MDT ENGINEERING

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STRUCTURAL CALCULATIONS FOR MAWER/HACKETT 2965 74TH AVE SE MERCER ISLAND, WA 98040

October 2, 2024

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 new structure. Following are the calculations provided:

1. Lateral Analysis
2. Vertical Analysis
3. Foundation Design
4. Structural Plans, 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.

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Lateral Analysis

Wind Design: Per 2021 IBC and ASCE 7-22

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 = 1.6

P = 1.6(16 PSF) = 25.6 PSF

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Lateral Analysis

Seismic Design: Per 2021 IBC and ASCE 7-22, 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 26 PSF in all directions.

Vwind = (28)(26 PSF) = 728 PLF

Seismic:

Veq = 1.2 (1.0) (W) / 6.5

= 0.1846W

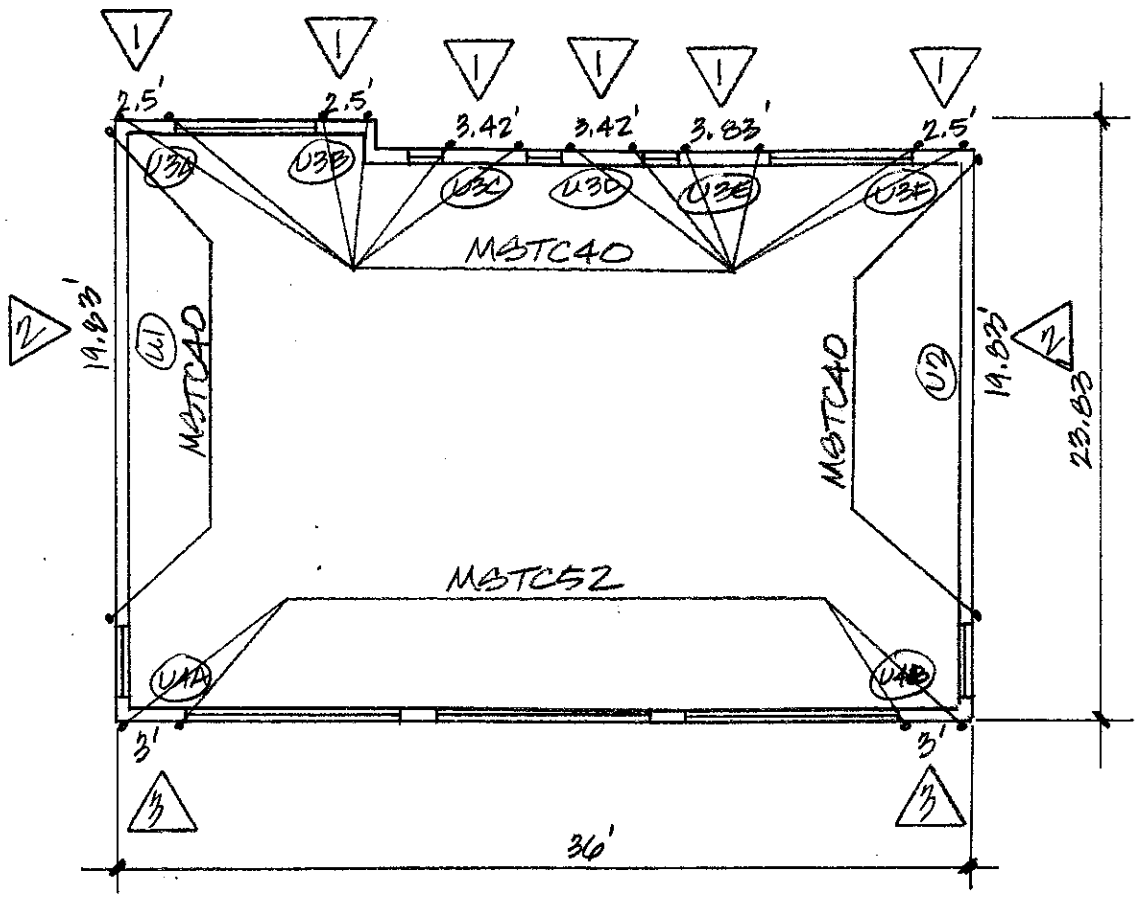
W = Roof: 36 (15) = 540
Walls: 2(9)(10) = 180
Floor: 70(15) = 1050
Walls: 2(9)(10) = 180
TOTAL = 1950 PLF

Veq = 0.1846 (1950) = 360 PLF / 1.4 = 257 PLF

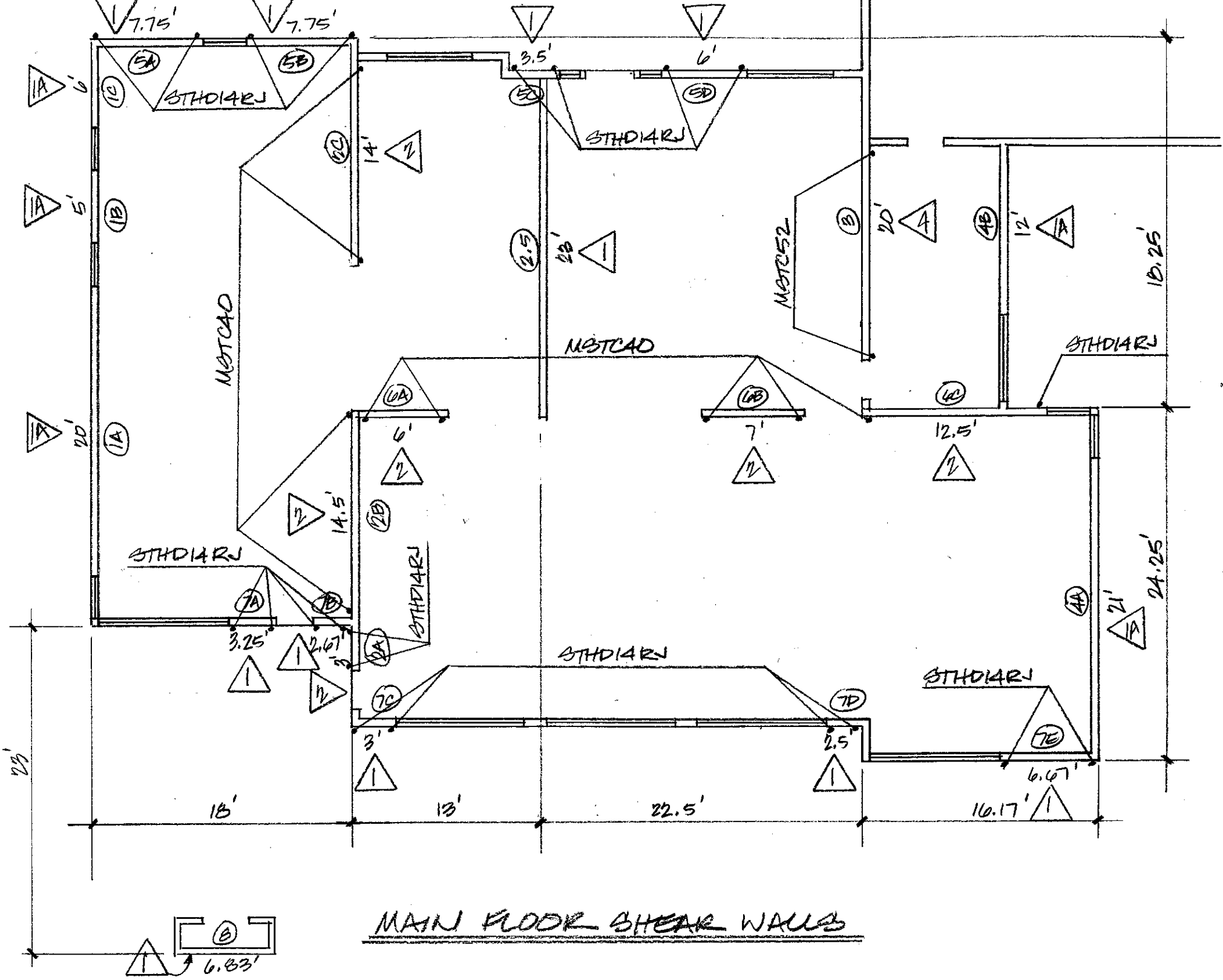
Redundancy Check: Max. increase = 1.3 Veqmax = 1.3 (257) = 334 PLF

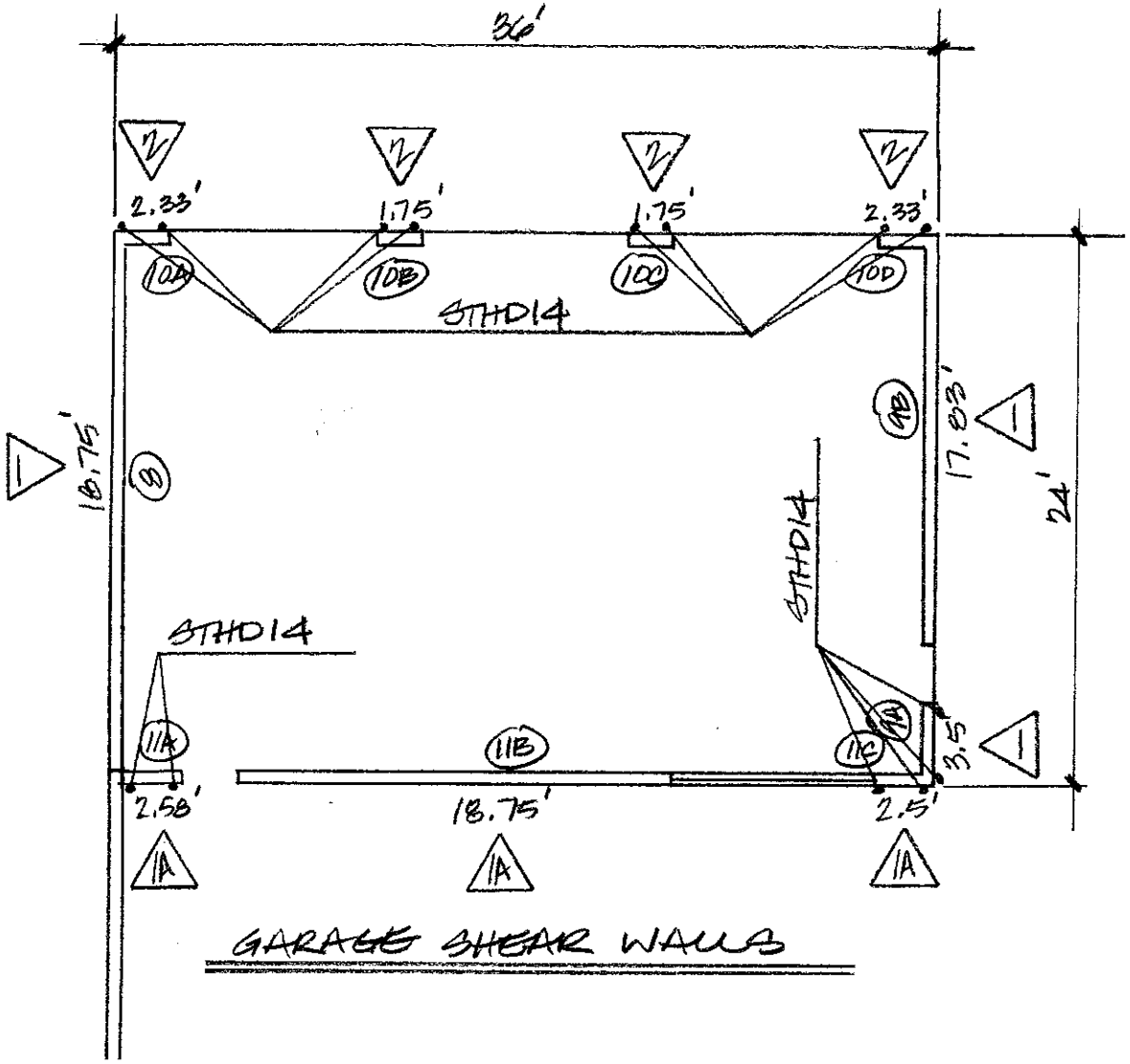
Vwind IS GREATER THAN Veq

Wind Controls



UPPER FLOOR SHEAR WALLS


7.75'
7.75'
3.5'
6'
5A
5B
5C
5D
STHD14RJ
14'
2.5'
28'
MBTC52
20'
4
4B
12'
1A
16.25'
MBTC40
MBTC40
STHD14RJ
6'
7'
12.5'
20'
14.5'
2B
STHD14RJ
STHD14RJ
3.25'
2.67'
2'
2A
STHD14RJ
STHD14RJ
7A
7B
7C
7D
7E
3'
2.5'
6.67'
4A
21'
24.25'
23'
18'
13'
22.5'
16.17'
B
6.83'
MAIN FLOOR SHEAR WALLS



GARAGE SHEAR WALLS

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Wind Load	25.6						
SW#	ib Area Wio	Area He	Total Shear	Wall Length	Total Wall Length	Shear Per Foot	sw type
U1	18	12.5	5760	19.83			
					19.83	290	2
U2	18	12.5	5760	19.83			
					19.83	290	2
U3	12	8.5	2611	2.50			
				2.50			
				3.42			
				3.42			
				3.83			
				2.50	18.17	144	1
U4	12	8.5	2611	3.00			
				3.00			
					6.00	435	3
1	9	6.5	1498	20.00			
				5.00			
				6.00	31.00	48	1A
2	15.5	10	9728	3.00			
				14.50			
				14.00			
					31.50	309	2
2.5	17.75	10	3195	23.00			
					23.00	139	1

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Wind Load	25.6						
SW#	ib Area Wid	Area He	Total Shear	Wall Length	Total Wall Length	Shear Per Foot	sw type
3	19.25	10	10688	20.00			
					20.00	534	4
4	8	8.5	1741	21.00			
				12.00			
					33.00	53	1A
5	9.125	10	4947	7.75			
				7.75			
				3.50			
				6.00			
					25.00	198	1
6	21.25	10	8051	6.00			
				7.00			
				12.50	25.50	316	2
7	12.125	10	3104	3.25			
				2.67			
				3.00			
				2.50			
				6.67	18.09	172	1
8	18	9	4147	18.75			
					18.75	221	1
9	18	9	4147	3.50			
				17.83			
					21.33	194	1

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Wind Load	25.6						
SW#	ib Area Wi	o Area He	Total Shear	Wall Length	Total Wall Length	Shear Per Foot	sw type
10	12	6.75	2074	2.33			
				1.75			
				1.75			
				2.33	8.16	254	2
11	12	9	2765	2.58			
				18.75			
				2.50	23.83	116	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
U1	290	19.83	5750.7	150	9	2610	1123	MSTC40
U2	290	19.83	5750.7	150	9	2610	1123	MSTC40
U3A	144	2.5	360	150	9	1296	1109	MSTC40
U3B	144	2.5	360	150	9	1296	1109	MSTC40
U3C	144	3.42	492.48	150	9	1296	1040	MSTC40
U3D	144	3.42	492.48	150	9	1296	1040	MSTC40
U3E	144	3.83	551.52	150	9	1296	1009	MSTC40
U3F	144	2.5	360	150	9	1296	1109	MSTC40
U4A	435	3	1305	150	9	3915	3690	MSTC52
U4B	435	3	1305	150	9	3915	3690	MSTC52
1A	48	20	960	150	9	432	-1068	NO UPLIFT
1B	48	5	240	150	9	432	57	NEGLECT
1C	48	6	288	150	9	432	-18	NO UPLIFT
2A	309	3	927	150	9	2781	2556	STHD14RJ
2B	309	14.5	4480.5	150	9	2781	1694	MSTC40
2C	309	14	4326	150	9	2781	1731	MSTC40
2.5	139	23	3197	150	9	1251	-474	NO UPLIFT
3	534	20	10680	150	9	4806	3306	MSTC52
4A	53	21	1113	150	9	477	-1098	NO UPLIFT
4B	53	12	636	150	9	477	-423	NO UPLIFT
5A	198	7.75	1534.5	150	9	1782	1201	STHD14RJ
5B	198	7.75	1534.5	150	9	1782	1201	STHD14RJ
5C	198	3.5	693	250	9	1782	1344.5	STHD14RJ
5D	198	6	1188	250	9	1782	1032	STHD14RJ
6A	316	6	1896	250	9	2844	2094	MSTC40
6B	316	7	2212	250	9	2844	1969	MSTC40
6C	316	12.5	3950	250	9	2844	1281.5	MSTC40
7A	172	3.25	559	150	9	1548	1304.25	STHD14RJ
7B	172	2.67	459.24	150	9	1548	1347.75	STHD14RJ
7C	172	3	516	150	9	1548	1323	STHD14RJ
7D	172	2.5	430	150	9	1548	1360.5	STHD14RJ
7E	172	6.67	1147.24	150	9	1548	1047.75	STHD14RJ
8	221	18.75	4143.75	150	9	1989	582.75	NEGLECT
9A	194	3.5	679	150	9	1746	1483.5	STHD14
9B	194	17.83	3459.02	150	9	1746	408.75	NEGLECT
10A	254	2.33	591.82	150	9	2286	2111.25	STHD14
10B	254	1.75	444.5	150	9	2286	2154.75	STHD14

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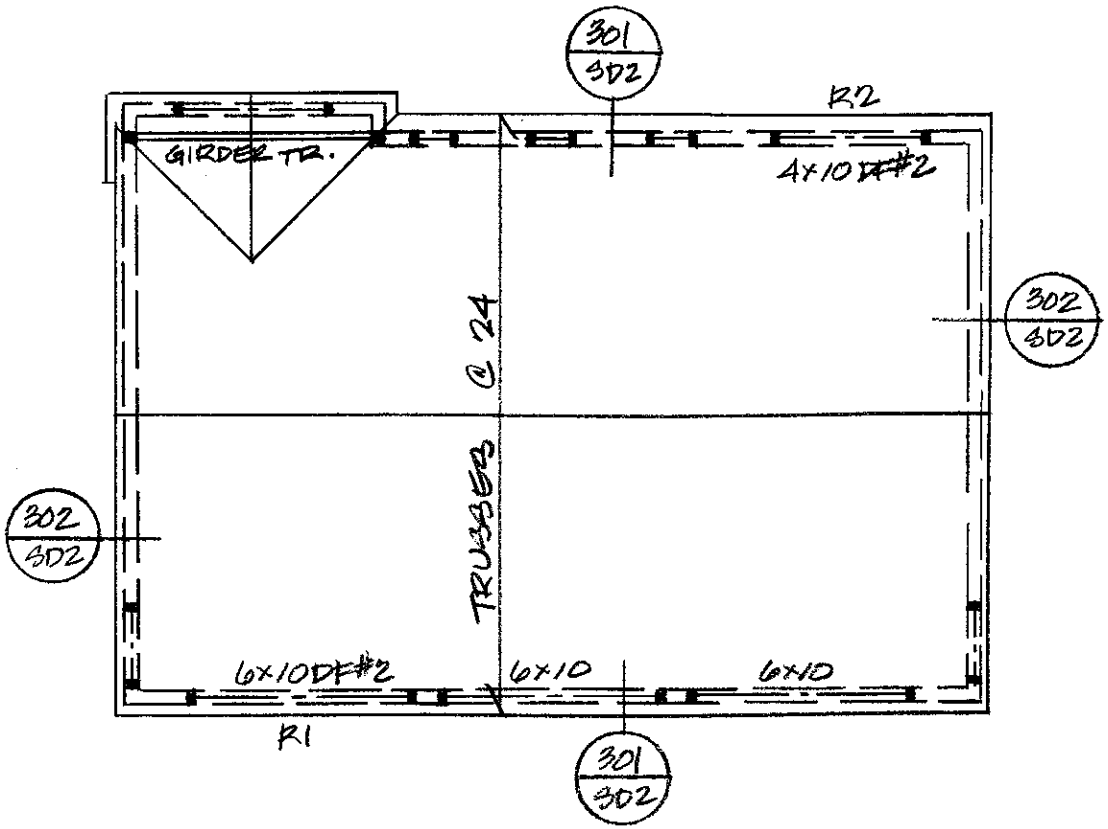
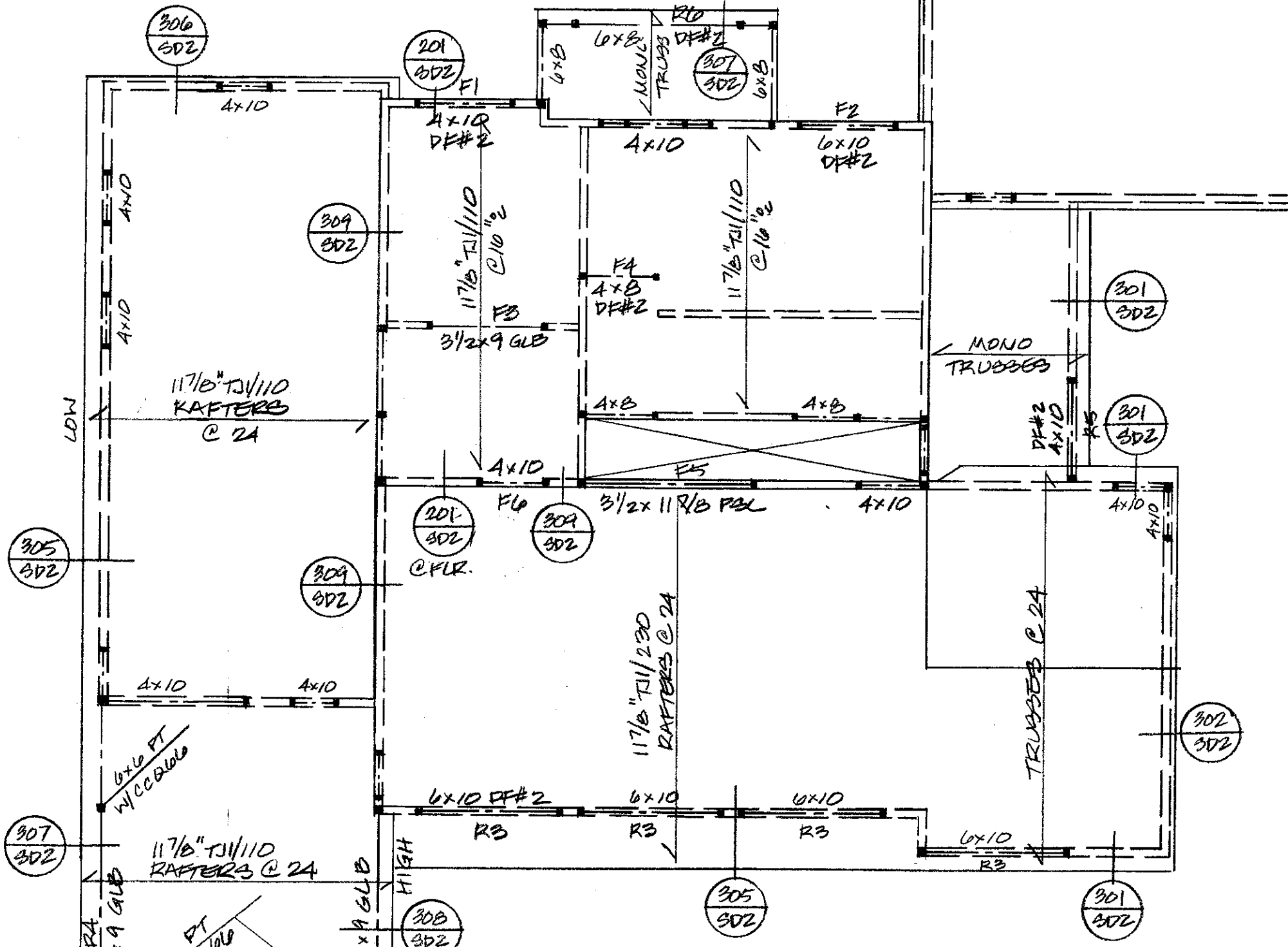
10C	254	1.75	444.5	150	9	2286	2154.75	STHD14
10D	254	2.33	591.82	150	9	2286	2111.25	STHD14
11A	116	2.58	299.28	150	9	1044	850.5	STHD14
11B	116	18.75	2175	150	9	1044	-362.25	NO UPLIFT
11C	116	2.5	290	150	9	1044	856.5	STHD14

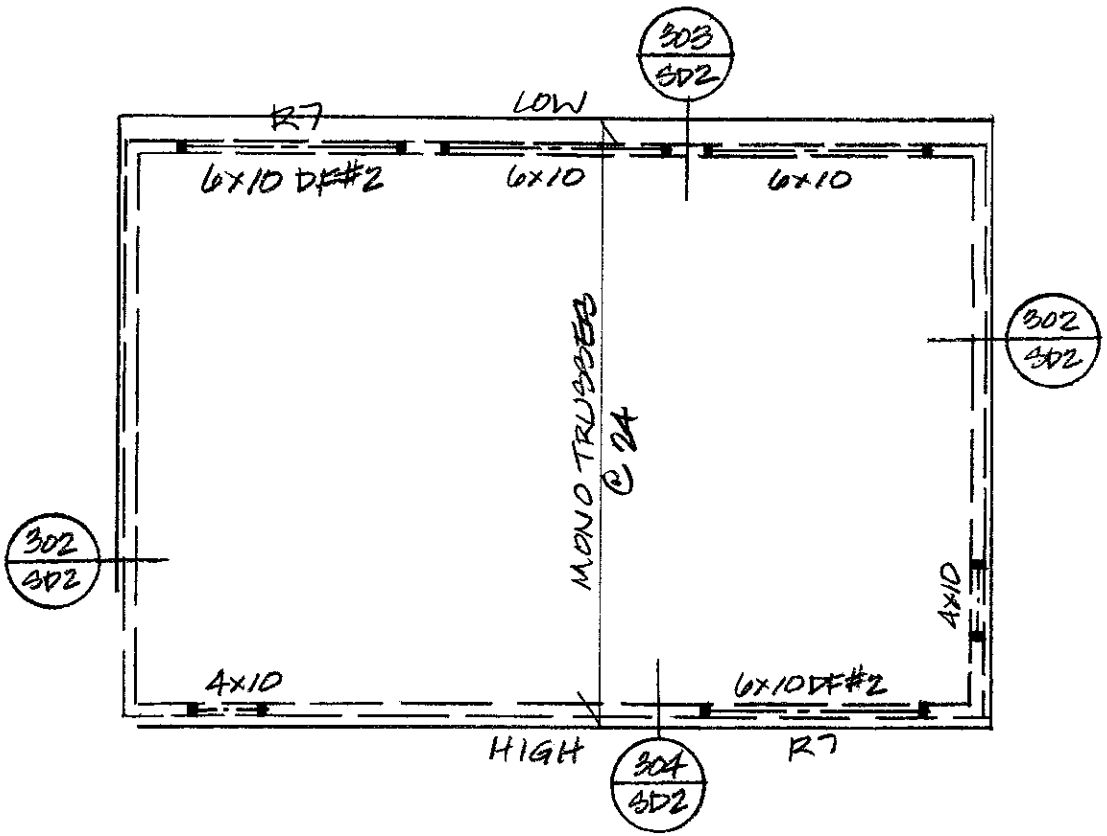


ROOF FRAMING PLAN

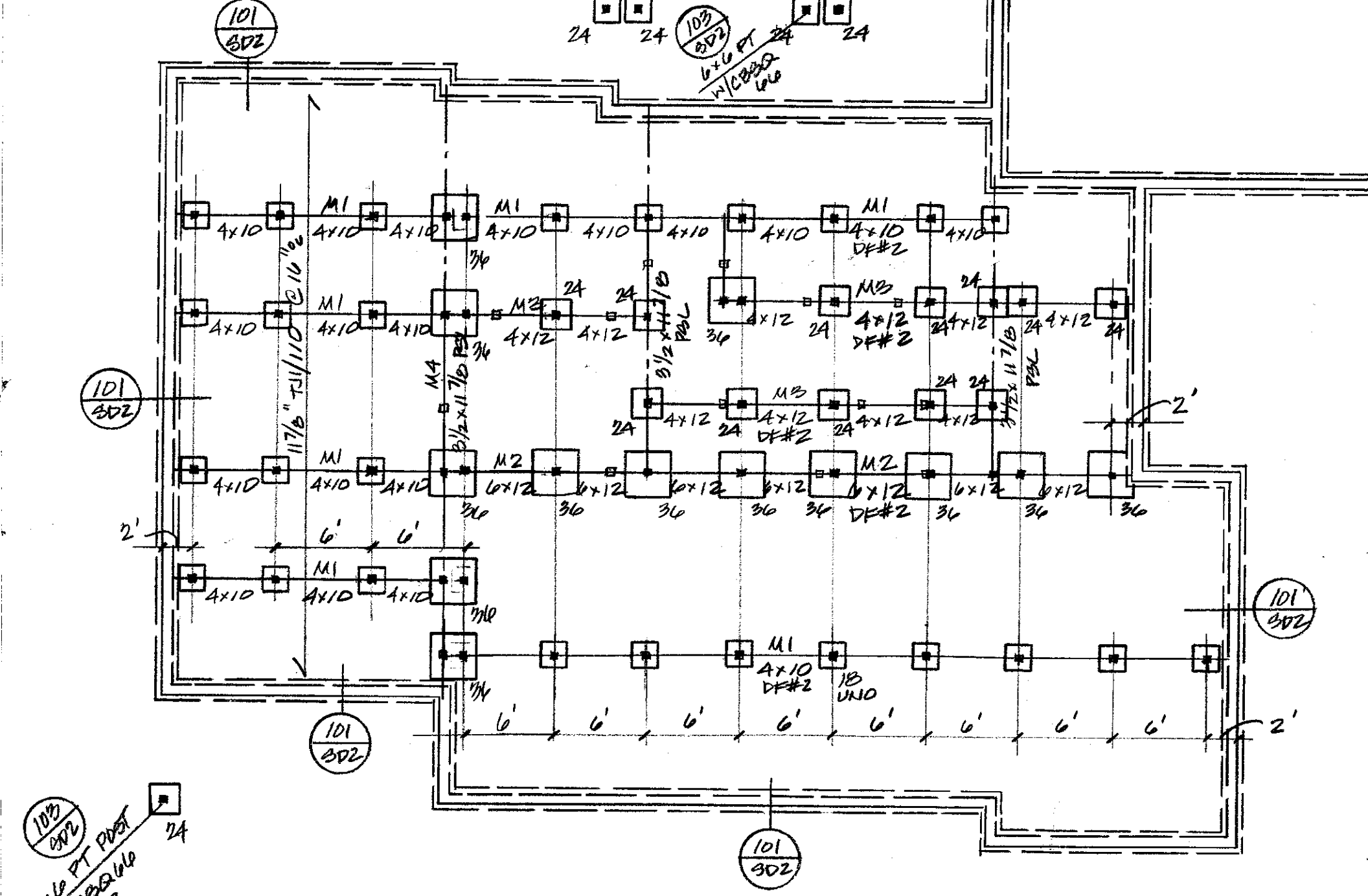
NOTE: ALL HEADERS SHALL BE 4X10 DF#2, UNO.



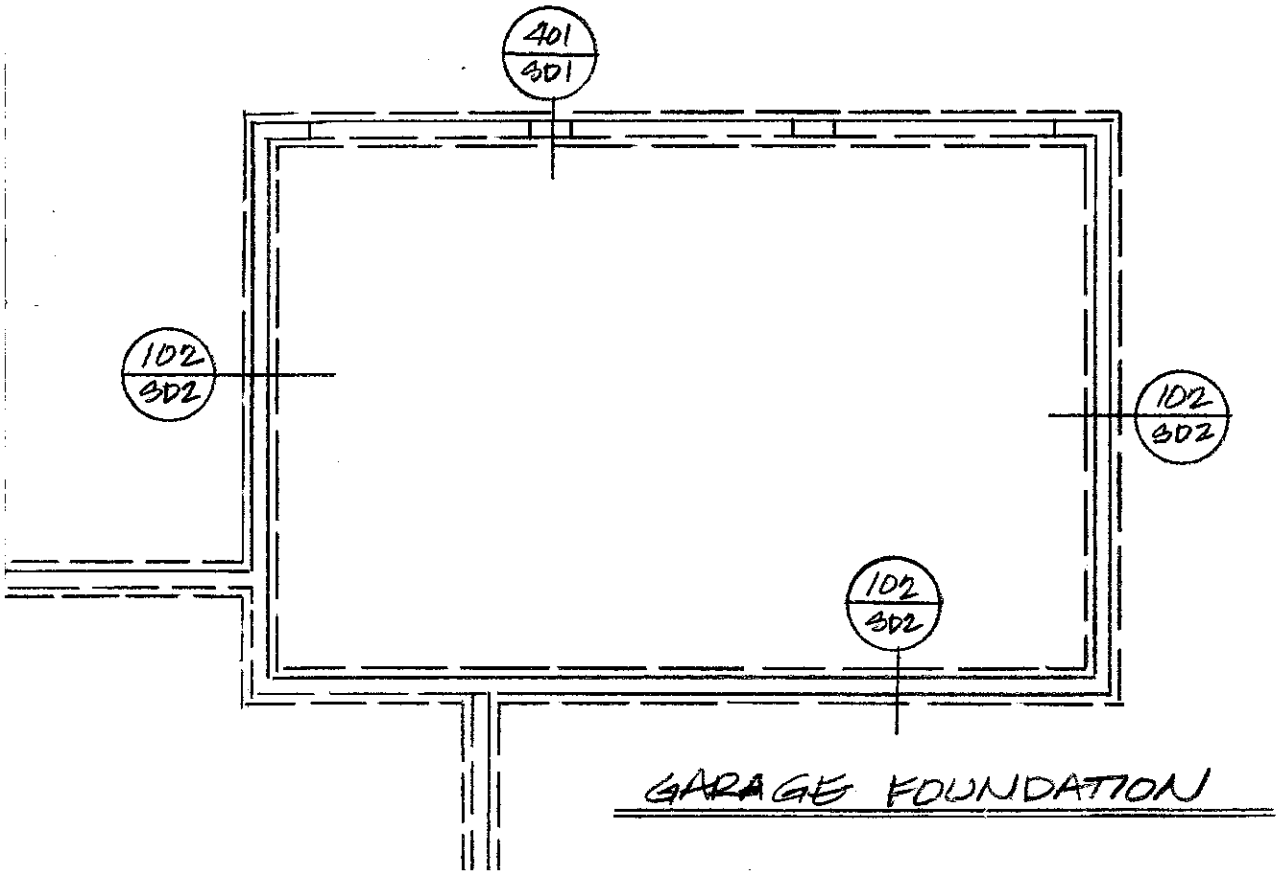
UPPER FLOOR & LOWER ROOF FRAMING



GARAGE ROOF FRAMING



FOUNDATION & MAIN FLOOR FRAMING



GARAGE FOUNDATION

MAHER/HACKETT/ROOF 9/24

R1 $\ell = 9.5'$ $W = 12.5(40) = 500$ PLF

$M = 5641'^{\#}$ $R = 2375^{\#}$

$S_{REQ} = 67$ $A_{REQ} = 31$

6×10 DF#2

R2 $\ell = 6.5'$ $W = 500$ PLF

$M = 2641'^{\#}$ $R = 1625^{\#}$

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

4×10 DF#2

R3 $\ell = 9.5'$ $W = (11+4)(40) = 600$ PLF

$M = 6769'^{\#}$ $R = 2850^{\#}$

$S_{REQ} = 81$ $A_{REQ} = 37$

6×10 DF#2

R4 $\ell = 14'$ $W = 10(40) = 400$ PLF

$M = 9800'^{\#}$ $R = 2800^{\#}$

$S_{REQ} = 43$ $A_{REQ} = 20$

$I_{REQ} = 274$

5½×9 GLB

R5 $\ell = 6.5'$ $W = 6(40) = 240$ PLF

$M = 1768'^{\#}$ $R = 780^{\#}$

$S_{REQ} = 15$ $A_{REQ} = 8$

4×10 DF#2

MAWER/HACKETT/ROOF 9/24

R6 $l = 11'$ $W = (3+1)(40) = 160$ PLF

$M = 2420$ '# $R = 880$ #

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

6×8 DF#2

R7 $l = 9.5'$ $W = 13(40) = 520$ PLF

$M = 5866$ '# $R = 2470$ #

$S_{REQ} = 70$ $A_{REQ} = 32$

6×10 DF#2

MAWER/HACKETT/UPPER FLOOR 9/24

F1 $l = 6.5'$ $W = 7.5(50) + 90 + 2(40) = 545$ PLF

$M = 2878'^{\#}$ $R = 1771^{\#}$

$S_{REQ} = 34$ $A_{REQ} = 19$

4×10 DF#2

F2 $l = 6.5'$ $W = 12.5(40) + 90 + 6.5(50) = 915$ PLF

$M = 4832'^{\#}$ $R = 2974^{\#}$

$S_{REQ} = 58$ $A_{REQ} = 35$

6×10 DF#2

F3 $l = 7.5'$ $W = 12.5(50) = 625$ PLF

$M = 4395'^{\#}$ $R = 2344^{\#}$

$S_{REQ} = 60/22$ $A_{REQ} = 30/17$

3½×9 GLB

F4 $l = 5'$ $W = 9.5(50) = 475$ PLF

$M = 1484'^{\#}$ $R = 1188^{\#}$

$S_{REQ} = 20$ $A_{REQ} = 14$

4×8 DF#2

F5 $l = 11'$ $W = 10.5(40) + 90 + 12.5(40) = 1010$ PLF

$M = 15276'^{\#}$ $R = 5555^{\#}$

$I_{REQ} = 302$

3½×11⅞ PSL

MAHER/HACKETT/UPPER FLOOR 9/24

F6 $l = 4.5'$ $W = 5(50) + 90 + 12.5(40) + 10.5(40) = 1260$ PLF

$M = 3189'\#$ $R = 2835\#$

$S_{REQ} = 38$ $A_{REQ} = 26$

4×10
DF#2

MAWER/HACKETT/MAIN FLOOR 9/24

M1 $l = 6'$ $W = 11(50) = 550$ PLF

$M = 2475'^{\#}$ $R = 1650^{\#}$

$S_{REQ} = 34$ $A_{REQ} = 20$

4x10 DF#2

M2 $l = 6'$ $W = 11(50) + 90 + 5(50) + 11(40) + 90 + 12.5(40)$
$= 1920$ PLF

$M = 8640'^{\#}$ $R = 5760^{\#}$

$S_{REQ} = 103$ $A_{REQ} = 59$

6x12 DF#2

M3 $l = 6'$ $W = 6(50) + 90 + 9.5(50) = 865$ PLF

$M = 3893'^{\#}$ $R = 2595^{\#}$

$S_{REQ} = 53$ $A_{REQ} = 27$

4x12 DF#2

M4 $l = 10'$ $W = 9(40) + 90 + 2(40) + 50 = 530$ PLF

$M = 7250'^{\#}$ $R = 2900^{\#}$

3½x11⅞ PSL

MAWER/HACKETT/FOUNDATION 9/24

FOOTINGS:

R4 $P = 2800^{\#}$

$A_{FTG} = 2800/1500 = 1.87 SF \Rightarrow$ 18" □ FTG

M1/M1 $P = 1650(2) = 3300/1500 = 2.2 SF \Rightarrow$ 18" □ FTG

M2/M2 $P = 5760(2) = 11520^{\#}/1500 = 7.7 SF \Rightarrow$ 36" □ FTG

M3/M4/M4/M1 $P = 2595 + 2900 + 2900 + 1650 = 10045^{\#}$

$A_{FTG} = 10045/1500 = 6.7 SF \Rightarrow$ 36" □ FTG

M3/M3 $P = 2595(2) = 5190^{\#}$

$A_{FTG} = 5190/1500 = 3.5 SF \Rightarrow$ 24" □ FTG