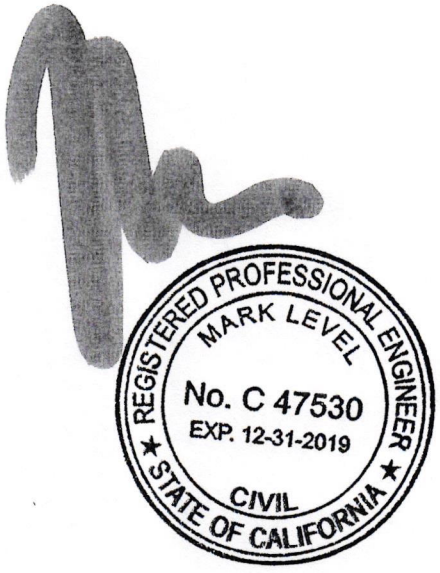
BLD19-5179 PCI

STRUCTURAL CALCULATIONS FOR

THE HOYT DUPLEX

127-129 URSULINE ROAD
SANTA ROSA, CA.



LEVEL STRUCTURAL ENGINEERING
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DATE: JUNE 2019

HOYT DUPLEX
127-129 URSULINE RD, SANTA ROSA, CA.

LEVEL STRUCTURAL ENGINEERING
DATE: 6/2019 MH

1/8

JOB DESCRIPTION SINGLE STORY DUPLEX, LIGHT WOOD FRAMED W/ RAISED WOOD FLOOR ON SPREAD FOOTING GRID FDN.

MATERIALS CONCRETE F'c=2500 p.s.i. MASONRY F'm=1500 p.s.i. REINFORCING STEEL #3 BARS - GR. 40 #4 BARS AND LARGER - GR.60 STRUCTURAL STEEL ASTMA-36 HSS - ASTM A-50 GRADE B

CODES 2016 CBC, ASCE7-10, 2012 NDS, 2015 IRC

LUMBER

LUMBER & WOOD GRADES AS FOLLOWS: DOUGLAS FIR SDRY NO. 2 OR BETTER	Fb - SINGLE USE (p.s.i.) DRY/WET	Fb - MULTIPLE USE (p.s.i.) DRY/WET	Fv (p.s.i.) DRY/WET	E MODULUS (p.s.i.) DRY/WET
2x4, 3x4, and 4x4	1350/1148	1552/	180/175	1.6E6/1.44E6
2x6, 3x6, 4x6, and 4x8	1170/995	1346/	180/175	1.6E6/1.44E6
2x8, 3x8, and 4x10	1080/1080	1242/	180/175	1.6E6/1.44E6
2x10, 3x10, and 4x12	990/990	1139/	180/175	1.6E6/1.44E6
2x12 and 3x12	900/900	1035/	180/175	1.6E6/1.44E6
6x BEAMS and STRINGERS (6X12-6X16 D.F. No. 1)	1310/1111	N/A	170/165	1.6E6/1.44E6
6x POSTS and TIMBERS (D.F. No. 1)	1200/1020	N/A	170/165	1.6E6/1.44E6
LVL ande PSL	2900/N/A	N/A	290/N/A	2.0E6/N/A
GLU-LAMS DF/DF 24F-V8	2400/N/A	N/A	240/N/A	1.8E6/N/A
GLU-LAMS AC/AC 20F-V13	2000/N/A	N/A	265/257	1.5E6/1.35E6
2X and 4x SEL STR. WESTERN CEDAR GROUP	1000/1000	N/A	155/155	1.1E6/1.1E6
6x SEL. STR. (P&T) WESTERN CEDAR GROUP	1100/858	N/A	140/138	1.4E6/1.15E6

DESIGN LOADING

GRAVITY LOADS

	ROOF	U. FLOOR	L. FLOOR	WALLS	DECKS	N/A
MATERIAL	(A/C) (4/12 SLOPE)	(N/A)	(WOOD)	(WOOD)	(WOOD)	(ϕ)
LIVE LOADS (p.s.f.)	20	ϕ	40	N/A	40	ϕ
DEAD LOADS (p.s.f.)	14	ϕ	12	14	10	ϕ

LATERAL LOADS

SEISMIC

LATITUDE = 38.4953 LONGITUDE = 122.7422

SEISMIC DESIGN CATEGORY = E

SEISMIC SITE CLASS = D

Ss = 2.465, Fa = 1.0, Sms = 2.465, Cs = Sds/(R/I)

Sds = 2/3 x Sms = 1.6, R = 6.5, I = 1.0

Fs = Cs x W, Cs = .026, Fs = .026 x W

WIND 110 MPH, EXPOSURE "C" MWFRS PROCEDURE

$q = (.00256(Kz)(Kst)(Kd)(V^2))$ RISK CATEGORY II V=110 MPH

Kz = 0.85 TO 1.04 Kst=1.0 Kd=0.85 G = 0.85 Cp = 0.8

Fw = q(G)(Cp) - qi(GCpi), GCpi = + 0.18 ROOF Fwu = - _____ psf

Fw = q(0.85)(0.8) + 0.18, Fw = (0.85)(q) EAVES Fwu = - _____ psf

H= 0'-15'	Kz= 0.85	q = 22.4 psf	Fw = 19.3 psf
H= 15'-20'	Kz= 0.90	q = 23.7 psf	Fw = 20.4 psf
H= 20'-25'	Kz= 0.94	q = 24.8psf	Fw = 21.4 psf
H= 25'-30'	Kz= 0.98	q = 25.8 psf	Fw = 22.2 psf
H= 30'-35'	Kz= 1.04	q = 27.4 psf	Fw = 23.6 psf

SOILS DESIGN PARAMETERS

GEOTECHNICAL REPORT BAUER ASSOCIATES

JOB NO. 3476.92 DATE JAN 19, 2018

ALLOWABLE BEARING (psf) 2000

LATERAL PASSIVE (psf) 350

SLIDING COEFFICIENT 0.35

EQUIVALENT FLUID PRESSURE VALUES (pcf)

SKIN FRICTION (psf) N/A

RETWALL SEISMIC = H^2 @ N/A (H)

N/A
LEVEL BACKFILL

N/A
SLOPED BACKFILL

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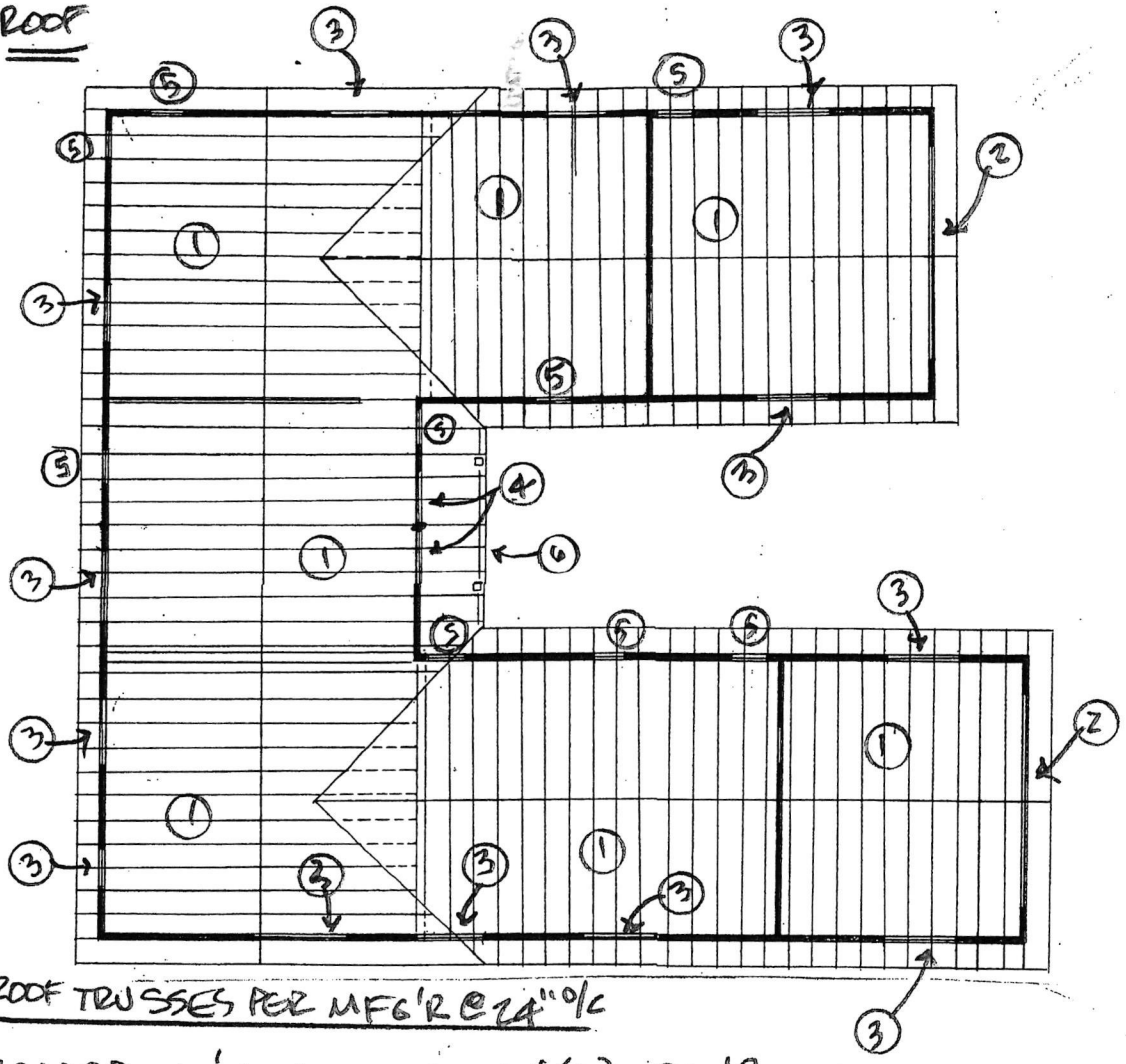
GRAVITY ANALYSIS

ROOF



① ROOF TRUSSES PER MFG'R @ 24" O/C

② HEADER 18' SPAN
$W_{LL} = 4(20) = 80$ plf.
$W_{DL} = 4(14) + 6(14) = 140$ plf.
$V_{MAX} = 1980^{\#}$
$M_{MAX} = 8910^{\#\text{ft}}$
∴ 3½"x11⅞ LVL

③ HEADER 6' SPAN, 14' TRIB
$E_{REQ'D}$ @ 1.6 (10) = 5.868 psi
$V_{MAX} = 428^{\#}$
$M_{MAX} = 2142^{\#\text{ft}}$
∴ 6X8 DF NO2

④ HEADER 8' SPAN, 18' TRIB
$V_{MAX} = 2448^{\#}$
$M_{MAX} = 4896^{\#\text{ft}}$
$E_{REQ'D}$ @ 1.6 (10) = 1.468
∴ 6X8 DF NO2

⑤ HEADER 3' SPAN, 14' TRIB
$V_{MAX} = 714^{\#}$
$M_{MAX} = 535^{\#\text{ft}}$
∴ 6X6 DF NO2

⑥ BEAM 12' SPAN, 3' TRIB
$V_{MAX} = 612^{\#}$
$M_{MAX} = 1836^{\#\text{ft}}$
∴ 4X8 DF NO2

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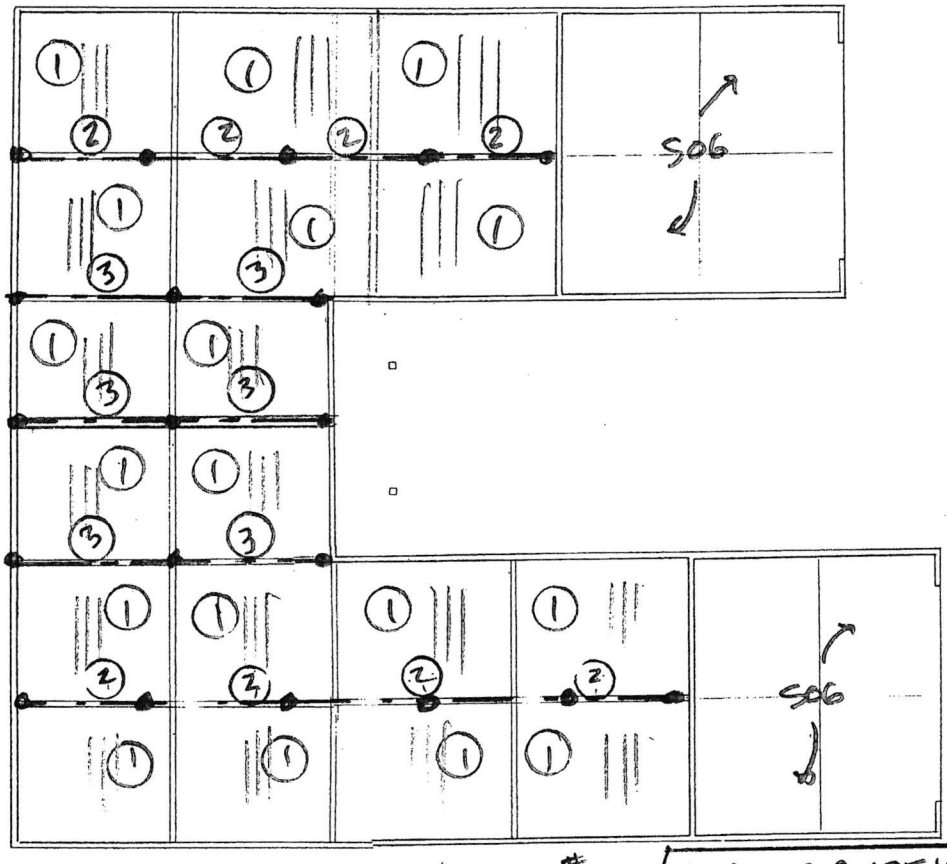
GRAVITY ANALYSIS

FDN/FLOOR



① FLOOR JOISTS 12' SPAN 16" O/C

$V_{MAX} = 414^{\#}$
$M_{MAX} = 1244^{\#}$
$E I_{REQ'D\ LL} = L/480) = 8.27 E6psi$

∴ 2x10 SCL-1.9E DF NO2, 16" O/C

② GIRDER 11'-6" SPAN 11'-6" TRIB

$V_{MAX} = 3438^{\#}$
$M_{MAX} = 9885^{\#}$
$E I_{REQ'D\ LL} = L/480) = 6.13 E6psi$

∴ 3 1/2 X 11 7/8 LVL

③ GIRDER 13'-SPAN 11' TRIB

$V_{MAX} = 3418^{\#}$
$M_{MAX} = 12083^{\#}$
$E I_{REQ'D\ LL} = L/480) = 8.76 E6psi$

∴ 3 1/2 X 11 7/8 LVL

HOYT DUPLEX

6/2019 NJ

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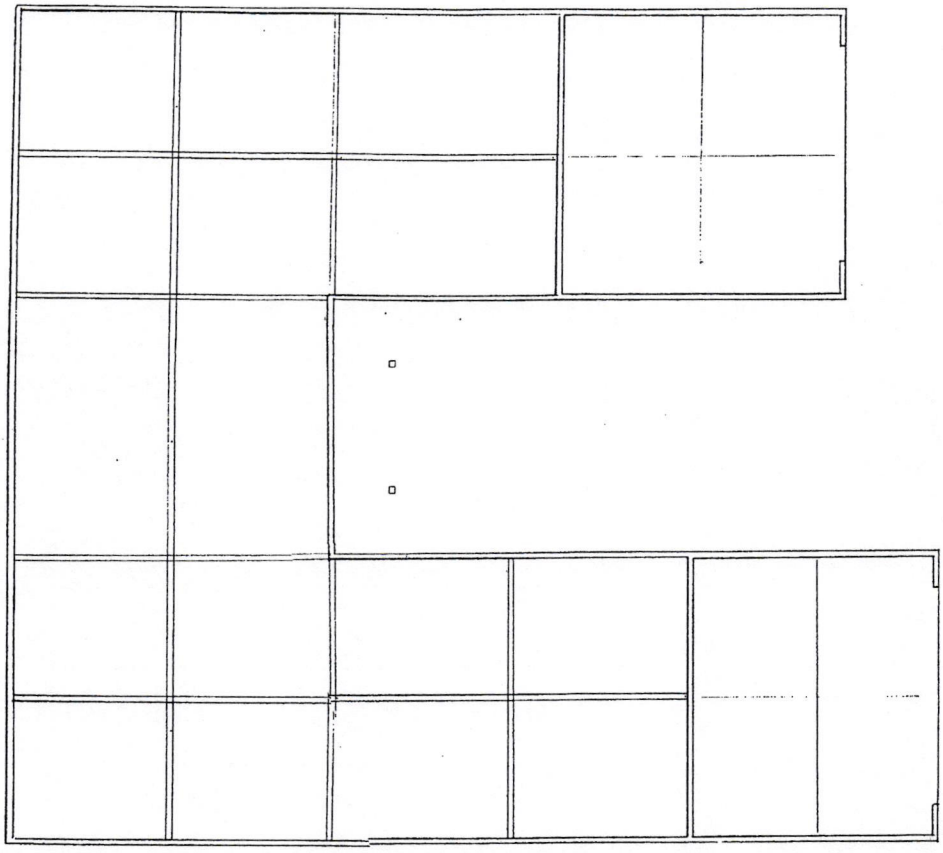
GRAVITY ANALYSIS



GRADE BEAM - CHECK

PER GEOTECH. GRADE BEAM MUST SIMPLE SPAN 5'-0" OR 3'-0" CANTILEVER

$W_{ULL} = 1.6*$
$W_{UDL} = 1.2*$

	ROOF	WALL	FLOOR	GR BM	TOTALS
LIVE LOAD	WLL / W_{ULL}	18(20) / 576	N/A / NA	6(40) / 384	N/A / N/A	600 / 960
DEAD LOAD	W_{DL} / W_{UDL}	18(14) / 302	8(14) / 135	6(14) / 100	300 / 360	748 / 897

W_{TL} / W_{UTL}	1348 / 1858

C $M_U = 1858(3)^2/2 = 8361^{\#}$

SS $M_U = 1858(5)^2/8 = 2903^{\#}$

d = 15"

$$d = 15" - \sqrt{\frac{2(8361)(12)}{.85(.9)(3000)(15)} + 225} = .20 \text{ IN}$$

$$A_{S REQ} = .85(3000)(15)(.2)/60\,000 = .1310^2 \therefore 1\text{-}\#4 \text{ T\&B}$$

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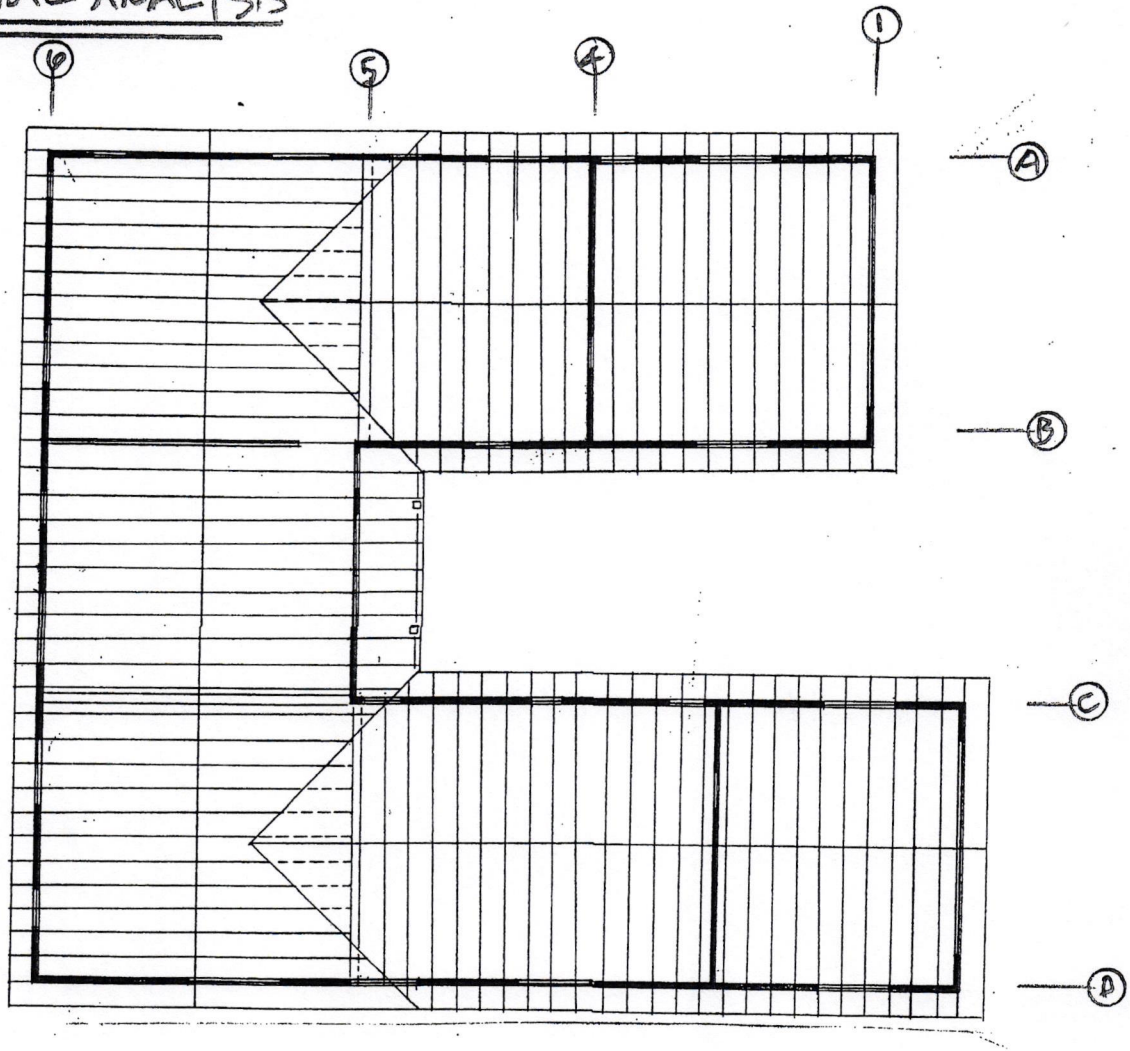
LATERAL ANALYSIS



① WALL LINE

WIND, $F_W = 14(8)(19.3psf)(.6) = 1297^{\#}$

SEISMIC $F_S = .26\left[14(28)^{\#}(14) + 48(4.5)^{W}(14psf)\right].7 = 1550^{\#}$

$v = 1550^{\#}/6' = 258plf$, SW RATIO INCREASE $= 9/2(3) = 1.5$

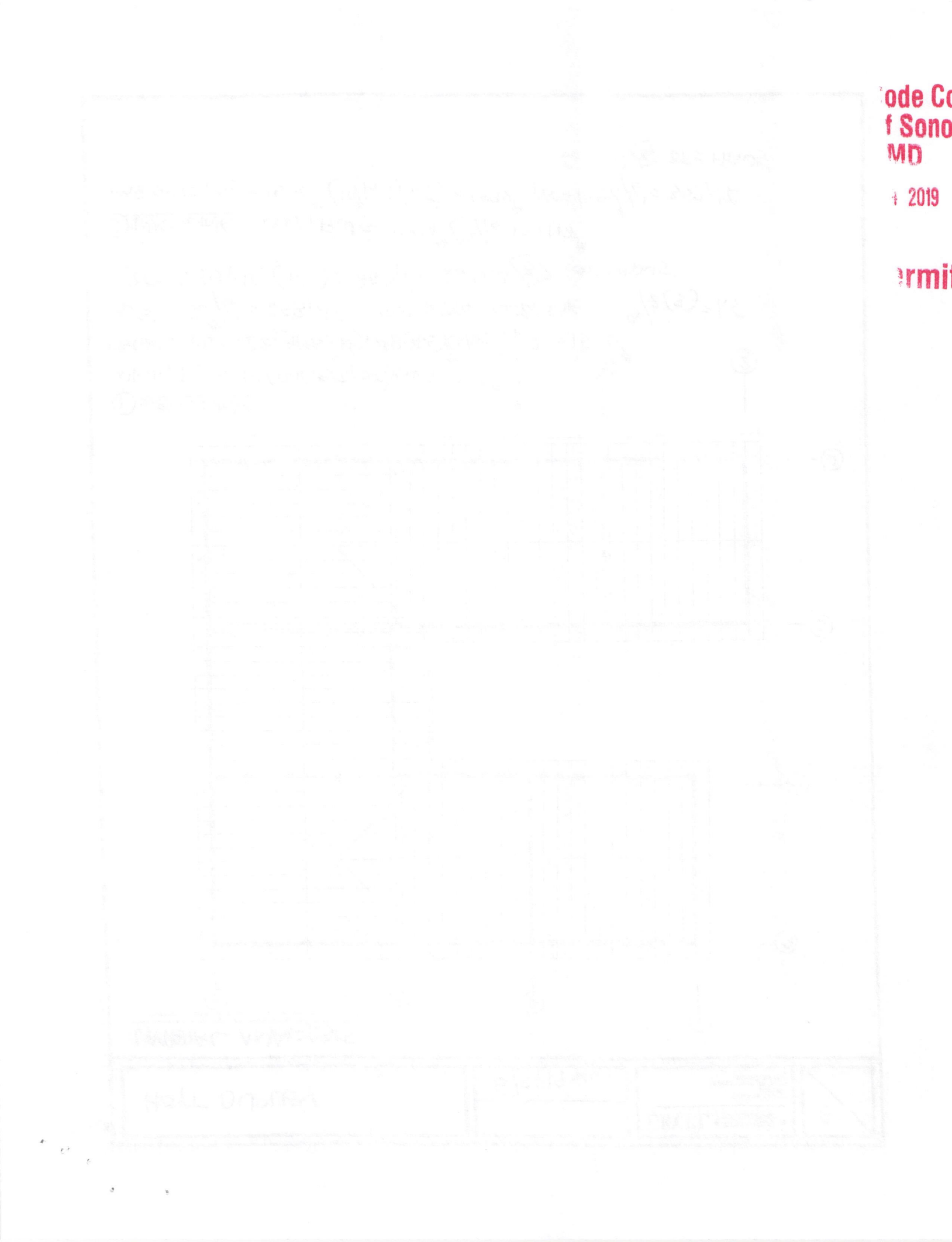
$v = 258plf\,(1.5) = 387plf$ ∴ SW 3 OT = HDU5

② WALL LINE

WIND, $F_W = 1297^{\#}(12/14) = 1117^{\#}$

SEISMIC, $F_S = 1550^{\#}(12/14)(1.5) = 1992^{\#}$, $v = 1992^{\#}/6' = 332plf$

∴ SW 3 OT = HDU5



LATERAL ANALYSIS

③ WALLINE WIND, $F_W = 24(8)(19.3)(.6) = 2224^{\#}$

④ SEISMIC, $F_S = .26\left[22(28)(14) + 68(4)(14)\right].7 = 2263^{\#}$

$v = 2263^{\#}/14' = 161$ plf ∴ SW [1] OT NEG.

⑤ WALLINE WIND, $F_W = 23(8)(19.3\text{psf})(.6) = 2131^{\#}$

SEISMIC, $F_S = .26\left[(9.5)(28) + 15(28)14\text{psf} + 13(72)(4\text{psf}) + 96(4)(14\text{psf})\right].7$

$= 5100^{\#}$ $v = 5100^{\#}/7' = 728$ plf ∴ SW [5] OT = HOLD

⑥ WALLINE WIND, $F_W = 16(6)(19.3)(.6) = 1111^{\#}$

SEISMIC, $F_S = .26\left[16(72)(14) + 94(4.5)(14)\right].7 = 4013^{\#}$

$v = 4013^{\#}/40' = 101$ plf ∴ SW [1] OT NEG.

Ⓐ WALLLINE WIND, $F_W = 14(9)(19.3)(.6) = 1460^{\#}$

SEISMIC, $F_S = .26\left[14(74)(14) + 104(4)(14)\right].7 = 3700^{\#}$

$v = 3700^{\#}/40' = 95$ plf ∴ SW [1] OT NEG.

Ⓑ WALLLINE WIND, $F_W = 23(9)(19.3)(.6) = 2397^{\#}$

SEISMIC, $F_S = .26\left[102(4\text{psf})(4) + (14(72) + 11(34))14\right].7 = 4560^{\#}$

$v = 4560^{\#}/33' = 138$ plf ∴ SW [1] OT NEG.

Ⓒ WALL LINE WIND, $F_W = 23(9)(19.3)(.6) = 2397^{\#}$

SEISMIC, $F_S = .26\left[(14(82) + 10(34))14\text{psf} + 108(4.5)(14)\right].7 = 5030^{\#}$

$v = 5030^{\#}/34' = 148$ plf ∴ SW [1] OT NEG.

Ⓓ WALL LINE WIND, $F_W = 14(9)(19.3)(.6) = 1460^{\#}$

SEISMIC, $F_S = .26\left[14(82)(14) + (36+78)4(14\text{psf})\right].7 = 4087^{\#}$

$v = 4087^{\#}/48' = 85$ plf ∴ SW [1] OT = NEG.

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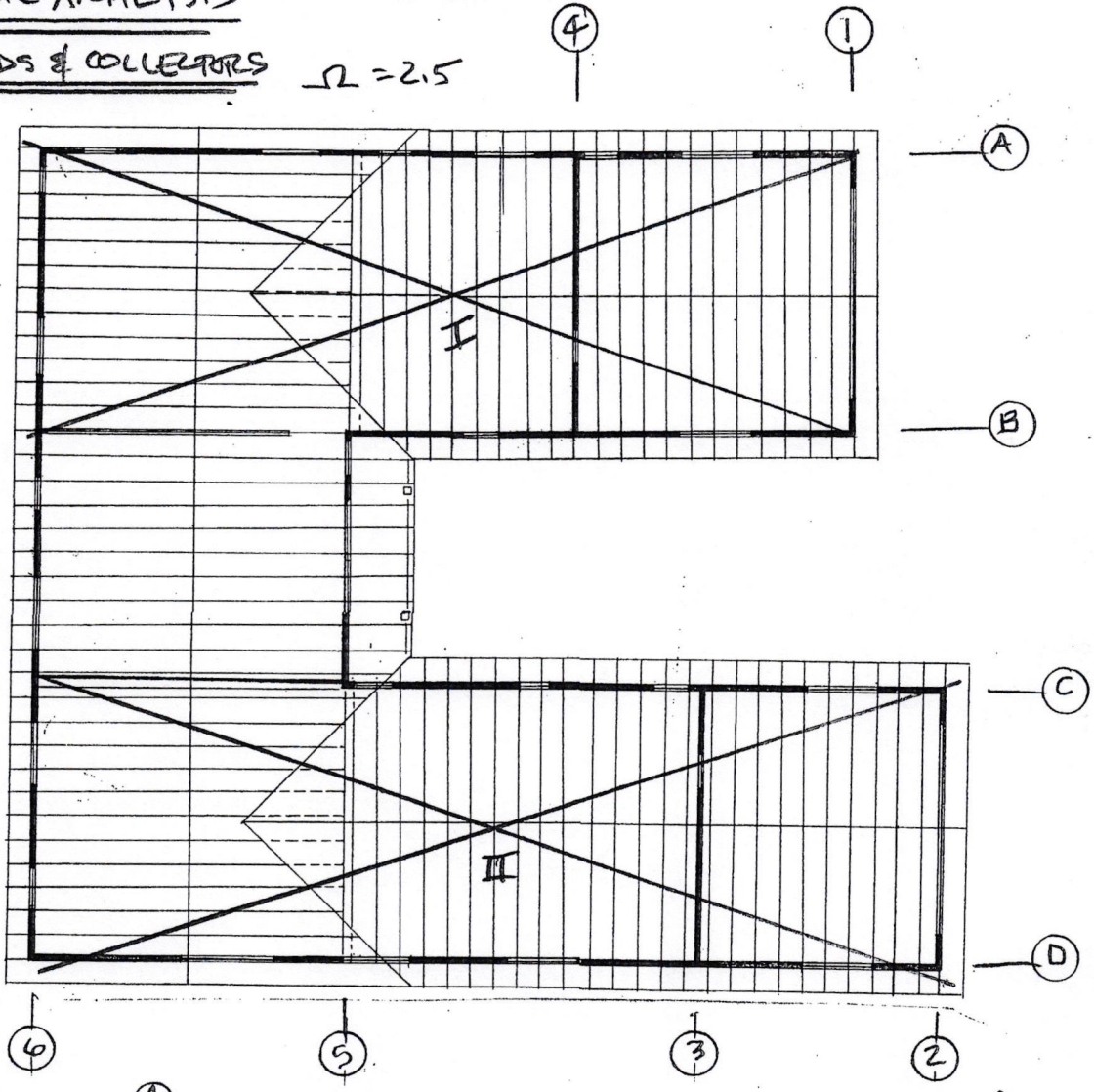
LATERAL ANALYSIS

CHORDS & COLLECTORS $\Omega = 2.5$



DIAPHRAGM I

(A)(B) CHORD FORCE

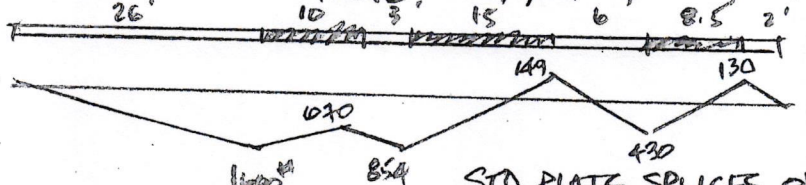
WIND, $w_{WIND} = 9(19.3)(.6) = 105$ p/f.

SEISIC, $w_s = .26[2(4)(14) + 28(14)].7 = 92$ p/f

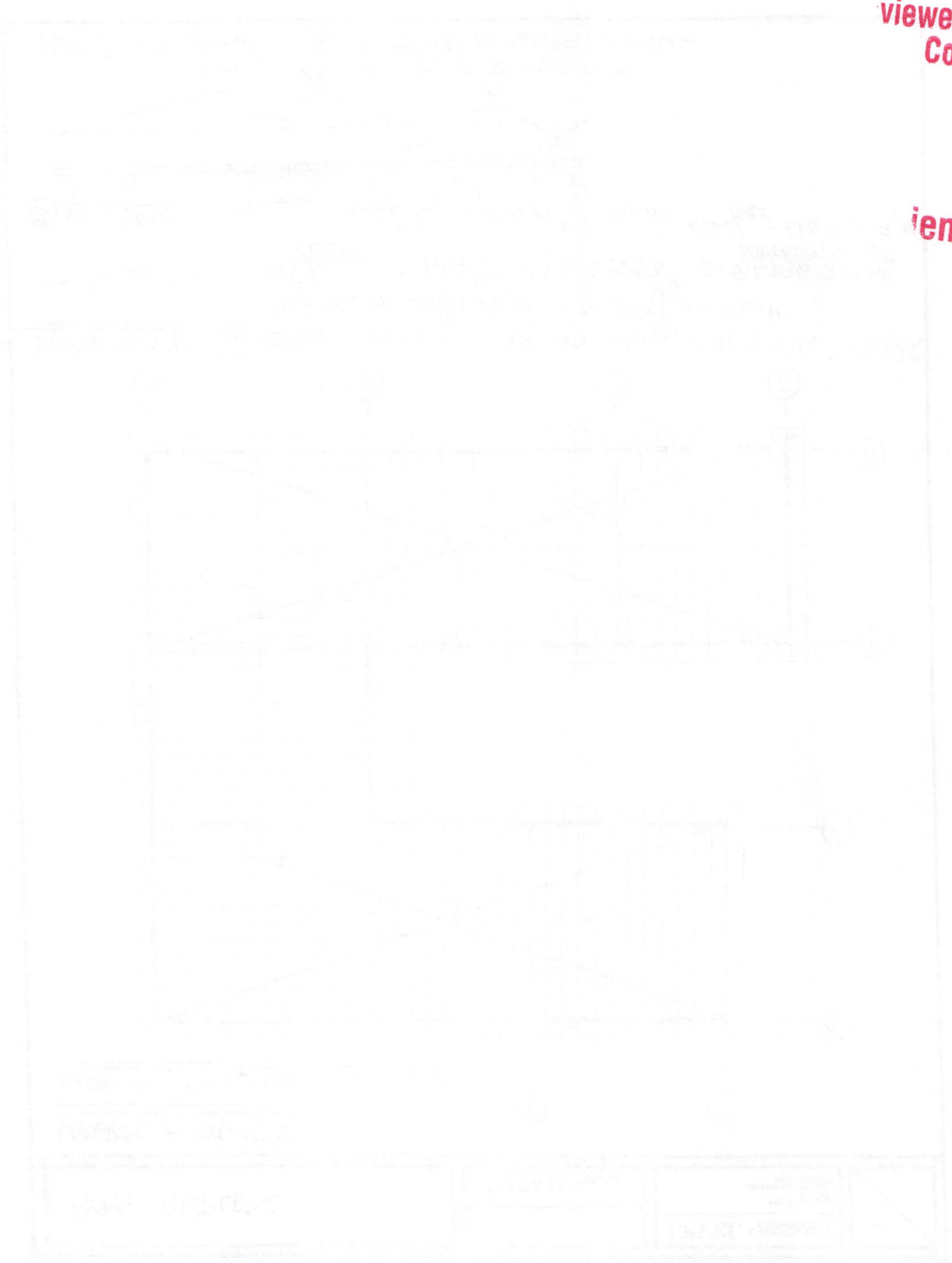
MAX $F_{CHORD} = 105(46)^2/8(24) = 1157^{\#}(2.5) = 2893^{\#}$ ∴ ST6236 STRAP @ PLATE SPLICES

(B) COLLECTOR

$v_{TOTAL} = 4560^{\#}/74' = 61.6$ p/f. , $v_{SW} = 4560/35.5 - 61.6 = 66.9$ p/f



$1600(2.5) = 4000^{\#}$ ∴ STD PLATE SPLICES OK // MST48 @ TRUSS TO WALL



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LATERAL ANALYSIS

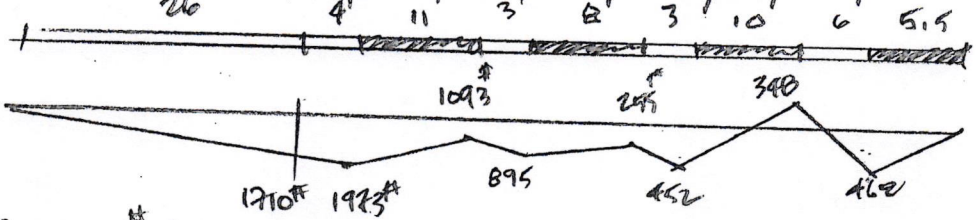
CHORDS & COLLECTORS

DIAPHRAGM II (C) (D) CHORD FORCE $w_N = 105$ plf, $w_S = 92$ plf.

$$\text{MAX } F_{CHORD} = 105(56.1)^2/8(24) = 1715^{\#} * 2.5 = 4287^{\#}$$

∴ MST48

(C) COLLECTOR $v_T = 5030^{\#}/76.15' = 65.8$ plf, $v_{SW} = 5030^{\#}/34.15 - 65.8\text{plf} = 80$ plf.

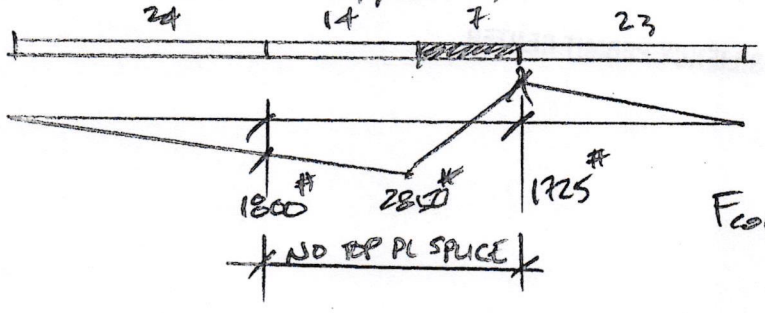


∴ $1710^{\#}(2.5) = 4275^{\#}$ ∴ MST48

MIXED DIAPHRAGMS

(5) WALL LINE $F_{CHORD} = 105(24)^2/8(26) = 291^{\#}$

$F_{COLLECTOR}$ $v_T = 5100^{\#}/68' = 75$ plf. $v_{SW} = 5100^{\#}/7' = 728.5 - 75 = 653.6$ plf.



$F_{COL} = 1800^{\#}(2.5) = 4500^{\#}$

∴ MST48