STRUCTURAL CALCULATIONS

FOR

HOUSING DEVELOPMENT

SAN LUIS OBISPO, CALIFORNIA

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ARCHITECT

TEXTEL, INC.

PLANNING, ARCHITECTURE, ENGINEERING

DATE March, 1970 **LLOYD DYSLAND & ASSOCIATES** PAGE 1
STRUCTURAL ENGINEERS
LOS ANGELES, CALIFORNIA JOB NO 6965
BY

JOB SAN LUIS OBISPO HOUSING DEVELOPMENT

Lloyd Dysland 32588

DESIGN DATA:

CODES: Uniform Building Code - 1967 Edition
See Table, P 260 of Appendix 'B' of
F.H.A. Minimum Property Standards

For members carrying primarily roof loads, allowable stresses may be increased by 25%

Max. design soil pressure = 2000 psf at min. depth of 2'-" below adjacent grade

Roof Loads	Comp. Roof	6.0
	½" Plywd. Sht'g.	2.0
	Roof trusses	4.0
	Gyp. Bd. Clg.	2.4
	Misc. - Insul.	0.6
	DL	15.0 p.s.f.
	LL	20.0 p.s.f.
Second Floor	Asphalt Tile	0.5
	(½" Sheath.	1.8
	½" Plywd.	1.8
	Joists	2.8
	Gyp. Bd. Clg.	2.4
	Misc.	0.7
	DL	10.0 p.s.f.
	LL	40.0 p.s.f.
Exterior Walls	2x4 Studs -	1.2
	Exterior sheath	10.0
	Gyp. Bd. Int.	2.4
	Misc.	1.4
		15.0 p.s.f.
Interior Walls	studs -	1.2
	Gyp. Bd. ea. side	4.8
		6.0 p.s.f.

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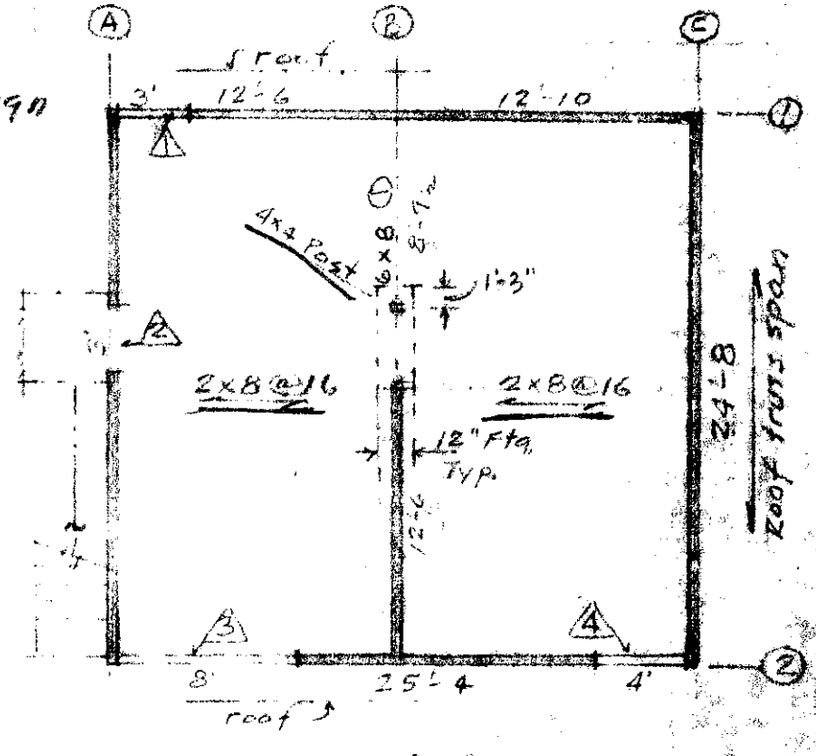
Unit 'A' - One Bedroom

Roof - See truss design by Truss Mfgr.

2nd Floor

Double floor joists under partitions that are parallel to joists



FL Rm. ① Span = 8'-8" c.c.

w = 50# x 12.5' = 625#/'
P.W. 10
635#/'

M = 635 x 8.67²/8 = 5960'#

I/c = 5950 x 12 / 1500 = 47.5"³

I = 5950 x 8.67 / 325 = 159"⁴

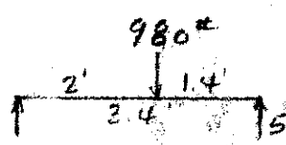
USE 6" x 8"

Lintels

△ at roof 3'-0 opng.

Roof P.L. = 2 x 35 x 14' = 980#

USE 4x6



M = 980 x 2 x 1.4 / 3.4 = 806'#

f_b = 806 x 12 / 19.1 = 506 psi

@ Second floor

floor 50# x 1.0 = 50#
wall 15# x 5 = 75#
125#/'

USE 4x4 @ 2nd floor

△ at roof 3'-0 Opng.

roof 2 x 40# + 4(15+50) = 340#
wall 15# x 5 = 75#
415#/'

M = 415 x 3.4²/8 = 600'#

V = 415 (1.7 - .30) = 581#

at floor

floor 50# x 6' = 300#
wall 15# x 5 = 75#
375#/'

4x4 at floor & roof

f_b = 600 x 12 / 7.94 = 907 psi

v = 581 x 1.5 / 13.1 = 66.5 psi

Unit 'A' One B.R.

(3) at roof 8'-0 Opng

roof $35^{\#} \times 28/2 + 14 = 504^{\#}$
wall $15^{\#} \times 2.5 = \underline{38}$
$542^{\#}/'$

single 2x4 under ea. end etc.

$M = 542 \times 8.5^2/8 = 4900'^{\#}$
$I/c = 4900 \times 12/1500 = 39.2''^3$ USE
$V = 542(4.25 - .85) = 1850^{\#}$ 4x10"
$A_{min} = 1.5 \times 1850/120 = 23.2''$

at floor
floor $50^{\#} \times 1.0 = 50^{\#}$
wall $15^{\#} \times 5' = \underline{75^{\#}}$
$125^{\#}/'$

$M = \frac{125}{542} \times 4900 = 1130'^{\#}$ USE
$I/c = 1130 \times 12/1500 = 9.1$ 4"x8"

(4) at roof 4'-0 Opng.

$W = 542^{\#}/'$

$M = 542 \times 4.4^2/8 = 1310'^{\#}$
$V = 542(2.2 \times .45) = 949^{\#}$
4x6
$f_b = 1310 \times 12/19.1 = 822.$ psi

@ 2nd floor

$W = 125^{\#}/'$

USE 4x6

Unit 'A' One B.R. Design Soil Pressure = 2000#/s'

Footings.

at wall (A)

Roof 35# x 2	= 70#
+ 65# x 4'	= 260
2nd fl. 50# x 6'	= 300
wall 15# x 20'	= 300
ftg.	= 500
	1430#/'

Use 12" wide ftg.

at wall (B)

floor 50# x 12.5'	= 625#
wall 15# x 8.0	= 120
ftg.	= 500
	1245#/'

Use 12" wide ftg.

at wall (C)

roof 35# x 2'	= 70#
2nd fl. 50# x 6.3	= 315
wall 15# x 20'	= 300
ftg.	= 500
	1185#/'

Use 12" wide ftg.

Post at Wall (B)

R = 635 x 6.1 = 3880#

Length of 12" ftg Reqd.

$= \frac{3880}{2000-500} = 2.6'$ ok.

at wall (1)

roof 35# x 28½	= 490#/'
floor 50# x 1.0	= 50
Wall 15" x 20'	= 300
ftg.	= 500
	1340#/'

Use 12" wide ftg.

Bm. (1) R = 635# x 4.3 = 2750#

Length of ftg. req'd.

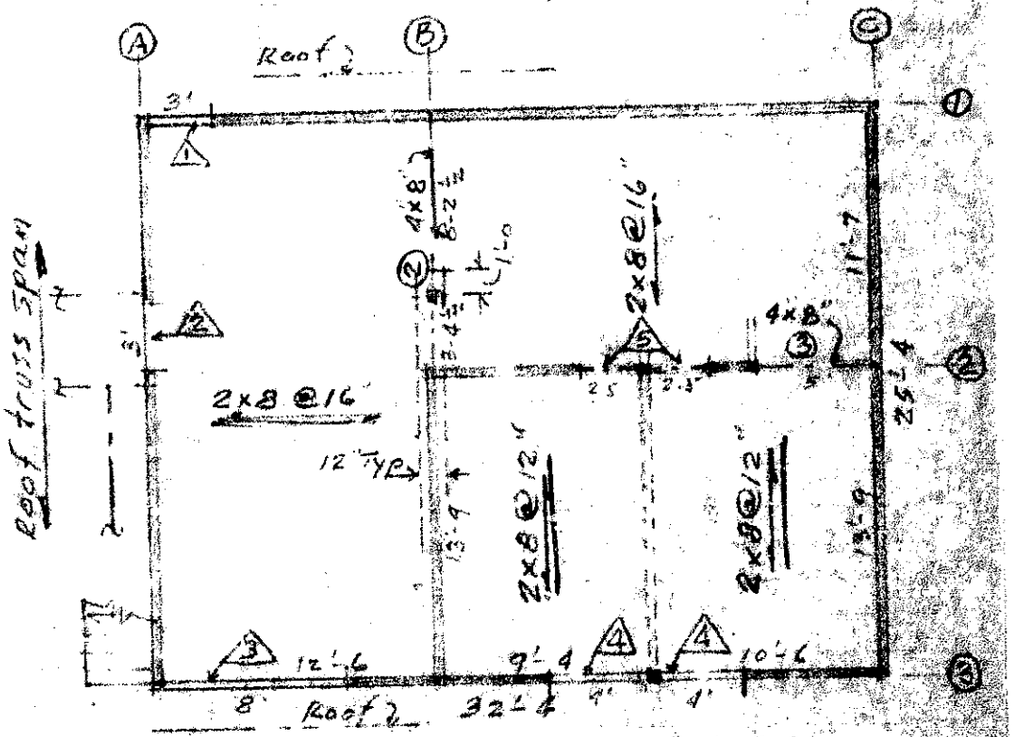
$\frac{2750}{2000-1340} = 4.15'$ ok.

at wall (2)

LU = 1340#/'

Use 12" wide ftg.

Unit B - 2 B.R.



Roof

See truss design by truss Mfgr.

Second Floor

Use double joists under partitions parallel to joists

See p.1 for joists.

Floor Beams

(2) Span = 8'-1 c.c.
$w = 50" \times 7 = 350$
$+ \frac{10}{360}$ #/'

$M = 360 \times 8.1^2/8 = 2960'"$
$I/c = \frac{2960 \times 12}{1500} = 23.7"^3$
$I = \frac{2960 \times 8.1}{325} = 73.5"^4$

Use 4x8

(3) Span = 5'-6 c.c.
$w = 50" \times \frac{25}{2} = 625$#
$+ \frac{10}{635}$ #/'

$M = 635 \times 5.5^2/8 = 2400'"$
$I/c = \frac{2400 \times 12}{1500} = 19.2"^3$
$A_{min} = 635 \times 2/80 = 15.9"^2$

Use 4x8

Lintels

△1 at roof - Use 4x6 same as △1 for Unit A p.2
@ 2nd floor - Use 4x4 Do.

△2 at roof & 2nd floor
4x4 ok Same as △2 for Unit A p.2

△3 at roof - Use 4x10 same as △3 for Unit A p.3
@ 2nd floor Use 4x8 Do.

Unit B - 2 B.R.

④ at roof - same as ④ for Unit A P.2
at 2nd floor w = 50"×6.5'×10 = 335#/' < 542#/' @ roof
Use 4×6 at roof & 2nd floor

⑤ at 2nd floor 2'-6 opening
floor 50"×12.5' = 625
10
635#/'

4×4

M = 635×2.8'/8 = 622'#
V = 635(1.4-.30) = 700#
f_b = 622×12/7.94 = 940 psi
v = 700×1.5/131 = 80 psi ok.

Footings

at Wall Ⓐ
Same as Wall Ⓐ Unit A
12" wide ftg.

at Wall Ⓑ
floor = 50"×7' = 350
wall = 15"×8.0 = 120
ftg. = 500
970#/'
Use 12" wide ftg.

@ post -
R = 360# × 11.5/2 = 2070#
Length of 12" ftg. req'd.
= 2070/2000-500 = 1.38'

at Wall Ⓒ
roof = 35"×2' = 70#
floor = 50"×1' = 50
wall = 15"×20' = 300#
ftg. = 500
920#/'
Use 12" wide ftg.

at wall ③
roof = 35"×28.7/2 = 500
2nd flr. 50"×6.75 = 338
wall 15"×20' = 300
ftg. = 500
1638#/'
Use 12" wide ftg.

at wall ②
2nd flr. 50"×25/2 = 625#
wall 15"×8' = 120
ftg. = 500#
1245#/'
Use 12" wide ftg.

at wall ①
roof 35"×28.7/2 = 500
2nd flr. 50"×11.5/2 = 287
wall 15"×20' = 300
ftg. = 500
1587#/'
Use 12" wide ftg.

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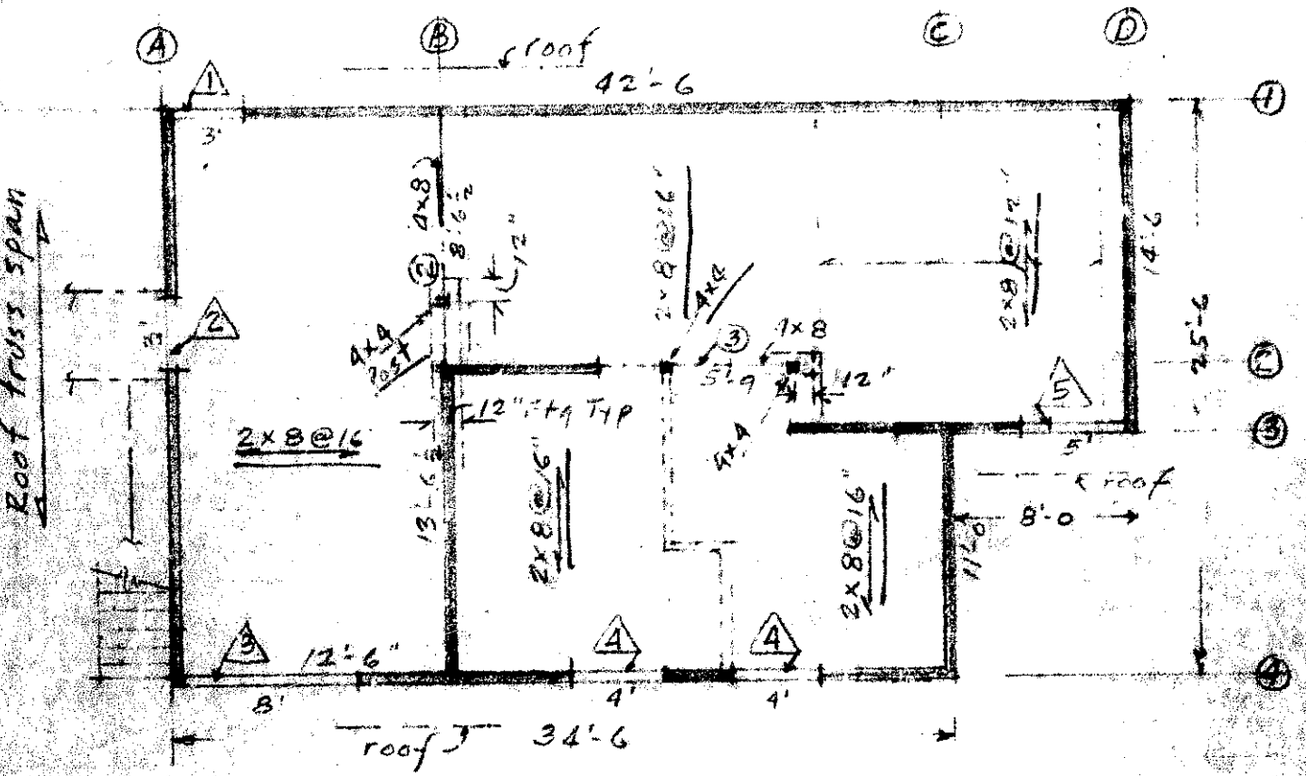
JOB San Luis Obispo Housing

UNIT 'C' 3 B.E.



Roof See truss design by Truss Mfgr.

Second Floor
See p.1 for joists. Use double joists under partitions that are parallel to joists

Floor Beams

(2) Span 8'-5 c.c.
floor 50" x 7' = 350#
+ 10
360#

$M = 360 \times 8.42^2/8 = 3200''$
$I/c = \frac{3200 \times 12}{1500} = 25.6''^3$
$I = \frac{3200 \times 8.42}{325} = 83.0''^4$

USE 4x8

(3) Span 5'-9 c.c.
floor 50" x 5.2/1 = 630#
+ 10
640#/1

$M = 640 \times 5.75^2/8 = 2640''$
$I/c = \frac{2640 \times 7}{1500} = 21.1$
$A_{min} = \frac{640(2.9 \times 60)}{80} = 18.4''^2$

USE 4x8

Unit C 3 B.R.

Lintel:

(1) at roof - Use 4x6 same as (1) for Unit 'A' p.2
at 2nd flr. - Use 4x8 Do

(2) at roof & 2nd floor - Use 4x4 same as (2) Unit A p.2

(3) at roof - Use 4x10 same as (3) for Unit A p.2
@ 2nd flr. Use 4x8 Do.

(4) at roof & 2nd floor
Use 4x6 same as for (4) unit 'B' p.6

(5) at roof 5'-0 opening

roof $35" \times \frac{29}{2} + 10 = 518"$
wall $15" \times 2.5 = \frac{38}{556\#/}$

$M = 556 \times 5.5^2/8 = 2100"$
$I/c = \frac{2100 \times 12}{1500} = 16.8$
$A_{min} = \frac{556(2.75-.45)}{80} \cdot 16.0" = $

at 2nd floor

floor $50" \times 6.6 = 330$
wall $15" \times 5 = \frac{75}{405\#/}$

Use 4x6 at roof & at 2nd floor

Unit 'C' 3 B.R.

Footings

at wall Ⓐ
Same as wall Ⓐ unit A
12" wide ftg.

at wall Ⓑ
Same as wall Ⓑ Unit B
12" wide ftg.

@ post - wall B
Fl. Bm. ② R = 360 × 17/2 = 2160#
Length of 12" ftg. req'd.
= 2160 / 2000 - 500 = 1.44'

at wall Ⓒ
Same as wall Ⓒ Unit B
12" wide ftg.

at wall Ⓓ
Same as wall Ⓒ Unit B
12" wide ftg.

at wall ①
roof 35# × 24/2 = 507#
2nd flr. 50# × 7 = 350
wall 15# × 20' = 300
ftg. = 500
1657#/'
Use 12" wide ftg.

at wall ② interior
Same as wall ② Unit B
12" wide footing

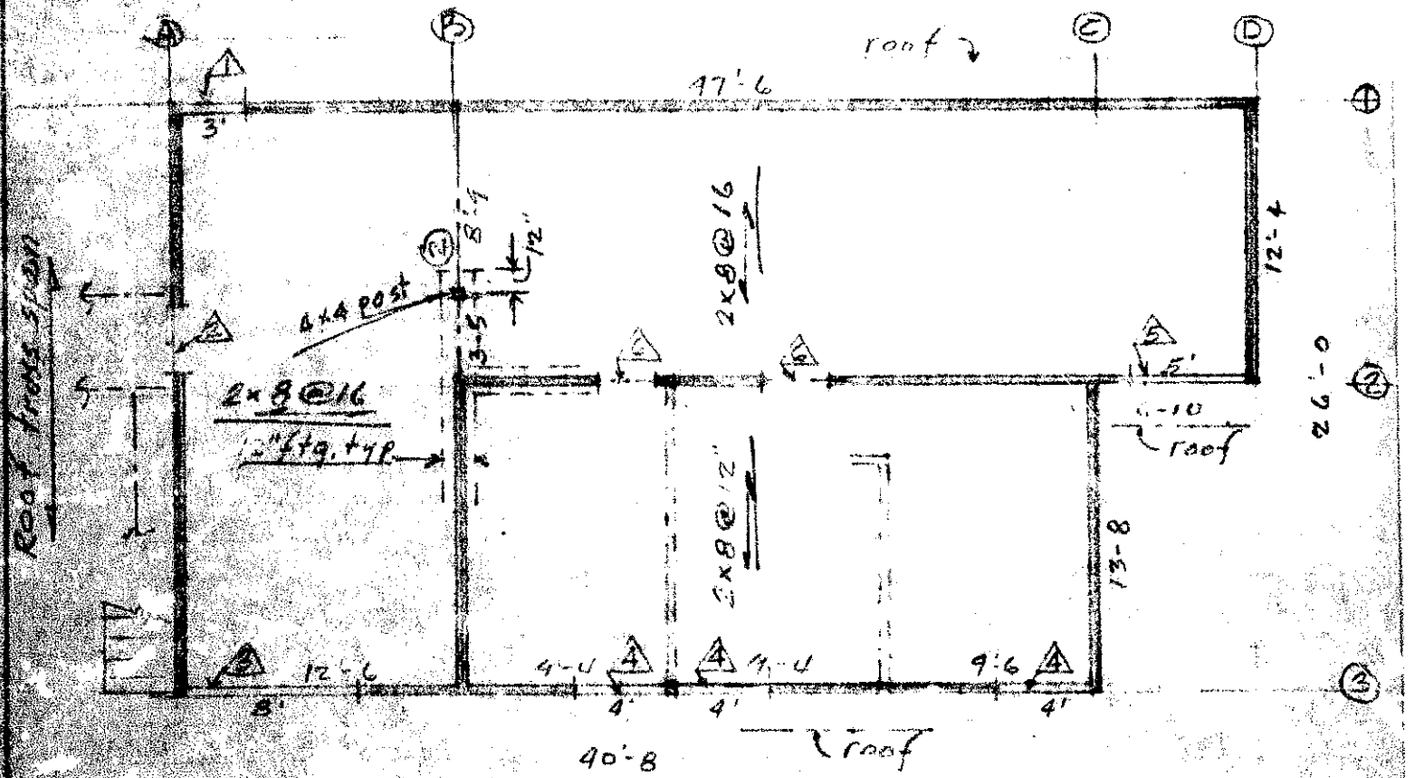
@ Int. post - wall ②
Fl. Bm. ③ R = 640 × 4.4 = 2800#
Length of 12" ftg. req'd
= 2800 / 200 - 500 = 1.88' o/c.

at wall ③
Same as wall ② Unit B
12" wide ftg.

at wall ④
Same as wall ①
Use 12" wide ftg.

at wall ② exterior
roof 35# × 18/2 = 316#
2nd flr. 50# × 7 = 350
wall 15# × 20' = 300
ftg. = 500
1466#/'
Use 12" wide footing

UNIT 'D' 4 B.R.



Roof

See truss design by truss Mfg'r.

Second Floor

see p.1 for joists: Use double joists under partitions that are parallel to joists

Floor G.M. (2) Span = 8'-7 c.c.

flr. 50#×7' = 350#
+ 10
360#

$M = 360 \times 8.6^2/8 = 3330''^{\#}$ USE 4×8

$I/c = \frac{3330 \times 2}{1500} = 26.6''^3$

$I = \frac{3330 \times 8.6}{325} = 88.2''^4$

$A_{min} = \frac{360(4.3-.60)}{80} = 16.7''^2$

Lintels

(1) at roof. Use 4×6 Same as (1) for Unit A
at 2nd flr. Use 4×4 Do.

(2) at roof & 2nd floor. Use 4×4 same as (2) unit A

Unit D - 4 B.R.

(3) at roof - Use 4x10 same as for (3) Unit A
at 2nd floor Use 4x8 Do.

(4) at roof & 2nd floor - Use 4x6 Same as for (4) unit B

(5) at roof & 2nd floor - Use 4x6 as for (5) Unit C

(6) at 2nd floor - Use 4x4 same as for (5) Unit B

Footings

at wall (A)
same as wall (A) Unit A
12" wide ftg.

at wall (B)
same as wall (B) Unit B
12" wide ftg

at wall (C)
same as wall (C) Unit B
12" wide ftg.

at wall (D)
same as wall (C) Unit B
12" wide ftg.

at wall (1)
roof $35^{\#} \times \frac{29.5}{2} = 515^{\#}$
2nd flr. $50^{\#} \times 6 = 300$
wall $15^{\#} \times 20 = 300$
ftg $= 500$
$1615^{\#}/'$
Use 12" wide ftg.

at wall (2)
2nd flr. $50^{\#} \times \frac{26}{2} = 650^{\#}$
wall $15^{\#} \times 8 = 120$
ftg $= 500$
$1270^{\#}/'$
Use 12" wide ftg.

at wall (3)
same as wall (1) Unit C
12" wide ftg.

at post - wall (B)
flr. Bm. (2) $R = 360 \times \frac{17}{2} = 2160^{\#}$
Length of 12" ftg. req'd.
$= \frac{2160}{2000 - 50} = 1.11'$

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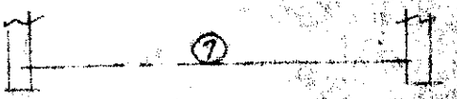
Typical - Stair Landing at Breezeway

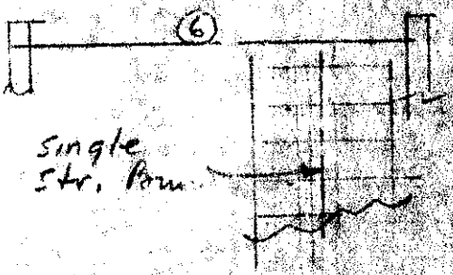
Bm. ⑥



Str. Bm. D.L. $30^{\#} \times 3 \times \frac{12}{2} = 540^{\#}$

$LL = \frac{100}{30} \times 540 = 1800$

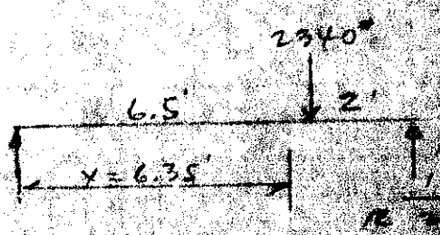
$P_{TL} = 2340^{\#}$



Uniform DL $20^{\#} \times 4/2 = 40^{\#}$
Railing 5
Bm 20
$65^{\#}/'$

L.L. $100^{\#} \times 4/2 = 200^{\#}$

$W_{TL} = 265^{\#}/'$



$M_x = \frac{1680}{2} \times 6.35 = 5350'^{\#}$

$S_x = \frac{5350 \times 12}{1500} = 429^{"3}$ $A_{min} = 1.5 \times 2660/1200 = 33.4$

Choice
6 x 8	S = 57.6	A = 41.3
8 x 10	S = 74.5	A = 34.4
4 x 12	S = 79.9	A = 41.7

Bm. ⑦ $w = 120^{\#} \times 2' = 240^{\#}/'$

$M = 240 \times \overline{8.5}^{2} \times 1.5 = 26{,}000'^{\#}$

$S_x = 26000^{\#}/1500 = 17.3$ $A_{min} = 1.5 \times 1020/1200 = 12.8^{\square"}$

Use 4 x 8" or depth to match Bm. ⑥.

UNIT A - One B.R. - Lateral Forces

N-S Dir. Lat.

Seis. at roof
roof 15# × 26.3' = 395
walls 15# × 4 × 2 = 120
partn. 6 × 4 × 2 = 48
563# × .133 = 75#/'. Wind governs

Wind at roof
W_{L_1} = 15#(3.5+4) = 113#/'
W_{L_2} = 15# × 4 = 60#/'

Tot. wind load at roof = 113# × 25.3 = 3400# = W_{L_1}
Breezeway roof = 60# × 4 = 240# = W_{L_2}

Seis. at floor
floor 10# × 24.7 = 247#
walls 15# × 10 × 1.5 = 225
partns 6# × 10 × 1 = 60
532 × .133 = 71#/'. Wind governs

Wind at floor
W = 15# × 9 = 135#/'

Tot. wind load at floor = 135# × 25.3' = 3420#

E-W Dir. Lat. Wind governs obviously

15# × 3' × 28' = 1260#
15# × 4 × 24.7 = 1480
Tot. wind load at roof = 2740# = W_2

Tot wind load at floor = 15# × 9' × 24.7 = 3340# = W_2

1st Story Walls - (cont'd from p.14)

E-W Dir. 1st Stry Lat. = 2740# + 3340# = 6080#
Lat. to Wall ④ = 6080/2 = 3040#
Shear Cap. wall ② = 300# × 12' = 3600# > 3040# ok.
Shear Cap. wall ① = 300# × 22' = 6600# > 3040# ok.

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JOB

Unit A - One B.R. - Lat. Forces:

Case I - Two Units together

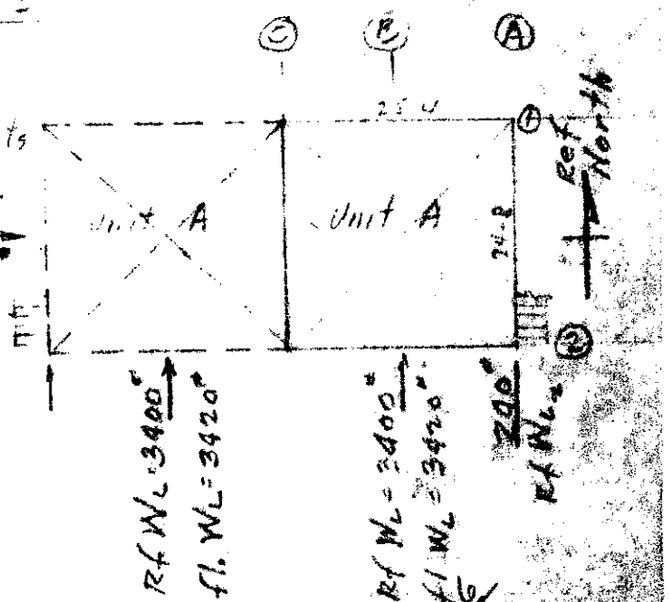
Roof diaph.

N-S dir. $v = \frac{3400}{2 \times 26} = 65^{\#}/_{'}$ for 1 or 2 units

Use 3/8" Plywd. unblocked 8d @ 6" edges 8d @ 12" Inter.

$R_f W_L = 2740^{\#}$

$Fl. W_L = 3340^{\#}$



Flange stress $= \frac{3400 \times 25.3}{8 \times 24.7} = 435^{\#}$

Use Typ 6-16d top Fl. Splice

Value $= 1.33 \times 107^{\#} \times 6 = 850^{\#}$

2nd Story Shear Walls.

Rf Lat. to Wall © = 3400# as common wall

Shear Cap. of wall = $25^{\#} \times 24' = 3000^{\#}$

Use 1 - Diag. brace $\frac{1000^{\#}}{4000^{\#}} > 3400^{\#}$ o.k.

Rf Lat. to Wall Ⓐ $= \frac{3400}{2} + 240^{\#} = 1940^{\#}$

Sh. Cap. of wall $= 250^{\#}(12+8) = 6300^{\#} > 1940^{\#}$ o.k.

E-W Dir. Rf. Lat $= 2740^{\#}$

Shear Cap of Walls $= 250^{\#}(22+12) = 10,700^{\#} > 2740$ o.k.

2nd Fl. diaph. N-S dir. $v = \frac{3420}{2 \times 24} = 71^{\#}/_{'}$ > E-W dir. v by Insp.

Use 1/2" Plywd. 5 ply, unblocked - 8d @ 6" edge nailing 10d @ 12" Inter. 3/8" T&G

N-S dir. Flg. Stress $= \frac{3420 \times 25.3}{8 \times 24.7} = 437^{\#}$ Use 6-16d top Fl. Splice - Typ

1st Sty. Walls - Load to Wall © = [Δ Rf Lat = 1700# + 1700# = 3400#; Δ 2nd fl. Lat = $\frac{3420}{4} + \frac{3420}{4} = 1710^{\#}$]

shear cap. of Wall $= 175^{\#} \times 24 = 4200^{\#}$

+1 diag. brace - $\frac{1000}{5200^{\#}} > 5110^{\#}$ o.k. Load to wall © = 5110#

Use 5/8 Gyp bd one side blocked, w/ 6d @ 4" nailing + one 1x4 diag. brace

{for Case II - Single Unit - Cen. Frame: 3 side + 5/8 Gyp. bd. one side of Ro. Fram. Wall.

Load to 1st Sty. Walls A+B $= \frac{3400}{2} + \frac{3}{4} \times 3420 = 4330^{\#}$

Shear cap. walls A+B $= 300^{\#} \times 24 = 7200$

$250^{\#} \times 12 = 3000$

$\frac{}{10200^{\#}} > 4330^{\#}$ o.k.

Unit B - 2 B.R. Lat. Forces

Wind governs for all cases by inspection - see Unit A p.13

N-S Dir Roof Lat. W_L = 15#(3.5+4')×32.3' = 3660#
Breezeway Roof Lat W_L = 15#×4'×4' = 240#

N-S Dir. 2nd Flr. Lat. W_L = 15#×9'×32.3' = 4360#

E-W Dir. Roof Lat. W_L = (15#×3'×28.7)+(15#×4'×25.3') = 2610#
E-W Dir. 2nd Flr. Lat W_L = 15#×9'×25.3' = 3420#

N-S Dir. Roof Diaph. v = $\frac{3660}{2\times 27}$ = 68#/'

Use 3/8" Plywd. Shtg. Unblocked
8d @ 6" edge nailing
8d @ 12" Inter. nailing.

N & S wall flange stress = $\frac{3660\times 32.4}{8\times 25.3}$ = 590#

Use typ. 6-16d top plate splice

Shear Walls - 2nd Sty.

N-S Dir. Rf Lat. to wall Ⓔ = 3660#
Shear Cap Wall Ⓔ = 175#×25' = 4350# > 3660# ok.

N-S Dir. Rf Lat. to Wall Ⓐ = 3660/2 = 1830#
Shear Cap. Wall Ⓐ = 300#(14+8) = 6600# > 1830# ok.

E-W Dir. Rf. Lat. = 2810#/2 = 1410# to ea. wall ① & ③

Shear Cap. wall ② = 300#(9-6) = 4500# > 1410# ok.
Wall ① = 300#×32' = 9600# > 1410# ok.

① Shear wall Ⓒ when common to 2 units w/ spring clips (omit) at one side of wall - Shear wall to have 3/8" Gyp bd. one side, blocked w/ 6d cooler nails @ 4" at all edges & at all inter. interior bearings

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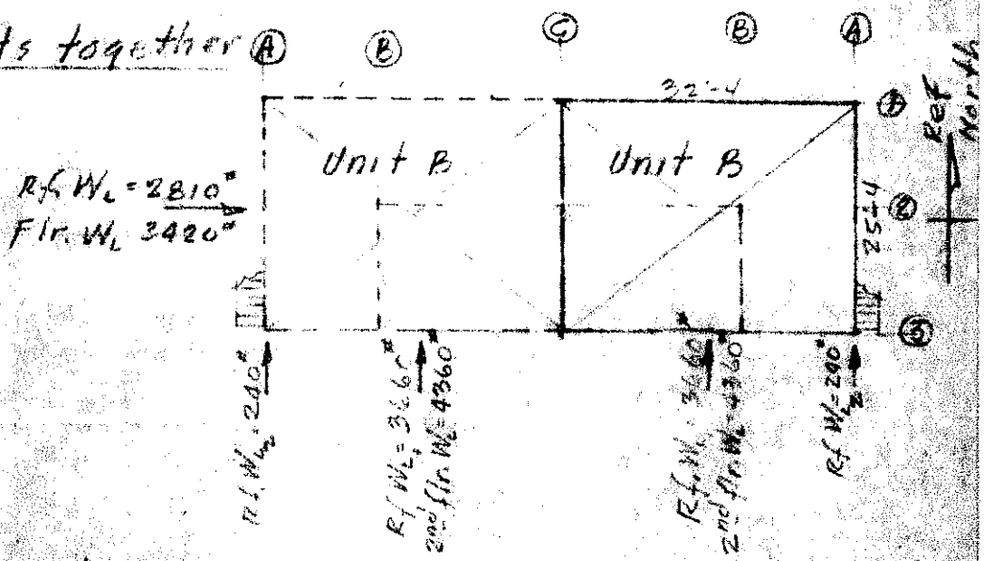
Unit B - 2 B.R. Lat. Forces -

Case I - two units together



2nd Flr. Diaph.

N-S Dir. $v = \frac{4360^{\#}}{2 \times 25} = 87^{\#}/'$

Use ½" plywd. Shtg. unblocked
8d @ 6" edge nailing
8d @ 12" Inter. "

N-S Walls Flange stress = $\frac{4360^{\#} \times 32.3}{8 \times 25.3} = 695^{\#}$

Use typ. plate splice 6-16d nails @ top plate

Shear Walls - 1st Story

Lat. to Wall Ⓒ $= 3660 + \left(\frac{2 \times 4360}{3}\right) = 6560^{\#}$

Ⓒ Shear Cap. of wall $175^{\#} \times 25' = 4360^{\#}$ {for 5/8 4ypl'd. one side 6d @ 4" nailing
+ 3 diag. braces $= 3000$
$7360^{\#} > 6560^{\#}$ ok.

Lat. to Walls Ⓐ + Ⓑ $= \frac{3660}{2} + \left(\frac{2}{3} \times 4360\right) = 4730^{\#}$

Shear Cap. Walls $= 300(13.5 + 8.5) + 250 \times 13.5 = 9970^{\#} > 4730^{\#}$ ok.

Ⓑ Shear Wall Ⓒ when common to 2 units w/ spring
w/ Chks on one side of wall - Shear wall to hair
5/8" 4yplwd. one side, blocked, w/ 6d cooler nails
@ 4" at all edges & at all interior bearings

Lat. to wall Ⓒ $= \frac{2810 + 3420}{2} = 3115^{\#}$
Shear Cap. of wall $= 300^{\#}(9 + 6) = 4500^{\#} > 3115^{\#}$ ok.
" " " Ⓑ - ok. By Inspection

Unit C - 3 B.R. Lat. Forces

Wind governs for all cases by Inspection - see Unit A, p.13

N-S Dir. roof Lat. $W_L = 15^{\#}(3.5+4)42.5' = 4800^{\#}$ $W_L = 113^{\#}/'$

Breezeway roof Lat. $W_{L_2} = 15^{\#} \times 4' \times 4' = 240^{\#}$

N-S Dir. 2nd flr. Lat. $W_L = 15^{\#} \times 9' \times 42.5' = 5750^{\#}$ $W_L = 135^{\#}/'$

E-W Dir. roof Lat. $W_L = (15^{\#} \times 3' \times 29') + (15^{\#} \times 4 \times 25.5) = 2830^{\#}$ ($1300^{\#}$, $1530^{\#}$)

$W_L = 2830/25.5 = 111^{\#}/'$

E-W Dir. 2nd flr. Lat. $W_L = 15^{\#} \times 9' \times 25.5' = 3450^{\#}$ $W_L = 135^{\#}/'$

N-S Dir. roof diaph. $v = \frac{4800}{2 \times 27} = 89^{\#}/'$

Use 3/8" Plywd. shtg, unblocked

8d @ 6" edge nailing

8d @ 12" Inter. nailing

N&S wall flange stress $= \frac{4800 \times 42.5}{8 \times 25.5} = 1000^{\#}$

$1000/1.33 \times 107 = 7.05$

Use 8-16d top plate splice

Shear Walls - 2nd Story

N-S Dir. Rf. Lat. to wall D $= 113^{\#} \times 8 = 905^{\#}$

Shear Cap. Wall D $= 125^{\#} \times 14' = 1720^{\#} > 905^{\#}$ ok.

N-S Roof Lat to wall C $= 113^{\#} \times 21.3 = 2420^{\#}$

Sh. cap. wall C $= 300^{\#} \times 11' = 3300^{\#} > 2420^{\#}$ ok.

N-S Roof Lat to wall A $= 113^{\#} \times 17.3 = 1950^{\#}$

Sh. cap. wall A $= 300^{\#} \times (13+8.5') = 6450^{\#} > 1950^{\#}$ ok.

E-W Dir. Rf. Lat. $= 2830^{\#}$

Sh. Cap. Wall ⑨ $= 300^{\#}(9+6') = 4500^{\#} > \frac{2830}{2}$ ok.

Sh. Cap. of 2nd story walls for E-W Dir. Roof Lat. is ok. by comparison w/ wall ⑨

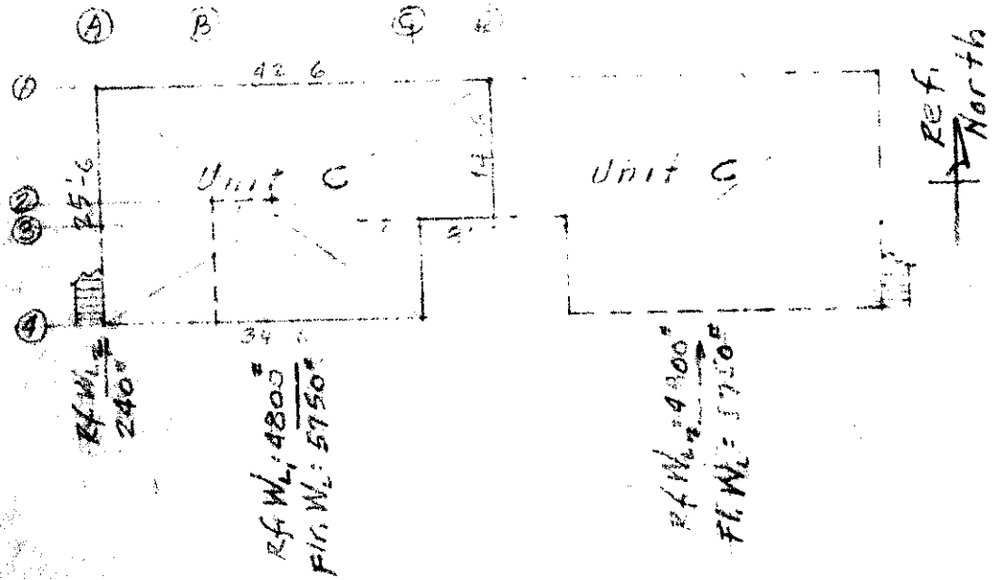
DATE Mar. '70
BY
JOB

LLOYD DYSLAND & ASSOCIATES
STRUCTURAL ENGINEERS
LOS ANGELES, CALIFORNIA

JOB NO. 6965

Unit C - 3 B.R. Lat. Forces

CASE I



2nd Flr. diaphragm. - N-S dir. v = $\frac{135^{\#} \times 34.5'}{2 \times 25'} = 93^{\#}$

Use ~~1/2" Ply~~ 3/8" T&G Redwood, Sht'g. Unblocked
10d @ 6" edge nailing
10d @ 12" Inter nailing

N&S walls flange stress = $\frac{135 \times 34.5^2}{8 \times 25.5} = 79c^{\#}$

Use typ. to. plate splice - 6-16d nails

Shear walls - 1st story -

Lat. to wall D = $(113^{\#} + 135^{\#}) \times 8' = 1980^{\#}$ (as common wall)

Shear cap. of wall = $175^{\#} \times 14' = 2450^{\#} > 1980^{\#}$ o.k.
→ for 7/8 Gyp bd one side, 5d @ 4"

Lat. to wall C = $1.3(173^{\#} + 4') + (135^{\#} \times 15') = 4420^{\#}$

Shear cap. of wall E = $325^{\#} \times 11 = 3570^{\#}$
+ 1 Diagonal brace $1000^{\#}$
$4570^{\#} > 4420^{\#}$ ok.

Lat to walls Ⓐ+Ⓑ = $(113^{\#} \times 173') + (135^{\#} \times 23.5') = 5130^{\#}$

Shear Cap walls $300^{\#}(13+4') + (250^{\#} \times 10') = 9850^{\#} > 5130^{\#}$ ok.

E-W lat. to 1st sty. walls = $2830 + 3450 = 6280^{\#}$

Shear Cap. wall ④ = $300^{\#}(9+6') = 4500^{\#}$
③ = $250 \times 9.5' = 2370^{\#}$
② = $250 \times 6 = 1500$
① = $300 \times 42' = 12,600^{\#}$
} ok.

Unit D-4 B.R. Lat. Forces

Wind Lat. governs for all cases by Inspection - See Unit A, p.13

N-S Dir. roof Lat. $W_{L_1} = 15^{\#}(3.5+4')47.5' = 5350^{\#}$ $w_L = 113^{\#}/'$
Breezeway roof Lat. $W_{L_2} = 15^{\#} \times 4' \times 4' = 240^{\#}$

N-S Dir. 2nd flr. Lat. $W_L = 15^{\#} \times 9' \times 47.5' = 6400^{\#}$ $w_L = 135^{\#}/'$
E-W Dir. roof Lat. $W_L = (15^{\#} \times 3' \times 28') + (15^{\#} \times 4' \times 26') = 2820^{\#}$ $w_L = 108^{\#}/'$
E-W Dir. 2nd flr. Lat. $W_L = 15^{\#} \times 9' \times 26' = 3500^{\#}$ $w_L = 135^{\#}/'$

N-S Dir. roof diaph. $v = \frac{5350}{2 \times 27.5} = 97^{\#}/'$
Use 3/8" Plywd. shtg. unblocked
8d @ 6" edge nailing
8d @ 12" Inter. nailing

N&S wall flange stress $= \frac{113^{\#} \times 40.7'}{8 \times 26} = 900^{\#}$
Use 8-16d top plate splice

Shear walls at 2nd story

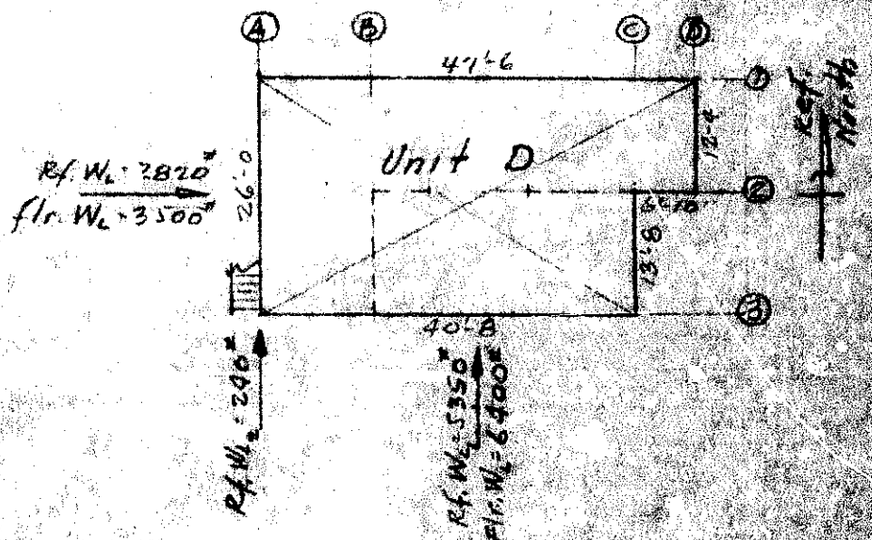
N-S Dir. Rf. Lat. $W_L = 5350^{\#}$
Capacity of shear walls $= 300^{\#}(26'+13.5+8.5) = 14{,}400^{\#}$ o.k.

E-W Dir. Rf. Lat. $W_L = 2820^{\#}$
Capacity of Shear Wall ③ $= 300^{\#}(9'+10') = 5700^{\#}$
" " " " ① $= 300^{\#} \times 44' = 13{,}200^{\#}$ } o.k.

2nd floor diaph. N-S dir. $v = \frac{6400}{2 \times 26} = 123^{\#}/'$
Use ~~1/2"~~ 5/8" T&G plywd. shtg. unblocked
18d @ 6" edge nailing
18d @ 12" Inter. nailing

N&S walls flange stress $= \frac{6400 \times 45}{8 \times 26} = 1380^{\#}$
1380/1133 x 107 = 9.7
Use 10-16d nails or 2-1/2" ϕ Bolts } top plate splice @ N & S walls.
Use typ. plate splice (6-16d nails) @ E & W walls

Unit D - 4 B.R. Lat. Forces



Shear Walls at 1st Story

1st story N-S dir. Lat. = 5350# + 6405# = 11,700#

300# (13.5 + 7 + 26) = 14,500
250# × 14' = 3500
18,000# > 11,700# ok.

1st Story E-W dir. Lat. = 2820 + 3500 = 6320#

Shear capacity: Wall ③ 300# (9 + 10') = 5700#
" " " ② 250# (6 + 12') = 4500# ok.
" " " ① 300# × 44' = 13,200#

DATE _____ BY _____

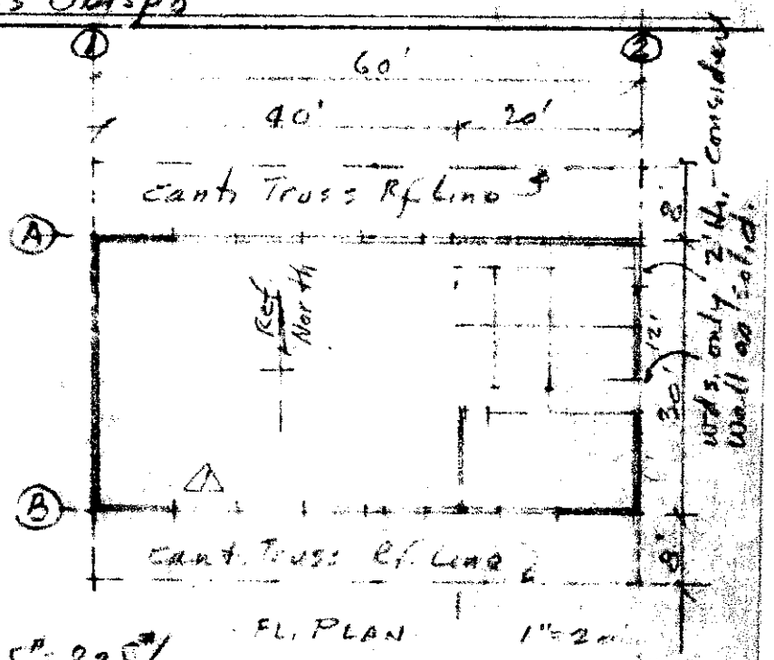
LLOYD DYSLAND & ASSOCIATES
STRUCTURAL ENGINEERS
LOS ANGELES, CALIFORNIA

PAGE R-1
JOB NO. 6965

JOB Recreation Bldg - San Luis Obispo

Roof Trusses - See Truss Mfgrs. Design

	6.0
3/8" Plywood Sh'tg.	1.1
Roof Trusses	4.0
Gyp. Bd. Clg.	2.4
Misc. - Insul.	1.5
D.L.	15.0
L.L.	20.0
T.L.	350 #/'



Roof Lintel ⚠

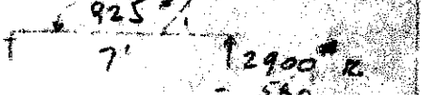
Span 7'-0" : 35# x 23' + 15# = 825#/'

M = 825 x 7²/8 = 5050'#

f_b = 5050 x 12 / 1.25 x 1500 = 32.2"³

d_{min} = 4.5 x 2320 / 120 = 29.0"

Use 4"x10" Lintel S = 54.5 A = 34.4



Axial Load to Post = 2 x 2900 = 5800#

$f_{b\,wind}$ = 15# x 1.5² / 1.33 = 113#/' M_w = 113 x 9² x 1.5 = 13,700'#

Use 4x6 Mul. Posts in 6" wall P_{DL} = 24k f_b = 13700 / 19.1 = 720 psi

P_{DL} = 1.5/3.5 x 5800 = 2480

Ratios DL + wind = 2480/24,400 + 720/1500 = .58 < 1.33 OK.

Footings - Des. S.P. 2000 #/'

At Unif. Line 'A' - Roof 32# x 23' = 735#/'

Wall 10 x 9 = 90

Ftg. = 400

Ftg. Lo = 1225#/'

USE 12" WIDE FTG.

Length of Ftg. Req'd. for 4x6 Post Lo = 5260# / 1600# = 3.3' ok

typ. Ftg. 12" x 18" M.S. w/ 1-#4 Cont. top & bot.

Lat. Forces. 2x6 @16 stud walls w/ 5/8 Gyp'bd. ea. side, unblocked, 6d nailed walls @ 7" o.c. all-w = 250#/'

N-S Dir.-Seis. Lat.

Rf. & L.L.+L. = .133 x 12" x 46' x 60' = 4400#
Walls = 3 x .133 x 10" x 4.5' x 60 = 1080#
W_s = 5480#

N-S Dir - Wind Lat = 15# x 8' x 60' = 7200# = W_w governs

E-W Dir. Seis Lat.
Rf & L.L. = .133 x 12" x 60' x 46 = 4400#
Walls .133 x 9 x 10" x 4.5 x 3.5 = 720
W_s = 5120# governs

E-W Dir. Wind Lat.
15# x 66.3' x 10.5/9 = 2420#
15# x 4.5' x 30' = 2030
Ww 4450

N-S Dir. Lat. - Roof Diaphr: 3600/30 = 120#/' < 180#/'

fw → 3/8 Plywd. Sh'g. unblocked - 8d @ 6" edge nailing; 8d @ 12" Inter. nailing

N & S Roof fascia - flange stress =
7200# x 60'/8 x 46' = 1130# 1130/1.33 x 107 = 8.3

→ 2x Roof fascia - flange splice 9-16d nails? or 2-5/8 ϕ Bolts

Lat. force to wall Ⓐ &/or Ⓒ = 7200/2 = 3600#
Shear capacity of walls = 300#(30+30) = 18000# > 3600# ok.

Lat. force to wall Ⓑ = 5120/2 = 2560#
Shear Cap. wall Ⓑ = 300#(9+9) = 5400# > 2560# ok.
3/4 D.L.R.M. = .75 x [(15# x 23')(9') + (15# x 9')(4.5')] x 9 x 45 = 14,600'#
Wind O.T.M. = 1300# x 9 = 11,700 < 14,600 No Uplift

Lat. Forces - E-W Dir.

Shear Capacity - Wall Line B : 250# x 18' = 4500#
8.5 + 9.5 = 18 L.F. Wall V: 5120/2 = 2560# | o.c.

OTM to 8'-6 Wall Section = $\frac{8.5}{18} \times 2560 \times 9' = 11800'^{\#}$

3/4 D.L.R.M. = .75 x 10# x 23' x 8.5 x 4.2' = 6150'#

Uplift = $\frac{5650}{8} = 705^{\#}$

Use Simpson HD-2 @ one end of 8.5' Sec. & 9.5 Sec.

Wall Line A 8.5 + 19.5' = 28 L.F.

V to 8.5' wall sec. = $\frac{8.5}{28} \times 2560 = 780^{\#}$

OTM = 780# x 9' ——————— 7000'#

3/4 D.L.R.M. = .75 x 10# x 23' x 8.5' x 4.2' = 6150'#

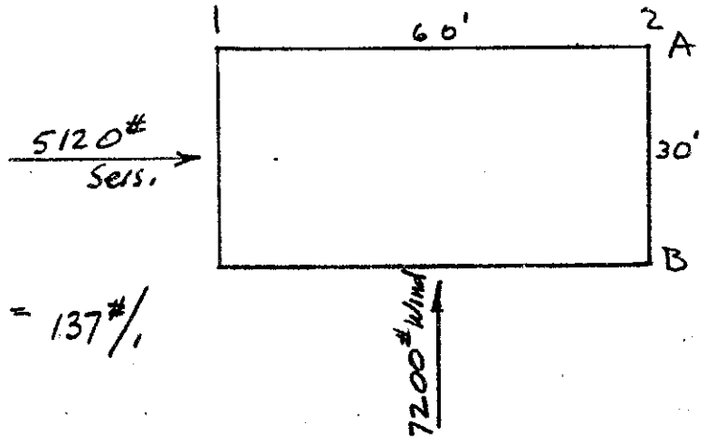
Holdown Not Req'd. Uplift = 850#/8 = 106# Nog!

Building No.	Use	No. of Units	Occupancy Classification	Stories	Floor Area (Max.)	Floor Area (Total)	Occupant Load	Valuation
1592 1	Apt.	10	H	Two	4,390	8,670	43	$106,000
1588 2	Apt.	6	H	Two	3,050	6,040	30	72,000
1586 3	Apt.	8	H	Two	3,570	6,850	33	81,000
1584 4	Apt.	4	H	Two	1,310	2,560	13	30,000
1582 5	Apt.	4	H	Two	1,700	3,330	16	39,500
1578 6	Apt.	8	H	Two	4,400	8,680	43	106,000
1576 7	Apt.	8	H	Two	3,570	6,850	33	81,000
8	Maintenance	-	F-2	One	300	300	3	1,800
1574 9	Apt.	6	H	Two	3,200	6,340	31	75,500
1572 10	Apt.	12	H	Two	6,430	12,600	63	151,000
1569 11	Apt.	6	H	Two	3,140	6,220	31	74,000
1564 12	Apt.	8	H	Two	4,400	8,680	43	106,000
1564 13	Apt.	4	H	Two	2,210	4,190	20	49,000
1562 14	Apt.	4	H	Two	1,700	3,330	16	39,500
1558 15	Apt.	4	H	Two	1,490	2,740	16	32,000
1556 16	Apt.	8	H	Two	3,570	6,850	33	81,000
1552 17	Apt.	14	H	Two	4,900	9,650	47	114,500
1534 18	Apt.	6	H	Two	3,050	6,040	30	72,000
1530 19	Recreation	-	B-3	One	2,760	2,760	125	18,700
						SUGGESTED VALUATION		$1,330,500

112,480.00

Recreation Bldg. See p. R-1 (Recheck Shear Walls)

See p. R-2 for loads.



Walls 1 & 2 - with rotation

Load = 7200.#

$v = 7200/(29.3+23.2) = 137\#/'$

Wall A

Load = $5120/2 = 2560.\#$

$v = 2560/28.2 = 91.\#/'$

Wall B

Load = 2560#

$v = 2560/18.2 = 141.\#/'$

Use 1/2" gyp. wallboard on interior face of exterior walls, blocked & nailed with 5d coolers @ 4" o.c.

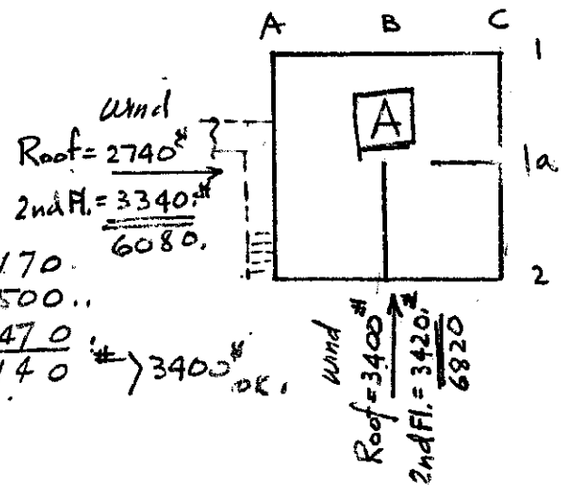
DATE Feb. 3, 1971 **LLOYD DYSLAND & ASSOCIATES** PAGE 21
BY LD STRUCTURAL ENGINEERS JOB NO. 6965
LOS ANGELES, CALIFORNIA
JOB Malonna Terrace Apartments

Recheck Shear Walls

Unit A - One Bedroom Apt. See p. 2

Isolated Apt.:

See p. 13 for calculation of loads.



N to S - Upper Story

Capy:
A (½" unblkd, 7" sp) = 100# × 21.7' = 2170
B (" ") = 200 × 12.5' = 2500
C (" ") = 100 × 24.7' = 2470
Shear capy = 7140# > 3400# OK.

N to S - Lower Story

A (½" unblkd, 7" sp.) = 100# × 21.7' = 2170
B (" ") = 200 × 12.5' = 2500
C (" ") = 100 × 24.7' = 2470
7140# > 6820# OK

E to W - Upper Story

1 (½" unblkd, 7" sp) = 100# × 22' = 2200.#
2 (" ") = 100# × 12.7 = 1270
3470.# > 2740# OK

E to W - Lower Story

1 (½" unblkd, 4" sp.) = 125# × 22' = 2750.
1a (" ") = 250 × 7.5 = 1870.
2 (" ") = 125 × 12.7 = 1590.
6210 > 6080.# OK.

TYPICAL

All walls in one direction are assumed capable of being loaded to their full capacity simultaneously with torsion due to eccentricity of load and reaction resisted by plywood diaphrams and transverse shear walls.

Use ½" gypsum wall board at all interior wall surfaces, except party walls.

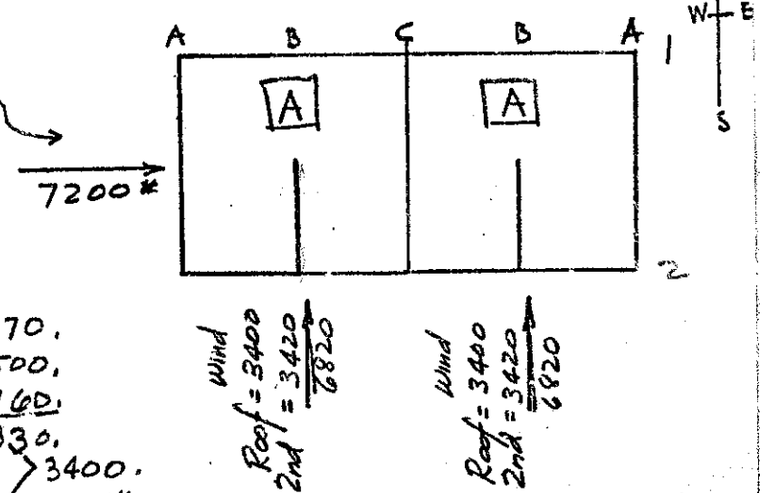
Use 5/8 gypsum wallboard at each side of party walls - only one side effective for shear resistance.

Unit A, continued

2 Adjacent Units!

E to W Seismic (See p. 13)

Roof = 75# × 24.7' × 2 = 3700.#
2nd = 71# × " " = 3500.#



N to S - Upper Story - (One side)

A (½" Unblkd, 7" sp) = 100# × 21.7 = 2170.
B " " " = 200 × 12.5 = 2500.
½ of C (⅝" Blkd, 4" sp) = 175/2 × 24.7 = 2160.
6830.
> 3400. ok.

N to S - Lower Story - (One side)

Same as upper story > 6820. ok.

E to W - Upper Story

1 (½" unblkd, 7" sp.) = 100# × 44' = 4400.
2 (" , 7") = 100 × 25.4 = 2540
6940.# > 3700 ok.

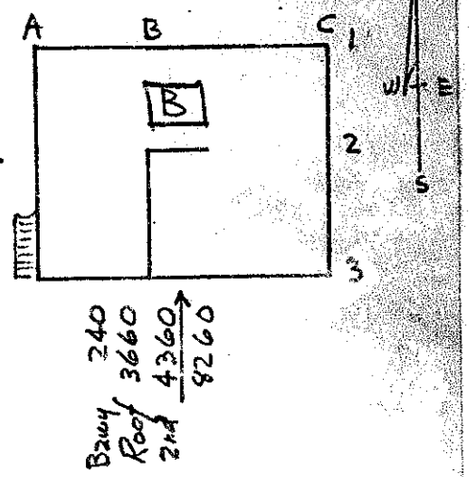
E to W - Lower Story

1 (½" unblkd, 4" sp.) = 125 × 44' = 5500
2 (" ") = 125 × 25.4 = 3180
8680# > 7200. ok.

Unit B - Two Bedroom Apt. See p. 5

See p. 15 for wind loads.

Isolated Apt.:



N to S - Upper Story

A (½" unblkd, 7" sp.) = 100# × 22' = 2200
B (" ") = 200 × 13.5 = 2700
C (" ") = 100 × 25 = 2500
7400#
> 3900
ok

Unit B, continued

N to S, Lower story

A (½" unblkd, 4" Sp.) = 125# × 22' = 2750
B (" ") = 250 × 13.5 = 3380.
C (" ") = 125 × 25 = 3120.
} 9250# > 8260 OK

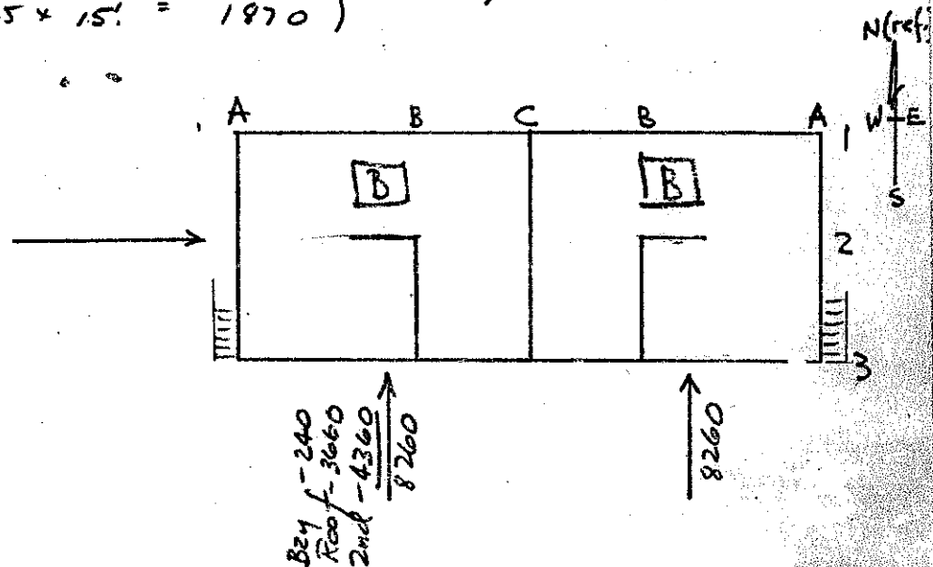
E to W, Upper story

1 (½" unblkd, 7" Sp.) = 100# × 30' = 3000
2 (" ") = 100 × 6.5' = 650
3 (" ") = 100 × 15' = 1500
} 5150# > 2810 OK

E to W, Lower story

1 (½" unblkd, 4" Sp.) = 125 × 30' = 3750
2 (" ") = 125 × 6.5' = 810
3 (" ") = 125 × 15' = 1870
} 6430# > 6230 OK.

2 Adjacent Units!



N to S Upper Story (one side)

A (½" unblkd, 7" Sp.) = 100 × 22 = 2200.
B (" ") = 200 × 13.5 = 2700.
½ of C (⅝ blkd, 4" Sp.) = 175/2 × 25 = 2120
} 7020.# > 3900.# OK.

N to S Lower story (one side)

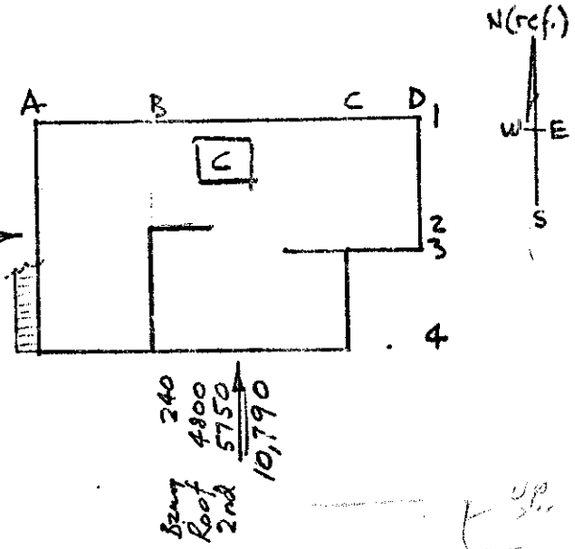
A (½" unblkd, 4" Sp.) = 125 × 22 = 2750
B (" ") = 250 × 13.5 = 3370
C (⅝ blkd, 4" Sp.) = 175/2 × 25 = 2120.
} 8240# ≈ 8260, OK.

E to W

By inspection lateral resistance is double that of single unit. Wind load is same as for single unit and seismic load as shown on p. 13 is less than double wind load. Therefore requirements for single unit are ok for double unit.

Unit C - 3 Bedroom Apt. See p. 7

See p. 17 & 18 for wind loads.



N to S - Upper story

A (½" unblkd, 7" sp.) = 100' × 21.8 = 2180
B (" ") = 200 × 13.3 = 2660
C (" ") = 100 × 11.0 = 1100
D (" ") = 100 × 13.8 = 1380
7320# < 5040

N to S - Lower story

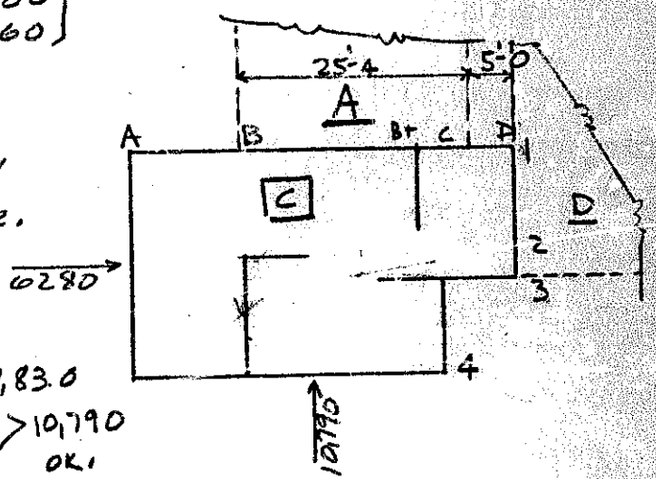
A (½" blkd, 4½ sp.) = 150 × 21.8 = 3270
B (" ") = 300 × 13.3 = 3990
C (" ") = 150 × 11.0 = 1650
D (" ") = 150 × 13.8 = 2080
10,990# > 10,790 OK

E to W - Upper story (& Lower story)

1 (½" unblkd, 7" sp.) = 100 × 40.0 = 4000
2 (" ") = 200 × 6.5 = 1300
3 (" ") = 100 × 8.0 = 800
+ 200 × 6.5 = 1300
4 (" ") = 100 × 14.6 = 1460
8860 > 6280. OK for upper & lower stories.

Unit C with Bldg D attached at Wall D-3

N to S upper story with wall D using blocked 5/8 gypsd & nails @ 4" OK by comparison with calcs. above.



N to S - lower story

A (½" blkd, 4" sp.) = 150 × 21.8 = 3270
B (" ") = 300 × 13.3 = 3990
C (" ") = 150 × 11.0 = 1650
D (5/8 blkd, 4" sp.) = ½ × 175 × 13.8 = 1210
B+ (½" blkd, 4" sp.) = 300 × 5.7 = 1710
11,830 > 10,790 OK.

Unit C with Bldg. A attached at Wall 1

N to S - OK

E to W - upper story - OK by comparison with single unit

E to W - lower story

1 (½" unblkd, 4" sp.) = 125 × 14.7 = 1840.
(5/8 blkd, 4" sp.) = ½ × 175 × 25.3. = 2220
2 (½" unblkd, 4" sp.) = 250 × 6.5 = 1620.
3 (" ") = 125 × 8.0 + 250 × 6.5 = 2620.
4 (" ") = 125 × 14.6 = 1820
10,120 > 6280 OK.

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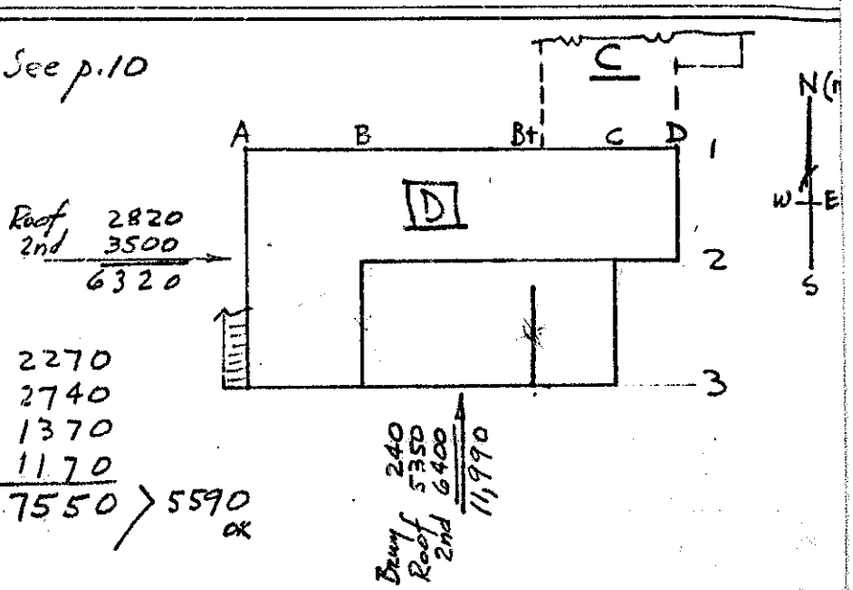
LOS ANGELES, CALIFORNIA

Unit D - 4 Bedroom Apt.

See p. 10

See p. 19 & 20 for wind loads.



Roof 2820
2nd 3500
6320

Bsmt 240
Roof 5350
2nd 6400
11,990

N to S - Upper story

A (½"-blkd. 7"sp.)	= 100 x 22.7 =	2270
B (" ")	= 200 x 13.7 =	2740
C (" ")	= 100 x 13.7 =	1370
D (" ")	= 100 x 11.7 =	1170
	7550 > 5590	OK

N to S - Lower story

A (½"-blkd-4"sp.)	= 150 x 22.7 =	3400
B (" " ")	= 300 x 13.7 =	4100
C (" " ")	= 150 x 13.7 =	2060
D (" " ")	= 150 x 11.7 =	1750
Bt (" " ")	= 300 x 10.3 =	3090

E to W - Upper story & Lower story

1 (½"-blkd-7"sp.)	= 100 x 45.0 =	4500.
2 (" ")	= 200 x 28.8 =	5760
3 (" ")	100 x 19.5 =	1950.
	12,210 > 2820 & 6320	OK.

E to W - Lower story with Unit C attached

1 (½" blkd - 4"sp.)	= 150 x 30.5 =	4570.
+ (⅝ blkd - 4"sp.)	= +½ x 175 x 14.5 =	1270.
2 (½ blkd - ")	= 150 x x 28.8 =	4320.
3 (½ " ")	= 150 x x 19.5 =	2920.
	13,090 < 6,320	OK.