



# CALCULATIONS

SOF RIVERINE AND COMBATANT  
CRAFT OPERATIONS FACILITY  
**N 62467-05-D-0096**

**FINAL DESIGN ISSUE  
SEPTEMBER 4, 2009**

US DEPARTMENT OF THE NAVY – NAVFAC SOUTHEAST

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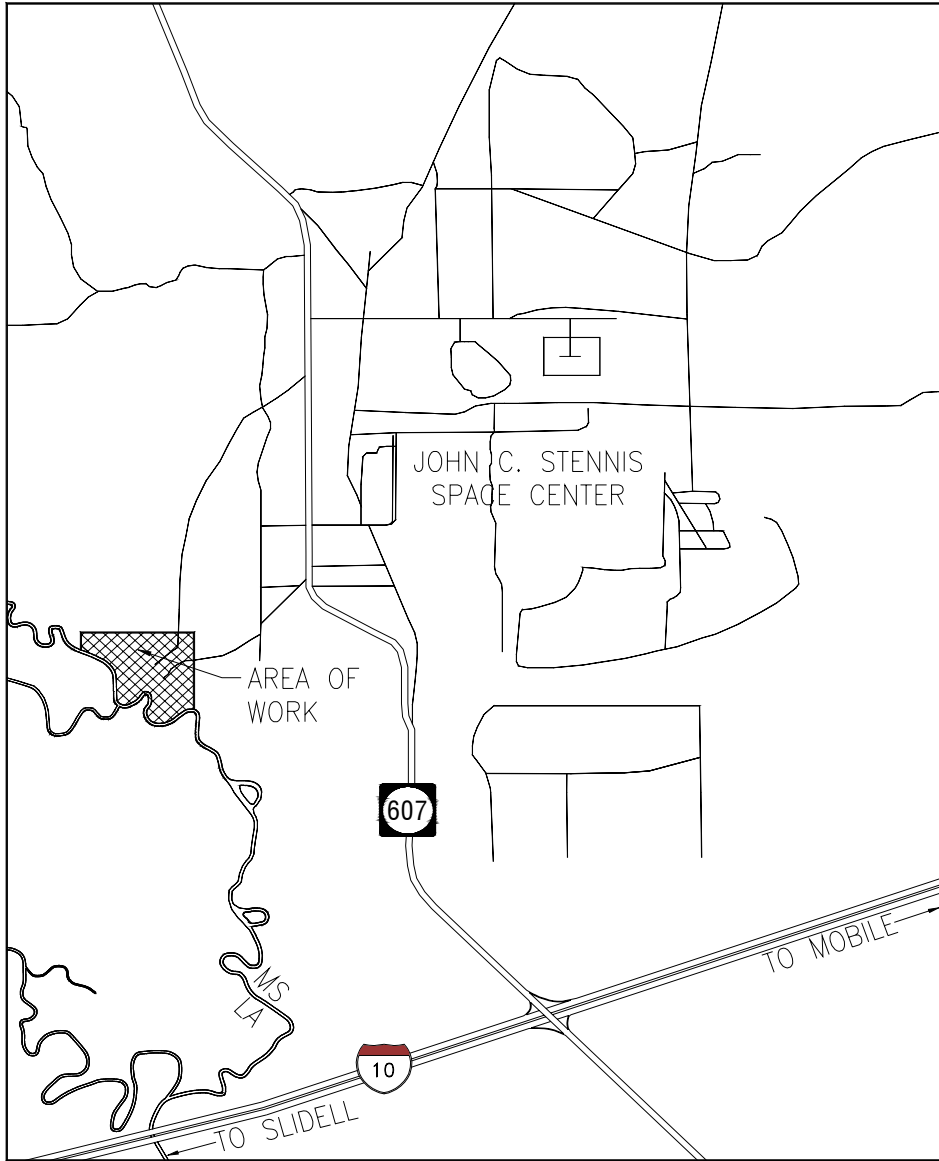
# ***SOV RIVERINE AND COMBATANT CRAFT OPERATIONS FACILITY***

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

## ***Hydrology Study***

April 6, 2009

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## VICINITY MAP

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N. T. S.

**SOV RIVERINE AND COMBATANT  
CRAFT OPERATIONS FACILITY**

8.749 Acre Parcel

Located at

John C. Stennis Space Center

*Hancock County Mississippi*

**SITE DESCRIPTION**

The property is bounded by Lower Gainesville Road on the North, Endeavour Blvd. on the East, the Pearl River on the East, and by the East Pearl River Canal South of the Parcel.

**CURRENT DRAINAGE**

The property has several peaks and valleys with a variety of contours throughout the site that allow drainage into the East Pearl River Canal at the South end of the site.

**STUDY METHODOLOGY**

The modified rational method was used to determine peak flows for the 10-year storm event for the limits of construction, both prior and post-development.

The swales were designed using the modified rational method for a 10-year storm event. The expected rainfall intensity was taken from Data Book for Civil Engineers Vol. 1 1960, Fig. "B" pg. 18-01 (Seelye).

The runoff from areas not serviced by a swale do not require any detention because prior and post development runoff patterns remain in place. Therefore no calculations for these areas were performed.

**PROPOSED DRAINAGE**

The bldg elevations are set at 16.00' and the end invert drain is set at 8.50'. On-site drainage swales are designed for a 10-year storm event and flow into an 18"x29" arch outlet pipe.

Rainwater shall run off the roofs into the gutter system and into the down spouts. Once in the down spouts water shall run onto the concrete aprons which will direct the water to the center and sides of the concrete aprons allowing the water to flow into the swales and out to the East Pearl River Canal as designed.

Improvements to the existing ditch that runs along the western limit of construction (gravel road) will preserve the natural drainage pattern and provide adequate drainage for the site development not serviced by the new swale.

Property to the north of the development will retain ponding characteristics post-development. All pond water created by the grading of the site will drain into an 15"RCP which is connected to

the site swale that discharges into the East Pearl River Canal. Based on the survey received, the area of offsite ponding used for calculations is 0.569 acres.

**SUMMARY OF CALCULATIONS**

Existing grounds area = 8.749 acres, C=0.15 Tc=75.12 min.

Post-Development Area into swale:

Parking lot, Buildings= 2.495 acres, C=0.90 Tc=31.80 min.

Green space= 2.087 acres, C=0.15 Tc=31.80 min.

Offsite Ponding= 0.569 acres, C=0.15 Tc=19.04 min.

Note: Remaining 4.167 acres sheet flows into existing drainage pattern which discharges into the East Pearl River Canal.

# OVERALL SITE CALCULATIONS

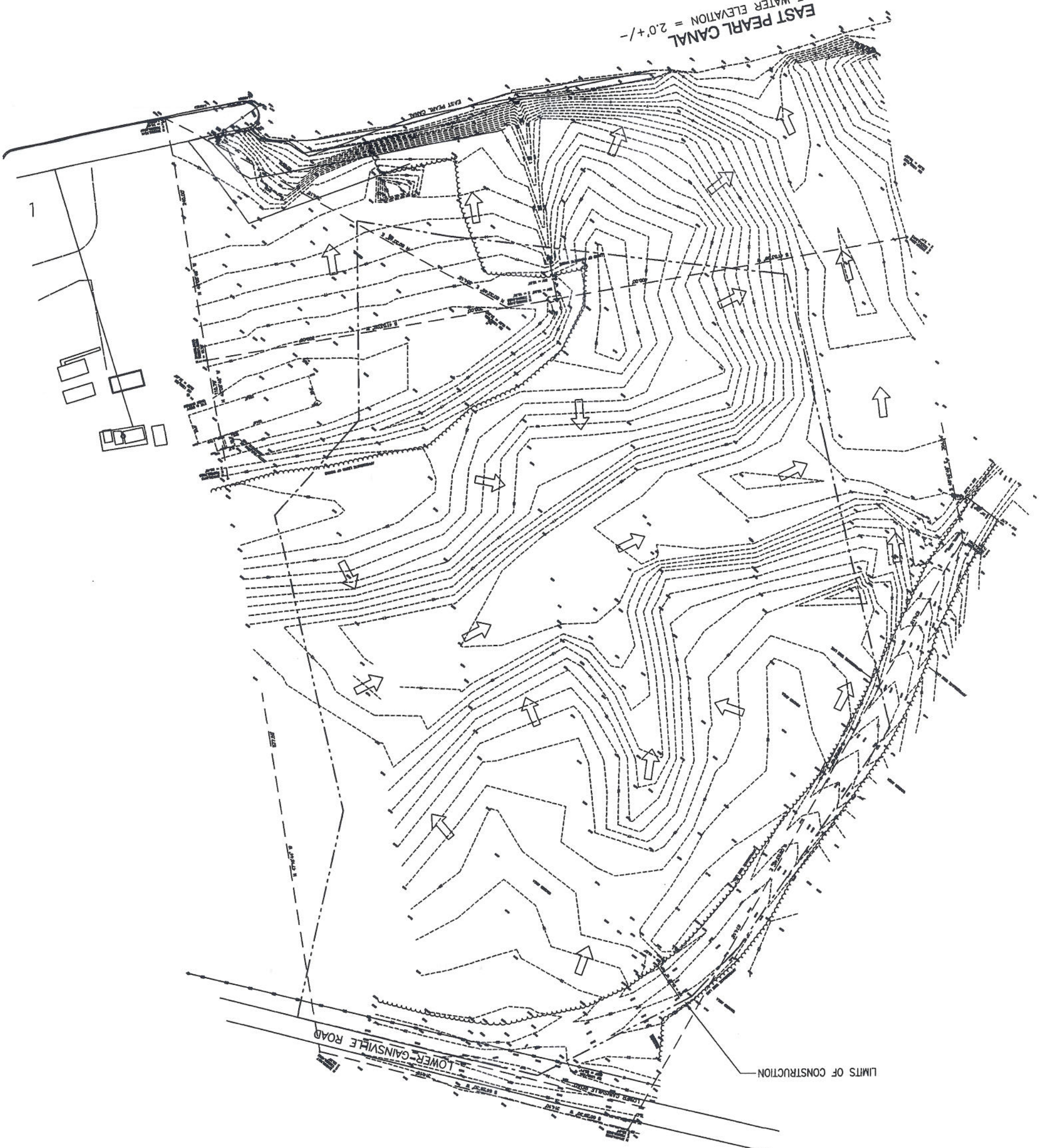
|  |                                 |  |                    |
|--|---------------------------------|--|--------------------|
| <b>PROJECT:</b>  | <b>STENNIS RIVERINE</b>         |  |                    |
|  | STORMWATER RUN-OFF CALCULATIONS |  |                    |
| Formulas used:   |                                 |  |                    |
| <b>[1] RATIONAL METHOD: Q=Aci</b>  |                                 |  |                    |
| where:   | Q=                              | Peak discharge of watershed in cubic feet per second (cfs) due to maximum storm assumed.             |                    |
|  | A=                              | Area of watershed in acres.  |                    |
|  | c=                              | Coefficient of run-off [2].  |                    |
|  | i=                              | Intensity of rainfall in inches per hour based on concentration time. [3]                            |                    |
| <b>[4] TC= <math>\frac{(L^{0.8}(\frac{1000}{c} - 9)^{0.7})}{(1140(s^{0.5}))}</math></b>        |                                 |  |                    |
| where:   | TC=                             | Time of concentration= time required for rain falling at most remote point to reach discharge point. |                    |
|  | c=                              | Site run-off coefficient based on conditions shown.  |                    |
|  | s=                              | Percent slope of overland flow.  |                    |
| <b>AREA OF WORK - PRIOR DEVELOPMENT</b><br>10 Year Frequency                                   |                                 |  |                    |
| <b>Q<sub>1</sub> = Aci</b>   |                                 |  |                    |
| Watertight Surfaces  |                                 | 0  | sqft = 0.000 Acres |
| c(1) =   | 0.9                             |  |                    |
| Gravel Surface   |                                 | 10000  | sqft = 0.230 Acres |
| c(2) =   | 0.25                            |  |                    |
| Green Space  |                                 | 371109   | sqft = 8.519 Acres |
| c(3) =   | 0.15                            |  |                    |
| Summary  |                                 | 381109   | sqft = 8.749 Acres |
| c =  | 0.15                            |  |                    |
| Duration (D) = Time of concentration (TC)  |                                 |  |                    |
| where  | L =                             | 810  | run-off length ft  |
|  | c =                             | 0.15   | run-off coef       |
|  | S =                             | 0.7407   | percent slope      |
| therefore  | TC = D =                        | 75.12  | minutes            |
| Expected rainfall intensity  | i =                             | 3.15   | in/hr              |
|  | Q <sub>1</sub> =                | 4.206  | cfs                |
| <b>AREA OF WORK - POST DEVELOPMENT</b><br>10 Year Frequency                                    |                                 |  |                    |
| <b>Q<sub>2</sub> = Aci</b>   |                                 |  |                    |
| Watertight Surfaces  |                                 | 130390   | sqft = 2.993 Acres |
| c(1) =   | 0.9                             |  |                    |
| Gravel Surface   |                                 | 10000  | sqft = 0.230 Acres |
| c(2) =   | 0.25                            |  |                    |
| Green Space  |                                 | 240719   | sqft = 5.526       |
| c(3) =   | 0.15                            |  |                    |
| Summary  |                                 | 381109   | sqft = 8.749 Acres |
| c =  | 0.41                            |  |                    |
| D = Time of concentration (TC)   |                                 |  |                    |
| where  | L =                             | 960  | Runoff length ft   |
|  | c =                             | 0.41   | Runoff coef        |
|  | S =                             | 0.5208   | Percent Slope      |
| therefore  | TC = D =                        | 36.12  | minutes or         |
| and from Rainfall Intensity Table  | I =                             | 3.15   | in/hr              |
|  | Q <sub>2</sub> =                | 11.278   | cfs                |
| <b>References:</b>   |                                 |  |                    |
| 1. Chen, W.F. <u>The Civil Engineering Handbook</u> . 1995. Eq.# 31.1, pg. 1036                |                                 |  |                    |
| 2. Seelye, Elwyn E. <u>Data Book for Civil Engineers</u> . Vol.1 1960. Tbl. B, pg. 18-02       |                                 |  |                    |
| 3. Seelye, Elwyn E. <u>Data Book for Civil Engineers</u> . Vol.1 1960. Fig.B, pg. 18-01        |                                 |  |                    |
| 4. Chen, W.F. <u>The Civil Engineering Handbook</u> . 1995. Tbl. 31.2 Regan Equation (n=0.013) |                                 |  |                    |
| 5. Chen, W.F. <u>The Civil Engineering Handbook</u> . 1995. Eq.# 28.32, pg. 969                |                                 |  |                    |



# PRIOR-DEVELOPMENT

8.79 ACRES

EAST PEARL CANAL  
AVERAGE WATER ELEVATION = 2.0' +/-



LIMITS OF CONSTRUCTION





# CALCULATIONS FOR WATERSHED SERVICED BY NEW SWALE AND OUTLET PIPES

|   |  |  |                    |
|---|--|--|--------------------|
| <b>PROJECT:</b>   | <b>STENNIS RIVERINE</b>  |  |                    |
|   | <b>STORMWATER RUN-OFF CALCULATIONS</b>   |  |                    |
| <b>Formulas used:</b>   |  |  |                    |
|   | <b>[1] RATIONAL METHOD: Q=Aci</b>  |  |                    |
| where:  | Q=   | Peak discharge of watershed in cubic feet per second (cfs) due to maximum storm assumed.             |                    |
|   | A=   | Area of watershed in acres.  |                    |
|   | c=   | Coefficient of run-off [2].  |                    |
|   | i=   | Intensity of rainfall in inches per hour based on concentration time. [3]                            |                    |
|   | <b>[4] TC= <math>\frac{(L^{0.8} (\frac{1000}{c} - 9)^{0.7})}{(1140(s^{0.5}))}</math></b> |  |                    |
| where:  | TC=  | Time of concentration= time required for rain falling at most remote point to reach discharge point. |                    |
|   | c=   | Site run-off coefficient based on conditions shown.  |                    |
|   | s=   | Percent slope of overland flow.  |                    |
| <b>WATERSHED SERVICED BY DRAINAGE SWALE - POST DEVELOPMENT</b>                              |  |  |                    |
| 10 Year Frequency   |  |  |                    |
| <b>Q<sub>1</sub> = Aci</b>  |  |  |                    |
| Watertight Surfaces   |  | 108688   | sqft = 2.495 Acres |
| c(1) =  | 0.9  |  |                    |
| Gravel Surface  |  | 0  | sqft = 0.000 Acres |
| c(2) =  | 0.25   |  |                    |
| Green Space   |  | 94492  | sqft = 2.169 Acres |
| c(3) =  | 0.15   |  |                    |
| Summary   |  | 203180   | sqft = 4.664 Acres |
| c =   | 0.55   |  |                    |
| Duration (D) = Time of concentration (TC)   |  |  |                    |
| where   | L = 960  | run-off length ft  | Elev diff = 6      |
|   | c = 0.55   | run-off coef   |                    |
|   | S = 0.6250   | percent slope  |                    |
| therefore   | TC = D = 32.09   | minutes  |                    |
| Expected rainfall intensity   | i = 3.15   | in/hr  |                    |
|   | <b>Q<sub>1</sub> = 8.099 cfs</b>   |  |                    |
| <b>DISCHARGE END AREA REQUIREMENTS</b>  |  |  |                    |
| 10 Year Frequency   |  |  |                    |
| Area requirements for pipe servicing swale located in Zone #1 of the corresponding Key Plan |  |  |                    |
| <b>[5] A= <math>\frac{Q}{(c\sqrt{2gh})}</math></b>  |  |  |                    |
| where:  | A=   | Discharge Area required  |                    |
|   | g=   | Acceleration of gravity  |                    |
|   | c=   | Discharge coefficient  |                    |
|   | h=   | Hydraulic head   |                    |
|   | Q=   | Flow volume from run-off   |                    |
| Pipe #1: Servicing swale located in Zone #1 of the corresponding Key Plan.                  |  |  |                    |
| Q =   | 1.380  | cfs  | H = 3.80 feet      |
| c =   | 0.62   | coefficient  | A = 0.14 sqft      |
| g =   | 32.16  | ft/ft/sec  |                    |
| <b>REQUIRED CONDUIT = 5.11 inch diameter</b>  |  |  |                    |
| Pipe #2: Servicing all zones shown in the corresponding Key Plan.                           |  |  |                    |
| Q =   | 8.099  | cfs  | H = 3.80 feet      |
| c =   | 0.62   | coefficient  | A = 0.84 sqft      |
| g =   | 32.16  | ft/ft/sec  |                    |
| <b>REQUIRED CONDUIT = 12.38 inch diameter</b>   |  |  |                    |

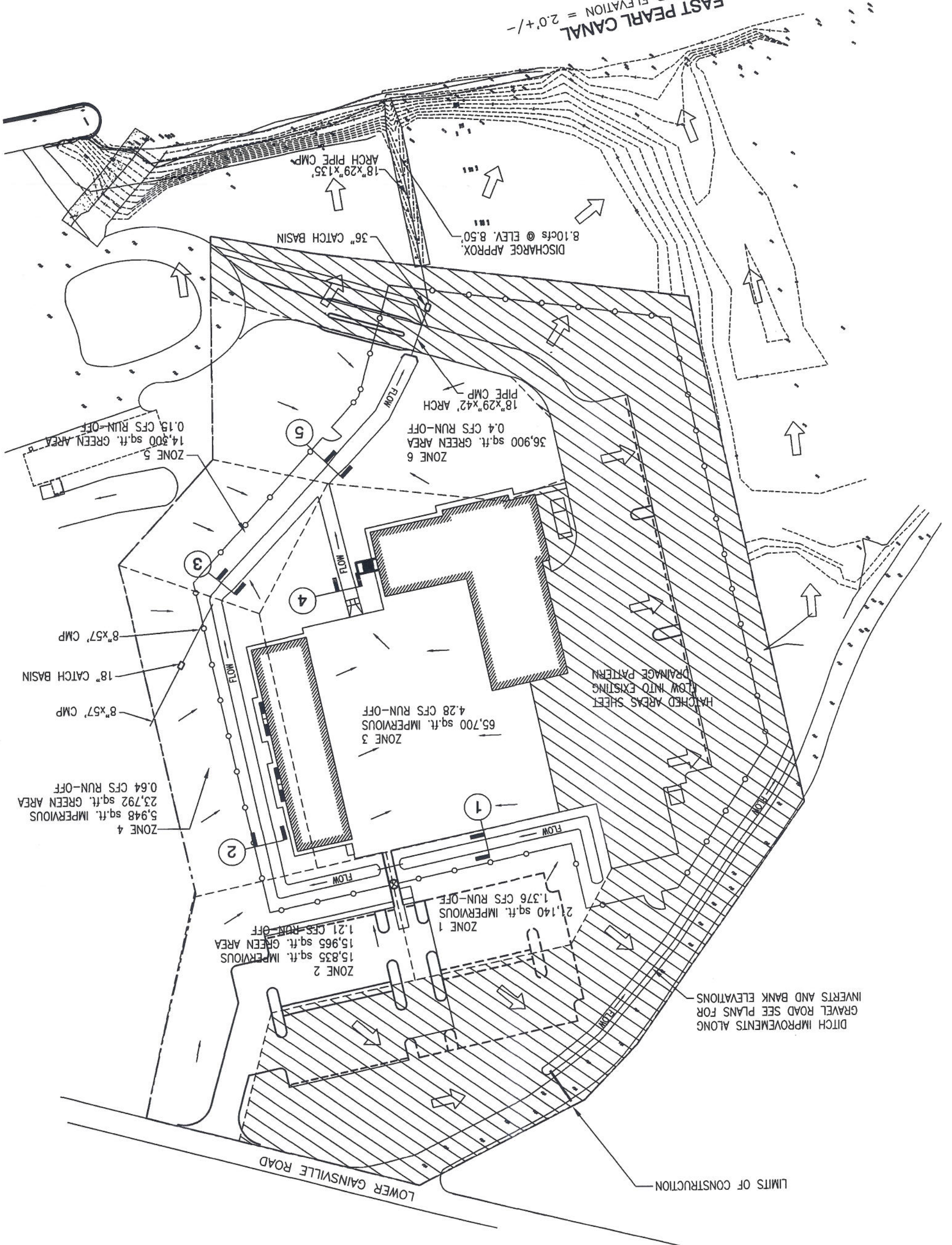


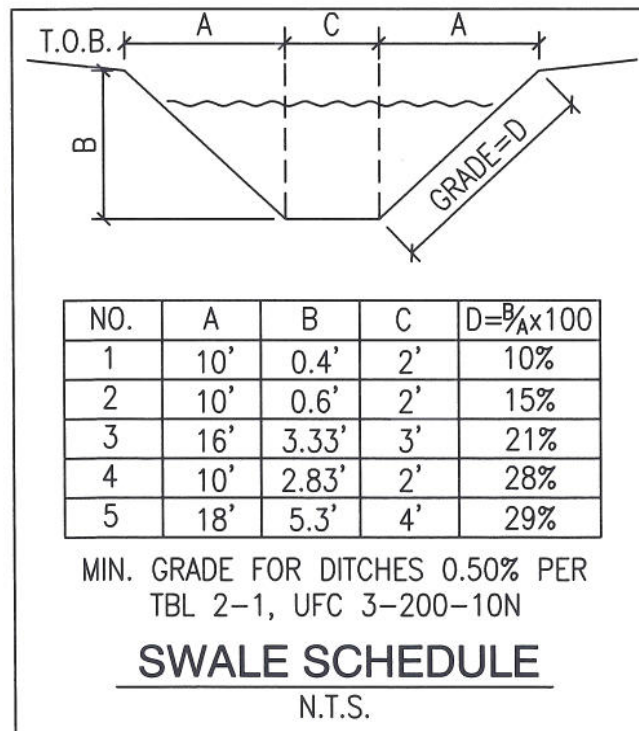
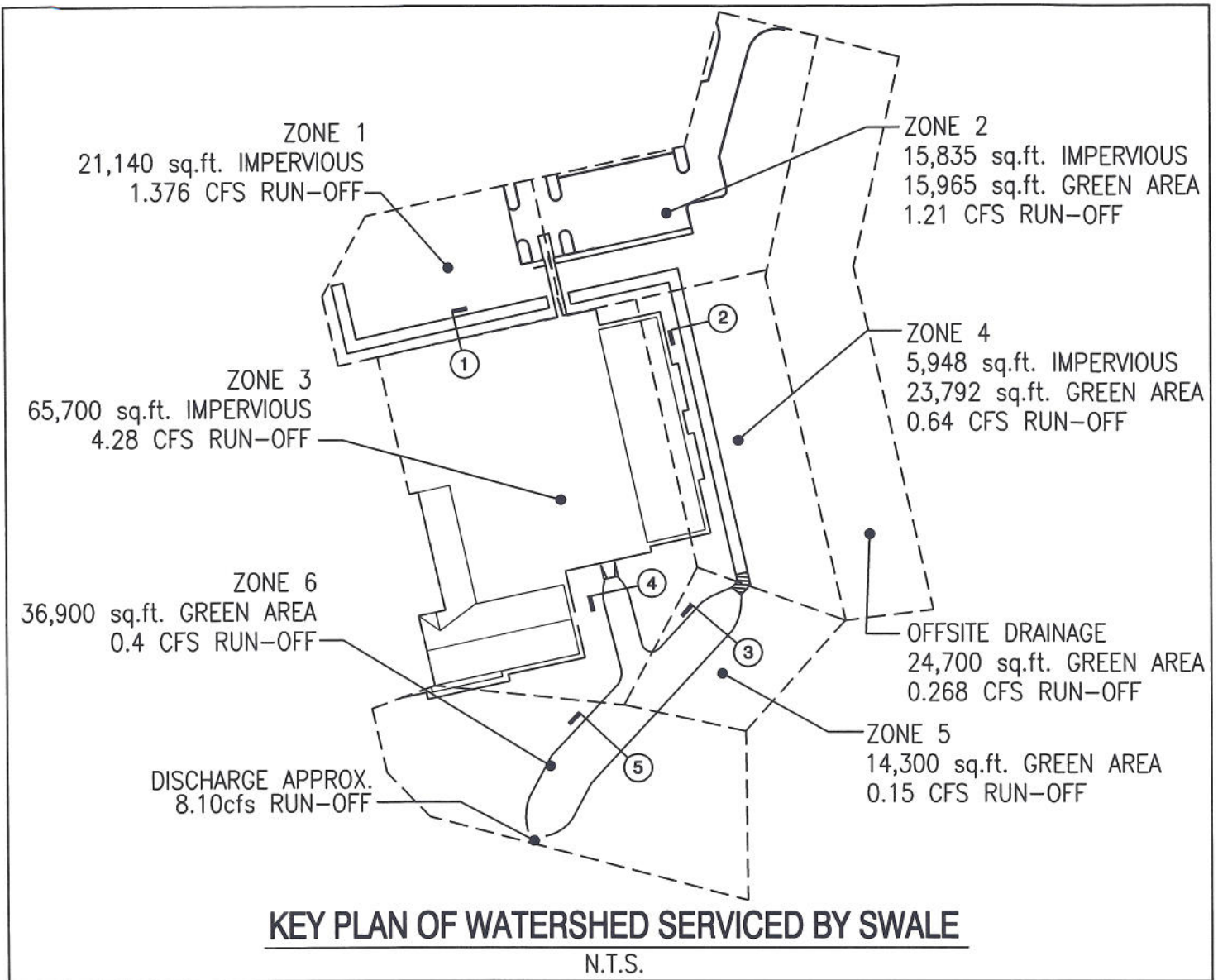


# POST-DEVELOPMENT

8.79 ACRES

EAST PEARL CANAL  
AVERAGE WATER ELEVATION = 2.0' +/-









# OFFSITE PONDING CALCULATIONS

|   |   |  |                    |
|---|---|--|--------------------|
| <b>PROJECT:</b>   | <b>STENNIS RIVERINE - OFFSITE PONDING</b> |  |                    |
|   | STORMWATER RUN-OFF CALCULATIONS           |  |                    |
| Formulas used:  |   |  |                    |
| <b>[1] RATIONAL METHOD: Q=Aci</b>   |   |  |                    |
| where:  | Q=  | Peak discharge of watershed in cubic feet per second (cfs) due to maximum storm assumed.             |                    |
|   | A=  | Area of watershed in acres.  |                    |
|   | c=  | Coefficient of run-off [2].  |                    |
|   | i=  | Intensity of rainfall in inches per hour based on concentration time. [3]                            |                    |
| <b>[4] TC= <math>\frac{(L^{0.8}(\frac{1000}{s} - 9)^{0.7})}{(1140(s^{0.5}))}</math></b> |   |  |                    |
| where:  | TC=                                       | Time of concentration= time required for rain falling at most remote point to reach discharge point. |                    |
|   | c=  | Site run-off coefficient based on conditions shown.  |                    |
|   | s=  | Percent slope of overland flow   |                    |
| <b>OFFSITE WATERSHED SERVICED BY DRAINAGE SWALE - POST DEVELOPMENT</b>                  |   |  |                    |
| 10 Year Frequency   |   |  |                    |
| <b>Q<sub>1</sub> = Aci</b>  |   |  |                    |
| Watertight Surfaces   |   | 0  | sqft = 0.000 Acres |
| c(1) =  | 0.9                                       |  |                    |
| Gravel Surface  |   | 0  | sqft = 0.000 Acres |
| c(2) =  | 0.25                                      |  |                    |
| Green Space   |   | 24700  | sqft = 0.567 Acres |
| c(3) =  | 0.15                                      |  |                    |
| Summary   |   | 24700  | sqft = 0.567 Acres |
| c =   | 0.15                                      |  |                    |
| Duration (D) = Time of concentration (TC)   |   |  |                    |
| where   | L =                                       | 50   | run-off length ft  |
|   | c =                                       | 0.15   | run-off coef       |
|   | S =                                       | 4.0000   | percent slope      |
| therefore   | TC = D =                                  | 19.04  | minutes            |
| Expected rainfall intensity   | i =                                       | 3.15   | in/hr              |
|   | Q <sub>1</sub> =                          | 0.268  | cfs                |
| <b>DISCHARGE END AREA REQUIREMENTS</b>  |   |  |                    |
| 10 Year Frequency   |   |  |                    |
| Area requirements for pipe servicing the offsite ponding Northeast of property.         |   |  |                    |
| <b>[5] A= <math>\frac{Q}{(c\sqrt{2gh})}</math></b>                                      |   |  |                    |
| where:  | A=  | Discharge Area required  |                    |
|   | g=  | Acceleration of gravity  |                    |
|   | c=  | Discharge coefficient  |                    |
|   | h=  | Hydraulic head   |                    |
|   | Q=  | Flow volume from run-off   |                    |
| Pipe Servicing Offsite Drainage   |   |  |                    |
| Q =   | 0.268                                     | cfs  | H = 3.80 feet      |
| c =   | 0.62                                      | coefficient  | A = 0.03 sqft      |
| g =   | 32.16                                     | ft/ft/sec  |                    |
| <b>REQUIRED CONDUIT = 2.25 inch diameter</b>  |   |  |                    |

***FY2008 MILCON P-210  
N4412  
SOF RIVERINE AND COMBATANT  
CRAFT OPERATIONS FACILITY***

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

***BLDG. 2440/2441  
CONVENTIONAL  
FOUNDATION DESIGN***

January 16, 2009

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60% DESIGN BUDG 2441/2440

CONVENTIONAL SLAB ON GRADE

MODULUS OF SUBGRADE REACTION

TABLE 4-1  $k = \text{in}/\text{lb}/\text{in}^3 = k = 300 \text{ } \phi$   
TM 5-804-1

ALL SUBGRADE SHALL BE SELECT GRANULAR MATERIAL COMPACTED TO 95% STANDARD PROCTOR DENSITY

SOIL BEAR CAPACITY 2000 PSIF

ASSUME NO ADVERSE SOIL CONDITIONS  
ASSUME NO HEAVY DISTRIBUTED LOADS

MATERIAL PROPERTIES

$f'_c = 4000 \text{ psi}$

$f_y = 60 \text{ ksi}$

CONCRETE FLEXURAL STRENGTH

$$9\sqrt{f'_c} = 9\sqrt{4000} = 569.2 \text{ SAY } \underline{\underline{570}} \text{ } \phi$$

| TYPE TRAFFIC | TABLE   | 5-1    | DESIGN  |          |
|--------------|---------|--------|---------|----------|
| FORIC LIFT   | # AXLES | AVG DV | MAX OPD | VAI-C    |
| 10K          | 1       | 50     | 50      | <u>8</u> |

TABLE 5-1 6.9 SAY 7"

CHECK 7" SLAB FOR STATIONARY LOAD

TABLE 3-1

$$d = 938 + \frac{570 - 550}{600 - 550} (1023 - 938) = \underline{\underline{972}}$$

$K = 300$  CONSTANT FACTOR 1.7 TABLE 3-1

$$1.7 \times 972 = 1652.4 \text{ SAY } 1650 \text{ lb/ft}^2$$

ASSUME MAX STATIONARY LOAD = 1200 lb/ft<sup>2</sup>

$$1650 > 1200 \quad \underline{\underline{OK}}$$

CHECK THICKED SLAB FOR EXTENSION WALL

6" REINFORCED BLOCK

$$63 \text{ lb/ft}^2 \times 25 = 1575$$

4" BRICK VENEER

$$42 \text{ lb/ft}^2 \times 6 = 252$$

$$\underline{\underline{1827 \text{ lb}}}$$

$$P = 9.93 \sqrt{F'_c} t_2^2 \sqrt{\frac{K}{19,000 \sqrt{F'_c} t_2}}$$

$$t_2 = 24$$

$$T_c = 7$$

$$\sqrt{F'_c} = 63.2$$

$$P = 3129.5 >> 1827 \quad \underline{\underline{OK}}$$

PERCENT STEEL TABLE F-4 = .062

ASSUME #4 @ 12" O.C. = .2 > .062 OK

Table 4-1. Typical values of modulus of subgrade reaction

| Types of Materials                                   | Modulus of Subgrade Reaction, k, in lb/in <sup>3</sup><br>for Moisture Contents of |          |           |           |           |           |           |      |
|--|--|----------|-----------|-----------|-----------|-----------|-----------|------|
|  | 1  | 5        | 9         | 13        | 17        | 21        | 25        | Over |
|  | to<br>4%   | to<br>8% | to<br>12% | to<br>16% | to<br>20% | to<br>24% | to<br>28% | 29%  |
| Silts and clays<br>Liquid limit > 50<br>(OH, CH, MH) | --   | 175      | 150       | 125       | 100       | 75        | 50        | 25   |
| Silts and clays<br>Liquid limit < 50<br>(OL, CL, ML) | --   | 200      | 175       | 150       | 125       | 100       | 75        | 50   |
| Silty and clayey<br>sands (SM & SC)                  | 300  | 250      | 225       | 200       | 150       | --        | --        | --   |
| Gravelly sands<br>(SW & SP)                          | 300+   | 300      | 250       | --        | --        | --        | --        | --   |
| Silty and clayey<br>gravels (GM & GC)                | 300+   | 300+     | 300       | 250       | --        | --        | --        | --   |
| Gravel and sandy<br>gravels (GW & GP)                | 300+   | 300+     | --        | --        | --        | --        | --        | --   |

NOTE: k values shown are typical for materials having dry densities equal to 90 to 95 percent of the maximum CE 55 density. For materials having dry densities less than 90 percent of maximum CE 55 density, values should be reduced by 50 lb/in<sup>3</sup>, except that a k of 25 lb/in<sup>3</sup> will be the minimum used for design.

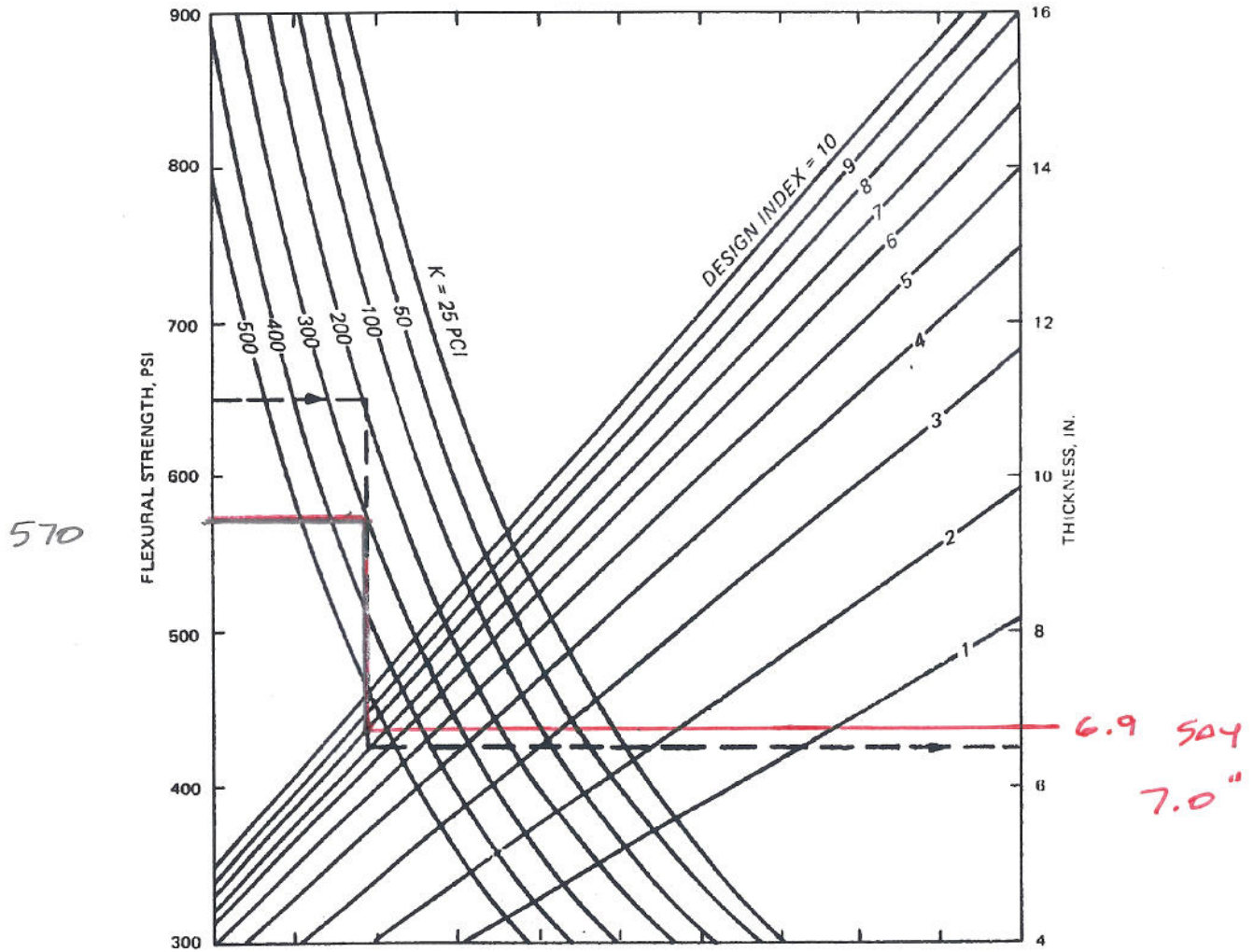
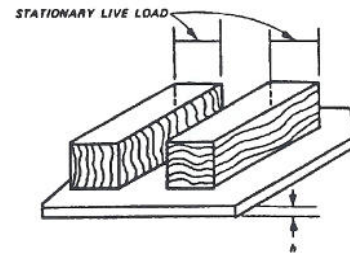


Figure 5-1. Design curves for concrete floor slabs by design index.

Table 3-1. Maximum allowable stationary live load

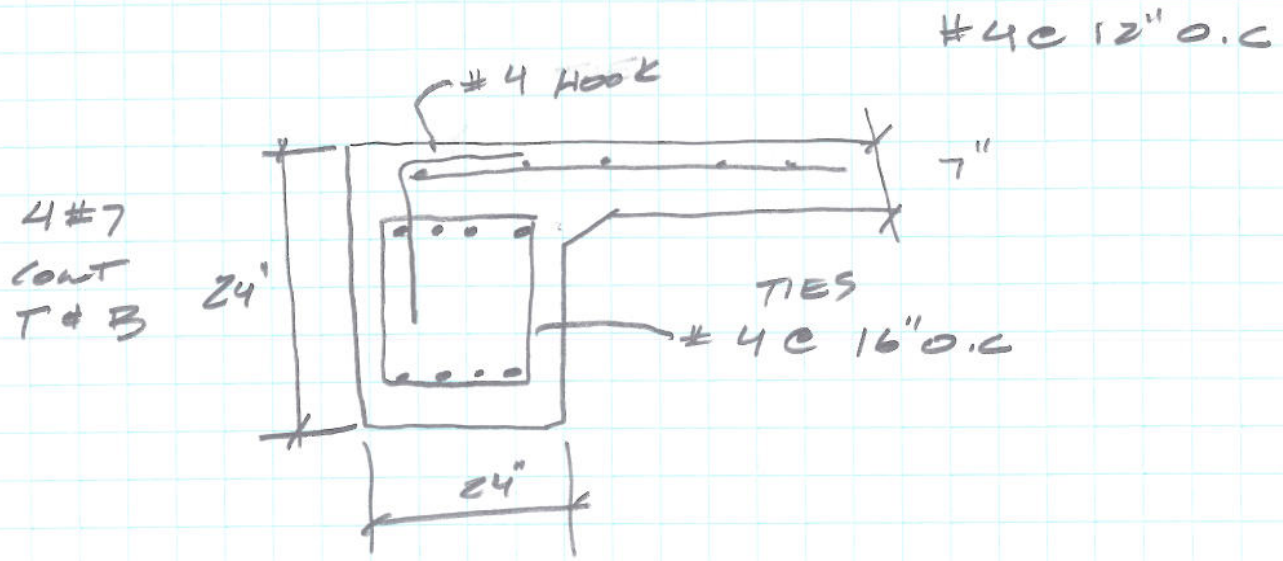
| Slab Thickness<br>inches<br>h | Stationary Live Load w in lb/ft <sup>2</sup> for These Flexural Strengths of Concrete |                        |                        |                        |
|-------------------------------|---|------------------------|------------------------|------------------------|
|                               | 550 lb in <sup>2</sup>  | 600 lb in <sup>2</sup> | 650 lb in <sup>2</sup> | 700 lb in <sup>2</sup> |
| 6                             | 868   | 947                    | 1,026                  | 1,105                  |
| 7                             | 938   | 1,023                  | 1,109                  | 1,194                  |
| 8                             | 1,003   | 1,094                  | 1,185                  | 1,276                  |
| 9                             | 1,064   | 1,160                  | 1,257                  | 1,354                  |
| 10                            | 1,121   | 1,223                  | 1,325                  | 1,427                  |
| 11                            | 1,176   | 1,283                  | 1,390                  | 1,497                  |
| 12                            | 1,228   | 1,340                  | 1,452                  | 1,563                  |
| 14                            | 1,326   | 1,447                  | 1,568                  | 1,689                  |
| 16                            | 1,418   | 1,547                  | 1,676                  | 1,805                  |
| 18                            | 1,504   | 1,641                  | 1,778                  | 1,915                  |
| 20                            | 1,586   | 1,730                  | 1,874                  | 2,018                  |



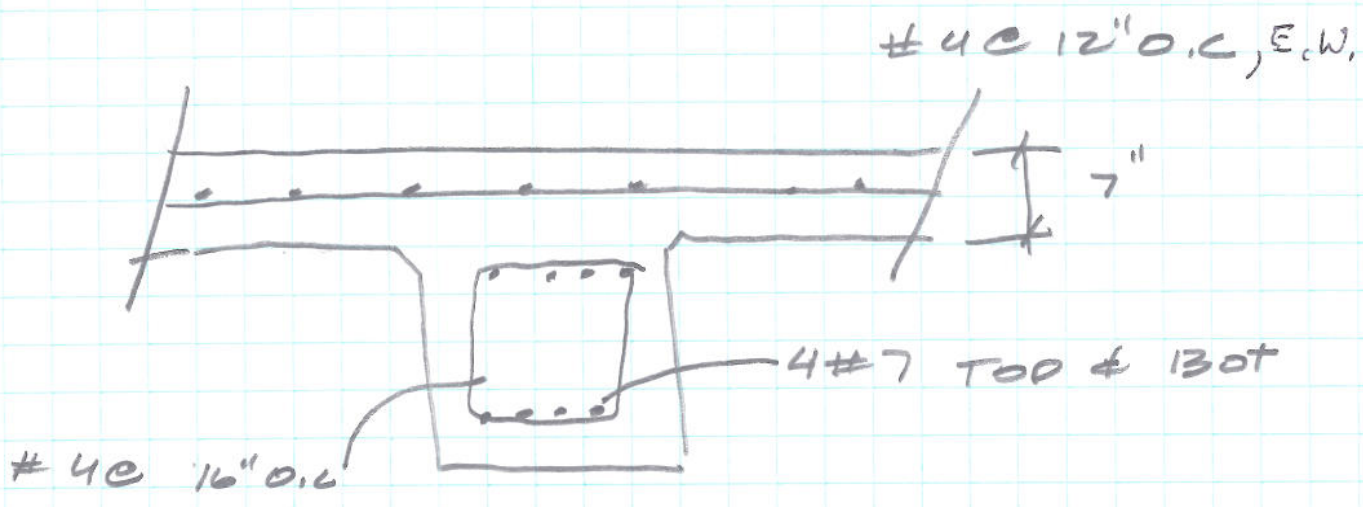
NOTE: Stationary live loads tabulated above are based on a modulus of subgrade reaction (k) of 100 lb/in<sup>3</sup>. Maximum allowable stationary live loads for other moduli of subgrade reaction will be computed by multiplying the above-tabulated loads by a constant factor. Constants for other subgrade moduli are tabulated below.

|                              |     |     |     |     |     |
|------------------------------|-----|-----|-----|-----|-----|
| Modulus of Subgrade reaction | 25  | 50  | 100 | 200 | 300 |
| Constant factor              | 0.5 | 0.7 | 1.0 | 1.4 | 1.7 |

For other modulus of subgrade reaction values, the constant values may be found from the expression  $\sqrt{k/100}$ .



EXTERIOR WALL



4000 psi  
 $f_y = 60 \text{ ksi}$

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N4412  
SOF RIVERINE AND COMBATANT  
CRAFT OPERATIONS FACILITY***

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

***BLDG. 2442  
CONVENTIONAL  
FOUNDATION DESIGN***

January 16, 2009

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

# BUILDING DESIGN BUILDING 244Z

①

CONVENTIONAL - SLAB ON GRADE  
USING TM 5-809-

MODULUS OF SUBGRADE REACTION  $K=300$

USE SELECT GRANULAR MATERIAL

COMPACTED TO 95% STANDARD PROCTOR DENSITY  
FROM SOILS REPORT - SOIL BEARING CAP - 2000 PSF  
ASSUMPTIONS:

1. NO ADVERSE SOIL CONDITIONS
2. NO HEAVY DISTRIBUTED LOADS

PROPERTIES OF MATERIALS

$$f_c = 4000 \text{ PSI}$$

$$f_s = 60 \text{ KSI}$$

CONCRETE FLEXURAL STRENGTH:

$$9\sqrt{f_c} = 9\sqrt{4000} = 569.2 \text{ SAY } 570 -$$

USE TRAFFIC TABLE 5-1 W/ DESIGN INDEX 10 (SEVERE)  
THIS BUILDING SLAB TO SUPPORT 32 KIP AXLE LOAD  
AS REQUIRED BY G201003 - PAVED SURFACES  
SLAB THICKNES = 7.4" - USE 8" SLAB

CHECK 8" SLAB FOR STATIONARY LOAD

TABLE 3-1

$$b = 8"$$

$$FLEX ST = 570$$

$$1003 + \frac{570 - 550}{600 - 550} \times (1094 - 1003) = 1031.4$$

$$K = 300 \times 1.7 (\text{FACTOR})$$

$$1.7 \times 1031 = 1753 \text{ SAY } 1750 \text{ lbs/ft}^2$$

ASSUME MAX STA. LOAD = 1200 lbs/SF

$$1750 > 1200 \quad \text{OK}$$

TITLE

**DAMMON ENGINEERING  
ARCHITECTS / ENGINEERS**

P.O. BOX 2830  
(504) 649-5832

SLIDELL, LA. 70459  
(504) 641-5950

SCALE

DATE

ENGR

DG NO.

RE

(2)

### CHECK SLABS THICKNESS ON EXT WALL

THIS BLDG HAS A 6' HIGH CMU WALL SURROUND  
 8" CMU (REINFORCED)  $63 \text{ lb/ft}^2 \times 6 = 378$   
 4" BRICK VENEER  $42 \text{ lb/ft}^2 \times 6 = 252$   $= 630 \text{ LB/FT}$

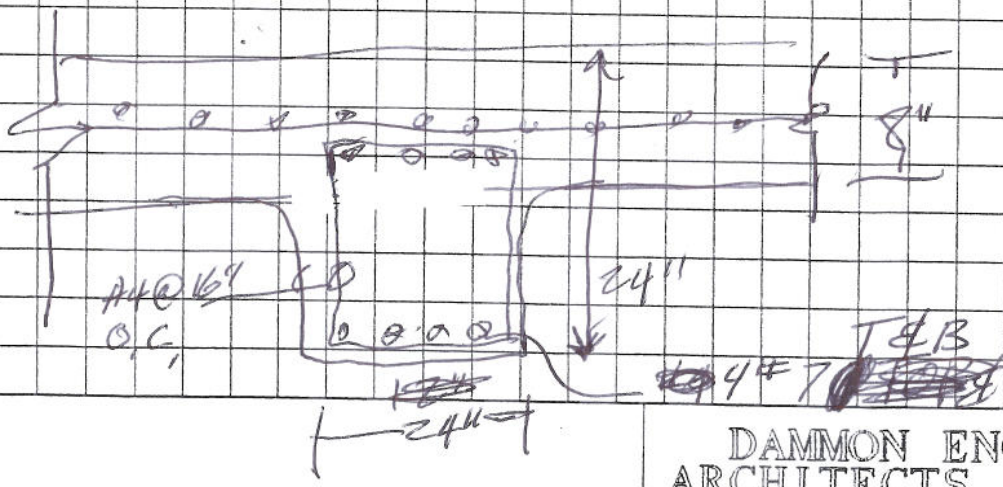
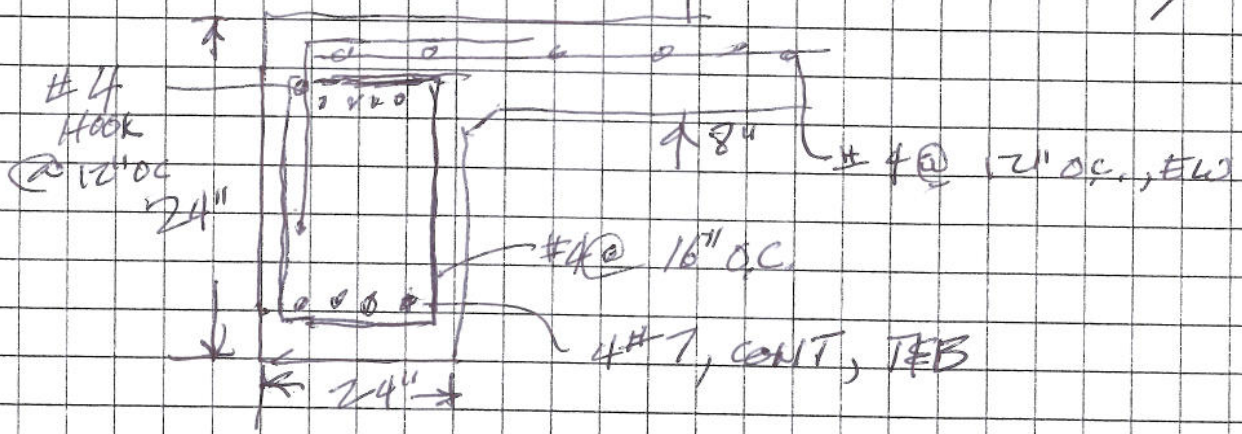
TABLE 3-3

P = FROM TABLE 3-3 FOR  $630 \text{ LB/FT} = 570 > 550$  SO THAT 6" WOULD BE SUFFICIENT, WE HAVE 24"

THE ABOVE NEGLECTS COLUMN LOADS WHICH ARE SEPARATE

PERCENT STEEL (TABLE 5-4 = .076)

ASSUME #4 @ 12" O.C. AREA OF #4 =  $196 \text{ IN}^2 > .076 \text{ OK}$



|       |      |      |        |    |
|-------|------|------|--------|----|
| TITLE |      |      |        |    |
| SCALE | DATE | ENGR | DG NO. | RE |

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$h_r$   
THICKNESS OF  
REINFORCED  
CONCRETE  
PAVEMENT, IN.

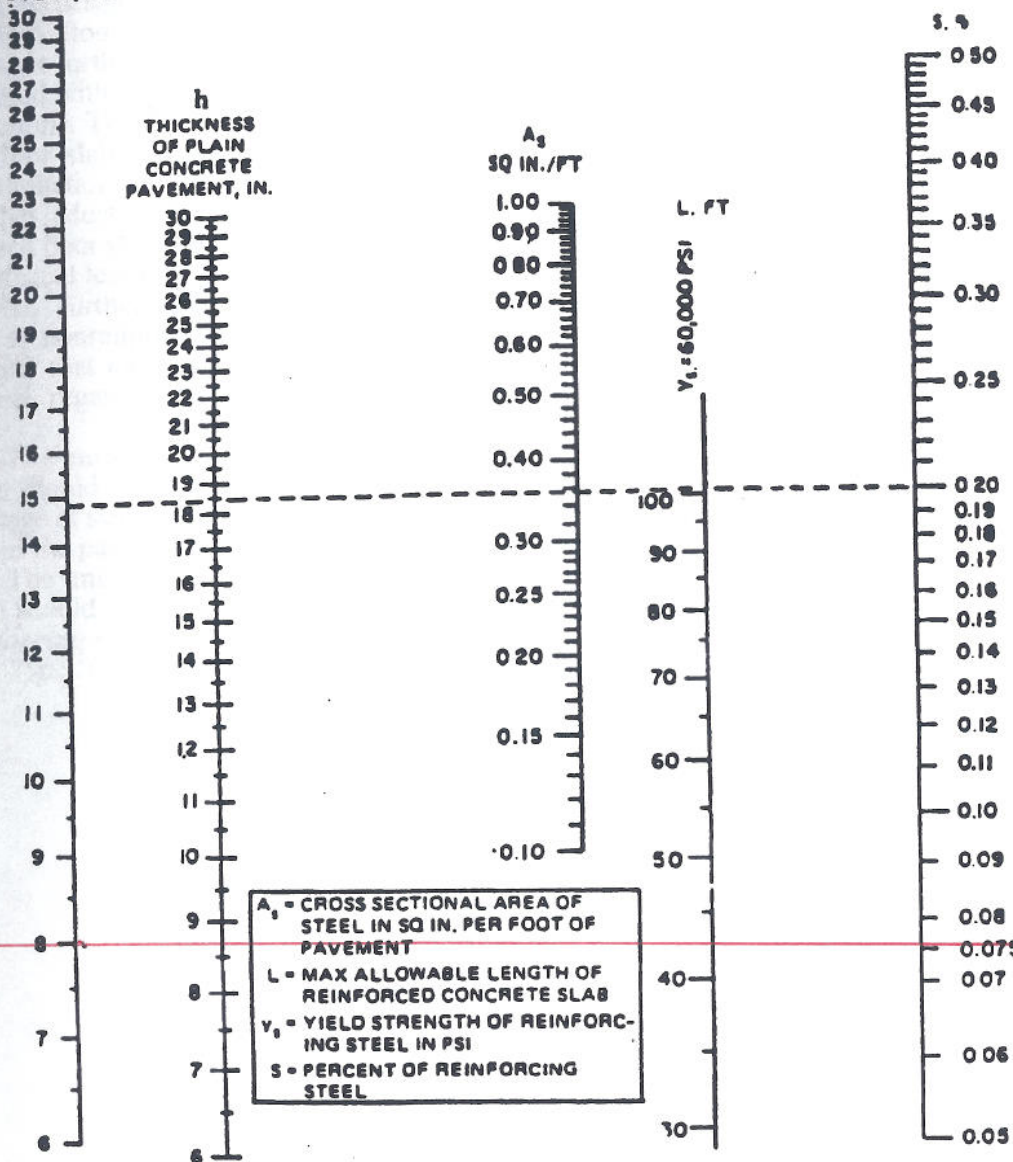
$h$   
THICKNESS  
OF PLAIN  
CONCRETE  
PAVEMENT, IN.

$A_s$   
SQ IN./FT

L, FT

$v_s = 60,000$  PSI

S, %



$A_s$  - CROSS SECTIONAL AREA OF STEEL IN SQ IN. PER FOOT OF PAVEMENT  
 L - MAX ALLOWABLE LENGTH OF REINFORCED CONCRETE SLAB  
 $v_s$  - YIELD STRENGTH OF REINFORCING STEEL IN PSI  
 S - PERCENT OF REINFORCING STEEL

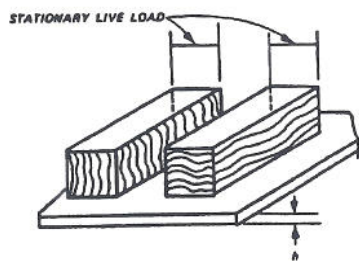
**REINFORCED CONCRETE PAVEMENT DESIGN**

NOTE: MINIMUM THICKNESS OF REINFORCED CONCRETE FLOOR SLABS WILL BE 6 IN.

Figure 5-4. Design thickness for reinforced floor slabs.

Table 3-1. Maximum allowable stationary live load

| Slab Thickness<br>inches<br>h | Stationary Live Load w in<br>lb/ft <sup>2</sup> for These Flexural<br>Strengths of Concrete |                           |                           |                           |
|-------------------------------|---|---------------------------|---------------------------|---------------------------|
|                               | 550 lb<br>in <sup>2</sup>   | 600 lb<br>in <sup>2</sup> | 650 lb<br>in <sup>2</sup> | 700 lb<br>in <sup>2</sup> |
| 6                             | 868   | 947                       | 1,026                     | 1,105                     |
| 7                             | 938   | 1,023                     | 1,109                     | 1,194                     |
| 8                             | 1,003   | 1,094                     | 1,185                     | 1,276                     |
| 9                             | 1,064   | 1,160                     | 1,257                     | 1,354                     |
| 10                            | 1,121   | 1,223                     | 1,325                     | 1,427                     |
| 11                            | 1,176   | 1,283                     | 1,390                     | 1,497                     |
| 12                            | 1,228   | 1,340                     | 1,452                     | 1,563                     |
| 14                            | 1,326   | 1,447                     | 1,568                     | 1,689                     |
| 16                            | 1,418   | 1,547                     | 1,676                     | 1,805                     |
| 18                            | 1,504   | 1,641                     | 1,778                     | 1,915                     |
| 20                            | 1,586   | 1,730                     | 1,874                     | 2,018                     |



NOTE: Stationary live loads tabulated above are based on a modulus of subgrade reaction (k) of 100 lb/in<sup>3</sup>. Maximum allowable stationary live loads for other moduli of subgrade reaction will be computed by multiplying the above-tabulated loads by a constant factor. Constants for other subgrade moduli are tabulated below.

|                              |     |     |     |     |     |
|------------------------------|-----|-----|-----|-----|-----|
| Modulus of Subgrade reaction | 25  | 50  | 100 | 200 | 300 |
| Constant factor              | 0.5 | 0.7 | 1.0 | 1.4 | 1.7 |

For other modulus of subgrade reaction values, the constant values may be found from the expression  $\sqrt{k/100}$ .

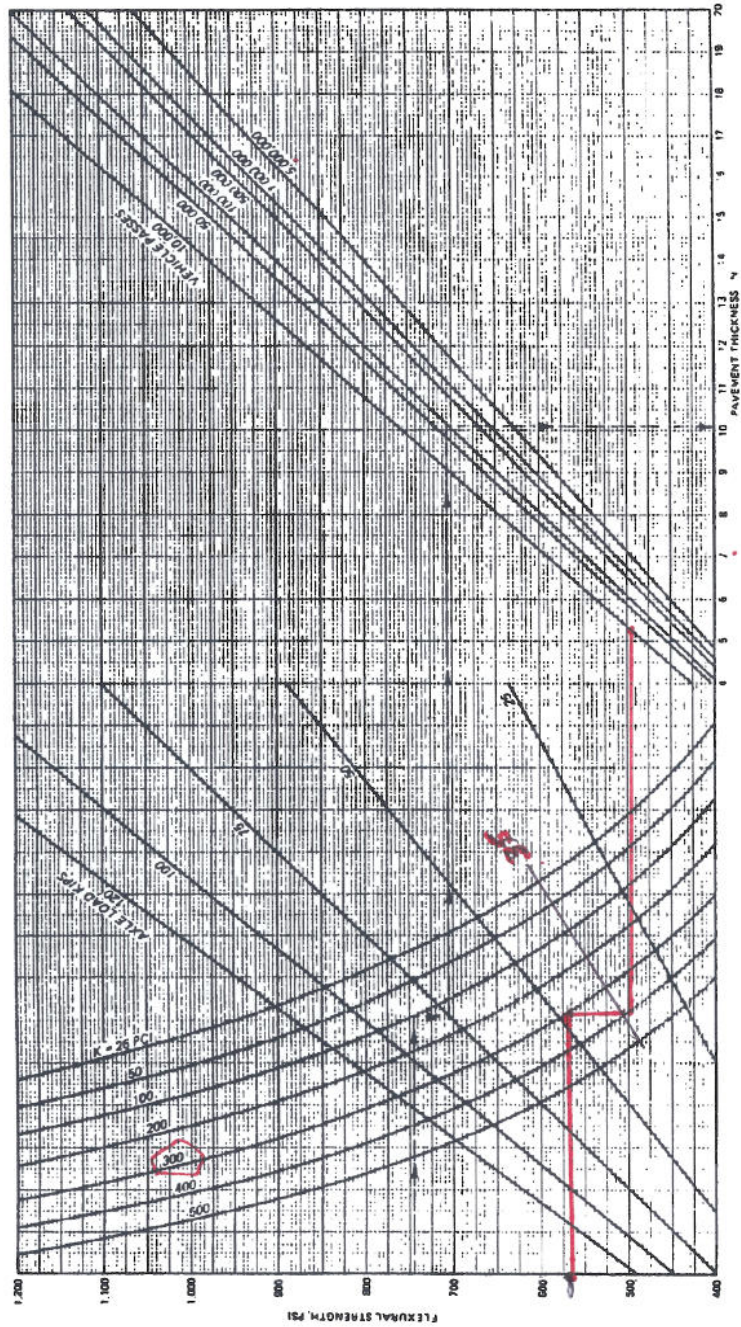


Figure 5-2. Design curves for concrete floor slabs for heavy forklifts.

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# CALCULATIONS

DESIGN OF ASPHALT RDS & PARKING

TRAFFIC CLASS III, CBR 9-10, (SEE CONCRETE DESIGN)

BASE 4"

SURFACE 1.5"

RFP MIN

8" BASE

2" ASPHALT

ASPHALT INSTITUTE "THICKNESS DESIGN MANUAL"

**Table 4-4. Thickness Design: Low Volume Secondary and Rural Roads / PARKING**

| A. For Asphalt Concrete Base Pavements |                   |     |   |         |       |
|--|-------------------|-----|---|---------|-------|
| Design Criteria*                       |                   |     | Thickness in Inches<br>Asphalt Concrete |         |       |
| Traffic Class<br>(ADT)                 | Subgrade<br>Class | CBR | Base                                    | Surface | Total |
| II<br>(50-200 ADT)                     | Good              | 9   | 4.0                                     | 1.0     | 5.0   |
|  | Moderate          | 6   | 5.0                                     | 1.0     | 6.0   |
|  | Poor              | 3   | 5.5                                     | 1.5     | 7.0   |
| III<br>(201-700 ADT)                   | Good              | 9   | 4.0                                     | 1.5     | 5.5   |
|  | Moderate          | 6   | 5.0                                     | 1.5     | 6.5   |
|  | Poor              | 3   | 6.0                                     | 1.5     | 7.5   |
| IV<br>(1,501-4,500 ADT)                | Good              | 9   | 5.5                                     | 2.0     | 7.5   |
|  | Moderate          | 6   | 6.5                                     | 2.0     | 8.5   |
|  | Poor              | 3   | 7.5                                     | 2.0     | 9.5   |

| B. For Untreated Aggregate Base Pavements |                   |     |                                |                             |                                |       |
|---|-------------------|-----|--------------------------------|-----------------------------|--------------------------------|-------|
| Design Criteria*                          |                   |     | Thickness in Inches            |                             |                                |       |
| Traffic Class<br>(ADT)                    | Subgrade<br>Class | CBR | Untreated<br>Aggregate<br>Base | Asphalt<br>Concrete<br>Base | Asphalt<br>Concrete<br>Surface | Total |
| II<br>(50-200 ADT)                        | Good              | 9   | 5.0                            | .0                          | 3.0                            | 8.0   |
|   | Moderate          | 6   | 8.0                            | .0                          | 3.0                            | 11.0  |
|   | Poor              | 3   | 8.0                            | 2.0                         | 2.0                            | 12.0  |
| III<br>(201-700 ADT)                      | Good              | 9   | 7.0                            | .0                          | 3.0                            | 10.0  |
|   | Moderate          | 6   | 8.0                            | 2.0                         | 2.0                            | 12.0  |
|   | Poor              | 3   | 8.0                            | 3.0                         | 2.0                            | 13.0  |
| IV<br>(1,500-4,500 ADT)                   | Good              | 9   | 8.0                            | 3.0                         | 2.0                            | 13.0  |
|   | Moderate          | 6   | 8.0                            | 3.5                         | 2.0                            | 13.5  |
|   | Poor              | 3   | 8.0                            | 4.5                         | 2.0                            | 14.5  |

\*See chapter 3 for traffic and soil class details

product

# Mirafi® X-Series Woven Polypropylene Geotextiles

## for Sediment Control, Soil Separation, and Road Base Stabilization

### PRODUCT DESCRIPTION

Mirafi® X-Series products are woven geotextiles comprised of UV stabilized polypropylene slit film. Mirafi® X-Series Woven Polypropylene Geotextiles provide excellent puncture and tear resistant properties in addition to high tensile strengths.

### FEATURES AND BENEFITS

- **Construction.** Woven construction offers excellent resistance to installation abuse.
- **Strength.** High modulus provide outstanding performance in a wide range of applications.
- **Flow.** Uniform openings provide excellent filtration and flow characteristics.
- **Fabrication.** Mirafi® Silt Fence is prefabricated using Mirafi® 100X geotextile and 3.2 cm (1.25") nominal square hardwood posts. Mirafi® Silt Fence is available with 2.5 m (8.3') or 3 m (10') post spacings.

Mirafi® Envirofence is prefabricated using Mirafi® 100X, 3.2 cm (1.25") nominal square hardwood posts, and a net backing for additional support. Mirafi® Envirofence is available with 2.5 m (8.3') post spacings. All Mirafi® prefabricated silt fence products are ready for immediate

installation upon delivery.

- **Cost.** Mirafi® 500X/600X geotextiles were developed to improve the economics and performance of roadway systems by reducing the amount of aggregate required, increasing the design life and reducing the maintenance cost, preventing periodic overstressing of the subgrade, and eliminating costly project delays by allowing all-weather construction. In addition, panels can be sewn together in the factory or in the field, providing cross-roll direction strength to facilitate installation, and providing reinforcement strength.

### APPLICATIONS

#### Mirafi® 100X and 100CX

Mirafi® 100X and 100CX are predominantly used for sediment control applications. Controlling the run-off is advantageous to owners, contractors, and engineers who face the economic costs associated with site sediment loss. Installed correctly, these sediment control geotextiles in silt fence structures function as a filter and a run-off flow velocity check. Fine-grained sediment is trapped by the geotextile while storm water run-off passes through the geotextile at a moderate rate.

#### Mirafi® 500X

Mirafi® 500X applications include separation under parking lots, residential streets, and roadways. Mirafi® 500X is used over good to moderate strength subgrades for separation and confinement of base materials. Mirafi® 500X is also utilized over moderate to poor subgrades for separation, confinement, and stabilization of base material. Mirafi® 500X meets AASHTO M288-96 Specifications for Stabilization and Separation - Class 3.

#### Mirafi® 600X

Mirafi® 600X is used for separation and stabilization over very weak subgrades; and separation, confinement, and reinforcement for critical roadways and site construction where very coarse, angular, and abrasive base material is required. Mirafi® 600X provides stabilization and reinforcement when heavy loads are expected. Mirafi® 600X is effective in the construction of low embankments over weak subgrades, eliminating the need for costly excavation and replacement with expensive fill. Mirafi® 600X meets AASHTO M288-96 Specifications for Stabilization and Separation - Class 1.



Mirafi® Silt Fence with posts used for sedimentation control



Mirafi® 500X used for separation under residential street



Mirafi® 600X used for stabilization in roadway repair



Ten Cate Nicolon

product **Mirafi® X-Series Woven Polypropylene Geotextiles**  
**for Sedimentation Control, Soil Separation, and Road Base Stabilization**

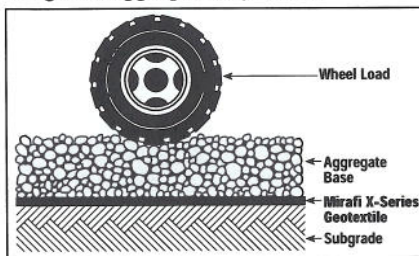
## Mirafi® X-Series Technical Data

| Property                           | Test Method | Units             | 100CX      | 100X       | 500XL      | 500X       | 600X       |
|------------------------------------|-------------|-------------------|------------|------------|------------|------------|------------|
| Grab Tensile Strength <sup>1</sup> | ASTM D 4632 | kN (lbs)          | 0.40 (90)  | 0.55 (124) | 0.62 (140) | 0.90 (200) | 1.40 (315) |
| Grab Tensile Elongation            | ASTM D 4632 | % MD / CD         | 15 / 15    | 15 / 15    | 15 / 10    | 15 / 10    | 15 / 10    |
| Trapezoid Tear Strength            | ASTM D 4533 | kN (lbs)          | 0.22 (50)  | 0.29 (65)  | 0.20 (45)  | 0.33 (75)  | 0.53 (120) |
| Mullen Burst Strength              | ASTM D 3786 | kPa (psi)         | 1376 (200) | 2060 (300) | 2240 (325) | 2756 (400) | 4134 (600) |
| Puncture Strength                  | ASTM D 4833 | kN (lbs)          | 0.22 (50)  | 0.27 (60)  | 0.29 (65)  | 0.40 (90)  | 0.53 (120) |
| UV Resistant after 500 hours       | ASTM D 4355 | % Strength        | 70         | 70         | 70         | 70         | 70         |
| Apparent Opening Size              | ASTM D 4751 | mm (US Sieve)     | 0.60 (30)  | 0.60 (30)  | 0.60 (30)  | 0.30 (50)  | 0.425 (40) |
| Permittivity                       | ASTM D 4491 | sec <sup>-1</sup> | 0.1        | 0.1        | 0.05       | 0.05       | 0.05       |

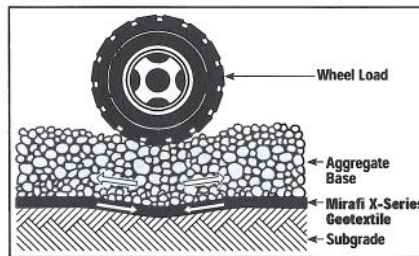
<sup>1</sup> Values apply to both machine and cross-machine directions

| Packaging         |  |                                   |         |           |            |                          |                          |
|-------------------|--|-----------------------------------|---------|-----------|------------|--------------------------|--------------------------|
| Roll Width        |  | m (ft)                            | 0.9 (3) | 0.9 (3)   | 3.8 (12.5) | 3.8 (12.5)<br>5.3 (17.5) | 3.8 (12.5)<br>5.3 (17.5) |
| Roll Length       |  | m (ft)                            | various | 100 (330) | 154 (504)  | 132 (432)<br>94.2 (309)  | 110 (360)<br>78.7 (258)  |
| Est. Gross Weight |  | kg (lbs)                          | various | 12 (26)   | 95 (190)   | 95 (210)                 | 109 (240)                |
| Roll Area         |  | m <sup>2</sup> (yd <sup>2</sup> ) | various | 92 (110)  | 585 (700)  | 502 (600)                | 418 (500)                |

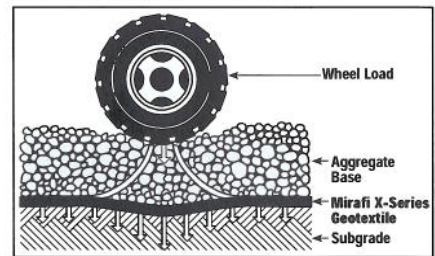
**Subgrade/Aggregate Separation**



**Aggregate Confinement**



**Subgrade Load Distribution**



[www.mirafi.com](http://www.mirafi.com)

**TECHNICAL SERVICES**

Complete technical assistance is available from Ten Cate Nicolon and its sales representatives. Service include assistance during design and specification stages as well as initial stages of installation.

**WARRANTY**

Ten Cate Nicolon warrants that the product that it sells will conform to the specifications published in this literature. For information on limitations to this warranty, contact Ten Cate Nicolon.

**CORPORATE OFFICE**

365 South Holland Drive • Pendergrass, GA 30567  
 (888) 795-0808 • (706) 693-2226 • Fax (706) 693-4400



Ten Cate Nicolon  
 34 of 108



**TC Mirafi**

**TECHNICAL DATA SHEET**

## Mirafi 600X

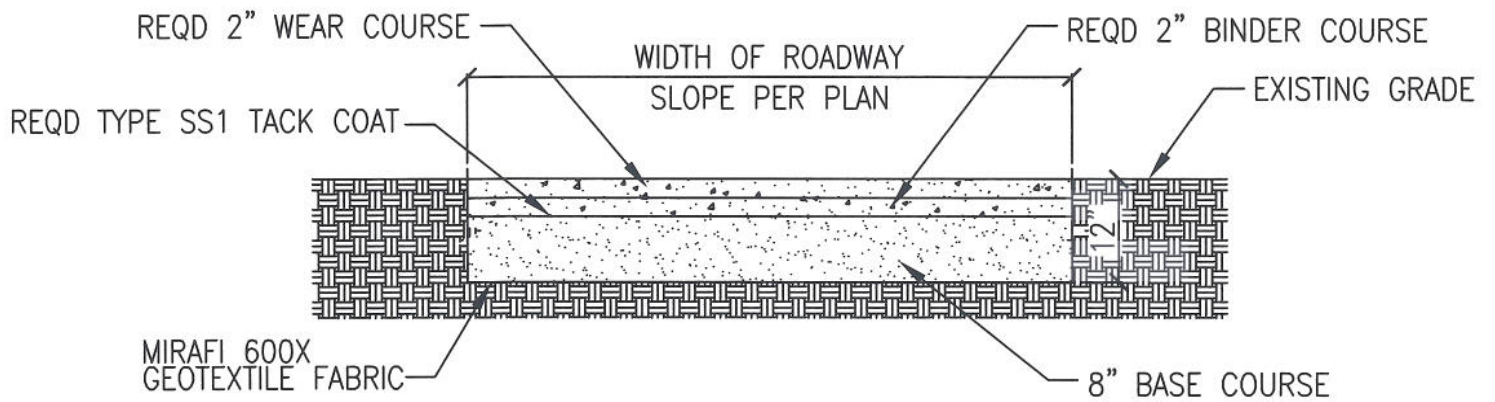
Mirafi 600X is composed of high-tenacity polypropylene yarns, which are woven into a stable network such that the yarns retain their relative position. 600X is inert to biological degradation and resistant to naturally encountered chemicals, alkalis, and acids.

| Mechanical Properties        | Test Method  | Unit   | Minimum Average Roll Value |            |
|------------------------------|--------------|--|----------------------------|------------|
|                              |              |  | MD                         | CD         |
| Wide Width Tensile Strength  | ASTM D 4595  | kN/m (lbs/in)                                      | 30.6 (175)                 | 30.6 (175) |
| Grab Tensile Strength        | ASTM D 4632  | kN (lbs)   | 1.40 (315)                 | 1.40 (315) |
| Grab Tensile Elongation      | ASTM D 4632  | %  | 15                         | 10         |
| Trapezoid Tear Strength      | ASTM D 4533  | kN (lbs)   | 0.53 (120)                 | 0.53 (120) |
| Mullen Burst Strength        | ASTM D 3786  | kPa (psi)  | 4134 (600)                 |            |
| Puncture Strength            | ASTM D 4833  | kN (lbs)   | 0.53 (120)                 |            |
| Percent Open Area            | COE-02215-86 | %  | 1                          |            |
| Apparent Opening Size (AOS)  | ASTM D 4751  | mm<br>(U.S. Sieve)                                 | 0.425<br>(40)              |            |
| Permittivity                 | ASTM D 4491  | sec <sup>-1</sup>                                  | 0.05                       |            |
| Flow Rate                    | ASTM D 4491  | l/min/m <sup>2</sup><br>(gal/min/ft <sup>2</sup> ) | 163<br>(4.0)               |            |
| UV Resistance (at 500 hours) | ASTM D 4355  | % strength retained                                | 70                         |            |

| Physical Properties                 | Test Method | Unit                                   | Typical Value             |                        |
|-------------------------------------|-------------|--|---------------------------|------------------------|
| Weight                              | ASTM D 5261 | g/m <sup>2</sup> (oz/yd <sup>2</sup> ) | 203 (6.0)                 |                        |
| Thickness                           | ASTM D 5199 | mm (mils)                              | 0.64 (25)                 |                        |
| Roll Dimensions<br>(width x length) | --          | m<br>(ft)                              | 3.8 x 110<br>(12.5 x 360) | 5.5 x 76<br>(18 x 250) |
| Roll Area                           | --          | m <sup>2</sup> (yd <sup>2</sup> )      | 418 (500)                 | 418 (500)              |
| Estimated Roll Weight               | --          | kg (lb)                                | 109 (240)                 | 109 (240)              |

**DISCLAIMER:** TC Mirafi warrants our products to be free from defects in material and workmanship when delivered to TC Mirafi's customers and that our products meet our published specifications. Contact your local TC Mirafi Representative for detailed product specification and warranty information.

600X.DOC  
Revision: 2  
Date: Jan. 1, 1999



**ASPHALT ROADWAY PAVEMENT SECTION**

N.T.S.

26  
C3.1  
C3.2

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January 16, 2009

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CONCRETE ROADS

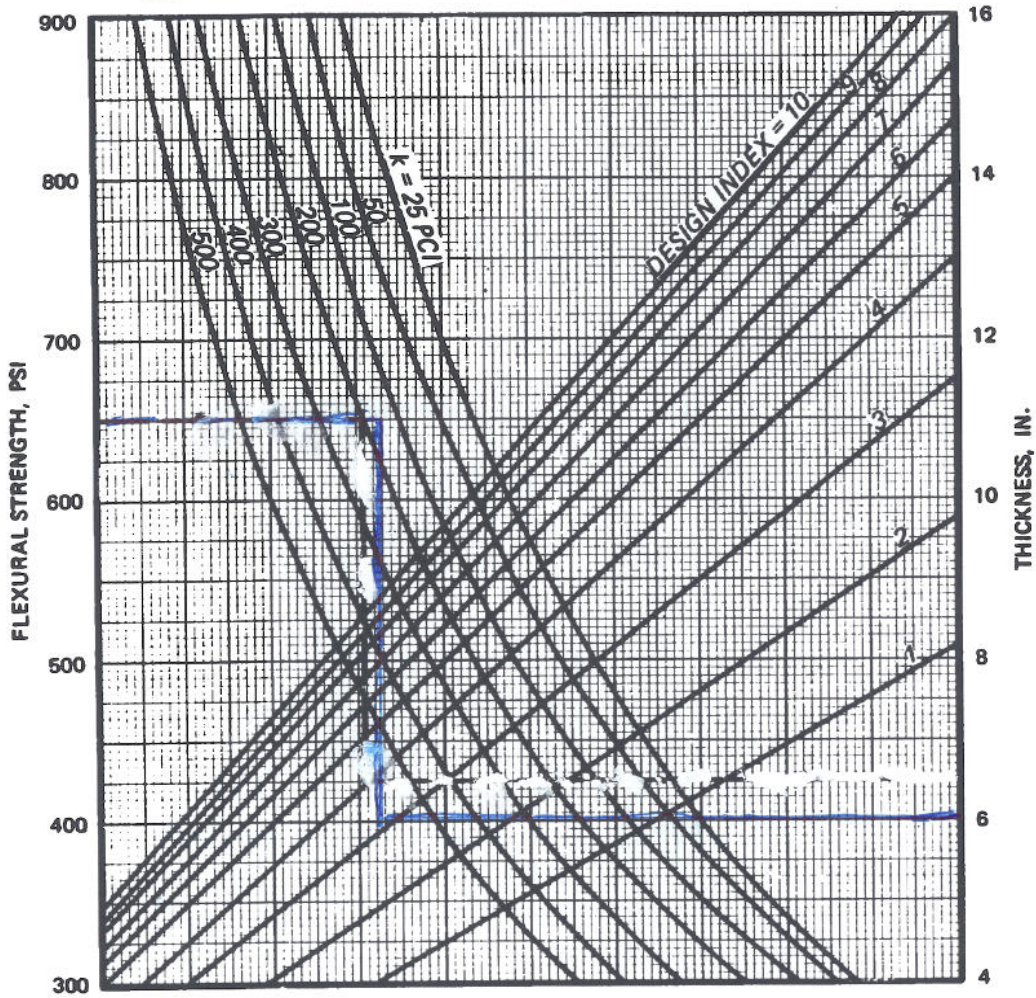


Figure 12-1. Design Curves for Plain Concrete Roads and Streets, and RCCP.

USING CBR (CALIF. BEARING RATIO)  
 CBR = 10 AVE K = 180 (SUBGRADE MOD.)  
 CLASS E EFFECTIVE DHV (EQ PASSENGER  
 CARS PER HR. 18 MPH TRAFFIC  
 CAT. III 15% TRUCKS

TRAFFIC CAT III DESIGN INDEX "3"

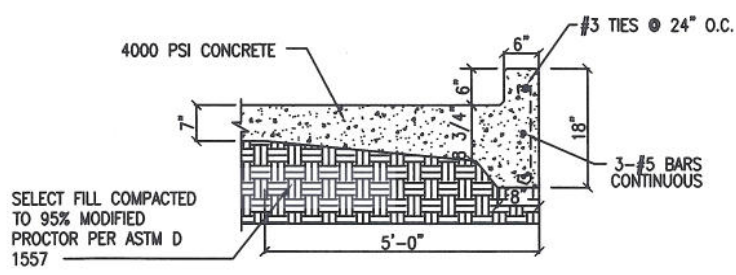
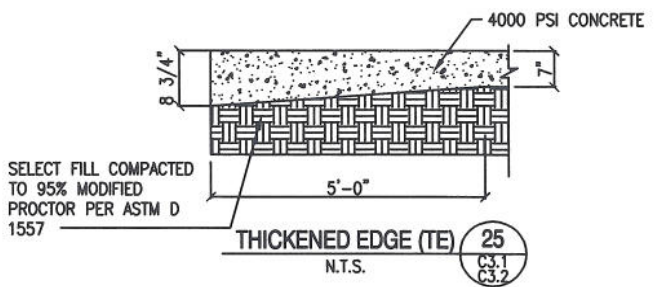
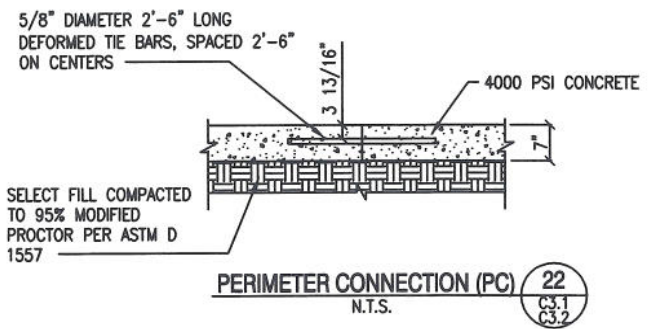
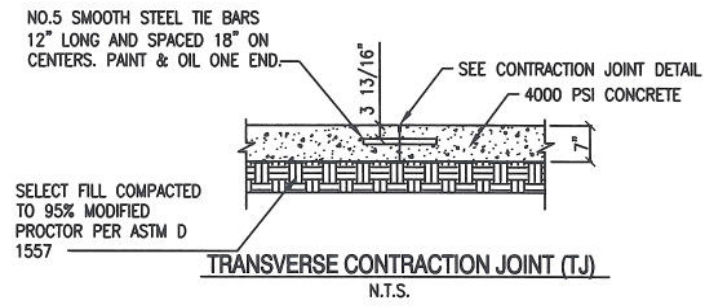
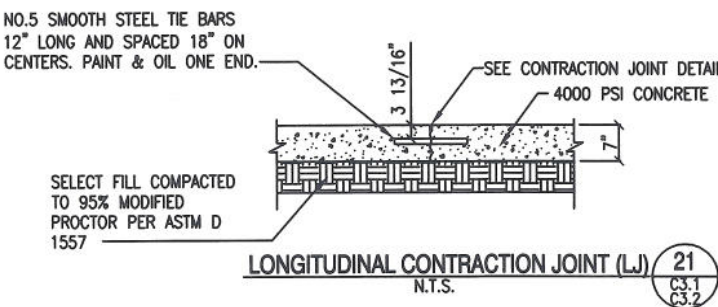
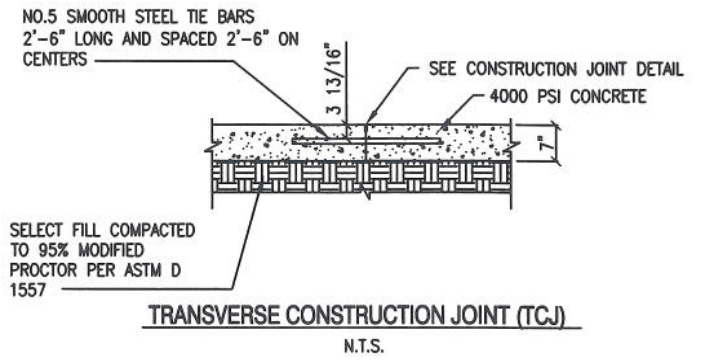
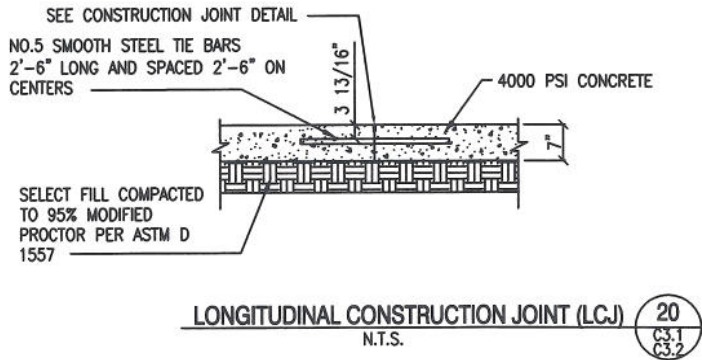
RESULTS

FLEX. STRENGTH 650 PSI

K = 180

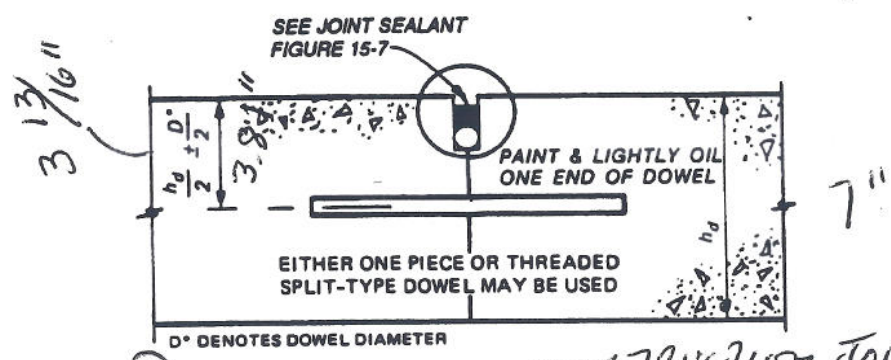
DESIGN INDEX = 3

SLAB THICKNESS = 6" PROJ. MIN = 7" OK



**CURB DETAIL** (31)  
C3.1 C3.2

$3.5 \pm 0.3125$



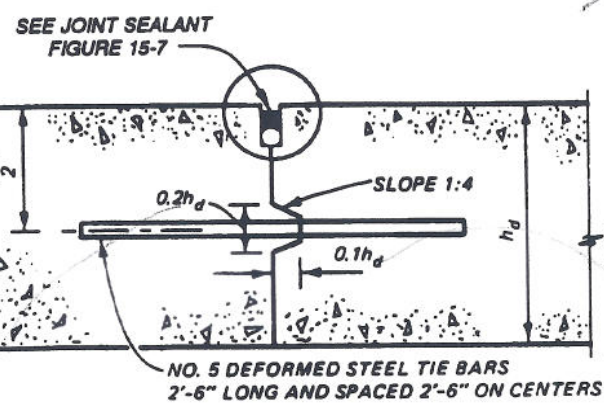
①

a. DOWELED TRANSVERSE OR LONGITUDINAL

CONSTRUCTION JOINT

TCS

$3 \frac{13}{16}$   
 $3.8$   
 $0.2h_d$   
 $1 \frac{1}{2}$



②

b. KEYED AND TIED LONGITUDINAL

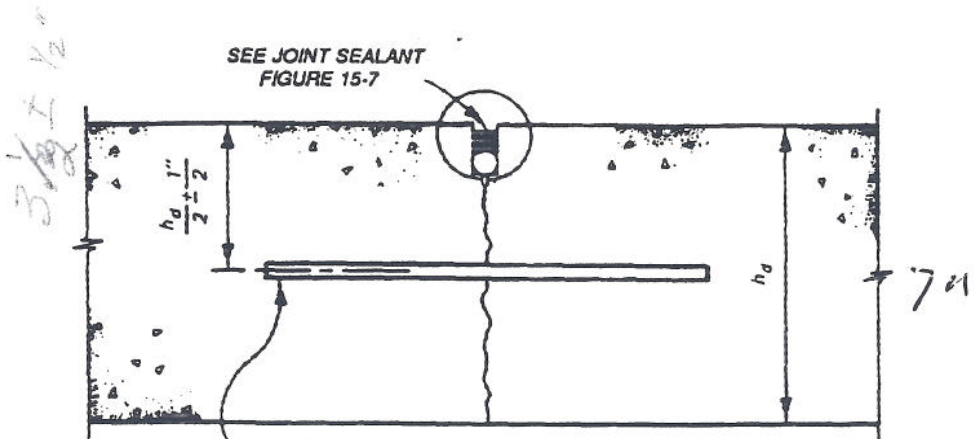
A

CONSTRUCTION JOINT

$3 \frac{1}{4}$   
 $0.1h_d = 0.1(12) = 1.2$

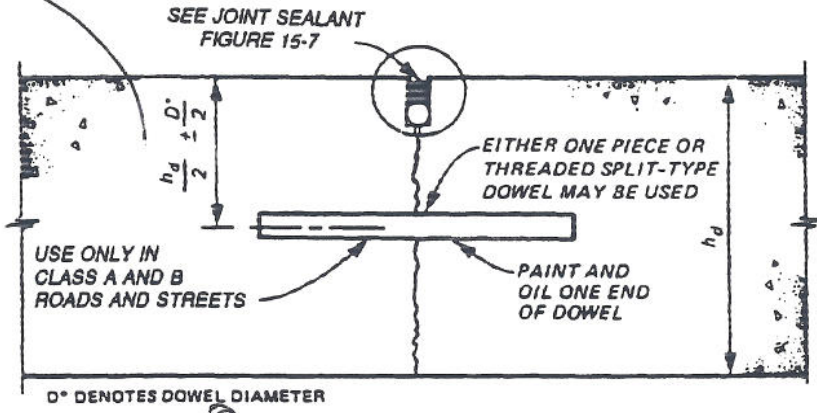
NOTES: TO BE USED ONLY WHEN SLAB THICKNESS IS 9 INCHES OR MORE  
 A TOLERANCE OF  $\pm 1/16$ " MAY BE ALLOWED FOR KEY DIMENSIONS AND LOCATION  
 VERTICAL TOLERANCE OF  $\pm 1/4$ " ALLOWED FOR PLACEMENT OF TIE BAR  
 TIED JOINTS IN PAVEMENT WIDTH > 75 FT IS NOT RECOMMENDED.

Figure 15-4. Construction Joints for Plain Concrete Pavements. (Sheet 1 of 4)



NO. 5 DEFORMED STEEL TIE BARS 2'-6" LONG AND SPACED 2'-6" ON CENTERS, USED ONLY IN JOINTS 15 FEET OR LESS FROM FREE EDGES OF PAVED AREAS GREATER THAN 100 FEET IN WIDTH.

3) a. LONGITUDINAL CONTRACTION JOINT



USE ONLY IN CLASS A AND B ROADS AND STREETS

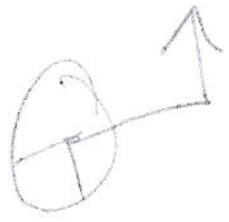
EITHER ONE PIECE OR THREADED SPLIT-TYPE DOWEL MAY BE USED

PAINT AND OIL ONE END OF DOWEL

D" DENOTES DOWEL DIAMETER

4) b. TRANSVERSE CONTRACTION JOINT

Figure 15-3. Contraction Joints for Plain Concrete Pavements.



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

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

***Sanitary Sewer Pumping Station***

July 27, 2009

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

Sanitary Sewer Pumping Station

Occupant load estimated @ 269 X 20 gal/day  
equals 3.736 gal/min flow.

Maintenance oil/water separator with a  
flow rate of 30 gal/min.

$$f_{\text{HEAD LOSS}} = \text{HAZEN WILLIAM FORMULA} = 0.2083 \left(\frac{100}{C}\right)^{1.852} \left(\frac{Q^{1.852}}{D^{4.8655}}\right)$$

$$Q = V \cdot A \quad \frac{34 \text{ gpm} \left(\frac{1}{60 \text{ sec}}\right)}{V} = \pi \left(\frac{1.75}{12}\right)^2$$

$$V = 6.174 \text{ fps}$$

Reynolds Number

$$Re = \frac{V \left(\frac{1.75}{12}\right)}{(1.2 \times 10^{-5})} = 64,312 \text{ Turbulent Flow}$$

$$\text{Head loss per } 100' = 0.2083 \left(\frac{100}{130}\right)^{1.852} \times \left(\frac{34^{1.852}}{1.5^{4.8655}}\right) = 12.22'$$

550' pipe ÷ 21' ≈ 26 couplings

1.5' head loss equivalent per coupling x 26 = 39'

550' + 39' (equivalent) = 589'

$\frac{589}{100} \times 14.91 = 87.8'$  w/26 couplings

$$h_v = \frac{V^2}{2(\text{gravity})} = \frac{(6.174)^2}{2(32.2)} = 0.59$$

Sanitary Sewer Pumping Station  
cont.

Total Head

$$87.8' + 0.59' + 2' = 90.4'$$

Velocity = 6.174 Fps

Flow = 34 gpm

---

Hydraulic Horsepower  $\frac{(90.4)(34)(1.1)}{3956} = 0.85 \text{ hp}$   
 minimum 1.07 hp

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

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

## ***Light Pole Foundation Design***

Aug. 25, 2009

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

Calculate Minimum Foundation  
Exterior Light Pole

REF. ASCE 7-05 & IBC 2006

$V = 140 \text{ mph}$

Exposure: C ( $K_z = 1.04$ )

Importance factor: I

Topographic Factor:  $K_{zt} = 1$

Wind Directionality:  $K_d = 0.95$

$$g_z = 0.00256 K_z K_{zt} K_d V^2 I (16/\text{ft}^2)$$

$$= 0.00256 (1.04)(1)(0.95)(140^2)(1)$$

$$= 49.57 \text{ psf}$$

Light Fixture Surface Area = .5' x 2.5'

Pole = 41.5' x .67'  $\phi$

$$(LH \times LW \times g_z \times 1.4 (.5LH + PH)) + (PH \times PW \times g_z \times .66 \times .5PH)$$

$$(0.5 \times 2.5 \times 49.57 \times 1.4 (.5(.5) + 41.5)) + (41.5 \times 0.67 \times 49.57 \times .66 \times .5(41.5))$$

$$-(GD \times GW \times SP \times .5GD \times .66) = 0$$

$$-(7.784 \times 1.5 \times 750 \times .5(7.784) \times .66) = 0$$

Assumed Soil pressure < 750 psf

Foundation below surface < 7.784'

Foundation footprint 1.5' diameter  $\phi$

***FY2008 MILCON P-210  
N4412  
SOF RIVERINE AND COMBATANT  
CRAFT OPERATIONS FACILITY***

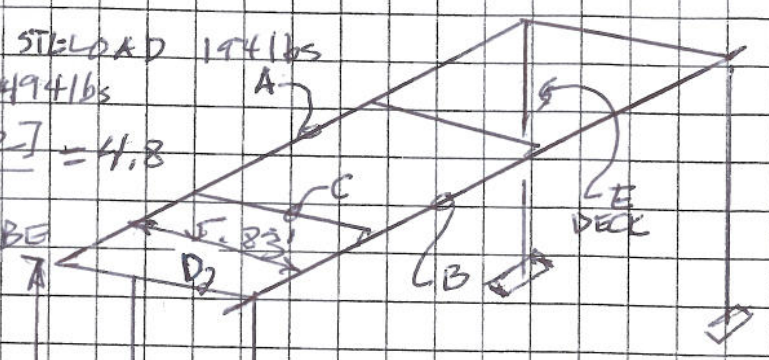
*Located at  
John C. Stennis Space Center  
Hancock County Mississippi*

***BLDG. 2442  
CATWALK  
FRAMING DESIGN***

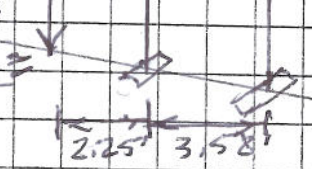
January 16, 2009

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

① LL 125 lb/ft<sup>2</sup> EQ LOAD 300 lbs STEEL LOAD 194 lbs  
 A & B L = 14' EQ + STC LOAD = 494 lbs  
 $S = \frac{[4 \times 5.83^{2.9} \times 125] + 494 [14 \times 12]}{24000 \times 8} = 4.8$   
 SELECT 6" X 4" X 5/16 RECT TUBE



② (C) L = 5.83' DL = 375 lbs ft  
 LL = 125 lb/ft<sup>2</sup>  
 $S = \frac{[5.83 \times 14' \times 125] + 375 \times 12}{24000 \times 8}$



COL. WALK WAY FRAME  
 DIRECTX  
 DEFLECTION  
 FOR A & B  
 $D_{MAX} = \frac{L}{240} = \frac{14 \times 12}{240} = .714$

S = 3.8  
 SELECT 6 X 4 X 5/16 ANGLE

$$D = \frac{.013 \times 14 \times 2.915 \times 125^3 + 300 \times (14 \times 12)^3}{24000 \times 17.4 \times 10^4} = .0639" \quad O.K.$$

③ COLUMN (USE FRONT COL.)

CAL MAX LOAD = 14 X 4.5 X 125 + 690 = 8,565 lbs SAY 9 KIPS

TRY 4 X 4 X 1/4" SQ TUBE COL.  
 $\frac{K L}{r} = \frac{1 \times 7}{151} = 4.6 \quad F_a \text{ COL} = 32$   
 $P = A \times F_a = 3.59 \times 9 = 32.31$

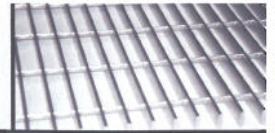
MAX AXIAL LOAD FOR 4 X 4 X 1/4" = 87.2 KIPS  
 LOAD ON COL = 9 KIPS

FLOOR GRATING  
 LIGHT DUTY WELDED 5/8" SA RATED" BAR GRATING  
 SPAN - MAX 6 FT  
 1 1/4" X 1/8 WT 6.02 lbs/ft<sup>2</sup>  
 UNIFORM CONC. LOAD 409 lbs  
 UNIFORM LOAD = 172 lb/sf

|       |      |      |        |    |
|-------|------|------|--------|----|
| TITLE |      |      |        |    |
| SCALE | DATE | ENGR | DG NO. | RE |

DAMMON ENGINEERING  
 ARCHITECTS / ENGINEERS  
 P.O. BOX 2830  
 (504) 649-5832  
 SLIDELL, LA. 70459  
 (504) 641-5950

# BAR GRATING



## TiteWeld™ 7-TW-4 Welded Steel



### Load Tables 7-TW-4 TiteWeld

| Bearing Bar (Inches) | Wt. Lbs. Sq. Ft. | Sect. Prop. Ft. of Width* |   | ClearSpan |       |       |       |       |       |       |   |  |       |       |       |  |  |
|----------------------|------------------|---------------------------|---|-----------|-------|-------|-------|-------|-------|-------|---|--|-------|-------|-------|--|--|
|                      |                  |                           |   | 2'-0"     | 2'-6" | 3'-0" | 3'-6" | 4'-0" | 4'-6" | 5'-0" | 5'-6"   | 6'-0"  | 6'-6" | 7'-0" | 8'-0" |  |  |
| 3/4                  | 13.73            | Sx=.482<br>1x=.181        | U | 1446      | 926   | 643   | 472   | 362   | 286   | 231   | U - Safe uniform load in lbs./sq.ft.<br>C - Safe concentrated load in lbs./ft.<br>D - Deflection in inches. |  |       |       |       |  |  |
|                      |                  |                           | D | .099      | .155  | .223  | .304  | .398  | .503  | .620  | 671   |  |       |       |       |  |  |
|                      |                  |                           | C | 1446      | 1157  | 964   | 827   | 723   | 643   | 579   |   |  |       |       |       |  |  |
|                      |                  |                           | D | .079      | .124  | .179  | .243  | .318  | .402  | .497  |   |  |       |       |       |  |  |
| 1                    | 18.09            | Sx=.857<br>1x=.429        | U | 2571      | 1646  | 1143  | 840   | 643   | 508   | 411   | 340   | Loads and deflections given in<br>this table are theoretical, and are<br>based on a unit stress of 18,000 psi. |       |       |       |  |  |
|                      |                  |                           | D | .074      | .116  | .168  | .228  | .298  | .377  | .465  | .563  | 671  |       |       |       |  |  |
|                      |                  |                           | C | 2571      | 2057  | 1714  | 1469  | 1286  | 1143  | 1029  | 935   | 857  |       |       |       |  |  |
|                      |                  |                           | D | .060      | .093  | .134  | .182  | .238  | .302  | .373  | .451  | .536   |       |       |       |  |  |
| 1-1/4                | 22.45            | Sx=1.339<br>1x=.837       | U | 4018      | 2571  | 1786  | 1312  | 1004  | 794   | 643   | 531   | 446  | 380   | 328   | 251   |  |  |
|                      |                  |                           | D | .060      | .093  | .134  | .182  | .238  | .302  | .372  | .450  | .536   | 629   | 730   | 953   |  |  |
|                      |                  |                           | C | 4018      | 3214  | 2679  | 2296  | 2009  | 1786  | 1607  | 1461  | 1339   | 1236  | 1148  | 1004  |  |  |
|                      |                  |                           | D | .048      | .074  | .107  | .146  | .191  | .241  | .298  | .360  | .429   | .503  | .584  | .762  |  |  |
| 1-1/2                | 26.81            | Sx=1.929<br>1x=1.446      | U | 5786      | 3703  | 2571  | 1889  | 1446  | 1143  | 926   | 765   | 643  | 548   | 472   | 362   |  |  |
|                      |                  |                           | D | .050      | .078  | .112  | .152  | .199  | .251  | .310  | .375  | .447   | .525  | 608   | .795  |  |  |
|                      |                  |                           | C | 5786      | 4629  | 3857  | 3306  | 2893  | 2571  | 2314  | 2104  | 1929   | 1780  | 1653  | 1446  |  |  |
|                      |                  |                           | D | .040      | .062  | .089  | .122  | .159  | .201  | .248  | .300  | .358   | .420  | .487  | .635  |  |  |
| 1-3/4                | 31.20            | Sx=2.625<br>1x=2.297      | U | 7875      | 5040  | 3500  | 2571  | 1969  | 1556  | 1260  | 1041  | 875  | 746   | 643   | 492   |  |  |
|                      |                  |                           | D | .043      | .067  | .096  | .130  | .170  | .216  | .266  | .322  | .383   | .450  | .521  | .681  |  |  |
|                      |                  |                           | C | 7875      | 6300  | 5250  | 4500  | 3938  | 3500  | 3150  | 2864  | 2625   | 2423  | 2250  | 1969  |  |  |
|                      |                  |                           | D | .034      | .053  | .077  | .104  | .136  | .172  | .213  | .258  | .306   | .360  | .417  | .545  |  |  |
| 2                    | 35.59            | Sx=3.429<br>1x=3.429      | U | 10286     | 6583  | 4572  | 3359  | 2571  | 2032  | 1646  | 1360  | 1143   | 974   | 840   | 643   |  |  |
|                      |                  |                           | D | .037      | .058  | .084  | .114  | .149  | .189  | .233  | .282  | .335   | .393  | .456  | .596  |  |  |
|                      |                  |                           | C | 10286     | 8229  | 6857  | 5878  | 5143  | 4572  | 4114  | 3740  | 3429   | 3165  | 2939  | 2571  |  |  |
|                      |                  |                           | D | .030      | .047  | .067  | .091  | .119  | .151  | .186  | .225  | .268   | .315  | .365  | .477  |  |  |
| 2-1/4                | 36.92            | Sx=4.339<br>1x=4.882      | U | 13018     | 8332  | 5786  | 4251  | 3255  | 2571  | 2083  | 1721  | 1446   | 1232  | 1063  | 814   |  |  |
|                      |                  |                           | D | .033      | .052  | .074  | .101  | .132  | .168  | .210  | .250  | .298   | .350  | .406  | .530  |  |  |
|                      |                  |                           | C | 13018     | 10414 | 8679  | 7439  | 6509  | 5786  | 5207  | 4734  | 4339   | 4006  | 3719  | 3255  |  |  |
|                      |                  |                           | D | .026      | .041  | .060  | .081  | .106  | .134  | .166  | .200  | .238   | .280  | .324  | .424  |  |  |
| 2-1/2                | 44.31            | Sx=5.357<br>1x=6.697      | U | 16072     | 10286 | 7143  | 5248  | 4018  | 3175  | 2571  | 2125  | 1786   | 1522  | 1312  | 1004  |  |  |
|                      |                  |                           | D | .030      | .047  | .067  | .091  | .119  | .151  | .186  | .225  | .268   | .315  | .365  | .476  |  |  |
|                      |                  |                           | C | 16072     | 12857 | 10714 | 9184  | 8036  | 7143  | 6429  | 5844  | 5357   | 4945  | 4592  | 4018  |  |  |
|                      |                  |                           | D | .030      | .037  | .054  | .073  | .095  | .121  | .149  | .180  | .215   | .252  | .292  | .381  |  |  |

\* Based on 27.429 bars / ft. of grating width. Bearing bars 7/16" c.c. Add .6 lbs./sq. ft for 7-TW-2. 1/8" bearing bars available upon inquiry.

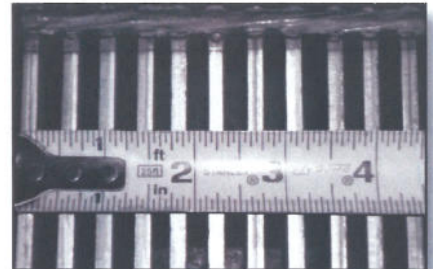
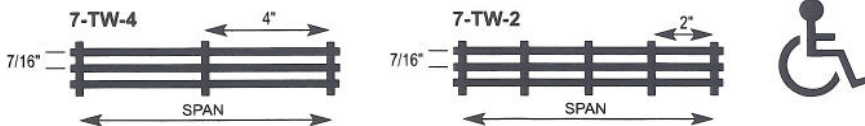
NOTE: Grating for spans to the left of the heavy line have a deflection less than 1/4" for uniform loads of 100 lbs./sq. ft. This is a maximum deflection to afford pedestrian comfort and can be exceeded for other types of load at the discretion of the engineer. The actual "Ped (pedestrian) Span" under this condition is shown above for each size of grating. When serrated grating is specified, the depth of grating required for a specific load will be 1/4" greater than that shown in these tables. 3/4" x 3/16" serrated grating is NOT available.

### Panel Width Chart (in.) 7-TW-4 TiteWeld

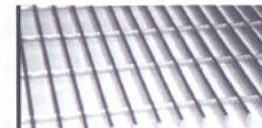
Dimensions Are Out-to-Out of Bearing Bars\*\*

| No. of Bars | 2       | 3       | 4       | 5       | 6       | 7        | 8        | 9        | 10       | 11       | 12       | 13       | 14      | 15      | 16      |
|-------------|---------|---------|---------|---------|---------|----------|----------|----------|----------|----------|----------|----------|---------|---------|---------|
| 3/16" Bars  | 5/8     | 1-1/16  | 1-1/2   | 1-15/16 | 2-3/8   | 2-13/16  | 3-1/4    | 3-11/16  | 4-1/8    | 4-9/16   | 5        | 5-7/16   | 5-7/8   | 6-5/16  | 6-3/4   |
| No. of Bars | 17      | 18      | 19      | 20      | 21      | 22       | 23       | 24       | 25       | 26       | 27       | 28       | 29      | 30      | 31      |
| 3/16" Bars  | 7-3/16  | 7-5/8   | 8-1/16  | 8-1/2   | 8-15/16 | 9-3/8    | 9-13/16  | 10-1/4   | 10-11/16 | 11-1/8   | 11-9/16  | 12       | 12-7/16 | 12-7/8  | 13-5/16 |
| No. of Bars | 32      | 33      | 34      | 35      | 36      | 37       | 38       | 39       | 40       | 41       | 42       | 43       | 44      | 45      | 46      |
| 3/16" Bars  | 13-3/4  | 14-3/16 | 14-5/8  | 15-1/16 | 15-1/2  | 15-15/16 | 16-3/8   | 16-13/16 | 17-1/4   | 17-11/16 | 18-1/8   | 18-9/16  | 19      | 19-7/16 | 19-7/8  |
| No. of Bars | 47      | 48      | 49      | 50      | 51      | 52       | 53       | 54       | 55       | 56       | 57       | 58       | 59      | 60      | 61      |
| 3/16" Bars  | 20-5/16 | 20-3/4  | 21-3/16 | 21-5/8  | 22-1/16 | 22-1/2   | 22-15/16 | 23-3/8   | 23-13/16 | 24-1/4   | 24-11/16 | 25-1/8   | 25-9/16 | 26      | 26-7/16 |
| No. of Bars | 62      | 63      | 64      | 65      | 66      | 67       | 68       | 69       | 70       | 71       | 72       | 73       | 74      | 75      | 76      |
| 3/16" Bars  | 26-7/8  | 27-5/16 | 27-3/4  | 28-3/16 | 28-5/8  | 29-1/16  | 29-1/2   | 29-15/16 | 30-3/8   | 30-13/16 | 31-1/4   | 31-11/16 | 32-1/8  | 32-9/16 | 33      |
| No. of Bars | 77      | 78      | 79      | 80      | 81      | 82       | 83       |          |          |          |          |          |         |         |         |
| 3/16" Bars  | 33-7/16 | 33-7/8  | 34-5/16 | 34-3/4  | 35-3/16 | 35-5/8   | 36-1/16  |          |          |          |          |          |         |         |         |

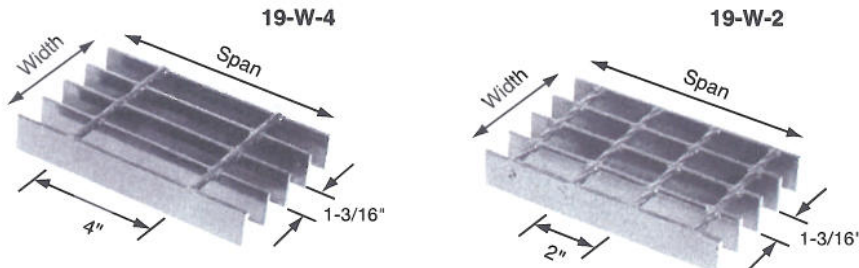
\*\* Add 1/4" for extended cross bars. Deduct 1/16" for 1/8" bearing bars. Standard panel widths indicated in bold.



# BAR GRATING



## Light Duty Welded Steel 19-W-4/19-W-2



Load Table 19-W-4/19-W-2

| Bar Size Inches | Wt.* Lbs. Sq. Ft. | Sect. Prop. Ft. of Width* | Clear Span |       |       |       |       |       |       |  |       |       |  |       |      |
|-----------------|-------------------|---------------------------|------------|-------|-------|-------|-------|-------|-------|--|-------|-------|--|-------|------|
|                 |                   |                           | 2'-0"      | 2'-6" | 3'-0" | 3'-6" | 4'-0" | 4'-6" | 5'-0" | 5'-6"                                    | 6'-0" | 6'-6" | 7'-0"  | 8'-0" |      |
| 3/4 x 3/16      | 5.67              | Sx=.194<br>1x=.073        | U          | 581   | 372   | 258   | 190   | 145   | 115   | U – Safe uniform load in pounds/sq. ft.  |       |       |  |       |      |
|                 |                   |                           | D          | .096  | .150  | .216  | .294  | .382  | .485  | C – Safe concentrated load in pounds/ft. |       |       |  |       |      |
|                 |                   |                           | C          | 581   | 465   | 387   | 332   | 290   | 258   | grating width                            |       |       |  |       |      |
|                 |                   |                           | D          | .077  | .120  | .173  | .235  | .307  | .388  | D – Deflection in inches                 |       |       |  |       |      |
| 1 x 1/8         | 5.15              | Sx=.228<br>1x=.114        | U          | 686   | 439   | 305   | 224   | 172   | 136   | 110                                      | 91    | 76    | Loads and deflections given in this table are theoretical, and are based on a unit stress of 18,000 psi. |       |      |
|                 |                   |                           | D          | .072  | .112  | .162  | .220  | .289  | .365  | .451                                     | .545  | .646  |  |       |      |
|                 |                   |                           | C          | 686   | 549   | 458   | 392   | 343   | 305   | 274                                      | 250   | 229   |  |       |      |
|                 |                   |                           | D          | .058  | .090  | .130  | .176  | .230  | .292  | .360                                     | .436  | .519  |  |       |      |
| 1 x 3/16        | 7.35              | Sx=.344<br>1x=.171        | U          | 1030  | 659   | 458   | 336   | 257   | 203   | 165                                      | 136   | 114   |  |       |      |
|                 |                   |                           | D          | .072  | .112  | .162  | .220  | .289  | .365  | .451                                     | .545  | .646  |  |       |      |
|                 |                   |                           | C          | 1030  | 824   | 686   | 588   | 515   | 458   | 412                                      | 374   | 343   |  |       |      |
|                 |                   |                           | D          | .058  | .090  | .130  | .176  | .230  | .292  | .360                                     | .436  | .519  |  |       |      |
| 1-1/4 x 1/8     | 6.20              | Sx=.358<br>1x=.223        | U          | 1072  | 686   | 477   | 350   | 268   | 212   | 172                                      | 142   | 119   | 102  | 88    |      |
|                 |                   |                           | D          | .058  | .090  | .130  | .176  | .230  | .292  | .360                                     | .435  | .516  | .607   | .704  |      |
|                 |                   |                           | C          | 1072  | 858   | 715   | 613   | 536   | 477   | 429                                      | 390   | 358   | 330  | 306   |      |
|                 |                   |                           | D          | .046  | .072  | .104  | .141  | .184  | .233  | .288                                     | .348  | .415  | .486   | .562  |      |
| 1-1/4 x 3/16    | 9.03              | Sx=.536<br>1x=.335        | U          | 1610  | 1031  | 716   | 526   | 403   | 318   | 258                                      | 213   | 179   | 152  | 131   |      |
|                 |                   |                           | D          | .058  | .090  | .130  | .176  | .230  | .292  | .360                                     | .435  | .516  | .607   | .704  |      |
|                 |                   |                           | C          | 1610  | 1288  | 1074  | 920   | 805   | 716   | 644                                      | 586   | 537   | 496  | 466   |      |
|                 |                   |                           | D          | .046  | .072  | .104  | .141  | .184  | .233  | .288                                     | .348  | .415  | .486   | .562  |      |
| 1-1/2 x 1/8     | 7.35              | Sx=.515<br>1x=.387        | U          | 1544  | 988   | 686   | 504   | 386   | 305   | 247                                      | 204   | 172   | 146  | 126   | 96   |
|                 |                   |                           | D          | .048  | .075  | .108  | .147  | .192  | .243  | .300                                     | .363  | .432  | .506   | .587  | .665 |
|                 |                   |                           | C          | 1544  | 1236  | 1030  | 882   | 772   | 686   | 618                                      | 562   | 515   | 475  | 441   | 386  |
|                 |                   |                           | D          | .038  | .060  | .086  | .118  | .154  | .194  | .240                                     | .291  | .346  | .405   | .470  | .541 |
| 1-1/2 x 3/16    | 10.94             | Sx=.773<br>1x=.579        | U          | 2320  | 1485  | 1031  | 758   | 580   | 458   | 371                                      | 307   | 258   | 220  | 189   | 145  |
|                 |                   |                           | D          | .048  | .075  | .108  | .147  | .192  | .243  | .300                                     | .363  | .432  | .506   | .587  | .665 |
|                 |                   |                           | C          | 2320  | 1856  | 1547  | 1326  | 1160  | 1031  | 928                                      | 844   | 773   | 714  | 663   | 580  |
|                 |                   |                           | D          | .038  | .060  | .086  | .118  | .154  | .194  | .240                                     | .291  | .346  | .405   | .470  | .541 |
| 1-3/4 x 3/16    | 12.62             | Sx=1.052<br>1x=.902       | U          | 3158  | 2021  | 1404  | 1031  | 790   | 624   | 505                                      | 418   | 351   | 299  | 258   | 197  |
|                 |                   |                           | D          | .041  | .064  | .093  | .126  | .165  | .208  | .257                                     | .312  | .370  | .435   | .505  | .587 |
|                 |                   |                           | C          | 3158  | 2526  | 2105  | 1805  | 1579  | 1404  | 1263                                     | 1148  | 1053  | 972  | 902   | 790  |
|                 |                   |                           | D          | .033  | .051  | .074  | .101  | .132  | .167  | .206                                     | .249  | .296  | .348   | .403  | .467 |
| 2 x 3/16        | 14.30             | Sx=1.375<br>1x=1.375      | U          | 4125  | 2640  | 1833  | 1347  | 1031  | 815   | 660                                      | 545   | 458   | 390  | 337   | 258  |
|                 |                   |                           | D          | .036  | .056  | .081  | .110  | .144  | .182  | .225                                     | .272  | .324  | .380   | .441  | .516 |
|                 |                   |                           | C          | 4125  | 3300  | 2750  | 2357  | 2062  | 1833  | 1650                                     | 1500  | 1375  | 1269   | 1178  | 1031 |
|                 |                   |                           | D          | .029  | .045  | .065  | .088  | .115  | .146  | .180                                     | .218  | .259  | .304   | .353  | .416 |
| 2-1/4 x 3/16    | 15.87             | Sx=1.740<br>1x=1.958      | U          | 5221  | 3341  | 2340  | 1704  | 1305  | 1031  | 835                                      | 690   | 580   | 494  | 426   | 326  |
|                 |                   |                           | D          | .032  | .050  | .072  | .098  | .128  | .162  | .200                                     | .242  | .288  | .338   | .392  | .452 |
|                 |                   |                           | C          | 5221  | 4176  | 3480  | 2983  | 2610  | 2320  | 2088                                     | 1898  | 1740  | 1606   | 1492  | 1305 |
|                 |                   |                           | D          | .026  | .040  | .058  | .078  | .102  | .130  | .160                                     | .194  | .230  | .270   | .314  | .361 |
| 2-1/2 x 3/16    | 17.55             | Sx=2.148<br>1x=2.685      | U          | 6445  | 4125  | 2864  | 2104  | 1611  | 1273  | 1031                                     | 852   | 716   | 610  | 526   | 403  |
|                 |                   |                           | D          | .029  | .045  | .065  | .088  | .115  | .146  | .180                                     | .218  | .259  | .304   | .353  | .416 |
|                 |                   |                           | C          | 6445  | 5156  | 4297  | 3683  | 3222  | 2864  | 2578                                     | 2344  | 2148  | 1983   | 1841  | 1611 |
|                 |                   |                           | D          | .023  | .036  | .052  | .070  | .092  | .117  | .144                                     | .174  | .207  | .243   | .282  | .329 |

\*Based on 11 bars/ft. of grating width. Bearing bars 1-3/16" c.c. Add .8 lbs./sq. ft. for 19-W-2.

NOTE: Grating for spans to the left of the heavy line have a deflection less than 1/4" for uniform loads of 100 lbs./sq. ft. This is the maximum deflection to afford pedestrian comfort and can be exceeded for other types of load at the discretion of the engineer. When serrated grating is specified, the depth of grating required for a specified load will be 1/4" greater than that shown in these tables.

### 19-W-4/19-W-2 Panel Width Chart (in.)

### Dimensions Are Out-to-Out of Bearing Bars\*\*

| No. of Bars | 2       | 3      | 4       | 5       | 6        | 7      | 8       | 9       | 10       | 11      | 12      | 13      | 14      | 15       | 16       |
|-------------|---------|--------|---------|---------|----------|--------|---------|---------|----------|---------|---------|---------|---------|----------|----------|
| 3/16" Bar   | 1-3/8   | 2-9/16 | 3-3/4   | 4-15/16 | 6-1/8    | 7-5/16 | 8-1/2   | 9-11/16 | 10-7/8   | 12-1/16 | 13-1/4  | 14-7/16 | 15-5/8  | 16-13/16 | 18       |
| No. of Bars | 17      | 18     | 19      | 20      | 21       | 22     | 23      | 24      | 25       | 26      | 27      | 28      | 29      | 30       | 31       |
| 3/16" Bar   | 19-3/16 | 20-3/8 | 21-9/16 | 22-3/4  | 23-15/16 | 25-1/8 | 26-5/16 | 27-1/2  | 28-11/16 | 29-7/8  | 31-1/16 | 32-1/4  | 33-7/16 | 34-5/8   | 35-13/16 |

\*\*Deduct 1/16" for 1/8" bearing bars. Standard panel widths indicated with white numbers.

***FY2008 MILCON P-210  
N4412  
SOF RIVERINE AND COMBATANT  
CRAFT OPERATIONS FACILITY***

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

***BLDG. 2440  
ARMORY CEILING  
SYSTEM DESIGN***

March 30, 2009

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

# BLDG 2440 ARMOR/CEILING DESIGN

GIVEN - NO KNOWN LL. NON OCCUPIED SPACE ABOVE.

ASSUME - 1.5VL METAL DECK  
 4-1/2" NORMAL WEIGHT CONC. } 65 PSF  
 #4 REBAR - 9x9 GRID IN SLAB

(POSSIBLE FUTURE LOADS) - CEILING BELOW 3 } 14 PSF  
 MECH/ELEC 5 }  
 MISC 6 } 65 + 14 = 79 PSF

LRFD FACTOR LOAD  
 DESIGN LOAD =  $1.2D + 1.6L = 1.2(65 + 14) + 0 = 94.8 (95) \text{ PSF}$   
 $95 \times 1.5 = 142.5 \text{ PLF}$

TABLE OPEN WEB STEEL JOIST - K SERIES  
 DESIGN SPAN 20'

12K1 TOTAL-241 LIVE-142

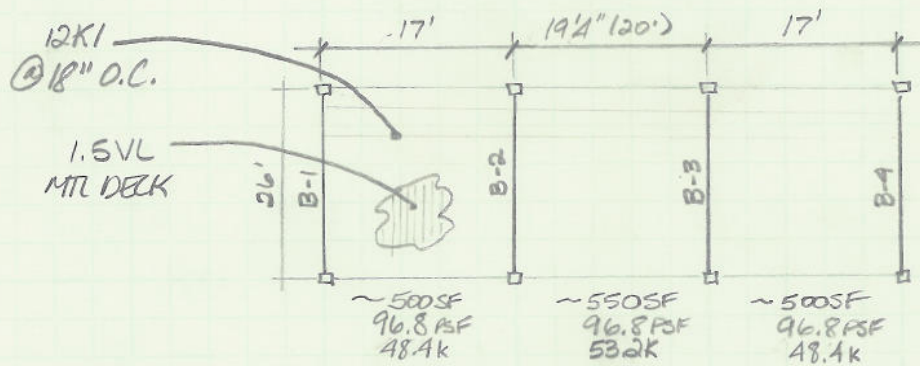
$142.5 \text{ PLF} > 241 \text{ OK}$

USE 12K1 JOIST @ 18" O.C.

WEIGHT OF JOISTS WORST CASE

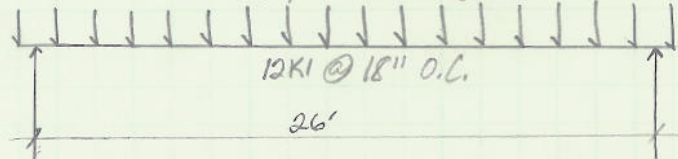
$20' \times 51\text{b} = 1001\text{b EA.}$

$18 \times 1001\text{b} = 1800\text{lbs.}$



B-1 AND B-4

$48.4/2 = 24.2\text{k}/18 = 1.34\text{k EA JOIST} \Rightarrow 930.7 \text{ PLF}$

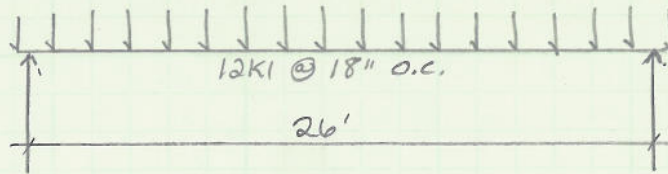


$$M_{\max} = (24.2\text{k} \cdot 26) / 6 = 104.9\text{k}$$

$$S = 12(104.9\text{k}) / 22\text{k} = 57.2$$

USE W18x35 (6x17-3/4")

B-2 AND B-3  
 $(48.2/2) + (53.2/2) = 50.8/18 = 2.82k \text{ EA JOIST} \Rightarrow 1954 \text{ PLF}$



$$M_{\max} = (50.8k \cdot 26) / 6 = 220.1k$$

$$S = 12(220.1k) / 22k = 109.1$$

USE W24x55 (7x23-5/8")

### WORST CASE COLUMN LOAD

B-2/B-3 EFFECTIVE LENGTH =  $KL = 11'$   
 $12.1k + 13.3k = 25.4k$  DESIGN STRENGTH

ALLOWABLE  $5 \times 5 \times 1/4$  86 KIPS

USE  $5 \times 5 \times 1/4$  SQ. STRUCTURAL TUBING

***FY2008 MILCON P-210  
N4412  
SOF RIVERINE AND COMBATANT  
CRAFT OPERATIONS FACILITY***

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

***BLDG. 2440/2441  
EXTERIOR WALL  
THERMAL RESISTANCE  
REPORT***

March 13, 2009

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

## SOV RIVERINE AND COMBATANT CRAFT OPERATIONS FACILITY

Located at  
John C. Stennis Space Center  
Hancock County Mississippi

### CLIMATE ZONE AND MINIMUM INSULATION REQUIREMENTS

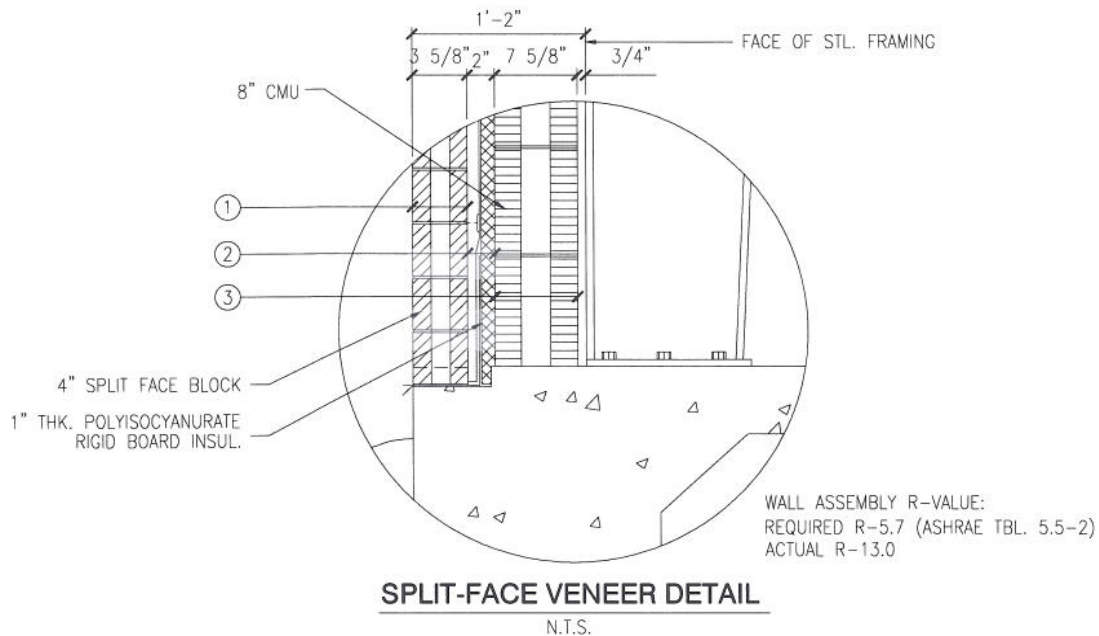
Project is located in Hancock County, Mississippi. Climate Zone 2A, minimum insulation value for mass walls above-grade **R-5.7**, maximum U-factor **U-0.151**.

### DESCRIPTION OF EXTERIOR WALL COMPONENTS

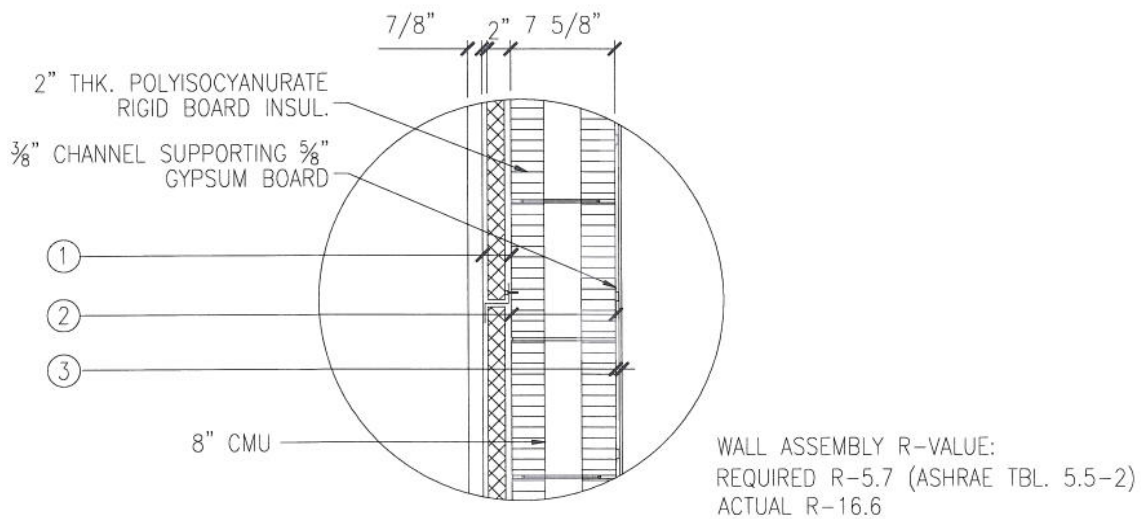
#### ***Bldg. 2440 Operation Facility / 2441 Maintenance:***

Exterior walls are continuous 8" concrete block masonry from first floor to eave height, top of masonry = 24.0'. The perimeter of the building shall have a 4" split-face concrete block veneer 6' in height.

A wall system of low-density CMU blocks, polyisocyanurate rigid board insulation, and air spaces are used to achieve the required assembly minimum thermal resistance. See details below.



1. **R-1.3:** Medium density (115 lb./ft<sup>3</sup>), 4" Split-face concrete block veneer. Includes standard air film resistances. (ASHRAE 90.1-2007 TBL. A3.1B)
2. **R-9.3:** 1" thick Dyplast Shield™ Cavity Wall Insulation with reflective surface and 1" dead air space. (<http://www.dyplastproducts.com>)
3. **R-2.4:** Low density (85 lb./ft.<sup>3</sup>), 8" CMU wall grouted at vertical and horizontal reinforcement, remaining cells empty. (ASHRAE 90.1-2007 TBL. A3.1C)



### CMU WALL DETAIL

N.T.S.

1. **R-12.8:** 2" thick Dyplast Shield™ Insulation with reflective surface. (<http://www.dyplastproducts.com>)
2. **R-2.4:** Low density (85 lb./ft.<sup>3</sup>), 8" CMU wall grouted at vertical and horizontal reinforcement, remaining cells empty. (ASHRAE 90.1-2007 TBL. A3.1C)
3. **R-1.4:** 3/8" channel (R-0.82) fastened to CMU wall, 5/8" gyp. board (R-0.56) fastened to channels. (Values for air space created by channel and gypsum board taken from ASHRAE 90.1-2007 TBL. A9.8A and TBL. A9.4D respectively)

### SUMMARY

Minimum insulation value, and maximum U-Factor value requirements for exterior above-grade walls have been met and exceeded.

8" CMU wall with 4" split-face veneer:

|                  |                  |
|------------------|------------------|
| Minimum: R-5.7   | Provided: R-13   |
| Maximum: U-0.151 | Provided: U-0.08 |

8" CMU wall with metal panel exterior finish and gypsum board interior finish:

|                  |                  |
|------------------|------------------|
| Minimum: R-5.7   | Provided: R-16.6 |
| Maximum: U-0.151 | Provided: U-0.06 |

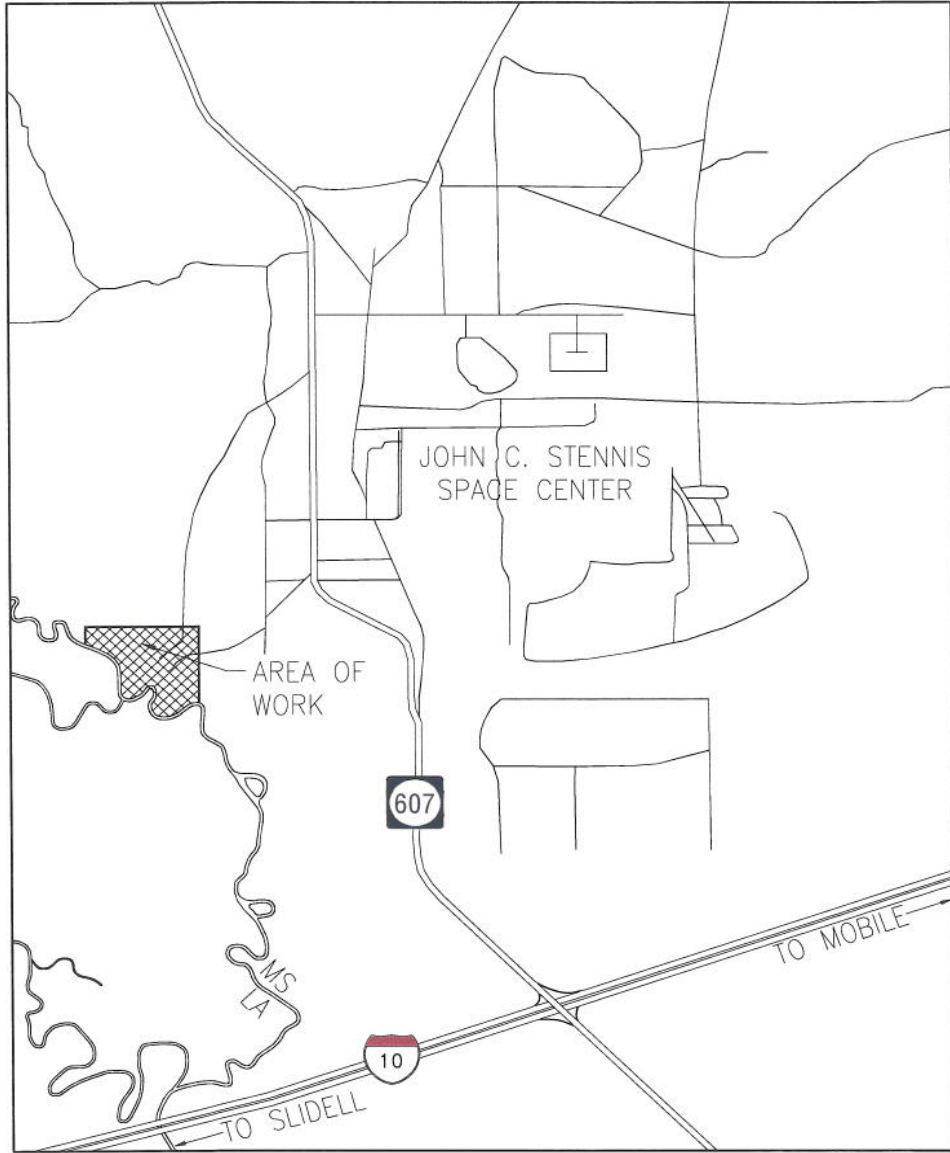
***FY2008 MILCON P-210  
N4412  
SOF RIVERINE AND COMBATANT  
CRAFT OPERATIONS FACILITY***

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

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

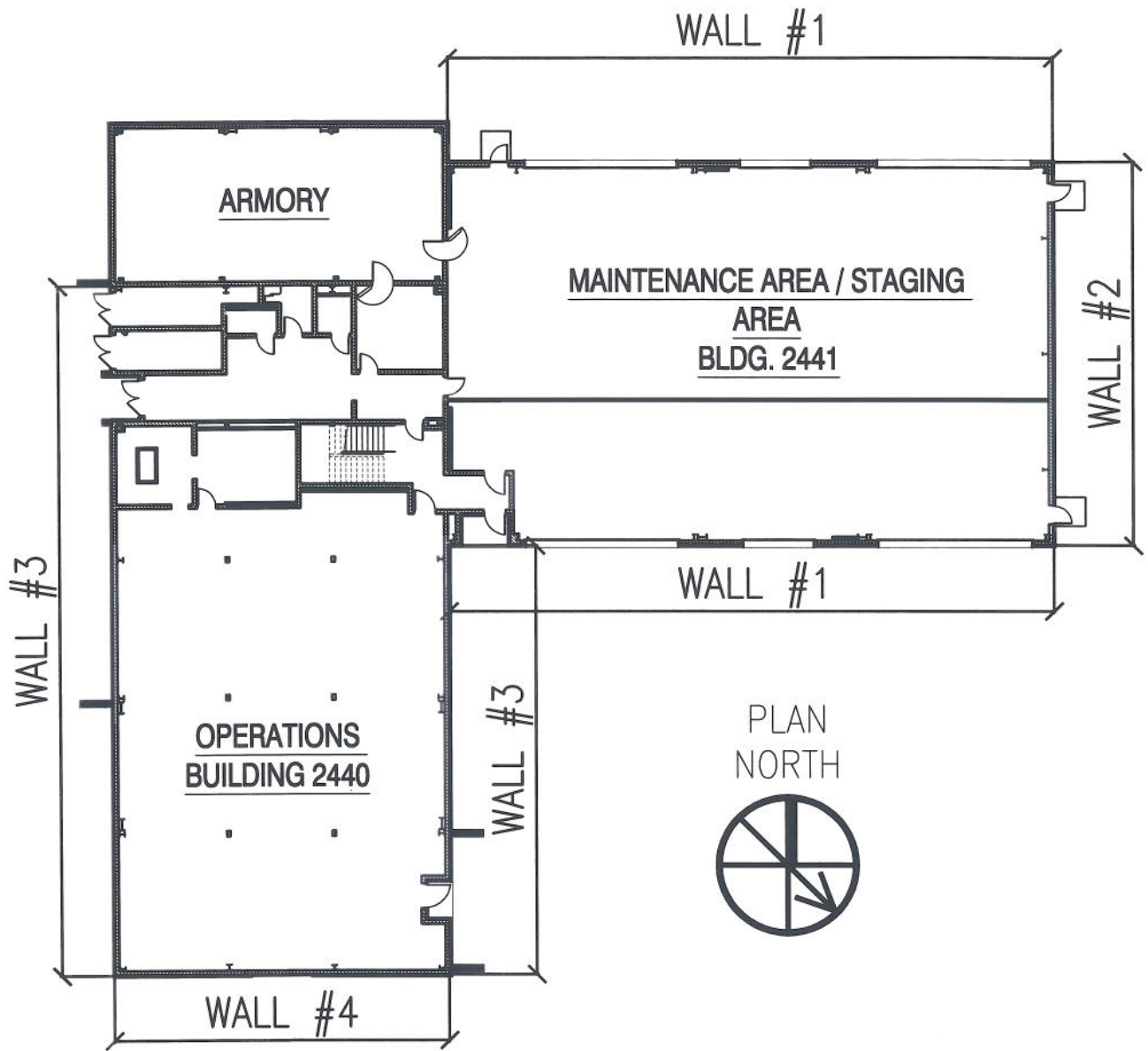
April 30, 2009

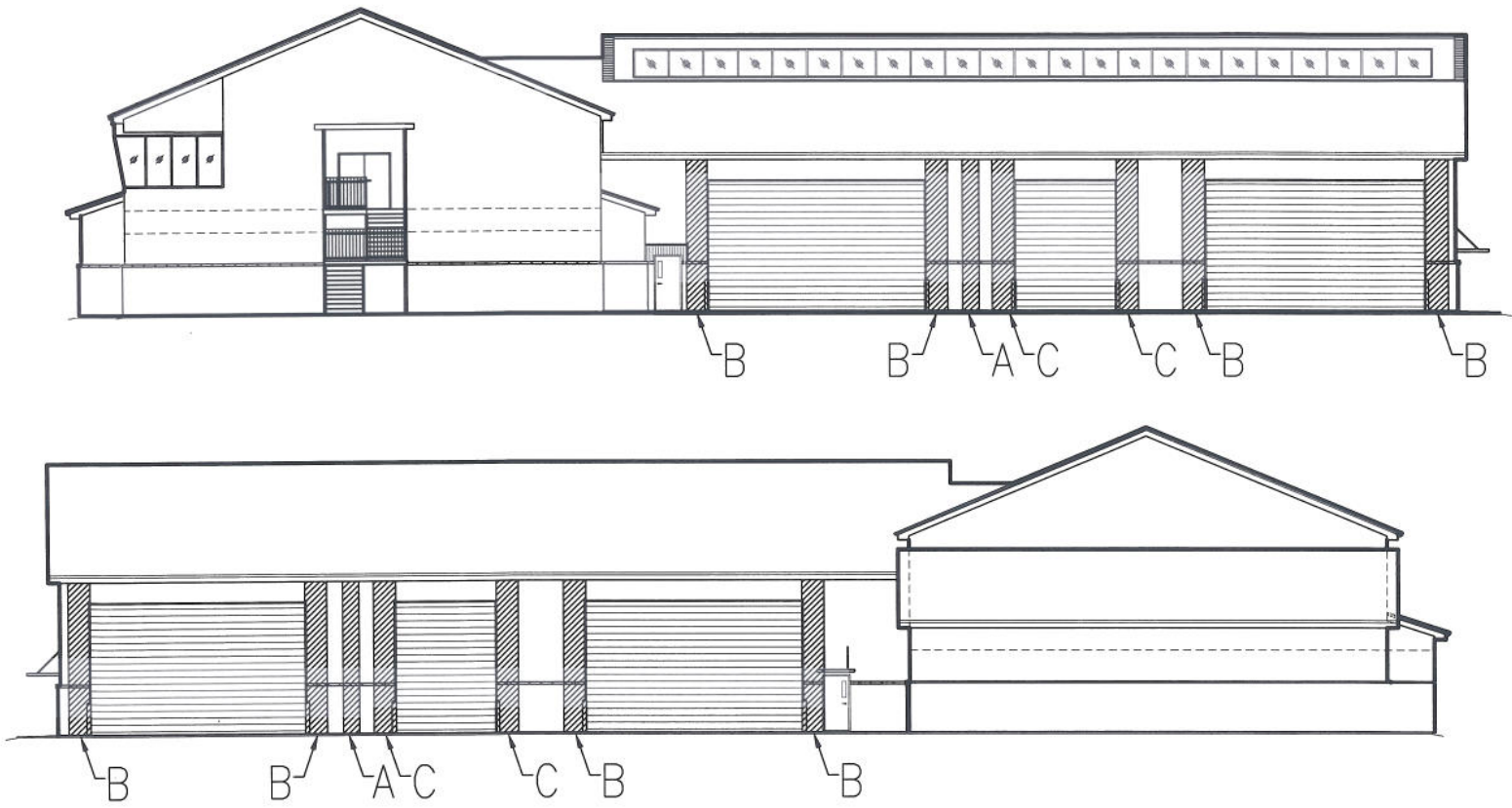
*Prepared by:*  
Dammon Engineering  
1095 Florida Avenue  
Slidell, La. 70458  
985-649-5832  
dammonengineering.com



## VICINITY MAP

N. T. S.





WALL #1 ELEMENTS

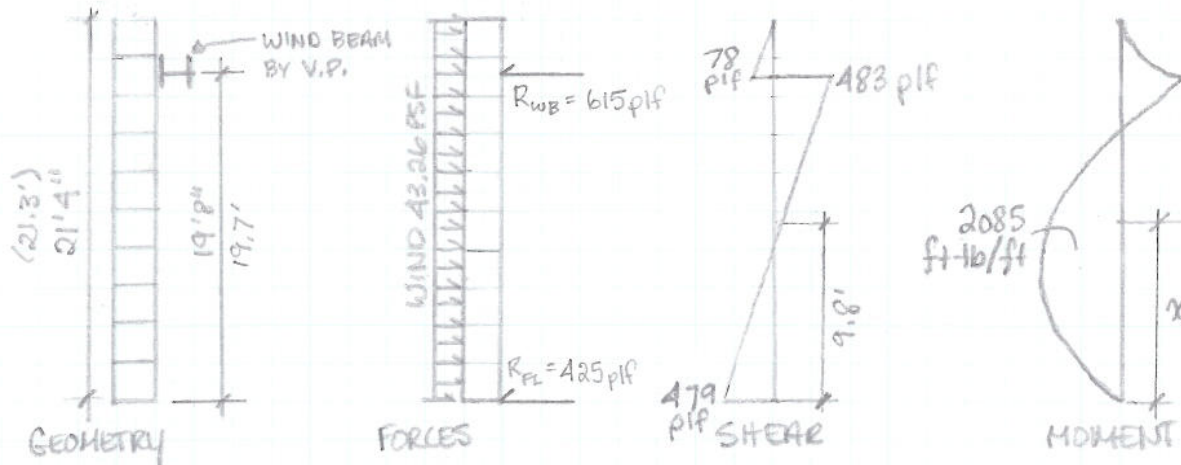
## STENNIS RIVERINE DESIGN OF REINFORCED CMU NONLOADBEARING WALL FOR FLEXURE BLDG 2441 — WALL #1 ELEMENT A

### MATERIALS:

|               |                    |
|---------------|--------------------|
| UNIT STRENGTH | 4050 psi           |
| MORTAR        | TYPE N             |
| $f'_m$        | 3500 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:

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

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

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

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

### 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.

$$p = \frac{A_s}{b \cdot d} = \frac{0.20 \text{ in}^2}{24 \cdot 3.8} = 0.002 \quad \rho n = 0.002 \cdot 15.26 = 0.03$$

$$K^2 + 2\rho n K - 2\rho n = 0$$

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

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

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

$$K = \frac{-0.06 \pm 0.49}{2} = 0.215''$$

### 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 @ 8" 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

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

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

1916 < 4170 ft-lb/ft      DOES NOT WORK

ASSUME NEW  $f'_m$

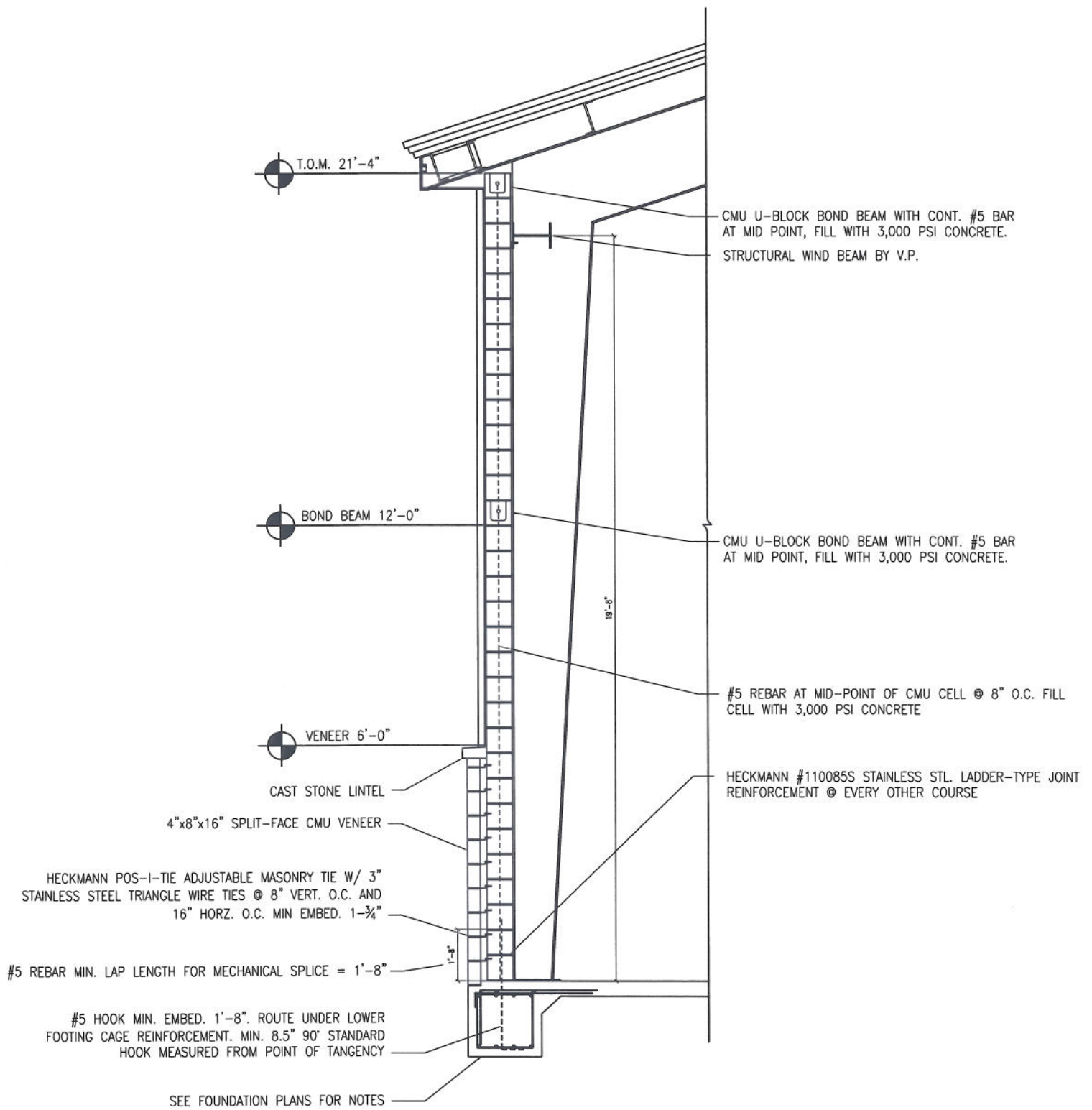
ESTIMATE REQ'D STRENGTH:  $\frac{4170}{1916} \cdot 1500 \text{ psi} = 3265 \text{ psi}$  UNIT STRENGTH

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



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

## STENNIS RIVERINE

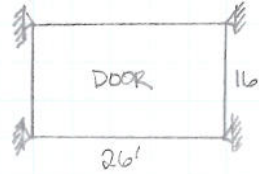
DESIGN OF REINFORCED CMU NONLOADBEARING WALL FOR FLEXURE  
BLDG 2441 ELEMENT B (DESIGN FOR 26' x 16' OPENING)

### MATERIALS:

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

### LOADING:

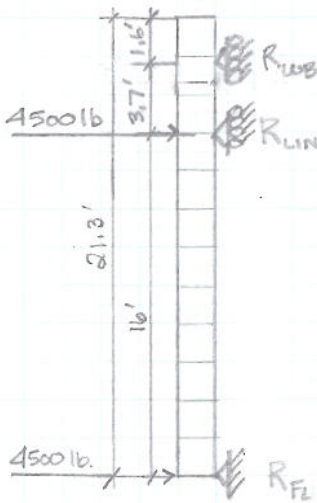
WIND 130 MPH = 43.26 psf  
NEGLECT SELF WEIGHT



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

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

### REACTIONS @ LINTEL AND FLOOR FROM DOOR



$$R_{LIN} = \left( \frac{4500 \text{ lbs} \cdot 16'}{16'} \right) = 4500 \text{ lbs.} = 346 \text{ plf}$$

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

TOTAL = 9000 lbs.

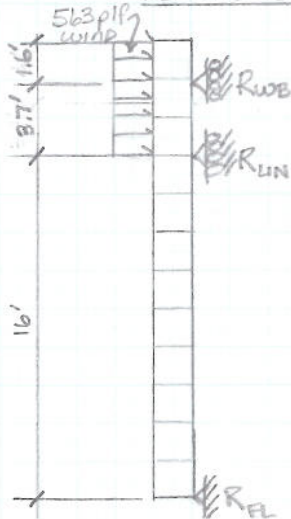
$$\text{ACTUAL: } [43.3 \text{ psf} \cdot (13' \cdot 16')] = 9006$$

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

∴ 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:



$$R_{WB} = \left( \frac{43.3 \cdot (5.3)^2 / 2'}{3.7'} \right) = 164.1 \text{ plf} (13') = 2136 \text{ lbs}$$

$$R_{LIN} = \left[ 43.3 \left( \frac{3.7^2}{2} - \frac{16^2}{2} \right) \right] / 3.7' = 65.1 \text{ plf} (13') = 847 \text{ lbs.}$$

2983 lbs

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

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

∴ OK

$$\text{MAX MOMENT} = (164.1 - 65.1) \left( \frac{1.5}{2} \right) = 74.8 \text{ ft-lb/ft}$$

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

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

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

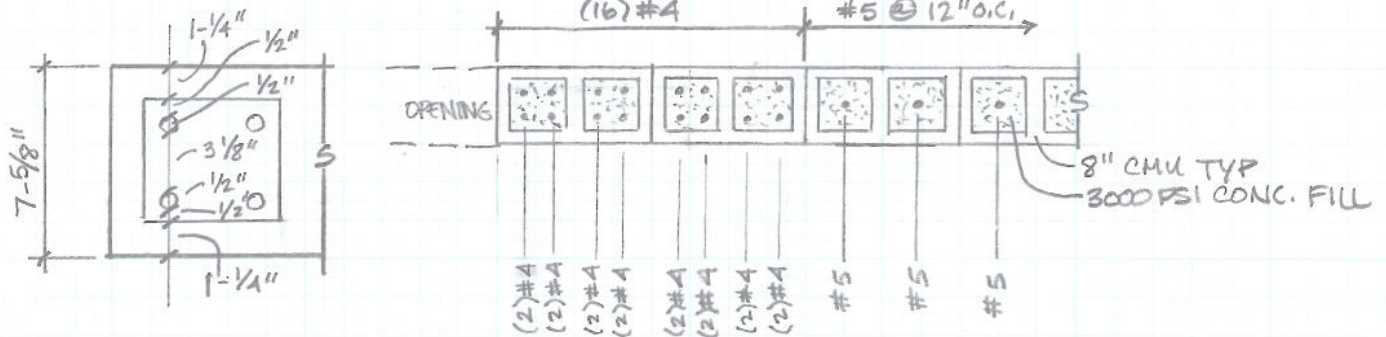
$$j = \left(1 - \frac{K}{3}\right) = \left(1 - \frac{0.5}{3}\right) = 0.83$$

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

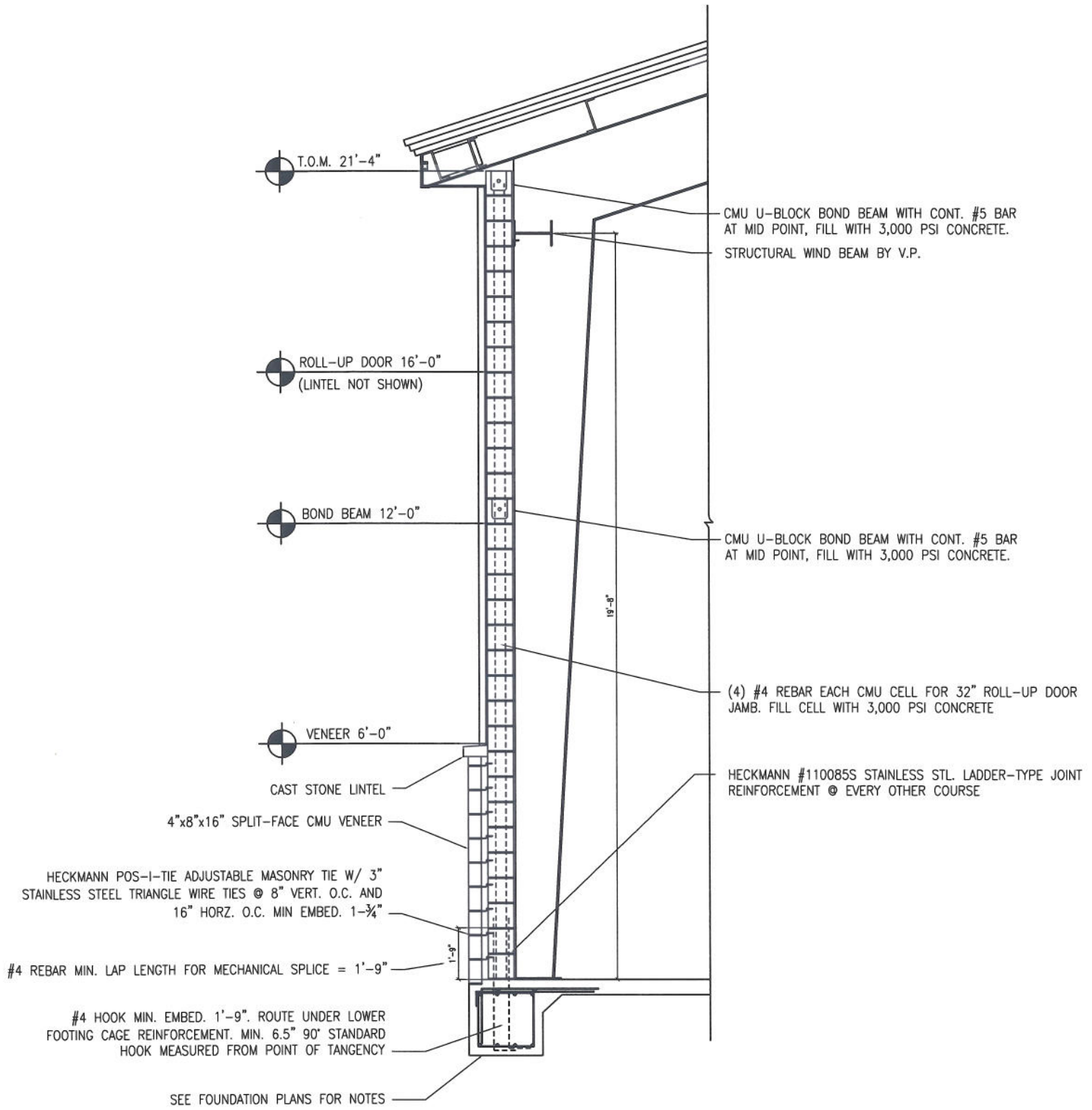
$$M_m = \frac{bd^2}{2} \cdot K \cdot j \cdot F_b = \frac{32 \text{ in} \cdot 3.8^2}{2} (0.5)(0.83) \frac{1795 \text{ psi}}{12} = 14342 \text{ ft-lb.}$$

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

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



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



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

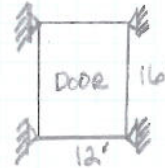
## STENNIS RIVERINE DESIGN OF REINFORCED CMU NONLOADBEARING WALL FOR FLEXURE BLDG 2441 — WALL #1 ELEMENT C

### 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:

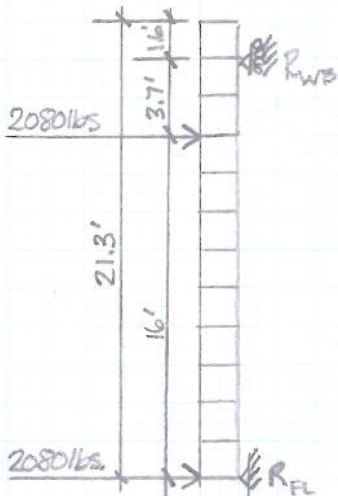
WIND 130 MPH = 43.26 psf  
NEGLECT SELF WEIGHT



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

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

### REACTIONS @ UNTEL AND FLOOR FROM DOOR:



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

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

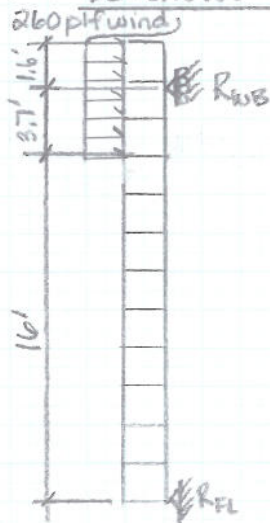
$$\left. \begin{array}{l} \text{TOTAL} = 4160 \text{ lbs.} \\ \text{[ACTUAL} = 43.3 \cdot (16 \cdot 12) / 2 = 4157] \end{array} \right\}$$

∴ 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:



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

$$R_{FL} = 260 \text{ plf} \cdot \left( \frac{5.3^2}{2} - \frac{1.6^2}{2} \right) \frac{1}{19.7'} = 170 \text{ lbs}$$

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

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

1095 Florida Ave.  
Slidell, LA 70458P.O. Box 2830  
Slidell, LA 70459985-649-5832  
FAX 985-641-5950MOMENT @ 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

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

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:

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

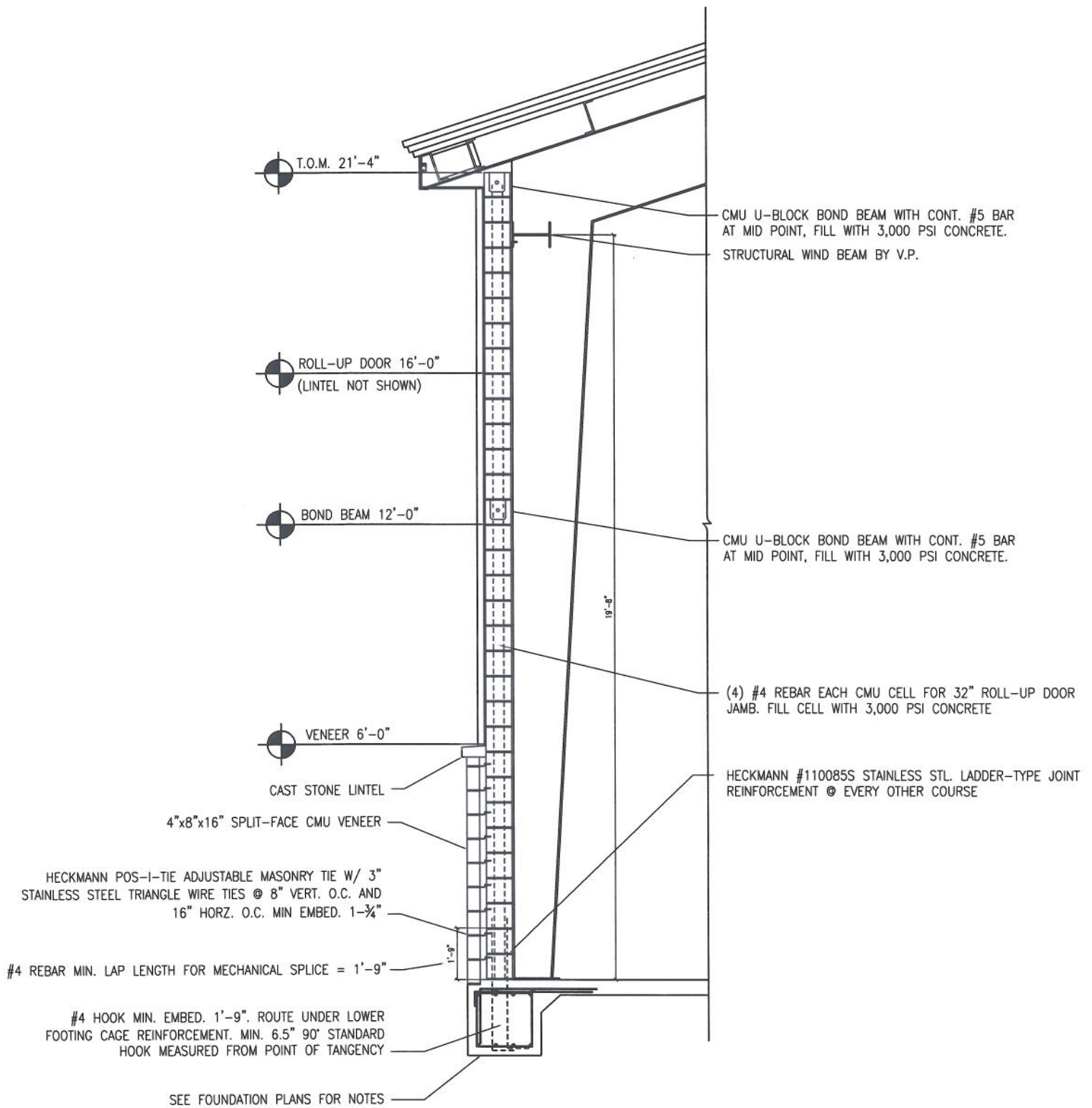
$$M_t > 10765 \text{ ft-lb.} \quad \therefore \text{OK}$$

ALLOWABLE CAPACITY IN COMPRESSION

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

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

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



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

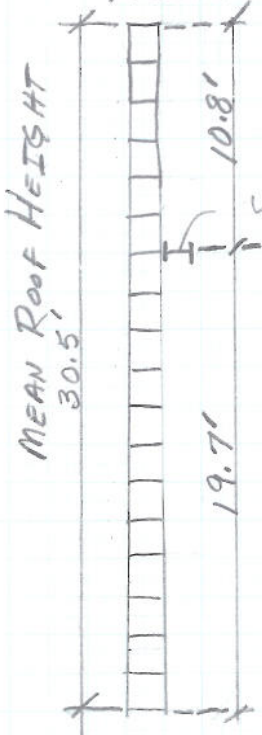
S TENNIS RIVERINE  
DESIGN OF REINFORCED CMU NON-LOADBEARING WALL  
FOR FLEXURE BLDG 2441 WALL # 2

MATERIALS:

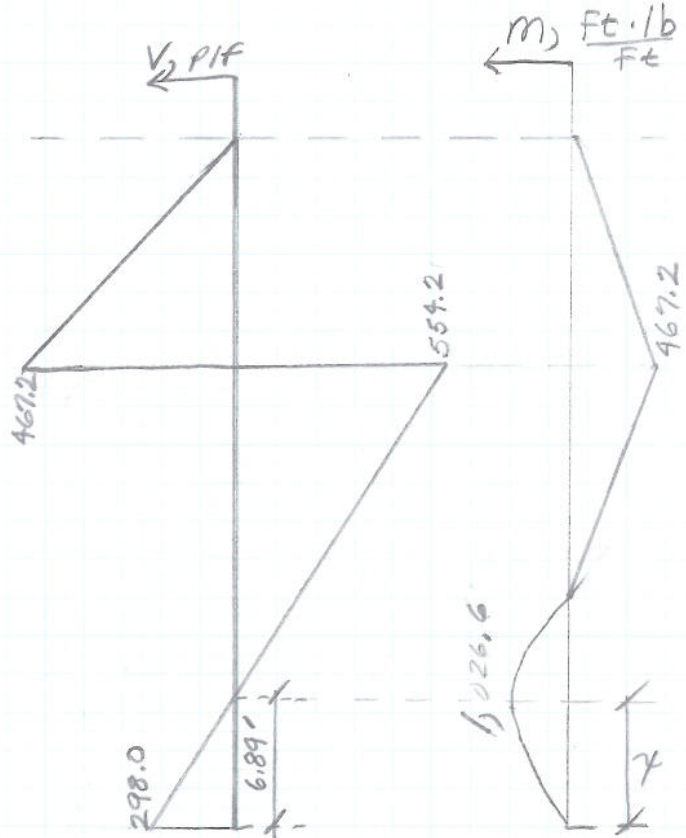
UNIT STRENGTH 4050 psi  
MORTAR TYPE N  
 $f'_m$  2500 psi  
 $E_m$   $2.25 \times 10^6$   
 $n$  12.89  
REINFORCEMENT GRADE 60

LOADING:

WIND 130 MPH = 43.26 psf  
NEGLECT SELF WEIGHT



WIND BEAM



REACTIONS:

$$R_{WB} = \frac{(43.26 \text{ psf} \times (30.5)^2)}{2 \times 19.7} = 1,021.4 \text{ PIF}$$

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

$$x = \frac{298 \text{ PIF}}{43.26 \text{ psf}} = 6.89 \text{ FT}$$

BLDG 2441 WALL #2 Cont.

ESTIMATE REINFORCEMENT

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

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

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

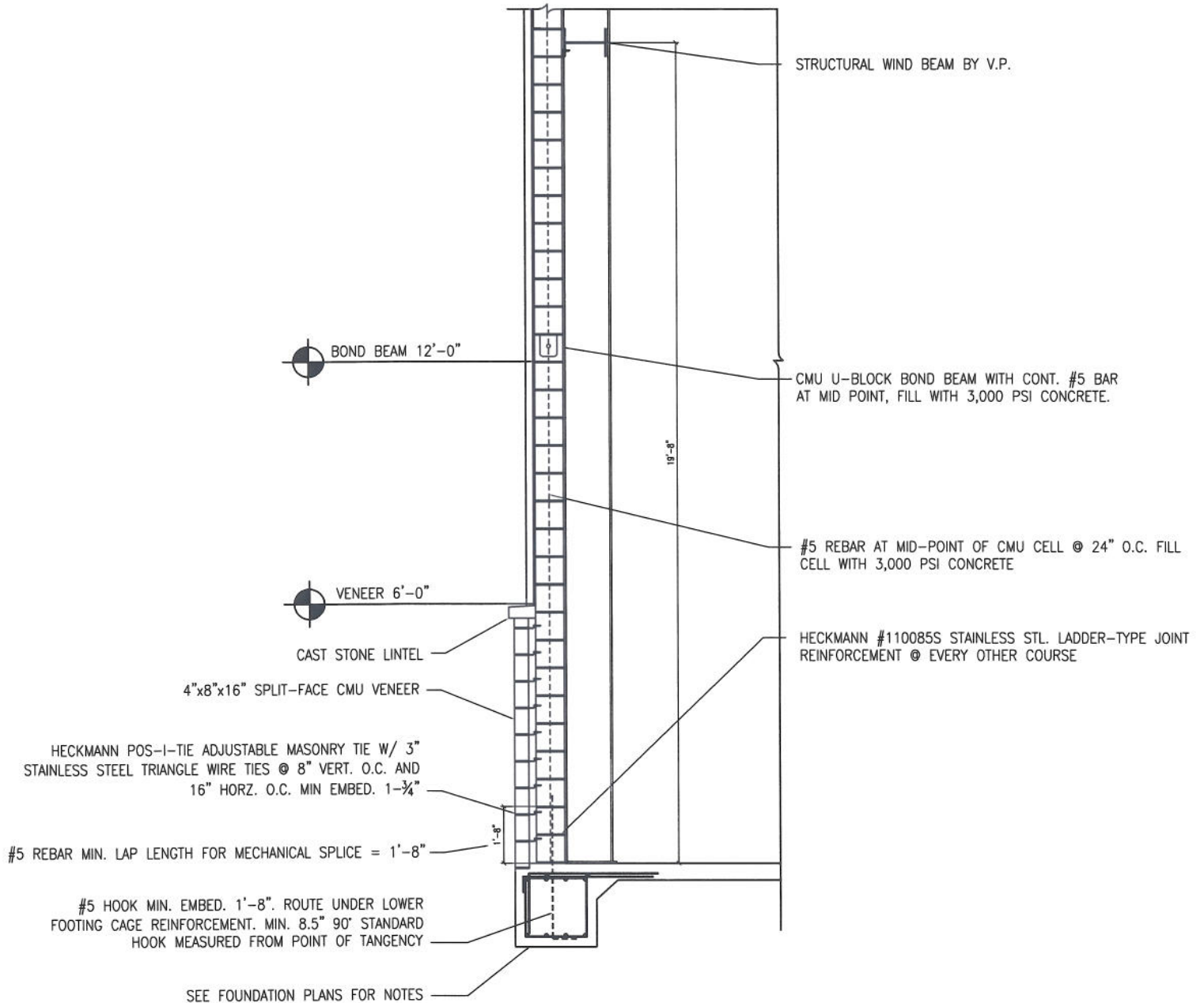
$$M_m = \left(\frac{bd^2}{2}\right) k j F_b =$$

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

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

USE #5 @ 24" O.C. 8" CMU TYPE N MORTAR

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



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

## STENNIS RIVERINE DESIGN OF REINFORCED CMU NONLOADBEARING WALL FOR FLEXURE BLDG 2440 WALL #3

MATERIALS:

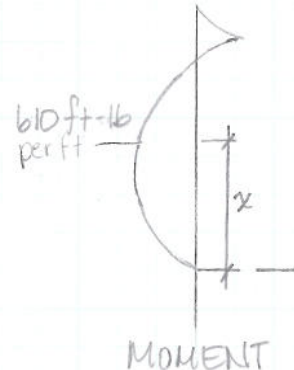
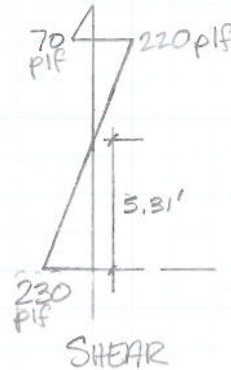
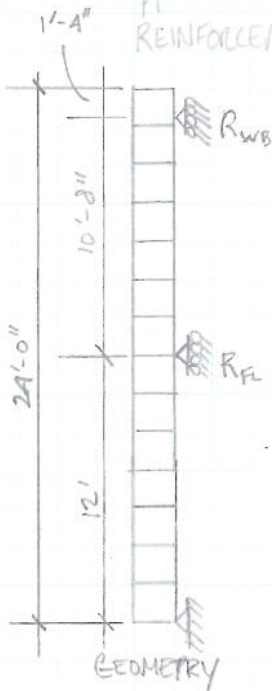
|               |                    |
|---------------|--------------------|
| UNIT STRENGTH | 2150 psi           |
| MORTAR        | TYPE N             |
| $f'_m$        | 1500 psi           |
| $E_m$         | $2.25 \times 10^6$ |
| $n$           | 12.89              |
| REINFORCEMENT | GRADE 60           |

LOADING:

WIND 130 mph = 43.3 psf  
NEGLECT SELF WEIGHT

NOTE

CONTINUOUS LATERAL SUPPORT @ 12.0'  
CONSIDER UPPER COMPONENT FOR CALCULATIONS  
DUE TO HIGHER MAX MOMENT



REACTIONS:

$$R_{WB} = \left[ \frac{43.3 \cdot (12')^2}{2} \right] / 10.67' = 292.2 \text{ plf}$$

$$x = \frac{230 \text{ plf}}{43.3} = 5.31'$$

$$R_{FL} = 43.3 \left[ \frac{\left( \frac{10.67}{2} - \frac{12^2}{2} \right)}{10.67'} \right] = 230 \text{ plf}$$

$$M = 230 \text{ plf} \left( \frac{5.31'}{2} \right) = 610 \text{ ft-lb/ft}$$

ESTIMATE REINFORCEMENT:

TRY 8" CMU, STEEL @ MID DEPTH  $d = 3.8"$

$$A_s = \frac{M}{f_s \cdot j \cdot d} = \frac{610 \text{ ft-lb} \cdot 12}{24000 \text{ psi} \cdot 0.9 \cdot 3.8} = 0.09 \text{ in}^2/\text{ft}$$

1095 Florida Ave.  
Slidell, LA 70458P.O. Box 2830  
Slidell, LA 70459985-649-5832  
FAX 985-641-5950DESIGN STRENGTH

USING 24" WIDE STRIP

DESIGN MOMENT =  $610 \text{ ft-lb} \cdot 2 = 1220 \text{ ft-lb}$ .

$$p = \frac{A_s}{bd} = \frac{0.20}{24 \cdot 3.8} = 0.002$$

$$pn = 0.03$$

$$K = 0.28$$

$$j = \left(1 - \frac{K}{3}\right) = 0.91$$

ALLOWABLE CAPACITY IN TENSIONTRY #4 @ 16" o.c.  $A_s = 0.15$ 

$$M_t = A_s j d F_s = 0.15 \text{ in}^2 (0.93)(3.8)(24000) \frac{1.33}{12} = 1410 \text{ ft-lb./ft}$$

$$1410 > 1220 \therefore \text{OK}$$

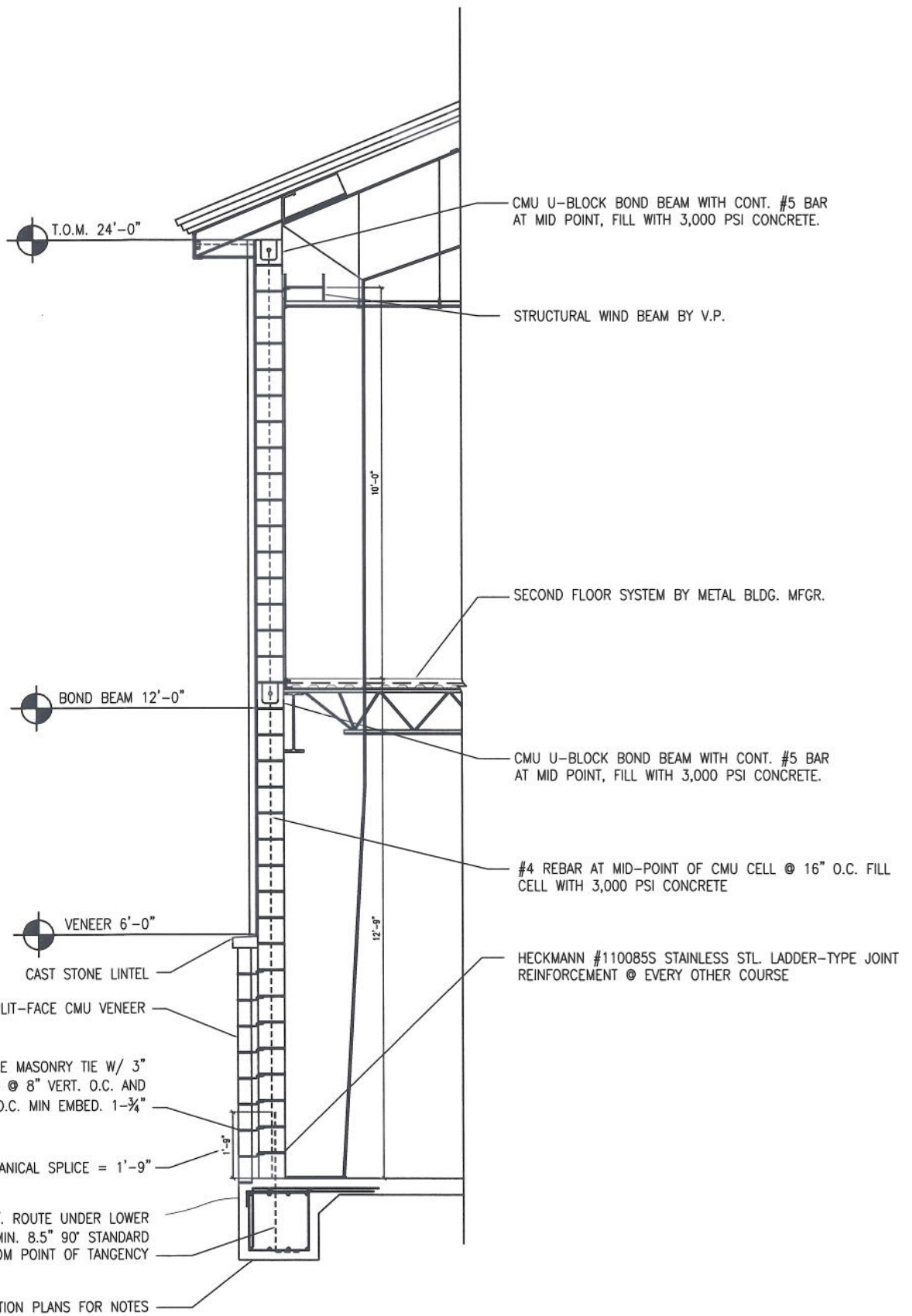
ALLOWABLE CAPACITY IN COMPRESSION

$$F_b = 665 \text{ psi}$$

$$M_m = \frac{ba^2}{2} K j F_b = \frac{24'' \cdot 3.8''^2}{2} (0.28)(0.91) \left(\frac{665 \text{ psi}}{12}\right) = 2446 \text{ ft-lb.}$$

$$2446 > 1220 \therefore \text{OK}$$

USE #4 REBAR @ 16" o.c. w/ 8" CMU (1500psi) TYPE N MORTAR



**WALL#3 TYPICAL DETAIL**  
N.T.S.

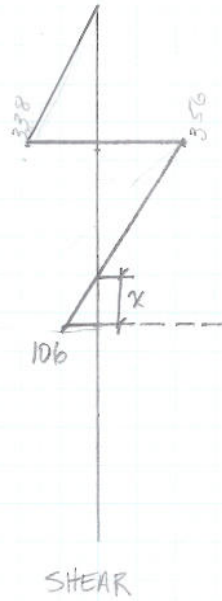
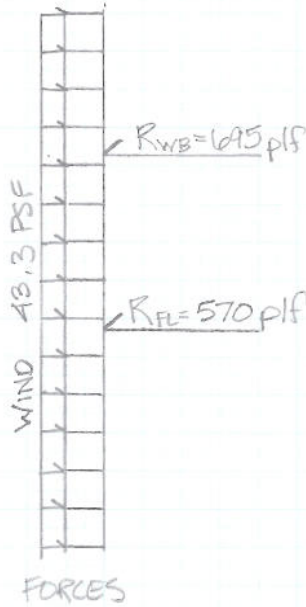
STENNIS RIVERINE  
DESIGN OF REINFORCED CMU NONLOADBEARING WALL FOR FLEXURE  
BLDG 2440 WALL #4

MATERIALS:

UNIT STRENGTH 2150 psi  
MORTAR TYPE N  
f'c 1500 psi  
E<sub>m</sub> 2.25 x 10<sup>6</sup>  
n 12.89  
REINFORCEMENT GRADE 60

LOADING:

WIND 130 MPH = 43.3 psf  
NEGLECT SELF WEIGHT



REACTIONS:

$$R_{WB} = \left[ \frac{43.3 (18.5')^2}{2} \right] / 10.67' = 695 \text{ plf}$$

$$x = \frac{106.6 \text{ plf}}{43.3} = 2.5'$$

$$R_{FL} = 43.3 \left[ \frac{(10.67')^2}{2} - \frac{7.83^2}{2} \right] / 10.67' = 106.6 \text{ plf}$$

$$M = 106.6 \text{ plf} \left( \frac{2.5'}{2} \right) = 133.27 \text{ ft-lb/ft}$$

ESTIMATE REINFORCEMENT:

TRY 8" CMU, STEEL @ MID DEPTH  $d = 3.8"$

$$A_s = \frac{M}{F_s j d} = \frac{135 \text{ ft-lb/ft} \cdot 12}{24000 \text{ psi} (0.9)(3.8")(1.33)} = 0.02 \text{ in}^2/\text{ft}$$

1095 Florida Ave.  
Slidell, LA 70458P.O. Box 2830  
Slidell, LA 70459985-649-5832  
FAX 985-641-5950DESIGN STRENGTH:

USE 24" WIDE STRIP

$$\text{DESIGN MOMENT} = 133.3 \text{ ft-lb/ft} \times 2 = 270 \text{ ft-lb}$$

$$p = 0.005 \quad p_n = 0.06 \quad K = 0.28 \quad j = 0.98$$

ALLOWABLE CAPACITY IN TENSION

TRY #5 @ 16" O.C.

$$M_t = A_s (0.98)(3.8)(24000) \frac{1.33}{12} = 3070 \text{ ft-lb}$$

$$3070 > 270 \text{ ft-lb} \quad \therefore \text{OK}$$

ALLOWABLE CAPACITY IN COMPRESSION

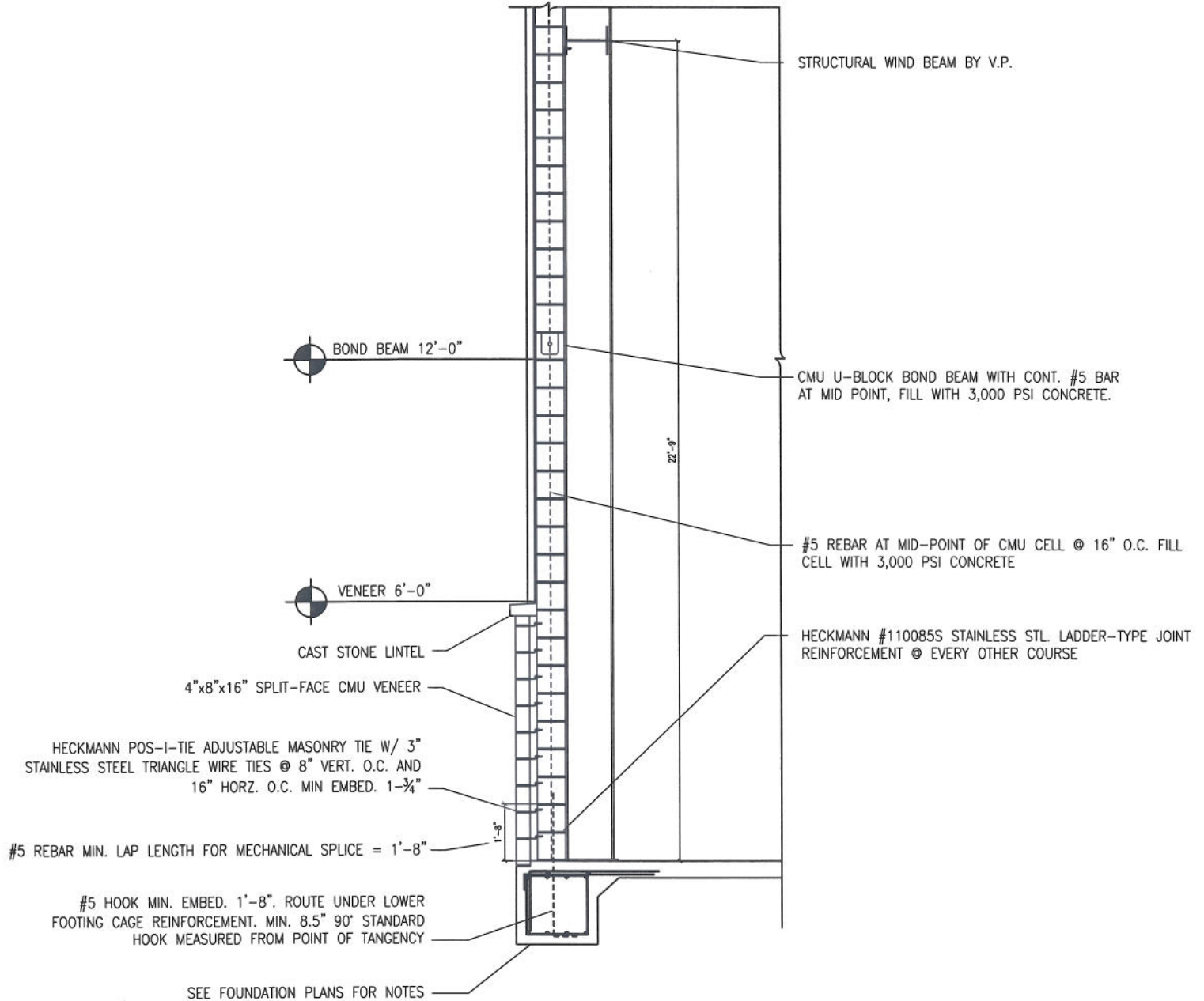
$$F_b = \frac{1}{3}(f'_m)1.33 = \frac{1}{3}(1500)1.33 = 665 \text{ psi}$$

$$M_m = \left( \frac{24 \cdot 3.8^2}{2} \right) (0.28)(0.98) \left( \frac{665}{12} \right) 1.33 = 2635 \text{ ft-lb}$$

$$2635 > 270 \quad \therefore \text{OK}$$

USE #5 @ 16" O.C.      8" CMU TYPE N MORTAR

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



**WALL#4 TYPICAL DETAIL**  
 N.T.S.

1095 Florida Ave.  
Slidell, LA 70458P.O. Box 2830  
Slidell, LA 70459985-649-5832  
FAX 985-641-5950TYPICAL ANCHORAGE AND SPLICE FOR #5 REBAR

USE #5 REBAR FOR HOOK, GRADE 60

 $l_d$  = REQ'D DEVELOPMENT LENGTH

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

$$l_e = 13d_b = 8.125"$$

VENEER WALL CONNECTION

USE "POS-1-TIE" TAPCON SCREW FOR CMU EMBED @ 8" VERTICAL O.C. AND 16" HORIZ. 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.

HORIZ. 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

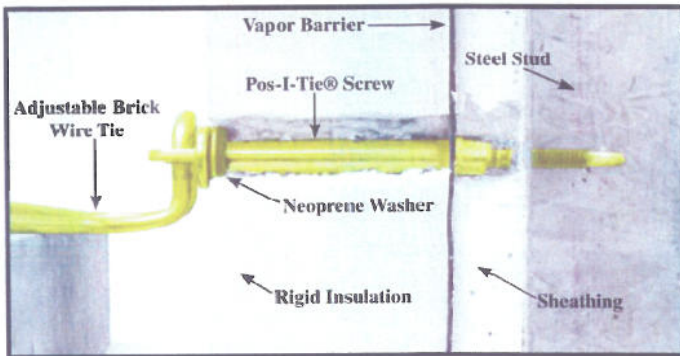
$$l_d = 20.1"$$

$$l_e = 6.5"$$

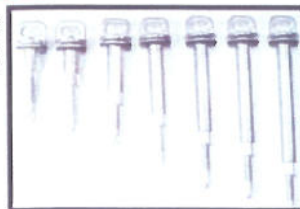
## ARCHITECTURAL SPECIFICATION INFORMATION

# 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)

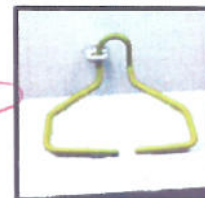
## NO. 75 POS-I-TIE® ADVANTAGES

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.



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

Special Lengths available.

CMU ANCHOR TO WIND BEAM



# 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

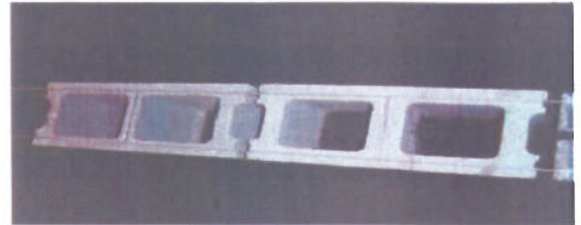
Special sizes and lengths are available.

- 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>.)

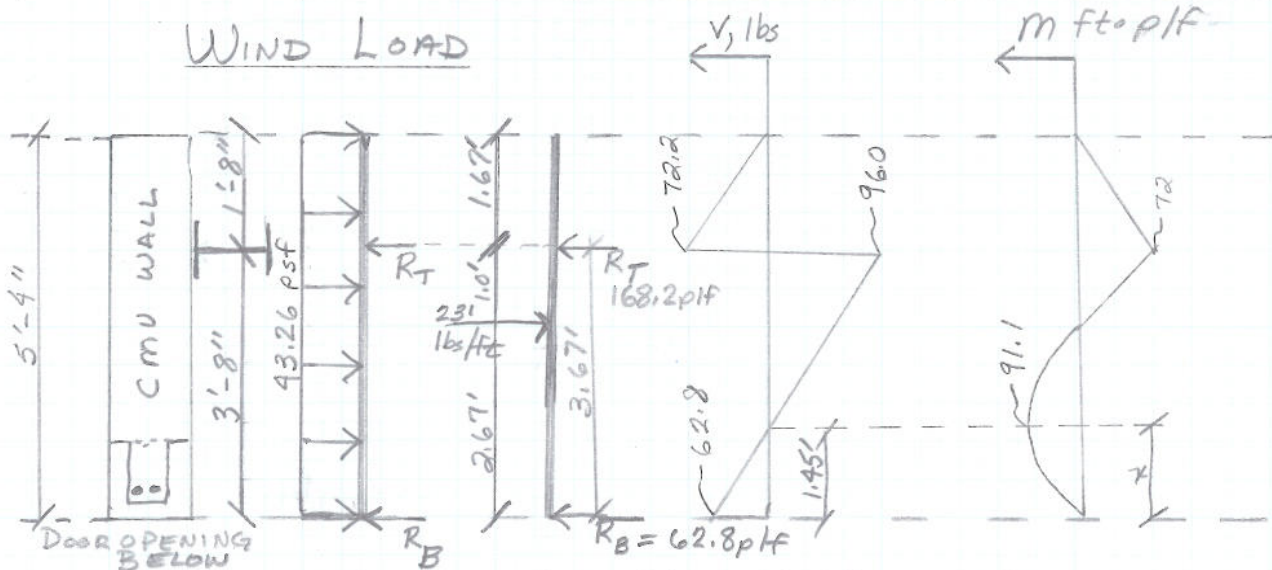
Conforms to requirements of ASCE / ACI 530 / TMS402 Building Code requirements for masonry structures.

Approvals:

Comments:

BLDG 2441 12 Ft Door Lintel Calculation

WIND LOAD



$$\sum M_{RT} = 0 \Rightarrow R_B = \frac{1}{3.67'} (231 \text{ lb/ft} \times 10 \text{ ft}) = 62.8 \text{ plf}$$

$$\sum F_x = 0 \Rightarrow R_T = 231 \text{ plf} - 62.8 \text{ plf} = 168.2 \text{ plf}$$

$$x = \frac{62.8}{43.26} = 1.45'$$

$$M_{max} = \frac{1}{2} [1.45' \times 62.8 \text{ plf}] = 91.1 \text{ ft-plf}$$

USE 8" cmu

$$d = \frac{7.63}{2} = 3.8''$$

$$A_s = \frac{M}{F_s j d}$$

Assume  $j = 0.9$  for initial estimate.

ALLOW  $\frac{1}{3}$  stress increase for wind load.

$$A_{s \text{ required}} = \frac{91.1 \text{ ft-plf} \times 12 \text{ in/ft}}{24,000 \text{ psi} \times 1.33 \times 0.9 \times 3.8''} = 0.100 \text{ in}^2$$

USE #4 @ 24" o.c.

$$A_s = 0.20 \frac{12}{24} = 0.10 \text{ in}^2$$

(2)

## BLDG 2441 12 FT DOOR LINTEL CALC. WIND LOAD (CONT)

Try #4 @ 24" O.C.

CHECK STRENGTH

USE 2.0' WIDE STRIP TO TEST

$$\therefore \text{DESIGN MOMENT} = 91.1 \text{ ft}\cdot\text{plf} \times 2 = 182.2 \text{ ft}\cdot\text{plf}$$

$$p = \frac{A_s}{bd} = \frac{0.20 \text{ in}^2}{24" \times 3.8"} = 0.002$$

$$np = 16.1 \times 0.002 = 0.0322$$

$$k^2 + 2npk - 2np = 0 \Rightarrow k^2 = 0.064k - 0.064 = 0$$

$$k = 0.220 \quad j = \left(1 - \frac{k}{3}\right) = 1 - \frac{0.220}{3} = 0.927$$

ALLOWABLE TENSION FLEXURAL CAPACITY

$$M_T = A_s j d F_s = 0.20 \text{ in}^2 \times 0.927 \times 3.8 \text{ in} \times 24000 \text{ psi}$$

$$\Rightarrow M_T = 1874 \text{ ft}\cdot\text{plf} > 182.2 \text{ ft}\cdot\text{plf} \times \frac{1.33}{12 \text{ in/ft}}$$

ALLOWABLE COMPRESSION FLEXURAL CAPACITY

$$F_b = \frac{1}{3} F'_m \times 1.33 = \frac{1}{3} [1500 \text{ psi}] \times 1.33 = 665 \text{ psi}$$

$$M_c = \frac{bd^2}{2} k j F_b$$

$$= \frac{24" \times (3.8")^2}{2} \times 0.220 \times 0.927 \times \frac{665 \text{ psi}}{12 \text{ in/ft}}$$

$$\Rightarrow M_c = 1958 \text{ ft}\cdot\text{plf} > 182.2 \text{ ft}\cdot\text{plf}$$

Use #4 @ 24" O.C.

BLDG 2441 12 FT DOOR LINTEL CALC (3)

WEIGHT LOAD

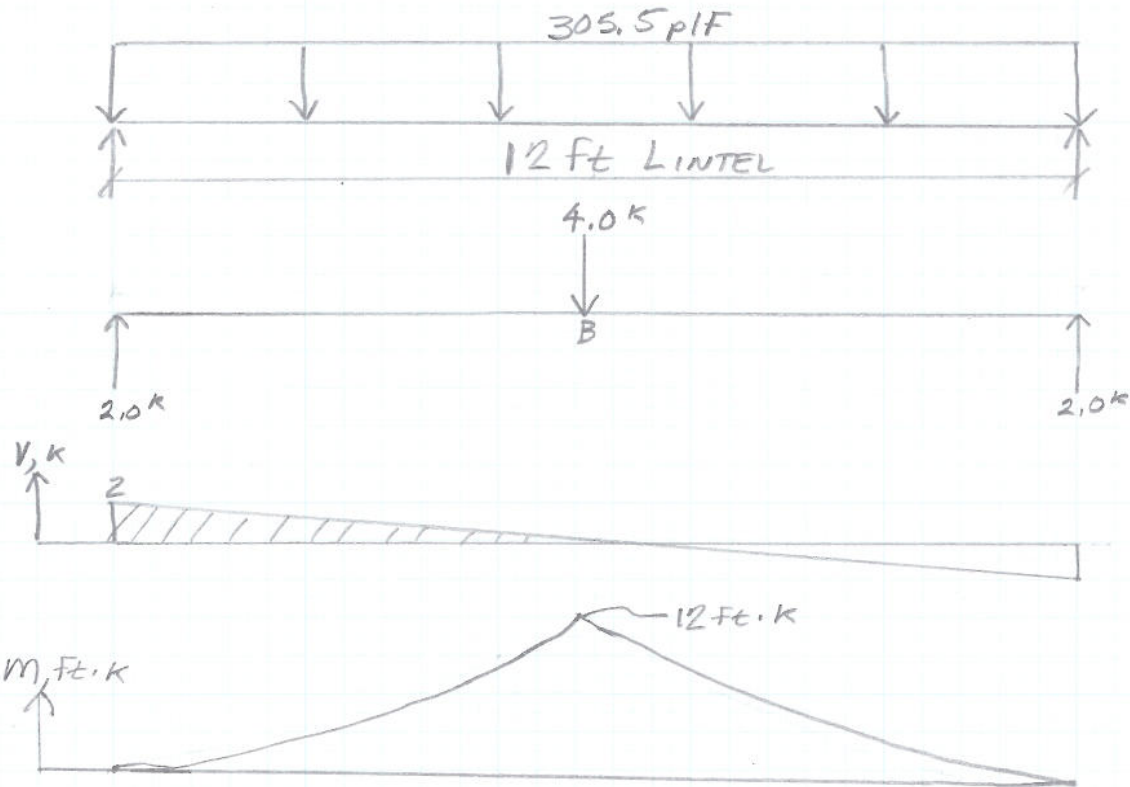
CALCULATE LINTEL TO SUPPORT WEIGHT

WEIGHTS:

- HOLLOW CORE CMU: 55 pcf
- MORTAR, MASONRY: 116 pcf
- CONCRETE: 150 pcf
- STEEL: 489 pcf

[1 EA Solid Filled CMU w/ 1 bar] x LENGTH = 207.9 lbs / COURSE  
 6 COURSES = 1247.4 lbs  
 1 EA U-SHAPED BLOCK SOLID FILLED W/ 1 BAR 2418.95 lbs  
 Total Weight 3666.35 lb

WEIGHT PER LINEAR FOOT = 305.5 p/f



BLDG 2441 12FT DOOR LINTEL CALC

WEIGHT LOAD (CONT)

MORTAR TYPE N  
 $f'_m = 2500 \text{ psi}$   
 $E_m = 2.25 \times 10^6 \text{ psi}$   
 CMU STRENGTH = 4050 psi  
 REINFORCEMENT = GRADE 60,  $E = 29 \times 10^6 \text{ psi}$

REQUIRED: DETERMINE EFFECTIVE DEPTH, MODULAR RATIO, & ALLOWABLE STRESSES

ASSUME TOTAL DEPTH TO BE SOLIDLY GROUTED & CONSIDERED FOR LINTEL DEPTH IS LIMITED TO  $h = 24 \text{ in.}$

ASSUME COVER TO CENTROID OF TENSION STEEL = 3.0 in  
 THEN  $d = 16 \text{ in.} - 3.0 \text{ in} = 13 \text{ in.}$

ASSUME  $b = 7.63 \text{ in.}$

$E_s = 29 \times 10^6 \text{ psi}$

MODULAR RATIO  $n = \frac{E_s}{E_m} = \frac{29 \times 10^6 \text{ psi}}{2.25 \times 10^6 \text{ psi}} = 12.9$

THE ALLOWABLE COMPRESSIVE MASONRY STRESS:

$$F_b = \left(\frac{1}{3}\right) f'_m = \left(\frac{1}{3}\right) 2500 \text{ psi} = 833.3 \text{ psi}$$

THE ALLOWABLE TENSIL STEEL STRESS:

$$F_s = 24,000 \text{ psi}$$

REQUIRED: DETERMINE MOMENT CAPACITY OF SECTION FOR BALANCED CONDITION

$$k_b = \frac{n}{n + F_s/F_b} = \frac{12.9}{12.9 + (24 \text{ ksi} / 0.8 \text{ ksi})} = 0.301$$

$$j_b = 1 - \frac{k_b}{3} = 0.900$$

$$M_b = \frac{F_b k_b j_b b d^2}{2} = \frac{(833 \text{ psi})(0.301)(0.900)(7.63 \text{ in})(13 \text{ in})^2}{2}$$

$$\Rightarrow M_b = 145.5 \text{ in} \cdot \text{kips} = 12.1 \text{ ft} \cdot \text{kips} \therefore \text{OK}$$

BLDG 2441 12 FT DOOR LINTEL CALC  
WEIGHT LOAD (CONT)

REQUIRED: DETERMINE TENSION STEEL AREA:

$$A_s = \frac{M_b}{F_s j_b d} = \frac{145.5 \text{ in-kips}}{(24 \text{ ksi})(0.900)(13 \text{ in})} = 0.518 \text{ in}^2$$

USE 2 #6 BARS ( $A_s$  PROVIDED = 0.884 in<sup>2</sup>)

REQUIRED: DETERMINE COMPRESSION STEEL AREA  
 $f'_s = n F_b = 12.9 (833.3 \text{ psi}) = 10,749 \text{ psi} < F_s = 24,000 \text{ psi}$

$$A'_s = \frac{m}{f'_s (d) \left(\frac{n-1}{n}\right)} = \frac{145.5 \text{ in-kips}}{(10,749 \text{ psi})(13 \text{ in}) \left(\frac{12.9-1}{12.9}\right)} = 0.00113$$

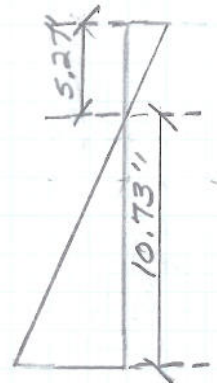
USE 1 #4 BAR ( $A'_s$  PROVIDED = 0.196 in<sup>2</sup>)

REVISE K AND CHECK ADEQUACY OF SECTION:

$$p = \frac{A_s}{bd} = \frac{0.884 \text{ in}^2}{(7.63 \text{ in})(13 \text{ in})} = 0.008912$$

$$np = 12.9 \times 0.008912 = 0.1150$$

$$p' = \frac{A'_s}{bd} = \frac{0.196 \text{ in}^2}{(7.63 \text{ in})(13 \text{ in})} = 0.00198$$



$$k = \left[ (np + (n-1)p')^2 + 2(np + (n-1)p') \right]^{1/2} - [np + (n-1)p']$$

$$(np + (n-1)p')^2 = 0.1150 + (12.9-1)0.00198 = 0.01920$$

$$2(np + (n-1)p') = 2(0.1150 + (12.9-1)0.00198) = 0.2771$$

$$np + (n-1)p' = 0.1150 + (12.9-1)0.00198 = 0.1386$$

$$k = \left[ 0.01920 + 0.2771 \right]^{1/2} - 0.1386 = 0.4057$$

$$kd = 5.27 \text{ inches}$$

6

## BLDG 2441 12 FT Door LINTEL CALC. Weight Load (CONT.)

Assume MASONRY COMPRESSION STRESS = 883.3 psi  
AND NEGLECTING HOLE EFFECT

$$f_s = (12.9)(883 \text{ psi}) \left( \frac{10.73''}{5.27} \right) = 21,887 \text{ psi} < F_s$$

MASONRY CONTROLS

$$M = \frac{883.3 \text{ psi}}{2} (7.63 \text{ in})(5.27 \text{ in}) \left[ 13 \text{ in} - \frac{5.27}{3} \right] = 188,3365 \text{ in}\cdot\text{lb}$$

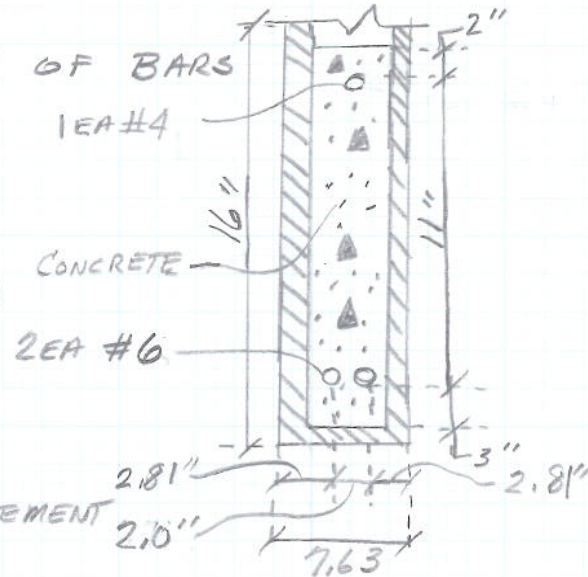
$$= 15.7 \text{ Ft}\cdot\text{kips} > 12 \text{ Ft}\cdot\text{kips} \therefore \text{OK}$$

### CHECK PLACEMENT OF BARS

① CLEARANCE BETWEEN PARALLEL BARS NOT LESS THAN 1in.

② CLEARANCE BETWEEN BARS AND CMU WALL NOT LESS THAN 1/2"

③ MINIMUM CLEARANCE COVER OVER REINFORCEMENT NOT LESS THAN 2".



### CHECK DEFLECTION:

$$I_{cr} = b k^3 \frac{d^3}{3} + n A_s (d - kd)^2 + (n-1) A'_s (kd - d')^2$$

$$= (7.63 \text{ in})(0.4057)^3 \frac{13^3}{3} + (12.9)(0.884 \text{ in}^2)(13 \text{ in} - 5.27 \text{ in})^2$$

$$+ (12.9-1)(0.196 \text{ in}^2)(5.27 \text{ in} - 13 \text{ in})^2$$

$$= 1,193.8 \text{ in}^4$$

### SHORT TERM DEFLECTION:

$$f_r = 2.5 \sqrt{f'_m} = 2.5 \sqrt{2500 \text{ psi}} = 125 \text{ psi}$$

$$I_g = (7.63 \text{ in}) \frac{(16 \text{ in})^3}{12} = 2,604 \text{ in}^4$$

BLDG 2441 12 FT DOOR LINTEL CALC (7)  
WEIGHT LOAD (CONT.)

$$M_{OR} = \frac{f_r I_g}{y_t} = \frac{(125 \text{ psi})(2604 \text{ in}^4)}{16 \text{ in}} = 20.3 \text{ in-kips}$$

$$M_a = 535 \text{ in-kips}$$

SHORT TERM DEFLECTION

$$\Delta = \frac{5 M_{OR} L^2}{48 E_m I_g} + \frac{5 (M_a - M_{OR}) L^2}{48 E_m I_{CR}}$$

$$\Delta = \frac{5 (20.3 \text{ in-k})(12.3 \text{ ft} \cdot 12 \text{ in/ft})^2}{48 (2.6 \times 10^3 \text{ ksi})(2604 \text{ in}^4)} + \frac{5 (535 \text{ in-kips} - 20.3 \text{ in-k})(12.3 \text{ ft} \times 12 \text{ in/ft})^2}{48 (2.6 \times 10^3 \text{ ksi})(1,193.8 \text{ in}^4)}$$

$$\Delta = 0.0068043 \text{ in} + 0.0376567 \text{ in}$$

$$\Delta = 0.04446$$

LONG TERM DEFLECTION

$$\lambda = \frac{\epsilon}{1 + 50 \rho'} = \frac{2}{1 + (50)(0.00198)} = 1.8198$$

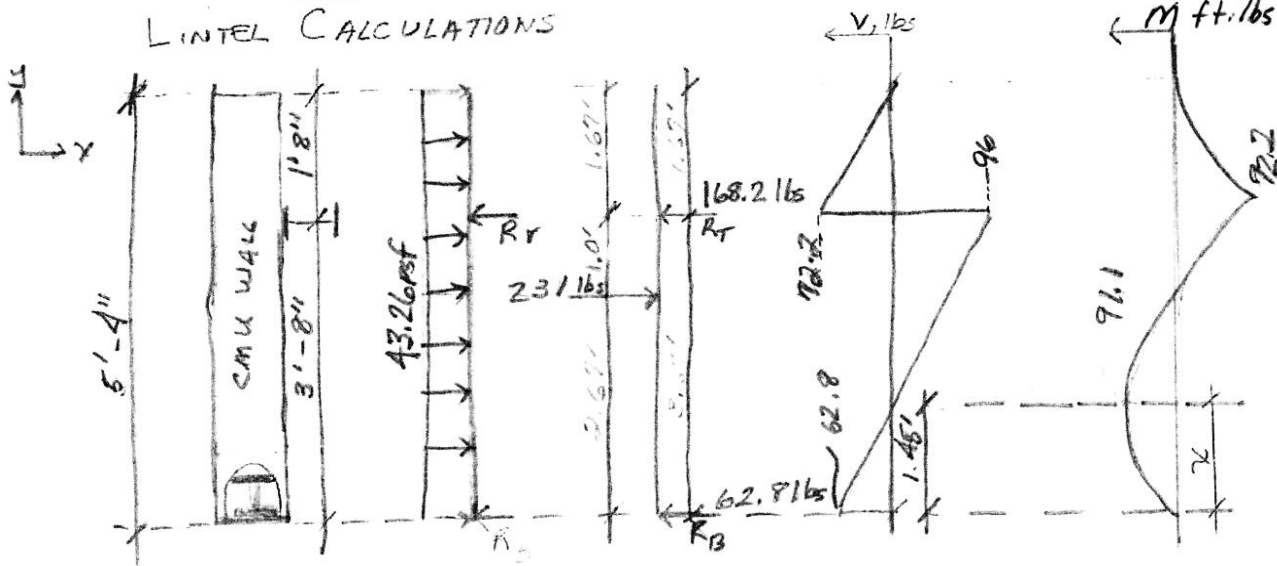
$$\text{TOTAL DEFLECTION} = 0.04446 \text{ in} + 1.8198(0.04446) = 0.1253$$

$$\Delta_{ALLOWED} = \frac{J}{600} \leq 0.3$$

$$= \frac{(12.33 \text{ ft}) 12 \text{ in/ft}}{600}$$

$$= 0.2466 \text{ in} > 0.1253 \text{ in} \therefore \text{OK}$$

## BUILDING 2441 LINTEL & WIND BEAM CALCULATIONS



$$\sum M_{R_T} = 0 \Rightarrow R_B = \frac{1}{3.6'} [231 \text{ lbs} \times 1.0'] = 62.8 \text{ lbs}$$

$$\sum F_x = 0 \Rightarrow R_T = 231 - 62.8 \text{ lbs} = 168.2 \text{ lbs}$$

$$x = \frac{62.8}{43.26} = 1.45'$$

$$M_{max} = \frac{1}{2} [1.45' \times 62.8 \text{ lbs}] = 91.1 \text{ ft-lbs}$$

Use 8" CMU

$$d = \frac{7.63''}{2} = 3.8''$$

$$A_s = \frac{M}{F_s j d}$$

Assume  $j = 0.9$  for initial estimate

Allow  $\frac{1}{3}$  stress increase for wind load

$$A_{s \text{ required}} = \frac{91.1 \text{ ft-lbs} \times 12 \frac{\text{in}}{\text{ft}}}{24,000 \text{ psi} \times 1.33 \times 0.9 \times 3.8''} = 0.100 \text{ in}^2$$

Use #4 @ 24 in o.c. ( $A_s = 0.20 \frac{12}{24} = 0.10 \text{ in}^2$ )

check strength

Use 2.0' wide strip  $\therefore$  Design moment =  $91.1 \text{ ft-lbs} \times 2 = 182.2 \text{ ft-lbs}$

$$p = \frac{A_s}{bd} = \frac{0.20 \text{ in}^2}{24 \times 3.8 \text{ in}} = 0.002$$

$$np = 0.0322$$

$$k = 0.220$$

$$k^2 + 0.064k - 0.064 = 0$$

$$j = \left(1 - \frac{k}{3}\right) = \left(1 - \frac{0.22}{3}\right) = 0.927$$

Bldg 2441

26 ft Door Lintel Weight (cont.)

Allowable Tension Flexural capacity

$$M_T = A_s j d F_s = 0.50 \text{ in}^2 \times 0.927 \times 3.8 \text{ in} \times 24,000 \text{ psi} \times \frac{1.33}{12 \text{ in/ft}}$$

$$\Rightarrow M_T = 1874 \text{ ft-lbs} > 182.2 \text{ ft-lbs} \therefore \text{OK}$$

Allowable Compression Flexural capacity

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

$$M_c = \frac{b d^2}{2} k_j F_b$$

$$M_c = \frac{24 \times (3.8 \text{ in})^2}{2} \times 0.220 \times 0.927 \times \frac{665 \text{ psi}}{12 \text{ in/ft}}$$

$$M_c = 1958 \text{ ft-lbs} > 182.2 \text{ ft-lbs} \therefore \text{OK}$$

USE #4 24" O.C.

Calculate beam to support weight

- CMU hollow core = 55 pcf
- Mortar, masonry = 116 pcf
- Concrete = 150 pcf
- Steel = 489 pcf

- 1 ea. solid filled CMU w/ 2 bars = 1806.7 lbs
- 6 courses hollow CMU = 5,720.0 lbs
- mortar = 1,508.0 lbs
- vertical #9 @ 24" = 43.6 lbs
- vertical concrete = 2,520.0 lbs
- Total weight = 11,598.3 lbs
- weight/lf = 446.1 plf

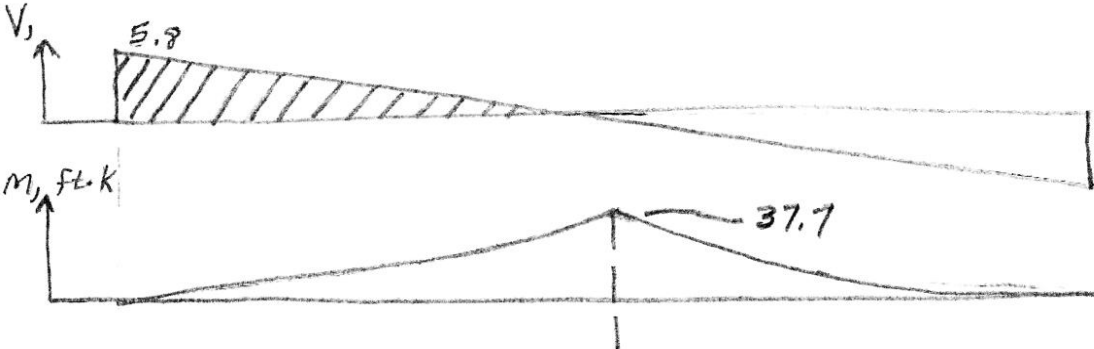
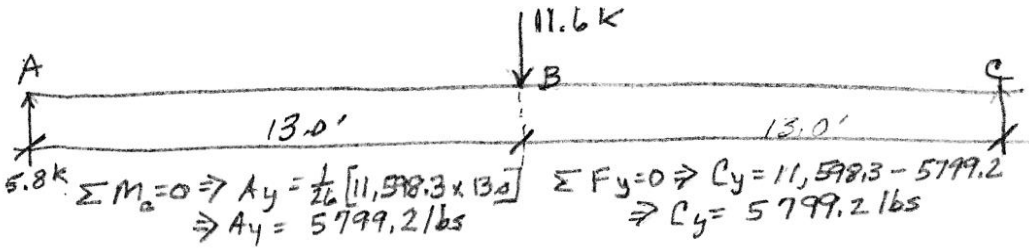
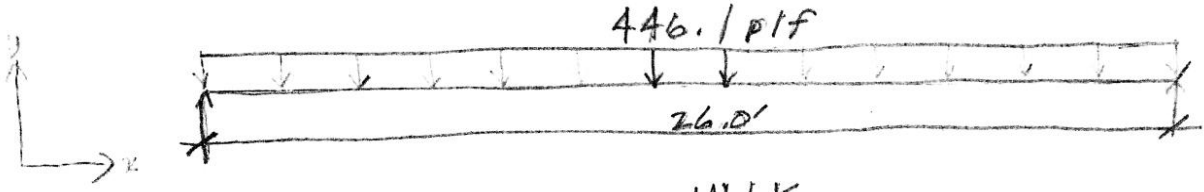
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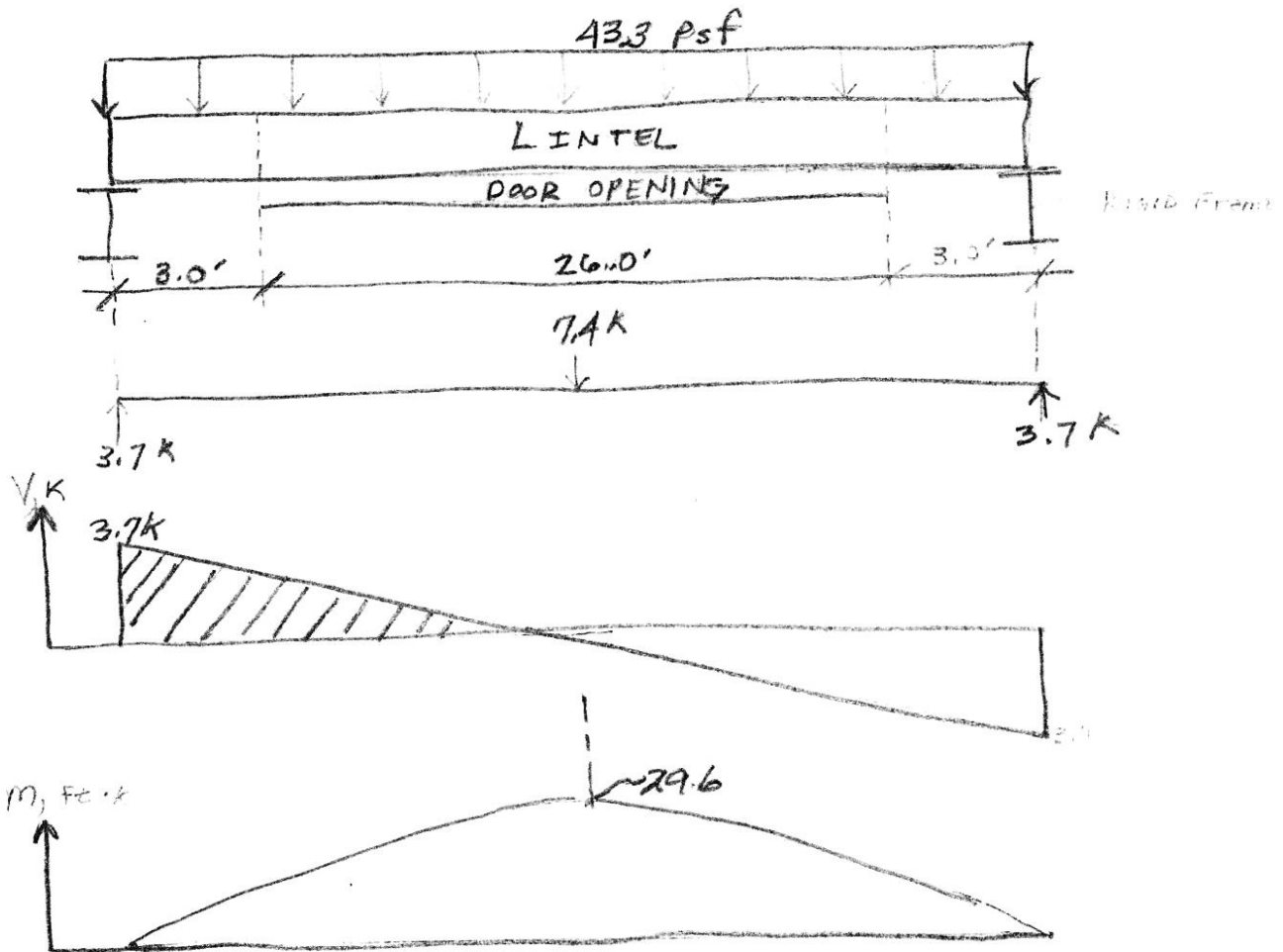
BLDG 2441

26 ft Door Lintel Weight Calc (cont.)



Section modulus  $S = \frac{M \times 12 \text{ in/ft}}{24,000 \text{ psi}} = \frac{37.7 \text{ k} \times 12 \text{ in/ft}}{24 \text{ k} \cdot \text{lb/in}^2} = 18.8 \text{ in}^3$

Bldg 2441 WIND BEAM CALCULATIONS



BEAM SELECTION

SECTION MODULUS  $S_{yy} = \frac{M \times 12 \text{ in/ft}}{24,000 \text{ psi}} = \frac{29.6 \text{ ft-K} \times 12 \text{ in/ft}}{24 \text{ KSI}} = 14.8 \text{ in}^3$   
 $S_{xx} = 18.9 \text{ in}^3$

|              | Depth         | $S_x$                       | $I_x$         | $S_y$       |
|--------------|---------------|-----------------------------|---------------|-------------|
| W 14 x 22    | 13.91"        | 29.0                        | 199.0         | 2.8         |
| MC 8 x 18.7  | 2.978"        | 1.97                        | 4.20          | 13.1        |
| <b>Total</b> | <b>16.89"</b> | <b>30.97 in<sup>3</sup></b> | <b>203.20</b> | <b>15.9</b> |

BEAM DEFLECTION

W 12 x 19 + MC 8 x 21.4

$\Delta = \frac{5 W L^3}{384 E I} = \frac{5 (11.6 \text{ K} + 0.6 \text{ K} + 0.5 \text{ K}) (312 \text{ in})^3}{384 (29,000 \text{ ksi}) I}$   
 $\Rightarrow \Delta = 0.8522 \text{ in}$

ALLOWED  $\Delta = \frac{1}{360} \times L = \frac{1}{360} \times 312 \text{ in} = 0.8667 \text{ in} \therefore \text{OK}$

***FY2008 MILCON P-210  
N4412  
SOF RIVERINE AND COMBATANT  
CRAFT OPERATIONS FACILITY***

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

***BDLG. 2442  
MASONRY DESIGN***

April 15, 2009

*Prepared by:*  
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STENNIS RIVERINE

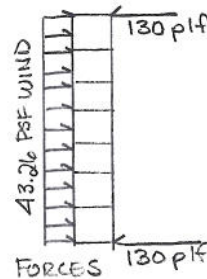
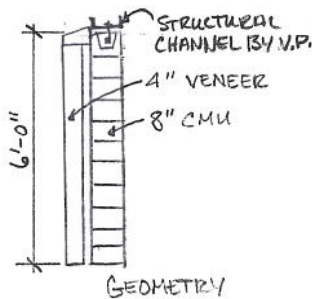
DESIGN OF REINFORCED CMU NON LOADBEARING WALL FOR FLEXURE  
BLDG 2442 ALL EXTERIOR MASONRY WALLS

MATERIALS:

UNIT STRENGTH 2,150 psi  
MORTAR TYPE N  
 $f'_m$  1,500 psi  
 $E_m$   $1.9 \times 10^6$  psi  
 $n$  (modular ratio) 15.26  
REINFORCEMENT GRADE 60

LOADING:

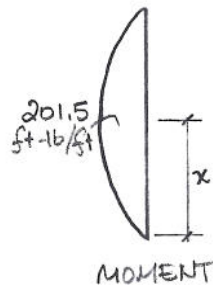
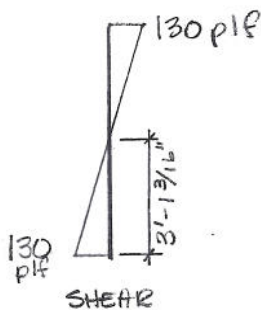
WIND 130 MPH = 43.26 psf  
NEGLECT SELF WEIGHT



REACTIONS:

$$R_r = \text{REACTION @ WIND ROOM} = \frac{(43.26 \text{ psf} \cdot (6 \text{ ft})^2)}{2} = 129.9$$

$$R_f = \text{REACTION @ SLAB} = \frac{(43.26 \text{ psf} \cdot (6 \text{ ft})^2)}{2} = 129.9 \text{ plf}$$



$$x = \frac{130 \text{ plf}}{43.26 \text{ psf}} = 3.1' = 3' - 1 \frac{3}{16}"$$

$$M = 130 \text{ plf} \cdot \left(\frac{3.1'}{2}\right) = 201.5 \text{ ft-lb./ft.}$$

ESTIMATE REINFORCEMENTS:

TRY 8" CMU, ASSUME STEEL @ MID-DEPTH.

$d =$  CENTROID OF STEEL = 3.8", ASSUME  $j = 1$  FOR INITIAL ESTIMATE

$$A_s = \frac{M}{F_s \cdot j \cdot d} = \frac{201.5 \text{ ft-lb.} \cdot 12 \text{ in/ft.}}{24000 \text{ psi} \cdot 1 \cdot 1.33 \cdot 3.8"} = 0.02 \text{ in}^2/\text{ft.}$$

TRY #4 @ 32" O.C.

$$A_{s \text{ provided}} = 0.20 \cdot \frac{12}{32} = 0.075 \text{ (REDUCE)}$$

TRY #4 @ 40" O.C.

$$A_{s \text{ prov.}} = 0.20 \cdot \left(\frac{12}{40}\right) = 0.06 \text{ (REDUCE)}$$

TRY #1 @ 48" O.C.

$$A_{s \text{ prov.}} = 0.20 \cdot \left(\frac{12}{48}\right) = 0.05 \text{ in}^2/\text{ft.}$$

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CHECK STRENGTH: (USING 24" WIDE STRIP)

$$\text{DESIGN MOMENT} = 201.5 \cdot 2' = 403 \text{ ft-lb/ft}$$

$$p = \frac{A_s}{bd} = \frac{0.20 \text{ in}^2/\text{ft}}{24 \text{ in} \cdot 3.8 \text{ in.}} = 0.002$$

$$np = 15.26 \cdot 0.002 = 0.035$$

$$K^2 + 2pnk - 2pn = 0 \Rightarrow K^2 + 2(0.03)K - 2(0.03) = 0 \Rightarrow K^2 + 0.06K - 0.06$$

$$\frac{-0.06 \pm \sqrt{(0.06)^2 - 4(1)(-0.06)}}{2} = \frac{-0.06 \pm 0.49}{2} = 0.215 = K \quad \text{Now } j = \left(1 - \frac{K}{\phi}\right) = 0.928$$

ALLOWABLE TENSION FLEXURAL CAPACITY:

$$M_t = A_s \cdot j \cdot d \cdot F_s = (0.05 \text{ in}^2/\text{ft}) \cdot 0.928 \cdot 3.8 \cdot 24000 \text{ psi} \cdot \frac{1.33}{12 \text{ in/ft}} = 469 \text{ ft-lb/ft.}$$

$$469 \text{ ft-lb/ft} > 201.5 \text{ ft-lb/ft.} \quad \text{OK}$$

ALLOWABLE COMPRESSION FLEXURAL CAPACITY:

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

$$M_m = \frac{b \cdot d^2}{2} \cdot K \cdot j \cdot F_b = \frac{24 \text{ in} \cdot (3.8)^2}{2} \cdot 0.215 \cdot 0.928 \cdot \frac{665 \text{ psi}}{12 \text{ in/ft}} = 1916 \text{ ft-lb/ft.}$$

$$1916 \text{ ft-lb/ft.} > 201.5 \text{ ft-lb/ft.} \quad \text{OK}$$

USE #4 REBAR @ 48" o.c.

ANCHORAGE

USE #4 BOWEL, GRADE 60  $l_d$  = REQ'D DEVELOPMENT LENGTH

$$l_d = \frac{0.13 \cdot d_b^2 \cdot f \cdot \gamma}{K \cdot \sqrt{f'_m}} = \frac{0.13 \cdot 0.5^2 \cdot 60,000 \cdot 1}{5(0.5) \cdot \sqrt{1500}} = 20.1" = 20 - 3/32"$$

$$l_e = 13 d_b = 6.5"$$

SPLICES

THE MINIMUM LENGTH OF LAP FOR SPLICES SHALL BE EQUAL TO  $l_d = 20.1"$

VENEER WALL CONNECTION

USE "POS-1-TIE" TAPCON SCREW FOR CHU EMBED. @ 8" VERTICAL O.C. AND 16" HORIZ. ON CENTER. MIN. EMBEDMENT LENGTH 1-3/4".

USE 3/16" x 3" STAINLESS STEEL TRIANGLE WIRE TIES @ EA. CONNECTION. SEE ATTACHED PRODUCT SHEET.

HORIZONTAL JOINT REINFORCEMENT

USE HECKMANN #110085 STAINLESS STEEL LADDER-TYPE MASONRY WALL REINFORCEMENT @ EVERY OTHER COURSE. SEE ATTACHED PRODUCT SHEET.

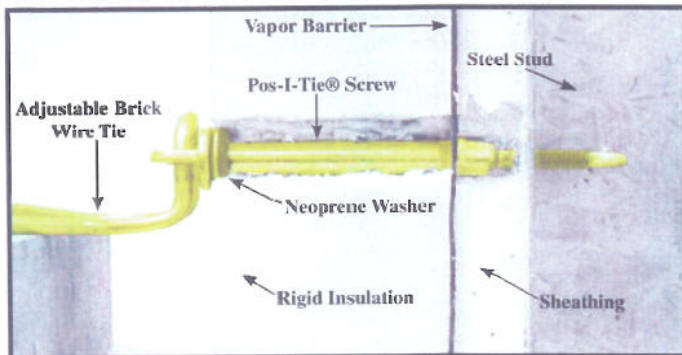


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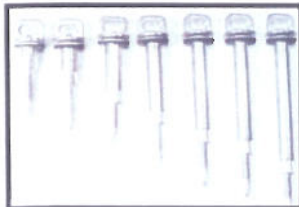
## ARCHITECTURAL SPECIFICATION INFORMATION

# 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

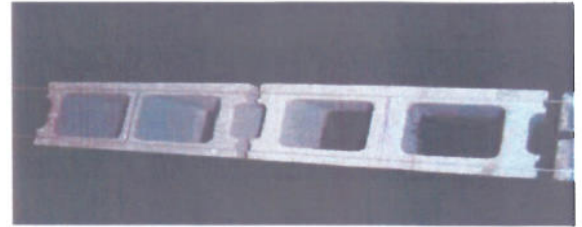
Special sizes and lengths are available.

- 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>)

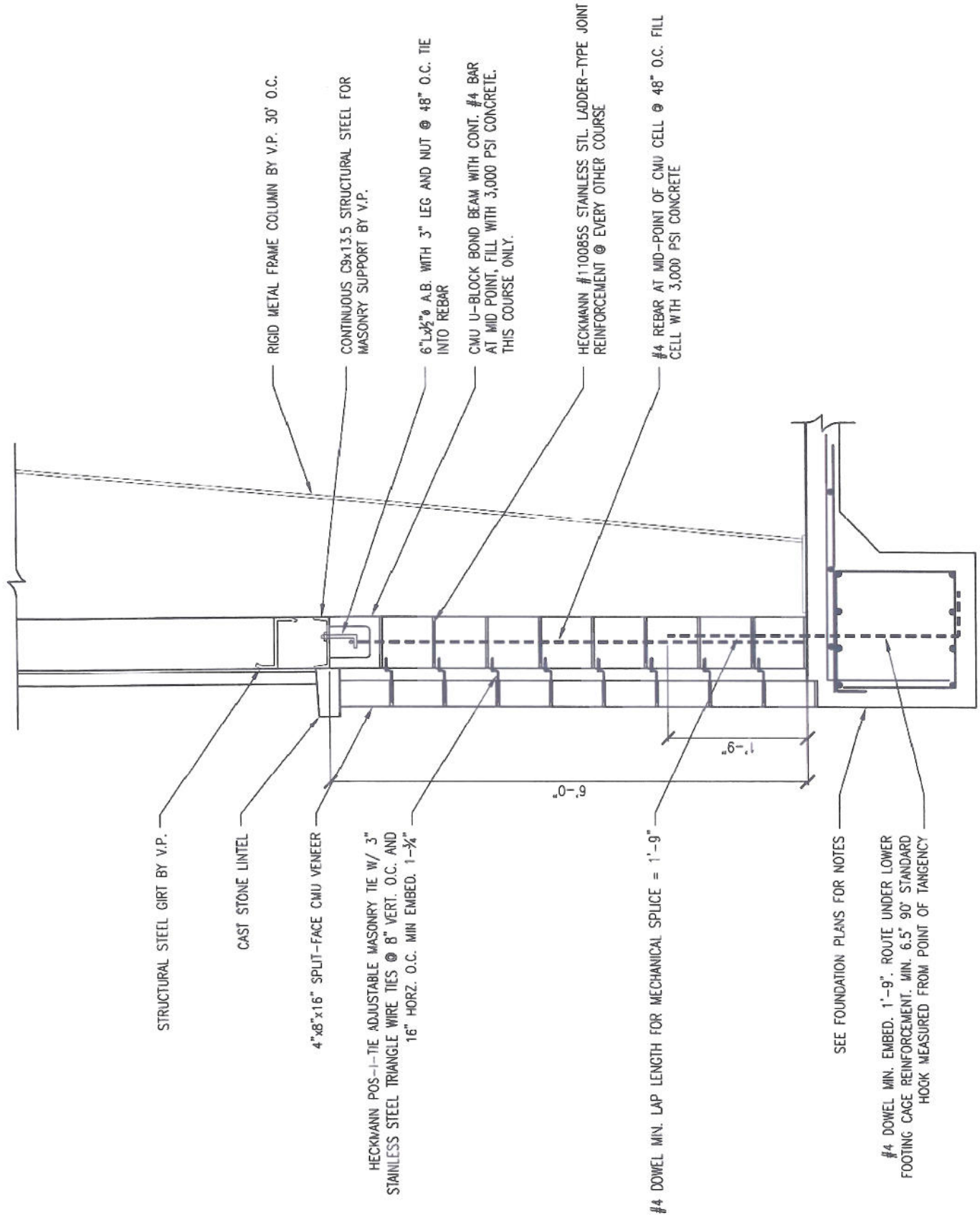
**Mill Galvanized:**

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:



STRUCTURAL STEEL GIRT BY V.P.

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"

RIGID METAL FRAME COLUMN BY V.P. 30' O.C.

CONTINUOUS C9x13.5 STRUCTURAL STEEL FOR MASONRY SUPPORT BY V.P.

6"x2" A.B. WITH 3" LEG AND NUT @ 48" O.C. TIE INTO REBAR

CMU U-BLOCK BOND BEAM WITH CONT. #4 BAR AT MID POINT. FILL WITH 3,000 PSI CONCRETE. THIS COURSE ONLY.

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

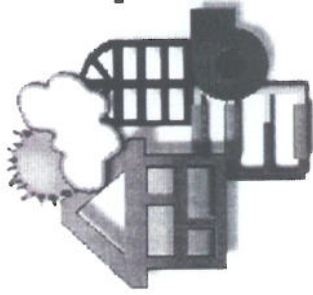
#4 REBAR AT MID-POINT OF CMU CELL @ 48" O.C. FILL CELL WITH 3,000 PSI CONCRETE

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

SEE FOUNDATION PLANS FOR NOTES

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

**8" CMU WALL WITH 4" CMU VENEER DETAIL**  
N.T.S.



# TRACE® Load 700 version 3.0

By Professional Engineering Services



**Project Name:** SBT 22 Riverine Operations and Training Facility

**Dataset Name:** C:\CDS\LOAD32\PROJECTS\Stennis Riverine FINAL.LDS

**Location:** Stennis Space Center, MS

**Building Owner:** NAVFAC / NASA / SPECWAR

**Program User:** Damien W. Serauskas, P.E.

**Company:** Professional Engineering Services

**Comments:**

**Location:** Keesler AFB, Mississippi

**Latitude:** 30.0 deg

**Longitude:** 89.0 deg

**Time Zone:** 6

**Elevation:** 26 ft

**Barometric Pressure:** 29.9 in. Hg

**Air Density:** 0.0760 lb/cu ft

**Air Specific Heat:** 0.2444 Btu/lb·°F

**Density-Specific Heat Product:** 1.1144 Btu/h·cfm·°F

**Latent Heat Factor:** 4,905.3 Btu·min/h·cu ft

**Enthalpy Factor:** 4.5588 lb·min/hr·cu ft

**Summer Design Dry Bulb:** 92 °F

**Summer Design Wet Bulb:** 82 °F

**Winter Design Dry Bulb:** 31 °F

**Summer Clearness Number:** 0.90

**Winter Clearness Number:** 0.90

**Summer Ground Reflectance:** 0.20

**Winter Ground Reflectance:** 0.20

**Design Simulation Period:** January through December

**Cooling Load Methodology:** TETD-TA1

**Heating Load Methodology:** UATD

# System Checksums

By Professional Engineering Services

Stennis 1st FI Cages

Single Zone

| Peaked at Time:<br>Outside Air: | COOLING COIL PEAK        |                       |                     |                 | CLG SPACE PEAK            |                      |                      |                  | HEATING COIL PEAK        |                      |                          |                      |
|---------------------------------|--------------------------|-----------------------|---------------------|-----------------|---------------------------|----------------------|----------------------|------------------|--------------------------|----------------------|--------------------------|----------------------|
|                                 | Mo/Hr: 8 / 17            | Mo/Hr: 7 / 24         | Mo/Hr: 13 / 1       | Mo/Hr: 31       | OADB/WB/HR: 91 / 81 / 147 | OADB: 82             | OADB: 31             | OADB: 31         |                          |                      |                          |                      |
|                                 | Space Sens. + Lat. Btu/h | Plenum Sensible Btu/h | Plenum Latent Btu/h | Net Total Btu/h | Percent Of Total (%)      | Space Sensible Btu/h | Percent Of Total (%) | Space Peak Btu/h | Coil Peak Tot Sens Btu/h | Percent Of Total (%) | Coil Peak Tot Sens Btu/h | Percent Of Total (%) |
| <b>Envelope Loads</b>           |                          |                       |                     |                 |                           |                      |                      |                  |                          |                      |                          |                      |
| Skyliite Solr                   | 0                        | 0                     | 0                   | 0               | 0.00                      | 0                    | 0.00                 | 0                | 0                        | 0.00                 | 0                        | 0.00                 |
| Skyliite Cond                   | 0                        | 0                     | 0                   | 0               | 0.00                      | 0                    | 0.00                 | 0                | 0                        | 0.00                 | 0                        | 0.00                 |
| Roof Cond                       | 0                        | 0                     | 0                   | 0               | 0.00                      | 0                    | 0.00                 | 0                | 0                        | 0.00                 | 0                        | 0.00                 |
| Glass Solar                     | 0                        | 0                     | 0                   | 0               | 0.00                      | 0                    | 0.00                 | 0                | 0                        | 0.00                 | 0                        | 0.00                 |
| Glass Cond                      | 0                        | 0                     | 0                   | 0               | 0.00                      | 0                    | 0.00                 | 0                | 0                        | 0.00                 | 0                        | 0.00                 |
| Wall Cond                       | 3,587                    | 973                   | 0                   | 4,560           | 4.32                      | 4,698                | 13.09                | -6,529           | -8,300                   | 10.78                | -8,300                   | 10.78                |
| Partition                       | 1,131                    | 0                     | 0                   | 1,131           | 1.07                      | 816                  | 2.27                 | -2,750           | -2,750                   | 3.57                 | -2,750                   | 3.57                 |
| Exposed Floor                   | 0                        | 0                     | 0                   | 0               | 0.00                      | 0                    | 0.00                 | 0                | 0                        | 0.00                 | 0                        | 0.00                 |
| Infiltration                    | 0                        | 0                     | 0                   | 0               | 0.00                      | 0                    | 0.00                 | 0                | 0                        | 0.00                 | 0                        | 0.00                 |
| <b>Sub Total ==&gt;</b>         | <b>4,718</b>             | <b>973</b>            | <b>0</b>            | <b>5,691</b>    | <b>5.39</b>               | <b>5,515</b>         | <b>15.36</b>         | <b>-9,279</b>    | <b>-11,050</b>           | <b>14.35</b>         | <b>-11,050</b>           | <b>14.35</b>         |
| <b>Internal Loads</b>           |                          |                       |                     |                 |                           |                      |                      |                  |                          |                      |                          |                      |
| Lights                          | 28,505                   | 0                     | 0                   | 28,505          | 26.99                     | 28,505               | 79.40                | 0                | 0                        | 0.00                 | 0                        | 0.00                 |
| People                          | 2,500                    | 0                     | 0                   | 2,500           | 2.37                      | 1,250                | 3.48                 | 0                | 0                        | 0.00                 | 0                        | 0.00                 |
| Misc                            | 0                        | 0                     | 0                   | 0               | 0.00                      | 0                    | 0.00                 | 0                | 0                        | 0.00                 | 0                        | 0.00                 |
| <b>Sub Total ==&gt;</b>         | <b>31,005</b>            | <b>0</b>              | <b>0</b>            | <b>31,005</b>   | <b>29.36</b>              | <b>29,755</b>        | <b>82.88</b>         | <b>0</b>         | <b>0</b>                 | <b>0.00</b>          | <b>0</b>                 | <b>0.00</b>          |
| <b>Ceiling Load</b>             | <b>482</b>               | <b>-482</b>           | <b>0</b>            | <b>0</b>        | <b>0.00</b>               | <b>632</b>           | <b>1.76</b>          | <b>-878</b>      | <b>0</b>                 | <b>0.00</b>          | <b>0</b>                 | <b>0.00</b>          |
| <b>Outside Air</b>              | <b>0</b>                 | <b>0</b>              | <b>0</b>            | <b>68,469</b>   | <b>64.83</b>              | <b>0</b>             | <b>0.00</b>          | <b>0</b>         | <b>-37,108</b>           | <b>48.20</b>         | <b>-37,108</b>           | <b>48.20</b>         |
| Sup. Fan Heat                   | 0                        | 0                     | 0                   | 716             | 0.68                      | 0                    | 0.00                 | 0                | 0                        | 0.00                 | 0                        | 0.00                 |
| Ret. Fan Heat                   | 0                        | 0                     | 0                   | 0               | 0.00                      | 0                    | 0.00                 | 0                | 0                        | 0.00                 | 0                        | 0.00                 |
| Duct Heat PkUp                  | 0                        | 0                     | 0                   | 0               | 0.00                      | 0                    | 0.00                 | 0                | 0                        | 0.00                 | 0                        | 0.00                 |
| OV/UNDR Sizing                  | 0                        | 0                     | 0                   | 0               | 0.00                      | 0                    | 0.00                 | -29,335          | -29,335                  | 38.10                | -29,335                  | 38.10                |
| Exhaust Heat                    | 0                        | -274                  | 0                   | -274            | -0.26                     | 0                    | 0.00                 | 499              | 499                      | -0.65                | 499                      | -0.65                |
| Terminal Bypass                 | 0                        | 0                     | 0                   | 0               | 0.00                      | 0                    | 0.00                 | 0                | 0                        | 0.00                 | 0                        | 0.00                 |
| <b>Grand Total ==&gt;</b>       | <b>36,206</b>            | <b>217</b>            | <b>0</b>            | <b>105,608</b>  | <b>100.00</b>             | <b>35,902</b>        | <b>100.00</b>        | <b>-39,492</b>   | <b>-76,994</b>           | <b>100.00</b>        | <b>-76,994</b>           | <b>100.00</b>        |

| TEMPERATURES |      |      |  |
|--------------|------|------|--|
| SADB         | Clq  | Htg  |  |
| Plenum       | 55.0 | 90.0 |  |
| Return       | 75.3 | 67.5 |  |
| Ret/OA       | 75.3 | 67.5 |  |
| Fn MirTD     | 84.1 | 47.1 |  |
| Fn BidTD     | 0.0  | 0.0  |  |
| Fn Frict     | 0.1  | 0.0  |  |
|              | 0.3  | 0.0  |  |

| AIRFLOWS |         |         |  |
|----------|---------|---------|--|
| Vent     | Cooling | Heating |  |
| Infil    | 900     | 900     |  |
| Supply   | 0       | 0       |  |
| Mincfm   | 1,611   | 1,611   |  |
| Return   | 1,611   | 1,611   |  |
| Exhaust  | 900     | 900     |  |
| Rm Exh   | 0       | 0       |  |
| Auxil    | 0       | 0       |  |

| ENGINEERING CKS |         |         |  |
|-----------------|---------|---------|--|
| % OA            | Cooling | Heating |  |
| cfm/ft²         | 55.9    | 55.9    |  |
| cfm/ton         | 0.29    | 0.29    |  |
| ft²/ton         | 183.04  |         |  |
| Btu/hr-ft²      | 632.68  |         |  |
| No. People      | 18.97   | -13.83  |  |
|                 | 5       |         |  |

| HEATING COIL SELECTION |              |            |            |
|------------------------|--------------|------------|------------|
| Capacity               | Coil Airfl   | Ent        | Lvg        |
| MBh                    | cfm          | °F         | °F         |
| -77.0                  | 1,611        | 47.1       | 90.0       |
| Main Htg               | 0.0          | 0.0        | 0.0        |
| Aux Htg                | 0.0          | 0.0        | 0.0        |
| Preheat                | -13.5        | 1,611      | 47.1       |
| Reheat                 | 0.0          | 0.0        | 0.0        |
| Humidif                | 0.0          | 0.0        | 0.0        |
| Opt Vent               | 0.0          | 0.0        | 0.0        |
| <b>Total</b>           | <b>-77.0</b> | <b>0.0</b> | <b>0.0</b> |

| AREAS       |       |     |
|-------------|-------|-----|
| Gross Total | Glass | (%) |
| 5,568       | ft²   |     |
| Floor       |       |     |
| Part        | 252   |     |
| ExFlr       | 0     |     |
| Roof        | 0     |     |
| Wall        | 2,754 |     |

| COOLING COIL SELECTION |            |              |                  |
|------------------------|------------|--------------|------------------|
| Total Capacity         | Sens Cap.  | Coil Airfl   | Enter DB/WB/HR   |
| ton                    | MBh        | cfm          | °F °F            |
| 8.8                    | 105.6      | 1,611        | 84.1 73.9        |
| Main Clq               | 52.0       | 0            | 110.4            |
| Aux Clq                | 0.0        | 0            | 0.0              |
| Opt Vent               | 0.0        | 0            | 0.0              |
| <b>Total</b>           | <b>8.8</b> | <b>105.6</b> | <b>54.6 54.6</b> |

# System Checksums

By Professional Engineering Services

Variable Volume Reheat (30% Min Flow Default)

Stennis 2nd Floor VAV

| Peaked at Time:<br>Outside Air: | COOLING COIL PEAK     |                           |                      | CLG SPACE PEAK          |                         |                       | HEATING COIL PEAK       |                      |                       |                         |                     |                        |
|---------------------------------|-----------------------|---------------------------|----------------------|-------------------------|-------------------------|-----------------------|-------------------------|----------------------|-----------------------|-------------------------|---------------------|------------------------|
|                                 | Mo/Hr: 8 / 16         | OADB/WB/HR: 92 / 81 / 145 | Mo/Hr: 8 / 16        | OADB: 92                | Mo/Hr: 13 / 1           | OADB: 31              |                         |                      |                       |                         |                     |                        |
| <b>Envelope Loads</b>           | <b>Space Sensible</b> | <b>Plenum Sensible</b>    | <b>Plenum Latent</b> | <b>Net Total</b>        | <b>Percent Of Total</b> | <b>Space Sensible</b> | <b>Percent Of Total</b> | <b>Space Peak</b>    | <b>Coil Peak</b>      | <b>Percent Of Total</b> |                     |                        |
| Skylite Solr                    | 0                     | 0                         | 0                    | 0                       | 0.00                    | 0                     | 0.00                    | 0                    | 0                     | 0.00                    |                     |                        |
| Skylite Cond                    | 0                     | 0                         | 0                    | 0                       | 0.00                    | 0                     | 0.00                    | 0                    | 0                     | 0.00                    |                     |                        |
| Roof Cond                       | 0                     | 43.661                    | 0                    | 43.661                  | 15.64                   | 0                     | 0.00                    | 0                    | -18.792               | 20.63                   |                     |                        |
| Glass Solar                     | 30.786                | 0                         | 0                    | 30.786                  | 11.03                   | 30.786                | 24.43                   | 0                    | 0                     | 0.00                    |                     |                        |
| Glass Cond                      | 6.457                 | 0                         | 0                    | 6.457                   | 2.31                    | 6.457                 | 5.12                    | -15.488              | -15.488               | 17.00                   |                     |                        |
| Wall Cond                       | 3.630                 | 592                       | 0                    | 4.223                   | 1.51                    | 3.630                 | 2.88                    | -5.957               | -7.227                | 7.93                    |                     |                        |
| Partition                       | 1.838                 | 0                         | 0                    | 1.838                   | 0.66                    | 1.838                 | 1.46                    | -4.726               | -4.726                | 5.19                    |                     |                        |
| Exposed Floor                   | 0                     | 0                         | 0                    | 0                       | 0.00                    | 0                     | 0.00                    | 0                    | 0                     | 0.00                    |                     |                        |
| Infiltration                    | 0                     | 0                         | 0                    | 0                       | 0.00                    | 0                     | 0.00                    | -1                   | -1                    | 0.00                    |                     |                        |
| <b>Sub Total ==&gt;</b>         | <b>42.711</b>         | <b>44.253</b>             | <b>0</b>             | <b>86.964</b>           | <b>31.15</b>            | <b>42.711</b>         | <b>33.89</b>            | <b>-26.172</b>       | <b>-46.233</b>        | <b>50.75</b>            |                     |                        |
| <b>Internal Loads</b>           | <b>Lights</b>         | <b>People</b>             | <b>Misc</b>          | <b>Sub Total ==&gt;</b> | <b>Ceiling Load</b>     | <b>Outside Air</b>    | <b>Sup. Fan Heat</b>    | <b>Ret. Fan Heat</b> | <b>Duct Heat Pkup</b> | <b>OV/UNDR Sizing</b>   | <b>Exhaust Heat</b> | <b>Terminal Bypass</b> |
| Lights                          | 24.481                | 16.389                    | 0                    | 40.870                  | 14.64                   | 24.481                | 19.43                   | 0                    | 0                     | 0.00                    | 0                   | 0                      |
| People                          | 65.000                | 0                         | 0                    | 65.000                  | 23.28                   | 32.500                | 25.79                   | 0                    | 0                     | 0.00                    | 0                   | 0                      |
| Misc                            | 9.015                 | 0                         | 0                    | 9.015                   | 3.23                    | 9.015                 | 7.15                    | 0                    | 0                     | 0.00                    | 0                   | 0                      |
| <b>Sub Total ==&gt;</b>         | <b>98.495</b>         | <b>16.389</b>             | <b>0</b>             | <b>114.885</b>          | <b>41.15</b>            | <b>65.995</b>         | <b>52.37</b>            | <b>0</b>             | <b>0</b>              | <b>0.00</b>             | <b>0</b>            | <b>0</b>               |
| <b>Ceiling Load</b>             | <b>16.445</b>         | <b>-16.445</b>            | <b>0</b>             | <b>0</b>                | <b>0.00</b>             | <b>17.316</b>         | <b>13.74</b>            | <b>-11.174</b>       | <b>-42.354</b>        | <b>46.49</b>            |                     |                        |
| <b>Outside Air</b>              | <b>0</b>              | <b>0</b>                  | <b>0</b>             | <b>80.559</b>           | <b>28.85</b>            | <b>4.991</b>          | <b>1.79</b>             | <b>0</b>             | <b>0</b>              | <b>0.00</b>             |                     |                        |
| <b>Sup. Fan Heat</b>            | <b>0</b>              | <b>0</b>                  | <b>0</b>             | <b>0</b>                | <b>0.00</b>             | <b>0</b>              | <b>0.00</b>             | <b>0</b>             | <b>0</b>              | <b>0.00</b>             |                     |                        |
| <b>Ret. Fan Heat</b>            | <b>0</b>              | <b>0</b>                  | <b>0</b>             | <b>0</b>                | <b>0.00</b>             | <b>0</b>              | <b>0.00</b>             | <b>0</b>             | <b>0</b>              | <b>0.00</b>             |                     |                        |
| <b>Duct Heat Pkup</b>           | <b>0</b>              | <b>0</b>                  | <b>0</b>             | <b>0</b>                | <b>0.00</b>             | <b>0</b>              | <b>0.00</b>             | <b>-7.545</b>        | <b>-7.545</b>         | <b>8.28</b>             |                     |                        |
| <b>OV/UNDR Sizing</b>           | <b>0</b>              | <b>0</b>                  | <b>0</b>             | <b>-8.190</b>           | <b>-2.93</b>            | <b>0</b>              | <b>0.00</b>             | <b>5.025</b>         | <b>5.025</b>          | <b>-5.52</b>            |                     |                        |
| <b>Exhaust Heat</b>             | <b>0</b>              | <b>0</b>                  | <b>0</b>             | <b>0</b>                | <b>0.00</b>             | <b>0</b>              | <b>0.00</b>             | <b>0</b>             | <b>0</b>              | <b>0.00</b>             |                     |                        |
| <b>Terminal Bypass</b>          | <b>0</b>              | <b>0</b>                  | <b>0</b>             | <b>0</b>                | <b>0.00</b>             | <b>0</b>              | <b>0.00</b>             | <b>-44.892</b>       | <b>-44.892</b>        | <b>100.00</b>           |                     |                        |
| <b>Grand Total ==&gt;</b>       | <b>157.651</b>        | <b>36.007</b>             | <b>0</b>             | <b>279.210</b>          | <b>100.00</b>           | <b>126.023</b>        | <b>100.00</b>           | <b>-44.892</b>       | <b>-91.108</b>        | <b>100.00</b>           |                     |                        |

### TEMPERATURES

|           |      |      |
|-----------|------|------|
| SADB      | Clq  | Hta  |
| Plenum    | 55.0 | 90.0 |
| Return    | 81.5 | 63.6 |
| Ret/OA    | 81.5 | 63.6 |
| Fn MtrTD  | 83.6 | 45.3 |
| Fn BltdTD | 0.1  | 0.0  |
| Fn Frict  | 0.2  | 0.0  |
|           | 0.5  | 0.0  |

### AIRFLOWS

|         |         |         |
|---------|---------|---------|
| Vent    | Cooling | Heating |
| Infil   | 1.131   | 1.027   |
| Supply  | 0       | 0       |
| Mincfm  | 5.655   | 1.831   |
| Return  | 1.831   | 1.831   |
| Exhaust | 5.655   | 1.831   |
| Rm Exh  | 1.131   | 1.027   |
| Auxil   | 0       | 0       |

### ENGINEERING CKS

|            |         |         |
|------------|---------|---------|
| % OA       | Cooling | Heating |
| cfm/ft²    | 20.0    | 56.1    |
| cfm/ton    | 0.71    | 0.23    |
| ft²/ton    | 243.02  |         |
|            | 343.10  |         |
| Btu/hr-ft² | 34.97   | -12.75  |
| No. People |         | 130     |

### HEATING COIL SELECTION

|              |               |          |            |
|--------------|---------------|----------|------------|
| Capacity     | Coil Airfl    | Ent      | Lva        |
| MBh          | cfm           | °F       | °F         |
| Main Hta     | -72.6         | 1.831    | 54.4       |
| Aux Hta      | 0.0           | 0        | 0.0        |
| Preheat      | -29.2         | 1.131    | 31.0       |
| Reheat       | -26.5         | 1.831    | 55.0       |
| Humidif      | 0.0           | 0        | 0.0        |
| Opt Vent     | 0.0           | 0        | 0.0        |
| <b>Total</b> | <b>-101.8</b> | <b>0</b> | <b>0.0</b> |

### AREAS

|             |       |
|-------------|-------|
| Gross Total | Glass |
| ft²         | (%)   |
| Floor       | 7.983 |
| Part        | 433   |
| ExFlr       | 0     |
| Roof        | 6.949 |
| Wall        | 3.560 |
|             | 364   |
|             | 10    |

### COOLING COIL SELECTION

|                |             |              |                |                |
|----------------|-------------|--------------|----------------|----------------|
| Total Capacity | Sens Cap.   | Coil Airfl   | Enter DB/WB/HR | Leave DB/WB/HR |
| ton            | MBh         | cfm          | °F             | °F             |
| Main Clq       | 23.3        | 279.2        | 187.4          | 5.615          |
| Aux Clq        | 0.0         | 0.0          | 0.0            | 0.0            |
| Opt Vent       | 0.0         | 0.0          | 0.0            | 0.0            |
| <b>Total</b>   | <b>23.3</b> | <b>279.2</b> | <b>187.4</b>   | <b>5.615</b>   |

# System Checksums

By Professional Engineering Services

## 2441 Boat Staging

## Unit Heaters

|                 | COOLING COIL PEAK  |                 |               |             | CLG SPACE PEAK |                |                |             | HEATING COIL PEAK  |                  |                  |                  |                  |
|-----------------|--------------------|-----------------|---------------|-------------|----------------|----------------|----------------|-------------|--------------------|------------------|------------------|------------------|------------------|
|                 | Mo/Hr              | Mo/Hr           | Mo/Hr         | Mo/Hr       | Mo/Hr          | Mo/Hr          | Mo/Hr          | Mo/Hr       | Mo/Hr              | Mo/Hr            | Mo/Hr            | Mo/Hr            | Mo/Hr            |
| Peaked at Time: | 0 / 0              | 0 / 0           | 0 / 0         | 0 / 0       | 0 / 0          | 0 / 0          | 0 / 0          | 0 / 0       | 0 / 0              | 13 / 1           | 13 / 1           | 13 / 1           | 13 / 1           |
| Outside Air:    | OADB/WB/HR:        | OADB/WB/HR:     | OADB/WB/HR:   | OADB/WB/HR: | OADB/WB/HR:    | OADB/WB/HR:    | OADB/WB/HR:    | OADB/WB/HR: | OADB/WB/HR:        | OADB             | OADB             | OADB             | OADB             |
|                 | Space Sens. + Lat. | Plenum Sensible | Plenum Latent | Net Total   | Space Sensible | Space Sensible | Space Sensible | Space Peak  | Coil Peak Tot Sens | Percent Of Total | Percent Of Total | Percent Of Total | Percent Of Total |
|                 | Btu/h              | Btu/h           | Btu/h         | Btu/h       | Btu/h          | Btu/h          | Btu/h          | Btu/h       | Btu/h              | (%)              | (%)              | (%)              | (%)              |
| Envelope Loads  | 0                  | 0               | 0             | 0           | 0              | 0              | 0              | 0           | 0                  | 0.00             | 0.00             | 0.00             | 0.00             |
| Skyliite Solr   | 0                  | 0               | 0             | 0           | 0              | 0              | 0              | 0           | 0                  | 0.00             | 0.00             | 0.00             | 0.00             |
| Skyliite Cond   | 0                  | 0               | 0             | 0           | 0              | 0              | 0              | 0           | 0                  | 0.00             | 0.00             | 0.00             | 0.00             |
| Roof Cond       | 0                  | 0               | 0             | 0           | 0              | 0              | 0              | 0           | -4.901             | 11.90            | 11.90            | 11.90            | 11.90            |
| Glass Solar     | 0                  | 0               | 0             | 0           | 0              | 0              | 0              | 0           | 0                  | 0.00             | 0.00             | 0.00             | 0.00             |
| Glass Cond      | 0                  | 0               | 0             | 0           | 0              | 0              | 0              | 0           | 0                  | 0.00             | 0.00             | 0.00             | 0.00             |
| Wall Cond       | 0                  | 0               | 0             | 0           | 0              | 0              | 0              | 0           | 0                  | 0.00             | 0.00             | 0.00             | 0.00             |
| Partition       | 0                  | 0               | 0             | 0           | 0              | 0              | 0              | 0           | 0                  | 0.00             | 0.00             | 0.00             | 0.00             |
| Exposed Floor   | 0                  | 0               | 0             | 0           | 0              | 0              | 0              | 0           | -6.052             | 17.11            | 17.11            | 17.11            | 17.11            |
| Infiltration    | 0                  | 0               | 0             | 0           | 0              | 0              | 0              | 0           | 0                  | 0.00             | 0.00             | 0.00             | 0.00             |
| Sub Total ==>   | 0                  | 0               | 0             | 0           | 0              | 0              | 0              | 0           | -29.223            | 70.99            | 70.99            | 70.99            | 70.99            |
| Internal Loads  | 0                  | 0               | 0             | 0           | 0              | 0              | 0              | 0           | -41.165            | 100.00           | 100.00           | 100.00           | 100.00           |
| Lights          | 0                  | 0               | 0             | 0           | 0              | 0              | 0              | 0           | 0                  | 0.00             | 0.00             | 0.00             | 0.00             |
| People          | 0                  | 0               | 0             | 0           | 0              | 0              | 0              | 0           | 0                  | 0.00             | 0.00             | 0.00             | 0.00             |
| Misc            | 0                  | 0               | 0             | 0           | 0              | 0              | 0              | 0           | 0                  | 0.00             | 0.00             | 0.00             | 0.00             |
| Sub Total ==>   | 0                  | 0               | 0             | 0           | 0              | 0              | 0              | 0           | -5.890             | 0.00             | 0.00             | 0.00             | 0.00             |
| Ceiling Load    | 0                  | 0               | 0             | 0           | 0              | 0              | 0              | 0           | 0                  | 0.00             | 0.00             | 0.00             | 0.00             |
| Outside Air     | 0                  | 0               | 0             | 0           | 0              | 0              | 0              | 0           | 0                  | 0.00             | 0.00             | 0.00             | 0.00             |
| Sup. Fan Heat   | 0                  | 0               | 0             | 0           | 0              | 0              | 0              | 0           | 0                  | 0.00             | 0.00             | 0.00             | 0.00             |
| Ret. Fan Heat   | 0                  | 0               | 0             | 0           | 0              | 0              | 0              | 0           | 0                  | 0.00             | 0.00             | 0.00             | 0.00             |
| Duct Heat PKup  | 0                  | 0               | 0             | 0           | 0              | 0              | 0              | 0           | 0                  | 0.00             | 0.00             | 0.00             | 0.00             |
| OV/LNDR Sizing  | 0                  | 0               | 0             | 0           | 0              | 0              | 0              | 0           | 0                  | 0.00             | 0.00             | 0.00             | 0.00             |
| Exhaust Heat    | 0                  | 0               | 0             | 0           | 0              | 0              | 0              | 0           | 0                  | 0.00             | 0.00             | 0.00             | 0.00             |
| Terminal Bypass | 0                  | 0               | 0             | 0           | 0              | 0              | 0              | 0           | 0                  | 0.00             | 0.00             | 0.00             | 0.00             |
| Grand Total ==> | 0                  | 0               | 0             | 0           | 0              | 0              | 0              | -41.165     | -41.165            | 100.00           | 100.00           | 100.00           | 100.00           |

### TEMPERATURES

|          |     |      |
|----------|-----|------|
| SADB     | Clq | Htg  |
| Plenum   | 0.0 | 95.0 |
| Return   | 0.0 | 52.3 |
| Ret/OA   | 0.0 | 55.0 |
| Fn MtrTD | 0.0 | 55.0 |
| Fn BldTD | 0.1 | 0.1  |
| Fn Frict | 0.3 | 0.2  |

### AIRFLOWS

|         |         |         |
|---------|---------|---------|
| Vent    | Cooling | Heating |
| Infil   | 0       | 0       |
| Supply  | 0       | 1,093   |
| Mincfm  | 0       | 924     |
| Return  | 0       | 0       |
| Exhaust | 0       | 2,016   |
| Rm Exh  | 0       | 1,093   |
| Auxil   | 0       | 0       |

### ENGINEERING CKS

|            |         |         |
|------------|---------|---------|
| % OA       | Cooling | Heating |
| 0.0        | 0.0     | 0.0     |
| cfm/ft²    | 0.00    | 0.13    |
| cfm/ton    | 0.00    | 0.00    |
| ft³/ton    | 0.00    | 0.00    |
| Btu/hr-ft² | 0.00    | -5.97   |
| No. People |         | 6       |

### HEATING COIL SELECTION

|          |            |      |      |
|----------|------------|------|------|
| Capacity | Coil Airfl | Ent  | Lva  |
| MBh      | cfm        | °F   | °F   |
| -41.2    | 924        | 55.0 | 95.0 |
| Main Htg |            |      |      |
| Aux Htg  | 0.0        | 0.0  | 0.0  |
| Preheat  | 0.0        | 0.0  | 0.0  |
| Reheat   | 0.0        | 0.0  | 0.0  |
| Humidif  | 0.0        | 0.0  | 0.0  |
| Opt Vent | 0.0        | 0.0  | 0.0  |
| Total    | -41.2      |      |      |

### AREAS

|             |       |
|-------------|-------|
| Gross Total | Glass |
| ft²         | (%)   |
| 6,900       |       |
| Floor       |       |
| Part        | 0     |
| ExFlr       | 0     |
| Roof        | 6,900 |
| Wall        | 5,460 |

### COOLING COIL SELECTION

|                |           |            |               |               |
|----------------|-----------|------------|---------------|---------------|
| Total Capacity | Sens Cap. | Coil Airfl | Enter DBWB/HR | Leave DBWB/HR |
| ton            | MBh       | cfm        | °F            | °F            |
| 0.0            | 0.0       | 0          | 0.0           | 0.0           |
| Main Clq       |           |            |               |               |
| Aux Clq        | 0.0       | 0          | 0.0           | 0.0           |
| Opt Vent       | 0.0       | 0          | 0.0           | 0.0           |
| Total          | 0.0       | 0          | 0.0           | 0.0           |

# System Checksums

By Professional Engineering Services

## 2442 Boat Storage

## Unit Heaters

|  | COOLING COIL PEAK        |                       |                     |                 | CLG SPACE PEAK       |                      |                      |                      | HEATING COIL PEAK |                          |                                |             |          |
|--|--------------------------|-----------------------|---------------------|-----------------|----------------------|----------------------|----------------------|----------------------|-------------------|--------------------------|--------------------------------|-------------|----------|
|  | Space Sens. + Lat. Btu/h | Plenum Sensible Btu/h | Plenum Latent Btu/h | Net Total Btu/h | Space Sensible Btu/h | Percent Of Total (%) | Space Sensible Btu/h | Percent Of Total (%) | Space Peak Btu/h  | Coil Peak Tot Sens Btu/h | Coil Peak Percent Of Total (%) | Mo/Hr: 13/1 | OADB: 31 |
| Peaked at Time: Outside Air: OADB/WB/HR: 0/0/0 |                          |                       |                     |                 |                      |                      |                      |                      |                   |                          |                                |             |          |
| Envelope Loads                                 |                          |                       |                     |                 |                      |                      |                      |                      |                   |                          |                                |             |          |
| SkyLite Solr                                   | 0                        | 0                     | 0                   | 0               | 0                    | 0.00                 | 0                    | 0.00                 | 0                 | 0                        | 0.00                           |             |          |
| SkyLite Cond                                   | 0                        | 0                     | 0                   | 0               | 0                    | 0.00                 | 0                    | 0.00                 | 0                 | 0                        | 0.00                           |             |          |
| Roof Cond                                      | 0                        | 0                     | 0                   | 0               | 0                    | 0.00                 | 0                    | 0.00                 | -6.010            | 10.74                    | 0.00                           |             |          |
| Glass Solar                                    | 0                        | 0                     | 0                   | 0               | 0                    | 0.00                 | 0                    | 0.00                 | 0                 | 0.00                     | 0.00                           |             |          |
| Glass Cond                                     | 0                        | 0                     | 0                   | 0               | 0                    | 0.00                 | 0                    | 0.00                 | 0                 | 0.00                     | 0.00                           |             |          |
| Wall Cond                                      | 0                        | 0                     | 0                   | 0               | 0                    | 0.00                 | 0                    | 0.00                 | -11.791           | 24.49                    | 0.00                           |             |          |
| Partition                                      | 0                        | 0                     | 0                   | 0               | 0                    | 0.00                 | 0                    | 0.00                 | 0                 | 0.00                     | 0.00                           |             |          |
| Exposed Floor                                  | 0                        | 0                     | 0                   | 0               | 0                    | 0.00                 | 0                    | 0.00                 | 0                 | 0.00                     | 0.00                           |             |          |
| Infiltration                                   | 0                        | 0                     | 0                   | 0               | 0                    | 0.00                 | 0                    | 0.00                 | -36.222           | 64.76                    | 0.00                           |             |          |
| Sub Total ==>                                  | 0                        | 0                     | 0                   | 0               | 0                    | 0.00                 | 0                    | 0.00                 | -48.014           | 100.00                   | 0.00                           |             |          |
| Internal Loads                                 |                          |                       |                     |                 |                      |                      |                      |                      |                   |                          |                                |             |          |
| Lights   | 0                        | 0                     | 0                   | 0               | 0                    | 0.00                 | 0                    | 0.00                 | 0                 | 0.00                     | 0.00                           |             |          |
| People   | 0                        | 0                     | 0                   | 0               | 0                    | 0.00                 | 0                    | 0.00                 | 0                 | 0.00                     | 0.00                           |             |          |
| Misc   | 0                        | 0                     | 0                   | 0               | 0                    | 0.00                 | 0                    | 0.00                 | 0                 | 0.00                     | 0.00                           |             |          |
| Sub Total ==>                                  | 0                        | 0                     | 0                   | 0               | 0                    | 0.00                 | 0                    | 0.00                 | -7.917            | 0.00                     | 0.00                           |             |          |
| Ceiling Load                                   | 0                        | 0                     | 0                   | 0               | 0                    | 0.00                 | 0                    | 0.00                 | 0                 | 0.00                     | 0.00                           |             |          |
| Outside Air                                    | 0                        | 0                     | 0                   | 0               | 0                    | 0.00                 | 0                    | 0.00                 | 0                 | 0.00                     | 0.00                           |             |          |
| Sup. Fan Heat                                  | 0                        | 0                     | 0                   | 0               | 0                    | 0.00                 | 0                    | 0.00                 | 0                 | 0.00                     | 0.00                           |             |          |
| Ret. Fan Heat                                  | 0                        | 0                     | 0                   | 0               | 0                    | 0.00                 | 0                    | 0.00                 | 0                 | 0.00                     | 0.00                           |             |          |
| Duct Heat PkUp                                 | 0                        | 0                     | 0                   | 0               | 0                    | 0.00                 | 0                    | 0.00                 | 0                 | 0.00                     | 0.00                           |             |          |
| OV/UNDR Sizing                                 | 0                        | 0                     | 0                   | 0               | 0                    | 0.00                 | 0                    | 0.00                 | 0                 | 0.00                     | 0.00                           |             |          |
| Exhaust Heat                                   | 0                        | 0                     | 0                   | 0               | 0                    | 0.00                 | 0                    | 0.00                 | 0                 | 0.00                     | 0.00                           |             |          |
| Terminal Bypass                                | 0                        | 0                     | 0                   | 0               | 0                    | 0.00                 | 0                    | 0.00                 | 0                 | 0.00                     | 0.00                           |             |          |
| Grand Total ==>                                | 0                        | 0                     | 0                   | 0               | 0                    | 100.00               | 0                    | 100.00               | -55.931           | 100.00                   | 0.00                           |             |          |

| COOLING COIL SELECTION |               |                |                   | HEATING COIL SELECTION |                |        |        |
|------------------------|---------------|----------------|-------------------|------------------------|----------------|--------|--------|
| Total Capacity ton     | Sens Cap. MBh | Coil Airfl cfm | Enter DB/WB/HR °F | Capacity MBh           | Coil Airfl cfm | Ent °F | Lvg °F |
| Main Clq               | 0.0           | 0.0            | 0.0               | Main Htg               | -55.9          | 55.0   | 95.0   |
| Aux Clq                | 0.0           | 0.0            | 0.0               | Aux Htg                | 0.0            | 0.0    | 0.0    |
| Opt Vent               | 0.0           | 0.0            | 0.0               | Preheat                | 0.0            | 0.0    | 0.0    |
| Total                  | 0.0           | 0.0            | 0.0               | Reheat                 | 0.0            | 0.0    | 0.0    |
|                        |               |                |                   | Humidif                | 0.0            | 0.0    | 0.0    |
|                        |               |                |                   | Opt Vent               | 0.0            | 0.0    | 0.0    |
|                        |               |                |                   | Total                  | -55.9          | 0.0    | 0.0    |

| AREAS       |           |             |   |
|-------------|-----------|-------------|---|
| Gross Total | Glass ft² | Percent (%) |   |
| Floor       | 8,554     |             |   |
| Part        | 0         |             |   |
| ExFir       | 0         |             |   |
| Roof        | 8,554     | 0           | 0 |
| Wall        | 9,160     | 0           | 0 |

| AIRFLOWS |         |         |  |
|----------|---------|---------|--|
|          | Cooling | Heating |  |
| Vent     | 0       | 0       |  |
| Infil    | 0       | 1,354   |  |
| Supply   | 0       | 1,255   |  |
| Misc     | 0       | 0       |  |
| Return   | 0       | 2,609   |  |
| Exhaust  | 0       | 1,354   |  |
| Rm Exh   | 0       | 0       |  |
| Auxil    | 0       | 0       |  |

| ENGINEERING CKS |         |         |  |
|-----------------|---------|---------|--|
|                 | Cooling | Heating |  |
| % OA            | 0.0     | 0.0     |  |
| cfm/ft²         | 0.00    | 0.15    |  |
| cfm/ton         | 0.00    | 0.00    |  |
| ft²/ton         | 0.00    | 0.00    |  |
| Btu/hr-ft²      | 0.00    | -6.54   |  |
| No. People      | 0       | 0       |  |

| TEMPERATURES |     |      |  |
|--------------|-----|------|--|
|              | Clq | Htg  |  |
| SADB         | 0.0 | 95.0 |  |
| Plenum       | 0.0 | 52.1 |  |
| Return       | 0.0 | 55.0 |  |
| Ret/OA       | 0.0 | 55.0 |  |
| Fn MtrTD     | 0.0 | 0.0  |  |
| Fn BidTD     | 0.1 | 0.1  |  |
| Fn Frict     | 0.3 | 0.2  |  |

DAMIEN W. SERAUSKAS, P.E.  
PROFESSIONAL ENGINEERING SERVICES

Plumbing Calculations  
16-Mar-09



PUBLIC OR NONPUBLIC? **PUBLIC**  
 DWSPE NO. **08-128** *Stennis Riverine ROF*  
 DO YOU WANT TO USE THE (PRIVATE, RESIDENTIAL) TABLE?  YES  NO (YES OR NO)  
 SYSTEM TYPE:   
 FLUSH VALVE = 1  
 FLUSH TANK = 2

| FIXTURES   | QTY | FIXTURE UNITS PER FIXTURE |      |            | TOTAL FIXTURE UNITS PER FIXTURE |               |                        |
|--|-----|---------------------------|------|------------|---------------------------------|---------------|------------------------|
|  |     | HOT                       | COLD | TOTAL      | HOT                             | COLD          | TOTAL                  |
| BATHROOM GROUP                                     | 0   | 3                         | 6    | 8          | 0                               | 0             | 0                      |
| BATHTUB  | 0   | 3                         | 3    | 4          | 0                               | 0             | 0                      |
| CLOTHES WASHER                                     | 3   | 2.25                      | 2.25 | 3          | 6.75                            | 6.75          | 9                      |
| DISHWASHING MACHINE                                | 0   | 1.4                       | 2.25 | 1.4        | 0                               | 0             | 0                      |
| DRINKING FOUNTAIN                                  | 3   | 0                         | 0.25 | 0.25       | 0                               | 0.75          | 0.75                   |
| KITCHEN SINK                                       | 1   | 3                         | 3    | 4          | 3                               | 3             | 4                      |
| LAUNDRY TRAY                                       | 0   | 1                         | 1    | 1.4        | 0                               | 0             | 0                      |
| LAVATORY   | 12  | 1.5                       | 1.5  | 2          | 18                              | 18            | 24                     |
| HOSE BIBB OR HYDRANT                               | 6   | 0                         | 4    | 4          | 0                               | 24            | 24                     |
| RESTAURANT SINK                                    | 0   | 3                         | 3    | 4          | 0                               | 0             | 0                      |
| SERVICE SINK                                       | 3   | 2.25                      | 2.25 | 4          | 6.75                            | 6.75          | 12                     |
| SHOWER HEAD  | 11  | 3                         | 3    | 4          | 33                              | 33            | 44                     |
| STALL OR WALL URINAL                               | 4   | 0                         | 5    | 5          | 16                              | 20            | 20                     |
| WATER CLOSET TANK                                  | 0   | 0                         | 5    | 5          | 0                               | 0             | 0                      |
| WATER CLOSET VALVE                                 | 8   | 0                         | 5    | 5          | 0                               | 40            | 40                     |
| <b>TOTAL F.U. DEMAND</b>                           |     |                           |      |            | <b>83.5</b>                     | <b>152.25</b> | <b>177.75</b>          |
| SUBTOTAL GPM DEMAND.....                           |     |                           |      |            | 40                              | 81            | 98                     |
| MISC. GPM DEMAND.....                              |     |                           |      |            | 0                               | 0             | 0                      |
| <b>TOTAL GPM DEMAND.....</b>                       |     |                           |      |            | <b>40</b>                       | <b>81</b>     | <b>98</b>              |
| PRESSURE AVAILABLE                                 |     |                           |      | <b>42</b>  |                                 |               | <b>PSI</b>             |
| PRESSURE REQUIRED                                  |     |                           |      | <b>25</b>  |                                 |               | <b>PSI</b>             |
| PRESSURE LOSS THROUGH METER SIZ 3.00 INCHES        |     |                           |      | 2.5        |                                 |               | <b>PSI</b>             |
| STATIC LOSS          STATIC LIFT (FT) = 14 FEET    |     |                           |      | 6.06       |                                 |               | <b>PSI</b>             |
| LOSS THROUGH SPECIAL DEVICES                       |     |                           |      | <b>3</b>   |                                 |               | <b>PSI</b>             |
| DISTANCE FROM MAIN TO BUILDING                     |     |                           |      | <b>120</b> |                                 |               | <b>FEET</b>            |
| PRESSURE LOSS FROM MAIN TO BUILDING                |     |                           |      | 3.64       |                                 |               | <b>PSI</b>             |
| PRESSURE AVAILABLE FOR SYSTEM                      |     |                           |      | 1.80       |                                 |               | <b>PSI</b>             |
| TOTAL EQUIVALENT LENGTH (WITHIN BUILDING)          |     |                           |      | <b>60</b>  |                                 |               | <b>FEET</b>            |
| DESIRED MAX. VELOCITY IN FPS                       |     |                           |      | <b>8</b>   |                                 |               | <b>FPS</b>             |
| PRESSURE LOSS PER 100' AVAILABLE FOR SYSTEM DESIGN |     |                           |      | 2.99       |                                 |               | <b>PSI/100'</b>        |
| COPPER (C) OR STEEL (S) PIPE                       |     |                           |      | <b>C</b>   |                                 |               |                        |
| BUILDING WATER SUPPLY PIPE SIZE (INCHES)           |     |                           |      | 2 1/2      |                                 |               | INCHES (BUILDING MAIN) |
|  |     |                           |      | 1 1/2      |                                 |               | INCHES (HOT)           |
|  |     |                           |      | 2 1/2      |                                 |               | INCHES (COLD)          |

NOTES:

**WASTE PIPE CALCULATIONS**  
16-Mar-09

| FIXTURES                                 | QTY | DFU | TOTAL        |
|--|-----|-----|--------------|
| BATHROOM GROUP                           | 0   | 6   | 0            |
| BATHTUB                                  | 0   | 2   | 0            |
| CLOTHES WASHER                           | 3   | 3   | 9            |
| DISHWASHING MACHINE                      | 0   | 2   | 0            |
| DRINKING FOUNTAIN                        | 3   | 0.5 | 1.5          |
| KITCHEN SINK                             | 1   | 2   | 2            |
| LAUNDRY TRAY                             | 0   | 2   | 0            |
| LAVATORY                                 | 12  | 1   | 12           |
| HOSE BIBB OR HYDRANT                     | 6   | 0   | 0            |
| RESTAURANT SINK                          | 0   | 4   | 0            |
| SERVICE SINK                             | 3   | 3   | 9            |
| SHOWER HEAD                              | 11  | 2   | 22           |
| STALL OR WALL URINAL                     | 4   | 8   | 32           |
| WATER CLOSET FT                          | 0   | 4   | 0            |
| WATER CLOSET FV                          | 8   | 6   | 48           |
| 2" FLOOR DRAINS                          | 2   | 1   | 2            |
| 3" FLOOR DRAINS                          | 14  | 1   | 14           |
| 4" FLOOR DRAINS                          | 2   | 1   | 2            |
| MISC. GPM FLOW.....                      |     |     | 0            |
| <b>TOTAL DRAINAGE FIXTURE UNITS.....</b> |     |     | <b>153.5</b> |
| <b>BUILDING WASTE SIZE LEAVING.....</b>  |     |     | <b>4"</b>    |

NOTE: ALL CALCULATIONS BASED ON INTERNATIONAL PLUMBING CODE WITH LA AMENDMENTS, 2000

# GULF CITIES TESTING & ENGINEERING

P.O. Box 6142 • Diamondhead, MS 39525 • (228) 255-9000 Fax (228) 255-9087  
Email: gulfcietest@bellsouth.net

February 3, 2009

Client: Broadmoor Design Group  
Metairie, LA

Ref: Sof Riverine and Combatant Craft Operations Facility  
Stennis Space Center  
Hancock County, MS

Attn: Craig T. Seals

Dear Mr. Seals:

Gulf Cities Testing Laboratories has visited the above referenced Project Site and met with your representatives concerning excavation and backfill procedures to be utilized during construction.

Our first visit was for the purpose of securing suitable samples for Proctors and Soil Classifications. A list of these Proctors and Soil Classifications and location on the project site is as follows:

- |   |      |       |      |                                |
|---|------|-------|------|--------------------------------|
| 1. Tan Fine to Medium Sand                    | (SW) | 115.2 | 11.1 | Submitted by Creel excavation  |
| 2. Tan Medium Sand                            | (SW) | 117.6 | 11.9 | S/W Ridge                      |
| 3. Tan & Gray Silty Clayey Sand               | (SW) | 122.8 | 12.3 | Military vehicle parking lot   |
| 4. White Coarse Sand                          | (SW) | 107.0 | 11.4 | South Bldg. area - 6'-8' depth |
| 5. Dark Tan Clayey Sand                       | (SC) | 124.0 | 12.3 | South End hill at 3'           |
| 6. Brown & Tan Very Fine Silty Sand w/organic | (SC) | 125.6 | 12.4 | North Ridge                    |

A swell exists on the site south/west to a northeast direction. The majority of this swell, to a depth of approximately 2' contains organics and deleterious materials, however, it was obvious some areas of the swell had deeper stratum of unsuitable materials.

The Unified Soils Classification of the materials would classify as CH & MH, unsuitable for structural fill.

It is our opinion that 2' be excavated in the swell area, and a decision made and agreed upon by all parties if additional material be removed.

The higher elevations of the site (North & Southwest ridges) should not need more than 12" to 18" removed and can be used as a backfill in other areas of the site.

A coarse sand should be placed in the 1st 12" of the 2' cut. All fill materials should be placed in 8" lifts & compacted to 95% of Modified Proctor.

If additional information is needed please contact us.



Respectfully Yours,

*Lanny N. Ladner*  
 Lanny N. Ladner

*Gulf Cities*  
**TESTING LABORATORIES**  
*e-mail gulfcitytest@bellsouth.net*

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Diamondhead, MS. 39525

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Fax: (228) 255-9087

February 19, 2009

**PROJECT :** Sof Riverine & Combatant Operations Facility  
Stennis Space Center  
Hancock County, MS.

**CLIENT :** Broadmoor Design Group

**SUBJECT:** Recommendations for placement and Testing of Soils  
Borrow Fill material

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At the request of the Broadmoor Corp. we visited the jobsite on 2/13/09 to discuss methods and procedures for excavation of existing soil and placing and testing of soil fill materials. Accompanying the writer was T. E. Petermann a Construction Consultant, registered PE in the State of Mississippi. The following are his observations and comments:

“ The site has been cleared and grubbed allowing an examination of the existing soil materials. Test pits have been dug to obtain additional samples and to examine the material for suitability. The typical sand clay select material available in this vicinity is capable of providing a densely compacted foundation pad for the buildings when placed under controlled conditions.

These prefabricated metal buildings constructed on a 2’ thick foundation pad of this select fill will have negligible differential settlement. A qualified soils technician will observe the tests and placement of fill materials at the time earthwork operations are being performed. Soils determined to be unsuitable will be replaced with select material. Proof rolling will also be used to determine suitability of soils in place”

**TESTING :** Select fill material should be compacted in 8” lifts to 95% density as determined by ASTM D1557 (modified proctor) as it is being placed. Samples have been obtained and

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laboratory results reported under separate cover. (see copy of soils report attached including unified soil classification) We trust this information will assist you in producing a satisfactory Soil foundation for this project in accordance with project specifications and industry standards.

We would be pleased to assist you in providing a qualified soils technician to witness proof rolling operations and in taking field density tests employing the latest technology (troxler nuclear guage)

Respectfully Submitted  
Gulf Cities Testing Labs




Lanny Ladner  
Senior Engineering Technician

w/attachment



T. E. Petermann, PE  
Construction Consultant



02-18-2009

### SOIL CLASSIFICATION CHART

| MAJOR DIVISIONS      |   |                              | SYMBOLS                       |                               | TYPICAL DESCRIPTIONS  |  |  |
|----------------------|---|------------------------------|-------------------------------|-------------------------------|---|--|--|
|                      |   |                              | GRAPH                         | LETTER                        |   |  |  |
| COARSE GRAINED SOILS | GRAVEL AND GRAVELLY SOILS                                   | CLEAN GRAVELS                |                               | GW                            | WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES                                   |  |  |
|                      |   | (LITTLE OR NO FINES)         |                               | GP                            | POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES                                 |  |  |
|                      |   | GRAVELS WITH FINES           |                               | GM                            | SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES  |  |  |
|                      | MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE    | GRAVELS WITH FINES           | (APPRECIABLE AMOUNT OF FINES) |                               | GC  | CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES  |  |
|                      |   |                              | SAND AND SANDY SOILS          | CLEAN SANDS                   |   | SW   | WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES  |
|                      |   |                              |                               | (LITTLE OR NO FINES)          |   | SP   | POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES |
|                      | MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE | SANDS WITH FINES             | (APPRECIABLE AMOUNT OF FINES) |                               | SM  | SILTY SANDS, SAND - SILT MIXTURES  |  |
|                      |   |                              | SAND AND SANDY SOILS          | CLEAN SANDS                   |   | SC   | CLAYEY SANDS, SAND - CLAY MIXTURES                     |
|                      |   |                              |                               | (APPRECIABLE AMOUNT OF FINES) |   | SC   | CLAYEY SANDS, SAND - CLAY MIXTURES                     |
|                      | FINE GRAINED SOILS  | SILTS AND CLAYS              | LIQUID LIMIT LESS THAN 50     |                               | ML  | INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY |  |
|                      |   |                              |                               | CL                            | INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS |  |  |
| SILTS AND CLAYS      |   | LIQUID LIMIT GREATER THAN 50 |                               | OL                            | ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY   |  |  |
|                      |   |                              |                               | MH                            | INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS                               |  |  |
|                      |   |                              |                               | CH                            | INORGANIC CLAYS OF HIGH PLASTICITY  |  |  |
|                      |   |                              |                               | OH                            | ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS   |  |  |
| HIGHLY ORGANIC SOILS |   |                              |                               | PT                            | PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS   |  |  |

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS