Weight Calculation:

Weight of Grouted Cells:

= (Area of one cell) * No. of Cells* Wall Height *Density of Grouted concrete

= (5.8 * 3.01/12^2) * 2 * 5' * 140 lb/ft^3

= 0.17 kip

Weight of Hollow CMU Block:

= (((5.8*1.25 / 12^2) * 4) + (5.51*1.25/12^2)*4)) *5' * γ_{cmu})

= 0.2258 kip

Total Weight of Masonry Wall = 0.17 + 0.2258 = **0.4 kip**

Applied shear and Moment Calculation:

$C_s = S_{DS} / (R/I) = (1.19*1)/1.25 = 0.95$

$V_{Masonry\text{-}Seismic} = C_s * W = 0.95*0.4 =$ **0.38 kip / unit Cell**

$M_{At\ Concrete\text{-}Masonry\ interface} = 0.38*5*2/3 =$ **1.27 Kip.ft / unit cell**

$c_{b\ (Neutral\ Axis\ depth)} = 0.547*d = 0.547*3.25 = 1.78''$ (f_y = 60,000 psi; Concrete Masonry)

$a_{b\ (Whitney\ Stress\ Block)} = 0.8* c_b = 0.8*1.78 = 1.42''$

$\Phi M_n = A_s f_y (d - a/2)$ _____(Eq-1)

A_s = #5(0.31 in^2)

Φ = 0.9 (Flexure)

Putting values in Eq-1

ΦM_n = 0.9*0.31*60 (3.25 - (1.42/2))

= 42.52 kip-in

= 3.54 kip-ft/Unit Cell > M_u (1.27 k.ft)

Therefore proposed Reinforcement is adequate.

Confirming proposed reinforcement does not exceed Max. reinforcement allowed

TABLE 6.3b	Steel Strain Factor to compute ρ_{max} for concrete masonry			
f'_m	1.0	1.5[1]	3.0[1,2]	4.0[1,3]
1500	0.0088	0.0071	0.0046	0.0037
2000	0.0117	0.0095	0.0061	0.0049
2500	0.0146	0.0119	0.0077	0.0062
3000	0.0175	0.0143	0.0092	0.0074
3500	0.0204	0.0167	0.0107	0.0087
4000	0.0233	0.0190	0.0122	0.0099

Since *R = 1.25 (ASCE 7-10 Table 15.4-2)* and *f'_m = 2000 psi*, using Linear Interpolation we get.

ρ_{max} = 0.0106

$A_{s(Max\text{-}Allowed)} = \rho_{max}*b*d = 0.0106 * 8.3'' * 3.25'' = 0.29\ in^2$

$A_{s\ (provided)}) \approx A_{s\ (Max\ -\ Allowed)}$ --- **Therefore #5 can be used**

Where Cracking Moment Strength = $S_n * f_r$ ____MSJC Code Section 3.1.8.2.1

Modulus of Rupture (fr) = 158 psi ____Table 9.1.9.2 (TMS 402-13/ACI-530)

$S_{n\ (Section\ Modulus)} = bh^2/6 = (8.3 * 11.022^2)/ 6$

= 168 in^3

Putting values in cracking moment Strength equation

= 168 in^3 * 158 lb/in^2 = **2.213 kip.ft / Unit Cell**

M_n / M_{cr} = 3.54 / 2.213 = 1.6 > 1.3 (Required by MSJC Code Section 3.3.4.2.2.2)

Therefore, the nominal flexure strength of CMU wall is greater than the cracking strength.

Shear Capacity Check:

V_u = 0.38 kip / unit Cell

Shear Capacity of Masonry Blocks (CMU) only

$$V_m = \left[4.0 - 1.75\left(\frac{M_u}{V_u d_v}\right)\right] A_n \sqrt{f'_m} + 0.25P_u$$

(MSJC Code Eq 3-21)

$M_u/V_u\ d_v$ = 1.27*12000 / ((0.38*1000)*3.25) = **12.34**?? (Seems too high!!!)

If $M_u/V_u\ d_v$ = 1.5 (Assumed)

V_m = (4-1.75*(1.5))*(8.3*11.022)*((2000)$^{1/2}$/1000) + 0.25*(0.9*0.4)

= 5.62^k + 0.1^k = 5.72 kips >> Vu (0.38 kips)

Since $V_m >> V_u$ (Therefore, no need for shear reinforcement)