

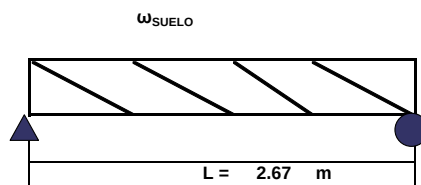
**PTAR  
CIUDAD VERDE**

**DISEÑO: MURO DE HORMIGON ARMADO**

PROYECTO: CIUDAD VERDE

**A- DIMENSIONES Y CARGAS: MUROS M1**

2.67 m X 4.00 m



|                         |   |       |                   |
|-------------------------|---|-------|-------------------|
| $\gamma_{\text{SUELO}}$ | = | 1,800 | kg/m <sup>3</sup> |
| $h_p$                   | = | 4.00  | m                 |
| $P_{\text{SUELO PROM}}$ | = | 7,200 | kg/m <sup>2</sup> |
| $b$                     | = | 1.00  | m                 |
| $\omega_{\text{SUELO}}$ | = | 7,200 | kg/m              |
| $L$                     | = | 2.67  | m                 |

$$V_{\text{MAX}} = \omega L/2 = 9,612.00 \text{ Kg, en el apoyo}$$

$$M_{\text{MAX}} = \omega L^2/8 = 6,416.01 \text{ kg.m}$$

$$M_U = 1.2M_{\text{MAX}} = 7,699.21 \text{ kg.m}$$

**B-REFUERZO**

$$r = 7.50 \text{ cms (C. l.)}$$

$$t = 25 \text{ cms}$$

$$\rho_{\text{MIN}} = 0.0025 \text{ (ACI 318, 14.3.3)}$$

$$\rho_{\text{MAX}} = 0.025 \text{ (ACI 318, 21.3.2.1)}$$

$$f'_c = 4,000 \text{ psi}$$

$$f_y = 60,000 \text{ psi}$$

$$d = 17.500 \text{ cms}$$

$$M_U \leq \phi M_n = 0.9 A_s f_y (d - A_s f_y / 1.7 b f'_c)$$

$$A_s = 12.42 \text{ cm}^2$$

$$\rho = 0.0071 > \rho_{\text{MIN}} \text{ OK}$$

UTILIZAR: #5 @ 0.20M CAC, HORIZONTAL, INTERNO

#4 @ 0.25M CAC, HORIZONTAL EXTERNO, VERTICAL A/C

**C-CORTANTE**

ACI 318, 11.3.1.1

$$V_c = 0.55 \sqrt{f'_c} b d = 16,105.71 \text{ Kg}$$

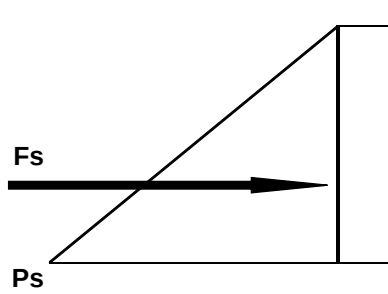
$$\phi V_c = 13,689.85 \text{ Kg} > V_{\text{MAX}} \text{ OK}$$

**PTAR  
CIUDAD VERDE**

**DISEÑO MURO DE HORMIGON ARMADO:**      **MUROS DE 6.76m X 4.00m**

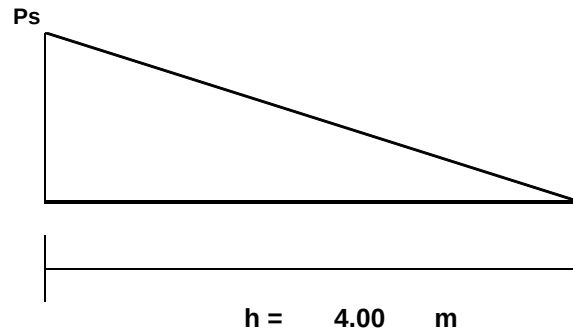
**PROYECTO: CIUDAD VERDE**

**A- DIMENSIONES Y CARGAS**



**h = 4.00 m**

$$\begin{aligned} \gamma_{\text{SUELO}} &= 1,800 \text{ kg/m}^3 \\ h &= 4.00 \text{ m} \\ P_{\text{SUELO}} &= 7,200 \text{ kg/m}^2 \\ b &= 1.00 \text{ m} \\ F_s &= 14,400.00 \text{ kg/m} \end{aligned}$$



$$V_{\text{MAX}} = 2F_s/3 = 9,600.00 \text{ Kg, en el apoyo}$$

$$M_{\text{MAX}} = 2F_s h/9\sqrt{3} = 7,390.08 \text{ kg.m}$$

$$M_U = 2M_{\text{MAX}} = 14,780.17 \text{ kg.m}$$

**B-REFUERZO**

$$\begin{aligned} r &= 7.50 \text{ cms} & (\text{C. I.}) \\ t &= 28 \text{ cms} \\ \rho_{\text{MIN}} &= 0.0025 & (\text{ACI 318, 14.3.3}) \\ \rho_{\text{MAX}} &= 0.025 & (\text{ACI 318, 21.3.2.1}) \\ f'_c &= 4,000 \text{ psi} \\ f_y &= 60,000 \text{ psi} \\ d &= 19.865 \text{ cms} \end{aligned}$$

$$M_U \leq \phi M_n = 0.9 A_s f_y (d - A_s f_y / 1.7 b f'_c)$$

$$\begin{aligned} A_s &= 21.79 \text{ cm}^2 \\ \rho &= 0.0110 > \rho_{\text{MIN}} \text{ OK} \\ A_{s\text{min}} &= 4.97 \text{ cm}^2 \end{aligned}$$

UTILIZAR:      #5 @ 0.20M CAC, VERTICAL  
#4 @ 0.25M CAC, HORIZONTAL

**C-CORTANTE**

**ACI 318, 11.3.1.1**

$$V_c = 0.55 \sqrt{f'_c} b d = 18,282.27 \text{ Kg}$$

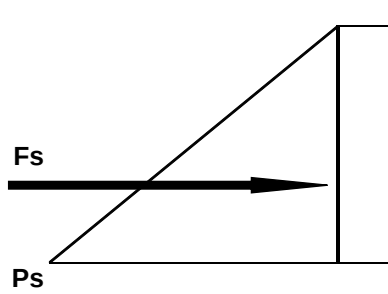
$$\phi V_c = 15,539.93 \text{ Kg} > V_{\text{MAX}} \text{ OK}$$

**PTAR  
CIUDAD VERDE**

**DISEÑO MURO DE HORMIGON ARMADO:**      **MUROS EN LECHO DE SECADO DE 2.97m X 1.17m**

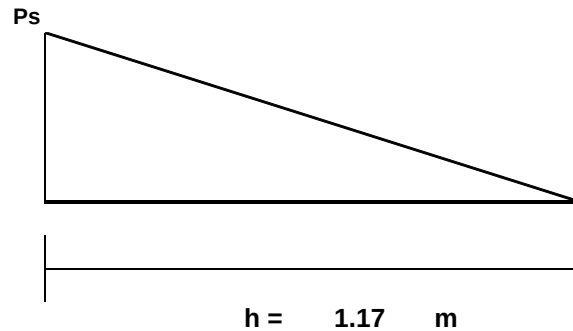
**PROYECTO: CIUDAD VERDE**

**A- DIMENSIONES Y CARGAS**



**h = 1.17 m**

$$\begin{aligned} \gamma_{\text{SUELO}} &= 1,800 \text{ kg/m}^3 \\ h &= 1.17 \text{ m} \\ P_{\text{SUELO}} &= 2,106 \text{ kg/m}^2 \\ b &= 1.00 \text{ m} \\ F_s &= 1,232.01 \text{ kg/m} \end{aligned}$$



$$V_{\text{MAX}} = 2F_s/3 = 821.34 \text{ Kg, en el apoyo}$$

$$M_{\text{MAX}} = 2F_s h/9\sqrt{3} = 184.94 \text{ kg.m}$$

$$M_U = 2M_{\text{MAX}} = 369.88 \text{ kg.m}$$

**B-REFUERZO**

$$\begin{aligned} r &= 7.50 \text{ cms} & (\text{C. I.}) \\ t &= 15 \text{ cms} \\ \rho_{\text{MIN}} &= 0.0025 & (\text{ACI 318, 14.3.3}) \\ \rho_{\text{MAX}} &= 0.025 & (\text{ACI 318, 21.3.2.1}) \\ f'_c &= 4,000 \text{ psi} \\ f_y &= 60,000 \text{ psi} \\ d &= 6.865 \text{ cms} \end{aligned}$$

$$M_U \leq \phi M_n = 0.9 A_s f_y (d - A_s f_y / 1.7 b f'_c)$$

$$\begin{aligned} A_s &= 1.45 \text{ cm}^2 \\ \rho &= 0.0021 < \rho_{\text{MIN}} \\ A_{s \text{ min}} &= 1.72 \text{ cm}^2 \end{aligned}$$

UTILIZAR:      #3 @ 0.30M CAC, A/D

**C-CORTANTE**

**ACI 318, 11.3.1.1**

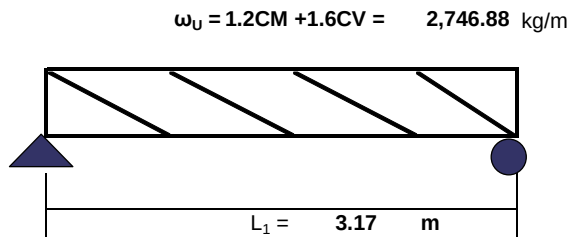
$$V_c = 0.55 \sqrt{f'_c} b d = 6,318.03 \text{ Kg}$$

$$\phi V_c = 5,370.33 \text{ Kg} > V_{\text{MAX}} \quad \text{OK}$$

DISEÑO: LOSA SUPERIOR DE HORMIGON ARMADO

PROYECTO: PTAR CIUDAD VERDE

A- DIMENSIONES Y CARGAS



ACI 318, TABLA 9.5a:  
UTILIZAR:

|              |          |                   |
|--------------|----------|-------------------|
| $L_1 =$      | 3.17     | m                 |
| $h =$        | $L/20$   |                   |
| $h =$        | 0.20     | m                 |
| $b_1 =$      | 3.38     | m                 |
| $b_2 =$      | 1.00     | m                 |
| $\gamma_c =$ | 2,400    | kg/m <sup>3</sup> |
| $\omega_U =$ | 2,746.88 | kg/m              |

$$CM = \gamma_c h b_1 = 1,622.40 \text{ kg/m}$$

$$CV = 500 \text{ kg/m}$$

$$M_{MAX} = \omega_U L^2 / 8 = 3,450.39 \text{ kg.m}$$

$$M_U = M_{MAX} = 3,450.39 \text{ kg.m}$$

B-REFUERZO

$$r = 7.50 \text{ cms (C. I.)}$$

$$\rho_{MIN} = 0.0018 \text{ (ACI 318, 14.3.3)}$$

$$\rho_{MAX} = 0.025 \text{ (ACI 318, 21.3.2.1)}$$

$$f'_c = 4,000 \text{ psi}$$

$$f_y = 60,000 \text{ psi}$$

$$d = 11.865 \text{ cms}$$

$$M_U \leq \phi M_n = 0.9 A_s f_y (d - A_s f_y / 1.7 b_2 f'_c)$$

$$A_s = 8.19 \text{ cm}^2$$

$$\rho = 0.0069 > \rho_{MIN} \quad \text{OK}$$

UTILIZAR: #4@ 0.20M CAC, A/D

NOTA: Adicional colocar barras de L max = 1.00 en esquinas de aberturas de tapas, formando ángulo de 45°.

**PTAR  
CIUDAD VERDE**

**DISEÑO: LOSA INFERIOR DE HORMIGON ARMADO**

**12.04m X 7.26m**

**PROYECTO: CIUDAD VERDE**

**A. PESO PROPIO ESTRUCTURA (A.1)**

$$\gamma_C = 2,400 \text{ kg/m}^3$$

$$\gamma_{H_2O} = 1,020 \text{ kg/m}^3$$

**PESO AGUA RESIDUAL (A.2)**

**MUROS:**  $h = 4.00 \text{ m}$   
 $L_1 = 12.04 \text{ m}$   
 $L_2 = 7.26 \text{ m}$   
 $t = 0.265 \text{ m}$

**LOSA SUP:**  $h = 0.20 \text{ m}$   
 $L_1 = 3.17 \text{ m}$   
 $L_2 = 6.76 \text{ m}$

**LOSA INF:**  $h = 0.35 \text{ m}$   
 $L_1 = 12.04 \text{ m}$   
 $L_2 = 7.26 \text{ m}$

**A.1:**

$$W_{PP} =$$

$$W_{MUROS} + W_{LOSA SUP} + W_{LOSA INF}$$

$$W_{MUROS} = \gamma_C h L t = 135,137.28 \text{ Kg}$$

$$W_{PP} = 229,134.05 \text{ Kg}$$

$$W_{LOSA SUP} = \gamma_C A t = 20,572.03 \text{ Kg}$$

$$W_{PP FACT} = 1.05 W_{PP} = 240,590.75 \text{ Kg}$$

$$W_{LOSA INF} = \gamma_C A t = 73,424.74 \text{ Kg}$$

**A.2:**

$$W_{H_2O} = \gamma_{H_2O} A h = 356,634.43 \text{ Kg}$$

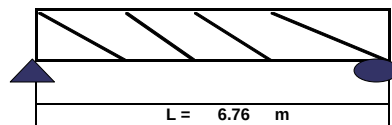
$$W_{H_2O @ 30\%} = 0.75 W_{H_2O} = 267,475.82 \text{ Kg}$$

$$W_{H_2O FACT} = 1.1 W_{H_2O @ 30\%} = 294,223.41 \text{ Kg}$$

$$W_{TOTAL} = W_{PP FACT} + W_{H_2O FACT} = 534,814.16 \text{ Kg}$$

**B- CARGAS DE DISEÑO**

$$\omega_U = 6,118.43 \text{ kg/m}$$



$$L = 6.76 \text{ m}$$

$$A = 87.41 \text{ m}^2$$

$$b = 1.00 \text{ m}$$

$$\omega_U = W_{TOTAL} b / A = 6,118.43 \text{ kg/m}$$

$$M_{MAX} = \omega L^2 / 8 = 34,949.68 \text{ kg.m}$$

$$M_U = M_{MAX} = 34,949.68 \text{ kg.m}$$

**C-REFUERZO**

$$r = 7.50 \text{ cms}$$

$$\rho_{MIN} = 0.0033$$

$$f'_c = 4,000 \text{ psi}$$

$$f_y = 60,000 \text{ psi}$$

$$d = 26.865 \text{ cms}$$

$$M_U \leq \phi M_n = 0.9 A_s f_y (d - A_s f_y / 1.7 b f'_c)$$

$$A_s = 39.56 \text{ cm}^2$$

$$\rho = 0.0147 > \rho_{MIN} \text{ OK}$$

UTILIZAR: #6 @ 0.20 M CAC, DIRECCION CORTA, SUPERIOR  
 #5 @ 0.20M CAC, DIRECCION LARGA SUPERIOR, A/D INFERIOR

**PTAR  
CIUDAD VERDE**

**DISEÑO: LOSA INFERIOR DE HORMIGON ARMADO**

**3.00 m X 12.00m**

**USAR PARA LECHO DE SECADO**

**PROYECTO: CIUDAD VERDE**

**A. PESO PROPIO ESTRUCTURA (A.1)**

$$\gamma_C = 2,400 \text{ kg/m}^3$$

$$\gamma_{H_2O} = 1,020 \text{ kg/m}^3$$

$$\gamma_{ACERO} = 7,850 \text{ kg/m}^3$$

**MUROS:**

$$h = 2.20 \text{ m}$$

$$L_1 = 2.65 \text{ m}$$

$$L_2 = 12.00 \text{ m}$$

$$t = 0.150 \text{ m}$$

**TECHO:**

$$h = 0.15 \text{ m}$$

$$L_1 = 3.00 \text{ m}$$

$$L_2 = 12.00 \text{ m}$$

**LOSA INF:**

$$h = 0.20 \text{ m}$$

$$L_1 = 3.00 \text{ m}$$

$$L_2 = 12.00 \text{ m}$$

**A.1:**

$$W_{PP} =$$

$$W_{MUROS} + W_{TECHO} + W_{LOSA INF}$$

$$W_{MUROS} = \gamma_C h L t = 19,998.00 \text{ Kg}$$

$$W_{PP} = 79,668.00 \text{ Kg}$$

$$W_{TECHO} = \gamma_C A t = 42,390.00 \text{ Kg}$$

$$W_{PP FACT} = 1.05 W_{PP} = 83,651.40 \text{ Kg}$$

$$W_{LOSA INF} = \gamma_C A t = 17,280.00 \text{ Kg}$$

**A.2:**

$$W_{H_2O} = \gamma_{H_2O} A h = 0.00 \text{ Kg}$$

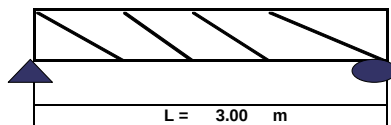
$$W_{H_2O @ 30\%} = 0.70 W_{H_2O} = 0.00 \text{ Kg}$$

$$W_{H_2O FACT} = 1.1 W_{H_2O @ 30\%} = 0.00 \text{ Kg}$$

$$W_{TOTAL} = W_{PP FACT} + W_{H_2O FACT} = 83,651.40 \text{ Kg}$$

**B- CARGAS DE DISEÑO**

$$\omega_U = 2,323.65 \text{ kg/m}$$



$$L = 3.00 \text{ m}$$

$$A = 36.00 \text{ m}^2$$

$$b = 1.00 \text{ m}$$

$$\omega_U = W_{TOTAL} b / A = 2,323.65 \text{ kg/m}$$

$$M_{MAX} = \omega L^2 / 8 = 2,614.11 \text{ kg.m}$$

$$M_U = M_{MAX} = 2,614.11 \text{ kg.m}$$

**C-REFUERZO**

$$r = 7.50 \text{ cms}$$

$$\rho_{MIN} = 0.0033$$

$$f'_c = 4,000 \text{ psi}$$

$$f_y = 60,000 \text{ psi}$$

$$d = 11.865 \text{ cms}$$

$$M_U \leq \phi M_n = 0.9 A_s f_y (d - A_s f_y / 1.7 b f'_c)$$

$$A_s = 6.11 \text{ cm}^2$$

$$\rho = 0.0051 > \rho_{MIN} \text{ OK}$$

UTILIZAR: #4 @ 0.20M CAC, A/D