DAMMON ENGINEERING, INC.
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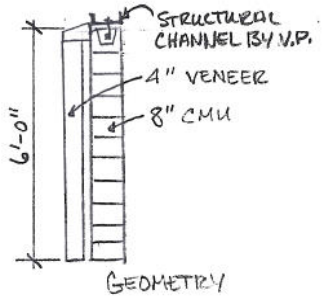
STENNIS RIVERINE

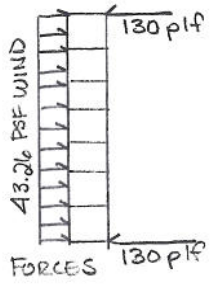
DESIGN OF REINFORCED CMU NON LOADBEARING WALL FOR FLEXURE
BLDG 2442 ALL EXTERIOR MASONRY WALLS

MATERIALS:

UNIT STRENGTH	2,150 psi
MORTAR	TYPE N
f'm	1,500 psi
Em	1.9×10^6 psi
n (modular ratio)	15.26
REINFORCEMENT	GRADE 60

LOADING:
WIND 130 MPH = 43.26 psf
NEGLECT SELF WEIGHT

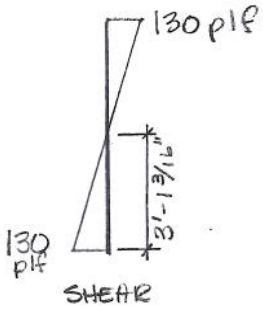


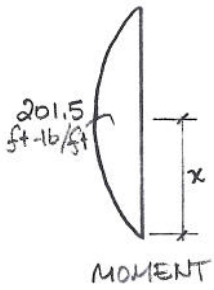


REACTIONS:

R_r = REACTION @ WIND BEAM = $\frac{\left(\frac{43.3\text{psf} \cdot (6\text{ft})^2}{2}\right)}{6\text{ft}} = 129.9$,

R_f = REACTION @ SLAB = $\frac{\left(\frac{43.3\text{ psf} \cdot (6\text{ft})^2}{2}\right)}{6\text{ft}} = 129.9$ plf





$x = \frac{130\text{plf}}{43.3\text{psf}} = 3.1' = 3'-1\,3/16"$

$M = 130\text{plf} \cdot \left(\frac{3.1'}{2}\right) = \underline{201.5}$ 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.
$A_{s\,provided} = 0.20 \cdot \frac{12}{32} = 0.075$ (REDUCE)

TRY #4 @ 40" O.C.
$A_{s\,prov.} = 0.20 \cdot \left(\frac{12}{40}\right) = 0.06$ (REDUCE)

TRY #4 @ 48" O.C.
$A_{s\,prov.} = 0.20 \cdot \left(\frac{12}{48}\right) = 0.05\text{ in}^2/\text{ft.}$

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CHECK STRENGTH: (USING 24" WIDE STRIP)

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

$p = \frac{A_s}{bd} = \frac{0.20 \text{ in}^2/\text{ft}}{24\text{in} \cdot 3.8\text{in}.} = 0.002$ $\quad np = 15.26 \cdot 0.002 = 0.035$

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

$\frac{-0.06 \pm \sqrt{(0.06)^2 - 4(1)(-0.06)}}{2} = \frac{-0.06 \pm 0.49}{2} = 0.215 = K$ $\quad$ Now $j = (1 - \frac{K}{3}) = 0.928$

ALLOWABLE TENSION FLEXURAL CAPACITY:

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

469 ft-lb/ft > 201.5 ft-lb/ft. OK

ALLOWABLE COMPRESSION FLEXURAL CAPACITY:

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

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

1916 ft-lb/ft. > 201.5 ft-lb./ft. OK

USE #4 REBAR @ 48" O.C.

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ANCHORAGE

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

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

$l_e = 13\, d_b = 6.5''$

SPLICES

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

VENEER WALL CONNECTION

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

USE 3/16"Ø 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.