

# APPENDICES



- A – LOAD CALCULATIONS
- B – RAM OUTPUT
- C – COST & SCHEDULE
- D – ACOUSTICAL ANALYSIS

# APPENDIX A



## LOAD CALCULATIONS

APPENDIX A  
LOAD CALCULATIONS

**WIND ANALYSIS**  
SIMPLIFIED METHOD - ASCE 7 - 02 SEC. 6.4

WIND LOAD FACTORS			
MEAN BUILDING HEIGHT	H (FT.) =	70	
BASIC WIND SPEED:	V (MPH) =	90	FROM PLANS
BUILDING CATEGORY:	CATEGORY	III	TABLE 1-1
IMPORTANCE FACTOR:	I =	1.15	TABLE 6-1
EXPOSURE CATEGORY:	CATEGORY	C	SEC. 6.5.6

ZONE	$P_{s30}$	
A	17.8	HORIZONTAL PRESSURES
B	-4.7	
C	11.9	
D	-2.6	

$P_s = \lambda * I * P_{s30}$
$I = 1.15$
$P_{s30} = 17.8 - (-4.7)$
$\lambda$ : SEE BELOW

HEIGHT	$\lambda$	I	$P_{TOT} = \lambda * I * P_{s30}$ (PSF)
0 - 15	1.21	1.15	22.5
20	1.29	1.15	23.7
25	1.35	1.15	24.6
30	1.4	1.15	25.3
35	1.45	1.15	26.0
40	1.49	1.15	26.6
45	1.53	1.15	27.2
50	1.56	1.15	27.7
55	1.59	1.15	28.1
60	1.62	1.15	28.5

LEVEL	PLF	NORTH-SOUTH			EAST-WEST		
		$F_x$	$V_x$	$M_x$	$F_x$	$V_x$	$M_x$
ROOF	140	35.3	0.0	2257.9	13.7	0.0	878.1
5	313	78.9	35.3	4298.7	30.7	13.7	1671.7
4	359	90.5	114.2	3799.7	35.2	44.4	1477.6
3	350	88.2	204.6	2469.6	34.3	79.6	960.4
2	311	78.4	292.8	1097.2	30.5	113.9	426.7
1	0	0.0	371.2	0.0	0.0	144.4	0.0
		$\Sigma =$		$\Sigma =$	$\Sigma =$		$\Sigma =$
		371.2		13923.1	144.4		5414.5

APPENDIX A  
LOAD CALCULATIONS

**SEISMIC DESIGN PARAMETERS**

BUILDING LOCATION :	FLAGSTAFF, ARIZONA		
NUMBER OF STORIES :	5		
INTER-STORY HEIGHT	14 FT		
BUILDING HEIGHT :	70 FT		
SEISMIC USE GROUP :	I		
OCCUPANY IMPORTANCE FACTOR :	1.00		TABLE 9.1.3 & TABLE 1.1
SITE CLASSIFICATION :	C		TABLE 9.4.1.2.1
0.2S ACCELERATION :	0.46 G-S		FIGURE 9.4.1.1A
1 S ACCELERATION :	0.13 G-S		FIGURE 9.4.1.1B
SITE CLASS FACTOR :	1.20		TABLE 9.4.1.2.4A
SITE CLASS FACTOR :	1.67		TABLE 9.4.1.2.4B
ADJUSTED ACCELERATIONS :			
	$= F_A S_S$		
	$= F_V S_1$		
	$= (2/3) S_{MS}$		
	$= (2/3) S_{M1}$		
DESIGN SPECTRAL RESPONSE ACCELERATIONS:			
	$S_{D5}$	0.368 G-S	
	$S_{D1}$	0.145 G-S	
SEISMIC DESIGN CATEGORY :	C		TABLE 9.4.2.1A & TABLE 9.4.2.1B

EQUIVALENT LATERAL LOAD METHOD CAN BE USED

**EQUIVALENT LATERAL FORCE PROCEDURE (9.5.3)**

**A. SEISMIC BASE SHEAR COEFFICIENT (9.5.3.2)**

RESPONSE MODIFICATION FACTOR :	$R_{N-S}$		
SEISMIC RESPONSE COEFFICIENT :	$C_{S, N-S}$	0.074	TABLE 9.5.2.2
	$C_{T, N-S}$	0.02	EQUATION 9.5.3.2.1-1
	X	0.75	TABLE 9.5.5.3.2
	$T_{N-S}$	0.48	TABLE 9.5.5.3.2
APPROXIMATE PERIOD OF STRUCTURE :	$T_{N-S}^X$		
SEISMIC RESPONSE COEFFICIENT NEED NOT BE			
GREATER THAN $C_{S, MAX, N-S}$	$S_{D1}/T(R_{N-S}/I)$	0.060	EQUATION 9.5.3.2.1-2
AND LESS THAN $C_{S, MIN}$	$= 0.044 I S_{DS}$	0.0162	EQUATION 9.5.3.2.1-3
THEREFORE, THE SEISMIC RESPONSE COEFFICIENT ( $C_{S, N-S}$ ) USED IS:		<b>0.060</b>	

APPENDIX A  
LOAD CALCULATIONS

**B. BUILDING WEIGHTS**

ROOF	1000 KIPS
5TH FLOOR	700 KIPS
4TH FLOOR	2500 KIPS
3RD FLOOR	2500 KIPS
2ND FLOOR	2300 KIPS
<b>TOTAL BUILDING W</b>	<b>9000 KIPS</b>

BASE SHEAR,  $V = C_{s,N-S}W = 538$  KIPS

**C. VERTICAL DISTRIBUTION OF SEISMIC FORCES (9.5.3.4)**

THE DISTRIBUTION OF LATERAL FORCES OVER THE HEIGHT OF THE BUILDING IS SHOWN IN TABLE 1 AND 2 BELOW.

EXPONENT  $K_{N-S} = 1 + (T_{N-S} - 0.5)/(2.5 - 0.5) = 1.000$

TABLE 1 : VERTICAL DISTRIBUTION OF SEISMIC FORCES (N-S)

LEVEL, X	$W_x$ (KIPS)	$H_x$ (FT)	$W_x H_x^k$	$C_{vx}$	$F_x$ (KIPS)	$V_x$ (KIPS)	$M_x$ (FT-KIPS)
ROOF	1000	64	64,000	0.207	111		7,127
5	700	54.5	38,150	0.123	66	111	3,618
4	2500	42	105,000	0.339	183	178	7,673
3	2500	28	70,000	0.226	122	360	3,410
2	2300	14	32,200	0.104	56	482	784
GROUND	$\Sigma =$ 9000		$\Sigma =$ 309350	$\Sigma =$ 1.000	$\Sigma =$ 538		$\Sigma =$ 22612

WHERE  $C_{vx} = W_x H_x^k / \sum_{ALL LEVELS} (W_x H_x^k)$   
 $F_x = C_{vx} V$

## APPENDIX B



RAM OUTPUT

APPENDIX B  
RAM OUTPUT



RAM Steel v10.0  
DataBase: model2  
Building Code: IBC

03/21/06 21:49:35  
Steel Code: AISC LRFD

**Gravity Beam Design Takeoff**

**STEEL BEAM DESIGN TAKEOFF:**

**Floor Type: mechanical**

**Story Level 4**

**Steel Grade: 50**

SIZE	#	LENGTH (ft)	WEIGHT (lbs)
W12X14	30	590.16	8354
W18X40	14	504.00	20237
	-----		-----
	<b>44</b>		<b>28591</b>

Total Number of Studs = 733

**Floor Type: typ**

**Story Levels 2 to 3**

**Steel Grade: 50**

SIZE	#	LENGTH (ft)	WEIGHT (lbs)
W8X10	38	385.58	3884
W12X14	35	698.04	9881
W14X22	6	177.48	3920
W16X26	12	396.74	10368
W16X31	36	1297.85	40321
W21X50	14	505.91	25306
W21X62	14	504.00	31385
	-----		-----
	<b>155</b>		<b>125063</b>

Total Number of Studs = 3374

**Floor Type: 2nd**

**Story Level 1**

**Steel Grade: 50**

SIZE	#	LENGTH (ft)	WEIGHT (lbs)
W8X10	35	369.70	3724
W12X14	36	726.57	10285
W14X22	36	973.95	21509
W16X26	12	396.74	10368
W16X31	7	253.85	7886
W21X44	1	36.46	1613
W21X50	6	217.45	10877
W21X62	14	504.00	31385

APPENDIX B  
RAM OUTPUT



RAM Steel v10.0  
DataBase: model2  
Building Code: IBC

**Gravity Beam Design Takeoff**

Page 2/2  
03/21/06 21:49:35  
Steel Code: AISC LRFD

SIZE	#	LENGTH (ft)	WEIGHT (lbs)
	147		97646

Total Number of Studs = 2215

**TOTAL STRUCTURE GRAVITY BEAM TAKEOFF**

**Steel Grade: 50**

SIZE	#	LENGTH (ft)	WEIGHT (lbs)
W8X10	111	1140.85	11491
W12X14	136	2712.80	38401
W14X22	48	1328.92	29348
W16X26	36	1190.21	31104
W16X31	79	2849.54	88528
W18X40	14	504.00	20237
W21X44	1	36.46	1613
W21X50	34	1229.26	61488
W21X62	42	1512.00	94154
	501		376364

Total Number of Studs = 9696





RAM Steel v10.0  
DataBase: model2  
Building Code: IBC

## Gravity Column Design Summary

04/04/06 15:12:08  
Steel Code: AISC LRFD

### Column Line A - 1

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
5th	29.5	4.9	12.6	1	0.59 Eq H1-1a	90.0	50	W10X33
4th	90.7	13.2	29.8	1	0.97 Eq H1-1a	90.0	50	W10X33
3rd	152.7	4.1	14.9	1	0.91 Eq H1-1a	90.0	50	W10X54
2nd	153.6	4.1	15.0	1	0.92 Eq H1-1a	90.0	50	W10X54

### Column Line A - 2

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
5th	64.7	8.0	24.6	3	0.71 Eq H1-1a	90.0	50	W10X33
4th	155.2	4.3	18.8	3	1.00 Eq H1-1a	90.0	50	W10X33
3rd	240.0	2.6	20.4	1	0.72 Eq H1-1a	90.0	50	W10X49
2nd	309.0	1.0	16.5	1	0.84 Eq H1-1a	90.0	50	W10X49

### Column Line A - 3

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
5th	67.6	8.0	20.3	1	0.65 Eq H1-1a	90.0	50	W10X33
4th	141.9	2.4	15.9	2	0.88 Eq H1-1a	90.0	50	W10X33
3rd	211.8	2.1	17.2	2	0.63 Eq H1-1a	90.0	50	W10X49
2nd	279.7	0.6	16.5	1	0.77 Eq H1-1a	90.0	50	W10X49

### Column Line A - 5

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
5th	29.2	2.4	11.9	3	0.56 Eq H1-1a	90.0	50	W10X33
4th	87.3	5.1	28.7	1	0.89 Eq H1-1a	90.0	50	W10X33
3rd	146.1	3.2	12.9	3	0.70 Eq H1-1a	90.0	50	W10X39
2nd	202.3	2.2	13.2	1	0.90 Eq H1-1a	90.0	50	W10X39

### Column Line A - 13

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
5th	7.3	2.6	7.4	1	0.21 Eq H1-1b	90.0	50	W10X33
4th	41.8	5.0	14.0	1	0.39 Eq H1-1b	90.0	50	W10X33
3rd	66.9	2.1	6.0	1	0.40 Eq H1-1a	90.0	50	W10X33
2nd	90.5	2.0	5.6	1	0.49 Eq H1-1a	90.0	50	W10X33

### Column Line B - 1

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
5th	57.7	8.5	5.5	2	0.67 Eq H1-1a	90.0	50	W12X40
4th	131.8	21.0	16.5	6	0.78 Eq H1-1a	90.0	50	W12X40
3rd	266.0	6.5	0.0	1	0.83 Eq H1-1a	90.0	50	W12X65
2nd	267.1	6.5	0.0	1	0.83 Eq H1-1a	90.0	50	W12X65



## Gravity Column Design Summary

### Column Line B - 2

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
5th	110.9	12.7	11.8	2	0.50 Eq H1-1a	90.0	50	W12X45
4th	262.9	6.6	9.2	3	0.95 Eq H1-1a	90.0	50	W12X45
3rd	412.0	4.1	7.2	2	0.69 Eq H1-1a	90.0	50	W12X65
2nd	524.0	1.7	7.2	6	0.85 Eq H1-1a	90.0	50	W12X65

### Column Line B - 3

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
5th	118.6	12.5	14.7	4	0.63 Eq H1-1a	90.0	50	W12X40
4th	217.0	3.3	11.1	5	0.93 Eq H1-1a	90.0	50	W12X40
3rd	315.3	3.0	12.0	5	0.77 Eq H1-1a	90.0	50	W12X53
2nd	402.8	0.8	11.9	10	0.95 Eq H1-1a	90.0	50	W12X53

### Column Line B - 8

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
5th	59.7	5.3	12.2	4	0.93 Eq H1-1a	90.0	50	W10X33
4th	123.6	10.9	18.7	10	0.91 Eq H1-1a	90.0	50	W10X33
3rd	228.3	6.2	9.6	4	0.62 Eq H1-1a	90.0	50	W10X49
2nd	308.2	4.9	9.1	10	0.79 Eq H1-1a	90.0	50	W10X49

### Column Line B - 15

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
5th	28.9	2.1	1.6	4	0.38 Eq H1-1a	90.0	50	W10X33
4th	55.7	6.2	7.0	10	0.39 Eq H1-1a	90.0	50	W10X33
3rd	111.1	2.7	2.8	4	0.53 Eq H1-1a	90.0	50	W10X33
2nd	142.5	2.6	2.5	10	0.66 Eq H1-1a	90.0	50	W10X33

### Column Line C - 1

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
5th	57.7	8.5	5.5	2	0.67 Eq H1-1a	90.0	50	W12X40
4th	131.8	21.0	16.5	6	0.78 Eq H1-1a	90.0	50	W12X40
3rd	266.0	6.5	0.0	1	0.83 Eq H1-1a	90.0	50	W12X65
2nd	267.1	6.5	0.0	1	0.83 Eq H1-1a	90.0	50	W12X65

### Column Line C - 2

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
5th	110.9	12.7	11.8	2	0.50 Eq H1-1a	90.0	50	W12X45
4th	262.9	6.6	9.2	3	0.95 Eq H1-1a	90.0	50	W12X45
3rd	412.0	4.1	7.2	2	0.69 Eq H1-1a	90.0	50	W12X65
2nd	524.0	1.7	7.2	6	0.85 Eq H1-1a	90.0	50	W12X65



## Gravity Column Design Summary

### Column Line C - 3

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
5th	120.3	11.0	17.1	2	0.67 Eq H1-1a	90.0	50	W10X39
4th	223.9	2.4	13.1	2	0.97 Eq H1-1a	90.0	50	W10X39
3rd	327.1	2.2	14.2	2	0.79 Eq H1-1a	90.0	50	W10X54
2nd	419.6	0.2	13.7	6	0.96 Eq H1-1a	90.0	50	W10X54

### Column Line C - 10

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
5th	63.4	5.7	13.2	3	0.81 Eq H1-1a	90.0	50	W10X39
4th	132.6	11.7	22.5	6	0.83 Eq H1-1a	90.0	50	W10X39
3rd	242.7	6.6	11.7	3	0.67 Eq H1-1a	90.0	50	W10X49
2nd	329.0	5.2	11.1	6	0.85 Eq H1-1a	90.0	50	W10X49

### Column Line C - 17

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
5th	28.6	2.1	1.7	4	0.37 Eq H1-1a	90.0	50	W10X33
4th	55.3	6.4	7.0	10	0.39 Eq H1-1a	90.0	50	W10X33
3rd	110.0	2.8	2.8	4	0.53 Eq H1-1a	90.0	50	W10X33
2nd	141.2	2.6	2.5	10	0.65 Eq H1-1a	90.0	50	W10X33

### Column Line D - 1

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
5th	57.7	8.5	5.5	2	0.67 Eq H1-1a	90.0	50	W12X40
4th	131.8	21.0	16.5	6	0.78 Eq H1-1a	90.0	50	W12X40
3rd	266.0	6.5	0.0	1	0.83 Eq H1-1a	90.0	50	W12X65
2nd	267.1	6.5	0.0	1	0.83 Eq H1-1a	90.0	50	W12X65

### Column Line D - 2

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
5th	100.5	11.6	13.2	4	0.52 Eq H1-1a	90.0	50	W14X43
4th	244.6	8.3	9.5	4	0.97 Eq H1-1a	90.0	50	W14X43
3rd	385.3	6.4	7.3	4	0.78 Eq H1-1a	90.0	50	W14X61
2nd	487.5	3.8	7.8	10	0.97 Eq H1-1a	90.0	50	W14X61

### Column Line D - 3

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
5th	117.6	11.7	17.8	4	0.67 Eq H1-1a	90.0	50	W12X40
4th	224.8	3.1	14.1	5	1.00 Eq H1-1a	90.0	50	W12X40
3rd	319.3	2.7	14.7	5	0.80 Eq H1-1a	90.0	50	W12X53
2nd	410.1	0.6	14.8	10	0.99 Eq H1-1a	90.0	50	W12X53



## Gravity Column Design Summary

### Column Line D - 12

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
5th	65.2	5.4	14.1	4	0.84 Eq H1-1a	90.0	50	W10X39
4th	131.7	10.9	23.4	10	0.84 Eq H1-1a	90.0	50	W10X39
3rd	238.0	6.2	12.2	4	0.66 Eq H1-1a	90.0	50	W10X49
2nd	322.6	4.9	11.6	10	0.84 Eq H1-1a	90.0	50	W10X49

### Column Line D - 19

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
5th	28.6	2.2	1.6	3	0.37 Eq H1-1a	90.0	50	W10X33
4th	55.1	6.4	6.8	6	0.39 Eq H1-1a	90.0	50	W10X33
3rd	109.6	2.8	2.7	2	0.52 Eq H1-1a	90.0	50	W10X33
2nd	140.6	2.7	2.4	6	0.65 Eq H1-1a	90.0	50	W10X33

### Column Line E - 1

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
5th	57.7	8.5	5.5	2	0.67 Eq H1-1a	90.0	50	W12X40
4th	131.8	21.0	16.5	6	0.78 Eq H1-1a	90.0	50	W12X40
3rd	266.0	6.5	0.0	1	0.83 Eq H1-1a	90.0	50	W12X65
2nd	267.1	6.5	0.0	1	0.83 Eq H1-1a	90.0	50	W12X65

### Column Line E - 2

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
5th	109.2	12.7	12.1	2	0.50 Eq H1-1a	90.0	50	W12X45
4th	259.9	6.6	9.1	3	0.94 Eq H1-1a	90.0	50	W12X45
3rd	407.6	4.1	7.5	2	0.68 Eq H1-1a	90.0	50	W12X65
2nd	518.4	1.7	7.5	6	0.85 Eq H1-1a	90.0	50	W12X65

### Column Line E - 3

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
5th	120.0	12.5	16.7	2	0.67 Eq H1-1a	90.0	50	W12X40
4th	221.5	2.6	12.7	2	0.96 Eq H1-1a	90.0	50	W12X40
3rd	322.7	2.4	13.8	2	0.80 Eq H1-1a	90.0	50	W12X53
2nd	413.3	0.2	13.9	6	0.99 Eq H1-1a	90.0	50	W12X53

### Column Line E - 11

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
5th	0.5	10.2	18.0	3	0.43 Eq H1-1b	90.0	50	W10X33
4th	101.0	10.5	22.7	6	0.88 Eq H1-1a	90.0	50	W10X33
3rd	205.8	6.1	11.8	3	0.59 Eq H1-1a	90.0	50	W10X49
2nd	288.9	4.7	11.2	6	0.76 Eq H1-1a	90.0	50	W10X49



## Gravity Column Design Summary

### Column Line E - 18

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
5th	28.6	2.1	1.6	3	0.37 Eq H1-1a	90.0	50	W10X33
4th	55.3	6.4	7.0	6	0.39 Eq H1-1a	90.0	50	W10X33
3rd	110.1	2.8	2.8	2	0.53 Eq H1-1a	90.0	50	W10X33
2nd	141.3	2.6	2.5	6	0.65 Eq H1-1a	90.0	50	W10X33

### Column Line F - 1

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
5th	57.7	8.5	5.5	2	0.67 Eq H1-1a	90.0	50	W12X40
4th	131.8	21.0	16.5	6	0.78 Eq H1-1a	90.0	50	W12X40
3rd	266.0	6.5	0.0	1	0.83 Eq H1-1a	90.0	50	W12X65
2nd	267.1	6.5	0.0	1	0.83 Eq H1-1a	90.0	50	W12X65

### Column Line F - 2

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
5th	110.9	12.7	11.8	2	0.50 Eq H1-1a	90.0	50	W12X45
4th	262.9	6.6	9.2	3	0.95 Eq H1-1a	90.0	50	W12X45
3rd	412.0	4.1	7.2	2	0.69 Eq H1-1a	90.0	50	W12X65
2nd	524.0	1.7	7.2	6	0.85 Eq H1-1a	90.0	50	W12X65

### Column Line F - 3

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
5th	118.9	12.5	16.4	4	0.66 Eq H1-1a	90.0	50	W12X40
4th	218.2	2.7	12.5	4	0.95 Eq H1-1a	90.0	50	W12X40
3rd	317.2	5.0	13.2	2	0.79 Eq H1-1a	90.0	50	W12X53
2nd	430.2	2.7	8.3	10	0.98 Eq H1-1a	90.0	50	W12X53

### Column Line F - 9

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
5th	60.8	4.2	15.7	4	1.00 Eq H1-1a	90.0	50	W10X33
4th	122.8	8.1	23.0	10	0.96 Eq H1-1a	90.0	50	W10X33
3rd	222.0	5.6	10.3	3	0.61 Eq H1-1a	90.0	50	W10X49
2nd	314.7	4.3	6.8	10	0.78 Eq H1-1a	90.0	50	W10X49

### Column Line F - 16

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
5th	28.9	2.1	1.6	3	0.38 Eq H1-1a	90.0	50	W10X33
4th	55.7	6.2	7.0	6	0.39 Eq H1-1a	90.0	50	W10X33
3rd	111.0	2.7	2.8	2	0.53 Eq H1-1a	90.0	50	W10X33
2nd	142.4	2.6	2.5	6	0.65 Eq H1-1a	90.0	50	W10X33



## Gravity Column Design Summary

### Column Line G - 1

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
5th	57.7	8.5	5.5	2	0.67 Eq H1-1a	90.0	50	W12X40
4th	131.8	21.0	16.5	6	0.78 Eq H1-1a	90.0	50	W12X40
3rd	266.0	6.5	0.0	1	0.83 Eq H1-1a	90.0	50	W12X65
2nd	267.1	6.5	0.0	1	0.83 Eq H1-1a	90.0	50	W12X65

### Column Line G - 2

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
5th	110.9	12.7	11.8	2	0.50 Eq H1-1a	90.0	50	W12X45
4th	262.9	6.6	9.2	3	0.95 Eq H1-1a	90.0	50	W12X45
3rd	412.0	4.1	7.2	2	0.69 Eq H1-1a	90.0	50	W12X65
2nd	524.0	1.7	7.2	6	0.85 Eq H1-1a	90.0	50	W12X65

### Column Line G - 3

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
5th	116.3	11.0	12.6	2	0.59 Eq H1-1a	90.0	50	W10X39
4th	210.5	2.8	10.0	3	0.88 Eq H1-1a	90.0	50	W10X39
3rd	293.2	3.2	11.3	5	0.77 Eq H1-1a	90.0	50	W10X49
2nd	393.7	1.1	7.7	10	0.95 Eq H1-1a	90.0	50	W10X49

### Column Line G - 6

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
5th	54.8	3.5	9.9	3	0.83 Eq H1-1a	90.0	50	W10X33
4th	107.7	6.8	17.1	6	0.79 Eq H1-1a	90.0	50	W10X33
3rd	196.9	4.5	9.3	4	0.71 Eq H1-1a	90.0	50	W10X45
2nd	278.5	3.1	7.2	10	0.92 Eq H1-1a	90.0	50	W10X45

### Column Line G - 14

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
5th	28.9	2.1	1.6	3	0.38 Eq H1-1a	90.0	50	W10X33
4th	55.9	6.1	7.0	6	0.39 Eq H1-1a	90.0	50	W10X33
3rd	111.8	2.7	2.8	2	0.53 Eq H1-1a	90.0	50	W10X33
2nd	143.4	2.5	2.5	6	0.66 Eq H1-1a	90.0	50	W10X33

### Column Line H - 1

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
5th	29.5	4.9	12.6	1	0.59 Eq H1-1a	90.0	50	W10X33
4th	90.7	13.2	29.8	1	0.97 Eq H1-1a	90.0	50	W10X33
3rd	152.7	4.1	14.9	1	0.91 Eq H1-1a	90.0	50	W10X54
2nd	153.6	4.1	15.0	1	0.92 Eq H1-1a	90.0	50	W10X54



## Gravity Column Design Summary

### Column Line H - 2

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
5th	64.7	8.0	24.6	4	0.71 Eq H1-1a	90.0	50	W10X33
4th	155.2	4.3	18.8	4	1.00 Eq H1-1a	90.0	50	W10X33
3rd	240.0	2.6	20.4	1	0.72 Eq H1-1a	90.0	50	W10X49
2nd	309.0	1.0	16.5	1	0.84 Eq H1-1a	90.0	50	W10X49

### Column Line H - 3

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
5th	66.2	8.0	19.6	1	0.63 Eq H1-1a	90.0	50	W10X33
4th	131.8	1.9	14.2	4	0.81 Eq H1-1a	90.0	50	W10X33
3rd	193.5	1.7	13.3	3	0.74 Eq H1-1a	90.0	50	W10X45
2nd	253.4	0.3	14.5	1	0.92 Eq H1-1a	90.0	50	W10X45

### Column Line H - 4

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
5th	26.1	1.5	9.9	4	0.48 Eq H1-1a	90.0	50	W10X33
4th	76.7	3.0	25.5	1	0.78 Eq H1-1a	90.0	50	W10X33
3rd	127.4	2.2	11.4	3	0.74 Eq H1-1a	90.0	50	W10X33
2nd	175.8	1.3	12.2	1	0.95 Eq H1-1a	90.0	50	W10X33

### Column Line H - 7

Level	Pu	Mux	Muy	LC	Interaction Eq.	Angle	Fy	Size
5th	7.3	2.6	7.5	1	0.21 Eq H1-1b	90.0	50	W10X33
4th	42.1	5.0	14.1	1	0.39 Eq H1-1b	90.0	50	W10X33
3rd	67.4	2.1	6.1	1	0.40 Eq H1-1a	90.0	50	W10X33
2nd	91.1	2.0	5.6	1	0.49 Eq H1-1a	90.0	50	W10X33



APPENDIX B  
RAM OUTPUT





## APPENDIX C



## COST & SCHEDULE

APPENDIX C  
COST & SCHEDULE

**STEEL SYSTEM COST ANALYSIS**

**BEAMS**

SIZE	LINEAR FOOTAGE	COSTS PER FOOT				COST
		MAT.	LABOR	EQUIP	TOTAL	TOTAL
W 8x10	1142	10.45	3.63	2.38	16.46	18797
W 12x14	2713	13.5	2.35	1.51	17.36	47098
W 14x22	1328	23	2.2	1.44	26.64	35378
W 16x26	1190	25	2.07	1.33	28.4	33796
W 16x31	2850	30	2.3	1.47	33.77	96245
W 18x40	504	42	3.28	1.58	46.36	23365
W 21x50	1266	48	3.28	1.58	52.36	66288
W 21x62	1512	53	3.29	1.54	57.83	87439

**TOTAL 408406**

**COLUMNS**

SIZE	LINEAR FOOTAGE	COSTS PER FOOT				COST
		MAT.	LABOR	EQUIP	TOTAL	TOTAL
W 10x33	790	34.5	3.96	2.59	41.05	32430
W 10x39	275	40.7	3.96	2.59	47.25	12994
W 10x45	250	46.9	3.96	2.59	53.45	13363
W 12x40	110	42	2.69	1.76	46.45	5110
W 12x58	115	59.3	2.9	1.9	64.1	7372
W 12x87	320	91	3.4	2.23	96.63	30922
W 12x96	340	99.5	3.4	2.23	105.13	35744

**TOTAL 137933**

**BRACES**

SIZE	LINEAR FOOTAGE	COSTS PER FOOT				COST
		MAT.	LABOR	EQUIP	TOTAL	TOTAL
W 10x77	1575	81	3.4	2.23	86.63	136442

**TOTAL 136442**

**METAL DECKING**

SIZE	SQUARE FOOTAGE	COSTS PER SQUARE FOOT				COST
		MAT.	LABOR	EQUIP	TOTAL	TOTAL
1.5" DEEP, 22 GAGE	78500	1.14	0.26	0.02	1.42	111470

**TOTAL 111470**

APPENDIX C  
COST & SCHEDULE

**WELDED WIRE FABRIC**

SIZE	SQUARE FOOTAGE	COSTS PER HUNDRED SQUARE FEET				COST
		MAT.	LABOR	EQUIP	TOTAL	TOTAL
6x6 W1.4 xW1.4	78500	12	18.05	0	30.05	23589

**TOTAL 23589**

**CONCRETE SLAB**

SIZE	SQUARE FOOTAGE	COSTS PER SQUARE FOOT				COST
		MAT.	LABOR	EQUIP	TOTAL	TOTAL
4"+ 1.5" DECK	78500	1.18	0.66	0.27	2.11	165635

**TOTAL 165635**

**SHEAR STUDS**

SIZE	NUMBER	COSTS PER SQUARE FOOT				COST
		MAT.	LABOR	EQUIP	TOTAL	TOTAL
3/4" DIA., 4" LONG	9696	0.46	0.69	0.28	1.43	13865

**TOTAL 13865**

**FIREPROOFING**

COMPONENT	SQUARE FOOTAGE	COSTS PER SQUARE FOOT				COST
		MAT.	LABOR	EQUIP	TOTAL	TOTAL
BEAMS	43768	0.41	0.45	0.07	0.93	40704
DECK	74447	0.62	0.54	0.09	1.25	93059
COLUMNS	8668	0.88	0.97	0.15	2	17336

**TOTAL 151099**

APPENDIX C  
COST & SCHEDULE

**PRECAST CONCRETE COST ANALYSIS**

**COLUMNS**

SIZE	LINEAR FOOTAGE	COSTS PER FOOT				COST
		MAT.	LABOR	EQUIP	TOTAL	TOTAL
24" x 24"	2160	74.5	19.55	10.7	104.75	226260

**TOTAL 226260**

**BEAMS**

SIZE	NUMBER	COSTS PER BEAM				COST
		MAT.	LABOR	EQUIP	TOTAL	TOTAL
34IT27	32	1268	88	48	1396	44672
25LB27	25	1268	88	48	1396	34900
26x24	25	1500	141	77	1718	42950

**TOTAL 122522**

**PLANK**

SIZE	SQUARE FOOTAGE	COSTS PER SQUARE FOOT				COST
		MAT.	LABOR	EQUIP	TOTAL	TOTAL
10" HOLLOW CORE	78500	6.1	0.78	0.43	7.31	573835

**TOTAL 573835**

**TOPPING**

SIZE	SQUARE FOOTAGE	COSTS PER SQUARE FOOT				COST
		MAT.	LABOR	EQUIP	TOTAL	TOTAL
2" LT WT CONCRET E	78500	1.04	0.67	0.27	1.98	155430

**TOTAL 155430**

**PRECAST SHEAR WALLS**

SIZE	SQUARE FOOTAGE	COSTS PER SQUARE FOOT				COST
		MAT.	LABOR	EQUIP	TOTAL	TOTAL
10" THICK	8640	12.15	4.35	3.55	20.05	173232

**TOTAL 173232**

APPENDIX C  
COST & SCHEDULE

**STEEL SYSTEM**

MATERIAL	COST
STEEL COLUMNS	\$137,933
STEEL BEAMS	\$408,406
STEEL BRACES	\$136,442
SHEAR STUDS	\$13,865
METAL DECKING	\$111,470
FIREPROOFING	\$151,099
WELDED WIRE FABRIC	\$23,589
CONCRETE SLAB	\$165,635
<b>TOTAL COST</b>	<b>\$1,148,439</b>

MATERIAL	COST
STRUCTURAL STEEL	\$682,780
CONCRETE	\$165,635
DECK/WWF/STUDS	\$300,023
<b>TOTAL</b>	<b>\$1,148,439</b>

**PRECAST SYSTEM**

MATERIAL	COST
PRECAST COLUMNS	\$226,260
PRECAST BEAMS	\$122,522
PRECAST SHEAR WALLS	\$173,232
HOLLOW-CORE PLANK	\$573,835
CONCRETE TOPPING	\$155,430
<b>TOTAL COST</b>	<b>\$1,251,279</b>

MATERIAL	COST
PRECAST CONCRETE	\$1,095,849
CONCRETE TOPPING	\$155,430
<b>TOTAL</b>	<b>\$1,251,279</b>

**DIFFERENCE**

SYSTEM	COST
STEEL	\$1,148,439
PRECAST CONCRETE	\$1,251,279

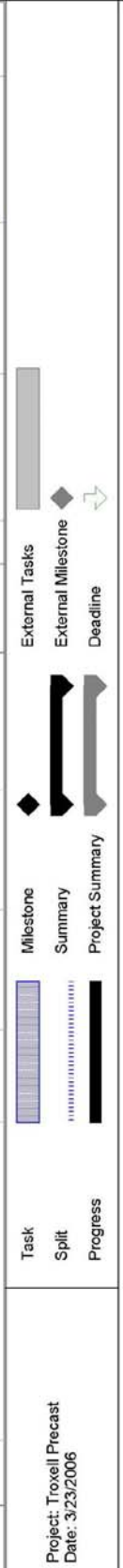
<b>DIFFERENCE</b>	<b>\$102,840</b>
<b>% DIFFERENCE</b>	<b>8.2</b>

COST PER SQUARE FOOT	
STEEL	\$14.63
PRECAST CONCRETE	\$15.94

APPENDIX C  
COST & SCHEDULE

Mike Troxell  
College of Business Administration - NAU  
Precast Package

ID	Task Name	Duration	Start	Finish	Predecessors	Timeline																		
						rch	April	May	June	July														
1	Precast Package	53 days	3/22/2006	6/2/2006		3/5	3/12	3/19	3/26	4/2	4/9	4/16	4/23	4/30	5/7	5/14	5/21	5/28	6/4	6/11	6/18	6/25	7/2	7/9
2	Precast Members	47 days	3/22/2006	5/25/2006																				
3	Precast Columns (1st-2nd)	6 days	3/22/2006	3/29/2006																				
4	Precast Columns (3rd-4th)	6 days	4/26/2006	5/3/2006	3,6,7,11,12																			
5	Precast Columns (5th)	3 days	5/23/2006	5/25/2006	4,8,9,13,14																			
6	Precast Beams (2nd Floor)	1 day	3/31/2006	3/31/2006	3,16																			
7	Precast Beams (3rd Floor)	1 day	4/14/2006	4/14/2006	6,3,11,17																			
8	Precast Beams (4th Floor)	1 day	5/4/2006	5/4/2006	4,7,12,18																			
9	Precast Beams (5th Floor)	1 day	5/18/2006	5/18/2006	8,4,13,19																			
10	Precast Plank	36 days	4/3/2006	5/22/2006																				
11	Precast Plank (2nd Floor)	7 days	4/3/2006	4/11/2006	6																			
12	Precast Plank (3rd Floor)	7 days	4/17/2006	4/25/2006	11,7																			
13	Precast Plank (4th Floor)	7 days	5/5/2006	5/15/2006	12,8																			
14	Precast Plank (5th Floor)	2 days	5/19/2006	5/22/2006	9,13																			
15	Shear Walls	42 days	3/30/2006	6/26/2006																				
16	Shear Walls (1st Floor)	1 day	3/30/2006	3/30/2006	3																			
17	Shear Walls (2nd Floor)	2 days	4/12/2006	4/13/2006	3,6,11																			
18	Shear Walls (3rd Floor)	2 days	4/26/2006	4/27/2006	3,17,7,12																			
19	Shear Walls (4th Floor)	2 days	5/16/2006	5/17/2006	4,18,8,13																			
20	Shear Walls (5th Floor)	1 day	5/26/2006	5/26/2006	5,9,14,19																			
21	Concrete Topping	36 days	4/14/2006	6/2/2006																				
22	Concrete Topping (2nd Floor)	9 days	4/14/2006	4/26/2006	6,11,16,17																			
23	Concrete Topping (3rd Floor)	10 days	5/4/2006	5/17/2006	4,7,12,18,22																			
24	Concrete Topping (4th Floor)	10 days	5/18/2006	5/31/2006	4,8,13,19,23																			
25	Concrete Topping (5th Floor)	2 days	6/1/2006	6/2/2006	5,9,14,20,24																			



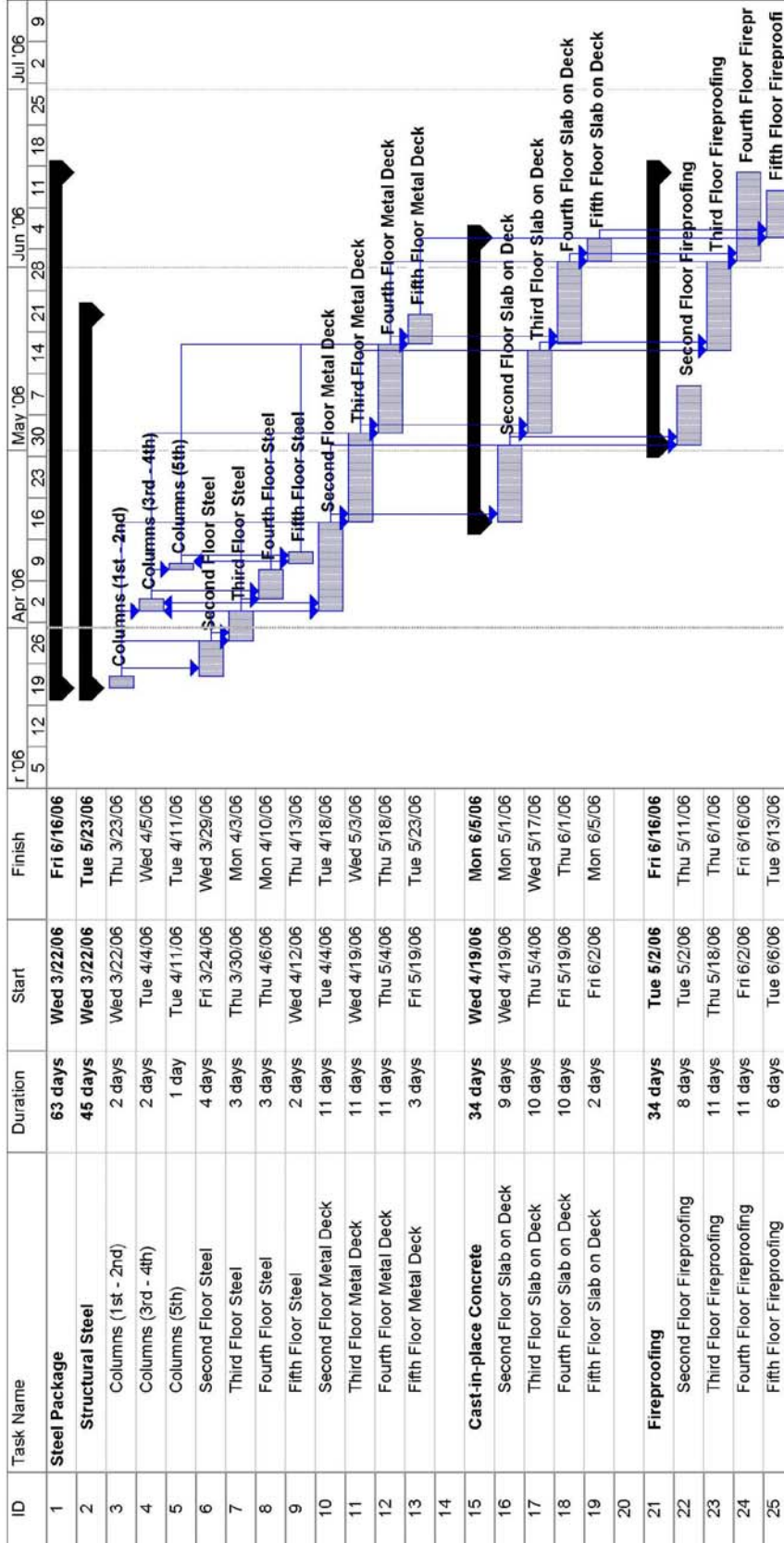
Project: Troxell Precast  
Date: 3/23/2006

Task  
 Split  
 Progress

Milestone  
 Summary  
 Project Summary

External Tasks  
 External Milestone  
 Deadline

APPENDIX C  
COST & SCHEDULE



Project: Troxell Steel  
Date: Sat 4/1/06

Task: [Bar with vertical lines]

Split: [Bar with horizontal lines]

Progress: [Solid black bar]

Milestone: [Diamond symbol]

Summary: [Bar with vertical lines]

Project Summary: [Bar with vertical lines]

External Tasks: [Bar with vertical lines]

External Milestone: [Diamond symbol]

Deadline: [Arrow symbol]

Page 1



## APPENDIX D



## ACOUSTICAL ANALYSIS



APPENDIX D  
ACOUSTICAL ANALYSIS

ACOUSTICAL ANALYSIS - OFFICE

FREQUENCY HZ	SOURCE			RECEIVER			SOURCE L <sub>W</sub>
	$\alpha_{\text{WALLS}}$	$\alpha_{\text{CEILING}}$	$\alpha_{\text{FLOOR}}$	$\alpha_{\text{WALLS}}$	$\alpha_{\text{CEILING}}$	$\alpha_{\text{FLOOR}}$	
125	0.10	0.01	0.29	0.55	0.02	0.76	88
250	0.05	0.01	0.10	0.14	0.03	0.93	89
500	0.06	0.02	0.05	0.08	0.03	0.83	82
1000	0.07	0.02	0.04	0.04	0.03	0.99	77
2000	0.09	0.02	0.07	0.12	0.03	0.99	71
4000	0.08	0.02	0.09	0.11	0.02	0.94	67

FREQUENCY HZ	$\alpha_{\text{SAB/AVG}}$	S $\alpha$	R <sub>Ts</sub>	$\alpha_{\text{SAB/AVG}}$	S $\alpha$	R <sub>Tr</sub>	RC-30 LP	SOURCE L <sub>P</sub>	NR	TL
125	0.1303	201.1	231.2	0.4935	25.7	50.8	45	70.36	25	22.9
250	0.0530	81.8	86.4	0.2601	13.6	18.3	40	75.64	36	37.6
500	0.0448	69.2	72.4	0.2036	10.6	13.3	35	69.40	34	37.8
1000	0.0457	70.5	73.9	0.2060	10.7	13.5	30	64.31	34	37.6
2000	0.0627	96.7	103.2	0.2577	13.4	18.1	25	56.86	32	33.9
4000	0.0648	100.0	106.9	0.2407	12.5	16.5	20	52.71	33	35.2

SOURCE		RECEIVER		
A <sub>WALLS</sub>	A <sub>FLOOR</sub>	A <sub>WALLS</sub>	A <sub>FLOOR</sub>	A <sub>PARTITION</sub>
606.5	468	468	33.7	9.2
AREAS ARE IN METERS SQUARED!!!				

APPENDIX D  
ACOUSTICAL ANALYSIS

ACOUSTICAL ANALYSIS - CLASSROOM

FREQUENCY HZ	SOURCE		RECEIVER		SOURCE L <sub>w</sub>
	$\alpha_{\text{WALLS}}$	$\alpha_{\text{CEILING}}$	$\alpha_{\text{WALLS}}$	$\alpha_{\text{FLOOR}}$	
125	0.10	0.01	0.55	0.02	88
250	0.05	0.01	0.14	0.03	89
500	0.06	0.02	0.08	0.03	82
1000	0.07	0.02	0.04	0.03	77
2000	0.09	0.02	0.12	0.03	71
4000	0.08	0.02	0.11	0.02	67

FREQUENCY HZ	$\alpha_{\text{SAB/AVG}}$	S $\alpha$	R <sub>TS</sub>	$\alpha_{\text{SAB/AVG}}$	S $\alpha$	R <sub>TR</sub>	RC-30 LP	SOURCE L <sub>p</sub>	NR	TL
125	0.1303	201.1	231.2	0.4523	213.1	389.1	40	70.4	30	26.0
250	0.0530	81.8	86.4	0.3476	163.7	251.0	35	75.6	41	38.2
500	0.0448	69.2	72.4	0.2937	138.3	195.9	30	69.4	39	38.1
1000	0.0457	70.5	73.9	0.3269	154.0	228.8	25	64.3	39	37.3
2000	0.0627	96.7	103.2	0.3581	168.7	262.8	20	56.9	37	34.2
4000	0.0648	100.0	106.9	0.3359	158.2	238.3	15	52.7	38	35.5

SOURCE		RECEIVER		
A <sub>WALLS</sub>	A <sub>FLOOR</sub>	A <sub>CEILING</sub>	A <sub>FLOOR</sub>	A <sub>PARTITION</sub>
606.5	468	468	143.8	143.8
AREAS ARE IN METERS SQUARED!!				