

Iglesia de Xerrallo

Cálculo justificativo y de
replantes

791.508
16-4-53

$\sqrt{3} = 1,7320508$

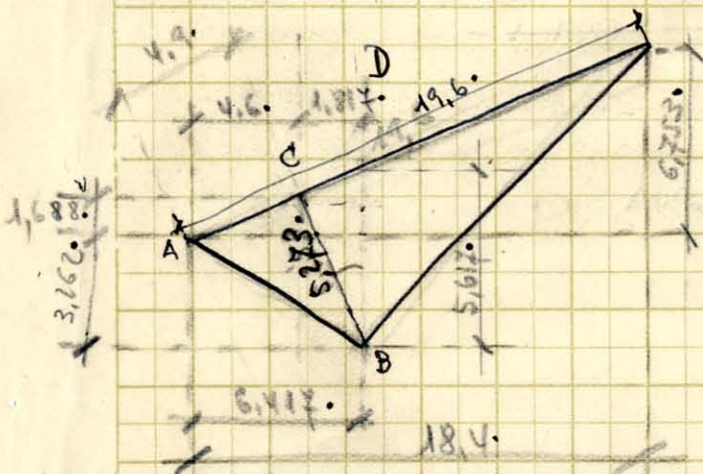
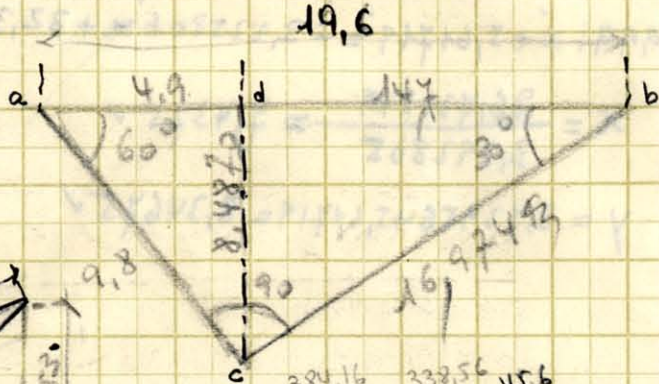
Balance de replantes

Lado $a\bar{b} = \frac{19,6}{2} = 9,80$

$\bar{a}d = \frac{9,8}{2} = 4,9$

$n \quad cb = \frac{\sqrt{3}}{2} \times 19,60 = 16,974098$

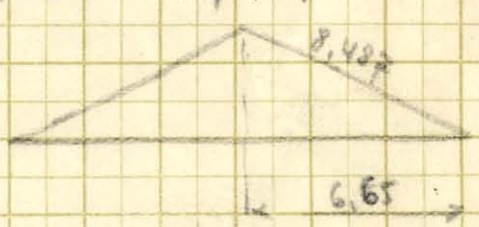
$\bar{c}d = \frac{1}{2} \bar{c}b = 8,487049$



$\sqrt{19,6^2 - 18,4^2} = 6,752778$
 $\frac{18,4}{19,6} \times 4,9 = 4,6$
 $\frac{6,752778}{19,6} \times 4,9 = 1,688194$
 $\sqrt{18,4^2 - 6,65^2} = 5,273281$

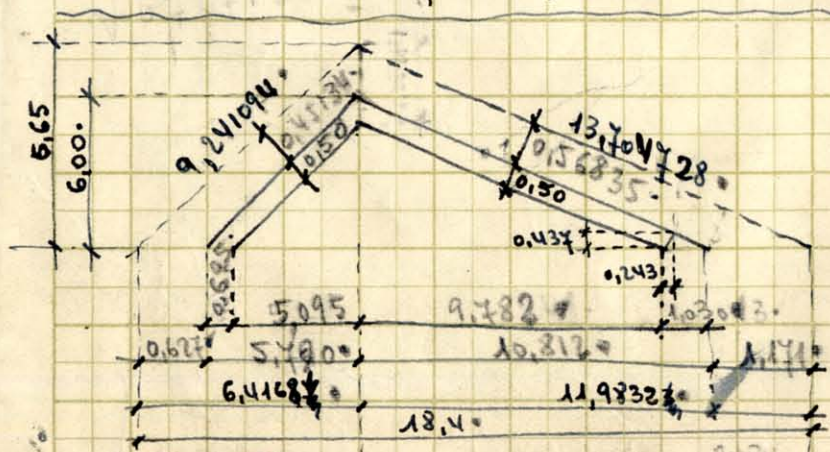
$\frac{6,75278}{3262} = 100149$

$\bar{a}b = \sqrt{4,9^2 + 5,27328^2} = 7,198437$
 $\frac{5,27328 \times 6,75278}{19,6} = 1,816800$
 $\frac{18,4 \times 5,27328}{19,6} = 4,950427$
 $\frac{18,4 \times 5,27328}{19,6} - 1,688194 = 3,262233$



$\frac{5,6171906}{1,816800} = 3,1552879$
 $\frac{1,816800}{\sqrt{28,252067}}$

$\frac{3,262233}{6,752778} = 10015000$



$\frac{6,41687}{6,65} \times 6,00 = 5,789594$
 $\frac{11,98313}{6,65} \times 6,00 = 10,81194$
 $\frac{6,65 \times 1,171}{13,704728} = 0,56835$
 $\frac{6,65 \times 0,627206}{9,241094} = 0,45134$
 $\frac{0,56835}{0,56835} = 1,03043$

$\frac{6,65 \times 0,5}{13,70457} = 0,24262$
 $\frac{6,65}{11,98313} \times 0,48719 = 0,43719$

$$y = \frac{6,45228}{18,4} x + 5,61719 = 0$$

$$x = 4,438$$

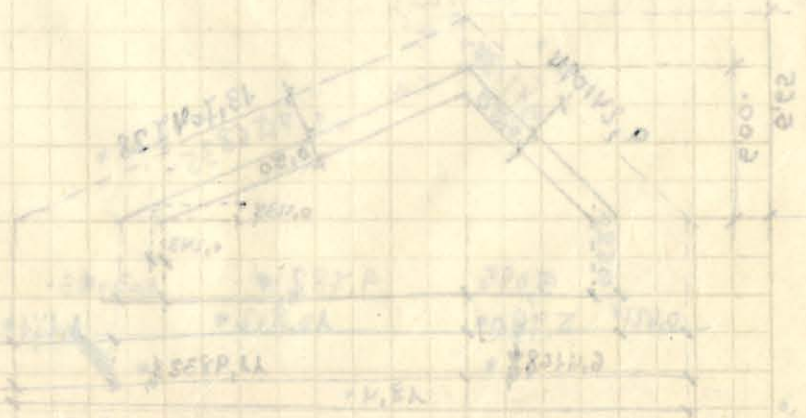
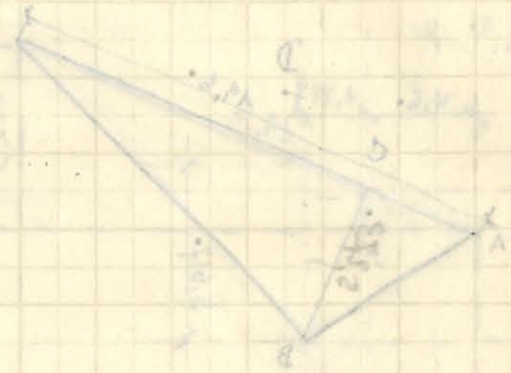
$$y = -\frac{1,00}{0,31} (x - 10,025)$$

$$y = 8,347$$

$$0,366999 x + 5,61719 = -3,25806 x + 32,338710$$

$$x = \frac{26,721519}{3,592805} = 7,4375 \checkmark$$

$$y = 2,72956 + 5,61719 = 8,34675 \checkmark$$

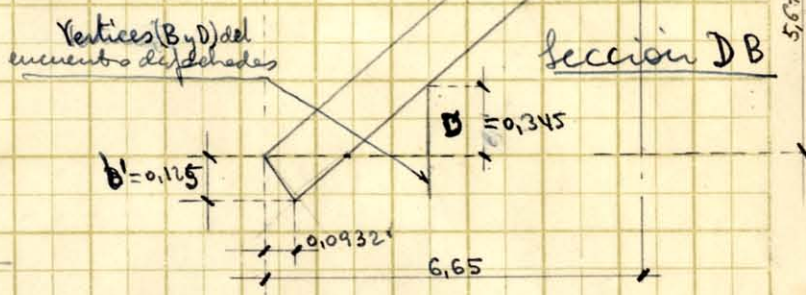
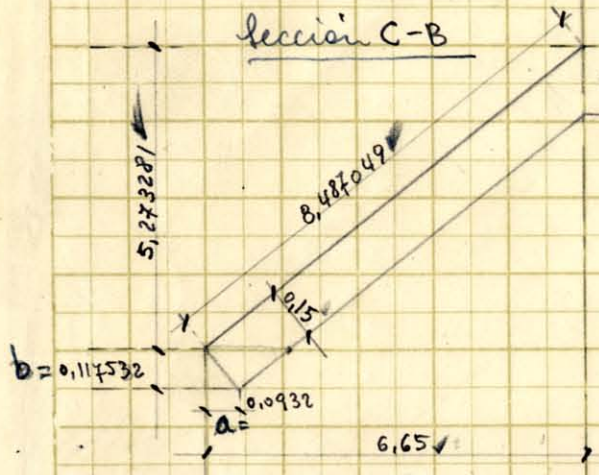
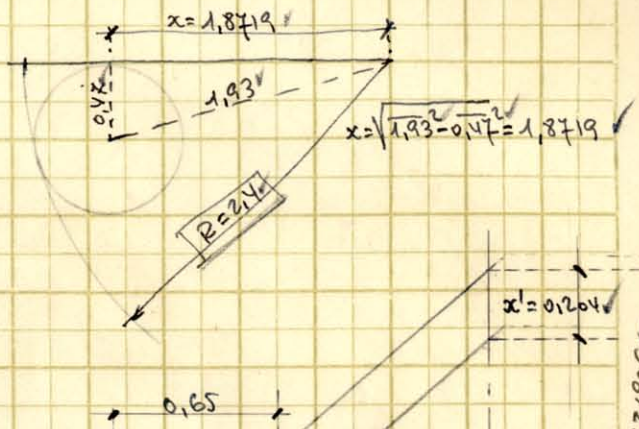


10,81191
0,24262
11,05453
10,81191
10,0241

$$\sqrt{10,81191^2 + 6,00^2} = 12,36517 \checkmark$$

$$\sqrt{5,789594 + 6,00^2} = 8,33483 \checkmark$$

$$\frac{12,36517 \times 10,0241}{10,81191} = 11,4642 \checkmark$$



$$x = 0,15 \times \frac{8,487049}{6,65} = 0,1914320 \checkmark$$

$$a = 0,15 \times \frac{5,273281}{8,487049} = 0,09329990 \checkmark$$

$$b = 0,15 \times \frac{6,65}{8,487049} = 0,11753202 \checkmark$$

$$x' = 0,191432 \times \frac{5,677106}{5,273281} = 0,2039223 \checkmark$$

$$b' = 0,11753202 \times \frac{5,677106}{5,273281} = 0,12519715 \checkmark$$

$$D = 0,65 \times \frac{5,677106}{6,65} - 0,2039223 = 0,3451265 \checkmark$$

Altura del vértice D de fachada \times sobre cota (7+1.016,50) $= 1.016,50 + 0,3451265 \checkmark$

Altura en C $= 10,01501 + 0,3451265 + 10,01501 \times \frac{10,81191}{11,4832} = 9,38122593 \checkmark$

encuentro del plano inclinado de la cristalería con el exterior

Altura del encuentro de la arista común al plano inclinado exterior de la cristalería y del plano de fachada BC, con la cara inferior de la cubierta.

$$y = 0,3451265 + \frac{10,01501}{11,4832} x = -\frac{1}{0,31} (x - 10,0241)$$

$$x = \frac{31,99067945}{4,06156067} = 7,87645010 \checkmark \quad y = \frac{6,582764}{6,9279029} = 0,9501 \checkmark$$

Compulsación: $\frac{9,03609943}{10,81191} \times 7,8764501 + 0,3451265 = 6,9279029 \checkmark$

Distancia desde el punto B al vertical del punto anterior

$$\frac{12,36517}{10,81191} \times 7,8764501 = 9,007996 \checkmark$$

Altura del encuentro de la arista común a los planos de fachada AC y DA con la cara inferior de la cubierta

$$\frac{3,262233}{6,4168} \times 2,94336813 + 0,3451265 = 3,28849463 \checkmark$$

9,38122593
3451265
9,03609943

de cubierta

Centros de escalera de coro

$$\sqrt{0,42^2 + 0,09^2} = 0,429534 \checkmark$$

$$\sin \alpha = \frac{0,09}{0,429534} = 0,209529 \checkmark$$

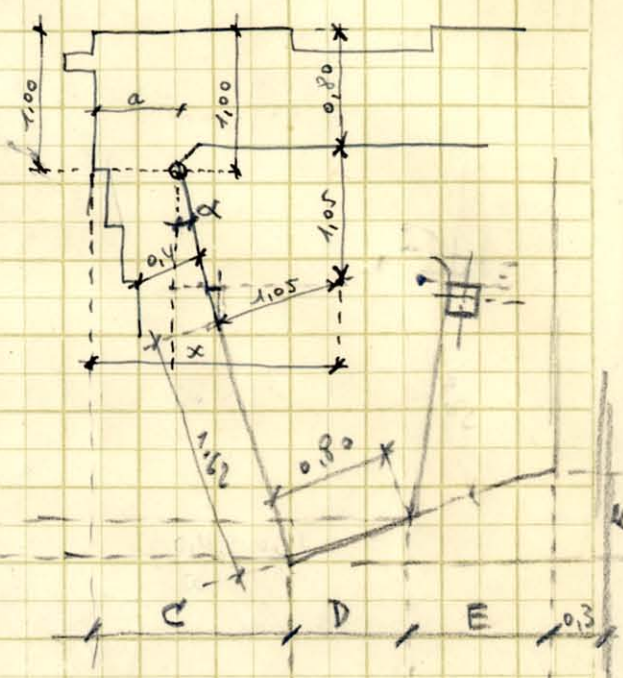
$$\cos \alpha = \frac{0,42}{0,429534} = 0,977804 \checkmark$$

$$a = \frac{0,429534 \times 0,42}{0,42} + 0,09 = 0,49908 \checkmark$$

$$x = 0,49908 + 1,05 \times \frac{0,429534}{0,42} + \frac{0,09}{0,42} \times 0,85 = 1,75504 \checkmark$$

1,95
1,755
0,185
5

1,0593



Huesos de escalera de coro

$$A = 1,62 \times \frac{1,5840}{0,429534} + 1,05 \times \frac{0,109}{0,429534} + 1,05 + 0,8 = 3,654 \checkmark$$

$$B = 0,80 \times \frac{0,109}{0,429534} = 0,16762 = 0,168 \checkmark$$

$$C = 0,49908 + 0,85 \times \frac{0,09}{0,42} + 1,05 \times \left(\frac{0,429534}{0,42} - \frac{0,42}{0,429534} \right) + 1,62 \times \frac{0,09}{0,429534} = 1,06778 = 1,068 \checkmark$$

$$D = 0,80 \times \frac{0,42}{0,429534} = 0,782 \checkmark$$

$$E = 3,4 - (0,3 + C + D) = 1,950 \checkmark$$

$$F = \frac{0,168}{0,428} \times 2,032 = 0,787 \checkmark$$

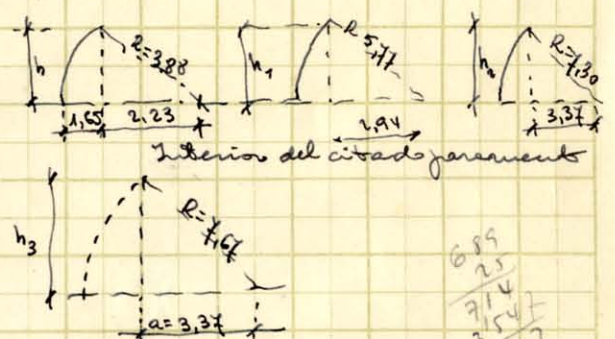
Paramentos interior del cuerpo de fachada

$$h = \sqrt{3,88^2 - 2,23^2} = 3,1751 \checkmark$$

$$h_1 = \sqrt{5,77^2 - 2,94^2} = 4,9648 \checkmark$$

$$h_2 = \sqrt{7,30^2 - 3,37^2} = 6,4756 \checkmark$$

$$h_3 = \sqrt{7,67^2 - 3,37^2} = 6,8900 \checkmark$$



Perfiles entre los dos paramentos del cuerpo de fachada

$$h = \sqrt{3,98^2 - 2,23^2} = 3,2966 \checkmark$$

$$h_1 = \sqrt{9,61^2 - 2,96^2} = 9,1428 \checkmark$$

$$h_2 = \sqrt{9,40^2 - 3,45^2} = 8,7440 \checkmark$$

| | |
|--------------|--------------|
| $R = 3,98$ | $a = 2,23$ |
| $R_1 = 9,61$ | $a_1 = 2,96$ |
| $R_2 = 9,40$ | $a_2 = 3,45$ |

Diviendos del cuerpo de fachada

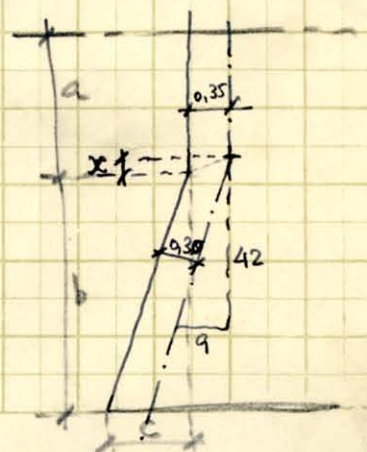
$$x = \frac{1}{0,09} (0,42 \times 0,35 - 0,429534 \times 0,30) = 0,202 \checkmark$$

$$a = 1,55 + 0,202 = 1,752 \checkmark$$

$$b = 6,85 - 1,752 = 5,098 \checkmark$$

$$c = \frac{0,09}{0,42} \times 5,098 = 1,092 \checkmark$$

2,0181398
3,09

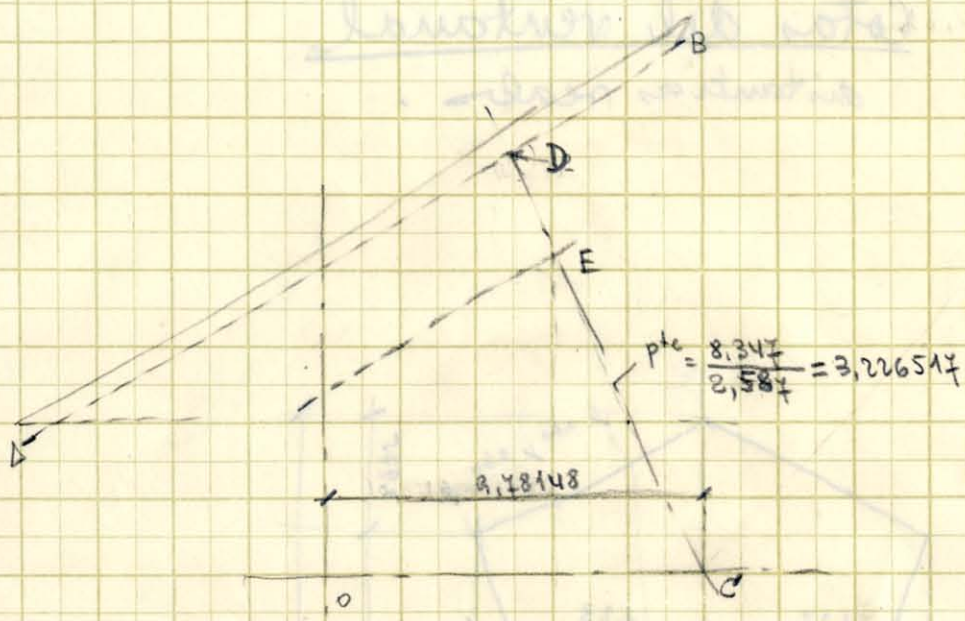


6,89
2,5
9,14
3,54
3,593

10,045
3,262
7,783

Vertical

3,6701
3,0993



ecuación de la recta AB $y = 5,41326837 + 0,36699875 x$

CD $y = -3,226517(x - 9,48148) = -3,226517x + 31,560112$

Coordenadas de D: $x_D = \frac{26,146843}{3,593516} = 7,276117$

$y_D = 5,413268 + 2,670328 = 8,083596$

Distancia CD. $\sqrt{y_D^2 + (9,48148 - x_D)^2} = 8,4629$

$y = 31,560112 - 3,226517x$

$y = B + \frac{10,04501}{11,98320}x = 0,82812 + 0,835754x$

$x_E = \frac{30,431992}{4,062271} = 7,565224$

$x_E - x_D = 0,289107$

$y_E = 0,82812 + 6,322665 = 7,150786$

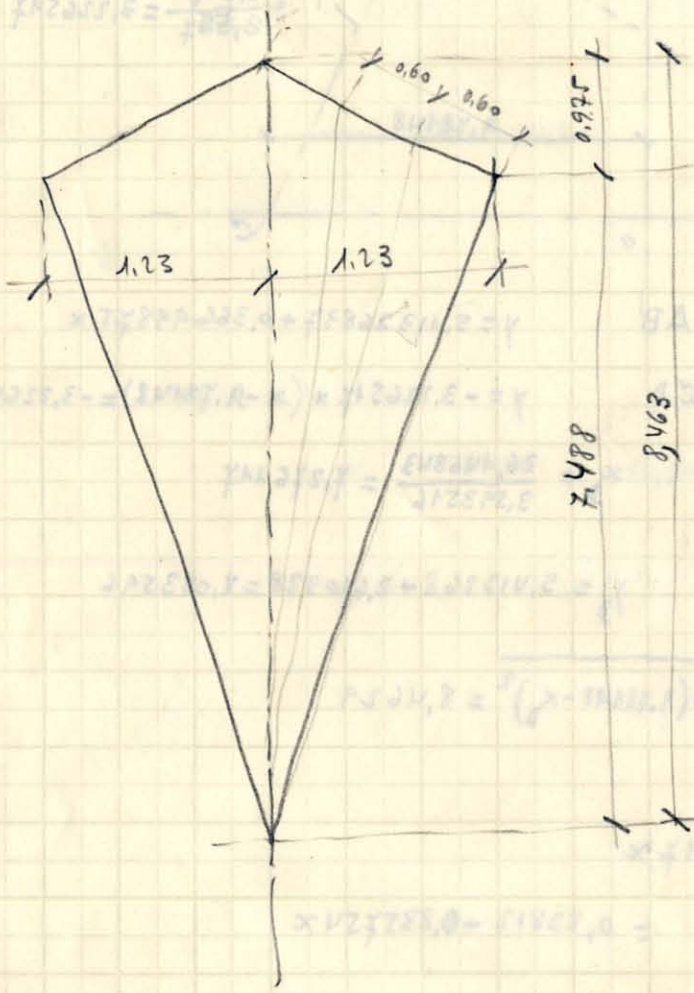
$y_D - y_E = 0,932810$

$DE = \sqrt{0,952566} = 0,976$

(Ver al dorso)

P.V.

Cotas del ventanal distancias reales.



(en el banco)

6,416803
5,789594
0,627206

Datos para la puerta principal

Arista superior de la cubierta

$$L = \sqrt{6,416803^2 + 6,65^2} = 9,241094 \checkmark$$

$$A = \frac{0,65 \times 6,65}{9,241094} = 0,464448 \checkmark$$

$$\Delta x = \frac{3,262233}{9,241094} \times 3,86475 = 1,3654 \checkmark$$

$$\Delta y = \quad \quad \times 4,61475 = 1,6301 \checkmark$$

$$\Delta z = \quad \quad \times 5,36475 = 1,8949 \checkmark$$

Arista inferior de la cubierta

$$b = \frac{9,241094}{6,4168} \times 0,040493 = 0,0583156 \checkmark$$

$$c = \frac{6,65}{6,4168} \times \quad = 0,0419646 \checkmark$$

$$B = \frac{6,65 \times (0,0932 + 0,0419646)}{9,241094} - 0,0583156 = 0,03895 \checkmark$$

$$\Delta x' = \frac{3,262233}{9,241094} \times 3,8288 - 0,110336 = 1,241283 \checkmark$$

$$\Delta y' = \quad \quad \times 4,5788 - \quad = 1,506043 \checkmark$$

$$\Delta z' = \quad \quad \times 5,3288 - \quad = 1,470800 \checkmark$$

Datos para la cámara sobre el muro

Distancia M = $\frac{6,65 \times 6,4168}{9,241094} = 4,617605 \checkmark$

" N = $\frac{6,65 \times M}{6,4168} = \frac{6,65^2}{9,241094} = 4,785418 \checkmark$

Altura del punto P = $\frac{3,262233}{9,241094} \times N = 1,689318 \checkmark$

" " " Q = 5,6171904

x = $\frac{Q-P}{M} \times 0,5 = 0,425 \checkmark$

Distancia G = $\frac{11,9832}{13,704728} = \frac{11,9832 \times 6,65}{13,704728} = 5,814656 \checkmark$

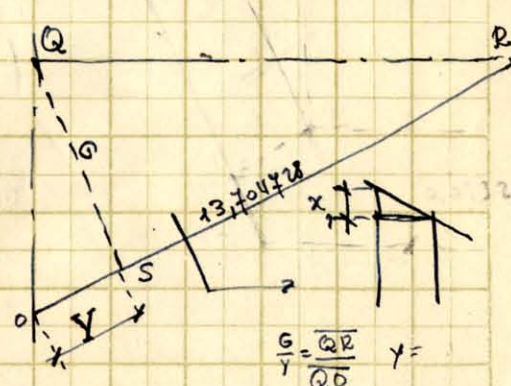
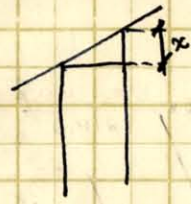
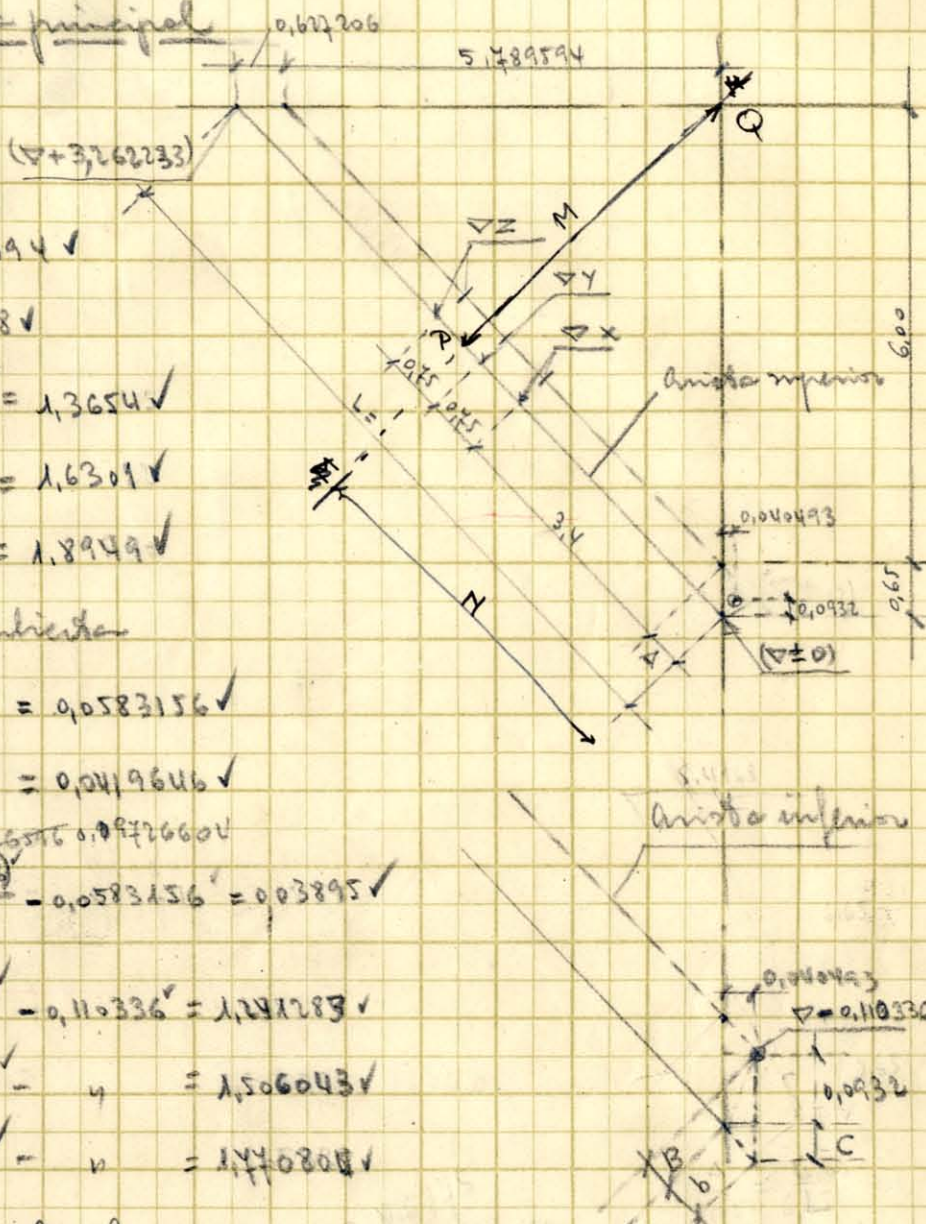
" " Y = $\frac{6,65^2}{13,704728} = 3,226806 \checkmark$

Altura del punto R = 10,01501

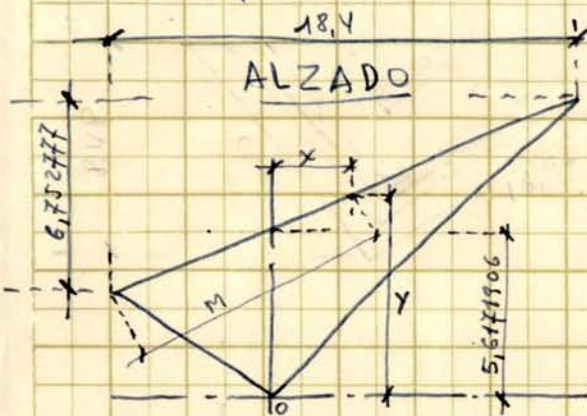
" " " S = $\frac{10,01501}{13,704728} \times Y = 2,358054 \checkmark$

" " " x₁ = $\frac{Q-S}{G} \times 0,5 = 0,180 \checkmark$

G x 6,65
11,9832



Máxima pendiente de la cubierta



Dando una sección, por AB se tiene:



$$L = \sqrt{6,65^2 + x^2}$$

$$y = 5,6171906 + \frac{6,752777}{18,4}x = 5,6171906 + 0,367x$$

$\tan \alpha = \frac{y}{L} = p$ y para que sea máxima se ha de cumplir

$$\frac{dp}{dx} = 0 \quad \text{o sea}$$

$$p = \frac{5,6171906 + 0,367x}{\sqrt{6,65^2 + x^2}} = U \cdot V$$

$$\frac{dp}{dx} = UV' + U'V$$

siendo $U = 5,6171906 + 0,367x$

$$U' = 0,367$$

siendo $V = (6,65^2 + x^2)^{-\frac{1}{2}} = W^{-\frac{1}{2}}$ siendo $W = (6,65^2 + x^2)$

$$\frac{dV}{dW} = -\frac{1}{2} W^{-\frac{3}{2}} \quad \frac{dW}{dx} = 2x$$

$$V' = -\frac{1}{2} W^{-\frac{3}{2}} \cdot 2x = -\frac{1}{2} \cdot 2x \cdot (6,65^2 + x^2)^{-\frac{3}{2}} =$$

$$V' = -(6,65^2 + x^2)^{-\frac{3}{2}} x$$

se tiene pues

$$\frac{dp}{dx} = -(5,6171906 + 0,367x)(6,65^2 + x^2)^{-\frac{3}{2}} x + 0,367(6,65^2 + x^2)^{-\frac{1}{2}} = 0$$

$$= -x(5,6171906 + 0,367x)(6,65^2 + x^2)^{-1} + 0,367 = 0$$

$$= -x(5,6171906 + 0,367x) + 0,367(6,65^2 + x^2) = 0$$

$$-x \cdot 5,6171906 - 0,367x + 0,367x \cdot 6,65^2 + 0,367x^2 = -5,6171906x + 16,2296575 = 0$$

$$x = \frac{16,2296575}{5,6171906} = 2,889283$$

$$M = \frac{19,6}{18,4} x (5,729594 + 2,889283) = 9,244891$$

$$y = 5,6171906 + 1,066037 = 6,677661$$

$$L = 7,25054868$$

$$\frac{y}{L} = 0,920978576$$

$$x = 2,89 \quad y = 6,677817$$

$$L = 7,25083443$$

$$\frac{y}{L} = 0,920972208$$

$$x = 2,887 \quad y = 6,6767160$$

$$L = 7,24963923$$

$$\frac{y}{L} = 0,920972143$$

$$x = 2,87 \quad y = 6,6447871$$

$$L = 7,21543494$$

$$\frac{y}{L} = 0,920912910$$

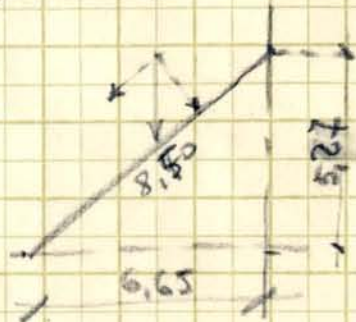
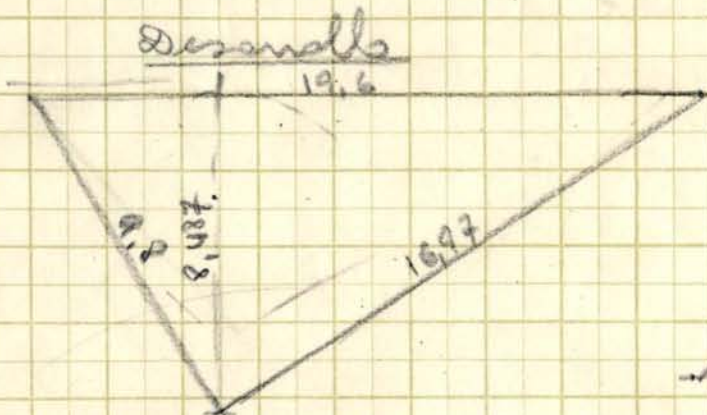
$$x = 3,00 \quad y = 6,7181869$$

$$L = 7,29537524$$

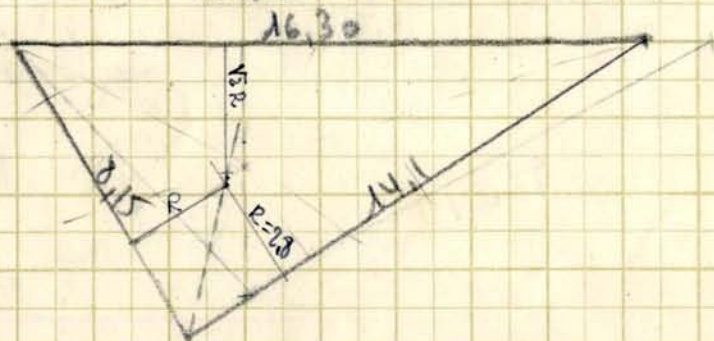
$$\frac{y}{L} = 0,92082981$$

Iglesia de Xernaldo.
Calculo

Placa



Dimensiones de la placa a ejes de centros



10,812
5,79
16,602

Peso propio por m² de desarrollo : $0,15 \times 2400 = 360 \checkmark$

Sobrecarga " " " : $= 80 \checkmark$
440 kg/m² ✓

Componente perpendicular al plano : $440 \times \frac{6,65}{8,50} = 340 \text{ kg/m}^2 \checkmark$

Momentos flectores (Formula dada por D. Eduardo)

$M_c = \frac{1}{6} \times 340 \times 3,8^2 = 450 \checkmark$ $d = 15$ $c = 13$ $t = 3,1 \text{ cm}^2$

$M_a = \frac{1}{6} \times 340 \times 3,9^2 = 860$ $t = 6 \text{ cm}^2 = 5 \phi 12 \text{ puz}$

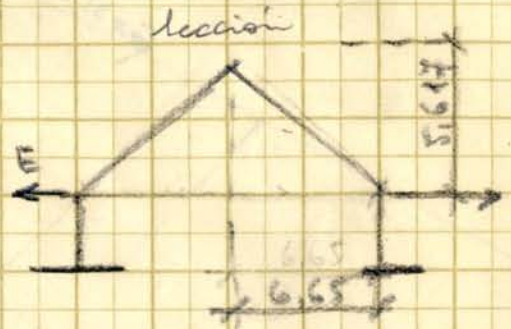
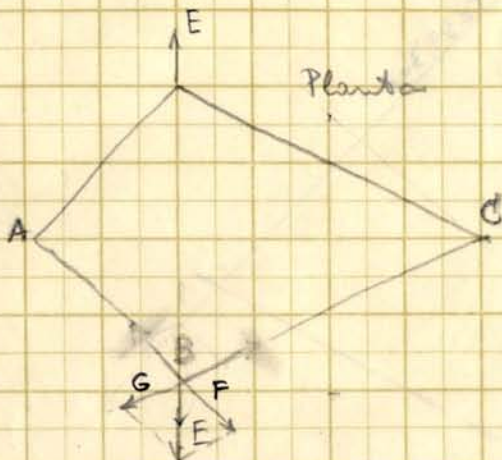
Se disponen armaduras ortogonales en el centro de $5 \phi 10 \text{ puz}$ (dicho por D. Eduardo)

Y siempre

Empuje sobre los vértices

Peso total: $440 \times \frac{19,6 \times 8,48}{2} \times 2 = 73.000 \text{ Kgs.}$

$E =$ Empuje horizontal: $73.000 \times \frac{6,65}{2} \times \frac{1}{5,617} = 43.100 \text{ Kgs.}$



Este empuje (E) se descompone horizontalmente en la dirección de los muros. Se tiene (gráficamente al dorso)

$F = 39.300$

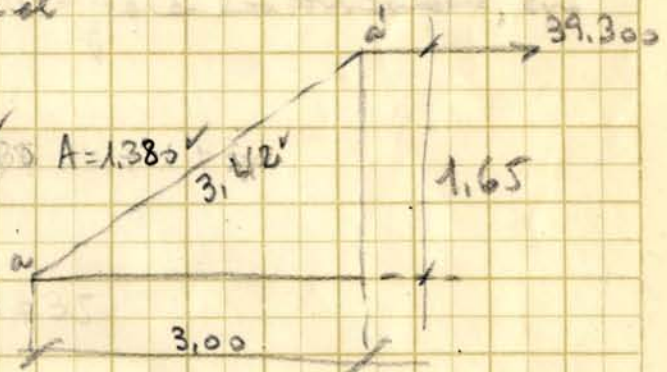
$G = 31.000$

En el muro AB, la tracción en el tirante a-a' vale

$39.300 \times \frac{3,42}{3,0} = 44.800 \text{ Kgs.} \quad A = 1,380$

y la tracción vertical en a resulta

$39.300 \times \frac{1,65}{3,0} = 21.600 \text{ Kgs.}$



El peso del muro y del cerramiento sobre el vértice y la puerta es

$(0,40 \times 0,62 \times 2.200 + 0,50 \times \frac{1,6 + 2,4}{2} \times 2.500) \times 3,2 = 11.600 \text{ Kgs.}$

y el peso de la cubierta desde el vértice hasta el extremo

$440 \times \frac{6,8}{2} \times 8,48 = 12.600 \text{ Kgs.}$

o sea un peso total de $11.600 + 12.600 = 24.200 \text{ Kgs.}$ que es superior a la tracción vertical de 21.600 Kgs; no obstante se prolonga el tirante por el umbral de la puerta (por el cerramiento)

y se anota este peso para coger más muro.

$T_i = [21.600 \times 3,0 - (1,380 \times 3,2 \times 1,6 + 2,200 \times 2,1)] \times \frac{1}{5,5} = 6.670$

$M_p = 6.670 \times 2,5 - 920 \times \frac{2,5}{2} = 13.800 \text{ mt.} \quad C = 55 \quad + = 23 \quad 2 \phi 35 + 3 \phi 16 \quad 2 \phi 16$

3640

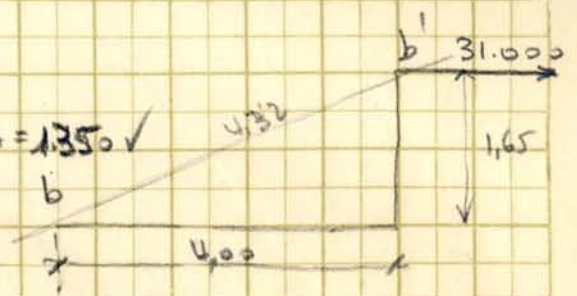
19.4
14.2

En el muro BC.

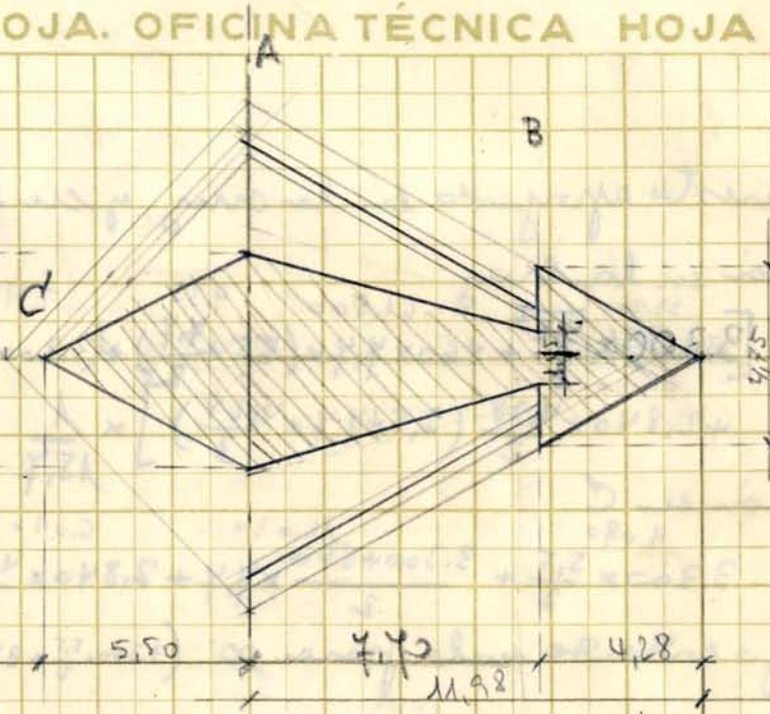
Tirante : $31.000 \times \frac{4.32}{4.0} = 33.500 \checkmark$ $f = 4.32$ $A = 1.350 \checkmark$

Presión en b : $31.000 \times \frac{1.65}{4.0} = 12.800 \checkmark$, que

está sobradamente resistida.



Viga giratoria
 la zona rayada
 es la que carga
 sobre la giratoria.
 los cargas
 verticales actuantes
 por un l. de viga



En A. $440 \times \frac{8.09}{6.65} \times \frac{5.61}{5.27} \times 5.40 = 3.300 \text{ kg/pul} \checkmark$
 " B. $\times 1.45 = 860 \text{ " } \checkmark$
 " " $\times 4.75 = 2.840 \text{ " } \checkmark$

Momentos en A.

$$2.840 \times \frac{4.28}{2} \times \left(\frac{7.4}{11} + \frac{4.28}{3} \right) + 860 \times \frac{7.4}{2} + (3.300 - 860) \times \frac{7.4}{6} = 106.200 \text{ mtkg}$$

$d = 430 \text{ g. l. } c = 420 \quad t = 23,5 \checkmark \text{ para } A = 1.500 \quad t = 19 \text{ (H } \phi 25)$
 $T = 2.840 \times \frac{4.28}{2} + \frac{3.300 + 860}{2} \times 7.4 = 22.400 \text{ kg. } \checkmark \quad T_{\text{media}} = \frac{22.400}{562 \times 40} = 1,00 \text{ kg/cm}^2$
 (línea al dorso)

Sección vertical en A
 $106.200 - 3.300 \times \frac{5.50}{6} \times \frac{1}{5.50} = 16.200 \text{ kg. } \quad t = 2028 \quad A = \frac{16.200}{17,3} = 1.320 \checkmark$

Cómo el peso es de 440 kg/pul^2 y se ha tomado

Loza de cubierta de cerámica

$L = 2,5 \quad \text{Carga de viento} = 1.800 \times 1,5 = 2.700 \checkmark$
 $\text{P.p.} = 0,18 \times 2.400 = 430 \checkmark$
 $M_c = 3.130 \times \frac{2,5^2}{8} = 2.440 \text{ mtkg. } \checkmark \quad d = 18 \quad c = 17,5 \quad t = 14,2 \text{ (H } \phi 16 \text{ mm)}$

$50g^2 + 267g - 3.740 = 0 \quad g = 6,4$
 $I = 100 \times \frac{6,4^3}{3} + 267 \times \frac{6,4^2}{2} = 24.100 \quad H = 13,5 \quad A = 1.130$

~~$50g^2 + 243g - 3.760 = 0 \quad g = 6,6$~~
 ~~$I = 100 \times \frac{6,6^3}{3} + 243 \times \frac{6,6^2}{2} = 28.800 \quad H = -56 \quad A = 1.110$~~
 $50g^2 + 213g - 3.300 = 0 \quad g = 6,3$
 $I = 100 \times \frac{6,3^3}{3} + 213 \times \frac{6,3^2}{2} = 26.400 \quad H = -58 \quad A = 1.180$

5,24
 2,24
 5,51
 550
 1015,65
 2,25
 1017,90
 1019,50
 1,60
 2,150
 2,160
 2,130
 2,220
 2,170
 1,6
 3775
 89
 267

Inyección apoyada en la cruz y en el punto C recibe

Reacción en la cruz

$$\left[33000 \times \frac{5.5}{3} + 860 \times 7.7 \times \left(5.5 + \frac{7.7}{2} \right) + (3300 - 860) \times \frac{7.7}{2} \times \left(5.5 + \frac{7.7}{3} \right) + 2.840 \times \frac{4.28}{2} \left(5.5 + 7.7 + \frac{4.28}{3} \right) \right] \times \frac{1}{15.7} = 16.600 \text{ Kg}$$

Reacción en C

$$3300 \times \frac{5.5}{2} + \frac{3300 + 860}{2} \times 7.7 + 2.840 \times \frac{4.28}{2} - 16.600 = 14.600 \text{ Kgs}$$

Espejo constante nula para x $(3300 \times \frac{5.5}{2} + 3300x - \frac{2.240}{7.7} \times \frac{x^2}{2} = 14.600)$

$$x = 5.5 + 1.8 = 7.3$$

Momento flexión en x

$$14.600 \times 7.3 - 3300 \times \frac{5.5}{2} \times \left(\frac{5.5}{3} + 1.8 \right) - 3300 \times \frac{1.8^2}{2} + \frac{2.240}{7.7} \times \frac{1.8^3}{6} = 68.600 \text{ mkg}$$

$$d = 100$$

$$c = 390$$

$$t \text{ para } A = 1.500 \quad t = 13 \text{ cm}$$

0 ser 2φ20 por cada borde de la placa

$$\begin{array}{r} 1418 \\ - 148 \\ \hline 1570 \end{array}$$

$$3300 \times \frac{5.5}{2} + 3300x - \frac{2.240}{7.7} \times \frac{x^2}{2} = 14.600$$

$$14514x^2 - 3300x + 5510 = 0$$

$$x = \frac{3300 \pm \sqrt{3300^2 - 4 \times 14514 \times 5510}}{2 \times 14514}$$

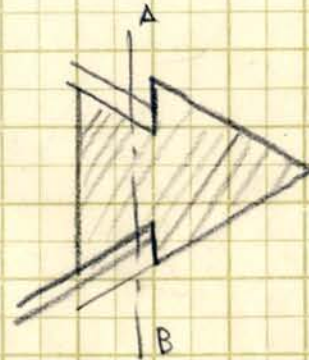
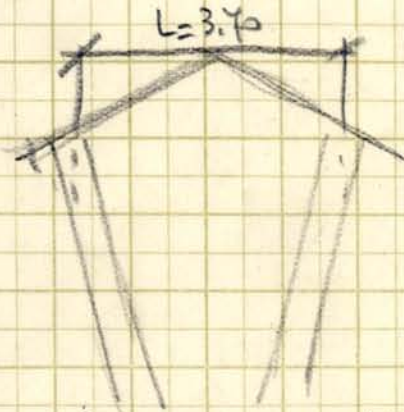
$$x = \frac{3300 \pm \sqrt{10890000 - 320000000}}{29028}$$

$$x = \frac{3300 \pm \sqrt{-309100000}}{29028}$$

$$x = \frac{3300 \pm 17580i}{29028}$$

$$\begin{array}{r} 95200 \\ 1647 \\ \hline 50100 \end{array}$$

Zona del ventanal



Supuestos como viga AB con la carga correspondiente a la zona
cubierta. Peso total: $2.840 \times \frac{4.18}{2} = 6.080 \checkmark$

$$590 \times 3.7 \times 2 = 4.340 \checkmark$$

$$\underline{10.450 \checkmark}$$

$$M_c = 10.450 \times \frac{3.7}{8} = 4.810 \text{ mfs.} \checkmark$$

Ancho de reparto = 2,00 m. $M = 2.405 \text{ mfs/m.} \checkmark$

$d = 15$ $c = 13$ $t = 17.8$ (~~5~~ $\phi 18$ mm)

$$50g^2 + 267g - 3.470 = 0 \quad g = 6.1 \checkmark$$

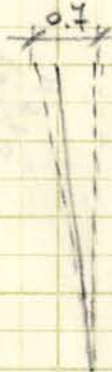
$$I = 100 \times \frac{6.1^3}{3} + 267 \times 6.1^2 = 20.400 \checkmark \quad H = -72 \checkmark \quad A = 1.200 \checkmark$$

y para $A = 1.500 \text{ g/cm}^2$ $t = \frac{17.8}{1.6} \times 1.2 = 13.6$ ($5 \phi 18$ mm)

175
89

Elementos resistentes del ventanal

Viga central



70.5
6.7
8.75

Carga uniforme por m. l. Anillo: Vidrio $0.7 \times 0.005 \times 2.400 = 10.0$
 Perfil = 6.0
 Madera $0.06 \times 0.09 \times 900 = 5.0$
21.0
 Abajo Perfil y madera = 11.0

Componente normal al ventanal. Anillo: $21 \times \frac{2.587}{8.75} = 6.20$
 Abajo: $11 \times \eta = 3.20$

$M = (3.2 \times 0.064 + 3.0 \times 0.115) \times 8.1 = 38 \text{ mtkg}$ $A = 200 \text{ kg/cm}^2$

Flecha: $\left(\frac{5}{384} \times 3.2 + 0.00652 \times 3.0 \right) \times \frac{8.1^4}{2.1 \times 27.8} = 1.62 = \frac{l}{500}$

Viga lateral

Lateralmente:

Carga unif. p.m. Anillo: $0.44 \times 0.005 \times 2.400 = 6$
 = 11.0
 Abajo = 11.0

Componente normal: Anillo $\frac{0.88}{8.15} \times 17 = 1.81$
 Abajo $\eta \times 11 = 1.17$

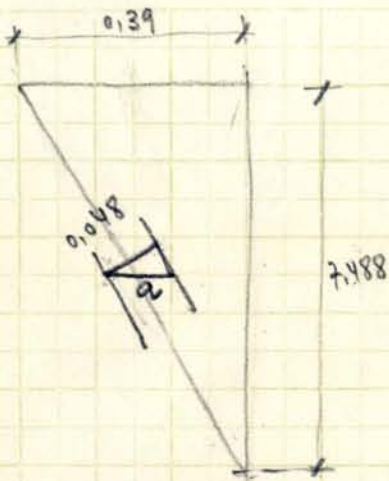
$f = \left(\frac{5}{384} \times 1.17 + 0.00652 \times 0.64 \right) \times \frac{7.8^4}{2.1 \times 6.29} = 5.5$

Para

$\left(\frac{1}{200} \right)^4 =$



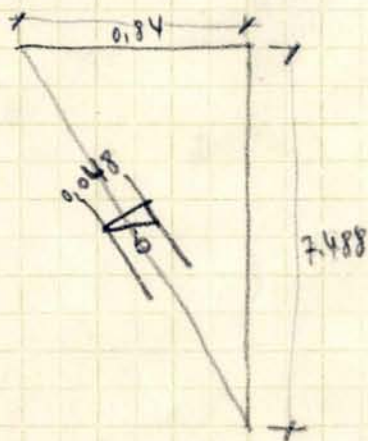
1.000 x 0.005
 240
 160
 7.8
 7.8
 624
 546
 0.005
 300
 0.007
 2020
 200 154 x 37



56,222244

$$h = \sqrt{7,488^2 + 0,39^2} = 7,498149$$

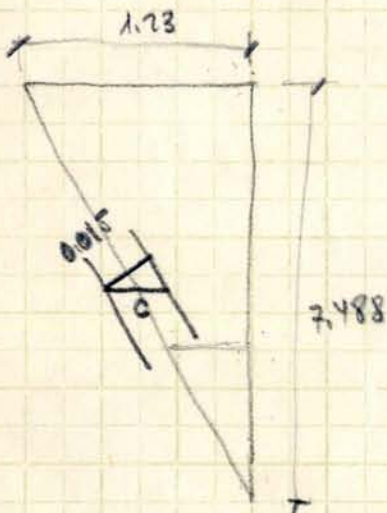
$$a = \frac{7,49815 \times 0,048}{7,488} = 0,04806$$



56,775744

$$h = \sqrt{7,488^2 + 0,84^2} = 7,534968$$

$$b = \frac{7,53497 \times 0,048}{7,488} = 0,04830$$



57,583044

$$h = \sqrt{7,488^2 + 1,23^2} = 7,588349$$

$$c = \frac{7,58835 \times 0,015}{7,488} = 0,01520$$

$$a + b + c = 0,11156$$

$$\frac{0,035}{11156} = 0,892$$

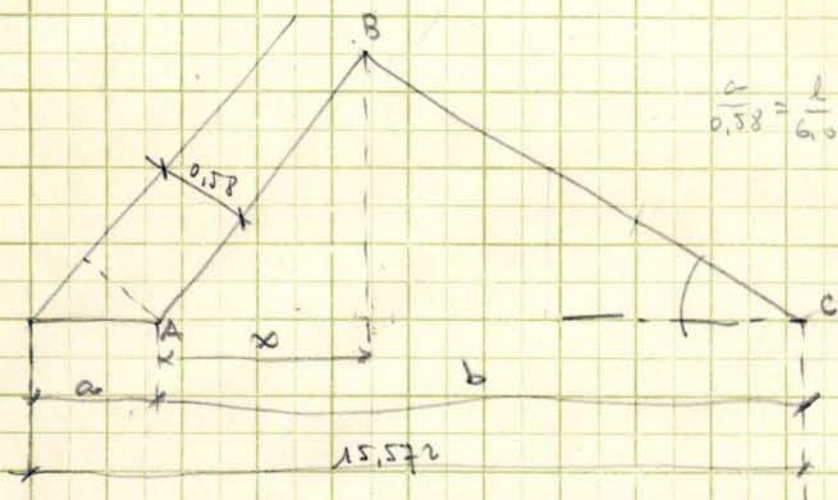
altura de encuentro = $\frac{7,488 \times 0,11156}{1,23} = \underline{\underline{0,6792}}$

$$0,146 - 0,89$$

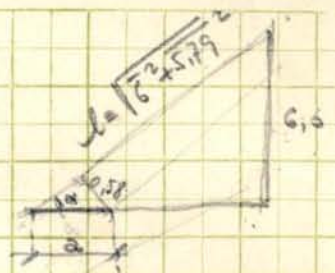
Cálculo del desarrollo
del paramento interior de
los muros

5,79
9,782
15,572

10,075
10,262
6,753



$$\frac{a}{0,58} = \frac{l}{6,0}$$



$$a \text{ and } \alpha = 0,58 = a \frac{6,0}{l}$$

$$a = \frac{0,58 \sqrt{6^2 + 5,79^2}}{6,0} = 0,806$$

$$b = 15,572 - a = 14,7660$$

$$(AB) \quad y = \frac{6,0}{5,79} x$$

$$x = \frac{5,79}{6,0} y$$

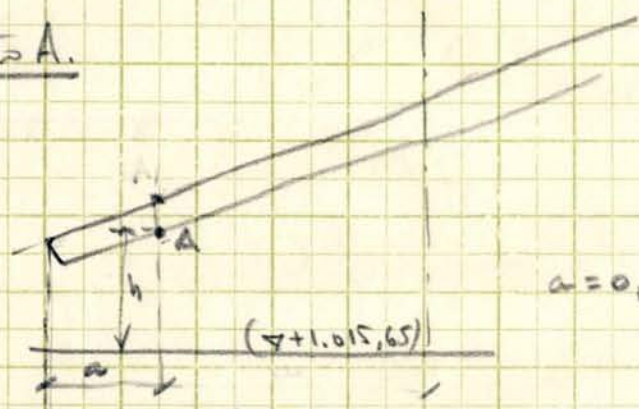
$$(BC) \quad y = -\frac{6,0}{10,812} (x - b)$$

$$y = -\frac{6,0}{10,812} \left(\frac{5,79}{6} y - b \right) = 5,3365 \quad x = \frac{5,79}{6} y = 5,1497$$

$$\overline{AB} = \sqrt{x^2 + y^2} = \underline{\underline{4,4161}}$$

$$\overline{BC} = \sqrt{(b-x)^2 + y^2} = \underline{\underline{10,9084}}$$

Abcisa del punto A.



$$a = 0,627 + 0,806 = 1,433 \checkmark$$

(y+1.015, 65)

$$\text{Abcisa } h = 3,262 + 0,85 + \frac{6,752777}{18,4} \cdot 1,433 = 0,2039 = \underline{\underline{4,434}}$$

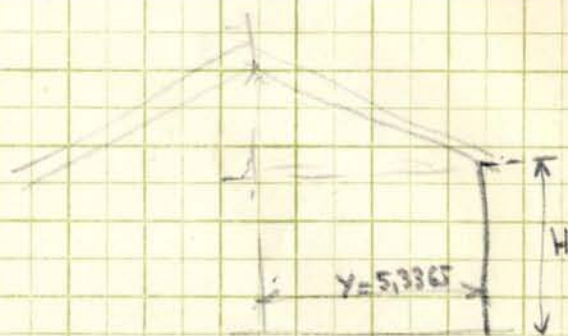
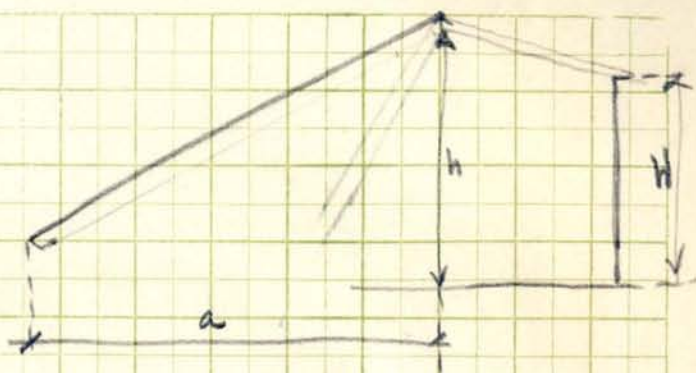
Altura del punto B

$$a = 0,627 + 0,806 + 5,1494 = 6,5827$$

$$h = 3,262 + 0,85 - 0,2039 + \frac{6,45244}{18,4} a = 6,3239$$

$$y = 5,3365$$

$$H = h - \frac{5,6142}{6,65} \times 5,3365 = \underline{\underline{1,8162}}$$



Punto C

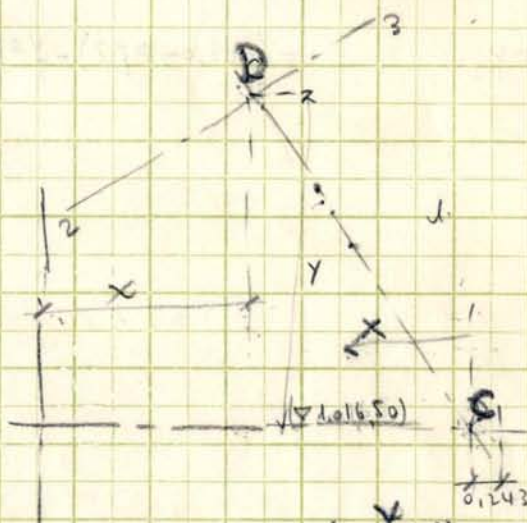
Recta DC. $y = -3,226517(x - 9,482)$ ✓

Recta 2.3 $y = 5,4133 + 0,367x$

$$-3,226517x + 3,226517 \times 9,482 = 5,4133 + 0,367x$$

$$\boxed{x} = \frac{3,226517 \times 9,482 - 5,4133}{0,367 + 3,226517} = 7,276573$$

$$y = 8,083802$$



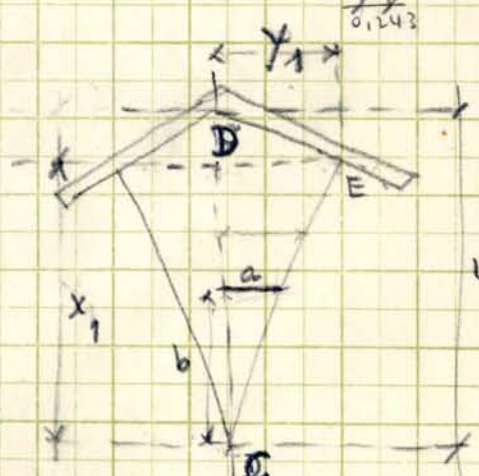
Distancia C-D. $L = \sqrt{(9,482 - x)^2 + y^2} = 8,463156$

Recta DE

$$a = \frac{6}{10,812} X = 0,554939 X$$

$$b = \frac{L}{9,482 - x} X = 3,377930 X$$

Escuadra recta DE. $\frac{y}{y_1} = \frac{a}{b} X_1 = 0,164283 X_1$



Recta CE

$Q = \sqrt{5,617^2 + 5,273^2} = 7,617$

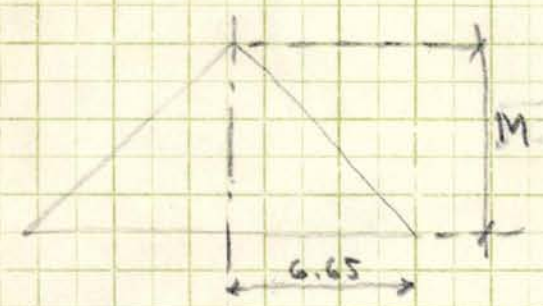
$\text{sen } \alpha = \frac{5,617}{19,60} = 0,28658168$ $17^\circ 13' 48''$

$\text{sen } \beta = \frac{5,273}{19,60} = 0,26903061$ $15^\circ 41' 11''$

$\gamma = \alpha - \beta = 2^\circ 55' 23''$

$\cos \gamma = 0,99869887$

Distancia $\overline{DC} = M = \frac{5,2733}{\cos \gamma} = 5,280170$



Equación de la recta CE

$y_1 = -\frac{6,65}{M} (x_1 - L)$

$0,164283 x_1 = -\frac{6,65}{5,280170} (x_1 - 8,463156)$

$x_1 = 7,486577$ $y_1 = 1,229919$

Punto E

$x_1 = \frac{b}{a} y_1$ $y_1 = -\frac{6,65}{M} (\frac{b}{a} y_1 - L)$

$y_1 (1 + \frac{6,65}{M} \frac{b}{a}) = L$ $y_1 = \frac{\frac{6,65}{M} L}{1 + \frac{6,65}{M} \frac{b}{a}} = 1,229923$

$x_1 = \frac{b}{a} y_1 = 7,486577$

Altura del punto E

$h_1 = 9,016,50 + x_1 \frac{y_1}{L} - 1,015,65 = 8,001$

Distancia de la vertical del punto E al punto C

$\frac{\sqrt{6,0^2 + 10,812^2}}{10,812} \times \frac{9,482 - x}{L} x_1 = \frac{231,935737}{91,503643} = 2,53471$

1,143660

~ 8,00

