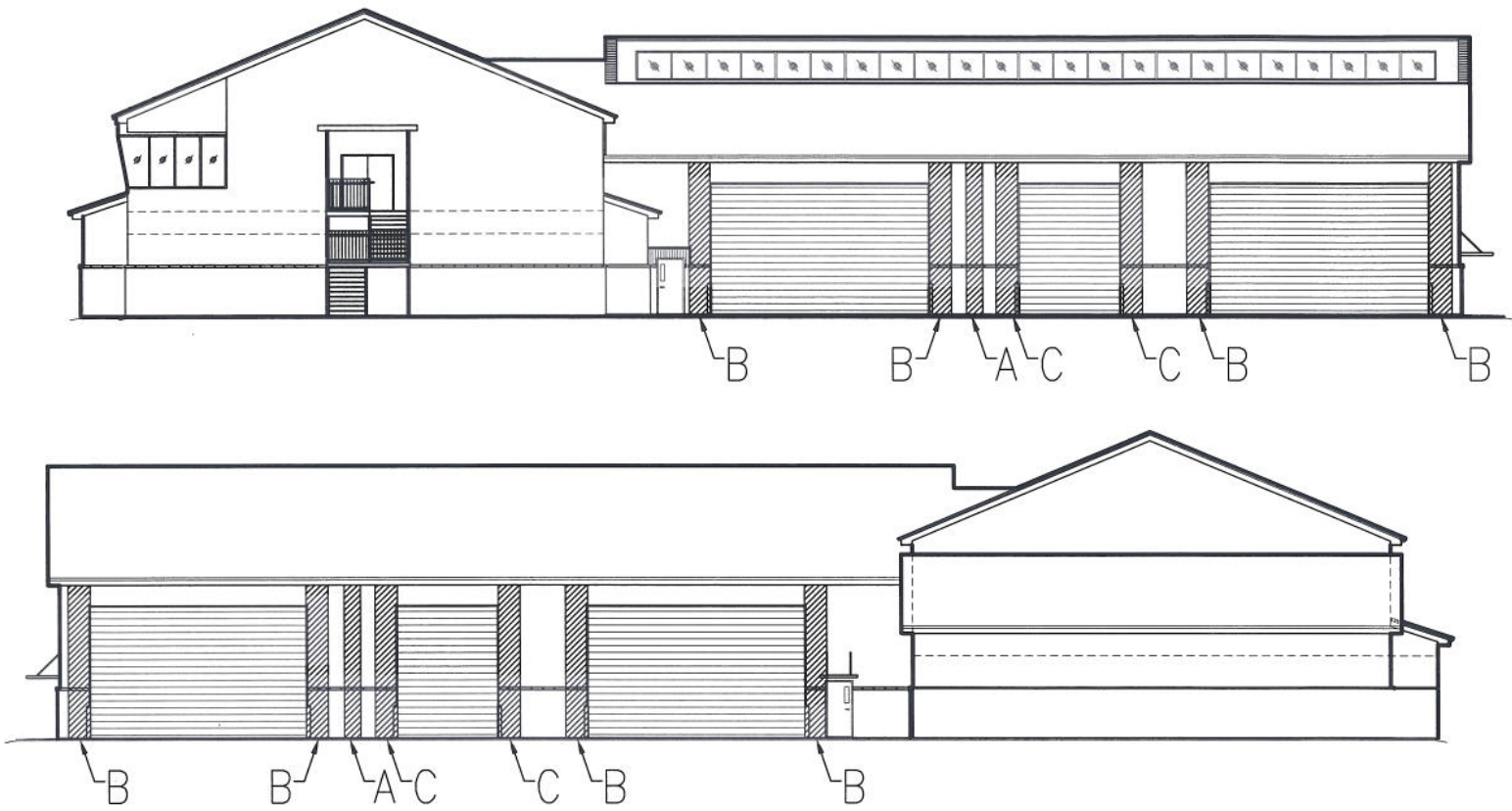
*Prepared by:*  
Dammon Engineering  
1095 Florida Avenue  
Slidell, La. 70458  
985-649-5832  
dammonengineering.com



## VICINITY MAP

N. T. S.





WALL #1 ELEMENTS

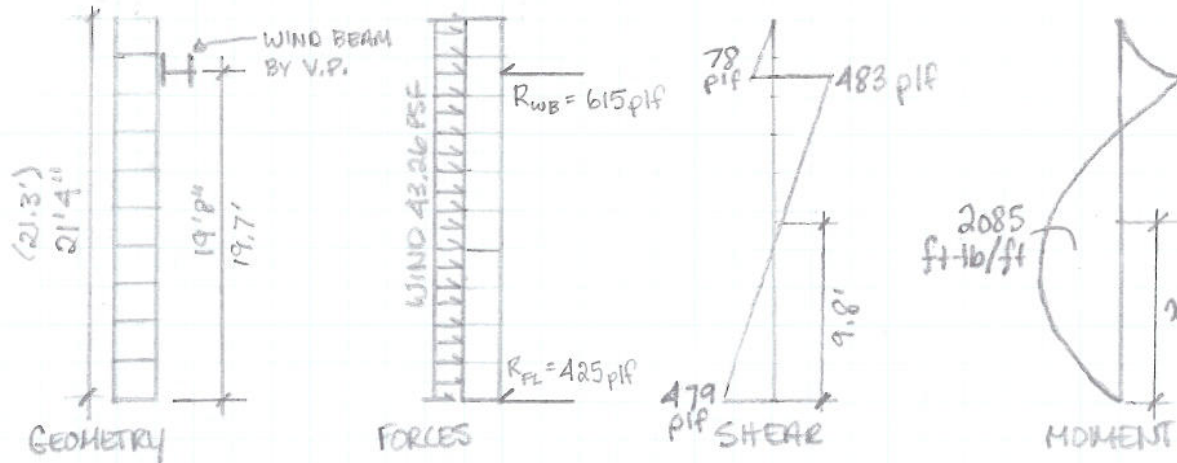
## STENNIS RIVERINE DESIGN OF REINFORCED CMU NONLOADBEARING WALL FOR FLEXURE BLDG 2441 — WALL #1 ELEMENT A

### MATERIALS:

UNIT STRENGTH	4050 psi
MORTAR	TYPE N
$f'_m$	2500 psi
$E_m$	$2.25 \times 10^4$
$n$	12.89
REINFORCEMENT	GRADE 60

### LOADING:

WIND 130 MPH = 43.26 psf  
NEGLECT SELF WEIGHT



### REACTIONS:

$$R_{WB} = \text{REACTION @ WIND BEAM} = \frac{43.3 \cdot (21.3')^2}{2} = 615 \text{ plf}$$

$$R_{FL} = \text{REACTION @ FLOOR} = 43.3 \cdot \left( \frac{(19.7')^2}{2} - \frac{(1.6')^2}{2} \right) = 425 \text{ plf}$$

$$x = \frac{425}{43.3} = 9.8'$$

$$M = 425 \text{ plf} \cdot \left( \frac{9.8'}{2} \right) = 2085 \text{ ft-lb}$$

### ESTIMATE REINFORCEMENTS:

TRY 8" CMU, ASSUME STEEL @ MID DEPTH

$$d = \frac{7.625''}{2} = 3.8''$$

$$A_s = \frac{M}{F_s j d} = \frac{2085 \text{ ft-lb} \cdot 12}{24000 \text{ psi} \cdot 0.9 \cdot 3.8} = 0.3 \text{ in}^2$$

USE 1/3 ALLOWABLE SAFETY FACTOR

$$A_s = \frac{2085 \text{ ft-lb} \cdot 12}{24000 \text{ psi} \cdot 0.9 \cdot 1.33 \cdot 3.8} = 0.2 \text{ in}^2$$

DESIGN STRENGTH

USING 24" WIDE STRIP DESIGN MOMENT = 2085 ft-lb \* 2 = 4170 ft-lb.

$$p = \frac{A_s}{b \cdot d} = \frac{0.20 \text{ in}^2}{24 \cdot 3.8} = 0.002$$

$$p_n = 0.002 \cdot 15.26 = 0.03$$

$$K^2 + 2p_n K - 2p_n = 0$$

$$K^2 + 0.06K - 0.06 = 0$$

$$j = 1 - \frac{K}{3} = 0.928$$

$$K = \frac{-0.06 \pm \sqrt{(0.06)^2 - 4(1)(-0.06)}}{2}$$

$$K = \frac{-0.06 \pm 0.19}{2} = 0.215''$$

ALLOWABLE CAPACITY IN TENSION

TRY #4 @ 12" O.C

$$M_t = A_s j d F_s = 0.4 \text{ in}^2 \cdot 0.9 \cdot 3.8'' \cdot 24000 \text{ psi} \cdot \frac{1.33}{12} = 3640 \text{ ft-lb/ft.}$$

3640 < 4170 ft-lb/ft. DOES NOT WORK

TRY #5 @ 12" O.C.

$$M_t = 0.62 \text{ in}^2 \cdot 0.9 \cdot 3.8'' \cdot 24000 \text{ psi} \cdot \frac{1.33}{12} = 5640 \text{ ft-lb/ft.}$$

5640 > 4170 ft-lb/ft. ∴ OK

ALLOWABLE CAPACITY IN COMPRESSION

$$F_b = \frac{1}{3} f'_m \cdot 1.33 = \frac{1}{3} (1500) \cdot 1.33 = 665 \text{ psi}$$

$$M_m = \frac{bd^2}{2} \cdot K \cdot j \cdot F_b = \frac{24'' \cdot 3.8''^2}{2} (0.215)(0.928) \frac{665 \text{ psi}}{12} = 1916 \text{ ft-lb}$$

1916 < 4170 ft-lb/ft DOES NOT WORK

ASSUME NEW  $f'_m$

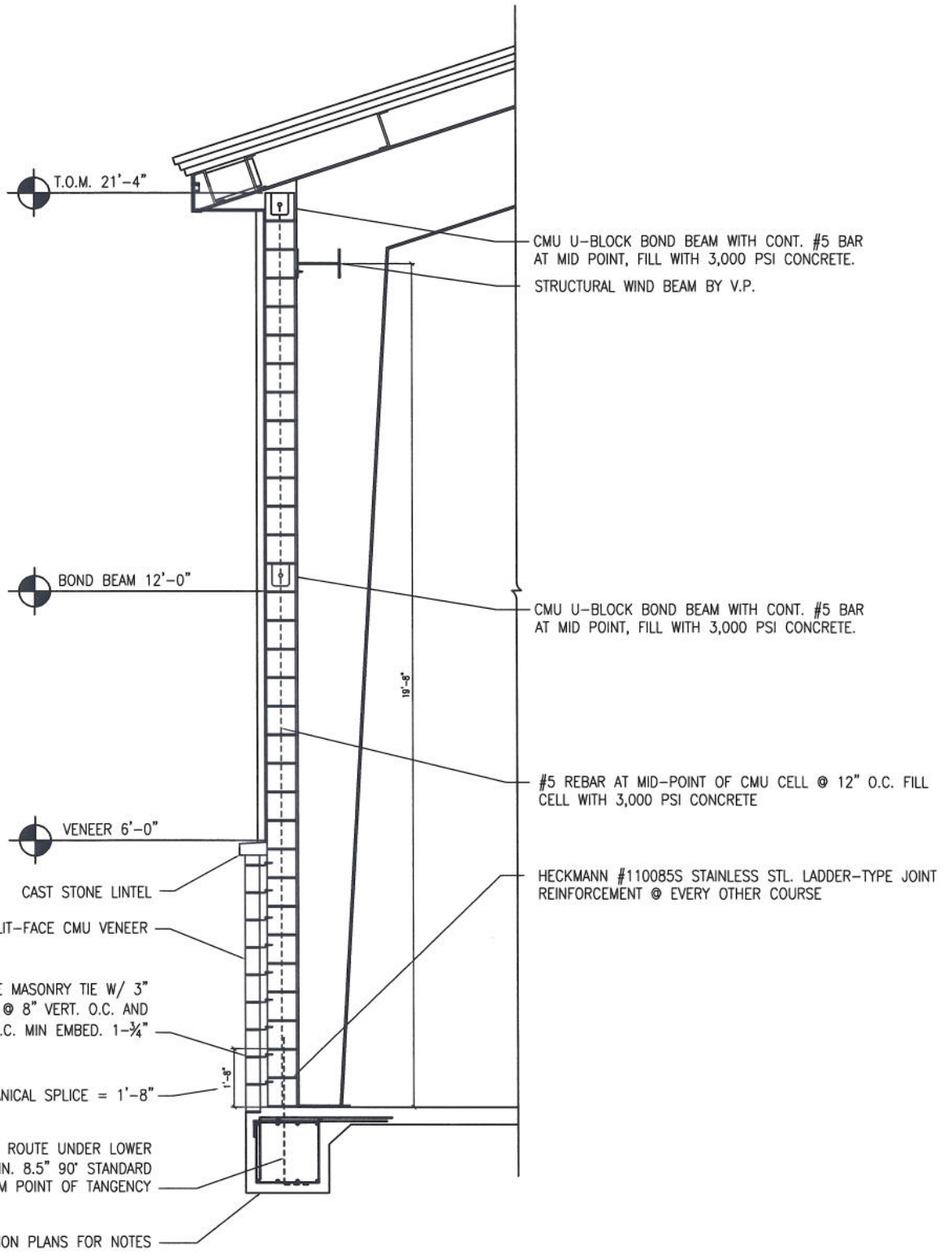
ESTIMATE REQ'D STRENGTH:  $\frac{4170}{1916} \cdot 1500 \text{ psi} = 3265 \text{ psi}$  UNIT STRENGTH

NEW  $f'_m = 2500 \text{ psi}$  - TYPE N MORTAR ⇒ 4,050 psi UNIT STRENGTH

$$F_b = 1795 \text{ psi}$$

$$M_m = 5170 \text{ ft-lb/ft} \quad \therefore \text{OK}$$

USE #5 @ 12" O.C. w/ 8" CMU (2500 psi) TYPE N MORTAR



**WALL #1 ELEMENT A DETAIL**  
 N.T.S.

## STENNIS RIVERINE

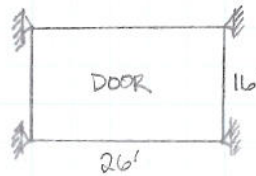
DESIGN OF REINFORCED CMU NONLOADBEARING WALL FOR FLEXURE  
BLDG 2441 ELEMENT B (DESIGN FOR 26' x 16' OPENING)

### MATERIALS:

UNIT STRENGTH	4050 psi
MORTAR	TYPE N
$f'_m$	2500 psi
$E_m$	$2.25 \times 10^6$ psi
$n$	12.89
REINFORCEMENT	GRADE 60

### LOADING:

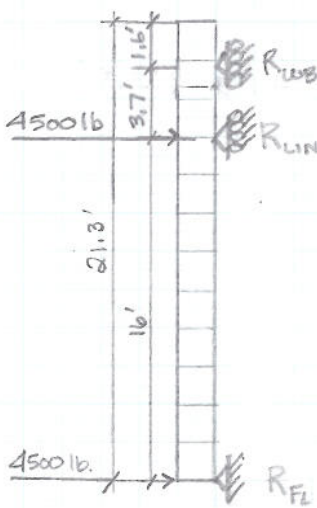
WIND 130 MPH = 43.26 psf  
NEGLECT SELF WEIGHT



$$R = \frac{(16 \cdot 26 \cdot 43.3)}{4}$$

$$R = 4500 \text{ lbs}$$

### REACTIONS @ LINTEL AND FLOOR FROM DOOR



$$R_{LIN} = \left( \frac{4500 \text{ lbs} \cdot 16'}{16'} \right) = 4500 \text{ lbs.} = 846 \text{ plf}$$

$$R_{FL} = \left( \frac{4500 \text{ lbs} \cdot 0'}{16'} \right) + 4500 \text{ lbs} = 4500 \text{ lbs.}$$

$$\text{TOTAL} = 9000 \text{ lbs.}$$

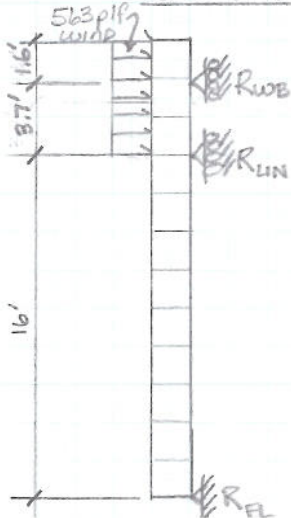
$$\text{ACTUAL: } [43.3 \text{ psf} \cdot (13' \cdot 16')] = 9000$$

$$\text{MAXIMUM MOMENT} = 0 \text{ lbs} \cdot 16' = 0 \text{ ft-lb/ft.}$$

∴ OK

$$\text{WIND LOAD} = W = \frac{(26' \cdot 43.3 \text{ psf})}{2} = 563 \text{ plf}$$

### REACTIONS @ WIND BEAM AND LINTEL FROM AREA ABOVE DOOR:



$$R_{WB} = \left( \frac{43.3 \cdot (5.3)^2 / 2}{3.7'} \right) = 164 \text{ plf} (13') = 2136 \text{ lbs}$$

$$R_{LIN} = \left[ 43.3 \left( \frac{3.7^2}{2} - \frac{46^2}{2} \right) \right] / 3.7' = 65.1 \text{ plf} (13') = 847 \text{ lbs.}$$

$$\text{TOTAL} = 2983 \text{ lbs}$$

$$x = \frac{65.1}{43.3} = 1.5'$$

$$\text{ACTUAL} = [43.3 \text{ psf} (5.3' \cdot 13')] = 2983$$

∴ OK

$$\text{MAX MOMENT} = (164.4 - 65.1) \left( \frac{1.5}{2} \right) = 74.8 \text{ ft-lb/ft}$$

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MOMENT @ HEAD LOCATION FROM UNIFORM WIND ON WALL ELEM. B

$$\text{MAX MOMENT} = 425 \text{ plf} \cdot 21.3' - 43.3 \text{ psf} \left( \frac{16^2}{2} \right) = 1260 \text{ ft.-lb./ft.}$$

DESIGN MOMENT

ASSUME 32" JAMB

$$\begin{aligned} \text{MAX MOMENT} &= (74.8 \text{ ft.-lb./ft} \cdot 13') + (1260 \text{ ft.-lb./ft} \cdot 2.67') \\ &= (9724 \text{ ft.-lb.} + 3364 \text{ ft.-lb.}) = 13,088 \text{ ft.-lb.} \end{aligned}$$

ESTIMATE REINFORCEMENT:

8" CMU ASSUME  $J=0.9$  FOR ESTIMATE  $d=3.8"$

$$A_s = \frac{M}{F_s J d} = \frac{13088 \text{ ft-lb} \cdot 12 \text{ in/ft}}{24000 \text{ psi} \cdot 0.9 \cdot 1.33 \cdot 3.8"} = 1.4 \text{ in}^2/\text{ft.}$$

TRY (8) #4 REBAR PER FOOT

ALLOWABLE CAPACITY IN TENSION

$$M_t = A_s \cdot j \cdot d \cdot F_s = 1.6 \text{ in}^2 \cdot 0.9 \cdot 3.8" \cdot 24000 \text{ psi} \cdot \frac{1.33}{12} = 14555 \text{ ft-lb.}$$

$M_t > \text{REQ. } M: 13,088 \text{ ft-lb.} \therefore \text{OK}$

ALLOWABLE CAPACITY IN COMPRESSION

$$p = \frac{(1.6)^2}{32 \text{ in} \cdot 3.8"} = 0.02 \quad np = 12.89 \cdot 0.02 = 0.2578$$

$$K = \frac{-0.5 \pm \sqrt{0.5^2 - 4 \cdot 1 \cdot (-0.5)}}{2}$$

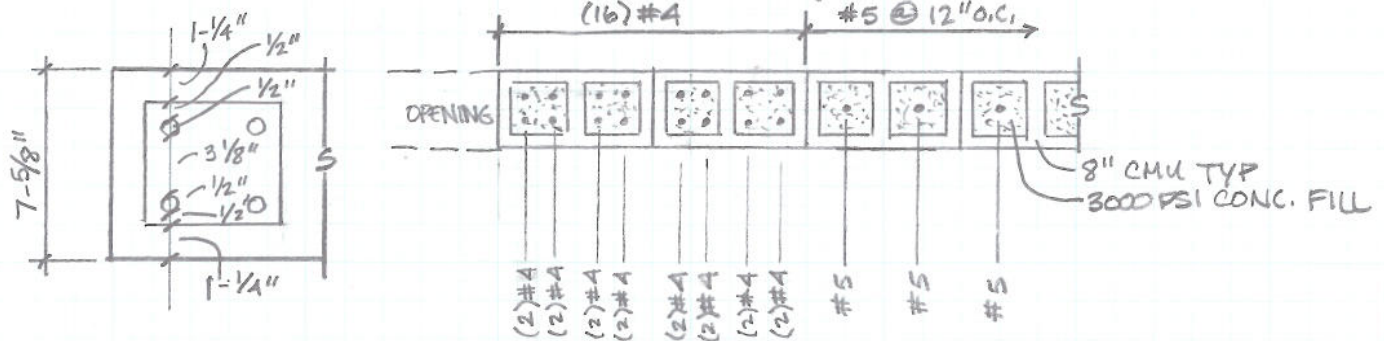
$$j = \left(1 - \frac{K}{3}\right) = \left(1 - \frac{0.5}{3}\right) = 0.83$$

$$K = \frac{-0.5 \pm 1.5}{2} = 0.5$$

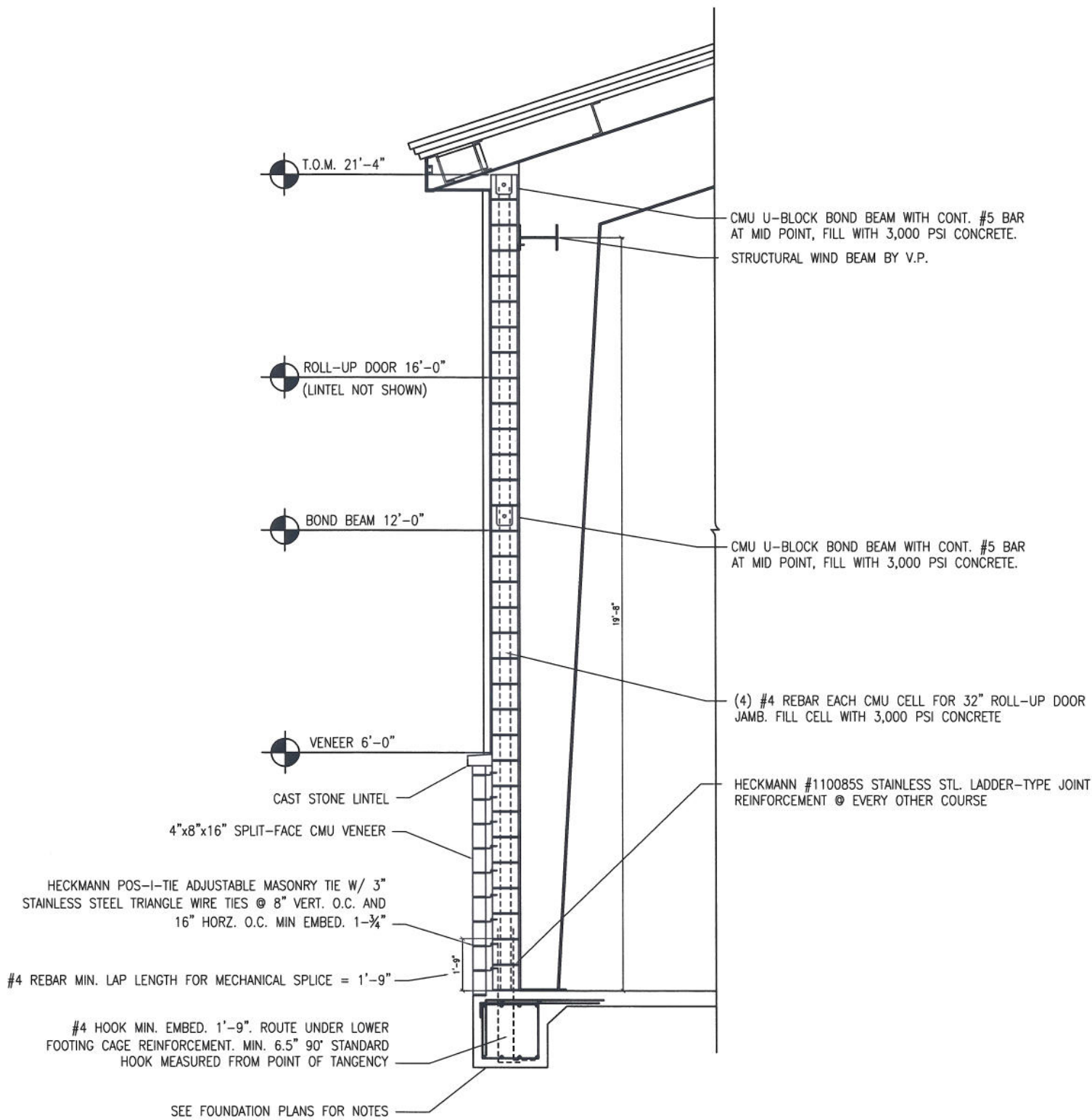
$$M_m = \frac{bd^2}{2} \cdot K \cdot j \cdot F_b = \frac{32 \text{ in} \cdot 3.8^2}{2} (0.5)(0.83) \frac{1795 \text{ psi}}{12} = 14342 \text{ ft-lb.}$$

$$F_b = \frac{1}{3}(4050) \cdot 1.33 = 1795 \text{ psi}$$

$M_m > \text{REQ. } M: 13,088 \text{ ft-lb.} \therefore \text{OK}$



USE (8) #4 REBAR PER FOOT AS SHOWN ABOVE.



T.O.M. 21'-4"

ROLL-UP DOOR 16'-0"  
(LINTEL NOT SHOWN)

BOND BEAM 12'-0"

VENEER 6'-0"

CAST STONE LINTEL

4"x8"x16" SPLIT-FACE CMU VENEER

HECKMANN POS-I-TIE ADJUSTABLE MASONRY TIE W/ 3" STAINLESS STEEL TRIANGLE WIRE TIES @ 8" VERT. O.C. AND 16" HORZ. O.C. MIN EMBED. 1-3/4"

#4 REBAR MIN. LAP LENGTH FOR MECHANICAL SPLICE = 1'-9"

#4 HOOK MIN. EMBED. 1'-9". ROUTE UNDER LOWER FOOTING CAGE REINFORCEMENT. MIN. 6.5" 90° STANDARD HOOK MEASURED FROM POINT OF TANGENCY

SEE FOUNDATION PLANS FOR NOTES

CMU U-BLOCK BOND BEAM WITH CONT. #5 BAR AT MID POINT, FILL WITH 3,000 PSI CONCRETE.  
STRUCTURAL WIND BEAM BY V.P.

CMU U-BLOCK BOND BEAM WITH CONT. #5 BAR AT MID POINT, FILL WITH 3,000 PSI CONCRETE.

(4) #4 REBAR EACH CMU CELL FOR 32" ROLL-UP DOOR JAMB. FILL CELL WITH 3,000 PSI CONCRETE

HECKMANN #110085S STAINLESS STL. LADDER-TYPE JOINT REINFORCEMENT @ EVERY OTHER COURSE

**WALL#1 ELEMENT B DETAIL**

N.T.S.

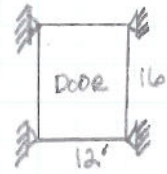
## STENNIS RIVERING DESIGN OF REINFORCED CMU NONLOADBEARING WALL FOR FLEXURE BLDG 2441 — WALL #1 ELEMENT C

### MATERIALS

UNIT STRENGTH	4050 psi
MORTAR	TYPE N
$f'_m$	2500 psi
$E_m$	$2.25 \times 10^6$
$n$	12.89
REINFORCEMENT	GRADE 60

### LOADING:

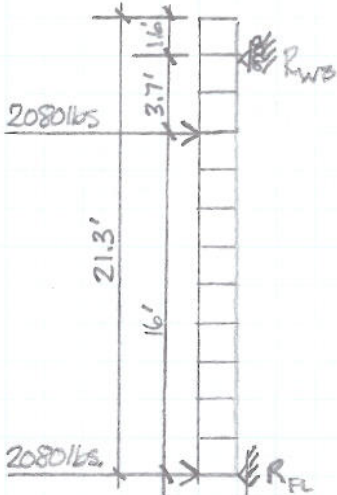
WIND 130 MPH = 43.26 psf  
NEGLECT SELF WEIGHT



$$R = \frac{(16 \cdot 12 \cdot 43.3 \text{ psf})}{4}$$

$$R = 2080 \text{ lbs.}$$

### REACTIONS @ UNTEL AND FLOOR FROM DOOR:



$$R_{WB} = \frac{2080 \text{ lbs} \cdot 16'}{19.7'} = 1690 \text{ lbs.}$$

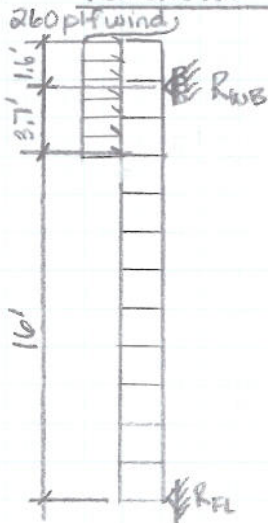
$$R_{FL} = \frac{2080 \text{ lbs} \cdot 3.7'}{19.7'} + 2080 \text{ lbs.} = 2470 \text{ lbs.}$$

$$\left. \begin{array}{l} \text{TOTAL} = 4160 \text{ lbs.} \\ \text{[ACTUAL} = 43.3 \cdot (16 \cdot 12) / 2 = 4157] \end{array} \right\} \therefore \text{O.K.}$$

$$\text{MAX MOMENT} = 780 \text{ lbs} \cdot 16' = 12480 \text{ ft-lb}$$

$$\text{WIND LOAD} = \left( \frac{12' \cdot 43.3 \text{ psf}}{2} \right) = 260 \text{ plf}$$

### REACTIONS @ WIND BEAM AND FLOOR FROM AREA ABOVE DOOR:



$$R_{WB} = \frac{260 \text{ plf} \cdot 5.3' \cdot 18.65'}{19.7'} = 1305 \text{ lbs.}$$

$$R_{FL} = 260 \text{ plf} \cdot \left( \frac{5.3^2}{2} - \frac{1.6^2}{2} \right) = 170 \text{ lbs}$$

$$x = \frac{135.1}{43.3} = 3.12'$$

$$\text{MOMENT} = 170 \text{ lbs} \cdot 16' = 2720 \text{ ft-lb.}$$

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MOMENT @ HEAD LOCATION FROM UNIFORM WIND ON WALL ELEM. C:

$$\text{MAX MOMENT} = 425 \text{ plf} \cdot 16' - 43.3 \text{ psf} \left( \frac{16^2}{2} \right) = 1260 \text{ ft-lb/ft.}$$

DESIGN MOMENT

ASSUME 32" JAMB

$$\text{MAX MOMENT} = (1260 \text{ ft-lb/ft.} \cdot 2.67 + 2720 \text{ ft-lb.} + 4680 \text{ ft-lb.}) = 10765 \text{ ft-lb.}$$

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## ESTIMATE REINFORCEMENT:

8" CMU ASSUME  $J=0.9$  FOR ESTIMATE  $d=3.8"$

$$A_s = \frac{M}{F_s j d} = \frac{10765 \text{ ft-lb} \cdot 12 \text{ in/ft}}{24000 \text{ psi} \cdot 0.9 \cdot 1.33 \cdot 3.8"} = 1.2 \text{ in}^2/\text{ft}$$

TRY (8) #4 REBAR PER FOOT

## ALLOWABLE CAPACITY IN TENSION:

$M_t = 14555 \text{ ft-lb}$  (SEE CALCULATIONS FOR WALL ELEM. B)

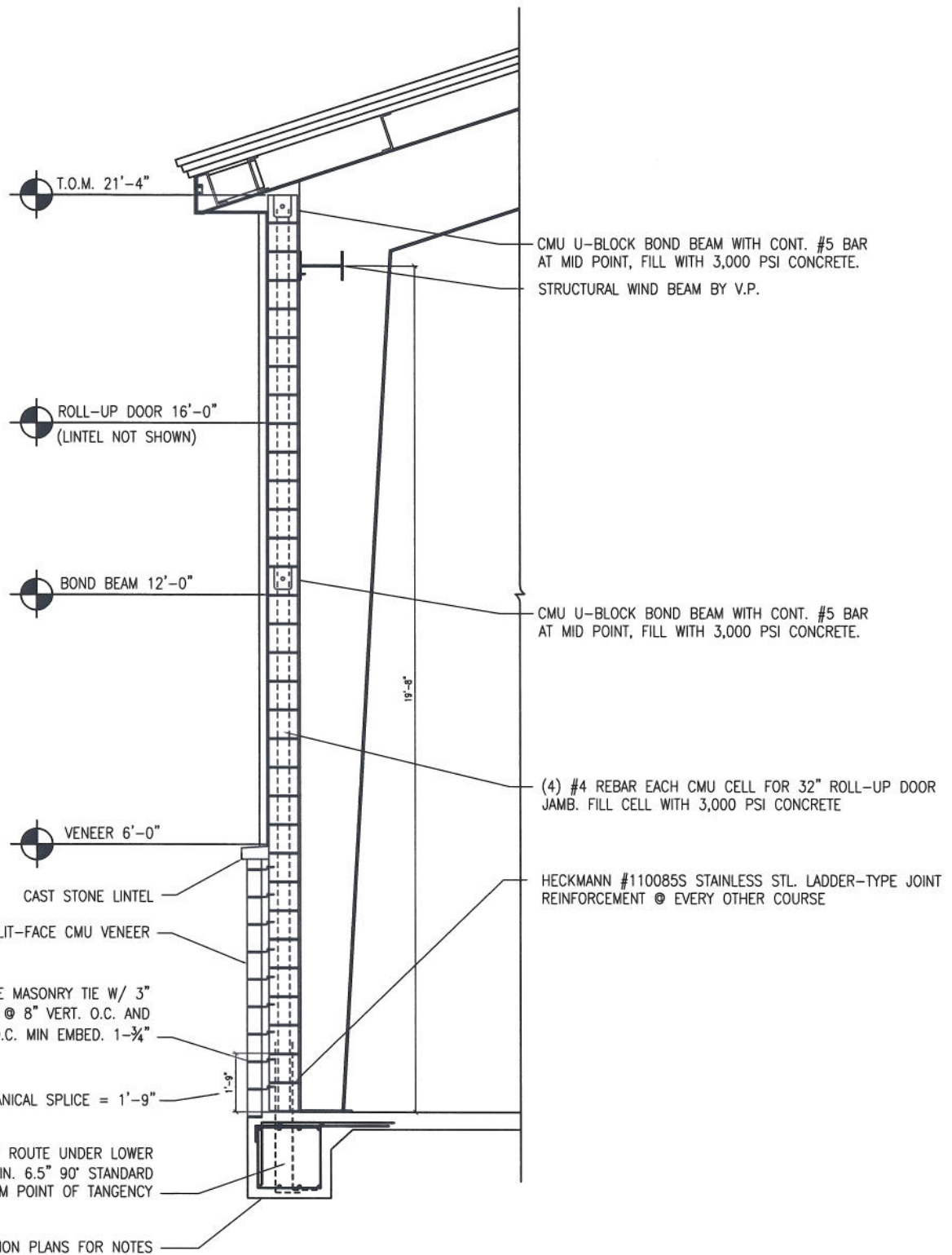
$M_t > 10765 \text{ ft-lb} \therefore \text{OK}$

## ALLOWABLE CAPACITY IN COMPRESSION

$M_m = 14342 \text{ ft-lb}$  (SEE ELEMENT B)

$M_m > 10765 \text{ ft-lb} \therefore \text{OK}$

USE (8) #4 REBAR PER FOOT AS SHOWN ON ELEM. B.



**WALL#1 ELEMENT C DETAIL**  
N.T.S.

## S TENNIS RIVERINE

(#1)

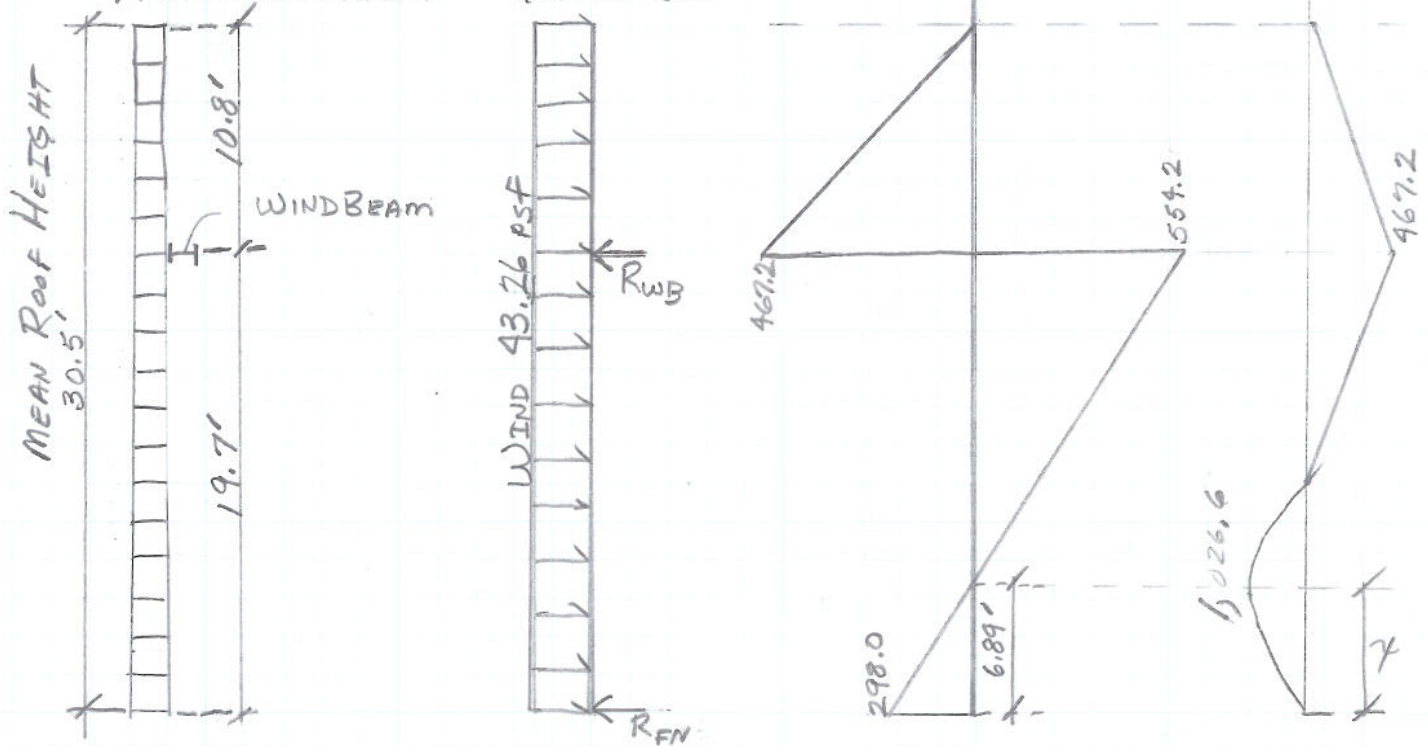
### DESIGN OF REINFORCED CMU NON-LOADBEARING WALL FOR FLEXURE BLDG 2441 WALL #2

#### MATERIALS:

UNIT STRENGTH 4050 psi  
MORTAR TYPE N  
 $f'_m$  2500 psi  
 $E_m$   $2.25 \times 10^6$   
 $n$  12.89  
REINFORCEMENT GRADE 60

#### LOADING:

WIND 130 MPH = 43.26 psf  
NEGLECT SELF WEIGHT



#### REACTIONS:

$$R_{WB} = \frac{(43.26 \text{ psf} \times (30.5)^2)}{2} = 1021.4 \text{ pif}$$

$$R_{FN} = 43.26 \text{ psf} \left( \frac{(19.7)^2}{2} - \frac{(10.8)^2}{2} \right) = 298.0 \text{ pif}$$

$$x = \frac{298 \text{ pif}}{43.26 \text{ psf}} = 6.89 \text{ ft}$$

#2

BLDG 2441 WALL #2 Cont.

ESTIMATE REINFORCEMENT

8" CMU, ASSUME STEEL MID-DEPTH  $d = \frac{7.625''}{2} = 3.8''$

$$A_s = \frac{M}{F_s j d} = \frac{(1026.6 \text{ ft}\cdot\text{lb})(12 \text{ in}/\text{ft})}{(24,000 \text{ psi})(1.33)(0.9)(3.8'')} = 0.113 \text{ in}^2/\text{ft}$$

Try #5 @ 24" O.C. ( $A_s = 0.31 \times \frac{12}{24} = 0.155 \text{ in}^2/\text{ft}$ )

DESIGN STRENGTH

USE 2.0 FT wide STRIP

DESIGN MOMENT =  $1026.6 \text{ ft}\cdot\text{lb}/\text{ft} = 2,053.2 \text{ ft}\cdot\text{lb}/\text{ft}$

$$p = \frac{A_s}{bd} = \frac{0.31 \text{ in}^2}{24 \text{ in} \times 3.8 \text{ in}} = 0.00339$$

$$np = 0.0438$$

$$k^2 + 2pnk - 2pn = 0$$

$$k = 0.335 \quad j = 1 - \frac{k}{3} = 0.889$$

ALLOWABLE CAPACITY IN TENSION

#5 @ 24" O.C.

$$M_t = A_s j d F_s = 0.31 \times 0.889 \times 3.8 \times 24,000 \cdot \frac{1.33}{12} =$$

$$M_t = 2,785.7 \text{ ft}\cdot\text{lb}/\text{ft} > 2,053.2 \text{ ft}\cdot\text{lb}/\text{ft}$$

ALLOWABLE CAPACITY IN COMPRESSION

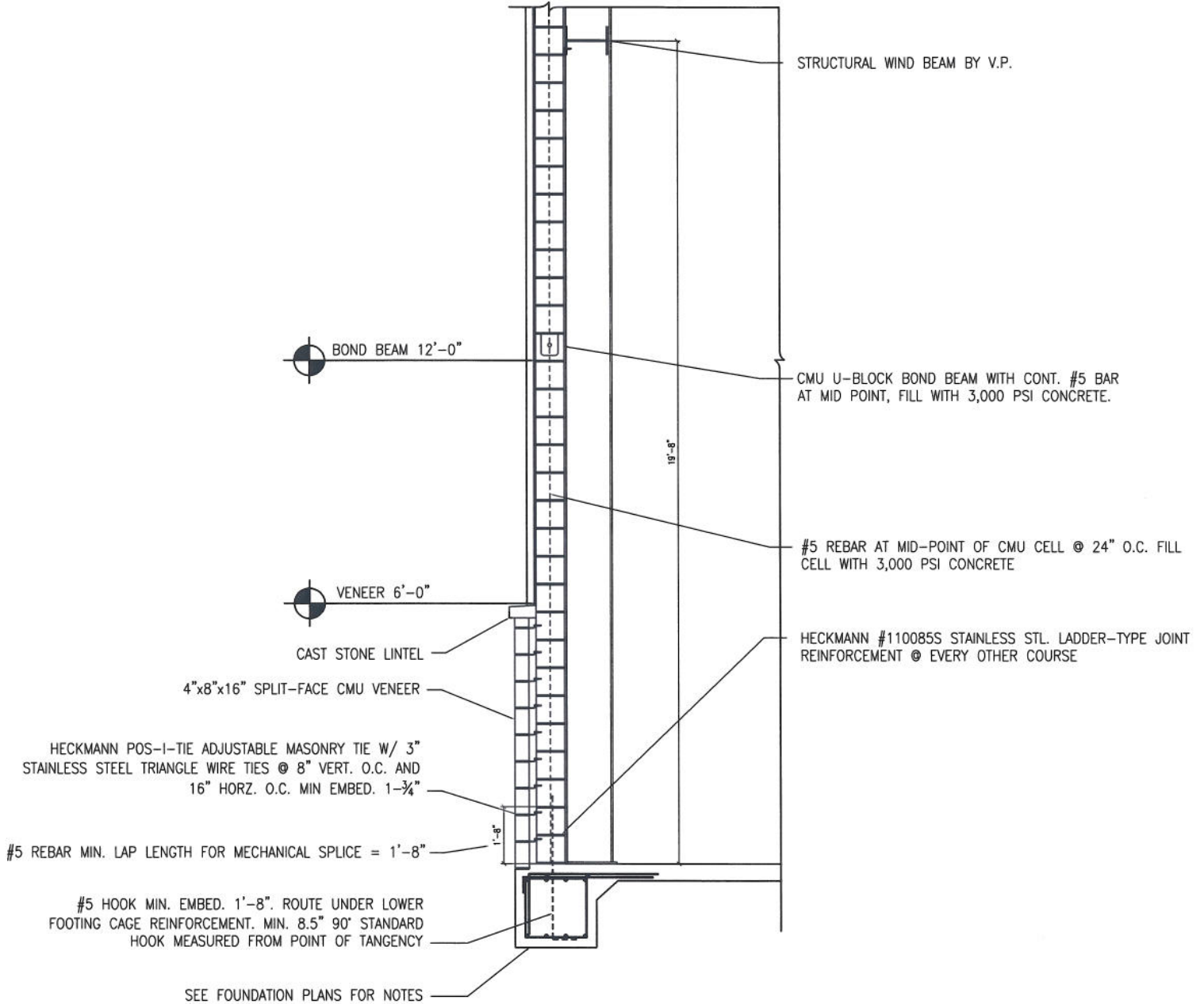
$$M_m = \left(\frac{bd^2}{2}\right) k j F_b =$$

$$F_b = \frac{1}{3} f'_m \times 1.33 = \frac{1}{3} (4,050 \text{ psi}) 1.33 = 1795 \text{ psi}$$

$$M_m = \left(\frac{24'' \times 3.8^2}{2}\right) 0.335 \times 0.889 \times \frac{1795 \text{ psi}}{12 \text{ in}/\text{ft}} = 7,719.3 \frac{\text{ft}\cdot\text{lb}}{\text{ft}}$$

USE #5 @ 24" O.C.

T.O.M. HEIGHT VARIES AT ENDWALL  
MEAN ROOF HEIGHT = 30'-6"



**WALL#2 TYPICAL DETAIL**  
N.T.S.

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## TYPICAL ANCHORAGE AND SPLICE FOR #5 REBAR

USE #5 REBAR FOR HOOK, GRADE 60  $l_d = \text{REQ'D DEVELOPMENT LENGTH}$

$$l_d = \frac{0.13 \cdot d_b^2 \cdot f \cdot \gamma \cdot j}{K \cdot \sqrt{f'_m}} = \frac{0.13 \cdot (0.625)^2 \cdot 60000 \cdot 1}{5 \cdot (0.625) \cdot \sqrt{2500}} = 19.5''$$

$$l_e = 13d_b = 8.125''$$

## VENEER WALL CONNECTION

USE "POS-1-TIE" TAPCON SCREW FOR CMU EMBED @ 8" VERTICAL O.C. AND 16" HORZ. O.C., MIN EMBED. LENGTH 1-3/4". USE 3/16"  $\phi$  x 3" S.S. TRIANGLE WIRE TIES @ EA. CONNECTION. SEE ATTACHED PRODUCT SHEET.

## HORZ. JOINT REINFORCEMENT

USE HELKMANN #110085 S.S. LADDER-TYPE MASONRY WALL REINFORCEMENT @ EVERY OTHER COURSE, SEE ATTACHED PRODUCT SHEET.

## TYPICAL ANCHORAGE AND SPLICE FOR #4 REBAR

USE #4 REBAR FOR HOOK, GRADE 60

$$l_d = 20.1''$$

$$l_e = 6.5''$$



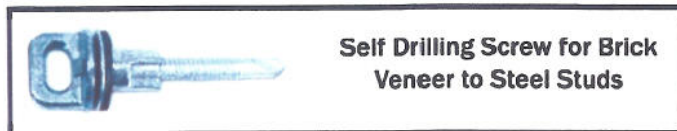
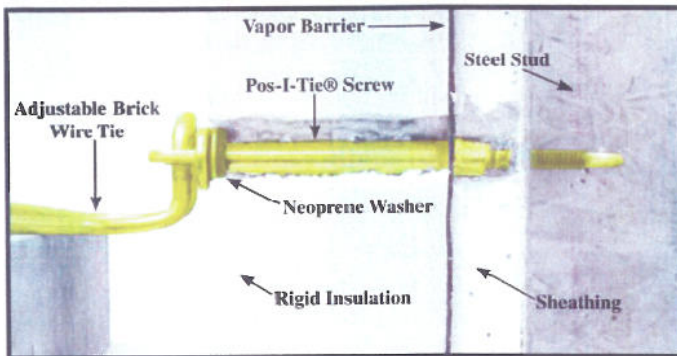
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 FAX: 708-865-2640

www.heckmannanchors.com  
 Email: info@heckmannbuildingprods.com

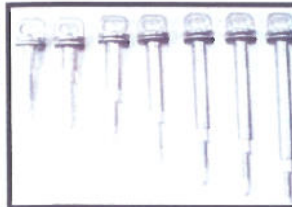
## ARCHITECTURAL SPECIFICATION INFORMATION

# THE ORIGINAL Pos-I-Tie®

U.S. Patent# 4473984 & 4764069 Canada Patent#1224344



Seven Barrel lengths available for Insulation/gypsum board sizes and combinations:  
 1/2" & 5/8", 1", 1-1/2", 2", 2-1/2", 3", and 3-1/2"



The Pos-I-Tie® conforms with the Energy Conservation Requirements of the Massachusetts State Building Code (780 CMR 13 Envelope)

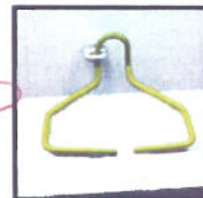
## NO. 75 POS-I-TIE® ADVANTAGES

1. Pos-I-Tie® system fully complies with the ACI 530 Code. The Barrel Screw is one piece. No more plates, screws and gaskets. Installs in seconds.
2. Uses consistent screw. Screw is provided as a part of the Pos-I-Tie® System. - No inferior screws can be substituted.
3. Provides positive connections. The Barrel Section actually penetrates sheathing and makes a Positive Lateral Connection with the backup for transfer of compression and tension loads to structural backup.
4. Enables speedy cost-saving installation. Only one screw needs to be placed, rather than two screws.
5. Corrosion Resistant. Pos-I-Tie® seals the hole it makes when it seats itself in the backup. Barrel section is made of ZAMAC 3, a 92% zinc alloy. Screws are Zinc electro plated.
6. Slotted Barrel allows for differential movement due to temperature variations. Tie design provides for allowable ACI 530 code vertical adjustment.
7. Allows for use of 4' x 8' insulation sheets. The Pos-I-Tie® holds the insulation in place!

**Test Data Available Upon Request**

## WIRE TIES

Ties are 3/16" diameter x 3", 3 1/2", 4", or 5" Long in Hotdip Galvanized, Mill Galvanized and Stainless Steel.



Triangular Wire Tie



Seismic Wire Tie



Single Wire Tie

(Check for local code acceptance of single wire tie.)

Special Lengths available.



# Heckmann Building Products Inc.

1501 N. 31<sup>st</sup> Avenue

Melrose Park, IL 60160-2911

800-621-4140 or 708-865-2403 Fax: 708-865-2640

www.heckmannbuildingprods.com

## SUBMITTAL SHEET: #1100 Ladder-Type Masonry Wall Reinforcement.

Manufactured from 9 Gage wire, 10' 8" long with butt-welded perpendicular cross wires welded 16" on center to avoid interference with reinforcement in block cores.

Wire is deformed for maximum bonding in mortar joints.

Packaged in 50 pc (500 lin ft) bundles

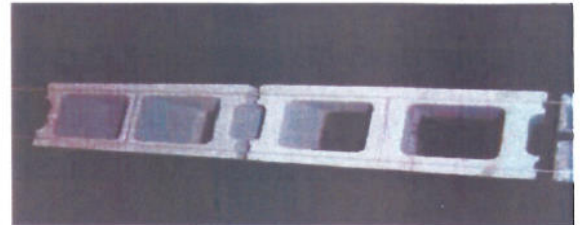
Special sizes and lengths are available.

- Reduces Cracking.
- Increases lateral flexural strength.
- Increases ductility and elasticity.

Standard Catalog Numbers

Size

Mill Galv	Hotdip Galv	Stainless Steel	Width	Wall Size
11006G	11006H	11006S	4	6
11008G	11008H	11008S	6	8
110010G	110010H	110010S	8	10
110012G	110012H	110012S	10	12



ASTM A82 cold drawn steel wire.  
Tensile Strength 80,000 PSI  
Yield Point 70,000 PSI minimum  
Reduction of Area 30%

**Finishes:**

**Stainless Steel:**

ASTM A 580 Type 304.

**Hotdip Galvanized:**

ASTM A 153 Class B-2: (1.50 oz/ ft<sup>2</sup>)(0.46kg/m<sup>2</sup>)

**Mill Galvanized:**

Wire: ASTM A 641 (0.1 oz/ ft<sup>2</sup>.)

Conforms to requirements of ASCE / ACI 530 / TMS402 Building Code requirements for masonry structures.

Approvals:

Comments: