MDT ENGINEERING

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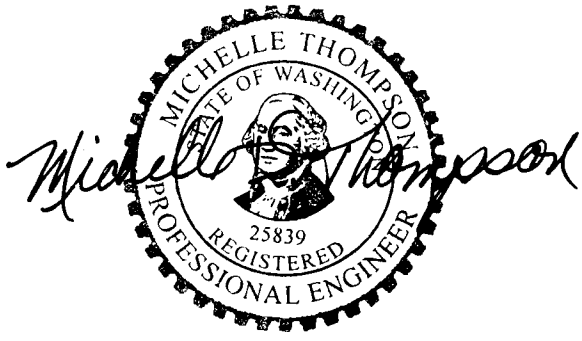
Structural Calculations For Mawer/Nair-Wendel Addition Mercer Island, WA

July 31, 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 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, 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 = (15)(16 PSF) = 240 PLF

Seismic:

Veq = 1.2 (1.0) (W) / 6.5

= 0.1846W

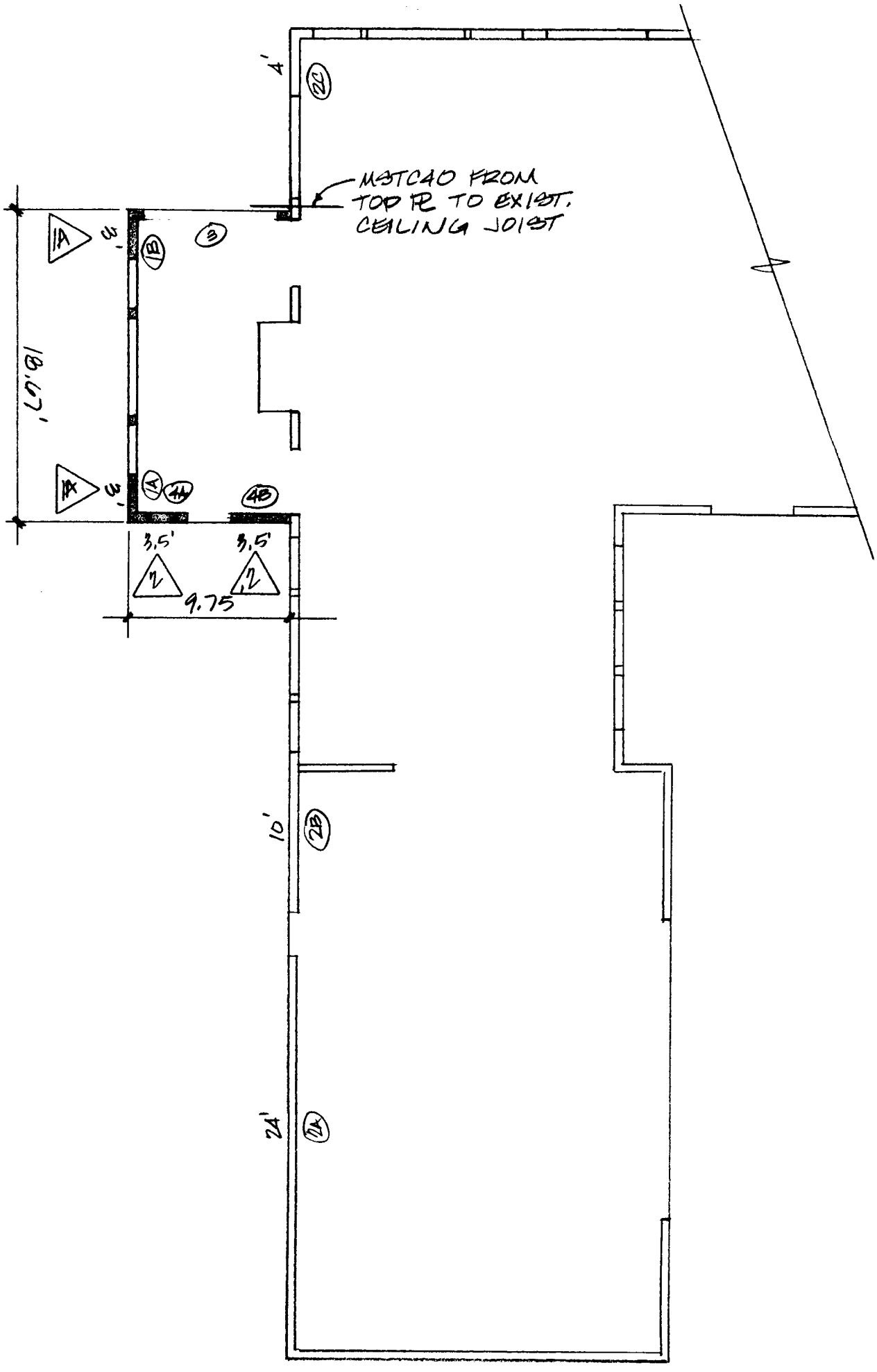
W = Roof: 18.67 (15) = 280
Walls: 2 (10)(10) = 200
480
Floor:
Walls:

Veq = 0.1846 (480) = 52/1.4 = 37 PLF

Redundancy Check: Max. increase = 1.3 Veqmax = 1.3 (37) = 48 PLF

Vwind > Veq

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


4'
2A
MSTC40 FROM TOP PL TO EXIST. CEILING JOIST
3
1B
1A
3'
18'-0"
1A
3'
4
4A
4B
3.5'
3.5'
2
2
9.75
10'
2B
24'
1A

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Wind Load SW#	16 ib Area Wid	Area Hei	Total Shear	Wall Length	Total Wall Length	Shear Per Foot	sw type
1	5	10	800	3.00			
				3.00			
					6.00	133	1A
2	16.5	15	3960	24.00			
				10.00			
				4.00			
					38.00	104	1A
3	9.33	10	1493	1.00			
					1.00	1493	
4	9.33	10	1493	3.00			
				3.00			
					6.00	249	2

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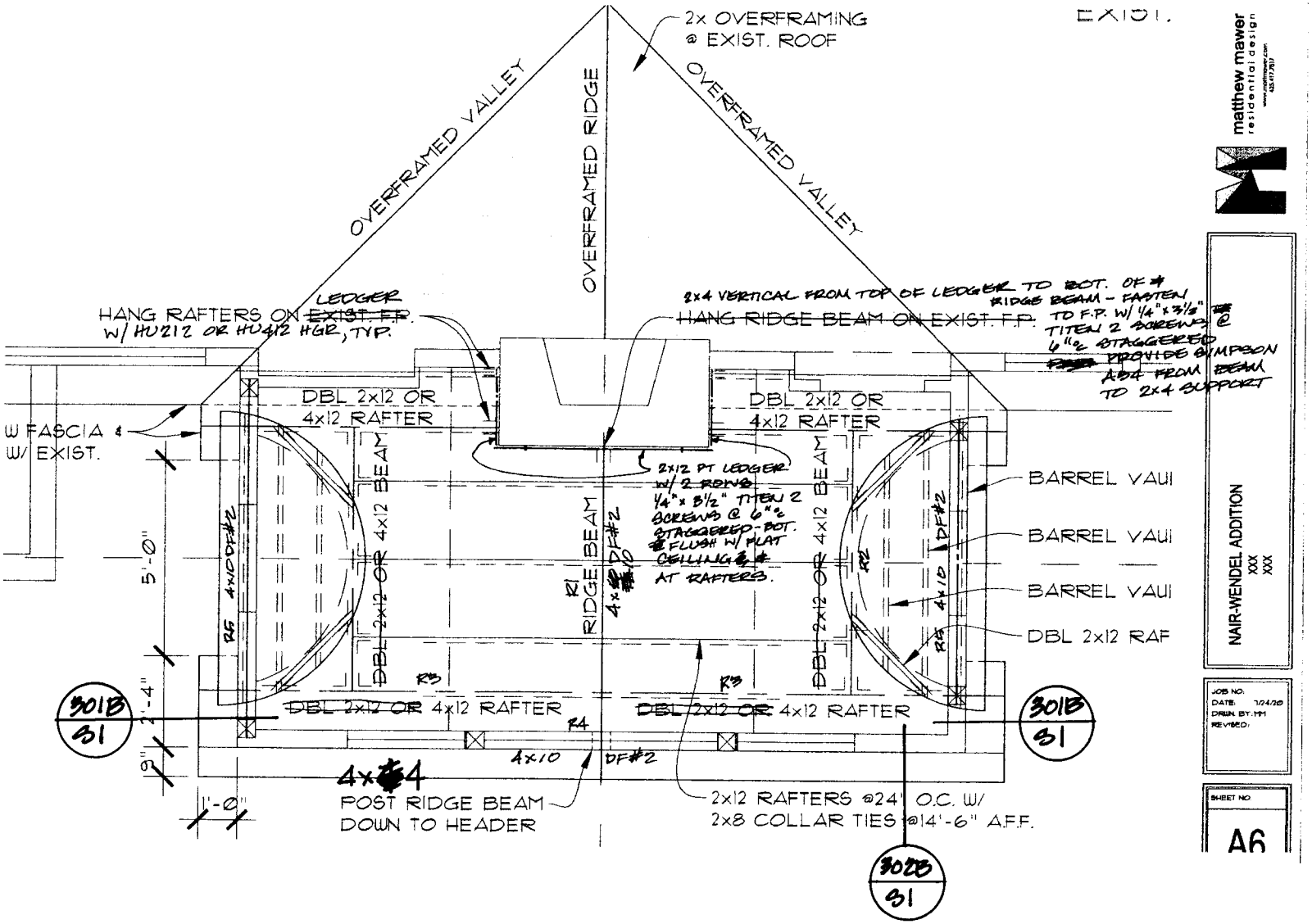
SW	Shear Per Foot	Length (feet)	Total Shear (lbs)	Dead load (lbs)	Wall Height (feet)	Gross Uplift (lbs)	Net Uplift (lbs)	Holddown/ Strap
1A	133	3	399	150	8	1064	839	MSTC40
1B	133	3	399	150	8	1064	839	MSTC40
2A	104	24	2496	150	8	832	-968	NO UPLIFT
2B	104	10	1040	150	8	832	82	NEGLECT
2C	104	4	416	150	8	832	532	NEGLECT
4A	249	3	747	150	8	1992	1767	MSTC40
4B	249	3	747	150	8	1992	1767	MSTC40



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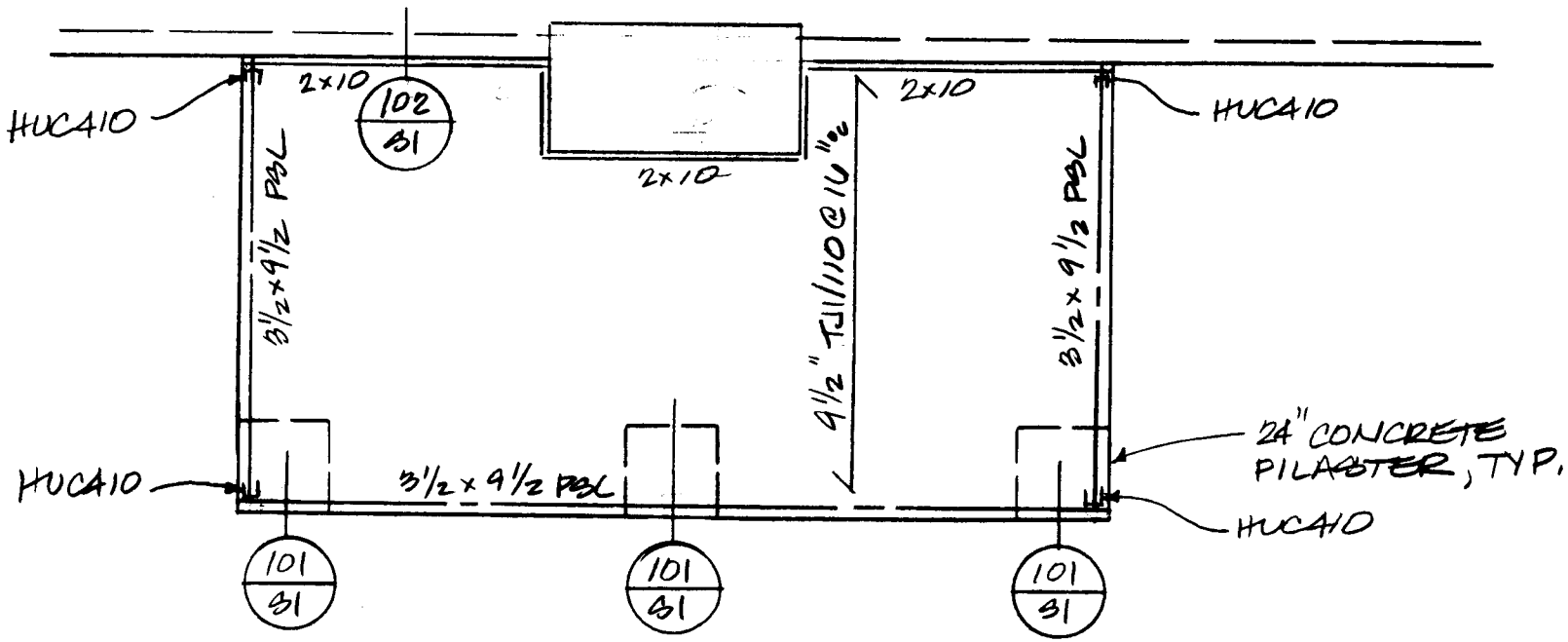
NAIR-WENDEL ADDITION
XXX
XXX

JOB NO.
DATE: 7/24/20
DRWN. BY: MM
REVISED:

SHEET NO.
A6



FOUNDATION & FLOOR FRAMING

1/4"=1'-0"

MAWER/NAIR-WENDEL/ROOF 7/20

R1 $l = 8'$ $W = 9.33(40) = 373$ PLF

$M = 2986'\text{-}\#$ $R = 1492\#$

$S_{REQ} = 36$ $A_{REQ} = 17$

4×10 DF#2

R2 $l = 7'$ $W = 4.67(40) = 187$ PLF

$M = 1143'\text{-}\#$ $R = 655\#$

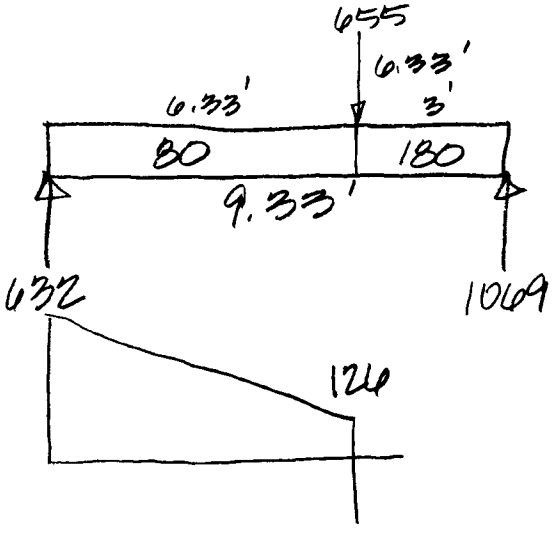
$S_{REQ} = 14$ $A_{REQ} = 7$

4×12 DF#2

R3 $l = 9.33'$ $W = 2(40) = 80$ PLF $0-6.33'$

$P = 655\#$ @ $6.33'$

$W = (3.5+1)(40) = 180$ PLF $6.33-9.33'$



$M = 2397'\text{-}\#$ $R = 1069\#$

$S_{REQ} = 29$ $A_{REQ} = 12$

4×12 DF#2

R4 $l = 6.5'$ $W = 2(40) = 80$ PLF

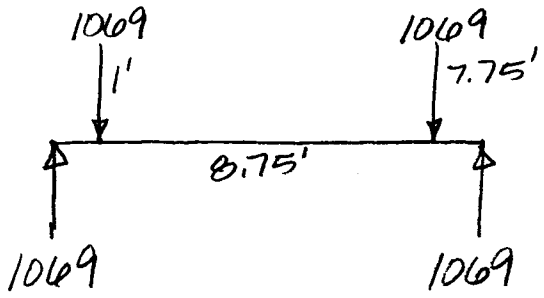
$P = 1492\#$

$M = 2847'\#$ $R = 1006\#$

$S_{REQ} = 34$ $A_{REQ} = 13$

4×10 DF#2

R5 $l = 8.75'$ $P = 1069\#$ @ $1'$ & $7.75'$



$M = 1069'\#$ $R = 1069\#$

$S_{REQ} = 13$ $A_{REQ} = 15$

4×10 DF#2

MAWER/NAIR-WENDEL/FLOOR 7/20

FI $l = 9.33'$ $W = 5(50) + 10(10) + 3(40) = 470$ PLF

$M = 5114'\#$ $R = 2193\#$

$I_{REQ} = 86$

3½ × 9½
P3L