

FAMILIA _____

1. HERRAMIENTAS

ARQUITECTOS-CONSTRUCTORES

Lista de herramientas recibidas

- 2 pallas
- 1 pico
- 1 flota de acero
- 1 hilo
- 1 nivel de hilo
- 1 nivel
- 1 martillo
- 1 cinta

Fecha _____

Firmas _____

Herramientas comunales recibidas

3 mangueras

2 carretillas

1 cincel para bloques

1 martillo de 3#

Fecha _____

Firmas _____

Herramientas comunales recibidas

- 3 mangueras
- 2 carretillas
- 1 cincel para bloques
- 1 martillo de 3#

Fecha 27, feb 76

Howard Davis

Firmas *Emma Rivera*

José D. Pardo

Manuel

SET-UP COST
TOOLS + COM

TOOLS	1200 p
COMMUNAL STRUCTURES	1600 p
	<hr/> 2800 pesos

FAMILY _____
 ARCHITECT-BUILDERS _____

OPERATION 2. EXCAVATION
 STARTING DATE Monday, Feb. 24

UNIT OF MEASURE m^2 House has _____ m^2 (TOTAL ROOFED AREA)

Materials Requisition

Material	Amount/ m^2	Limit	Amount Requisitioned	(Excess)
CAL	.008 m^3			
#3 RE-BAR (20" pieces)	.53			

Work Schedule

<u>Day</u>	<u>Operation</u>
Monday	Place re-bars marking column locations. KEEP THESE IN IN PLACE THROUGHOUT ALL OPERATIONS.
Wednesday	Excavate along walls, 8" deep and 20" wide, measured inward from outside of wall.
Wednesday	Agitate earth completely over entire area of building, to a depth of 10" down from new level.
Thursday	Flood the entire area with a mixture of cal and water, 1:20 by volume.
Monday <i>Sunday</i>	Compact it all. Ready to begin placing foundation blocks (OPERATION 3).

ON SCHEDULE YES _____ NO _____

If NO, _____ days behind.

Amount of penalty is _____ pesos.

Family _____

Architect-builder _____

FAMILY TOTALS.
 ARCHITECT-BUILDERS _____

OPERATION 2. EXCAVATION
 STARTING DATE Monday, Feb. 24

UNIT OF MEASURE m²

House has 375 m² (TOTAL ROOFED AREA)

Materials Requisition

Material	Amount/m ²	Limit	Amount Requisitioned	(Excess)
CAL	.008m ³		3 m ³	
#3 RE-BAR (20" pieces)	.53		186. 189.	

Work Schedule

<u>Day</u>	<u>Operation</u>
Monday	Place re-bars marking column locations. KEEP THESE IN IN PLACE THROUGHOUT ALL OPERATIONS.
Wednesday	Excavate along walls, 8" deep and 20" wide, measured inward from outside of wall.
Wednesday	Agitate earth completely over entire area of building, to a depth of 10" down from new level.
Thursday	Flood the entire area with a mixture of cal and water, 1:20 by volume.
Monday	Compact it all. Ready to begin placing foundation blocks (OPERATION 3).

ON SCHEDULE YES ___ NO ___

If NO, _____ days behind.

Amount of penalty is _____ pesos.

Family _____

Architect-builder _____

SITE WORK

Unit of measure m^2

CAE	$.008 m^2/ft^2$ $pesos/m^2$
CAE .008 m^3/m^2	7.1 $pesos/m^2$
CAE .008 m^3/m^2	
#3 REBAR 20" pieces @ 1.1 pesos/ft (1.8 pesos each) - .66 cols/ m^2	1.2 $pesos/m^2$
	8.3

FAMILIA
ARQUITECTO-CONSTRUCTOR



OPERACION 3. CIMENTACION
 FECHA A EMPEZAR Lunes 1 marzo 1976

Limite: 1.04m/m² x area de la casa = 5 m

Unidad de medida: m¹ de cimentacion

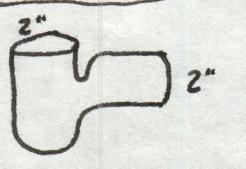

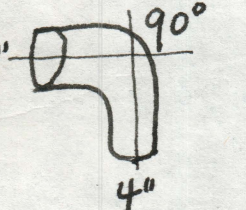
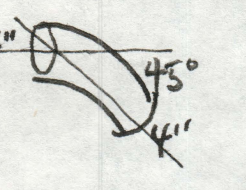
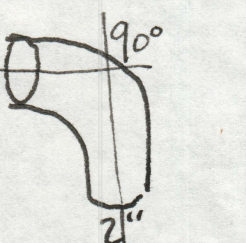
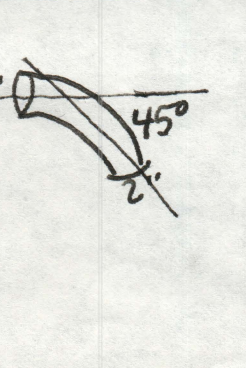
Casa tiene metros
 de cimentacion

Requisition de materiales

Material	Cantidad/m	Limite	Cantidad Solicitada	(Excedente) (Exceso)
TIERRA LIMO	1 pie ³			
BLOQUES DE CIMENTACION DE ESQUINA	.53			
BLOQUES DE CIMENTACION DE MURO	1.93			
BLOQUES DE COLUMNA (ROJO) CONCRETOS	.53		 : _____  : _____	
BLOQUES DE MURO CONCRETOS (ROJOS)	2.43		1: _____ 1/2: _____	
CEMENTO (MEZCIA 1:2)	1.9 cols. .002 m ³			
REVUELTA	1.12 metros .027 m ³			

PLUMERIA (SOLAMENTE DRENAJE ABAJO DEL PISO): PROXIMA PAGINA

DRENAJE (DIBUJO EN LA PROXIMA PAGINA)

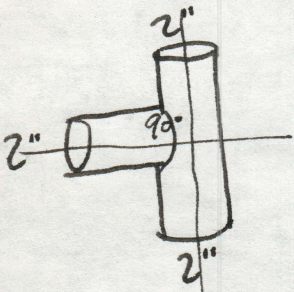
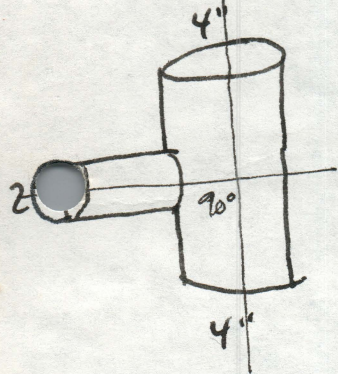
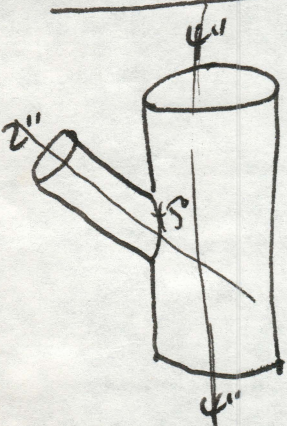
Material	Cantidad Solicitada
TUBO 4"	
TUBO 2"	
	1
	
	
	
	
	

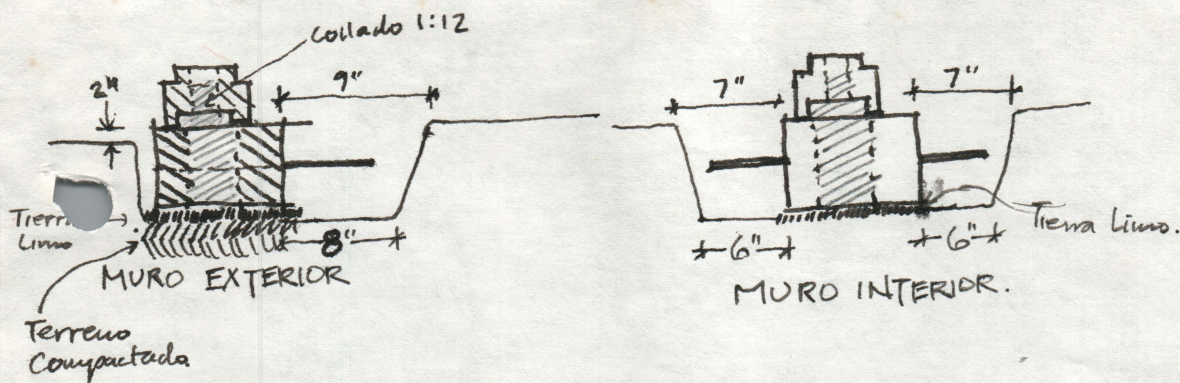
Material

Cantidad Solicitada



1





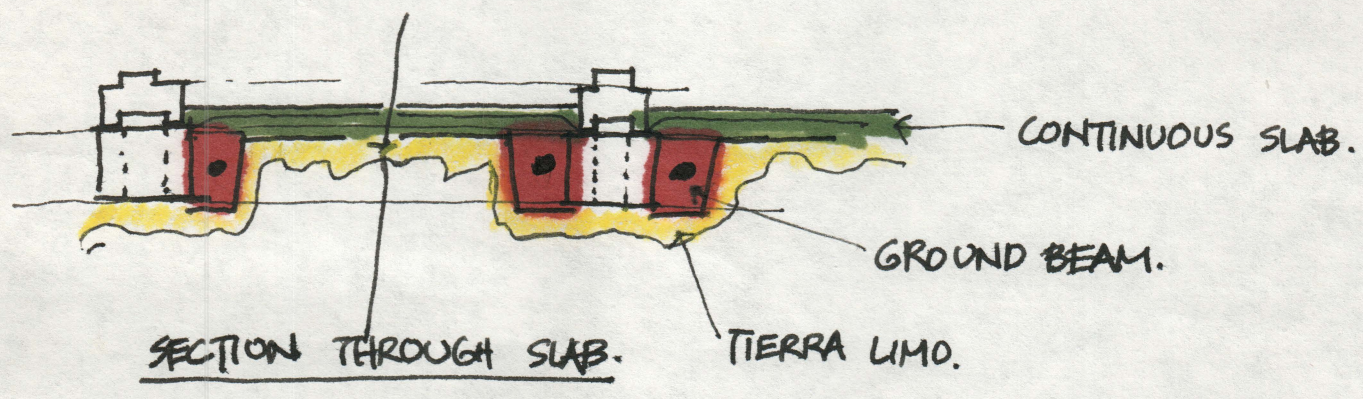
Horario de trabajo

Dia	Operacion
Lunes	1. Se coloca una capa delgada de tierra limo en la cual los bloques se colocaran, se compacta con 1" de espesor.
Lunes	2. Colocar y nivelar los bloques de cimentacion de esquinas ajustando las distancias entre los mismos. (De la mitad a la mitad.) Se colocan los bloques con la parte superior aproximadamente 2" arriba del terreno.
Martes	3. Se colocan primero los bloques-columnas rojos, asegurandose que la distancia entre ellos sea muy exacta para hacer un numero integral de bloques de muro (multiplos de 24 cms).
Martes	4. Se toman en las barillas que han marcado las posiciones de las columnas, y se colocan rellenas en el centro de las de columnas de tal manera que la parte de abajo quede de 2" de arriba de la parte de abajo de los bloques.
Miercoles	5. Determinar los lugares en los que se pasara el tubo de soil atravez de los muros. Hacer la trinchera para los tubos de soil; se ponen los tubos y otros cosas de la plomeria necesarios ahorita; llenar con tierra.
Jueves, Viernes	6. Coloque y nivele los bloques de cimentacion de muro. El nivel de la parte superior de los bloques de cimentacion debe de ser el mismo que en la parte superior de cimentacion de esquina.
Sabado, Domingo	7. Coloque los bloques de concreto rojo de los muros entre las columnas.
Domingo	8. Se rellenan las celdas de los bloques de muro, una en cada dos hasta la mitad de los bloques.

SLAB.

The unit of slabs is area.

The ^{unit} cost of the slab is calculated in 2 parts: the unit cost of the ground beams, plus the unit cost of the continuous 2" layer. In addition, the tierra lino used to form the beams and to adjust the thickness of the slab ~~is~~ ^{is} included in the unit price.



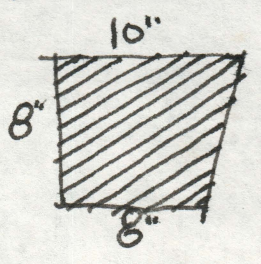
1. Ground beam.

First, since the beam has a uniform cross section, its unit is length. [$V = A \times l$, A is fixed]. So it is necessary first to correlate length of beam with area of slab. From the experience of these 2 houses, (SHOW PLANS of TAPIA + RODRIGUEZ), we have empirically 1.5 m of beam for every m^2 of slab.

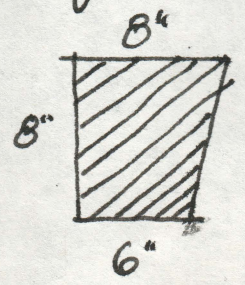
This includes: $\$$

1. Internal walls have beams on each side.
2. The slab is a waffle slabs with beams on ~~2~~ 2m. centers.

The cross sectional area of a beam is as follows.



EXTERIOR WALLS
(single beams)



INTERIOR WALLS
(double beams)

For this limit calculation, we use the larger throughout.

The cross-sectional area is then 72 sq in^2 , or

$$72 \times 6.45 \text{ cm}^2 = .046 \text{ m}^2$$

or a volume of $.046 \text{ m}^3 / \text{m}$ of beam.

Multiplying this by 1.5 m of beam / m^2 of slab, we have

$$\frac{1.5 \text{ m of beam}}{\text{m}^2 \text{ of slab}} \times \frac{.046 \text{ m}^3 \text{ of concrete}}{\text{m of beam}}$$

GROUND BEAM.
$.069 \text{ m}^3 \text{ of concrete} / \text{m}^2 \text{ of slab}$

The re-bar is included at this point as well.

The amount of re-bar needed is the length of beam, plus a factor for overlap. The amount of overlap is $8" / \text{rebar}$, or $8" / 30"$, or 2.2% . Not included is the fact that at the corners, a curve takes slightly less re-bar than an exact 90° bend.

WASTE FACTOR
RE-BAR

$$\text{So we have } \frac{1.5 \text{ m of rebar}}{\text{m}^2 \text{ of slab}} + \frac{.02 \times 1.5 \text{ m of rebar}}{\text{m}^2 \text{ of slab}}$$

GROUND BEAM.
$1.53 \text{ m of rebar} / \text{m}^2 \text{ of slab}$

(9.15m)
or, for $30"$ pieces of re-bar,

$.17 \text{ rebar} / \text{m}^2 \text{ of slab}$
--

2. Continuous 2" layer.

(3)

Per square meter, the volume of concrete is simply:

$$2" \times 1m \times 1m / m^2 \approx 2 \times 1000 \times 1000 / m^2$$
$$= 2 \times \frac{1}{12} (.305m) \times m^2 / m^2$$

$$= \frac{.05 m^3}{m^2 \text{ of slabs}}$$

CONTINUOUS LAYER	CONCRETE
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The amount of chicken wire required is simply the area of the slabs.

$$= \frac{1 m^2 \text{ chicken wire}}{m^2 \text{ of slabs}}$$

CONTINUOUS LAYER	CHICKEN WIRE
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Finally, the oxido rojo cap:

~~On experience~~ On one of the slabs in the initial buildings, we used $.00025 m^3$ oxido rojo / m^2 of slabs:

With a mix of 1:2:2

oxido rojo: cement: tierra limo, this means

- $.00025 m^3$ oxido rojo / m^2 of slabs.
- $.0005 m^3$ cement / m^2 of slabs.
- $.0005 m^3$ tierra limo / m^2 of slabs.

Tierra lining formwork.

(4)

This depends to a large extent on the excavation being done properly - the 1st 5 houses are not a good ~~example~~ example because ~~most~~ of the excavation was done too deep & a lot of T.L. had to be used to bring ~~the~~ the level up.

If we assume an average of 1" over the area of the slab, then per square meter we have

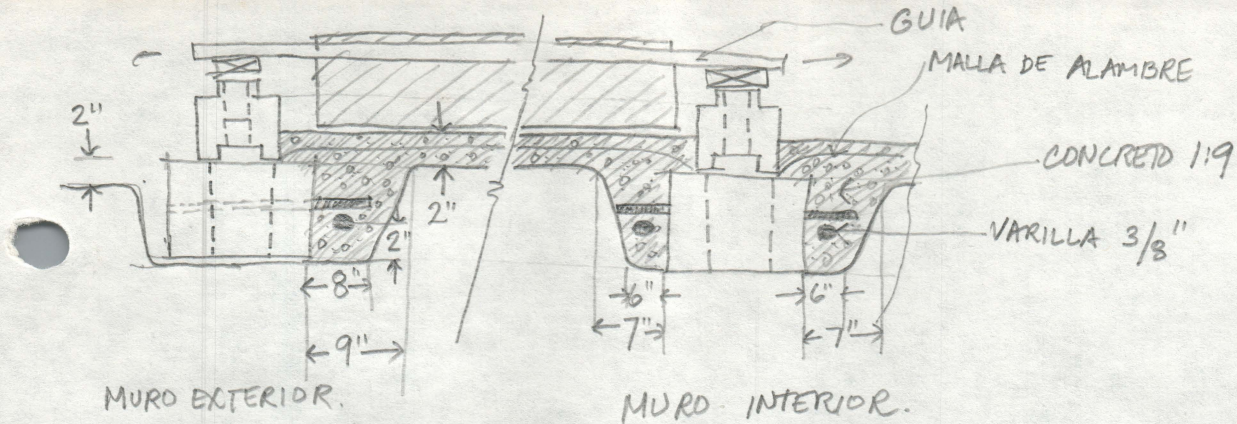
$$1" \times 1m \times 1m / m^2 = \overset{.025}{\cancel{.025}} m^3 / m^2 \text{ of slab}$$

Finally, the concrete volume must be converted into

FOUNDATION.

UNIT OF MEASURE m¹

	pesos/m
TIERRALIMO 1/4 ³ /m	1
CORNER FOUNDATION BLOCKS 12.5 pesos/each .66/meter.	8
WALL FOUNDATION BLOCKS 5.7 pesos/each 16" long. 8" from each meter subtracted for corner block	$\begin{array}{r} 6.65 \\ \underline{11} \\ 6.65 \\ \underline{6.65} \\ 73.15 \end{array}$
CONCRETE COLUMN BLOCK 2.4 pesos/each. .66/meter.	1.6
CONCRETE WALL BLOCK 3 pesos/each	7.3
Each 18" long [For every 3 blocks you need 4] → 4 pesos each	
FILL 1:12 .62 ³ /m .017 m ³ /m	$\begin{array}{r} 3.7 \\ \underline{2.8} \\ 2.4 \text{ p/m} \end{array}$
TOTAL.	$\begin{array}{r} 31.7 \\ \underline{32.6} \\ 31.3 \end{array}$



Horario de trabajo--Operacion 4--PISO

Sabado 13 marzo, y Domingo 14 marzo

1. Formar las vigas en el piso de acuerdo a los diagramas previstos. Las cantidades de concreto estimadas estan basadas en las dimensiones exactos de las nervaduras. Asegurarse de que todos los materiales que esten debajo de los pisos y las nervaduras este bien compactado.
2. Coloque 1 varilla de 3/8" en cada viga, 2" sobre la tierra. El traslape entre varillas no sera mayor de 8" y use 2 pedazos de alambre para unir las secciones de la varilla.
3. Coloque la malla de alambre, dejandola suelta en el centro, para levantarla cuando se este vaciando el concreto. Reparar la malla de alambre.
4. Coloque formas en las puertas exteriores.
5. Coloque, en la primera zona de vaciado, las guias para reglear el concreto y la regla para tal efecto.
6. Haga una rampa para la carretilla con tierra limo y tarimas de madera, para el vaciado del concreto y coloque un puente de padera de la rampa al primer sitio donde se vacie el concreto.
7. Coloque las mezcladores en posicion, con las cantidades de cemento necesarias cerca de cada una de ellos.
8. Prepare la mezcla para el color 1:2:2, oxido rojo:cemento:tierra limo.

El dia del colado:

9. Comiense las mezclas, usando una mezcla de 1:3:6 , cemento:grava:revuelto, (1/2 saco de cemento=1 bote) y entre 1 1/2 - 2 botes de agua. Puede ser necesario cambiar un poco la mezcla despues de la primera batida, dependiendo de la consistencia del revuelto.
10. Riegue la primera seccion de colado, hasta que se saturate el terreno; es necesario tener el terreno mojado antes de vaciar. Ase este se tiene que hacer antes de vaciar en cada seccion.
11. Mientras se esta vaciando, recuerde compactar el concreto con el compactador especial y levantar la malla de alambre, para despues reglear con la forma de madera. Dos pasadas con la regla sera suficiente.

- 12. Use la flota de aluminio para afinar la superficie y asentar la grava.
La superficie debe mantenerse suficientemente mojada. Una flotada puede ser suficiente.
- 13. Utilice la plana de acabadas para formar la orilla en las puertas exteriores.
- 14. Ahora espere entre 1 a 2 horas, antes de empezar el acabado final
- 15. Haga el aplanado final.

Por 2 dias, al menos, despues de vaciar:

- 16. Mantenga el piso mojado.

Recuerdo de trabajo

Dia	Operacion	Personas	Horas

FAMILIA
 ARQUITECTO-CONSTRUCTOR

OPERACION 4. PISO
 FECHA A EMPEZAR: Martes 9 marzo

Limite = .77 x area techada de la casa = _____ m²
 Casa tiene _____ m² del piso collado

Requisition de materiales

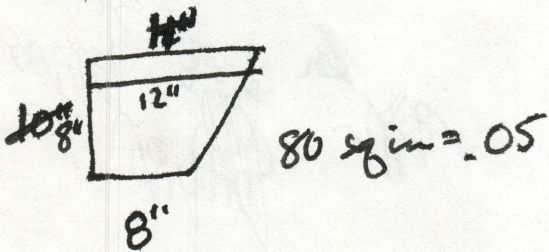
Material	Cantidad/m ²	Limite	Cantidad Solicitada	(Exceso)
VARILLA #3	.88m 1.7m			
MALLA DE ALAMBRE	1 m ²			
CONCRETO	.09m³ 1.4m ³			
REVUELTO	.06m ³			
GRAVA	.03m ³			
CEMENTO	.01m ³			
<u>CAPA DE OXIDO ROJO</u>				
OXIDO ROJO	.00025m ³			
TIERRA LIMO	.0005m ³			
CEMENTO	.0005m ³			
(TOTAL DE CEMENTO =PISO + CAPA)				

SLAB



Volume of material needed.

For every $4m^2 = 3m$ of beam.



8

~~10x10 = 100 sq in = .07 m²~~

Vol of concrete in beam = ~~.07~~ ^{.05} m³/m of beam

So, vol of concrete = $.05 m^3/m$ ^{3.5m} / $4m^2$

~~1.2~~ $2 m^3/m^2$ for beam

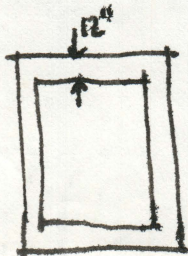
And slab,

$$\begin{array}{r} .0254 \times 2 \\ 2.05 \\ \hline 12'' \end{array}$$

12''

$$t = .05 = \frac{.15 m^3}{4 m^2} = .0375 \frac{m^3}{m^2}$$

$$\frac{.0375}{.05} = .75 \frac{m^3}{m^2}$$



$[2'' \times 1m \times 1m] / m^2$ to $2 m^3/m^2$

425

$$\begin{array}{r} .0047 \\ 8 \mid .0375 \\ \hline .32 \\ \hline .55 \end{array}$$

$+ .05 m^3/m^2$
 $.07$

$= .09 m^3/m^2$

~~425 m³/m²~~

SLAB.

m²

Add grant for other sides:

TERRA LIMO.

CONCRETE

14.4 p/m²
22

3.5 con
2.8 rda
6.3 p
3.5
9.8
2

#3 rebar

3.25

$\frac{m}{m} \times \frac{p}{m}$

3.5m of beams

$\times \frac{3.63 p}{m}$

4 m²

= .88m/m²

2.85

~~3.18~~ p/m²

2.85

MESH ~~7 p/m²~~

7 p/m² - 36.7

OXIDO ROJO

2 p/m²

~~4" PIPE ABS~~

~~4.21 / ft.~~

~~25m length~~

~~335 pesos~~

~~700 pesos~~

12.7 p/m²

700 pesos

55 meters

=

38.95 p/m²

700 pesos to include 25m of 12" pipe plus elbows.

Block GROUT

.01 m³/m

1.3 p/m x 1.04 m/m²
= 1.35 p/m²

~~39.9~~ p/m²
1.35

40.65 p/m²

6.3

40.65 p/m²

25.2/102

FAMILIA
ARQUITECTO-CONSTRUCTOR

OPERACION 5. COLUMNAS
FECHA A EMPEZAR:

Unidad de medida: # columnas
Limite: .53 x area techada de la casa = _____ columnas
Casa tiene _____ columnas

Requisition de materiales

Material	Cantidad/Columna	Limite	Cantidad Solicitada	(Exceso)
BLOQUES DE COLUMNA	12			
VARILLA 3/8"	7 1/2'			
MEZCLA 1:9	.037 m ³			
CEMENTO	.004 m ³			
GRAVA	.012 m ³			
REVUELTO	.024 m ³			

Horario de trabajo

Dia

Operacion

1. Colocar columnas, cada una de 12 bloques (sin incluir el bloque integral del piso).
 - a. Limpiar cada block, arriba y a bajo antes de colocarlos.
 - b. Use el nivel para manter las columnas a plomo, usando lodo donde sea necesario ajustar el angulo.
 - c. Corte una tira de madera, columna columna para asegurar que la distancia entre columnas se mantiene hasta arriba para que la pared pueda ser hecha con un numero modular de blocks.

2. Colocar varillas y rellenar celdas.
 - a. Varillas de 3/8".
 - b. Cortese cada varilla de 7 1/2 pies.
 - c. Rellenese las celdas hasta la mitad del ultimo block con mezcla 1:9.

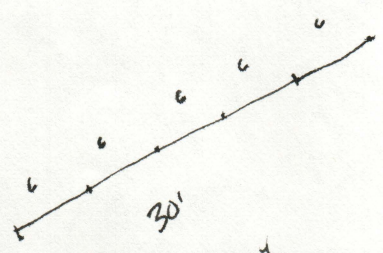
Recuerdo de trabajo

Dia	Operacion	Personas	Horas

COLUMNS

of columns.

COLUMN BLOCKS 12 @ 2.4 pesos	28.8 pesos
#3 rebar 6 1/2 ft @ 1.1 pesos/ft	7.2 pesos
1:12 fill @ .037 m ³ x 140 p/m ³	4.6 pesos
	40.6 pesos/col.



BEAMS FOR PORCH.

COLUMN FOUNDATIONS
1 @ 1.07/m²

RE-BAR FOR BEAM.
.18 m/m²

BEAM CONCRETE
.007 m³/m²

1.76
.18

8" x 8"

.14
.006

FAMILIA
 ARQUITECTO-CONSTRUCTOR

OPERACION 6. PAREDES.

FECHA A EMPEZAR:

Unidad de medida: m¹

Limite: .97 x area techada de la casa= _____ m

Casa tiene _____ metros de paredes.

Requisition de materiales

Material	Cantidad/m	Limite	Cantidad Solicitada	(Exceso)
BLOQUES DE MURO	27.5			
VARILLA 5/16" e	4.38m			
MEZCLA 1:9	.01m ³			
MEZCLA 1:12 e	.076m ³			
CEMENTO	.007m ³			
REVUELTO	.082m ³			
GRAVA	.003m ³			
CAJAS ELECTRICAS		4/cuarto		
TUBO ELECTRICO		2m/contacto 1m/apagador		

OPERACION 6. PAREDES.

Horario de trabajo

Dia

Operacion

1. Rellenar las celdas no coladas de los bloques rojos.
 - a. Colocar varillas de 18", (varilla de 5/16").
 - b. Pintar estos bloques con un punto negro en la parte exterior como identificacion de las celdas reforzadas.
 - c. Rellenar la mitad del block con mezcla 1:9.
2. Levantar todas las paredes solidas, y las que tengan puertas.
 - a. Limpiar bloques.
 - b. Colocarlos ensamblando machos enhembras.
3. Levantar paredes hasta cuatro bloques donde haya ventana.
--Repetir el proceso anterior.
4. Colocar ventanas.
 - a. Calcular el tamaño de las ventanas de tal manera que sean aproximadamente el 30% del area de piso en el comedor, sala y cocina, y 20% en recamaras, pasillos y vestibulos. El total del area de ventanas ~~vent~~ debe ser el 25% del area del piso interior.
 - b. Hacer un marco de tiras de madera.
 - c. Ajustar y checar el tamaño.
 - d. Modificar la altura de la ventana si es absolutamente necesario.
5. Construir la pared restante para hacer las ventanas.
--Repetir el proceso anterior.
6. Colocar cajas electricas, apagadores y contactos.
 - a. Definir su lugar.
 - b. Cortar los bloques y colocar el tubo conduit en la pared.
 - c. Colocar las piezas.

7. Colocar el armado y rellenar celdas.

a. Cortar varillas de $5/16''$ de $7\ 1/2$ pies.

b. Colocarlos en las celdas marcados.

c. Rellenarlos con mezcla 1:12 (Nota: 1:12 y no 1:9) hasta la mitad del ultimo block.

Recuerdo de trabajo

Dia	Operacion	Personas	Horas

WALLS

Unit of measure in

.01 m³/m.

ADDITIONAL GROUT (FOUNDATION)

BLOCKS 2.8 p/block 12 courses 33 in/width of length 3.75 blocks/3 (ends) waste: windows + doors	76.9
FILL 1:12 140 p/m ³ voids 3" x 5"	10.7 9.8
ANAMBROW 1.3 p/width of wall.	5.7
	92.4 93.3

208
 250

 458

WINDOW PERCENTAGES. 26% overall.

	Window Area	Floor Area	%
Howard.	51½	130	40
Chris	27	107	25
Julio	49½	229½	22
J+D	64½	211	31
Guest	14	80	18
Bedrooms	206.5	757.5	27
BATHRM	13	60	22
Coama	20	90	22
Comedor	20	143	14
alcove	38½	75	51
TOTAL	298	1125.5	26

6. WINDOW & DOOR FRAMES = 5.1% of total

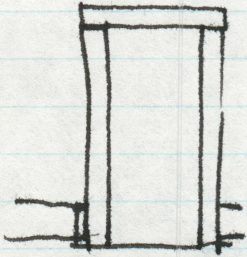
D: 1.9%

W: 3.2%

Door frames

Window frames

2x6



1x6

2x8

1x4

QUANTITIES

2x6

1x6

1x4

2x8

DOOR FRAMES ^{new estimate} UNIT OF MEASURE # of DOORS.

pesos/door

1- 2"x6"x16'

USADO @ 2.5 pesos/lz (Rocasa)

40 pesos

2- LEAD SINKERS. @ 2 pesos

Cerrajería y tornillería

Justo Sierra 889-

4

2 LAG BOLTS

$\frac{1}{2}$ " x 8 without @ 3.5 pesos
(Dontmitt)

7

Total

51 pesos/door.
(without trim at this point)

FAMILIA
ARQUITECTO-CONSTRUCTOR

OPERACION 7. MARCOS DE PUERTAS

Unidad de medida: numero de puertas
Limite: .08 x area techada de la casa
= _____ puertas
Casa tiene _____ puertas

Requisition de materiales

Material	Cantidad/puerta	Cantidad Solicitada	Exceso	Entregado
MADERA 2 x 6 x 16'	1			
TORNILLOS	2			
CCSAS DE PLOMO	2			

DOOR + WINDOW FRAMES.



18%

typical window 2'x4'

1x4 needs 27'
incl. 12% waste
@ 1 1/2 p/lr

40.5 pesos

1x6 needs 16'
incl. 20% waste
@ 2.5 p/lr
= 40 pesos.

2x8 needs 3'
5.5 p/lr
= 16.5 pesos
incl. 20% waste.

97 pesos
97 pesos

~~12.1 pesos~~
121 pesos/m²

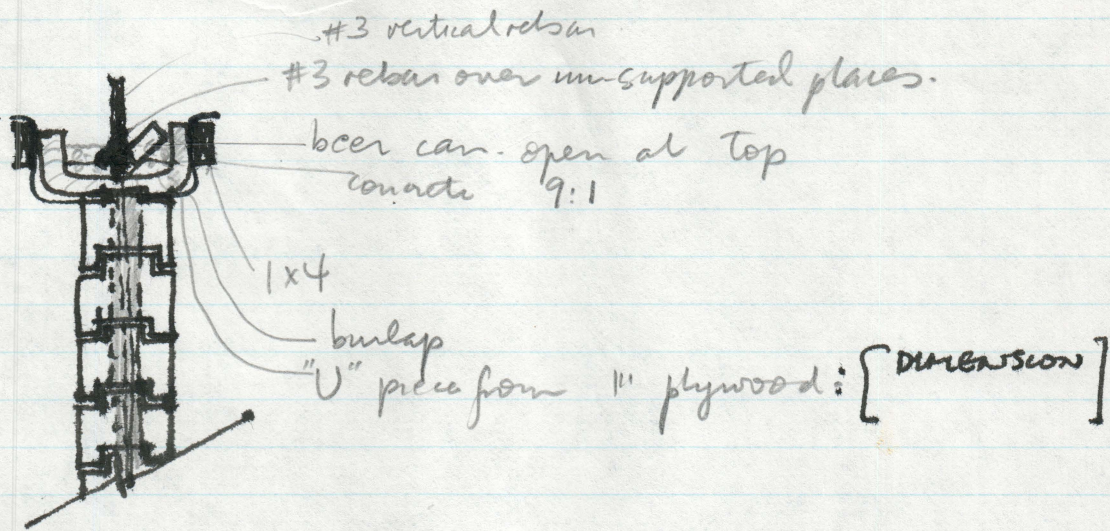
door frame

2x6
1- 3'
1- 14'
17' @ 4.1 p/lr = 69.7 pesos

1x4
1- 6'
2- 14'
34' @ 1.5 = 51 pesos
120.7 pesos

120.7 pesos/door

7. PERIMETER BEAM - 1st STAGE = 9.9% of total



1. Cut down top column blocks to be same height as walls.
2. Build P-beam from 1x4's, U pieces and a 21"-wide piece of burlap.
3. Put beam in place cutting out burlap for wall block cores.
3. Use a "U" over each column, and spaced [3'] apart over walls.
4. Put beam in place, cutting out burlap for wall block cores + ~~tes~~ re-bar. Sw corners + adjust for sag.
5. Put beer cans in place corresponding to locations of wood strips.

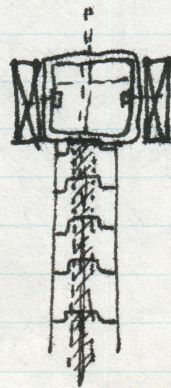


6. Pour concrete 9:1 mix, up to bottom of 1x4's.
6. Place #3 over openings + windows door lintels, extending [1'] beyond the edge

QUANTITIES.

- 1" plywood (# of U's)
- 1x4.
- burlap
- beer cans
- #3 rebar
- cement/sand/gravel (1:9)

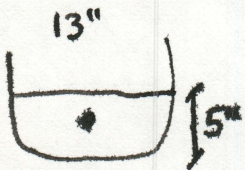
TOOLS



P-BEAM 1st STAGE

m'

U pieces 1 U/meter	
78 U's / 4x8 sheet = 4 pesos/U (312 peso)	4 pesos/m
1x4 1.55 pesos/ft x 2 = 3.10 pesos/ft x	10.2 p/m
(includes waste)	
BURLAP 515 mts = 3862.50 7.5 p/m	7.5
#3 REBAR-UNTEL Assume opening $\frac{1}{3}$ of beam length.	1.21 p/m
CONCRETE 1:9 MIX .043 .004 m ³ /m 160 p/m ³	6.4 p/m 6.9 p/m
	29.8 p/m



$$\frac{1}{3} = 0.13$$

$$.004 \text{ m}^3/\text{m}$$

$$.043$$

PERIMETER BEAM ^{new estimate} unit of measure = m'

pesos/m of beam.

2x6's which form sides of beam.

$$2.5 \text{ pesos/ft} \times 3.28 \text{ ft/meter} \times 2 = 16.4 \text{ p/meter}$$

16.40

Rocasa

1x2's to hold 2x6's together

should be scrap wood - assume it can be used
3 times

$$1.8 \text{ p/ft} \times 1 \text{ ft/meter} \times \frac{1}{3} = .3 \text{ pesos/meter}$$

.3

0-frames.

$$3.76 / \text{piece} \times 1 \text{ piece/meter} = 3.76 / \text{meter}$$

3.76

CASA

1x4's for over walls

should be scrap wood - assume it can be used
3 times.

$$1.6 \text{ p/ft} \times 6.6 \text{ ft/meter} \times \frac{1}{3} = 3.5 \text{ p/meter}$$

3.5

1x10's for over windows + clear spans.

$$4 \text{ p/ft} \times 3.28 \text{ p/meter} \times \frac{1}{3} = 4.37 \text{ p/meter}$$

4.37

(Assuming openings $\frac{1}{3}$ of beam length)

28.3 p/meter.

TOTAL

FAMILIA
ARQUITECTO-CONSTRUCTOR

OPERACION 8. VIGAS PERIMETRALES

Unidad de medida: metros lineales
Limite: 1.10 x area techada de la casa
= _____ metros de viga
Casa tiene _____ metros de viga

Requisition de materiales

Material	Cantidad/m	Limite	Solicitada	Excesso	Entregado
MADERA 2 x 6	2 m				
MADERA 1 x 2	1 pie				
"0"ls de acero	1				
MADERA 1 x 4	1.33m				
MADERA 1 x 10	1/3 m				

(Se necesita tambien un plano de la systema de vigas que muestra las posiciones de muros, ventanas, puertas, y vigas libres; con las medidas.)

Roof: 100 pavers

$$\begin{array}{r} 2.5 \\ 1.2 \\ \hline 5. \\ 2.5 \\ \hline 3.0 \end{array}$$

$$\begin{array}{r} 2.7 \\ 1.7 \\ \hline 18.9 \\ 2.7 \\ \hline 4.59 \end{array}$$

$$\begin{array}{r} .016 \\ 15 \\ \hline 80 \\ 16 \\ \hline .240 \end{array}$$

$$\begin{array}{r} 2.3 \\ 3 \\ \hline .7 \end{array}$$

7.6 M² of vault.

3. SACKS PERLITE (2)

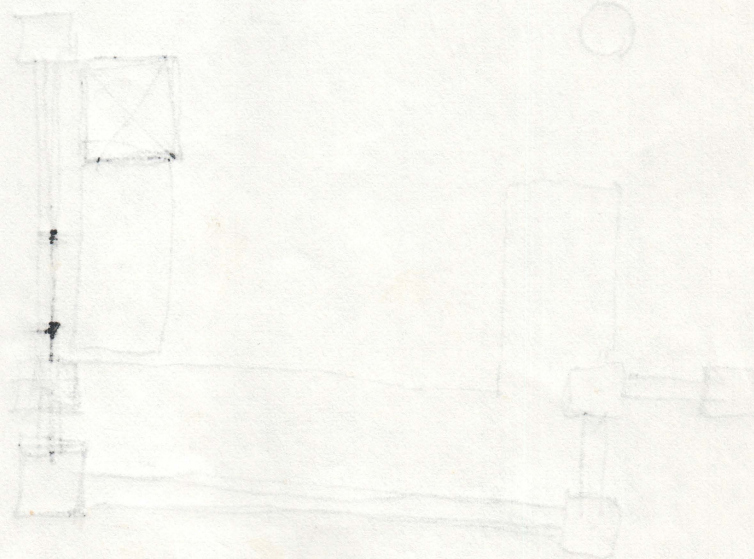
.700 US.

3. SACKS CEMENT (2)

.700 US.

$$15 \times .016 \times \text{M}^3 \text{ PUMICE} = .24 \text{ M}^3 = \frac{2.00 \text{ US}}{16.00 / 7.6 \text{ M}^2}$$

26.31 pesos/meter.



ROOF BASKETS.

Unit of measure is
1.10 m of beam / m² of roof

p/m² of operation

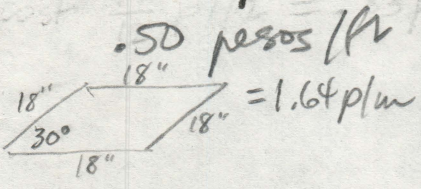
1x2's on inside of beam.

5.8

$$.8 \text{ p/ft} \times 3.28 \text{ ft/m} \times 1.10 \text{ m} = 2.9 \text{ p/m} \times 2 = 5.8 \text{ p/m}^2$$

Wood strips.

1.21 = multiplier for curvature.



Strips are 18" apart
4.43 m / m² of area
x 1.21 = 5.36 m / m²

8.8

$$.50 \text{ p/ft} \times 3.28 \text{ ft/m} \times 5.36 \text{ m/m}^2 = 8.8$$

#3 re-bar.

$$3.70 \text{ p/meter} \times 1.10 \text{ m/m}^2 \times \frac{30.7}{30} = 4.16$$

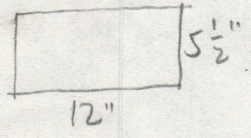
6.05

+ rebar over gable ends

overlap: $4.16 \times 1.10 = 4.57$

Tapra $\rightarrow \frac{33.4}{89.6} = 37\% \times 1.1 = .4$ $.4 \times 3.7 = \frac{1.48}{6.05}$

Concrete in beam.



Volume = $.04 \text{ m}^3/\text{m} \times 160 \text{ p/m}^3 = 6.4 \text{ p/m}$
6:3:1 = ^{reverts} sand:gravel:cement / $6.4 \times 1/10$

7.04

Reuelto .025 m³

grava .014 m³

Cement .005 m³

TOTAL

27.7 p/m²

Concrete .044 m³/m²

ROOF TOTAL

BASKETS	27.7
1 st COAT	48.0
2 nd COAT	31.95
	<u>107.65 p/m²</u>

FAMILIA _____

OPERACION. CANASTAS DE TECHOS

Unidad de medida para esta operacion: m^2
La limite para vigas es 1.10 m de viga/ m^2 de techo.

Casa tiene _____ m^2 de techo.

Casa tiene _____ m de vigas, que es un exceso de _____ m de viga.

Material	Cantidad/ m^2	Limite	Requisito	(Exceso)
Tiras de madera	5.36 m			
Varilla #3	1.5 m			
Madera 1x2	2.2 m			
Cemento	.005 m^3			
Revuelto	.025 m^3			
Grava	.014 m^3			

COSTOS EXTRAS

GABLE ENDS

of gable ends.

Assume a house of 55 m²
has 6 gable ends each 3m wide
with an area of 22 m²
= 13.2 m²

costing 46.5 p/m²

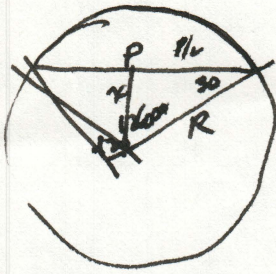
or 50 considering more
waste

~~13.2 m²~~

Almost 2/vaults.

112.50/gable

Insured
needs to
be done -



$$\cos 30 = \frac{P}{2R}$$

$$\frac{2 \cos 30}{\cancel{P}} = R = \frac{P}{2 \cos 30} = \frac{P}{2 \frac{\sqrt{3}}{2}} = \frac{P}{\sqrt{3}}$$

$$\frac{\sqrt{3}}{\cancel{P}} \neq R = \frac{P}{\sqrt{3}}$$

$$\sin 30 = \frac{r}{R}$$

$$r = R \sin 30$$

$$= \frac{P}{\sqrt{3}} \frac{1}{2}$$

$$= \frac{P}{2\sqrt{3}}$$

$$A = \frac{\pi R^2}{3} - \triangle$$

$$A = \frac{\pi}{3} \frac{P^2}{3} - \triangle$$

$$A = \frac{\pi}{3} \frac{P^2}{3} - \triangle$$

$$= \frac{\pi P^2}{9} - \frac{P}{2\sqrt{3}} \frac{P}{2} \frac{1}{2}$$

$$= \frac{\pi P^2}{9} - \frac{P^2}{8\sqrt{3}}$$

$$= P^2 \left[\frac{3.14 - 1}{9} \right]$$

$$= P^2 [0.34 - .07]$$

$$= .27 P^2$$

FAMILIA _____

OPERACION. TECHO 1^a CAPA

Unidad de medida para esta operacion: m²

Casa tiene _____ m² de techo.

Material	Cantidad/m ²	Limite	Requisito	(Exceso)
Jute	1.21 m ²			
Alambre de pollo	1.21 m ²			
Cemento	.013 m ³			
Perlite	.033 m ³			
Volcanico	.031 m ³			

COSTOS EXTRAS

ROOF FIRST COAT. ^{new estimate.} Unit of measure m²

p/m² of ~~total~~ operation

Burlap 7.5 pesos/m² x 1.21 = 9.1

9.1

Chicken wire.

Chicken wire costs 8.54 p/m² x 1.21 = 10.3

10.3

Lightweight concrete 3/4" thick

4 1/2 : 2 1/2 : 1 perlite: pumice: cement.

Expt. bldg. 7.6 m² of vault used 3 sacks perlite, 3sacks cement, and .24 m³ of pumice, or 217.5p / 7.6 m² = 28.6 p/m²

28.6 p/m²

	7.6 m ²	Cost./m ²
Cement	.096	.013
Perlite	.25 m ³	.033
Pumice	.24 m ³	.031

48.0

TOTAL

114.6

FAMILIA _____

OPERACION. TECHO 2^a CAPA

Unidad de medida para esta operacion; m²

El limite para vigas es 1.10m de viga/m² de techo.

Casa tiene _____ m² de techo

Casa tiene _____ m de vigas, exceso de _____ m de vigas.

Material	Cantidad/m ²	Limite	Requisicion	(Exceso)
Madera 2 x 3	.75 m			
Madera 1 x 4	.75 m			
Varilla #5	.71 m			
Cemento	.01 m ³			
Arena	.043 m ³			
Escoria Volcanica	.032 m ³			

ROOF 2nd COAT.

Beam: 1.10 m/m²
Unit of measure m²

p/m² of ~~base~~ ^{of operation}

2x3 cornice piece.

1.25 pesos/ft x 3.28 ft/meter x 1.10 m/m²

4.51 ✓

1x4 cornice piece.

1.6 pesos/ft x 3.28 ft/meter x 1.10 m/m²

5.77

Drip piece. Broken wood strip pieces.

9.05 p/m x 1.10 m/m² x $\frac{31}{30}$ = 10.28
↑
overlap

10.28

#5 rebar.

9.05 p/m x 1.10 m/m² x $\frac{31}{30}$ x .63 = 10.28 =
(overlap)
of. use one gable ends
x .63

16.47

Concrete 4: 3: 1 Sand: pumice: cement.

Total volume of concrete is

15.2

Amt. in beam + [1.21 x 1 1/2" x 1 m²] = .046 m³/m² + Amt in beam
.029

Amt in beam = 5 1/2" x 7 3/8" = 40.6 in² = .026 m³/m²

31.95 p/m²

.026 m³/m² x 1.10 m/m² = .029 m³/m²

TOTAL.

.029 + .046 = .075 m³/m²

sand : .043 m³/m² x 65 p/m³ = 2.8 p/m²

pumice : .032 m³/m² x 100 p/m³ = 3.2 p/m²

cement : .01 m³/m² x 922 p/m³ = 9.2 p/m²

10.77

15.2 p/m² + 1.67 p/m² = 16.7 p/m²

FAMILIA _____

OPERACION. GABLETE

Unidad de medida: Area₂total
de gablete= _____ m²

Requisición de materiales

Material	Cantidad <i>/m³</i>	Limite	Solicitada	Exceso
BLOQUES DE MURO	13			
CEMENTO	.0003m ³			
REVUELTO	.003m ³			
<i>VARANA 5/16"</i>	<i>2.7m</i>			

COSTOS EXTRAS

PLUMBING

3300
estimate

60 p/m² of house

60 p/m²

PRECIOS TENTATIVOS.

CONTACTO 7.05 } 16.60
CAJA 2'x3" x 3 1/2" 9.55 }

APAGADOR 7.80 }
CAJA 2x3x3 1/2 9.55 } 25.75
ROSETA 8.40 }

APAGADOR 3 VIAS 11.55 }
CAJA 2x3x3 1/2 9.55 } 29.50
ROSETA 8.40 }

SOCKET 6.80 } 12.75
CAJA 5.95 }

TUBO 1/2" 1.99/m

ALAMBRE #12 225.00 ¢/100 m

ELECTRICAL per room.

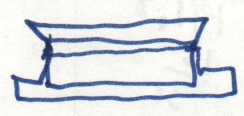
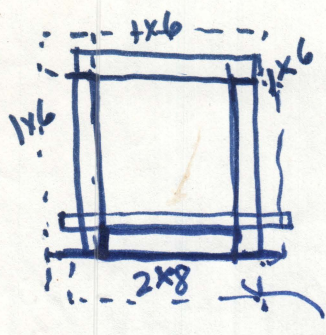
195 pesos/room

195 p/room.

(For the 5 families, there are a total of 33 rooms,
for a total electrical budget of 6435 pesos.

2/2/76
Doug

2x4 type Window



- 4 pieces inside 1x4
- 3 " outside 1x4
- 1 piece - sill - 1x6
- 3 pieces 1x6
- 1 2x8 sill

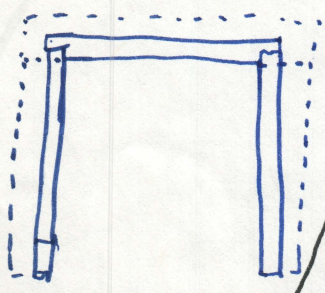
13.5 ft ⁽²⁷⁾
 $\frac{10.5}{24 \text{ ft}} \times 1x4 @ 1.5p/ft = 37p$
 $16 \text{ ft } 1x6 @ 2.5p/ft = 37p$
 $30 \text{ ft } 2x8 @ 5.5p/ft = 13.8p$
frame only 87.8p

Total - 2x2
 frame & window
 191.8
 87.8 FRAME
279.6 - TOT

20' 2x2 = 1.4p/ft = 28
 glass ~ 7ft² @ 5.6p/ft² = 39p
 = 12p
 = 25p
 191.8p each

Door

2/2/76



6-3" type 3" wide
 3 pieces of 2x6 - 15.3 ft @ 4.1p/ft = 63.3p (frame)
 6 pieces of 1x4 - 20 ft @ 1.5p/ft = 30p (trim)
93.3p

1x4	1	6'
1x4	2	14'
2x6	1	3'
2x6	1	14'

used door/with hardware = 125p
 new door with hardware = ~250p

343.3
 93
 50p - new door cont frame

∴ if door used cost = 218.3p
 " " new " = 343.3p est 375p ea

218
 93.3
 125p - used door cont frame

WINDOWS + DOORS.windows. 2'x4' typical2x2 @ 1.4p/ft²
with 30% waste

38p (.27 feet)

glass 7ft²
@ 5.6p/ft²
39p

putty 12p

hardware 25p.

114

148.7m² of windowsdoors

250 pesos/door.

Estimating Costs For Windows

Acknowledgements:

I am indebted to Howard Davis, Esq. and Arch., of New York, N.Y., who made this study possible by lending his Royal (Model: Quiet de Luxe) typewriter to me. He may live long and be rewarded for his generosity!

Thanx, Howie!

Sizes of Windows - now, this is wrong. It must say: TYPES OF WINDOWS

The existing Macaroni buildings have 45 openings which are to be closed by windows. Out of these 45 openings there are 4 windows which require special detailing and construction and therefore are not included in this paper. We deal with 41 windows.

A close look at these 41 windows shows, that they fit into 6 groups of typical sizes and proportions. As the design of these 41 windows has been totally free and unrestricted, one can assume that their shapes and sizes do represent a typical distribution of window-types as we can expect them in the buildings now under construction or now beeing laid out.

Criteria for the grouping of windows:

- * One- wing or Two- wing
- * ^{area} Size (sqft)
- * Proportions (width of the rough opening in relation to its heigth)

Group I: One- wing windows

- I-I Small, square one- wing window
7 cases, average size: 21x23 in, area: 3.4 sqft, w:h 1:1
- I-II Narrow, tall one- wing window, only horizontal mullion
5 cases; average size 12x42 in; area 3.7 sqft; w:h 1:3

IIII Normal one-wing window, horizontal and vertical mullions
 8 cases; average size 24x47 in; area 7,7 sqft; w:h 1:2

Group II: Two-Wing Windows

II-I Small two-wing window, each wing with horizontal partition only
 9 cases; average size 24x33 in; area 5.6 sqft; w:h 1:1.5

II-II ~~Small~~ Normal two-wing window, each window with horizontal partition only
 7 cases; average size 430x43 in; area 8.6 sqft; w:h 1:1.5

II-III Tall two-wing window, crosslike mullions on each wing
 3 cases; average size 47x46 in; area 15 sqft; w:h 1:1

Then, there are two "Non-Classifiabes", bold design, as it is: one is 36x11 in, the other is 55x21 in, both having a w:h -ratio of roughly 3:1. Those two have to be priced separately, may that do who feels like it.

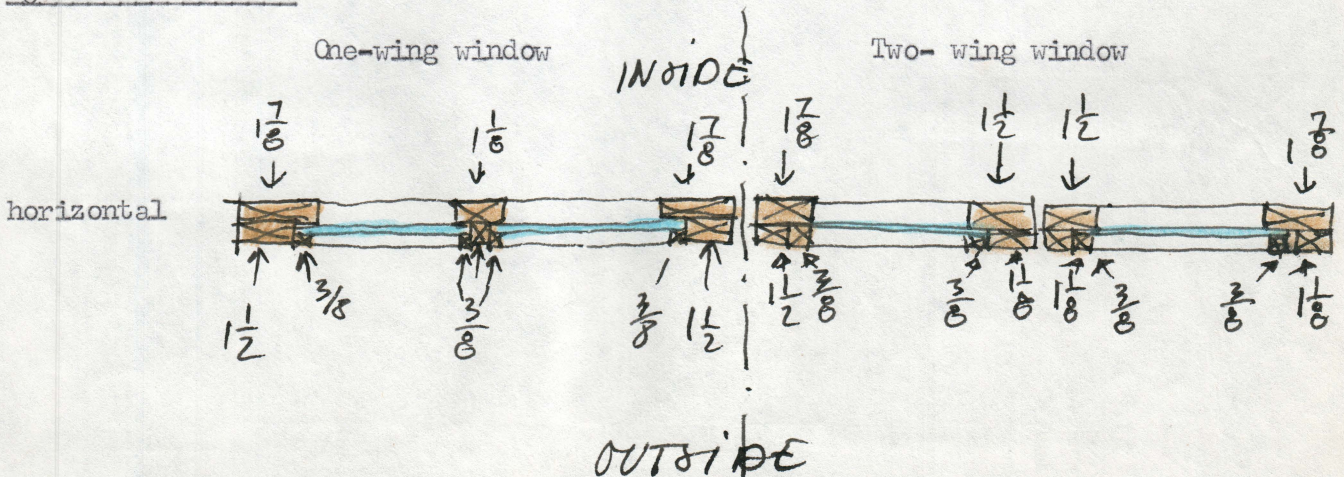
Construction of Windows - Materials needed

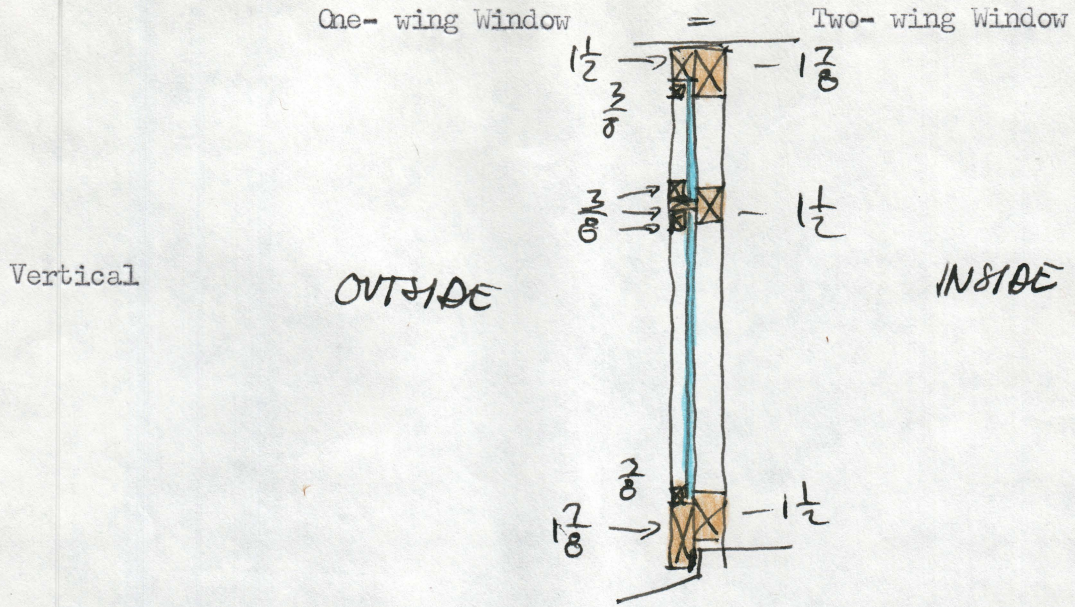
The windows are laminated from wood profiles, which are ripped on the site from 1-by-sixes. The profiles (or says one: sections??) are the following:

- * 1⁷/₈ x 3/₄
- * 1¹/₂ x "
- * 1¹/₈ x "
- * 3/₈ x "

In addition, there are 3/₄ by 3/₄ s needed as window-stops.

Schematic sections





Costs of Materials

According to their frequency of occurrence these different sections have to be ripped from the stock of lx6es. Those ratios are given below. With careful scheduling of the cuts, taking into account the width of the sawblade, the stock lumber can be ripped without any waste. If that is accomplished, the cost for each of the above mentioned sections can be calculated as fractions of the cost of the original lx6es. These costs are given in the table below. Base-prices for the lx6es are those of Proconsa, as of May, 1st.

	linft per linft lx6	cost of lx6	cost of linft	ratio of occurrence
$1\frac{7}{8}$	2.8	\$ 2.31 MN	\$.83 MN	2
$1\frac{1}{2}$	3.4	"	.68	2
$1\frac{1}{8}$	4.4	"	.53	.5
$\frac{3}{4}$	6.3	"	.47	1.8
$\frac{3}{8}$	11	"	.21	2.2

Materials other than lumber:

- Glass \$ 4.80 per sqft (MN)
- Hinges (1.5") \$ 2.20 per pair w/out screws (MN)
- Lockbolt \$ 3.30 ea. (MN)

Allowance for glue, nails, screws, caulk, sanderbelts and waste:
 \$ 5.00 each 5 sqft area of opening (MN)

Calculating Costs

For each window type with its specific measures the average costs are estimated.

These calculations are given in the appendix.

The results of these calculations are typical costs - or average costs - for each window type. These costs are given in absolute terms and relatively, as ratio:\$ per sqft.

The results are shown in the table and the graph below.

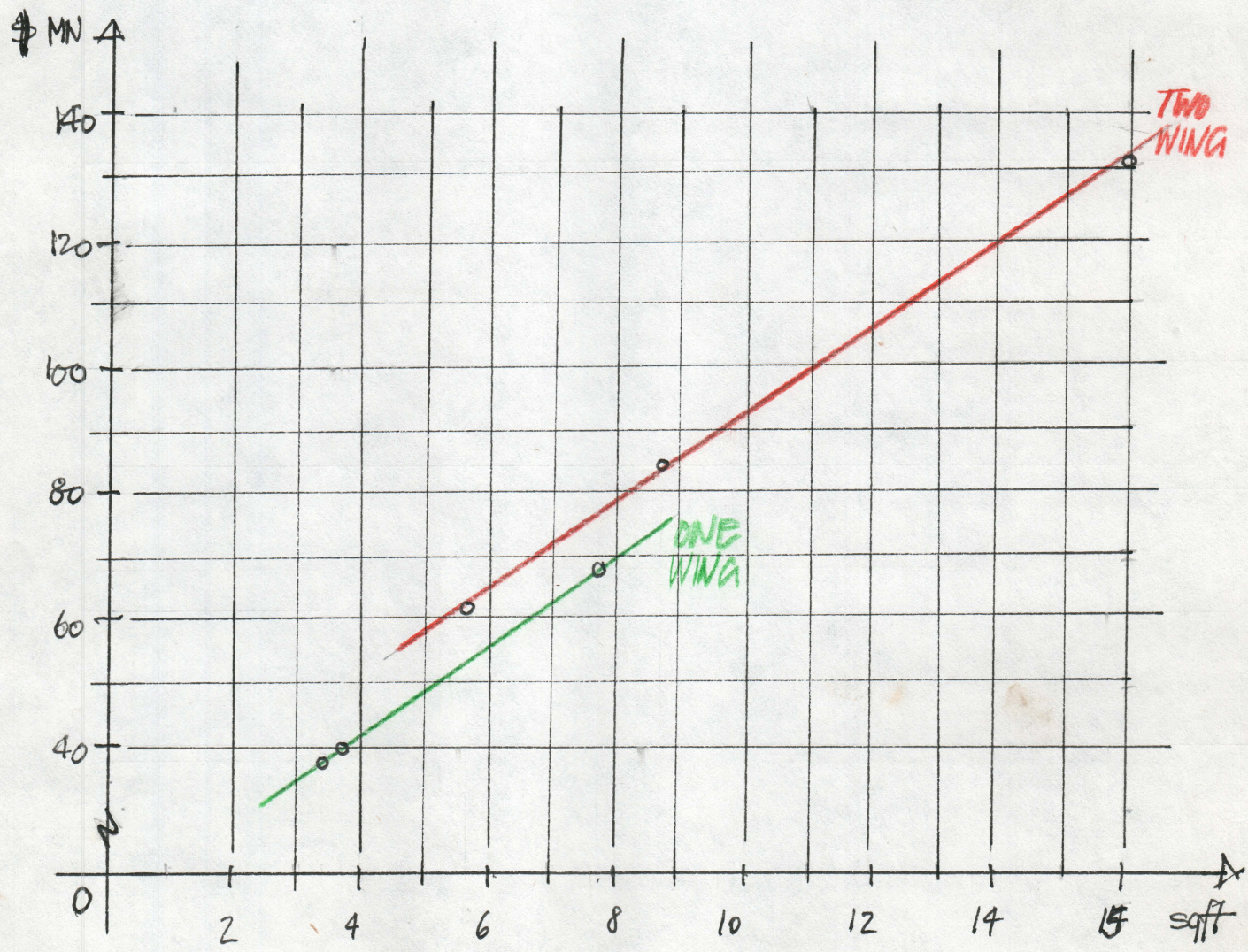
Window Type	Absolute Cost		Relative Cost	
	\$ US	\$MN	\$US/sqft	\$MN/sqft
I-I	3.10	38.80	.93	11.56
I-II	3.19	39.99	.91	11.42
I-III	5.37	67.15	.75	9.35
II-I	4.80	60.66	.88	11.00
II-II	6.69	83.62	.78	9.72
II-III	10.71	133.92	.71	8.93

Estimating Costs

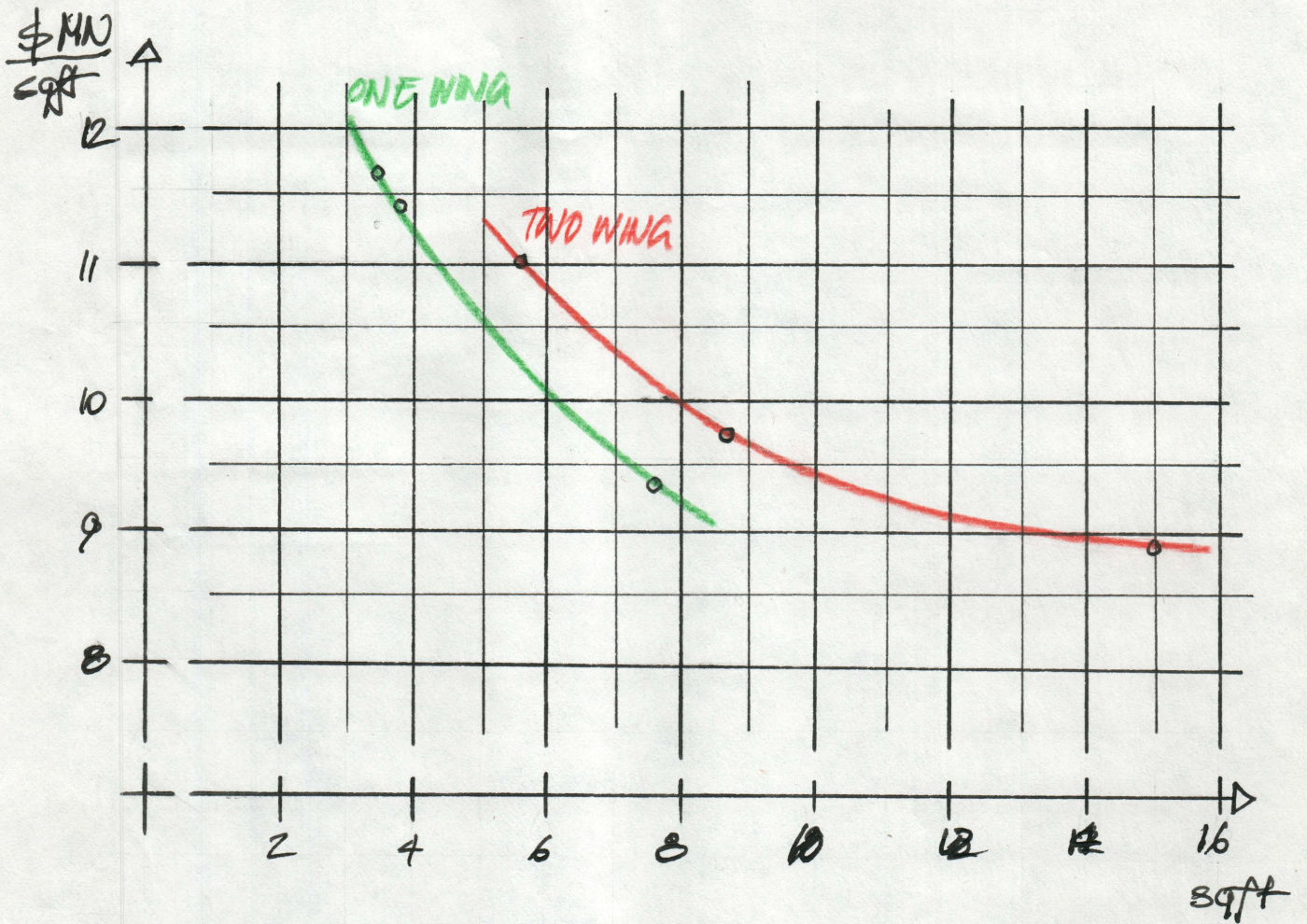
In order to be able to estimate costs for windows fast and easy, the results of the calculations are transformed into the form of diagrams. One gives absolute costs (of the finished window) in relation to its size and kind; the other gives relative costs: \$ per sqft.

Size (area) is given in sqft of the rough opening, type of window is indicated by one- wing or two- wing.

ABSOLUTE WINDOW COSTS

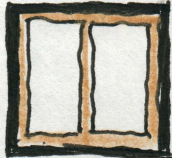



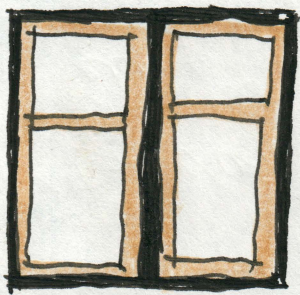
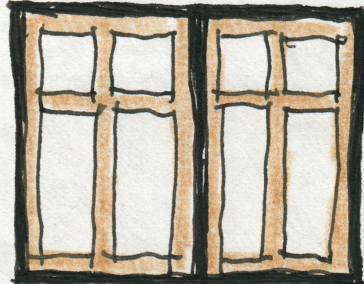


RELATIVE WINDOW COSTS



APPENDIX A

List and Grouping of windows

Type	Size	Area Size	Av. Area	Av. Proportion	Schematic Diagram
I-I	26x17	23.1x21.1	3.4	1:1	
	25x17				
	21x18				
	22x24				
	22x24				
	23x24				
I-II	12x40	12.6x42.5	3.7	1:3	
	12x40				
	12x45				
	12x45				
	15x42				
I-III	19x40	23.9x46.6	7.7	1:2	
	20x45				
	22x42				
	23x54				
	23x42				
	24x48				
	24x59				
25x47					
II-I	22x36	24.4x33.1	5.6	1:1.5	
	23x32				
	24x32				
	24x36				
	25x28				
	25x28				
	26x38				
	26x38				
25x30					
II-II	26x42	30.4x43.1	9.1	1:1.5	
	28x47				
	29x47				
	30x45				
	32x42				
	33x41				
	35x33				
II-III	50x41	47.3x45.7	15	1:1	
	47x48				
	45x48				

SUMMARY OF: MAKING WINDOWS

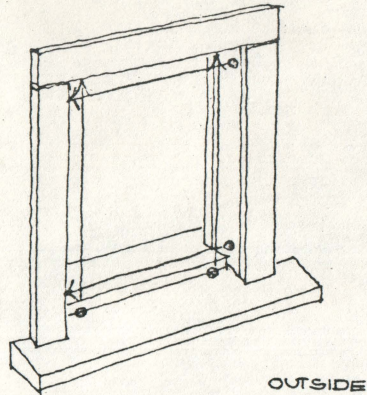
Operation 1--Measuring
 Compute Measurement Sheet

Operation 2--Cutting

Operation 3--Assembling
 Clamp
 Subdivide window

Operation 4--Fitting
 Fit window on sill
 sink nails, putty
 Sand
 Plane outside edges
 Re-check fit
 Scribe 1/8" from opening
 sand
 Re-check
 Break edges

Operation 5--Hinge



Operation one: Measuring the window opening

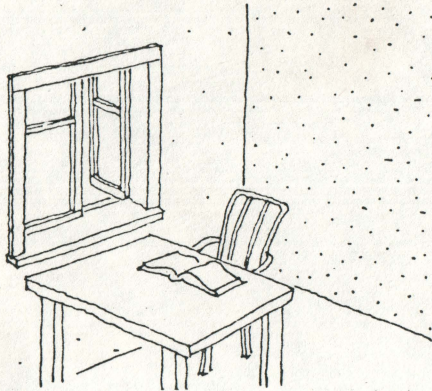
The better the window fits, the less dust and water will come into the house. In order to make a window that fits well, we use a "measurement sheet". Decide on which of the two kinds of windows you want to make. Take measurements of the window opening from the outside.

When measuring, be as accurate as possible, to $1/16$ ".

Measure height from lower sill on each side, measure width at bottom and again at top of window opening. Also measure widest and highest points if windows are not square.

Take the largest measurement for the width and height and write these numbers on the top squares of the measurement sheet. The sheet is divided into widths and heights and these are further divided into interior and exterior.

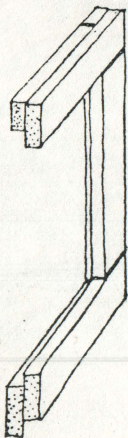
Making Windows



The windows we will make open to the outside. Most are two wing windows that meet at the center, some are one wing windows and open to one side. The design difference depends on the width and length ratio of the window openings.

Each window frame is made by laminating an exterior and interior frame together. This makes the frame stronger and prevents warping.

EXTERIOR

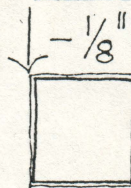
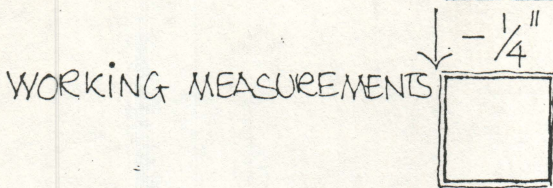
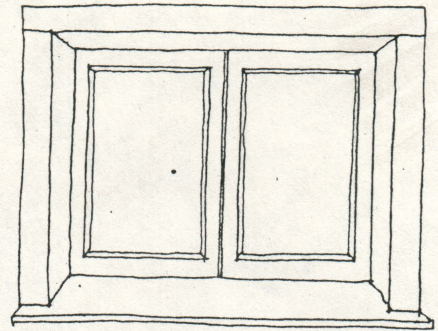
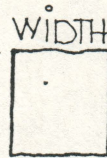
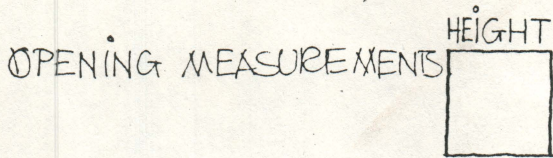


INTERIOR

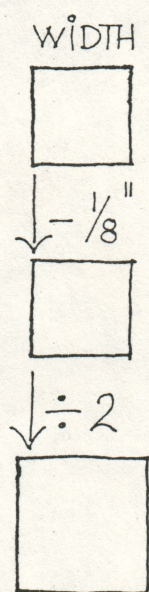
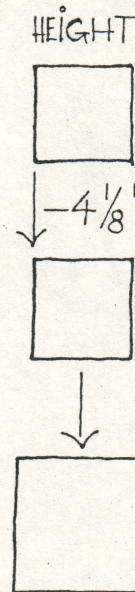
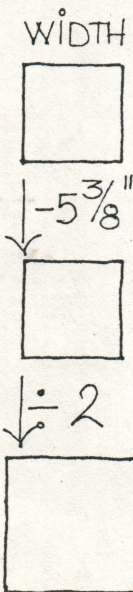
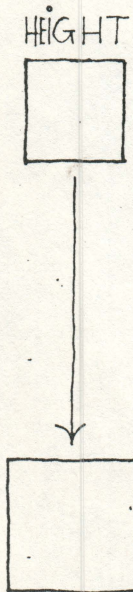
The windows are divided into squares on the top portion, with a $\frac{3}{8}$ " inset to hold the glass panes. There is another kind of inset at the bottom of the frame which fits into the sill and prevents dust from getting in. That is also the reason we put mullions around the window and place wood to cover center joint.

MEASUREMENT SHEET

FOR DOUBLE WING W.



RE-WRITE WORKING MEASUREMENTS FOR BOTH FRAMES:
EXTERIOR FRAME INTERIOR FRAME



TAKE THIS LENGTH AND CUT

2 PIECES $\frac{1}{8}''$ WIDTH
 2 PIECES $1\frac{1}{2}''$ WIDTH

TAKE THIS LENGTH AND CUT

2 PIECES $1\frac{1}{2}''$ WIDTH
 2 PIECES $1\frac{7}{8}''$ WIDTH

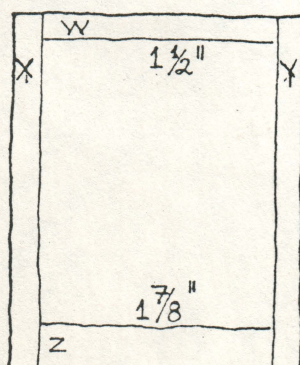
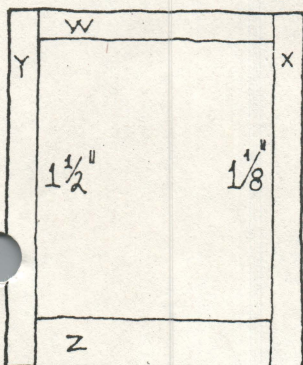
TAKE THIS LENGTH AND CUT

2 PIECES $1\frac{7}{8}''$ WIDTH
 2 PIECES $1\frac{1}{2}''$ WIDTH

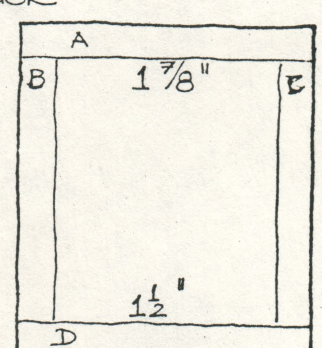
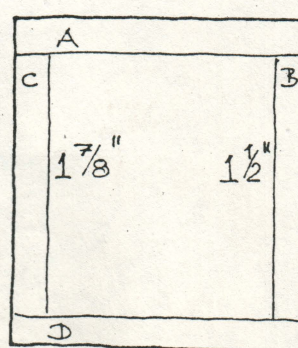
TAKE THIS LENGTH AND CUT

2 PIECES $1\frac{1}{2}''$ WIDTH
 2 PIECES $1\frac{7}{8}''$ WIDTH

EXTERIOR



INTERIOR



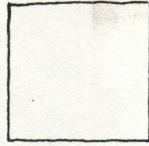
PLACE INTERIOR FRAME, A-B-C-D, ON TOP OF EXTERIOR FRAME, W-X-Y-Z.

MEASURING

SHEET

OPENING MEASUREMENT.

HEIGHT



$-\frac{1}{4}''$

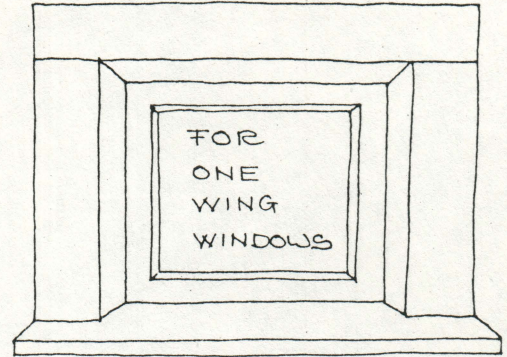
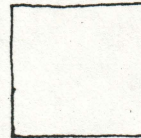
WORKING MEASUREMENT.



WIDTH

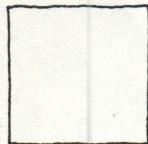
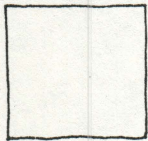


$-\frac{1}{8}''$



RE - WRITE WORKING MEASUREMENTS FOR BOTH
EXTERIOR FRAME AND INTERIOR FRAME

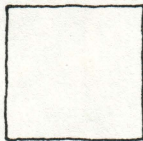
HEIGHT



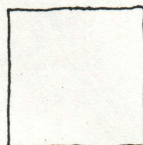
TAKE THIS LENGTH AND CUT

2 PIECES
 $1\frac{1}{2}''$ WIDTH

WIDTH



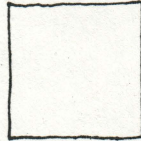
$-3'$



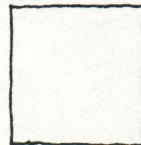
TAKE THIS LENGTH AND CUT

1PIECE $1\frac{7}{8}''$ WIDTH
 1PIECE $1\frac{1}{2}''$ WIDTH

HEIGHT



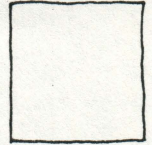
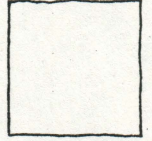
$-4\frac{1}{8}''$



TAKE THIS LENGTH AND CUT

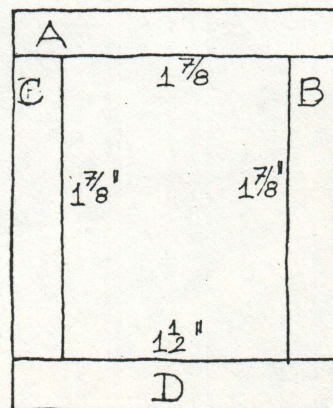
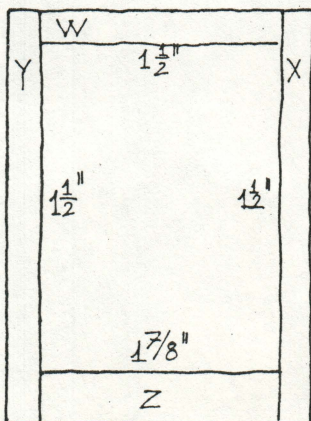
2 PIECES
 $1\frac{7}{8}''$ WIDTH

WIDTH



TAKE THIS LENGTH AND CUT

1PIECE $1\frac{7}{8}''$ WIDTH
 4PIECE $1\frac{1}{2}''$ WIDTH



PLACE INTERIOR FRAME, A-B-C-D ON TOP OF EXTERIOR FRAME, W-X-Y-Z.

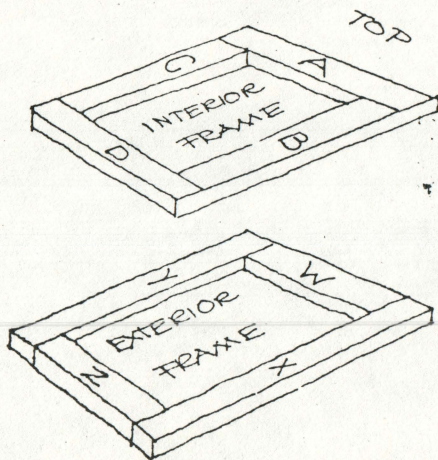
measurements. Remember, we make two rectangles, interior and exterior, and join them together. Follow the operations for each column, doing the math carefully.

Operation two: Cutting the Frames

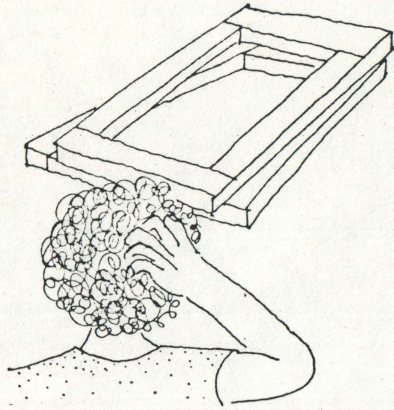
Cut the number and size pieces on the bottom of the measuring sheet to your specifications. Cut as accurately as possible, taking into account the width of the saw blade. Sand one side of every piece. This sanded side will be the inside edges of the window frame.

Operation Three: Assembling window Frames

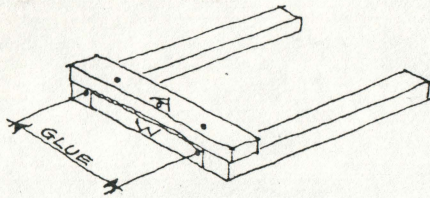
In order to ease the difficulty of assembly, I have taken a frame and divided it into interior and exterior parts: interior--top A, sides C and B, bottom D, exterior--top W, sides Y and X, bottom E.



Put the window together on a flat surface. First put the

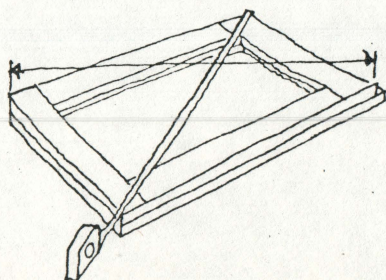
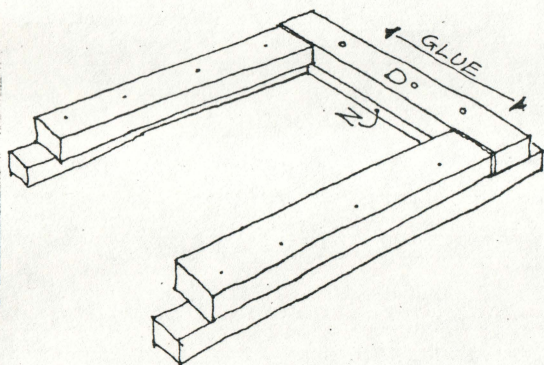
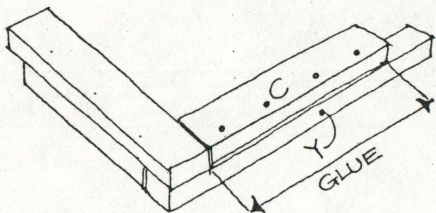
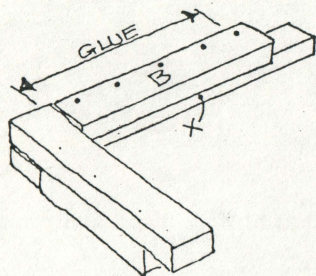


exterior rectangle together, WYXZ, then the interior rectangle, ABCD. If any piece is cut off more than $1/8$ ", re-cut the piece above or below shorter. If any piece is cut off more than $1/8$ ", re-cut that piece. Place the sanded edge to the inside and place the worst side of the wood to the center joint to be glued. The four corners are the most important in holding the window together. We glue them last so the glue will be fresh when we clamp.



We will begin to glue and nail starting at the top of the window frame, pieces A and W. Remember to start the nails into the wood before placing the pieces together.

Place a generous amount of glue on W, spreading and covering the top of the piece. Use the side pieces, Y and X, to help center A above W. Outside top edges along length of wood should be flush, but more important, A should extend $3/8$ " over W inside frame. Nail.

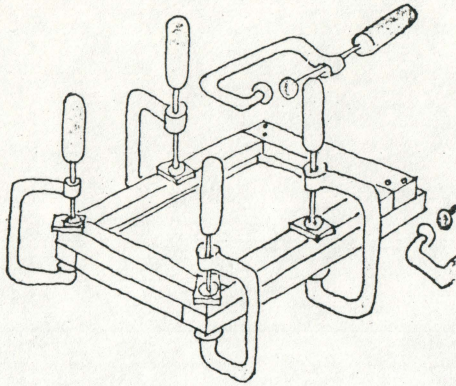


Now moving on to the side pieces, B and X, put top of X flush with outside edges of AW. Glue and nail B on top of X. Do not glue edge where BX meets AW. Do the same on the other side, CY. Be sure B overlaps X $3/8$ " and C overlaps Y $3/8$ ".

D and Z should be placed in such a way that Z completes the exterior rectangle and D completes the interior rectangle. D should overhang Z on the inside by $3/8$ ". Z overlaps D on the outside. Glue and nail. Don't put glue on overhang.

Now we glue and nail the corners. Remember to flatten the tip of the nail with your hammer when nailing corners so that your wood does not split. Be generous with the glue.

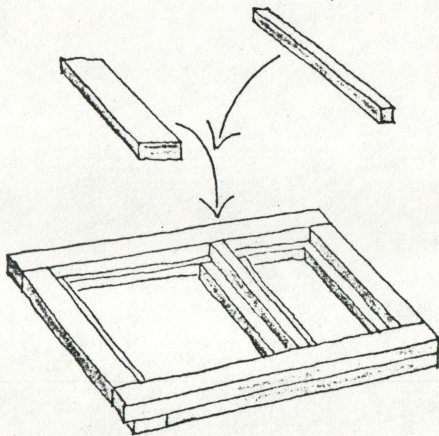
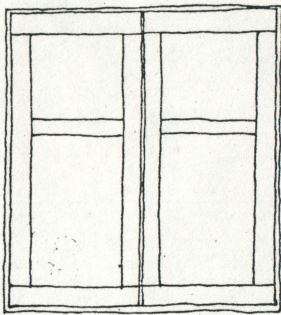
Begin by gluing the corners and nailing, one nail for each corner, at the outer edges. Measure with your tape from one corner diagonally to the other. Do this with the other two



corners. Adjust until diagonals are the same length. Nail again, one nail for each corner, this time on the lower side of each corner. Clamp tightly immediately after this gluing. Use at least 6 clamps, one on each corner and one in the middle of BX; one in the middle of CY. This is to prevent middle from coming unglued. Don't forget to place pieces of wood between clamp and frame or the clamp will mark up your frame. Clamp at least $\frac{1}{2}$ hour.

If two-winged window, do other side of window frame. If done right after first side you can open clamps and clamp the two windows together.

We are finished with the outer frames and now we subdivide the windows. We sub-divide windows because smaller planes are more pleasing than one large pane of glass. We sub-divide these windows into a window cross, at approxi-

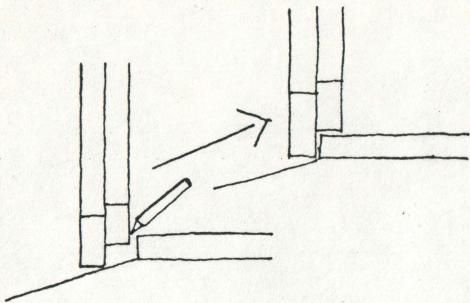


mately the upper $2/3$ rds of the window, so that square is formed at the top. This prevents a piece of wood from running along your eyesight as you sit and look out. Most windows, unless very small, should look this way.

This division also consists of two pieces, one on the exterior, and one on the interior. Cut the interior piece, $1\ 1/8$ " piece of wood, so it forms roughly a square at the top and fits snugly into the interior rectangle. Cut exterior pieces, $3/8$ " width, and center on $1\ 1/8$ " pieces. Glue and clamp (at least $1/2$ hour) or glue and toe nail (on interior side)

Operation four; Fitting the window

We are now ready to fit the window in place. Take your time. Work slowly and carefully. Better to lose an hour than make a new window. Place window in opening exactly where they will hang. If both cannot fit into opening, do one at a

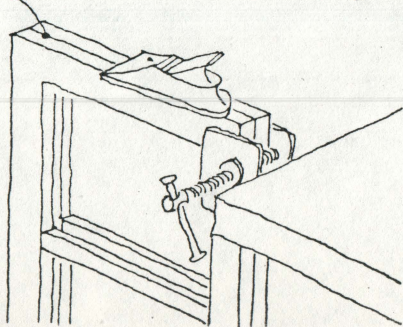


time. Check if the bottom overhang fits over the sill.

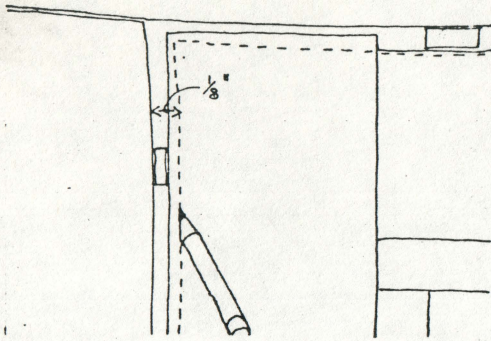
If not, with a pencil, mark on the bottom where the sill hits the interior of the frame.

Take out windows and cut off the extra wood by nailing a straight piece of wood 4" above this pencilled line. This is a saw guide. Bring saw height to wood thickness. The saw safety cover will catch and must be jammed in place by a piece of wood if the pencilled line is too close to the edge of the frame. cut. Be sure to keep saw flat. Chisel remaining remnants of wood away. Check fit. Sink all nails. Apply wood putty to nail holes and joints. Let dry. Sand front and back of window frames. Sand bottom lengths.

TO PLANE
EDGE TURN FRAME AROUND



Plane outside edges smooth and level. In order to plane end furthestest away from you, turn wood around, otherwise the end becomes rounded. Check planeing with a square to be sure you ar



a square to be sure you are planeing level.

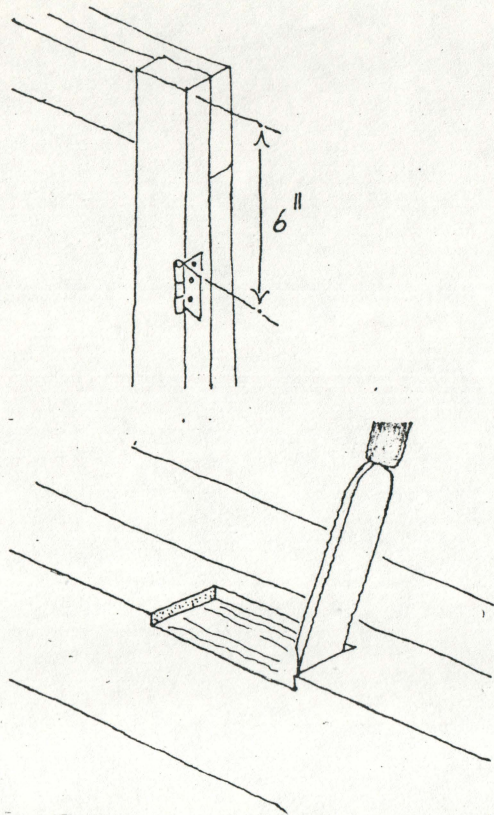
Wedge windows back in opening, with a $1/8$ " gap in center, in exactly the place where it will be hinged. Be sure windows are not tilted. Go outside and mark where the corners are so you can replace windows there again. With a pencil, scribe $1/8$ " from frame opening all around window ($3/16$ " to $1/4$ " on bottom) on the exterior side. Plane or saw off wood sticking out beyond this pencilled line. Re-check.

Fit in all remaining nail holes and nicks with putty. Let dry. Sand windows. Re-check. Break edges to prevent splintering by stroking sandpaper across inside edges of windows a few times on each side. You have now completed this operation.

Operation five: Hinging

Before doing this operation, be sure windows fit.

Mark exterior side of window 6" from top and bottom of each exterior end.



Place hinge below this mark. Mark outline of hinge with pencil. Chisel this area down about $1/16$ " (hinge thickness) so hinge is flush with edge. Mark holes where screws will later be. Make screwing easier by hitting nail into hole first. Screw in

