

**Lauren Wilke**  
Structural Option  
Advisor: M.K. Parfitt

**Boys Bear Country**  
Pigeon Forge, TN



**Appendix Section 1:  
Open Web Steel Joist System**

OPEN WEB STEEL JOIST SYSTEM TO REPLACE TYPICAL 30'x30' BAY.

@ 3' O.C. SPACING. - JOISTS

100 psf LL = 800 plf U

65 psf DL = 495 plf U

495 plf TL.

MINIMUM JOIST: 22K9

U = 349 plf > 300 plf OK

WT = 11.3 plf

TL = 497 plf > 495 plf OK

← CONTROLS.

24K8

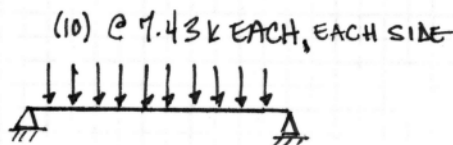
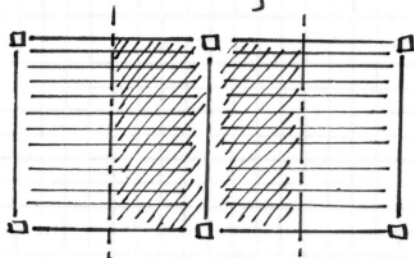
U = 387 plf > 300 plf OK

WT = 11.5 plf

TL = 500 plf > 495 plf OK

**USE 22K9 JOISTS @ 3' O.C.**

GIRDER SUPPORTING JOISTS.



$$P = (495 \text{ plf})(30')/2 = 7.43 \text{ k.}$$

AS DISTRIBUTED LOAD:

$$(10)(7.43 \text{ k})/30' = (2.5 \text{ klf})(z) = 5 \text{ klf.}$$

$$V = (10)(7.43 \text{ k}) = 74.3 \text{ k}$$

$$M = \frac{(5.0 \text{ klf})(30')^2}{8} = 563 \text{ k}$$

[TABLE 3-19] AISC 15th

$$c/2 = 4.5" \quad M = 608 \text{ k} \geq 563 \text{ k} \quad \underline{\text{OK}}$$

$$PNA = 7$$

$$\Sigma Q_n = 251 \text{ k}$$

$$a = 1.09" < 2" \quad \underline{\text{OK}}$$

[TABLE 3-21]

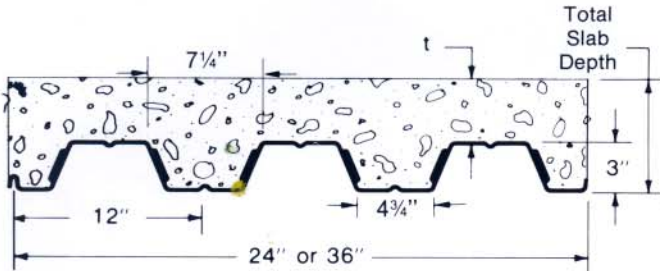
$$Q_n = 17.1 \text{ k} \quad \frac{251 \text{ k}}{17.1 \text{ k}} = 14.67 \rightarrow 15 \text{ STUDS.}$$

**USE W24x68 W/ (30) 3/4"  $\phi$  STUDS.**

NOTE: SAME AS EXISTING.

## 3 VLI

Maximum Sheet Length 42'-0"  
 Extra Charge for Lengths Under 6'-0"  
 ICBO Approved (No. 3415)



### STEEL SECTION PROPERTIES

Fy= 40 KSI

Deck Type	Design Thick.	Weight PSF	Ip in <sup>4</sup> /Ft	In in <sup>4</sup> /Ft	Sp in <sup>3</sup> /Ft	Sn in <sup>3</sup> /Ft
3VLI22	0.0295	1.77	0.746	0.745	0.429	0.442
3VLI21	0.0329	1.97	0.850	0.848	0.495	0.511
3VLI20	0.0358	2.14	0.938	0.937	0.553	0.572
3VLI19	0.0418	2.50	1.105	1.103	0.677	0.700
3VLI18	0.0474	2.84	1.251	1.251	0.795	0.803
3VLI17	0.0538	3.22	1.421	1.421	0.913	0.913
3VLI16	0.0598	3.58	1.580	1.580	1.013	1.013

### (N=9) NORMAL WEIGHT CONCRETE (145 PCF)

Total Slab Depth	Deck Type	SDI Max. Unshored Clear Span			Superimposed Live Load, PSF														
		1 Span	2 Span	3 Span	Clear Span (ft.-in.)														
5"	3VLI22	7'-8"	9'-7"	9'-7"	216	195	149	133	120	109	99	90	83	76	70	64	59	54	50
	3VLI21	8'-11"	11'-3"	11'-4"	230	206	187	170	128	116	106	96	88	81	74	68	63	58	54
	3VLI20	9'-6"	11'-11"	12'-4"	241	216	196	178	163	150	111	101	93	85	78	72	66	61	57
	3VLI19	10'-8"	13'-2"	13'-7"	265	237	214	194	178	163	151	140	102	94	86	79	73	67	62
	3VLI18	11'-8"	14'-1"	14'-6"	289	261	238	218	201	186	173	161	151	142	106	98	92	86	80
	3VLI17	12'-7"	14'-11"	15'-5"	309	278	253	231	212	196	182	170	159	150	141	133	97	91	85
44 PSF	3VLI16	13'-4"	15'-8"	15'-11"	327	294	267	243	223	206	191	178	167	156	147	139	132	96	89
	3VLI22	7'-0"	8'-9"	8'-9"	247	190	170	152	137	124	113	103	94	87	80	73	67	62	57
	3VLI21	8'-4"	10'-4"	10'-4"	262	235	213	162	146	133	120	110	101	92	85	78	72	66	61
	3VLI20	9'-0"	11'-5"	11'-9"	275	247	223	203	186	140	127	116	106	97	89	82	76	70	65
	3VLI19	10'-1"	12'-7"	13'-0"	302	270	244	222	203	186	172	128	117	107	98	90	83	77	71
	3VLI18	11'-1"	13'-5"	13'-11"	330	298	271	248	229	212	197	184	173	130	121	112	105	98	92
50 PSF	3VLI17	11'-11"	14'-3"	14'-9"	352	317	288	263	242	224	208	194	182	171	128	119	111	104	97
	3VLI16	12'-8"	15'-0"	15'-5"	373	335	304	277	255	235	218	203	190	178	168	159	117	109	102
	3VLI22	6'-5"	8'-1"	8'-1"	242	214	191	171	154	140	127	116	106	97	89	82	76	70	65
	3VLI21	7'-8"	9'-7"	9'-7"	294	264	204	183	165	149	135	124	113	104	95	88	81	75	69
	3VLI20	8'-7"	10'-11"	10'-11"	309	277	250	228	173	157	143	130	119	109	100	92	85	79	73
	3VLI19	9'-8"	12'-1"	12'-6"	339	304	274	249	227	209	157	143	131	120	110	102	94	87	80
57 PSF	3VLI18	10'-7"	12'-11"	13'-4"	370	334	304	279	257	238	221	207	158	146	136	126	118	110	103
	3VLI17	11'-5"	13'-9"	14'-2"	395	356	323	296	272	251	233	218	204	155	144	134	125	117	109
	3VLI16	12'-0"	14'-5"	14'-11"	400	376	341	311	286	264	245	228	213	200	189	141	132	123	115
	3VLI22	6'-0"	7'-5"	7'-5"	268	237	212	190	171	155	141	129	118	108	99	91	84	78	72
	3VLI21	7'-1"	8'-10"	8'-10"	326	254	226	203	183	165	150	137	126	115	106	97	90	83	77
	3VLI20	8'-1"	10'-1"	10'-1"	343	307	278	214	192	174	158	144	132	121	111	103	95	87	81
63 PSF	3VLI19	9'-3"	11'-7"	12'-0"	377	337	304	276	252	192	175	159	146	134	123	113	104	96	89
	3VLI18	10'-1"	12'-5"	12'-10"	400	371	338	309	285	264	246	189	175	162	151	140	131	122	115
	3VLI17	10'-11"	13'-3"	13'-8"	400	395	359	328	302	279	259	242	186	172	160	149	139	130	121
	3VLI16	11'-6"	13'-11"	14'-4"	400	400	378	345	317	293	272	253	237	222	169	157	146	136	128
	3VLI22	5'-7"	6'-11"	6'-11"	295	261	233	209	188	171	155	142	130	119	109	101	93	86	79
	3VLI21	6'-7"	8'-3"	8'-3"	316	279	249	223	201	182	165	151	138	127	116	107	99	91	84
69 PSF	3VLI20	7'-6"	9'-5"	9'-5"	377	338	262	235	212	192	174	159	145	133	122	113	104	96	89
	3VLI19	8'-11"	11'-3"	11'-7"	400	370	334	303	234	211	192	175	160	147	135	124	115	106	98
	3VLI18	9'-9"	12'-0"	12'-5"	400	400	371	340	313	290	226	208	192	178	166	154	144	135	126
	3VLI17	10'-6"	12'-9"	13'-2"	400	400	394	360	331	306	285	265	204	189	176	164	153	143	134
	3VLI16	11'-1"	13'-5"	13'-10"	400	400	379	348	322	298	278	260	200	185	172	161	150	140	
	3VLI22	5'-2"	6'-6"	6'-6"	321	285	254	228	205	186	169	154	141	130	119	110	101	93	86
75 PSF	3VLI21	6'-2"	7'-9"	7'-9"	344	304	271	243	219	198	180	164	150	138	127	117	108	100	92
	3VLI20	7'-1"	8'-10"	8'-10"	400	321	286	256	231	209	190	173	158	145	134	123	114	105	97
	3VLI19	8'-7"	10'-10"	11'-2"	400	400	364	331	255	231	209	191	175	160	147	136	125	116	107
	3VLI18	9'-4"	11'-7"	12'-0"	400	400	400	370	341	269	246	227	210	195	181	168	157	147	138
	3VLI17	10'-1"	12'-4"	12'-9"	400	400	400	393	361	334	310	241	223	206	192	179	167	156	146
	3VLI16	10'-8"	13'-0"	13'-5"	400	400	400	400	380	351	325	303	235	218	202	188	175	164	153

- NOTES:
- Minimum exterior bearing length required is 2.5 inches. Minimum interior bearing length required is 5.0 inches. If these minimum lengths are not provided, web crippling must be checked.
  - Always contact Vulcraft when using loads in excess of 200 psf. Such loads often result from concentrated, dynamic, or long term load cases for which reductions due to bond breakage, concrete creep, etc. should be evaluated.
  - All fire rated assemblies are subject to an upper live load limit of 250 psf.
  - Inquire about material availability of 17, 19 & 21 gage.

**STANDARD LOAD TABLE/OPEN WEB STEEL JOISTS, K-SERIES**  
Based on a Maximum Allowable Tensile Stress of 30 ksi

Joist Designation	28K6	28K7	28K8	28K9	28K10	28K12	30K7	30K8	30K9	30K10	30K11	30K12
Depth (In.)	28	28	28	28	28	28	30	30	30	30	30	30
Approx. Wt. (lbs./ft.)	11.4	11.8	12.7	13.0	14.3	17.1	12.3	13.2	13.4	15.0	16.4	17.6
Span (ft.)												
28	548 541 486	550 543 522	550 543 522	550 543 522	550 543 522	550 543 522						
29	511 486	550 522	550 522	550 522	550 522	550 522						
30	477 439	531 486	550 500	550 500	550 500	550 500	550 543	550 543	550 543	550 543	550 543	550 543
31	446 397	497 440	550 480	550 480	550 480	550 480	534 508	550 520	550 520	550 520	550 520	550 520
32	418 361	466 400	515 438	549 463	549 463	549 463	501 461	549 500	549 500	549 500	549 500	549 500
33	393 329	438 364	484 399	527 432	532 435	532 435	471 420	520 460	532 468	532 468	532 468	532 468
34	370 300	412 333	466 364	496 395	516 410	516 410	443 384	490 420	516 441	516 441	516 441	516 441
35	349 275	389 305	430 333	468 361	501 389	501 389	418 351	462 384	501 415	501 415	501 415	501 415
36	330 252	367 280	406 306	442 332	487 366	487 366	395 323	436 353	475 383	487 392	487 392	487 392
37	312 232	348 257	384 284	418 305	474 344	474 344	373 297	413 325	449 352	474 374	474 374	474 374
38	296 214	329 237	364 260	396 282	461 325	461 325	354 274	391 300	426 325	461 353	461 353	461 353
39	280 198	313 219	346 240	376 260	447 306	449 308	336 253	371 277	404 300	449 333	449 333	449 333
40	266 183	297 203	328 222	357 241	424 284	438 291	319 234	353 256	384 278	438 315	438 315	438 315
41	253 170	283 189	312 206	340 224	404 263	427 277	303 217	335 238	365 258	427 300	427 300	427 300
42	241 158	269 175	297 192	324 208	384 245	417 264	289 202	320 221	348 240	413 282	417 284	417 284
43	230 147	257 163	284 179	309 194	367 228	407 252	276 188	305 206	332 223	394 263	407 270	407 270
44	220 137	245 152	271 167	295 181	350 212	398 240	263 176	291 192	317 208	376 245	398 258	398 258
45	210 128	234 142	259 156	282 169	334 198	389 229	251 164	278 179	303 195	359 229	389 246	389 246
46	201 120	224 133	248 146	270 158	320 186	380 219	241 153	266 168	290 182	344 214	380 236	380 236
47	192 112	214 125	237 136	258 148	306 174	372 210	230 144	255 157	277 171	329 201	372 226	372 226
48	184 105	206 117	227 128	247 139	294 163	365 201	221 135	244 148	266 160	315 188	362 215	365 216
49	177 99	197 110	218 120	237 130	282 153	357 193	212 127	234 139	255 150	303 177	347 202	357 207
50	170 93	189 103	209 113	228 123	270 144	350 185	203 119	225 130	245 141	291 166	333 190	350 199
51	163 88	182 97	201 106	219 115	260 136	338 175	195 112	216 123	235 133	279 157	320 179	343 192
52	157 83	175 92	193 100	210 109	250 128	325 165	188 106	208 116	226 126	268 148	308 169	336 184
53	151 78	168 87	186 95	203 103	240 121	313 156	181 100	200 109	218 119	258 140	296 159	330 177
54	145 74	162 82	179 89	195 97	232 114	301 147	174 94	192 103	209 112	249 132	285 150	324 170
55	140 70	156 77	173 85	188 92	223 108	290 139	168 89	185 98	202 106	240 125	275 142	312 161
56	135 66	151 73	166 80	181 87	215 102	280 132	162 84	179 92	195 100	231 118	265 135	301 153
57							156 80	173 88	188 95	223 112	256 128	290 145
58							151 76	167 83	181 90	215 106	247 121	280 137
59							146 72	161 79	175 86	208 101	239 115	271 130
60							141 69	156 75	169 81	201 96	231 109	262 124



## STANDARD LOAD TABLE/OPEN WEB STEEL JOISTS, K-SERIES

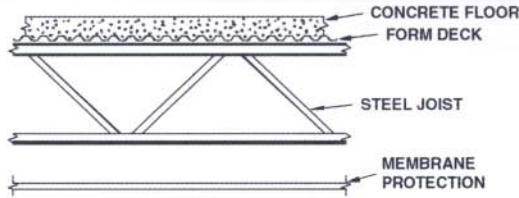
Based on a Maximum Allowable Tensile Stress of 30 ksi

Joist Designation	24K4	24K5	24K6	24K7	24K8	24K9	24K10	24K12	26K5	26K6	26K7	26K8	26K9	26K10	26K12
Depth (In.)	24	24	24	24	24	24	24	24	26	26	26	26	26	26	26
Approx. Wt. (lbs./ft.)	8.4	9.3	9.7	10.1	11.5	12.0	13.1	16.0	9.8	10.6	10.9	12.1	12.2	13.8	16.6
Span (ft.)															
↓ 24	520 516	550 544	550 544	550 544	550 544	550 544	550 544	550 544							
25	479 456	540 511	550 520	550 520	550 520	550 520	550 520	550 520							
26	442 405	499 453	543 493	550 499	550 499	550 499	550 499	550 499	542 535	550 541	550 541	550 541	550 541	550 541	550 541
27	410 361	462 404	503 439	550 479	550 479	550 479	550 479	550 479	502 477	547 519	550 522	550 522	550 522	550 522	550 522
28	381 323	429 362	467 393	521 436	550 456	550 456	550 456	550 456	466 427	508 464	550 501	550 501	550 501	550 501	550 501
29	354 290	400 325	435 354	485 392	536 429	550 436	550 436	550 436	434 384	473 417	527 463	550 479	550 479	550 479	550 479
30	331 262	373 293	406 319	453 353	500 387	544 419	550 422	550 422	405 346	441 377	492 417	544 457	550 459	550 459	550 459
31	310 237	349 266	380 289	424 320	468 350	510 379	550 410	550 410	379 314	413 341	460 378	509 413	550 444	550 444	550 444
32	290 215	327 241	357 262	397 290	439 318	478 344	549 393	549 393	356 285	387 309	432 343	477 375	519 407	549 431	549 431
33	273 196	308 220	335 239	373 265	413 289	449 313	532 368	532 368	334 259	364 282	406 312	448 342	488 370	532 404	532 404
34	257 179	290 201	315 218	351 242	388 264	423 286	502 337	516 344	315 237	343 257	382 285	422 312	459 338	516 378	516 378
35	242 164	273 184	297 200	331 221	366 242	399 262	473 308	501 324	297 217	323 236	360 261	398 286	433 310	501 356	501 356
36	229 150	258 169	281 183	313 203	346 222	377 241	447 283	487 306	280 199	305 216	340 240	376 263	409 284	486 334	487 334
37	216 138	244 155	266 169	296 187	327 205	356 222	423 260	474 290	265 183	289 199	322 221	356 242	387 262	460 308	474 315
38	205 128	231 143	252 156	281 172	310 189	338 204	401 240	461 275	251 169	274 184	305 204	337 223	367 241	436 284	461 299
39	195 118	219 132	239 144	266 159	294 174	320 189	380 222	449 261	238 156	260 170	289 188	320 206	348 223	413 262	449 283
40	185 109	208 122	227 133	253 148	280 161	304 175	361 206	438 247	227 145	247 157	275 174	304 191	331 207	393 243	438 269
41	176 101	198 114	216 124	241 137	266 150	290 162	344 191	427 235	215 134	235 146	262 162	289 177	315 192	374 225	427 256
42	168 94	189 106	206 115	229 127	253 139	276 151	327 177	417 224	205 125	224 136	249 150	275 164	300 178	356 210	417 244
43	160 88	180 98	196 107	219 118	242 130	263 140	312 165	406 213	196 116	213 126	238 140	263 153	286 166	339 195	407 232
44	153 82	172 92	187 100	209 110	231 121	251 131	298 154	387 199	187 108	204 118	227 131	251 143	273 155	324 182	398 222
45	146 76	164 86	179 93	199 103	220 113	240 122	285 144	370 185	179 101	194 110	217 122	240 133	261 145	310 170	389 212
46	139 71	157 80	171 87	191 97	211 106	230 114	272 135	354 174	171 95	186 103	207 114	229 125	250 135	296 159	380 203
47	133 67	150 75	164 82	183 90	202 99	220 107	261 126	339 163	164 89	178 96	199 107	219 117	239 127	284 149	369 192
48	128 63	144 70	157 77	175 85	194 93	211 101	250 118	325 153	157 83	171 90	190 100	210 110	229 119	272 140	353 180
49									150 78	164 85	183 94	202 103	220 112	261 131	339 169
50									144 73	157 80	175 89	194 97	211 105	250 124	325 159
51									139 69	151 75	168 83	186 91	203 99	241 116	313 150
52									133 65	145 71	162 79	179 86	195 93	231 110	301 142



# FIRE-RESISTANCE RATINGS WITH STEEL JOISTS

## FLOOR-CEILING ASSEMBLIES WITH MEMBRANE PROTECTION



Restrained Assembly Rating	Type of Protection System	Concrete		Minimum Joist Size See Note #3 & #4	Maximum Joist Spacing See Note #2	Primary Support Member Min. Depth & Wt. See Note #3	U. L. Design Number
		Thickness Above Deck	Type				
1 Hr.	Exposed Grid	2 1/2"	NW	10K1	72"	20G @14.0 plf. Min. Area Top & Bottom Chord 1.12 Sq. Inch	G256
			LW, NW	12K1, 18LH02	Unrestricted	---	D216
1 1/2 Hr.	Exposed Grid	2 1/2"	NW	10K1	48"	20G @13.0 plf.	G228
		2"	NW	10K1	48"	20G @13.0 plf.	G229
		2 1/2"	NW	10K1	48"	20G @13.0 plf.	G243
	Gypsum Brd.	2"	LW, NW	12K1	48"	----	G502
	Cementitious	2 1/2"	LW, NW	16K6 Min. 3/4" dia. web	Unrestricted	20G @20.0 plf.	G701
Sprayed Fiber	2 1/2"	LW, NW	16K6 Min. 3/4" dia. web	Unrestricted	20G @20.0 plf.	G801	
2 Hr.	Concealed Grid	2 1/4"	NW	10K1	48"	20G @13.0 plf.	G023
		2 1/2"	NW	8K1, 10K1	48"	20G @13.0 plf.	G031
		2 1/2"	NW	10K1	48"	20G @13.0 plf.	G036
	Exposed Grid	2 1/2"	NW	10K1	48"	W6x12	G213
			NW	10K1	48"	W8x31	G227
			NW	10K1	48"	20G @13.0 plf.	G228
			NW	10K1	48"	20G @13.0 plf.	G243
			NW	10K1	72"	20G @14.0 plf.	G256
	LW, NW	12K1, 18LH02	Unrestricted	Min. Area Top & Bottom Chord 1.12 Sq. inch	---	D216	
	Gypsum Board	2 1/2"	NW	10K1	48"	----	G505
			NW	10K1	48"	20G @14.0 plf. Min. Area Top & Bottom Chord 1.12 Sq. inch	G514
			NW LW,NW	10K1 10K1	48" 48"	20G @ 13.0 plf. 20G @ 13.0 plf.	G253 G529
			NW	12K1	Unrestricted	20G @ 20.0 plf.	D502
	Cementitious	2 1/2"	LW, NW	16K6 Min. 3/4" dia. web	Unrestricted	20G @ 20.0 plf.	D701
Sprayed Fiber	2 1/2"	LW, NW	16K6 Min.3/4" dia. web	Unrestricted	20G @ 20.0 plf.	D801	
3 Hr.	Concealed Grid	3 1/2"	NW	10K1	48"	20G @ 13.0 plf.	G033
		3 1/2"	NW	10K1	48"	20G @ 13.0 plf.	G036
	Exposed Grid	3 1/2"	NW	10K1	48"	W6x12	G213
			NW	10K1	48"	20G @ 13.0 plf.	G229
			NW	10K1	48"	20G @14.0 plf. Min. Area Top & Bottom Chord 1.12 Sq. inch	G256
			NW	12K1, 18LH02	Unrestricted	----	D216
			NW	10K1	48"	20 G @ 13.0 plf.	G523
	Gypsum Board	2 3/4"	LW, NW	10K1	48"	20 G @ 13.0 plf	G529

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## Appendix Section 2: Two-Way Concrete Slab System

$f'_c = 3,000$  psi  
Grade 60 Bars

FLAT SLAB SYSTEM				SQUARE EDGE PANEL With Drop Panels										SQUARE INTERIOR PANEL With Drop Panels (2)				No Beams											
SPAN	Factored Superimposed Load (psf)	Square Drop Panel	Square Column $\ell_c = 12'-0"$ (3)	REINFORCING BARS (E. W.)										REINFORCING BARS (E. W.)				Concrete											
				Column Strip (1)		Middle Strip		Total Steel (psf)		Edge (-) (ft-k)		Bot. (+) (ft-k)		Int. (-) (ft-k)		Col. Strip	Mid. Strip		Total Steel (psf)		Concrete								
$c-c$	$\ell_1 = \ell_2$ (ft)	Depth (in.)	Width (ft)	Top Ext.	Bot.	Top Int.	Bot.	Top Int.	Bot.	Top Int.	Bot.	Top Int.	Bot.	Top Int.	Bot.	Top Int.	Bot.	Top Int.	Bot.	Size (in.)	$\alpha_{rc}$	Size (in.)	$\alpha_{rc}$	Size (in.)	$\alpha_{rc}$	Size (in.)	$\alpha_{rc}$	Size (in.)	$\alpha_{rc}$
$h = 11$ in. = TOTAL SLAB DEPTH BETWEEN DROP PANELS (CONTINUED)																													
30	100	7	10.00	14-#5	11-#8	17-#6	10-#7	10-#6	3.40	77.1	555.7	689.2	100	12	0.072	15-#6	11-#6	12-#5	12-#5	12-#5	2.77	0.981							
30	200	7	10.00	14-#5	14-#8	16-#7	12-#7	10-#7	4.19	185.1	687.2	884.5	200	18	0.262	14-#7	20-#5	11-#6	13-#5	13-#5	3.40	0.981							
30	300	11	10.00	14-#5	22-#7	16-#7	11-#8	15-#6	4.92	331.1	801.9	1073.5	300	22	0.453	14-#7	10-#8	10-#7	16-#5	16-#5	4.09	1.018							
30	400	11	12.00	18-#6	22-#7	14-#8	11-#8	10-#8	5.49	687.4	805.8	1206.1	400	25	0.615	22-#6	17-#7	12-#7	14-#6	14-#6	4.92	1.063							
31	100	9	10.33	14-#5	16-#7	23-#5	14-#6	15-#5	3.42	81.3	618.7	765.8	100	12	0.068	15-#6	17-#5	13-#5	12-#5	2.75	1.000								
31	200	9	10.33	14-#5	20-#7	16-#7	13-#7	19-#5	4.34	230.9	749.3	974.9	200	18	0.255	14-#7	22-#5	12-#6	15-#5	3.55	1.000								
31	300	11	10.33	14-#5	18-#8	14-#8	12-#8	13-#7	5.25	362.5	890.1	1189.8	300	22	0.443	16-#7	15-#7	15-#6	18-#5	4.44	1.018								
32	100	9	10.66	15-#5	14-#8	18-#6	12-#7	12-#6	3.74	88.7	682.4	844.3	100	12	0.067	16-#6	19-#5	15-#5	13-#5	2.93	1.000								
32	200	9	10.66	15-#5	17-#8	18-#7	11-#8	15-#6	4.70	231.7	828.0	1076.1	200	18	0.251	16-#7	13-#7	19-#5	16-#5	3.88	1.000								
32	300	11	10.66	15-#5	20-#8	15-#8	13-#8	11-#8	5.61	395.5	984.6	1314.2	300	22	0.433	17-#7	22-#6	13-#7	20-#5	4.69	1.018								

$h = 11\frac{1}{2}$ in. = TOTAL SLAB DEPTH BETWEEN DROP PANELS																																	
SPAN	Factored Superimposed Load (psf)	Square Drop Panel	Square Column $\ell_c = 12'-0"$ (3)	REINFORCING BARS (E. W.)										REINFORCING BARS (E. W.)				Concrete															
				Column Strip (1)		Middle Strip		Total Steel (psf)		Edge (-) (ft-k)		Bot. (+) (ft-k)		Int. (-) (ft-k)		Col. Strip	Mid. Strip		Total Steel (psf)		Concrete												
$c-c$	$\ell_1 = \ell_2$ (ft)	Depth (in.)	Width (ft)	Top Ext.	Bot.	Top Int.	Bot.	Top Int.	Bot.	Top Int.	Bot.	Top Int.	Bot.	Top Int.	Bot.	Top Int.	Bot.	Top Int.	Bot.	Top Int.	Bot.	Top Int.	Bot.	Top Int.	Bot.	Top Int.	Bot.	Top Int.	Bot.	Top Int.	Bot.	Top Int.	Bot.
$h = 11\frac{1}{2}$ in. = TOTAL SLAB DEPTH BETWEEN DROP PANELS																																	
24	100	3	8.00	11-#5	9-#6	11-#6	10-#5	10-#5	2.60	43.1	284.2	353.8	100	12	0.080	14-#5	10-#5	10-#5	10-#5	2.48	0.986												
24	200	3	8.00	11-#5	11-#6	14-#6	8-#6	10-#5	2.93	100.8	347.6	450.0	200	17	0.252	18-#5	10-#5	10-#5	10-#5	2.70	0.986												
24	300	5	8.00	11-#5	13-#6	11-#7	12-#5	10-#5	3.18	180.7	398.6	539.4	300	21	0.471	13-#6	12-#5	10-#5	10-#5	2.90	1.004												
24	400	7	8.00	11-#5	11-#7	11-#7	10-#6	12-#5	3.55	254.3	453.8	631.6	400	23	0.597	14-#6	14-#5	8-#6	10-#5	3.16	1.023												
24	500	7	8.00	14-#5	10-#8	13-#7	16-#5	10-#6	4.25	319.6	523.7	726.6	500	24	0.675	12-#7	9-#7	9-#6	8-#6	3.81	1.023												
24	600	9	9.60	11-#6	16-#7	13-#7	8-#8	11-#6	4.84	396.6	644.8	823.1	600	24	0.613	12-#7	15-#6	10-#6	10-#6	4.25	1.078												
24	700	11	9.60	12-#6	20-#7	13-#7	12-#7	8-#8	5.70	465.0	746.4	919.9	700	24	0.589	12-#7	14-#7	16-#5	9-#7	4.97	1.105												
25	100	3	8.33	12-#5	15-#5	18-#5	11-#5	11-#5	2.78	48.2	322.6	401.4	100	12	0.078	16-#5	11-#5	11-#5	11-#5	2.66	0.986												
25	200	3	8.33	12-#5	13-#6	12-#7	12-#5	11-#5	3.14	112.3	394.1	509.5	200	18	0.294	14-#6	11-#5	11-#5	11-#5	2.88	0.986												
25	300	5	8.33	12-#5	11-#7	13-#7	10-#6	12-#5	3.53	202.5	454.5	613.8	300	21	0.458	15-#6	14-#5	11-#5	11-#5	3.16	1.004												
25	400	7	8.33	13-#5	17-#6	13-#7	11-#6	10-#6	3.85	285.4	518.0	719.2	400	23	0.580	12-#7	16-#5	12-#5	11-#5	3.42	1.023												
25	500	9	8.33	14-#5	11-#8	13-#7	10-#7	11-#6	4.36	350.5	588.8	826.8	500	25	0.716	12-#7	13-#6	10-#6	12-#5	3.79	1.041												
25	600	9	10.00	18-#5	14-#8	12-#8	9-#8	10-#7	5.31	444.3	707.1	934.5	600	25	0.675	18-#6	10-#8	16-#5	15-#5	4.59	1.078												
25	700	11	10.00	13-#6	22-#7	12-#8	15-#7	14-#6	6.18	521.3	824.5	1044.5	700	25	0.653	26-#5	15-#7	10-#7	10-#7	5.34	1.105												
26	100	5	8.66	12-#5	9-#7	12-#6	11-#5	11-#5	2.75	51.6	366.7	455.1	100	12	0.073	15-#5	11-#5	11-#5	11-#5	2.52	1.004												
26	200	5	8.66	12-#5	11-#7	12-#7	10-#6	11-#5	3.28	122.9	448.3	577.9	200	18	0.278	14-#6	9-#6	11-#5	11-#5	2.90	1.004												
26	300	7	8.66	12-#5	17-#6	23-#5	11-#6	13-#5	3.56	220.2	519.0	696.9	300	21	0.431	15-#6	15-#5	12-#5	11-#5	3.13	1.023												
26	400	9	8.66	12-#5	11-#8	13-#7	10-#7	15-#5	4.11	311.7	589.7	813.9	400	24	0.620	12-#7	18-#5	10-#6	12-#5	3.55	1.041												
26	500	9	8.66	16-#5	17-#7	12-#8	11-#7	10-#7	4.83	391.7	668.9	936.9	500	25	0.697	18-#6	11-#7	16-#5	12-#5	4.18	1.041												
26	600	11	10.39	12-#6	20-#7	12-#8	10-#8	11-#7	5.48	486.2	788.3	1059.3	600	26	0.716	26-#5	18-#6	10-#7	10-#7	4.75	1.105												

(Continued)

NOTES (1) 50 per cent of these bars may be placed in the middle third of column strip. (2) Drop panels same size as for edge panels. (3) Same column size and height above and below slab.



FLAT SLAB SYSTEM				SQUARE EDGE PANEL With Drop Panels										SQUARE INTERIOR PANEL With Drop Panels (3)										No Beams								
f'c = 3,000 psi Grade 60 Bars				Square Drop Panel				Square Column ℓc = 12'-0" (3)				REINFORCING BARS (E. W.)				REINFORCING BARS (E. W.)				Square Column ℓc = 12'-0" (3)				REINFORCING BARS (E. W.)				Concrete (cu. ft / sq. ft)				
SPAN c-c. ℓ1 = ℓ2 (ft)	Factored Superim- posed Load (psf)	Depth (in.)	Width (ft)	Top Ext.	Bot.	Top Int.	Bot.	Total Steel (psf)	MOMENTS		Edge (-) (ft-k)	Bot. (+) (ft-k)	Int. (-) (ft-k)	Top Bot.	Top Bot.	Top Bot.	Top Bot.	Size (in.)	αcc	Factored Superim- posed Load (psf)	Size (in.)	αcc	Top Bot.	Top Bot.	Top Bot.	Top Bot.	Total Steel (psf)	Concrete (cu. ft / sq. ft)				
									Top	Bot.																			Col. Strip	Mid. Strip	Col. Strip	Mid. Strip
<b>h = 12 in. = TOTAL SLAB DEPTH BETWEEN DROP PANELS</b>																																
25	100	3	8.33	12-#5	10-#6	18-#5	11-#5	11-#5	2.76	45.8	333.6	413.6	100	12	0.072	16-#5	11-#5	11-#5	0.072	16-#5	11-#5	11-#5	11-#5	2.66								
25	200	3	8.33	12-#5	13-#6	12-#7	12-#5	11-#5	3.13	107.6	407.4	523.6	200	17	0.227	14-#6	11-#5	11-#5	0.227	14-#6	11-#5	11-#5	11-#5	2.87								
25	300	5	8.33	12-#5	11-#7	12-#7	13-#5	11-#5	3.41	195.8	466.8	626.0	300	21	0.427	15-#6	13-#5	11-#5	0.427	15-#6	13-#5	11-#5	11-#5	3.10								
25	400	7	8.33	12-#5	12-#7	13-#7	15-#5	13-#5	3.69	276.4	528.8	728.8	400	24	0.616	15-#6	15-#5	12-#5	0.616	15-#6	15-#5	12-#5	11-#5	3.28								
25	500	9	8.33	14-#5	11-#8	13-#7	9-#7	15-#5	4.29	368.2	591.0	831.8	500	25	0.674	12-#7	13-#6	10-#6	0.674	12-#7	13-#6	10-#6	12-#5	3.79								
25	600	9	10.00	12-#6	19-#7	12-#8	11-#7	9-#7	5.20	434.1	730.7	946.9	600	25	0.634	18-#6	9-#8	11-#6	0.634	18-#6	9-#8	11-#6	15-#5	4.42								
25	700	11	10.00	12-#6	20-#7	12-#8	10-#8	10-#7	5.84	539.3	829.6	1048.4	700	25	0.611	18-#6	11-#8	10-#7	0.611	18-#6	11-#8	10-#7	10-#7	5.22								
26	100	3	8.66	12-#5	16-#5	14-#6	11-#5	11-#5	2.75	51.1	376.7	466.9	100	12	0.070	17-#5	11-#5	11-#5	0.070	17-#5	11-#5	11-#5	11-#5	2.60								
26	200	5	8.66	12-#5	14-#6	12-#7	13-#5	11-#5	3.13	118.2	461.2	591.5	200	18	0.257	14-#6	12-#5	11-#5	0.257	14-#6	12-#5	11-#5	11-#5	2.82								
26	300	5	8.66	12-#5	12-#7	26-#5	15-#5	9-#6	3.63	218.2	529.3	708.5	300	21	0.417	13-#7	15-#5	12-#5	0.417	13-#7	15-#5	12-#5	11-#5	3.31								
26	400	7	8.66	13-#5	11-#8	14-#7	9-#7	15-#5	4.07	308.6	600.3	825.5	400	24	0.600	13-#7	17-#5	13-#5	0.600	13-#7	17-#5	13-#5	12-#5	3.54								
26	500	9	8.66	16-#5	12-#8	12-#8	10-#7	9-#7	4.53	410.1	665.4	939.4	500	26	0.733	13-#7	14-#6	15-#5	0.733	13-#7	14-#6	15-#5	13-#5	3.94								
26	600	11	10.39	18-#5	20-#7	12-#8	10-#8	10-#7	5.39	506.4	797.6	1064.4	600	26	0.672	18-#6	10-#8	10-#7	0.672	18-#6	10-#8	10-#7	16-#5	4.60								
26	700	11	10.39	15-#6	17-#8	22-#6	15-#7	15-#6	6.16	601.8	909.6	1184.6	700	26	0.672	12-#8	12-#8	14-#6	0.672	12-#8	12-#8	14-#6	10-#7	5.40								
27	100	5	9.00	12-#5	18-#5	14-#6	12-#5	12-#5	2.83	54.5	426.0	526.7	100	12	0.066	12-#6	12-#5	12-#5	0.066	12-#6	12-#5	12-#5	12-#5	2.65								
27	200	5	9.00	12-#5	9-#8	13-#7	15-#5	12-#5	3.41	131.2	519.5	665.5	200	18	0.251	12-#7	14-#5	12-#5	0.251	12-#7	14-#5	12-#5	12-#5	3.06								
27	300	7	9.00	12-#5	11-#8	26-#5	9-#7	10-#6	3.87	236.8	598.5	797.6	300	22	0.453	12-#7	9-#7	9-#6	0.453	12-#7	9-#7	9-#6	12-#5	3.38								
27	400	9	9.00	13-#5	12-#8	27-#5	14-#6	9-#7	4.29	338.2	681.4	932.7	400	24	0.568	13-#7	14-#6	15-#5	0.568	13-#7	14-#6	15-#5	9-#6	3.77								
27	500	11	9.00	16-#5	19-#7	12-#8	9-#8	10-#7	4.98	452.8	755.1	1061.5	500	26	0.698	18-#6	12-#7	9-#7	0.698	18-#6	12-#7	9-#7	15-#5	4.25								
27	600	11	10.80	14-#6	16-#8	22-#6	10-#8	9-#8	5.60	562.1	860.9	1196.8	600	27	0.733	12-#8	11-#8	14-#6	0.733	12-#8	11-#8	14-#6	18-#5	4.94								
28	100	5	9.33	13-#5	11-#7	16-#6	10-#6	12-#5	3.04	60.3	476.7	589.2	100	12	0.065	14-#6	12-#5	12-#5	0.065	14-#6	12-#5	12-#5	12-#5	2.67								
28	200	5	9.33	13-#5	18-#6	16-#7	12-#6	13-#5	3.57	144.9	582.4	745.4	200	18	0.246	13-#7	15-#5	12-#5	0.246	13-#7	15-#5	12-#5	12-#5	3.10								
28	300	7	9.33	13-#5	12-#8	16-#7	10-#7	16-#5	4.05	261.8	672.3	894.3	300	22	0.442	26-#5	13-#6	10-#6	0.442	26-#5	13-#6	10-#6	12-#5	3.44								
28	400	9	9.33	15-#5	14-#8	16-#7	12-#7	10-#7	4.81	374.4	766.1	1046.5	400	24	0.554	15-#7	12-#7	12-#6	0.554	15-#7	12-#7	12-#6	15-#5	4.22								
28	500	11	11.20	18-#5	16-#8	22-#6	10-#8	15-#6	5.24	511.8	845.1	1189.8	500	27	0.714	15-#7	18-#6	14-#6	0.714	15-#7	18-#6	14-#6	12-#6	4.54								
29	100	7	9.66	13-#5	17-#6	15-#6	15-#5	13-#5	3.10	63.5	534.6	659.3	100	12	0.061	13-#6	13-#5	13-#5	0.061	13-#6	13-#5	13-#5	13-#5	2.69								
29	200	7	9.66	13-#5	15-#7	19-#6	10-#7	15-#5	3.76	155.7	653.8	834.3	200	18	0.234	13-#7	12-#6	13-#5	0.234	13-#7	12-#6	13-#5	13-#5	3.24								
29	300	9	9.66	13-#5	13-#8	15-#7	15-#6	10-#7	4.26	317.5	738.3	992.9	300	22	0.417	26-#5	11-#7	16-#5	0.417	26-#5	11-#7	16-#5	10-#6	3.70								
29	400	11	9.66	14-#5	16-#8	16-#7	10-#8	11-#7	5.04	411.4	859.9	1171.3	400	24	0.526	15-#7	10-#8	10-#7	0.526	15-#7	10-#8	10-#7	16-#5	4.35								
29	500	11	11.60	14-#6	23-#7	14-#8	11-#8	10-#8	5.72	565.1	947.2	1330.5	500	27	0.696	13-#8	12-#8	12-#7	0.696	13-#8	12-#8	12-#7	10-#7	5.07								
30	100	7	10.00	14-#5	11-#8	17-#6	12-#6	13-#5	3.33	69.8	593.6	731.8	100	12	0.060	15-#6	15-#5	13-#5	0.060	15-#6	15-#5	13-#5	13-#5	2.81								
30	200	7	10.00	14-#5	13-#8	16-#7	11-#7	12-#6	3.99	170.9	727.2	927.0	200	18	0.230	14-#7	19-#5	15-#5	0.230	14-#7	19-#5	15-#5	13-#5	3.32								
30	300	9	10.00	14-#5	20-#7	17-#7	10-#8	14-#6	4.70	348.6	822.7	1104.6	300	22	0.408	15-#7	17-#6	10-#7	0.408	15-#7	17-#6	10-#7	15-#5	4.01								
30	400	11	10.00	1-6#5	23-#7	14-#8	12-#8	13-#7	5.34	452.1	958.6	1303.5	400	24	0.514	16-#7	15-#7	11-#7	0.514	16-#7	15-#7	11-#7	18-#5	4.61								

NOTES (1) 50 per cent of these bars may be placed in the middle third of column strip. (2) Drop panels same size as for edge panels. (3) Same column size and height above and below slab.

Concrete (cu. ft / sq. ft)

No Beams

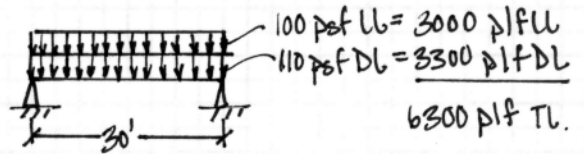
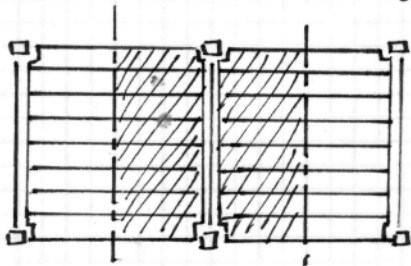
**Lauren Wilke**  
Structural Option  
Advisor: M.K. Parfitt

**Boys Bear Country**  
Pigeon Forge, TN



**Appendix Section 3:  
Pre-Cast Concrete Plank System  
Supported with Steel Framing and  
Supported with Pre-Cast Framing**

PRECAST PLANK ON STEEL FRAMING TO REPLACE 30'x30' BAY GIRDER.



$$V = \frac{wL}{2} = \frac{(6.3 \text{ klf})(30')}{2} = 94.5 \text{ k}$$

$$M = \frac{wL^2}{8} = \frac{(6.3 \text{ klf})(30')^2}{8} = 708.8 \text{ 'k}$$

$$\Delta: \Delta_T \text{ CONTROLS } \frac{5wL^4}{384EI} \leq \frac{L}{240}$$

$$\frac{(5)(6.3 \text{ klf})(30')^4 (1728)}{(384)(29000 \text{ ksi}) I} \leq \frac{(30')(12'')}{240} \quad I \geq 2639 \text{ in}^4$$

[TABLE 3-3] AISC 13th

TRY W27x84.  $I_x = 2850 \text{ in}^4 \geq 2639 \text{ in}^4$  OK

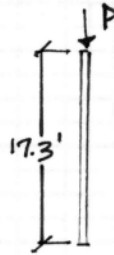
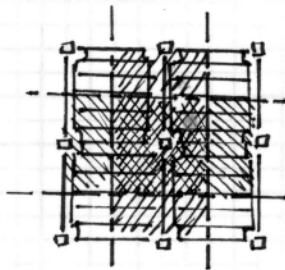
[TABLE 3-10]  $\neq$  [TABLE 3-6]

TRY W27x84 FALLS.

TRY W30x99  $M = 208 \text{ 'k} \geq (30')(6.3 \text{ klf}) = 189 \text{ k}$  OK

USE W30x99 GIRDER.

PRECAST PLANK ON STEEL FRAMING TO REPLACE 30'x30' BAY - COLUMN.



$$\begin{aligned}
 P &= (30')(30')(100 \text{ psf UL} + 110 \text{ psf DL}) \\
 &= 189 \text{ k / FLOOR.} \\
 &= (30')(30')(20 \text{ psf UL} + 20 \text{ psf DL}) \\
 &= 36 \text{ k / ROOF} \\
 \Sigma P &= 36 \text{ k} + (4)(189 \text{ k}) = 792 \text{ k}
 \end{aligned}$$

ALLOWABLE COMPRESSION =

$$\begin{aligned}
 (0.6)(46 \text{ ksi}) &= 27.6 \text{ ksi} \leftarrow \text{CONTROLS.} \\
 (0.5)(58 \text{ ksi}) &= 29 \text{ ksi}
 \end{aligned}$$

$$A_{REQD} = \frac{P}{\sigma} = \frac{189 \text{ k}}{27.6 \text{ k}} = 6.85 \text{ in}^2$$

$$\frac{P}{\sigma} = \frac{792 \text{ k}}{27.6 \text{ k}} = 28.7 \text{ in}^2$$

[TABLE 4-4], [TABLE 4-3] AISC 13th.

TRY HSS 14x14x5/8"  $A = 30.3 \text{ in}^2 \geq 28.7 \text{ in}^2$  OK  
 $P = 756 \text{ k} \neq 792 \text{ k}$  FAILS.

TRY HSS 20x12x5/8"  $A = 35.0 \text{ in}^2 \geq 28.7 \text{ in}^2$  OK  $d =$   
 $P = 854 \text{ k} \geq 792 \text{ k}$  OK  $b =$

ALLOWABLE COMPRESSION =

$$\begin{aligned}
 (0.6)(50 \text{ ksi}) &= 30 \text{ ksi} \leftarrow \text{CONTROLS.} \\
 (0.5)(65 \text{ ksi}) &= 32.5 \text{ ksi}
 \end{aligned}$$

$$A_{REQD} = \frac{P}{\sigma} = \frac{792 \text{ k}}{30 \text{ k}} = 26.4 \text{ in}^2$$

[TABLE 4-1]

TRY W14x120  $A = 35.3 \text{ in}^2 \geq 26.4 \text{ in}^2$  OK  $d = 14.5"$   
 $P = 820 \text{ k} \geq 792 \text{ k}$  OK  $b = 14.7"$

USE W14x120 COLUMN.



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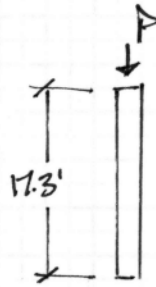
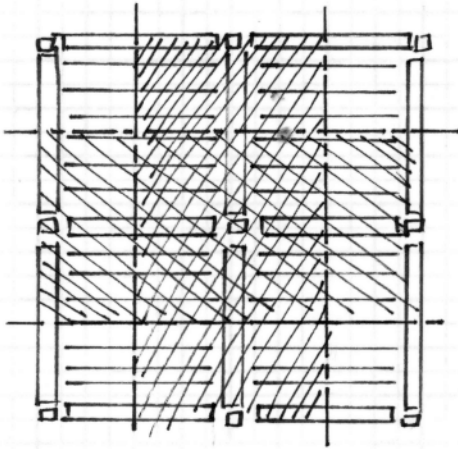
CLASS: AE 481W

DATE: 10-27-06

ASSIGNMENT: TECH REPORT #2  
PRE-CAST PLANK SYSTEM

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PRE-CAST PLANK SYSTEM SUPPORTED BY PRECAST GIRDER COLUMN.



$$\begin{aligned}
 P &= (30')(30')(100\text{psf LL} + 145\text{psf DL}) \\
 &= 221 \text{ k/FLOOR} \\
 &= (30')(30')(20\text{psf LL} + 20\text{psf DL}) \\
 &= 36 \text{ k/ROOF} \\
 \Sigma P &= 36 \text{ k} + (4)(221 \text{ k}) = 920 \text{ k}
 \end{aligned}$$

$$P = \frac{\sigma}{A} \quad A = \frac{P}{\sigma} = \frac{920 \text{ k}}{4 \text{ ksi}} = 230 \text{ in}^2 \rightarrow 16" \times 16" \text{ COLUMN.}$$

M

USE 18" X 18" COLUMN FOR COMPRESSION.

# Prestressed Concrete 12" x 4' SpanDeck—U.L.—J952 (2" C.I.P. TOPPING)

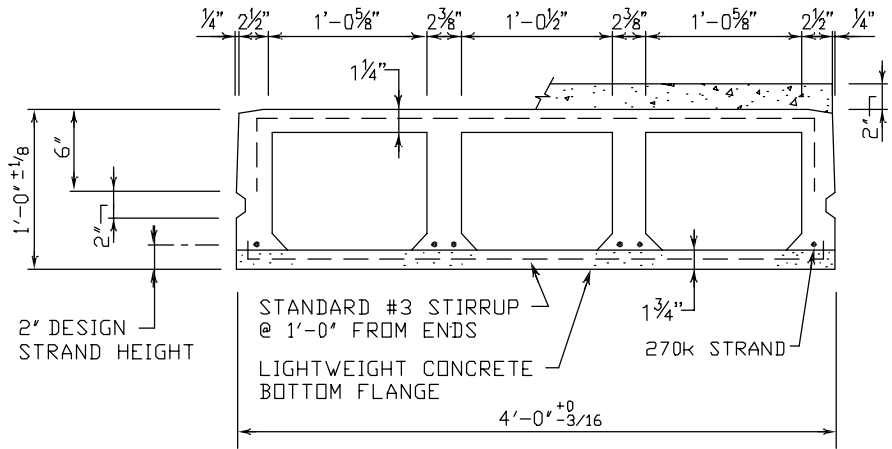
## PHYSICAL PROPERTIES

### Composite

$A' = 312 \text{ in.}^2$	$S'_b = 826 \text{ in.}^3$
$I' = 6542 \text{ in.}^4$	$S'_t = 1602 \text{ in.}^3$ (At Top of SpanDeck)
$Y'_b = 7.92 \text{ in.}$	$S'_{tt} = 1076 \text{ in.}^3$ (At Top of Topping)
$Y'_t = 4.08 \text{ in.}$ (To Top of SpanDeck)	Wt. = 410 PLF
$Y'_{tt} = 6.08 \text{ in.}$ (To Top of Topping)	Wt. = 102.5 PSF

### DESIGN DATA

1. Precast Strength @ 28 days = 5000 PSI.
2. Precast Strength @ release = 3000 PSI.
3. Precast Density = 150 PCF (Top and Webs)  
= 115 PCF (Soffit)
4. Strand =  $1/2"$   $\phi$ , 270 K Lo-Relaxation.
5. Composite Strength = 3000 PSI.
6. Composite Density = 150 PCF.
7. Strand Height = 2.00 in.
8. Ultimate moment capacities (when fully developed)...  
4 -  $1/2"$   $\phi$ , 270K = 139.7'K  
6 -  $1/2"$   $\phi$ , 270K = 198.7'K
9. Maximum bottom tensile stress is  $6\sqrt{f'_c} = 424 \text{ PSI}$ .
10. All superimposed load is treated as live load in the strength analysis of flexure and shear.
11. Flexural strength capacity is based on stress/strain strand relationships.
12. Shear values are the maximum allowable before shear reinforcement is required.
13. Deflection limits were not considered when determining allowable loads in this table.
14. All values in this table are based on ultimate strength and are not governed by service stress.
15. All loads shown refer to allowable loads applied after the topping has hardened.



12" SPANDECK CROSS SECTION

UL FIRE RATED J952

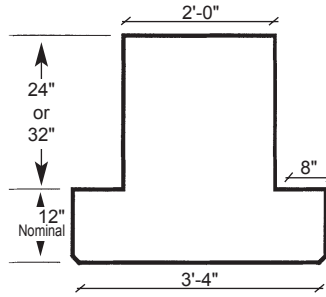
12" SPANDECK W/2" TOPPING		ALLOWABLE SUPERIMPOSED LOAD (PSF)																						
STRAND PATTERN		SPAN (FEET)																						
		18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Flexure	4 - $1/2"$ $\phi$	422	370	326	288	255	226	200	179	159	140	125	111	98	86	76	66	60						
Shear	4 - $1/2"$ $\phi$	409	381	357	335	315	294	266	242	221	201	184	171	162	152	139	127	115						
Flexure	6 - $1/2"$ $\phi$	636	562	499	445	398	357	321	289	261	236	213	193	175	158	144	130	117	106	95	86	77	69	61
Shear	6 - $1/2"$ $\phi$	423	395	370	348	327	308	292	276	261	248	236	221	202	186	172	158	146	134	124	115	110	105	98



This table is for simple spans and uniform loads. design data for any of these span-load conditions is available on request. Individual designs may be furnished to satisfy unusual conditions of heavy loads, concentrated loads, cantilevers, flange or stem openings and narrow widths.

**Strand Pattern Designation**

No. of Stands (10)  
**108 - S** ← S = Straight  
 Diameter of Strand in 16ths



**Concrete:**  
 $f'_c = 7500$  psi  
**Strand:** 1/2" dia. low relaxation, 270ksi, special, A = 0.167 in<sup>2</sup>

## INVERTED TEE BEAMS

Loads shown are in addition to a dead load of 5000 plf for tee weight. (5000 plf is equivalent to 2-60'-0" bays of 34" deep tees)

### 24IT36

Normal Weight

#### Live load capacity in pounds per lineal foot (plf)

Strand Pattern	e	DESIGN SPAN (Ft.)															
		22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	
148-S	11.75	7799	5752	4160	2896	1876	1042										
188-S	11.96			6717	5101	3797	2730	1846	1105								
228-S	11.86				7152	5584	4301	3237	2346	1596	948						
268-S	11.72					7292	5802	4567	3533	2657	1909	1266	708				
308-S	11.62						7259	5858	4684	3690	2842	2112	1480	928			
348-S	11.54							7108	5799	4692	3746	2932	2227	1544	922		
388-S	11.38								6837	5554	4442	3466	2617	1876	1226	653	
428-S	11.18									6986	5672	4550	3584	2747	1998	1339	756

**Section Properties**

A = 1041 in.<sup>2</sup>  
 I = 114,588 in.<sup>4</sup>  
 Y<sub>b</sub> = 15.7 in.  
 Y<sub>t</sub> = 19.93 in.  
 Z<sub>b</sub> = 7299 in.<sup>3</sup>  
 Z<sub>t</sub> = 5750 in.<sup>3</sup>  
 wt = 1084 plf  
 V/S = 6.91 in.

### 24IT44

Normal Weight

#### Live load capacity in pounds per lineal foot (plf)

Strand Pattern	e	DESIGN SPAN (Ft.)																	
		26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60
148-S	15.45	7558	5804	4389	3231	2271	1467	786	205										
188-S	15.66			7059	5577	4350	3321	2450	1707	1067	512								
228-S	15.56				7791	6310	5070	4020	3123	2352	1683	1100	588						
268-S	15.42						6756	5534	4490	3591	2813	2134	1537	1011	545				
308-S	15.32							7010	5822	4800	3914	3141	2463	1865	1334	861	438		
348-S	15.24								7120	5978	4987	4123	3365	2696	2103	1574	1081	582	
388-S	15.08									7092	6003	5053	4219	3483	2831	2230	1632	1096	612
428-S	14.88										6815	5726	4771	3927	3159	2473	1858	1307	809

**Section Properties**

A = 1233 in.<sup>2</sup>  
 I = 208,672 in.<sup>4</sup>  
 Y<sub>b</sub> = 19.4 in.  
 Y<sub>t</sub> = 24.6 in.  
 Z<sub>b</sub> = 10,756 in.<sup>3</sup>  
 Z<sub>t</sub> = 8483 in.<sup>3</sup>  
 wt = 1284 plf  
 V/S = 7.39 in.

**Lauren Wilke**  
Structural Option  
Advisor: M.K. Parfitt

**Boys Bear Country**  
Pigeon Forge, TN



**Appendix Section 4:  
Pre-Cast Double-Tee System**





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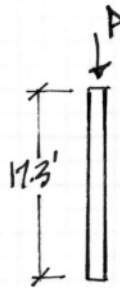
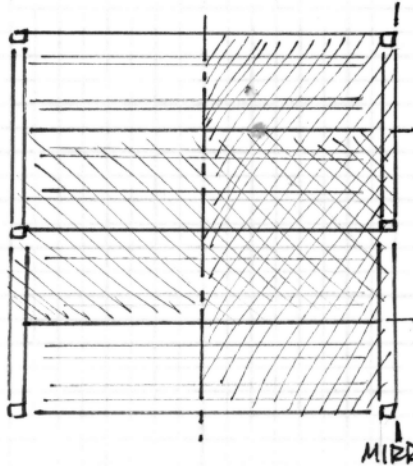
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ASSIGNMENT: TECH REPORT #2

PRECAST DOUBLE TEE SYSTEM.

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PRECAST DOUBLE TEE SYSTEM.



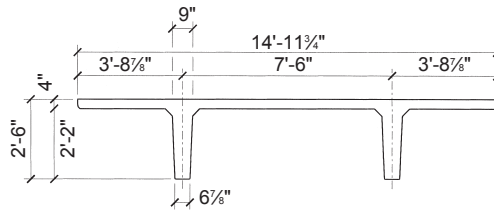
$$\begin{aligned}
 P &= (30' \times 20') (100 \text{ psf LL} + 100 \text{ psf DL}) \\
 &= 180 \text{ k / FLOOR.} \\
 &= (30' \times 30') (20 \text{ psf} + 20 \text{ psf}) \\
 &= 36 \text{ k / FLOOR.} \\
 \Sigma P &= 36 \text{ k} + (4)(180 \text{ k}) = 756 \text{ k.}
 \end{aligned}$$

$$A = \frac{P}{\sigma} = \frac{756 \text{ k}}{4 \text{ ksi}} = 189 \text{ in}^2 \rightarrow 14" \times 14"$$

\* NOTE: THIS IS ONLY FOR ONE BAY OF DOUBLE-TEES AS THEY SPAN TWICE THE ORIGINAL & LOCATE AS SUCH IN THE BUILDING.

USE 14" x 14" COLUMNS FOR COMPRESSION.

These are standard load tables for uniformly loaded simple spans. These tables are for guidance only. Individual designs may be furnished for unusual loading conditions, changes in cross-section, low camber requirements, etc.



Concrete:

$f'_c = 6000$  psi

$w_c = 150$  pcf

Strand: 1/2" dia. low relaxation, 270ksi special,  $A = 0.167$  in<sup>2</sup>

**15DT30**

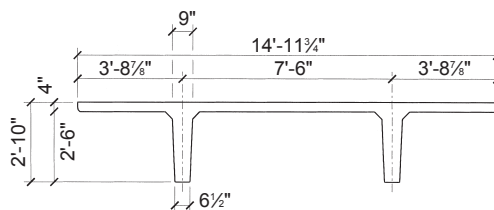
**Live load capacity in pounds per square foot (psf)**

Strand Pattern	$e_e$	DESIGN SPAN (FT)																					
		30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	
88-S	16.64	158	144	131	119	109	99	90	82	74	67	61	54	49	44	39	34	30	26	22			
128-S	17.51			238	220	203	188	175	162	150	139	129	120	111	103	95	88	82	76	70	64	59	
168-S	17.51							253	236	220	206	192	180	168	158	148	138	130	121	114	107	100	
208-S	17.16																					145	137
248-S	16.64																						

**Section Properties**

$A = 1132$  in.<sup>2</sup>  
 $I = 78,349$  in.<sup>4</sup>  
 $Y_b = 22.76$  in.  
 $Y_t = 7.24$  in.  
 $S_b = 3442$  in.<sup>3</sup>  
 $S_t = 10,822$  in.<sup>3</sup>  
 $wt = 1179$  plf  
 79 psf  
 $V/S = 2.42$  in.

Strand Pattern	$e_e$	DESIGN SPAN (FT)																				
		51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	
88-S	16.64																					
128-S	17.51	54	50	46	42	38	34	31	27	24	21											
168-S	17.51	93	87	82	76	71	66	62	57	53	49	46	42	39	36	33	30	27	24	22		
208-S	17.16	129	122	115	108	102	96	90	85	80	75	71	66	62	58	54	51	47	44	41	38	
248-S	16.64										99	93	88	83	79	74	70	66	62	59	55	



Concrete:

$f'_c = 6000$  psi

$w_c = 150$  pcf

Strand: 1/2" dia. low relaxation, 270ksi special,  $A = 0.167$  in<sup>2</sup>

**15DT34**

**Live load capacity in pounds per square foot (psf)**

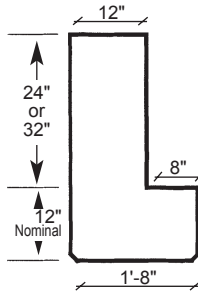
Strand Pattern	$e_e$	DESIGN SPAN (FT)																				
		30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
88-S	18.65	184	168	154	141	129	117	107	98	89	81	74	67	61	55	49	44	39	35	31	27	23
128-S	19.82			257	238	221	205	190	177	165	153	143	133	123	115	107	99	92	86	79	74	
168-S	19.96									242	227	213	200	187	176	165	155	146	137	129	121	
208-S	19.70																	207	195	184	174	165
248-S	19.23																					

**Section Properties**

$A = 1185$  in.<sup>2</sup>  
 $I = 109,621$  in.<sup>4</sup>  
 $Y_b = 25.65$  in.  
 $Y_t = 8.35$  in.  
 $S_b = 4274$  in.<sup>3</sup>  
 $S_t = 13,128$  in.<sup>3</sup>  
 $wt = 1234$  plf  
 82 psf  
 $V/S = 2.45$  in.

Strand Pattern	$e_e$	DESIGN SPAN (FT)																				
		51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	
88-S	18.65																					
128-S	19.82	68	63	58	53	49	45	41	37	34	30	27	24	21								
168-S	19.96	114	107	100	94	88	83	77	72	68	63	59	55	51	47	44	41	37	34	31	28	
208-S	19.70	156	147	139	132	124	118	111	105	99	94	88	83	79	74	70	66	62	58	54	51	
248-S	19.23									128	122	116	110	104	99	94	89	84	80	76	71	

These are standard load tables for uniformly loaded simple spans. These tables are for guidance only. Individual designs may be furnished for unusual loading conditions, changes in cross-section, low camber requirements, etc.



Concrete:  
 $f'_c = 7500$  psi  
 Strand:  $\frac{1}{2}$ " dia. low relaxation,  
 270ksi, special,  $A = 0.167$  in<sup>2</sup>

**L BEAMS**

Normally Use 23.5" Wide Stem

Loads shown are in addition to a dead load of 2500 plf for tee weight. (2500 plf is equivalent to A-60'-0" bay of 34" deep tees)

**12LB36**

**Live load capacity in pounds per lineal foot (plf)**

**Normal Weight**

Strand Pattern	e	DESIGN SPAN (Ft.)									
		20	22	24	26	28	30	32	34	36	38
78-S	12.76	5989	4514	3392	2519	1826	1268	810	431		
98-S	12.32	7996	6173	4787	3708	2852	2161	1596	1127	734	402
118-S	12.03		7731	6096	4824	3814	3000	2333	1781	1318	926
138-S	11.84			7316	5864	4712	3782	3021	2391	1862	1415
168-S	11.39				6878	5585	4542	3688	2980	2387	1885
188-S	11.09				6706	5436	4412	3574	2879	2297	1804
218-S	10.76				6511	5268	4266	3445	2765	2195	1713

**Section Properties**  
 $A = 504$  in.<sup>2</sup>  
 $I = 56,406$  in.<sup>4</sup>  
 $Y_b = 16.28$  in.  
 $Y_t = 19.71$  in.  
 $Z_b = 3465$  in.<sup>3</sup>  
 $Z_t = 2862$  in.<sup>3</sup>  
 $wt = 525$  plf  
 $V/S = 4.67$  in.

**12LB44**

**Live load capacity in pounds per lineal foot (plf)**

**Normal Weight**

Strand Pattern	e	DESIGN SPAN (Ft.)									
		22	24	26	28	30	32	34	36	38	
78-S	16.49	6278	4861	3759	2885	2179	1602	1124	723	383	
98-S	16.05		6701	5327	4236	3357	2637	2040	1540	1117	
118-S	15.76			6823	5527	4481	3625	2916	2322	1819	
138-S	15.57				6755	5551	4566	3750	3065	2486	
168-S	15.11					6977	5820	4861	4058	3378	
188-S	14.82					7826	6567	5524	4649	3909	
218-S	14.49						6836	5760	4858	4095	

**Section Properties**  
 $A = 600$  in.<sup>2</sup>  
 $I = 102,268$  in.<sup>4</sup>  
 $Y_b = 20.08$  in.  
 $Y_t = 23.92$  in.  
 $Z_b = 5093$  in.<sup>3</sup>  
 $Z_t = 4275$  in.<sup>3</sup>  
 $wt = 625$  plf  
 $V/S = 4.84$  in.

Lauren Wilke  
 Structural Option  
 Advisor: M.K. Parfitt



**Boys Bear Country**  
 Pigeon Forge, TN

## Appendix Section 5: Wooden Framing System

**TrussJoist Allowable Uniform Load Table**  
**7" 2.2E Parallam® PSL Commercial Beams – Typical 30' Beam Design at 4' O.C.**

Depth	20"		22"		24"		26"		28"		30"		32"	
	100% TL	115% TL	100% TL	115% TL	100% TL	115% TL	100% TL	115% TL	100% TL	115% TL	100% TL	115% TL	100% TL	115% TL
	100% LL	125% TL	100% LL	125% TL	100% LL	125% TL	100% LL	125% TL	100% LL	125% TL	100% LL	125% TL	100% LL	125% TL
16'	3,286	3,785	3,938	4,536	4,646	5,351	5,409	6,229	6,226	7,169	7,097	8,171	8,021	9,235
	3,182	4,118	3,938	4,935	4,646	5,821	5,409	6,775	6,226	7,798	7,097	8,887	8,021	10,044
18'	2,587	2,982	3,102	3,574	3,660	4,217	4,262	4,909	4,906	5,651	5,593	6,442	6,323	7,282
	2,304	3,245	2,994	3,889	3,660	4,588	4,262	5,341	4,906	6,148	5,593	7,008	6,323	7,921
20'	2,087	2,407	2,503	2,886	2,954	3,406	3,441	3,966	3,962	4,566	4,518	5,206	5,108	5,885
	1,717	2,620	2,241	3,141	2,847	3,706	3,441	4,316	3,962	4,968	4,518	5,664	5,108	6,403
22'	1,717	1,981	2,060	2,376	2,433	2,805	2,834	3,268	3,264	3,763	3,722	4,291	4,209	4,851
	1,312	2,157	1,717	2,587	2,190	3,054	2,731	3,557	3,264	4,095	3,722	4,670	4,209	5,279
24'	1,436	1,658	1,723	1,989	2,036	2,349	2,372	2,736	2,733	3,152	3,117	3,595	3,526	4,065
	1,024	1,806	1,343	2,166	1,717	2,558	2,148	2,979	2,636	3,431	3,117	3,913	3,526	4,425
26'	1,177	1,406	1,461	1,688	1,727	1,994	2,013	2,323	2,319	2,677	2,646	3,053	2,994	3,453
	814	1,532	1,070	1,839	1,370	2,171	1,717	2,530	2,113	2,915	2,557	3,325	2,994	3,760
28'	941	1,206	1,249	1,449	1,481	1,712	1,728	1,995	1,991	2,299	2,273	2,624	2,572	2,968
	657	1,270	865	1,579	1,110	1,865	1,394	2,174	1,717	2,505	2,083	2,857	2,490	3,232
30'	762	1,031	1,015	1,256	1,284	1,484	1,497	1,731	1,727	1,995	1,971	2,277	2,231	2,576
	537	1,031	709	1,369	911	1,618	1,145	1,886	1,414	2,174	1,717	2,481	2,057	2,806
32'	624	847	834	1,098	1,082	1,298	1,309	1,514	1,510	1,746	1,725	1,993	1,952	2,256
	445	847	588	1,128	756	1,415	952	1,651	1,177	1,903	1,432	2,172	1,717	2,458
34'	516	702	691	937	899	1,144	1,143	1,335	1,331	1,540	1,520	1,758	1,721	1,990
	373	702	493	937	634	1,217	800	1,456	990	1,679	1,205	1,917	1,448	2,169
36'	429	587	577	786	754	1,014	960	1,184	1,180	1,367	1,349	1,561	1,528	1,768
	315	587	417	786	537	1,023	678	1,292	840	1,491	1,024	1,702	1,231	1,927
38'	360	494	486	664	636	866	813	1,057	1,017	1,220	1,204	1,394	1,364	1,579
	269	494	356	664	459	866	580	1,103	718	1,332	877	1,521	1,055	1,723

Lauren Wilke  
 Structural Option  
 Advisor: M.K. Parfitt



**Boyd's Bear Country**  
 Pigeon Forge, TN

**TrussJoist Allowable Uniform Load Table**  
**7" 2.2E Parallam® PSL Commercial Beams – Typical 30' Girder Design**

Depth	38"		40"		42"		44"		46"		48"	
	100% TL	115% TL	100% TL	115% TL	100% TL	115% TL	100% TL	115% TL	100% TL	115% TL	100% TL	115% TL
Span	100% LL	125% TL	100% LL	125% TL	100% LL	125% TL	100% LL	125% TL	100% LL	125% TL	100% LL	125% TL
	16'	10,556	12,152	11,512	13,252	12,539	14,433	13,645	15,706	14,840	17,081	16,135
10,556		13,216	11,512	14,412	12,539	15,697	13,645	17,080	14,840	18,575	16,135	20,195
18'	8,732	10,055	9,465	10,898	10,242	11,792	11,068	12,743	11,948	13,755	12,887	14,835
	8,732	10,936	9,465	11,853	10,242	12,826	11,068	13,860	11,948	14,960	12,887	16,135
20'	7,081	8,156	7,806	8,990	8,563	9,862	9,305	10,716	9,994	11,508	10,721	12,345
	7,081	8,872	7,806	9,779	8,563	10,727	9,305	11,656	9,994	12,518	10,721	13,428
22'	5,838	6,726	6,436	7,414	7,061	8,134	7,714	8,885	8,394	9,668	9,100	10,481
	5,838	7,318	6,436	8,067	7,061	8,849	7,714	9,666	8,394	10,517	9,100	11,402
24'	4,892	5,638	5,394	6,216	5,919	6,820	6,466	7,451	7,037	8,107	7,630	8,790
	4,892	6,136	5,394	6,764	5,919	7,421	6,466	8,107	7,037	8,821	7,630	9,564
26'	4,156	4,792	4,583	5,283	5,029	5,798	5,495	6,334	5,981	6,893	6,486	7,474
	4,156	5,216	4,583	5,750	5,029	6,310	5,495	6,893	5,981	7,501	6,486	8,133
28'	3,572	4,120	3,939	4,543	4,324	4,986	4,725	5,448	5,143	5,930	5,578	6,430
	3,572	4,486	3,939	4,946	4,324	5,428	4,725	5,930	5,143	6,454	5,578	6,998
30'	3,101	3,578	3,420	3,946	3,755	4,332	4,104	4,734	4,467	5,152	4,845	5,588
	3,101	3,897	3,420	4,297	3,755	4,716	4,104	5,154	4,467	5,609	4,845	6,083
32'	2,715	3,135	2,995	3,458	3,289	3,796	3,595	4,149	3,914	4,516	4,246	4,898
	2,715	3,415	2,995	3,766	3,289	4,134	3,595	4,518	3,914	4,918	4,246	5,333
34'	2,395	2,767	2,643	3,053	2,903	3,352	3,173	3,664	3,455	3,989	3,749	4,327
	2,342	3,015	2,643	3,326	2,903	3,651	3,173	3,991	3,455	4,345	3,749	4,712
36'	2,128	2,459	2,348	2,714	2,579	2,980	2,820	3,258	3,071	3,547	3,332	3,848
	1,998	2,681	2,304	2,957	2,579	3,247	2,820	3,549	3,071	3,864	3,332	4,192
38'	1,901	2,199	2,099	2,427	2,305	2,665	2,521	2,914	2,746	3,173	2,980	3,443
	1,717	2,397	1,983	2,645	2,271	2,905	2,521	3,176	2,746	3,458	2,980	3,752



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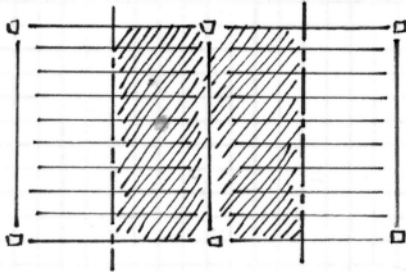
DATE: 10-27-06

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WOOD FRAMING SYSTEM

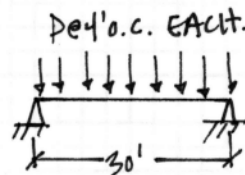
PAGE: \_\_\_\_\_ of \_\_\_\_\_

TRUSSJOIST PARALLAM TO REPLACE 30' BAY - GIRDER & COLUMN.



$$V = \frac{wL}{2} = \frac{(3.6 \text{ klf})(30')}{2} = 54 \text{ k}$$

$$M = \frac{wL^2}{8} = \frac{(3.6 \text{ klf})(30')^2}{8} = 405 \text{ k'}$$



$$\begin{aligned} P &= (100 \text{ psf})(15' \times 4') + (45 \text{ psf})(7' / 12')(20' / 12')(15') \\ &= 6656 \text{ POUNDS} \\ &= 6.7 \text{ k} \end{aligned}$$

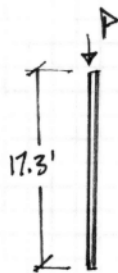
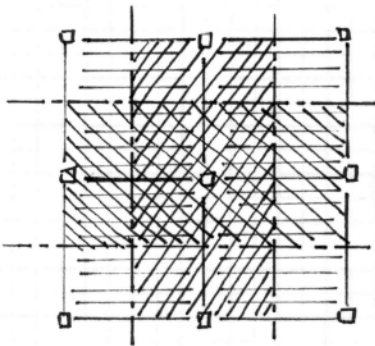
AS DISTRIBUTED LOAD:

$$\begin{aligned} (8 \times 6.7 \text{ k}) / 30' &= (1.8 \text{ klf} \times 2) \\ &= 3.6 \text{ klf} \end{aligned}$$

APPLIED LOAD = 3600 plf @ 30' SPAN.

USE 2.2E 7" x 42" PARALLAM FROM TRUSSJOIST TABLE

$$3755 \text{ plf} = 3600 \text{ plf} \text{ OK}$$



$$\begin{aligned} P &= (30' \times 30')(100 \text{ psf LL} + 25 \text{ psf DL}) \\ &= 113 \text{ k} / \text{FLOOR} \\ &= (30' \times 30')(20 \text{ psf LL} + 20 \text{ psf DL}) \\ &= 36 \text{ k} / \text{ROOF} \\ \Sigma P &= 36 \text{ k} + (4)(113 \text{ k}) = 488 \text{ k} \end{aligned}$$

$$A_{REQ} = \frac{P}{\sigma} = \frac{488 \text{ k}}{(0.6)(46 \text{ ksi})} = 17.7 \text{ in}^2$$

[TABLE 4-4] AISC 13th.

$$\begin{aligned} \text{TRY HSS } 12 \times 12 \times 1/2 \text{ " } & A = 20.9 \text{ in}^2 \geq 17.7 \text{ in}^2 \text{ OK} \\ & P = 503 \text{ k} \geq 488 \text{ k} \text{ OK} \end{aligned}$$

USE HSS 12x12x1/2 COLUMN.



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WOOD FRAMING SYSTEM

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### WOODEN FRAMING SYSTEM - FLOOR SHEATHING.

[TABLE 3.] NDS.

SUPPORTS 48" o.c. 5 PLY PLYWOOD. STRENGTH AXIS  $\perp$  TO SUPPORTS.

$$EI = 1,150,000 \text{ lb-in}^2/\text{ft.}$$

$$F_b S = 1,600 \text{ lb-in}/\text{ft.}$$

[TABLE 3.1.1]

$$C_g = 1.1 \text{ for EI}$$

$$C_g = 1.2 \text{ for } F_b S$$

$$C_s = 1.0 \text{ SINCE REGULAR SIZING.}$$

BENDING:

$$W_b = \frac{1.20 F_b S}{l_z^2} = \frac{(1.2)(1600 \text{ lb/ft})(1.2)(1.0)}{(48")^2} = 100 \text{ psf} \geq 100 \text{ psf} \quad \underline{\text{OK}}$$

↑ CONTROLS.

DEFLECTION:

$$\Delta = \frac{W l_z^4}{1743 EI} = \frac{l}{360} \quad l_z = 48" - 7" = 41.0"$$

$$\frac{l}{360} = \frac{48"}{360} = \frac{W (41.0")^4}{(1743)(1150000)(1.1)} \quad W = 104 \text{ psf} \geq 100 \text{ psf} \quad \underline{\text{OK}}$$

$$l_z = 48" - 7" + 0.25" = 41.25"$$

$$\frac{l}{360} = \frac{48"}{360} = \frac{W (41.25")^4}{(1743)(1150000)(1.1)} \quad W = 102 \text{ psf} \geq 100 \text{ psf} \quad \underline{\text{OK}}$$

SHEAR:

[TABLE 3.3]

$$\frac{F_s I_b}{Q} = 385 \text{ lb/ft}$$

[TABLE 3.3.1]

$$C_g = 1.3$$

$$l_z = 48" - 7" = 41.0"$$

$$W_s = \frac{20 F_s (I_b/Q)}{l_z} = \frac{(20)(385 \text{ lb/ft})(1.3)}{41.0"} = 244 \text{ psf} \geq 100 \text{ psf} \quad \underline{\text{OK}}$$

WOODEN FRAMING SYSTEM FLOOR SHEATHING CONT.

USE 5-PLY PLYWOOD NON-STRUCTURAL I GRADE  
48" O.C. SPAN RATING.

[TABLE 6.1]

SINGLE FLOOR - 48" O.C. SPAN.

USE 8d NAILS @ 6" ON ALL SUPPORTS  
W/ GLUE.