MDT ENGINEERING

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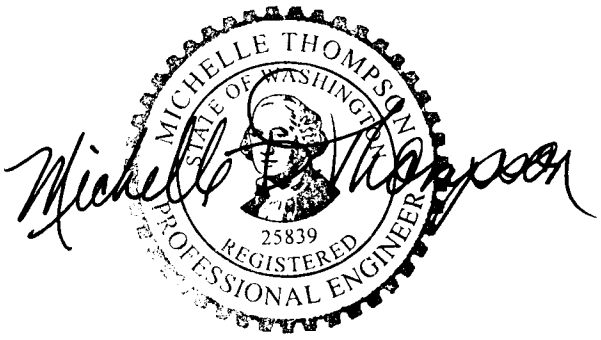
Structural Calculations
For Mawer/Benitez Remodel
Mercer Island, WA

March 4, 2020



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 remodel of the existing structure. Following are the calculations provided:

1. Lateral Analysis of remodeled area
2. Vertical Analysis of remodeled area
3. Foundation Design of remodeled area
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, 2015 EDITION, ASCE 7-10
2. INTERNATIONAL RESIDENTIAL CODE, 2015 EDITION
3. SIMPSON STRONG TIE WOOD CONTRUCTION CONNECTORS 2015-2016
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, 2015, ASCE 7-10, ALTERNATE ALL-HEIGHTS METHOD, ULTIMATE DESIGN WIND SPEED = 110 MPH, NOMINAL DESIGN WIND SPEED = 85 MPH, EXPOSURE B

2. SEISMIC: INTERNATIONAL BUILDING CODE, 2015, ASCE 7-10
   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 35 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 2015 IBC and ASCE 7-10

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 2015 IBC and ASCE 7-10, 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 = (22)(16 PSF) = 352 PLF

Seismic:

Veq = 1.2 (1.0) (W) / 6.5

= 0.1846W

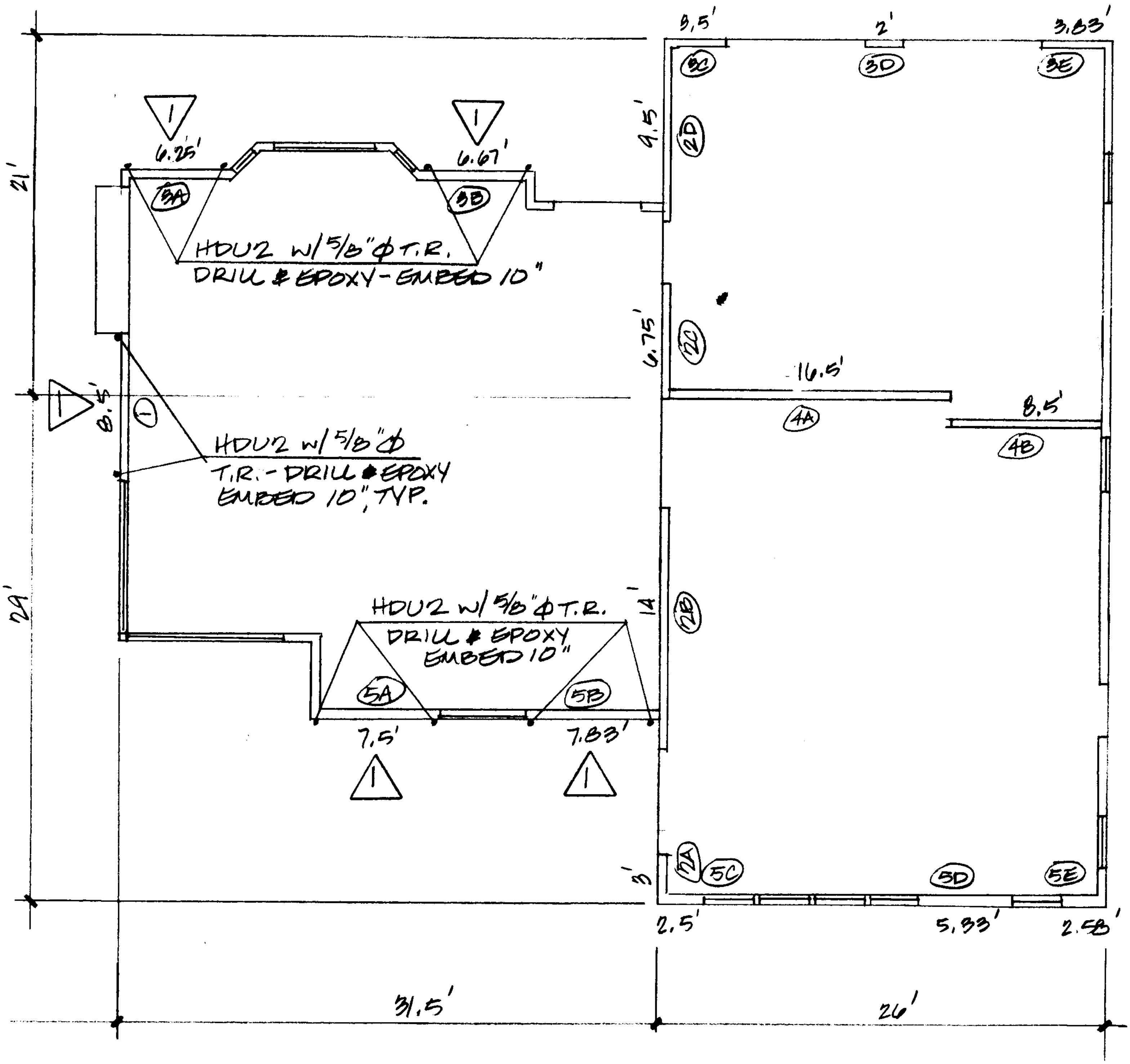
W = Roof: 26 (15) = 390
Walls: 2(8)(10) = 160
Floor: 31.5(15) + 26(10) = 733
Walls: 2(8)(10) = 160
1443 PLF

Veq = 0.1846 (1443) = 266/1.4 = 190 PLF

Redundancy Check: Max. increase = 1.3 Veqmax = 1.3 (190) = 247 PLF

Vwind > Veq

Wind Controls ~~**Seismic Controls**~~



3.5'
2'
3.83'
3C
3D
3E
1
6.25'
1
6.67'
3A
3B
9.5'
2D
21'
HDU2 W/ 5/8" ϕ T.R.
DRILL & EPOXY - EMBED 10"
6.75'
2C
16.5'
1
8.5'
1
4A
8.5'
4B
HDU2 W/ 5/8" ϕ
T.R. - DRILL & EPOXY
EMBED 10", TYP.
HDU2 W/ 5/8" ϕ T.R.
DRILL & EPOXY
EMBED 10"
14'
2B
29'
5A
5B
7.5'
7.83'
1
1
2A
5C
5D
5E
3'
2.5'
5.33'
2.58'
31.5'
26'

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Wind Load	16						
SW#	ib Area Wio	Area He	Total Shear	Wall Length	Total Wall Length	Shear Per Foot	sw type
1	15.75	7	1764	8.50			
					8.50	208	1
2	15.75	7	4988	3.00			
	13	15.5		14.00			
				6.75			
				9.50			
					33.25	150	1
3	10.5	18	3024	6.25			
				6.67			
				3.50			
				2.00			
				3.83	22.25	136	1
4	25	18	7200	16.50			
				8.50			
					25.00	288	2
5	14.5	18	4176	7.50			
				7.83			
				2.50			
				5.33			
				2.58	25.74	162	1

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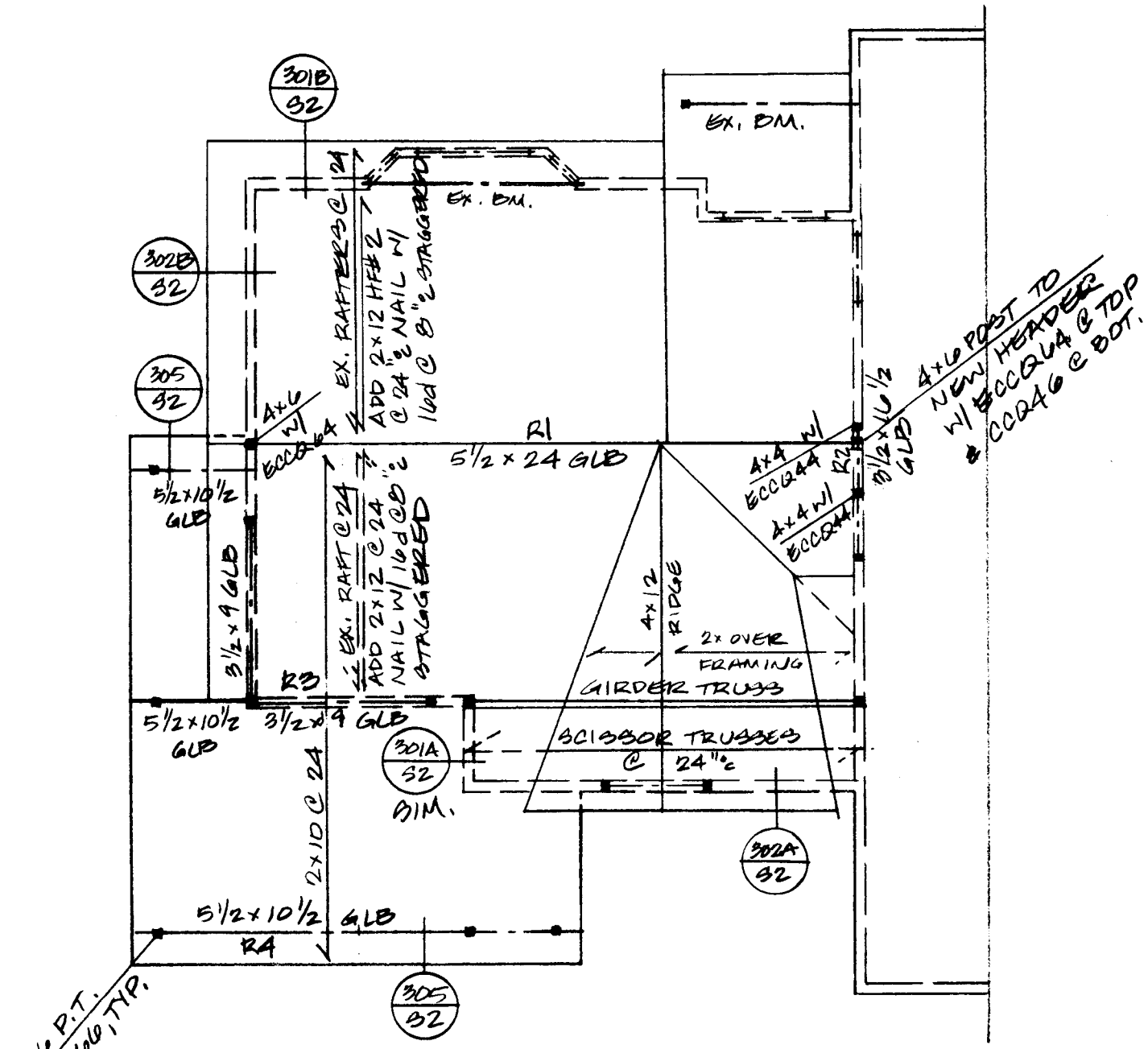
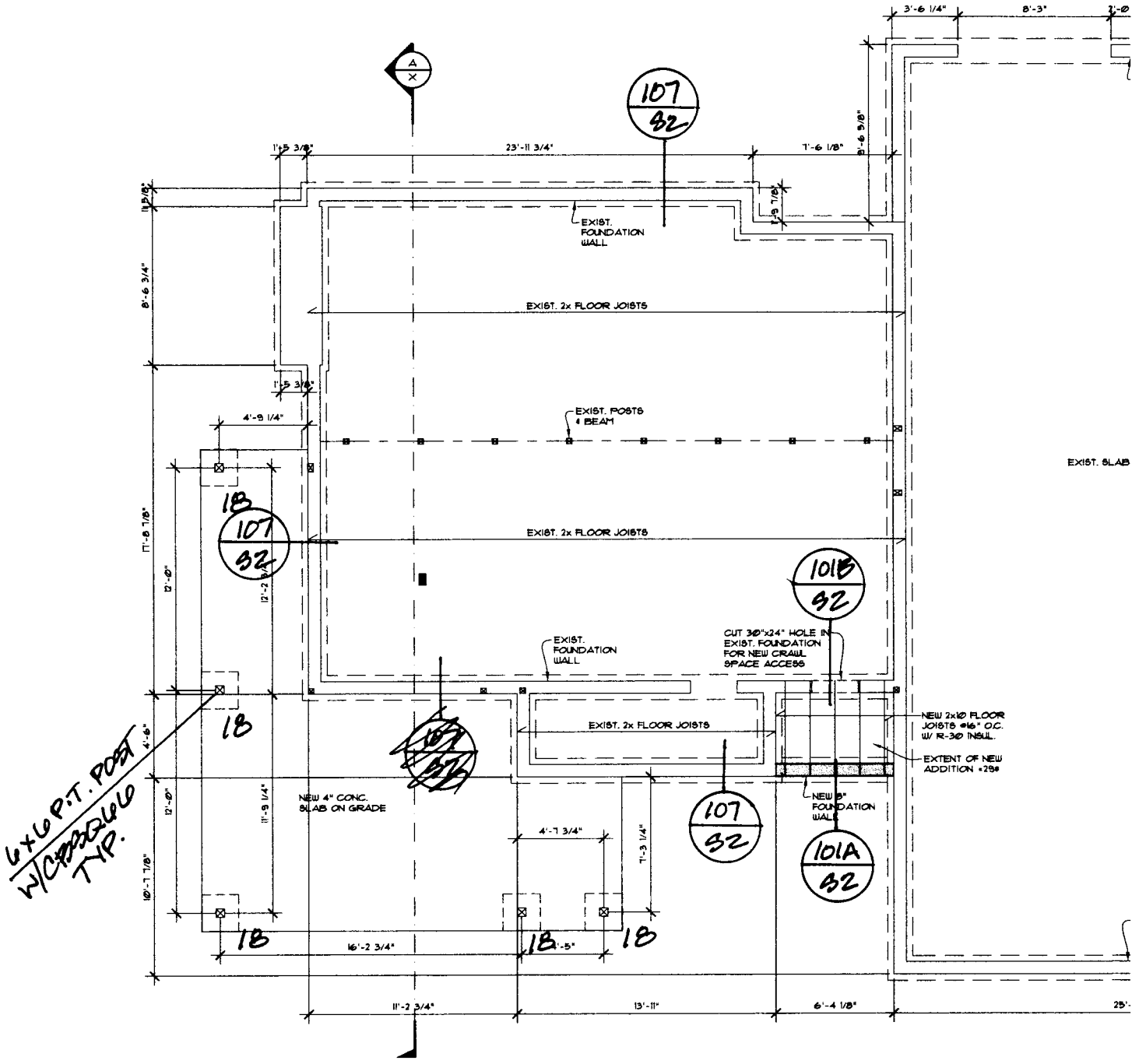
SW	Shear Per Foot	Length (feet)	Total Shear (lbs)	Dead load (lbs)	Wall Height (feet)	Gross Uplift (lbs)	Net Uplift (lbs)	Holddown/ Strap
1	208	8.5	1768	150	8	1664	1027	HDU2
2A	150	3	450	150	8	1200	975	EXIST
2B	150	14	2100	150	8	1200	150	EXIST
2C	150	6.75	1012.5	150	8	1200	694	EXIST
2D	150	9.5	1425	150	8	1200	488	EXIST
3A	136	6.25	850	150	8	1088	619	HDU2
3B	136	6.67	907.12	150	8	1088	588	HDU2
3C	136	3.5	476	150	8	1088	826	EXIST
3D	136	2	272	150	8	1088	938	EXIST
3E	136	3.83	520.88	150	8	1088	801	EXIST
4A	288	16.5	4752	150	8	2304	1067	EXIST
4B	288	8.5	2448	150	8	2304	1667	EXIST
5A	162	7.5	1215	150	8	1296	734	HDU2
5B	162	7.83	1268.46	150	8	1296	709	HDU2
5C	162	2.5	405	150	8	1296	1109	EXIST
5D	162	5.33	863.46	150	8	1296	896	EXIST
5E	162	2.58	417.96	150	8	1296	1103	EXIST



ROOF FRAMING PLAN

1/8" = 1'-0"



FOUNDATION & MAIN FLOOR FRAMING PL

SCALE: 1/4" = 1' - 0"

MAWER/BENITEZ

3/20

R1 $l = 32'$ $W = 13.5(40) = 540$ PLF

$M = 69120'\text{-}\#$ $R = 8640\#$

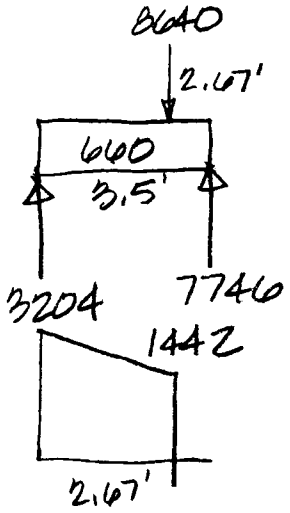
$S_{REQ} = 300$ $A_{REQ} = 62$

$I_{REQ} = 4424$

5½×24 GLB

R2 $l = 3.5'$ $W = 14.5(40) + 80 = 660$ PLF

$P = 8640\#$ @ 2.67'



$M = 6202'\text{-}\#$ $R = 7746\#$

$S_{REQ} = 27$ $A_{REQ} = 57$

5½×12 GLB

OR

3½×16½ GLB

R3 $l = 9.5'$ $W = 12.5(40) = 500$ PLF

$M = 5640'\text{-}\#$ $R = 2375\#$

$S_{REQ} = 25$ $A_{REQ} = 16$

$I_{REQ} = 204$

3½×9 GLB

MAHER/BENITEZ

3/20

R4 $l = 18'$ $W = 7.5(40) = 300\,PLF$

$M = 12150'^{\#}$ $R = 2700^{\#}$

$S_{REQ} = 53$ $\Delta_{REQ} = .20$

$I_{REQ} = 437$

$5\frac{1}{2} \times 10\frac{1}{2}$ GLB

MAWER/BENITEZ

3/20

FOOTINGS:

FTG @ R1: $P = 8640^{\#}$

$AREQ = 8640/1500 = 5.76\,SF$

$l = 5.76/1.33 = 4.33'$

EXISTING CONTINUOUS FOOTING IS OK

FTG @ R4: $P = 2700^{\#}$

$AREQ = 2700/1500 = 1.80\,SF$

USE 18" ⏀ FTG