MDT ENGINEERING

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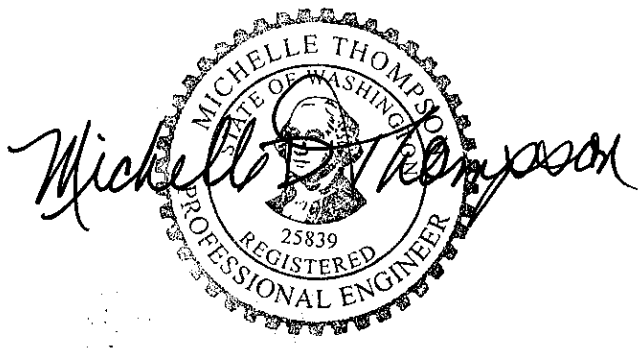
Structural Calculations
For Mawer/Kolbe Residence
7001 82nd Ave SE
Mercer Island, WA

August 23, 2021
REVISED 8/24/21



Building Official: Please accept this engineering packet only for the site noted above.

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Scope of Work

MDT Engineering was asked to provide the structural design for the addition to the existing structure. Following are the calculations provided:

1. Lateral Analysis
2. Vertical Analysis
3. Foundation Design
4. Structural Notes and Details

We have provided the designer with a digital copy of the structural calculations and detail sheets for your use in obtaining a building permit for the referenced project. The scope of this project is for the design phase only. If additional site inspections are required by the Building Dept., these will be performed at an additional hourly fee of $125.00 per hour. Also, revisions to the original design by the owner or required by the building department will be billed at an additional hourly fee of $125.00 per hour. Questions about the attached information should be addressed to MDT Engineering.

Michelle D. Thompson, PE
MDT Engineering, Inc.

STRUCTURAL NOTES

CODES AND SPECIFICATIONS

1. INTERNATIONAL BUILDING CODE, 2018 EDITION, ASCE 7-16
2. INTERNATIONAL RESIDENTIAL CODE, 2018 EDITION
3. SIMPSON STRONG TIE WOOD CONTRUCTION CONNECTORS 2021-2023
4. FASTENERS IN CONTACT WITH PRESSURE TREATED WOOD MUST BE STAINLESS STEEL, ZMAX(G185HDG PER ASTM A653), BATCH/POST HOT-DIP GALVANIZED (PER ASTM B695, CLASS 55 OR GREATER). UNCOATED AND PAINTED PRODUCTS SHOULD NOT BE USED WITH TREATED WOOD. WHEN USING STAINLESS STEEL HOT-DIP GALVANIZED CONNECTORS, THE CONNECTORS AND FASTENERS SHOULD BE MADE OF THE SAME MATERIAL.

DESIGN CRITERIA

1. WIND LOAD: INTERNATIONAL BUILDING CODE, 2018, ASCE 7-16, ALTERNATE ALL-HEIGHTS METHOD, ULTIMATE DESIGN WIND SPEED = 110 MPH, NOMINAL DESIGN WIND SPEED = 85 MPH, EXPOSURE B

2. SEISMIC: INTERNATIONAL BUILDING CODE, 2018, ASCE 7-16
   RISK CATEGORY II
   SEISMIC IMPORTANCE FACTOR, Ie=1.0
   MAPPED SPECTRAL RESPONSE ACCELERATION PARAMETERS, Ss=1.5, S1=0.5
   SITE CLASS D
   DESIGN SPECTRAL RESPONSE ACCELERATION PARAMETERS, Sds=1.0g, Sd1=0.5g
   SEISMIC DESIGN CATEGORY D2
   BASIC SEISMIC FORCE-RESISTING SYSTEM: LIGHT FRAME WALLS WITH WOOD SHEAR WALLS
   DESIGN BASE SHEAR, V = F (Sds) (W) / R = 0.1846 (W)
   RESPONSE MODIFICATION COEFFICIENT, R=6.5
   ANALYSIS PROCEDURE USED: SIMPLIFIED ALTERNATIVE STRUCTURAL DESIGN FOR SIMPLE BEARING WALL SYSTEMS

3. ROOF LOAD: DL = 15 PSF LL = 25 PSF (ROOF SNOW LOAD)

4. FLOOR LOAD: DL = 10 PSF LL = 40 PSF

5. DECK LOAD: DL = 10 PSF LL = 60 PSF

6. SOILS: ASSUMED 1500 PSF ALLOWABLE SOIL BEARING
   ASSUMED 30 PCF ACTIVE SOIL PRESSURE, 350 PCF PASSIVE PRESSURE, 0.35 COEFFICIENT OF FRICTION
   ALL FOOTINGS AND SLABS SHALL BEAR ON UNDISTURBED SOIL OR FILL COMPACTED TO 95% MODIFIED PROCTOR.

7. CONCRETE: 3000 PSI @ 28 DAYS (2500 PSI USED FOR DESIGN)
   GRADE 40 REINFORCEMENT
   MINIMUM 3" COVER FOR ALL REINFORCEMENT EXCEPT AS NOTED AT RETAINING WALLS OR OTHER DETAILS

TIMBER CONSTRUCTION NOTES

1. LUMBER GRADES AND ALLOWABLE STRESSES SHALL BE AS FOLLOWS UNLESS NOTED OTHERWISE ON PLAN:

ALL SAWN LUMBER	HF#2 OR BETTER, Fb = 875 PSI, Fv = 75 PSI, E = 1,300,000
GLULAM BEAMS	24F-V4, Fb = 2400 PSI, Fv = 165 PSI, E = 1,800,000
MICROLAM, LVL	Fb = 2600 PSI, Fv = 285 PSI, E = 1,900,000
PARALLAMS, PSL	Fb = 2600 PSI, Fv = 290 PSI, E = 2,000,000

2. WHEN TOP PLATE IS INTERRUPTED BY HEADER, HEADER SHALL HAVE STRAP CONNECTORS TO THE TOP PLATE EACH END, USE 2-SIMPSON MSTA24 CONNECTORS, UNLESS NOTED OTHERWISE.
3. ALL SHEAR WALL SHEATHING NAILS AND ANCHORS SHALL BE AS DETAILED ON THE DRAWINGS AND AS NOTED IN THE SHEAR WALL SCHEDULE.
4. FLOOR SHEATHING SHALL BE ¾" MINIMUM APA RATED FLOOR SHEATHING WITH 10d COMMON @ 6" OC AT ALL SUPPORTED PANEL EDGES AND 10d @ 12" OC AT INTERMEDIATE SUPPORTS.
5. ROOF SHEATHING SHALL BE 7/16" MINIMUM APA RATED ROOF SHEATHING WITH 8d COMMON @ 6" OC AT ALL SUPPORTED PANEL EDGES AND 8d @ 12" OC AT INTERMEDIATE SUPPORTS.

GENERAL CONSTRUCTION NOTES

1. CONTRACTOR SHALL VERIFY ALL DIMENSIONS IN THE FIELD. ANY VARIATIONS FROM THE DRAWINGS SHALL BE BROUGHT TO THE ATTENTION OF THE DESIGNER OR THE ENGINEER.
2. ADEQUATE SHORING AND BRACING OF ALL STRUCTURAL MEMBERS DURING CONSTRUCTION SHALL BE PROVIDED. ANY PROPOSED FIELD CHANGES MUST HAVE THE APPROVAL OF THE ENGINEER PRIOR TO CONSTRUCTION.

SHEAR WALL SCHEDULE

MARK	SHEATHING (NOTE 5)	FASTENER SPACING (COMMON OR GALVANIZED BOX)	BOTTOM PLATE NAILING OR ANCHOR BOLTS	FRAMING ANCHORS (NOTES 7 & 8)	ALLOWABLE SHEAR	NOTES
1A	7/16" MIN. APA RATED SHEATHING OR APA RATED SIDING 303 ONE SIDE	8d @ 6"OC	16d @ 8" OC OR ½" A.B. @ 5'-6"OC	RBC @ 32"OC LTP4@ 48"OC A35 @ 48"OC	130 PLF	1, 2, 3, 11
1	7/16" MIN. APA RATED SHEATHING OR APA RATED SIDING 303 ONE SIDE	8d @ 6"OC	16d @ 6" OC OR ½" A.B. @ 3'-2"OC OR 5/8" A.B. @ 5'-0" OC	RBC @ 18"OC LTP4@ 30"OC A35 @ 30"OC	242 PLF	1, 2, 3, 11
2	7/16" MIN. APA RATED SHEATHING OR APA RATED SIDING 303 ONE SIDE	8d @ 4"OC	16d @ 4" OC OR ½" A.B. @ 2'-2"OC OR 5/8" A.B. @ 3'-4" OC	RBC @ 12"OC LTP4@ 18"OC A35 @ 18"OC	353 PLF	1, 2, 3, 11
3	7/16" MIN. APA RATED SHEATHING OR APA RATED SIDING 303 ONE SIDE	8d @ 3"OC	¼" X 5" LAG SCREW @ 8"OC OR ½" A.B. @ 1'-8"OC OR 5/8" A.B. @ 2'-8" OC	RBC @ 10"OC LTP4@ 15"OC A35 @ 15"OC	456 PLF	1, 2, 3, 4, 9, 10, 11
4	7/16" MIN. APA RATED SHEATHING OR APA RATED SIDING 303 ONE SIDE	10d @ 3"OC	¼" X 5" LAG SCREW @ 6"OC OR ½" A.B. @ 1'-4"OC OR 5/8" A.B. @ 2'-0" OC	RBC @ 8"OC LTP4@ 12"OC A35 @ 12"OC	558 PLF	1, 2, 3, 4, 9, 10, 11
5	7/16" MIN. APA RATED SHEATHING OR APA RATED SIDING 303 ONE SIDE	10d @ 2"OC	¼" X 5" LAG SCREW @ 5"OC OR ½" A.B. @ 1'-0"OC OR 5/8" A.B. @ 1'-8"OC	RBC @ 6"OC LTP4 @ 10"OC A35 @ 10"OC	716 PLF	1, 2, 3, 4, 9, 10, 11
6	19/32" MIN. APA RATED SHEATHING BOTH SIDES	10d @ 2"OC	¼" X 5" LAG SCREW @ 2"OC OR 3/4" A.B. @ 1'-0" OC	LTP4@ 6"OC A35 @ 6"OC	1618 PLF	1, 2, 3, 4, 6, 9, 10, 11

1. ALL FASTENERS SHALL MEET THE FOLLOWING CRITERIA: 8d COMMON = 0.131" DIAMETER X 2 ½", 8d GALVANIZED BOX = 0.113 DIAMETER X 2 ½" 10d COMMON = 0.148" DIAMETER X 3", 10d GALVANIZED BOX = 0.128" DIAMETER X 3", 16d COMMON = 0.162" X 3 ½".
2. PANEL EDGES SHALL BE BACKED WITH 2" NOMINAL OR WIDER FRAMING. SPACE FASTENERS @ 12"OC ON INTERMEDIATE SUPPORTS.
3. PROVIDE ALL ANCHOR BOLTS WITH 3" X 3" X ¼" PLATE WASHERS. LOCATE WITHIN ½" OF SHEATHING.
4. AT GARAGE JAMBS, REFER TO LATERAL RESTRAINT PANEL DETAIL 401/S1.
5. PROVIDE 7/16" APA RATED SHEATHING (PLYWOOD OR OSB) OR APA RATED SIDING 303 OR INNER SEAL OSB RATED PANEL SIDING ON ALL EXTERIOR WALLS DESIGNATED AS SHEAR WALLS.
6. WHERE PANELS ARE APPLIED ON BOTH SIDES OF A WALL AND NAIL SPACING IS LESS THAN 6" OC ON EITHER SIDE, PANEL JOINTS SHALL BE OFFSET TO FALL ON DIFFERENT FRAMING MEMBERS OR FRAMING SHALL BE 3" NOMINAL OR THICKER AND NAILS ON EACH SIDE SHALL BE STAGGERED.
7. REFER TO TYPICAL SHEAR WALL DETAILS ON STRUCTURAL DETAIL SHEET FOR LOCATION OF FRAMING ANCHORS.
8. AT UPPER FLOOR INTERIOR SHEAR WALLS, REFER TO DETAIL 303/S2 OR 304/S2.
9. AT SHEAR WALL TYPES 3, 4, 5 AND 6, ALL FRAMING MEMBERS RECEIVING EDGE NAILING FROM ABUTTING PANELS SHALL NOT BE LESS THAN A SINGLE 3X MEMBER. FOR EXAMPLE, PROVIDE A 3X STUD AT VERTICAL JOINTS IN THE SHEATHING.
10. AT SHEAR WALL TYPES 3, 4, 5 AND 6, FOUNDATION SILL PLATES AND BOTTOM PLATES OF SHEAR WALLS, SHALL NOT BE LESS THAN A SINGLE 3X MEMBER. ALSO PROVIDE A 3X MINIMUM WIDTH MEMBER BELOW SHEAR WALL TO RECEIVE LAG SCREWS SUCH AS A 3X RIM JOIST, 3X JOIST OR BEAM OR BLOCKING BELOW SHEAR WALL.
11. FASTENERS AT PRESSURE PRESERVATIVE AND FIRE RETARDANT TREATED WOOD SHALL BE STAINLESS STEEL, G185 HDG, BATCH/POST HOT-DIP GALVANIZED OR MECHANICALLY GALVANIZED.

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Lateral Analysis

Wind Design: Per 2018 IBC and ASCE 7-16

Alternate all-heights method

Wind Speed, Vult=110 MPH, Vasd=85 MPH

Exposure B

Pnet = 0.00256(V)(Kz)(Cnet)(Kzt) or 16 PSF Minimum

Kzt = 1.0

P = 1.0(16 PSF) = 16 PSF

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Lateral Analysis

Seismic Design: Per 2018 IBC and ASCE 7-16, Sect. 12.14

Simplified Alternative Structural Design Criteria for Simple Bearing Wall Systems

Risk Category II

Site Class D

Seismic Importance Factor, I = 1.0

Fa = 1.0 Ss = 1.5

Fv = 1.5 S1 = 0.5 Sm1 = Fv x S1 = 1.5 x 0.5 = 0.75g

Sds = 2/3 x Fa x Ss = 2/3 x 1.0 x 1.5 = 1.0g

Sd1 = 2/3 x Sm1 = 2/3 x 0.75 = 0.5g

From Table 11.6-1, Seismic Design Category D

V = (F x Sds x W) / R W = Dead Load

R = Response Modification Factor

R = 6.5 for light frame walls with wood shear walls

F = 1.0 for 1 story

F = 1.1 for 2 story

F = 1.2 for 3 story

V = (1.2 x 1.0 x W) / 6.5 = 0.1846 x W

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Compare Wind and Seismic Base Shear

Wind: Use maximum wind load of 16 PSF in all directions.

Vwind = (28)(16 PSF) = 448 PLF

Seismic:

Veq = 1.2 (1.0) (W) / 6.5

= 0.1846W

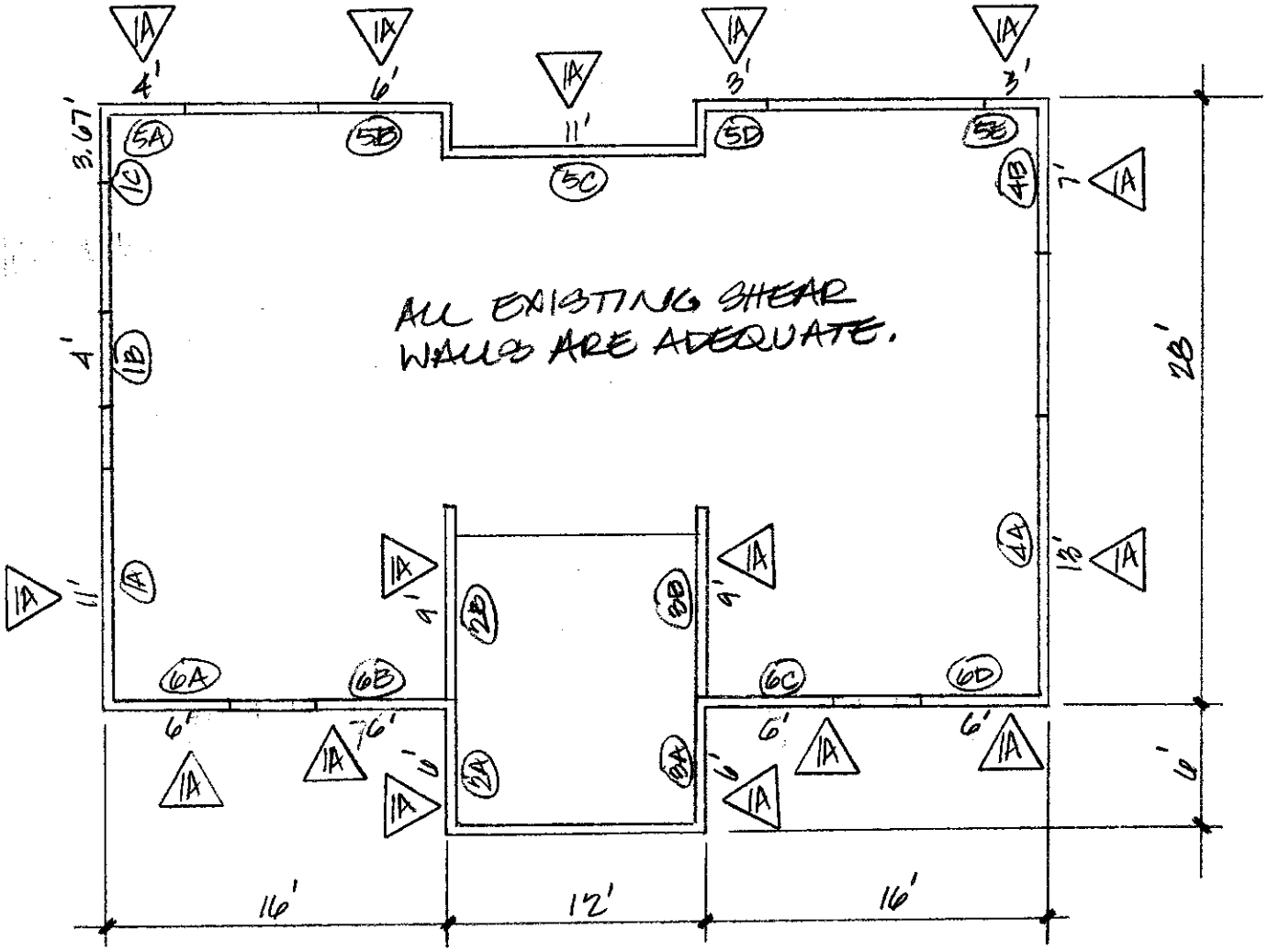
W = Roof: 44(15) = 660
Walls: 2(8)(10) = 160
Floor: 71.67(10) = 717
Walls: 2(8)(10) = 160
Floor: 66(10) = 660
Walls: 2(8)(10) = 160
2517 PLF

Veq = 0.1846 (2517) = 465/1.4 = 332PLF

Vwind > Veq

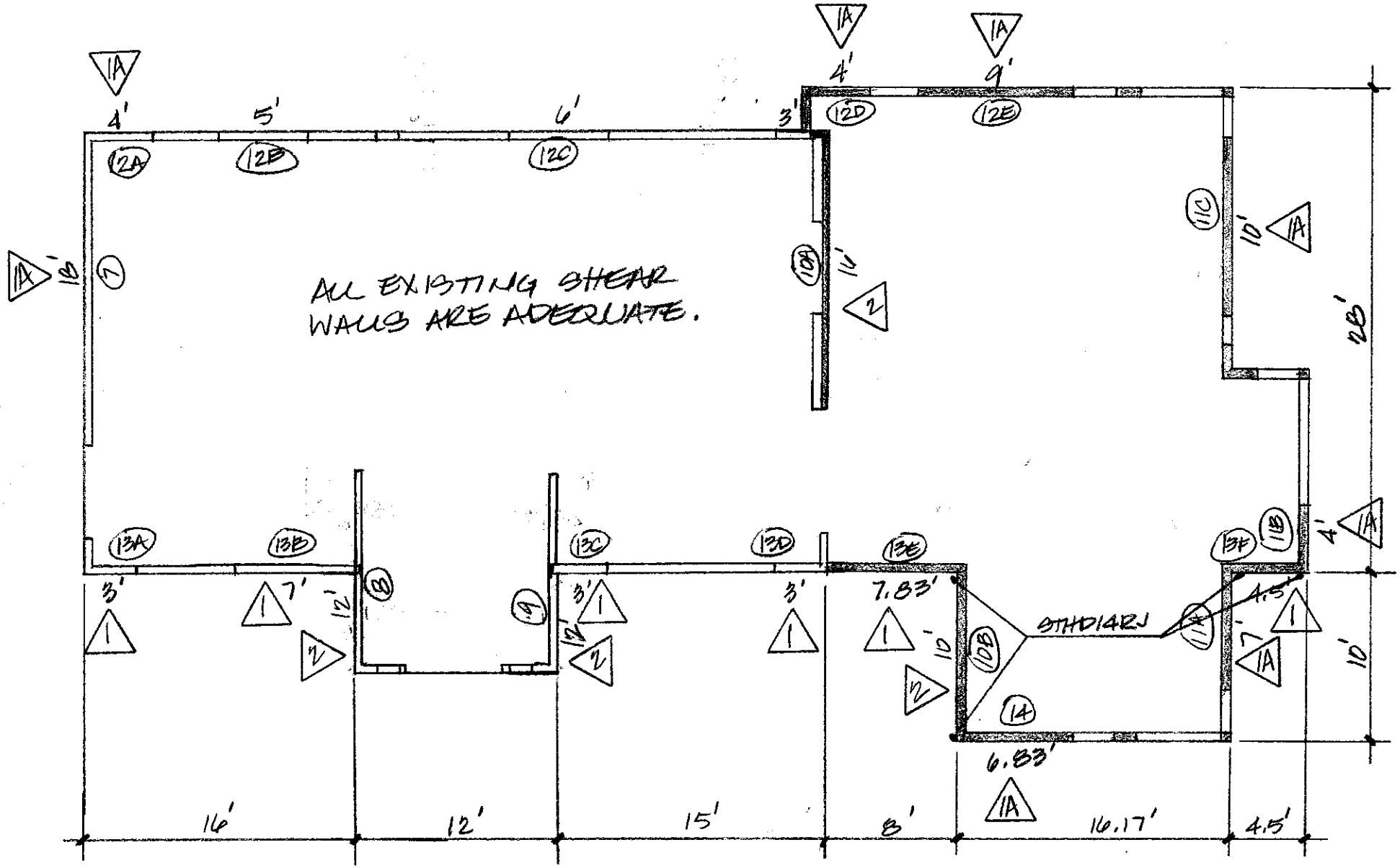
Wind Controls

~~**Seismic Controls**~~



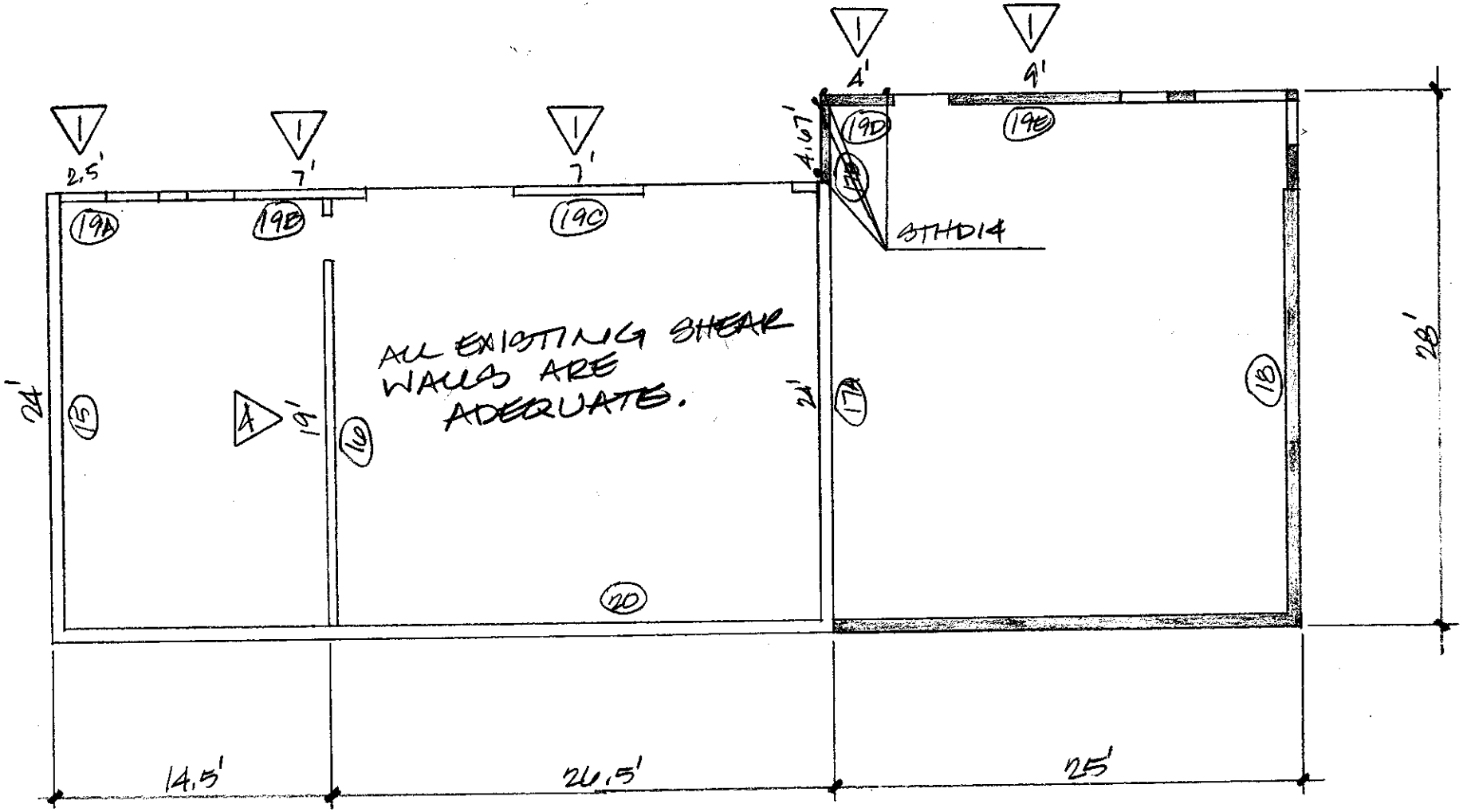
UPPER FLOOR SHEAR WALLS

1/8"=1'-0"



MAIN FLOOR SHEAR WALLS

1/8"=1'-0"



BASEMENT SHEAR WALLS

1/8"=1'-0"

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Wind Load	16						
SW#	ib Area Wic	Area He	Total Shear	Wall Length	Total Wall Length	Shear Per Foot	sw type
1	8	8	1024	11.00			
				4.00			
				3.67	18.67	55	1A
2	14	8	1792	6.00			
				9.00			
					15.00	119	1A
3	14	8	1792	6.00			
				9.00			
					15.00	119	1A
4	8	8	1024	13.00			
				7.00			
					20.00	51	1A
5	14	6	1344	4.00			
				6.00			
				11.00			
				3.00			
				3.00	27.00	50	1A
6	20	8	2560	6.00			
				6.00			
				6.00			
				6.00	24.00	107	1A
7	8	9	2176	18.00			
					18.00	121	1A

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Wind Load SW#	16 ib Area Wid	Area He	Total Shear	Wall Length	Total Wall Length	Shear Per Foot	sw type
8	14	9	3808	12.00			
					12.00	317	2
9	13.5	9	3736	12.00			
					12.00	311	2
10	23.6	9	4422	16.00			
				10.00	26.00	170	1
11	12.6	7.5	1512	7.00			
				4.00			
				10.00			
					21.00	72	1A
12	14	9	3360	4.00			
				5.00			
				6.00			
				4.00			
				9.00	28.00	120	1A
13	19	9	5296	3.00			
				7.00			
				3.00			
				3.00			
				7.83			
				4.50	28.33	187	1
14	5	9	720	6.83			

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Wind Load SW#	16 lb Area Wid	Area Hei	Total Shear	Wall Length	Total Wall Length	Shear Per Foot	sw type
					6.83	105	1A
15	7.25	9	3220	24.00			
					24.00	134	1A
16	20.5	9	10496	19.00			
					19.00	552	4
17	25.75	9	8130	24.00			
				4.67			
					28.67	284	2
18	12.5	9	3312	24.00			
					24.00	138	1A
19	14	9	5376	2.50			
				7.00			
				7.00			
				4.00			
				9.00	29.50	182	1
20	14	9	7312	66.00			
					66.00	111	1A

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SW	Shear Per Foot	Length (feet)	Total Shear (lbs)	Dead load (lbs)	Wall Height (feet)	Gross Uplift (lbs)	Net Uplift (lbs)	Holddown/ Strap
1A	55	11	605	150	8	440	-385	NO UPLIFT
1B	55	4	220	150	8	440	140	NEGLECT
1C	55	3.67	201.85	150	8	440	165	NEGLECT
2A	119	6	714	150	8	952	502	NEGLECT
2B	119	9	1071	150	8	952	277	NEGLECT
3A	119	6	714	150	8	952	502	NEGLECT
3B	119	9	1071	150	8	952	277	NEGLECT
4A	51	13	663	150	8	408	-567	NO UPLIFT
4B	51	7	357	150	8	408	-117	NO UPLIFT
5A	50	4	200	150	8	400	100	NEGLECT
5B	50	6	300	150	8	400	-50	NO UPLIFT
5C	50	11	550	150	8	400	-425	NO UPLIFT
5D	50	3	150	150	8	400	175	NEGLECT
5E	50	3	150	150	8	400	175	NEGLECT
6A	107	6	642	150	8	856	406	NEGLECT
6B	107	6	642	150	8	856	406	NEGLECT
6C	107	6	642	150	8	856	406	NEGLECT
6D	107	6	642	150	8	856	406	NEGLECT
7	121	18	2178	250	8	968	-1282	NO UPLIFT
8	317	12	3804	250	8	2536	1036	EXIST
9	311	12	3732	250	8	2488	988	EXIST
10A	276	16	4416	250	8	2208	208	NEGLECT
10B	276	10	2760	250	8	2208	958	STHD14RJ
11A	72	7	504	250	8	576	-299	NO UPLIFT
11B	72	4	288	250	8	576	76	NEGLECT
11C	72	10	720	250	8	576	-674	NO UPLIFT
12A	120	4	480	250	8	960	460	NEGLECT
12B	120	5	600	250	8	960	335	NEGLECT
12C	120	6	720	250	8	960	210	NEGLECT
12D	120	4	480	250	8	960	460	NEGLECT
12E	120	9	1080	250	8	960	-165	NO UPLIFT
13A	187	3	561	250	8	1496	1121	EXIST
13B	187	7	1309	250	8	1496	621	EXIST
13C	187	3	561	250	8	1496	1121	EXIST
13D	187	3	561	250	8	1496	1121	EXIST
13E	187	7.83	1464.21	250	8	1496	517.25	STHD14RJ
13F	187	4.5	841.5	250	8	1496	933.5	STHD14RJ
14	105	6.83	717.15	250	8	840	-13.75	NO UPLIFT

MAWER/KOLBE

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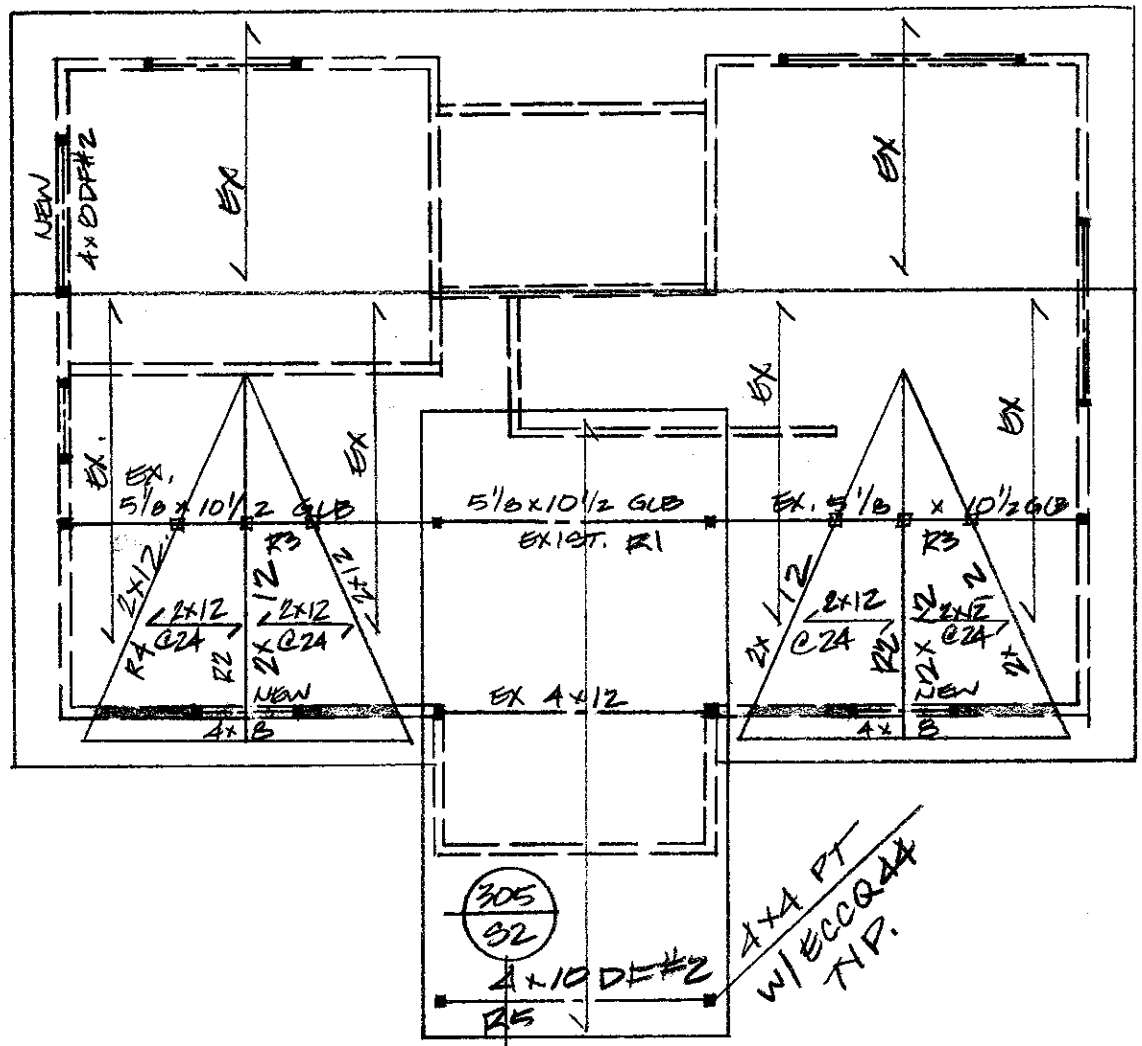
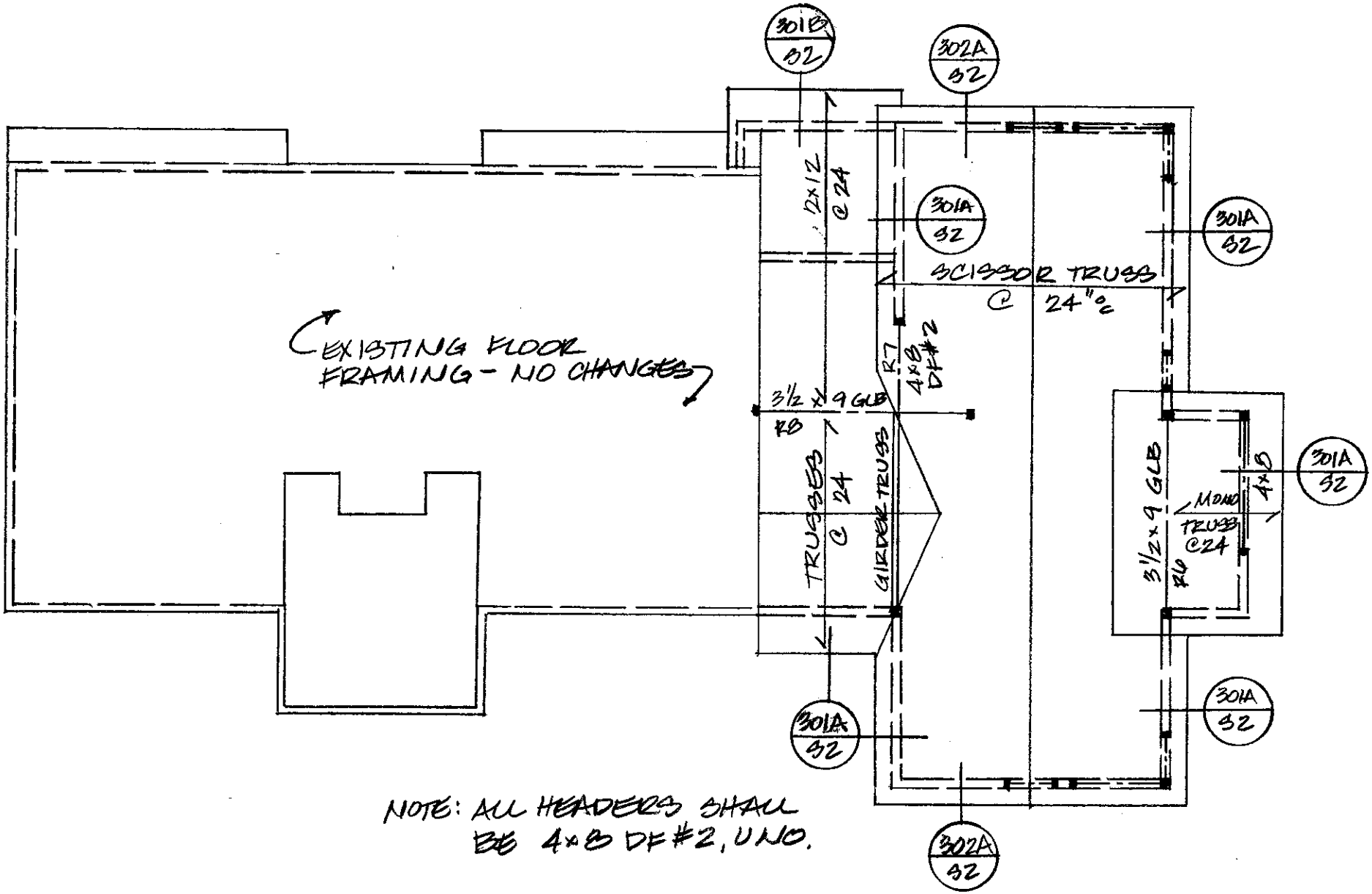
15	134	24	3216	350	8	1072	-3128	NO UPLIFT
16	138	19	2622	350	8	1104	-2221	NO UPLIFT
17A	284	24	6816	350	8	2272	-1928	NO UPLIFT
17B	284	4.67	1326.28	250	8	2272	1688.25	STHD14
18	138	24	3312	250	8	1104	-1896	NO UPLIFT
19A	182	2.5	455	350	8	1456	1018.5	EXIST
19B	182	7	1274	350	8	1456	231	NEGLECT
19C	182	7	1274	350	8	1456	231	NEGLECT
19D	182	4	728	250	8	1456	956	STHD14
19E	182	9	1638	250	8	1456	331	NEGLECT
20	111	66	7326	350	8	888	-10662	NO UPLIFT



NOTE: ALL NEW HEADERS SHALL BE 4x8 DF#2, UNO.

ROOF FRAMING PLAN

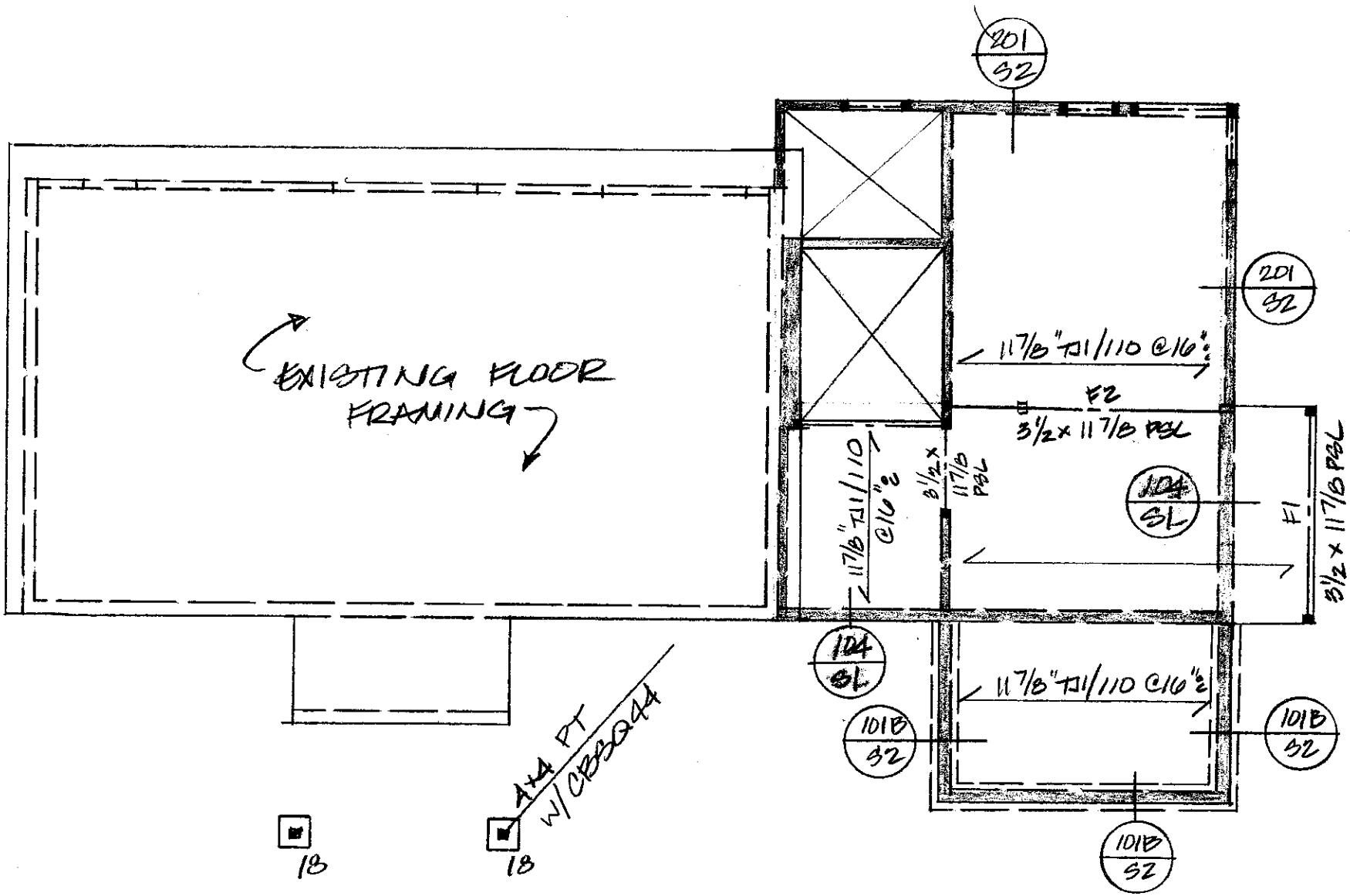
1/8"=1'-0"



NOTE: ALL HEADERS SHALL BE 4x8 DF#2, UNO.

UPPER FLOOR/LOWER ROOF

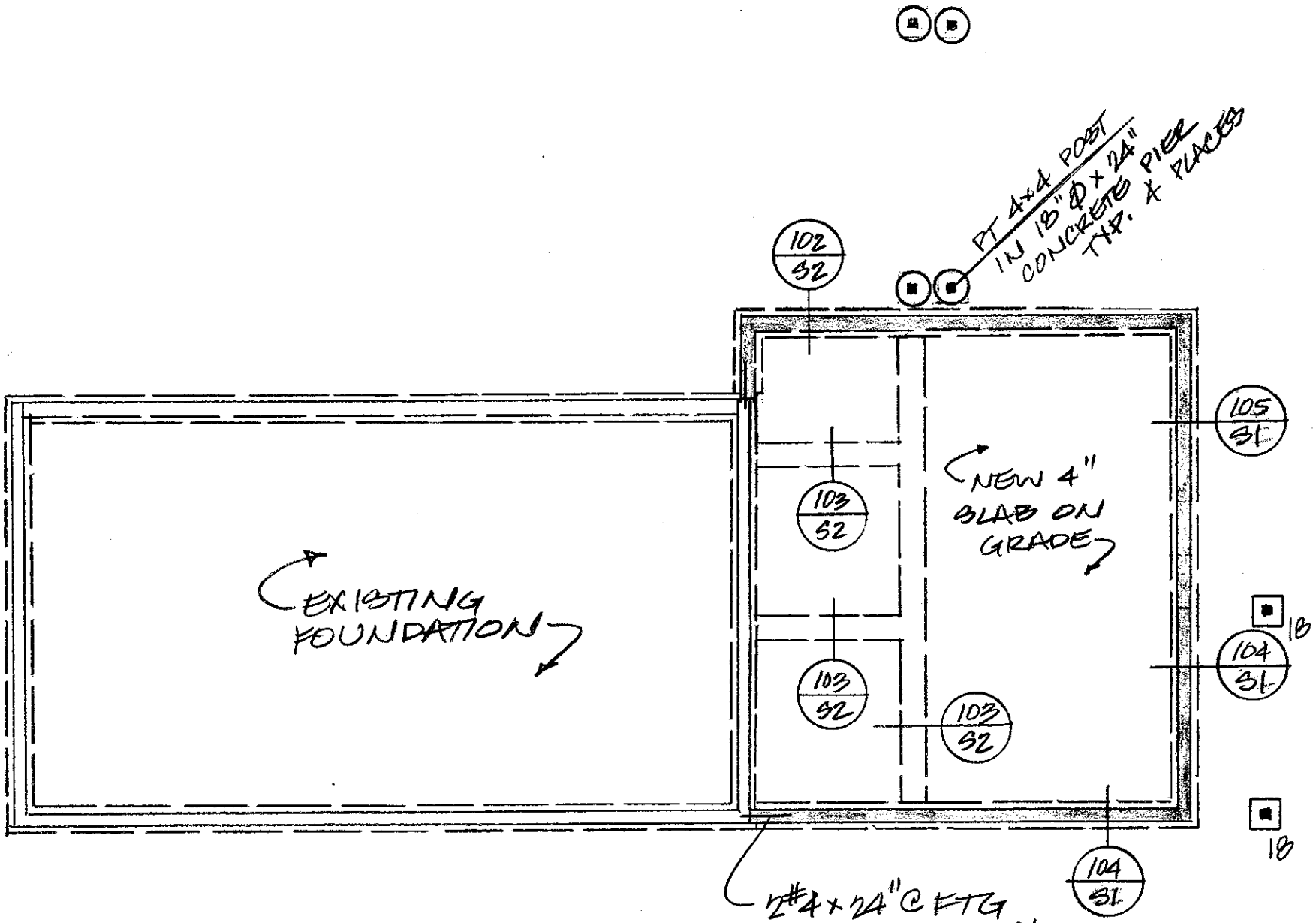
1/8" = 1'-0"



MAIN FLOOR FRAMING

1/8"=1'-0"

NOTE: ALL HEADERS SHALL BE 4x8 DF#2, UNO.



FOUNDATION PLAN

1/8"=1'-0"

MAWER/KOLBE/ROOF 8/21

R1 $l = 12'$ $W = 9(40) = 360$ PLF

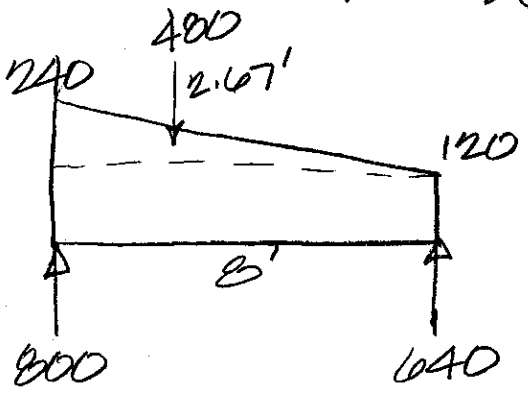
$M = 6480'\#$ $R = 2160\#$

$S_{REQ} = 28$ $A_{REQ} = 15$

5 1/8 x 10 1/2 GLB

R2 $l = 8'$ $W = 6(40) = 240$ PLF

$W = 3(40) = 120$ PLF



$M = 1707'\#$ $R = 800\#$

$S_{REQ} = 20$ $A_{REQ} = 11$

2x12 HF#2

R3 $l = 15.5'$ $W = 9(40) = 360$ PLF

$M = 10811'\#$ $R = 2790\#$

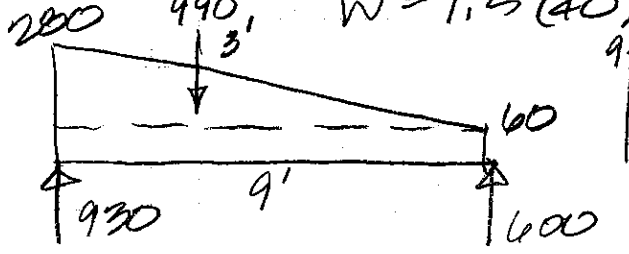
$S_{REQ} = 47$ $A_{REQ} = 20$

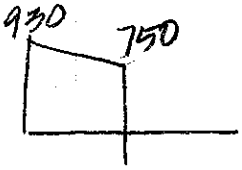
$I_{REQ} = 335$

5 1/8 x 10 1/2 GLB

R4 $l = 9'$ $W = 7(40) = 280$ PLF

$W = 1.5(40) = 60$ PLF





$M = 2520'\#$ $R = 930$

$S_{REQ} = 30$ $A_{REQ} = 16$

2x12 HF#2

MAWER/KOLBE/ROOF 8/21

R5 $l = 11.5'$ $W = 4.5(40) = 180$ PLF

$M = 2976'^{\#}$ $R = 1035^{\#}$

$S_{REQ} = 35$ $A_{REQ} = 12$

4×10 DF#2

R6 $l = 12'$ $W = 10(40) = 400$ PLF

$M = 7200'^{\#}$ $R = 2400^{\#}$

$S_{REQ} = 31$ $A_{REQ} = 17$

$I_{REQ} = 173$

3½×9 GLB

R7 $l = 5'$ $W = 9(40) = 360$ PLF

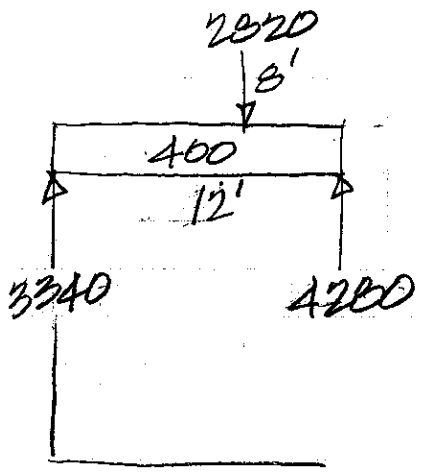
$M = 1125'^{\#}$ $R = 900^{\#}$

$S_{REQ} = 14$ $A_{REQ} = 10$

4×8 DF#2

R8 $l = 12'$ $W = 10(40) = 400$ PLF

$P = 900^{\#} + 8(40)(6) = 2820^{\#}$ @ 8'



$M =$ $'^{\#}$ $R =$ $^{\#}$

$S_{REQ} =$ $A_{REQ} =$

3½×9 GLB

MAWER/KOLBE/FLOOR 8/21

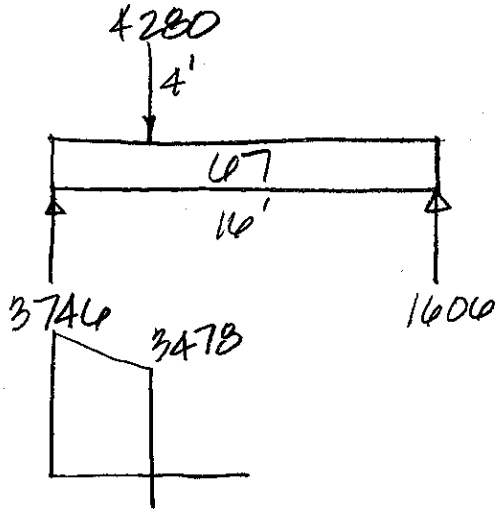
F1 $l = 12'$ $W = 2.25(50) + 80 + 4.25(40) = 363$ PLF

$M = 4525'^{\#}$ $R = 2178^{\#}$

$I_{REQ} = 157$

3½ × 11⅞ PSL

F2 $l = 16'$ $W = 67$ PLF $P = 4280^{\#}$ @ 4'



$M = 14448'^{\#}$ $R = 3746^{\#}$

$I_{REQ} = 416$

3½ × 11⅞ PSL

F3 $l = 4'$ $P = 2790^{\#}$

$M = 2790'^{\#}$ $R = 1395^{\#}$

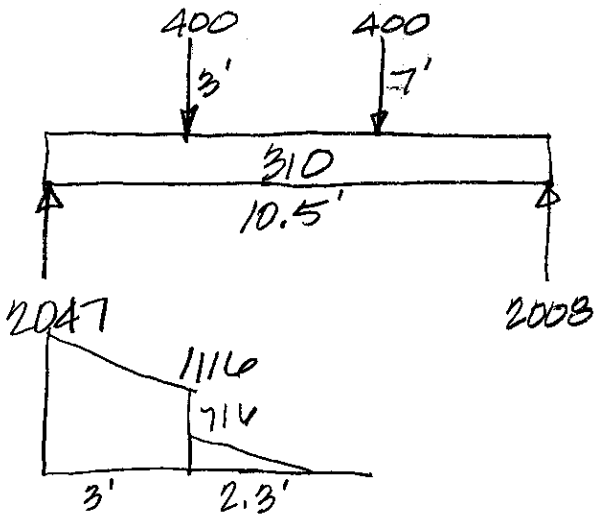
$S_{REQ} = 33$ $A_{REQ} = 19$

4 × 10 DF#2

MAYER/KOLBE/FLOOR 8/21

F4 $l = 10.5'$ $W = 3(50) + 80 + 2(40) = 310$ PLF

$P = 400\#$ @ 3' & 7'



$M = 5572'\#$ $R = 2047\#$

$S_{REQ} = 67/24$ $A_{REQ} = 25/14$

4 x 12 DF #2

OR

3 1/2 x 9 GLB