DESIGN CALCULATION COVER SHEET

Project	Detailed Design on Port Reactivation Project in La Union Province.	**Project Code**	JC1N004
Section	**BUILDING WORKS**	Calc. File No.	
Sub-Section	**MAINTENANCE & REPAIR SHOP**	Calc. Index No.	

Subject:

STRUCTURAL DESIGN

Calculation Objective:

The objective of the calculation is to provide a safe structure for the ocupation of the building, by the use of the Republic of El Salvador and American design standards.

References, Calculation Notes and Comments

The Structural Analysis has been made using the program: "STAAD-III rev 21.1W, RESEARCH ENGINEERS, Inc.". The analysis of the structure considers only the steel frames with the steel braces to resist the lateral forces, not considering the walls in the model.

Two model for the structure have been constructed:

1- For skylight roof reactions & 2- For the calculation of the Seismic, Dead & Live load of the building.

The Key for the STAAD-III rev 21.1W program is attached for future convinience.

All the design has been made by calculations sheet created for the project in Microsoft Excel, and based in the following bibliography:

1. Building Code Requirements for Structural Concrete (318M-99), American Concrete Institute (ACI).
2. Technical Specification for Seismic Design, Ministry of Public Works, El Salvador, 2001.
3. AISC, American Institute of Steel Construction, ninth Edition, 1989.
4. Technical Specification for Wind Design, Ministry of Public Works, El Salvador, 1997.
5. UBC, Uniform Building Code, Volume 2: Structural Engineering Design Provisions, 1997.

Rev	Prepared		No. of Pages	Checked		Reviewed		Superseded by Calc No.
	by	Date		by	Date	by	Date	
O	Rubén Martinez	Jul-02	75	A. MORIOKA	Jul-02		11 July 02	
A								
B								
C								

PROJECT: Detailed Design on Port Reactivation Project in La Union Province	Calc. File No.		Prepared by	R.Martinez
SECTION: Maintenance & Repair Shop	Calc. Index No.		Checked by	A.MORIOKA
SUBJECT: Loads	Date	July-02	Page	1 / 75

- Roof Loads

a) Dead Load

Metalic Sheet	10 kg/m²
Electric Instalations	10 kg/m²
Drainage Instalations	10 kg/m²
C channel ("Polin C")	10 kg/m²
Bracing System	10 kg/m²
	50 kg/m² *

* The selfweight for the Columns, Beams & Sub-beams are calculated by the STAAD-III structural Analisys Program.

b) Live Load

Wm = 20 kg/m² for roof with slope > 5%

Frame 2 to 9

Tributary Width = 6.00 m

Wd = 300.0 kg/m

W_L = 120.0 kg/m

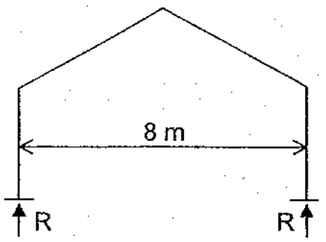
Frame 1 & 10

Tributary Width = 3.00 m

Wd = 150.0 kg/m

W_L = 60.0 kg/m

Reaction from Skylight roof.



Rd = 1.47 ton (from STAAD-III)

R_L = 0.51 ton (from STAAD-III)

- Second floor (office) Loads

a) Dead Load

Slab System (th=0.20m)	345 kg/m²
Floor finish (ceramic)	60 kg/m²
Ceiling	20 kg/m²
Electric Instalations	10 kg/m²
Sub-beams	10 kg/m²
	435 kg/m² *

* The selfweight for the Columns & Beams are calculated by the STAAD-III Structural Analysis Program.

Steel sheet wall.

Wwall = 30 kg/m²

Height = 3.00 m

Wwall = 90 kg/m

b) Live Load

Wm = 250 kg/m² for office

For deflection W = 100 kg/m²

Loads for second floor beams.

Beams axis 8 & 9

Tributary Width = 1.50

Wd+wall = 742.5 kg/m

WL = 375.0 kg/m

Sub-beams between axis 8 & 9

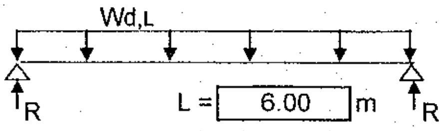
Tributary Width = 3.00 m

Wd = 1305.0 kg/m

WL = 750.0 kg/m

WLdef = 300 kg/m

Sub-beam reaction :



Rd = 3915 kg

RL = 2250 kg

Wall Load for Frames 1 & 10

Steel sheet wall. Wwall = 30 kg/m²

Beam A to C

Height 1 = 3.00 m Wwall = 90 kg/m

Height 2 = 7.50 m Wwall = 225 kg/m

Beam C to D

Height 1 = 7.50 m Wwall = 225 kg/m

Height 2 = 5.25 m Wwall = 157.5 kg/m

Beam C to D, A to B

Height 1 = 5.25 m Wwall = 157.5 kg/m

Height 2 = 3.00 m Wwall = 90 kg/m

PROJECT: Detailed Design on Port Reactivation Project in La Union Province	Calc. File No.		Prepared by	R.Martinez
SECTION: Maintenance & Repair Shop	Calc. Index No.		Checked by	A.MORIOKA
SUBJECT: Seismic Load	Date	July-02	Page	4 / 75

SEISMIC FORCES

V = Cs W

Cs = (A I C_o / R) (T_o / T)^2/3

Coefficient of Aceleration, A = 0.40

Importance Factor, I = 1.00

Response Modification Factor, R = 12.00

Soil Conditions Factors

C_o = 3.00

T_o = 0.60

Period of the Sructure, T = Ct hn^3/4

Type of structure coefficient, Ct = 0.085

Structure height, hn = 5.20 m

T = 0.293 seg

Cs = 0.161

PROJECT: Detailed Design on Port Reactivation Project in La Union Province	Calc. File No.		Prepared by	R.Martinez
SECTION: Maintenance & Repair Shop	Calc. Index No.		Checked by	A.MORIOKA
SUBJECT: Seismic Load	Date	July-02	Page	5 /75

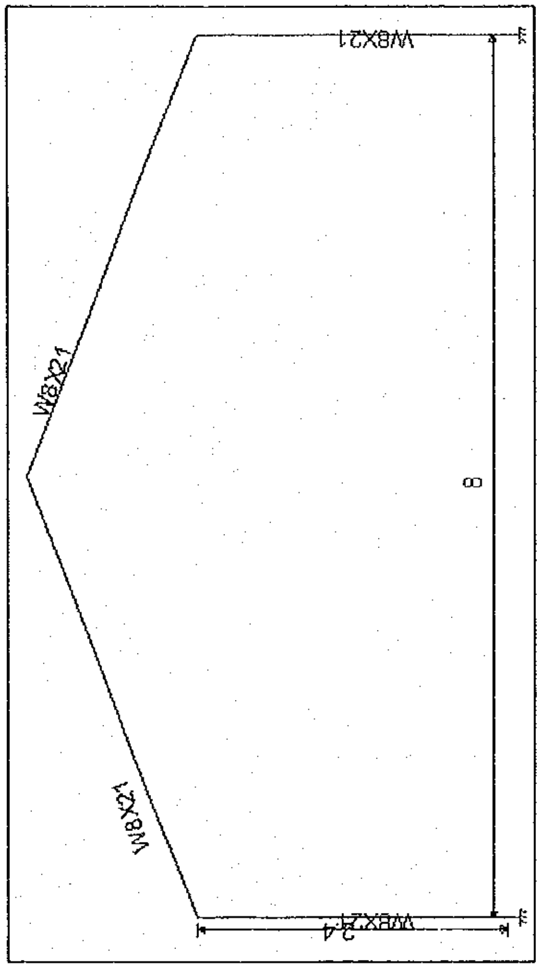
SEISMIC FORCES

		EISMIC FORCE (ton	
AXIS	JOINT N°	Z-DIR.	X-DIR.
1-A	1	0.1	1.27
1-C	2	2.01	0.1
1-D	3	1.9	0.1
1-E	4	0.7	1.31
2-A	16	0.1	1.48
2-B	17	0.72	1.52
3-A	27	1.6	1.53
3-E	28	0.72	1.53
4-A	38	1.6	1.52
4-E	39	0.7	1.48
5-A	49	0.1	1.47
5-E	50	0.66	1.47
6-A	60	0.1	1.47
6-E	61	0.64	1.47
7-A	71	0.1	1.47
7-E	72	0.63	1.47
8-A	82	1.96	5.75
8-B	83	5.4	0.22
8-C	84	4.53	0.15
8-D	85	5.4	0.22
8-E	86	0.63	5.74
9-A	99	1.95	5.8
9-B	100	5.42	0.22
9-C	101	2.75	0.2
9-D	102	5.42	0.22
9-E	103	0.64	5.8
10-A	116	0.1	0.72
10-B	117	0.3	0.49
10-C	118	0.28	0.49
10-D	119	0.31	0.66
10-E	120	0.63	0.74

Total seismic Force (from STAAD III) :

Z - Direction = 48.10 ton
X - Direction = 48.08 ton

MAINTENANCE & REPAIR SHOP
SKYLIGHT ROOF
STRUCTURAL MODEL, STAAD-III



PROJECT: Detailed Design on Port Reactivation Project in La Union Province	Calc. File No.		Prepared by	R.Martinez
SECTION: Maintenance & Repair Shop	Calc. Index No.		Checked by	A.MORIOKA
SUBJECT: Input for Structural model	Date	July-02	Page	2 ~~4~~ / 75

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                 *                                                  *
                 *            S T A A D - III                       *
                 *            Revision 21.1W                        *
                 *            Proprietary Program of                *
                 *            RESEARCH ENGINEERS, Inc.              *
                 *            Date=    JUL  5, 2002                 *
                 ****************************************************

         1. STAAD SPACE MAINTENANCE-REPAIR SHOP
         2. *SKYLIGHT ROOF
         3. INPUT WIDTH 72
         4. UNIT METER MTON
         5. JOINT COORDINATES
         6. 1 0 0 ; 2 0 2.40 ; 3 4.00 3.75
         7. 4 8.00 2.40 ; 5 8.00 0
         8. MEMBER INCIDENCE
         9. 1 1 2 ; 2 5 4
        10. 3 2 3 4
        11. MEMBER PROPERTY
        12. *COLUMNS
        13. 1 2 TABLE ST W8X21
        14. *BEAMS
        15. 3 4 TABLE ST W8X21
        16. CONSTANTS
        17. *E 20389042 ALL
        18. E STEEL ALL
        19. DEN STEEL ALL
        20. SUPPORT
        21. 1 5 FIXED
        22. LOAD 1 DEAD LOAD
        23. SELFWEIGHT Y -1
        24. MEMBER LOAD
        25. 3 4 UNI GY -0.30
        26. LOADING 2 LIVE LOAD
        27. MEMBER LOAD
        28. 3 4 UNI GY -0.12
        29. LOAD 3 SEISMIC LOAD
        30. MEMBER LOAD
        31. 3 4 UNI GZ -0.1
        32. PERFORM ANALYSIS
```

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   SUPPORT REACTIONS -UNIT MTON METE     STRUCTURE TYPE = SPACE
      -----------------

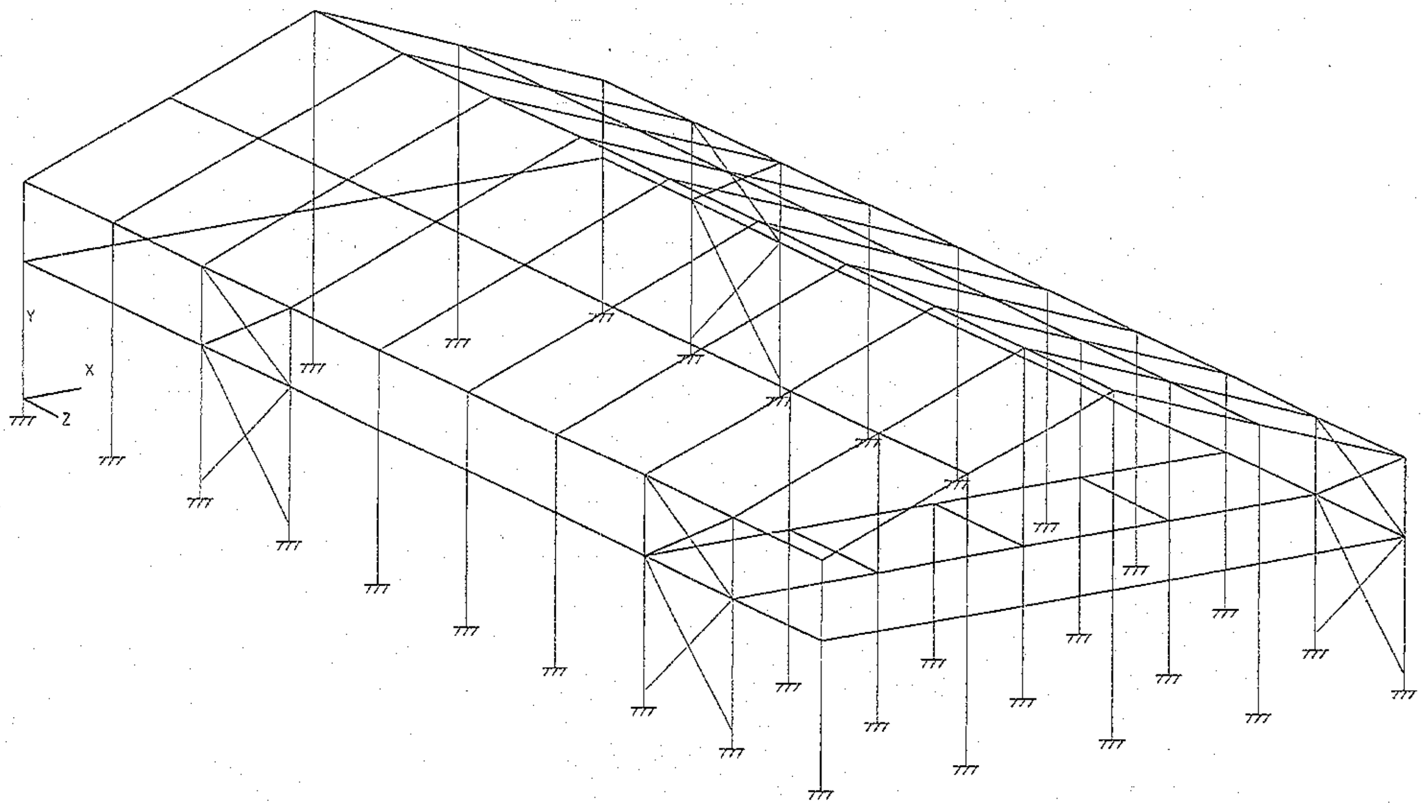
  JOINT  LOAD   FORCE-X   FORCE-Y   FORCE-Z     MOM-X     MOM-Y     MOM Z

      1     1      0.91      1.47      0.00      0.00      0.00     -1.00
            2      0.33      0.51      0.00      0.00      0.00     -0.36
            3      0.00      0.00      0.42      1.30     -0.14      0.00

      5     1     -0.91      1.47      0.00      0.00      0.00      1.00
            2     -0.33      0.51      0.00      0.00      0.00      0.36
            3      0.00      0.00      0.42      1.30      0.14      0.00
```

MN/ELEM

STRUCTURE DATA
TYPE = SPACE
NJ = 132
NM = 218
NE = 0
NS = 31
NL = 4
XMAX= 24.0
YMAX= 12.7
ZMAX= 54.0



J=132,M=218

UNIT MET MTO

S T A A D P O S T - P L O T (REV: 21.1W)
TITLE: MAINTENANCE & REPAIR SHOP

DATE: JUL 5, 2002

CALCULATION
Detailed Design
on Port Reactivation Project
in La Union Province

CALC FILE No.:		
CALC INDEX No.:	PAGE	
	INITIAL	DATE
PREPARED BY	R.M.G.	JULY/02
CH[illegible]	A.M.	JULY/02

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****************************************************
*                                                  *
*            S T A A D - III                       *
*            Revision 21.1W                        *
*            Proprietary Program of                *
*            RESEARCH ENGINEERS, Inc.              *
*            Date=    JUL  5, 2002                 *
****************************************************

   1. STAAD SPACE MAINTENANCE & REPAIR SHOP
   2. INPUT WIDTH 72
   3. UNIT METER MTON
   4. JOINT COORDINATES
   5. 1 0 0 0
   6. 2 12 0 0 4 24 0 0
   7. 5 0 5.2 0
   8. 6 12 5.2 0 8 24 5.2 0
   9. 9 0 8.2 0 10 6 10.45 0
  10. 11 8 11.2 0 12 12 12.7 0
  11. 13 16 11.2 0 14 18 10.45 0
  12. 15 24 8.2 0
  13. 16 0 0 6 17 24 0 6
  14. 18 0 5.2 6 19 24 5.2 6
  15. 20 0 8.2 6 21 6 10.45 6
  16. 22 8 11.2 6 23 12 12.7 6
  17. 24 16 11.2 6 25 18 10.45 6
  18. 26 24 8.2 6
  19. 27 0 0 12 28 24 0 12
  20. 29 0 5.2 12 30 24 5.2 12
  21. 31 0 8.2 12 32 6 10.45 12
  22. 33 8 11.2 12 34 12 12.7 12
  23. 35 16 11.2 12 36 18 10.45 12
  24. 37 24 8.2 12
  25. 38 0 0 18 39 24 0 18
  26. 40 0 5.2 18 41 24 5.2 18
  27. 42 0 8.2 18 43 6 10.45 18
  28. 44 8 11.2 18 45 12 12.7 18
  29. 46 16 11.2 18 47 18 10.45 18
  30. 48 24 8.2 18
  31. 49 0 0 24 50 24 0 24
  32. 51 0 5.2 24 52 24 5.2 24
  33. 53 0 8.2 24 54 6 10.45 24
  34. 55 8 11.2 24 56 12 12.7 24
  35. 57 16 11.2 24 58 18 10.45 24
  36. 59 24 8.2 24
  37. 60 0 0 30 61 24 0 30
  38. 62 0 5.2 30 63 24 5.2 30
  39. 64 0 8.2 30 65 6 10.45 30
  40. 66 8 11.2 30 67 12 12.7 30
  41. 68 16 11.2 30 69 18 10.45 30
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42. 70 24 8.2 30
43. 71 0 0 36 72 24 0 36
44. 73 0 5.2 36 74 24 5.2 36
45. 75 0 8.2 36 76 6 10.45 36
46. 77 8 11.2 36 78 12 12.7 36
47. 79 16 11.2 36 80 18 10.45 36
48. 81 24 8.2 36
49. 82 0 0 42 86 24 0 42
50. 87 0 5.2 42 91 24 5.2 42
51. 92 0 8.2 42 93 6 10.45 42
52. 94 8 11.2 42 95 12 12.7 42
53. 96 16 11.2 42 97 18 10.45 42
54. 98 24 8.2 42
55. 99 0 0 48 103 24 0 48
56. 104 0 5.2 48 108 24 5.2 48
57. 109 0 8.2 48 110 6 10.45 48
58. 111 8 11.2 48 112 12 12.7 48
59. 113 16 11.2 48 114 18 10.45 48
60. 115 24 8.2 48
61. 116 0 0 54 120 24 0 54
62. 121 0 5.2 54 125 24 5.2 54
63. 126 0 8.2 54 127 6 10.45 54
64. 128 8 11.2 54 129 12 12.7 54
65. 130 16 11.2 54 131 18 10.45 54
66. 132 24 8.2 54
67. MEMBER INCIDENCE
68. *COLUMNS
69. *FRAME AXIS 1
70. 1 1 5 5; 6 6 12; 7 7 14; 8 8 15
71. *FRAME AXIS 2
72. 9 16 18 11; 12 19 26
73. *FRAME AXIS 3
74. 13 27 29 15; 16 30 37
75. *FRAME AXIS 4
76. 17 38 40 19; 20 41 48
77. *FRAME AXIS 5
78. 21 49 51 23; 24 52 59
79. *FRAME AXIS 6
80. 25 60 62 27; 28 63 70
81. *FRAME AXIS 7
82. 29 71 73 31; 32 74 81
83. *FRAME AXIS 8
84. 33 82 87 39; 40 90 97 41
85. *FRAME AXIS 9
86. 42 99 104 48; 49 106 112; 50 107 114 51
87. *FRAME AXIS 10
88. 52 116 121 58; 59 123 129; 60 124 131 61
89. *BEAMS
90. *TOP BEAMS OF FRAMES
91. 62 9 10 67; 68 20 21 73; 74 31 32 79
92. 80 42 43 85; 86 53 54 91; 92 64 65 97
93. 98 75 76 103; 104 92 93 109
94. 110 109 110 115; 116 126 127 121
95. *SECOND BEAMS FRAME 1 & 10
96. 122 5 6 124; 133 121 122 136
97. *BEAMS FOR SECOND FLOOR
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PROJECT: Detailed Design on Port Reactivation Project in La Union Province	Calc. File No.		Prepared by	R.Martinez
SECTION: Maintenance & Repair Shop	Calc. Index No.		Checked by	A.MORIOKA
SUBJECT: Input for Structural model	Date	July-02	Page	12- 8 / 75

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 98. 125 87 88 128; 129 104 105 132
 99. *BEAMS FOR ROOF
100. 137 9 20 138; 139 12 23; 140 14 25 141
101. 142 20 31 143; 144 23 34; 145 25 36 146
102. 147 31 42 148; 149 34 45; 150 36 47 151
103. 152 42 53 153; 154 45 56; 155 47 58 156
104. 157 53 64 158; 159 56 67; 160 58 69 161
105. 162 64 75 163; 164 67 78; 165 69 80 166
106. 167 75 92 168; 169 78 95; 170 80 97 171
107. 172 92 109 173; 174 95 112; 175 97 114 176
108. 177 109 126 178; 179 112 129; 180 114 131 181
109. *LATERAL BEAMS
110. 182 5 18; 183 18 29; 184 29 40; 185 40 51
111. 186 51 62; 187 62 73; 188 73 87
112. 189 87 104; 190 104 121
113. 191 8 19; 192 19 30; 193 30 41; 194 41 52
114. 195 52 63; 196 63 74; 197 74 91; 198 91 108
115. 199 108 125
116. *SECOND FLOOR BEAMS
117. 200 88 105 202
118. *BRACES
119. *AXIS A & E
120. 203 27 40; 204 38 29; 205 29 42; 206 40 31
121. 207 82 104; 208 99 87; 209 87 109; 210 104 92
122. 211 103 125; 212 120 108; 213 108 132; 214 125 115
123. 215 17 30; 216 28 19; 217 19 37; 218 30 26
124. *ROOF
125. *219 10 20; 220 20 32; 221 32 42; 222 42 54
126. *223 54 64; 224 53 65; 225 65 75; 226 75 93
127. *227 93 109; 228 109 127; 229 10 23; 230 23 32
128. *231 32 45; 232 45 54; 233 65 78; 234 78 93
129. *235 93 112; 236 112 127; 237 14 23; 238 23 36
130. *239 36 45; 240 45 58; 241 69 78; 242 78 97
131. *243 97 112; 244 112 131; 245 14 26; 246 26 36
132. *247 36 48; 248 48 58; 249 58 70; 250 59 69
133. *251 69 81; 252 81 97; 253 97 115; 254 115 131
134. MEMBER PROPERTY
135. *PRINCIPAL COLUMNS
136. 1 4 5 8 9 TO 32 TABLE ST W24X84
137. 33 37 38 41 42 46 TABLE ST W24X84
138. 47 51 52 56 57 61 TABLE ST W24X84
139. *SECONDARY COLUMNS
140. 2 3 6 7 53 TO 55 TABLE ST W21X62
141. 58 TO 60 TABLE ST W21X62
142. 34 TO 36 39 40 TABLE ST W21X62
143. 43 TO 45 48 TO 50 TABLE ST W21X62
144. *PRINCIPAL FRAME BEAMS
145. 62 TO 121 TABLE ST W24X84
146. *SECOND BEAMS FRAMES 1 & 10
147. 122 TO 124 133 TO 136 TABLE ST W8X21
148. *BEAMS FOR SECOND FLOOR
149. 125 TO 132 TABLE ST W10X54
150. 200 TO 202 TABLE ST W14X53
151. *BEAMS FOR ROOF
152. 137 TO 181 TABLE ST W8X21
153. *LATERAL BEAMS
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PROJECT: Detailed Design on Port Reactivation Project in La Union Province	Calc. File No.		Prepared by	R.Martinez
SECTION: Maintenance & Repair Shop	Calc. Index No.		Checked by	A.MORIOKA
SUBJECT: Input for Structural model	Date	July-02	Page	13 ~~9~~ / 75

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154. 182 TO 188 190 TO 197 199 TABLE ST W8X21
155. 189 198 TABLE ST W14X53
156. *BRACES
157. *AXIS A&E
158. 203 TO 218 TABLE RA L50508
159. *ROOF
160. *219 TO 254 TABLE RA L50508
161. CONSTANTS
162. E STEEL ALL
163. DEN STEEL ALL
164. BETA 90 MEMBERS 2 3 6 7 34 TO 36 39 40
165. BETA 90 MEMBERS 43 TO 45 48 TO 50 58 TO 60
166. MEMBER TENSION
167. *203 TO 254
168. 203 TO 218
169. MEMBER RELEASE
170. *FRAMES 1 & 10
171. 122 TO 124 START MZ MX MY
172. 6 7 122 TO 124 END MZ MX MY
173. *BEAMS BETWEEN FRAMES
174. 137 TO 199 START MZ MX MY
175. 137 TO 199 END MZ MX MY
176. *FRAMES 8 & 9
177. 125 126 127 128 TO 132 START MZ MX MY
178. 35 39 40 125 126 127 TO 132 END MZ MX MY
179. 48 TO 50 END MZ MX MY
180. SUPPORT
181. 1 TO 4 16 17 27 28 38 39 FIXED
182. 49 50 60 61 71 72 FIXED
183. 82 TO 86 99 TO 103 116 TO 120 FIXED
184. LOAD 1 DEAD LOAD
185. SELFWEIGHT Y -1
186. MEMBER LOAD
187. 62 TO 67 116 TO 121 UNI GY -0.15
188. 68 TO 115 UNI GY -0.30
189. JOINT LOAD
190. 22 24 33 35 44 46 55 57 FY -1.47
191. 66 68 77 79 94 96 111 113 FY -1.47
192. * SECOND FLOOR
193. MEMBER LOAD
194. 189 198 200 TO 202 UNI GY -0.09
195. 200 TO 202 CON GY -8.258
196. 189 198 CON GY -4.13
197. 125 TO 132 UNI GY -1.40
198. *WALL LOAD
199. 122 TRAP GY -0.09 -0.225
200. 123 TRAP GY -0.225 -0.158
201. 124 TRAP GY -0.158 -0.09
202. 133 TRAP GY -0.09 -0.158
203. 134 TRAP GY -0.158 -0.225
204. 135 TRAP GY -0.225 -0.158
205. 136 TRAP GY -0.158 -0.09
206. 182 TO 188 190 TO 197 199 UNI GY -0.09
207. LOAD 2 LIVE LOAD
208. MEMBER LOAD
209. 62 TO 67 116 TO 121 UNI GY-0.10
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210. 68 TO 115 UNI GY -0.12
211. JOINT LOAD
212. 22 24 33 35 44 46 55 57 FY -0.52
213. 66 68 77 79 94 96 111 113 FY -0.52
214. *SECOND FLOOR
215. MEMBER LOAD
216. 200 TO 202 CON GY -4.50
217. 189 198 CON GY -2.25
218. 125 TO 132 UNI GY -0.750
219. LOAD 3 SEISMIC LOAD Z
220. SELFWEIGHT Z 0.161
221. MEMBER LOAD
222. 62 TO 67 116 TO 121 UNI GZ 0.0242
223. 68 TO 115 UNI GZ 0.0483
224. JOINT LOAD
225. 22 24 33 35 44 46 55 57 FZ 0.237
226. 66 68 77 79 94 96 111 113 FZ 0.237
227. * SECOND FLOOR
228. MEMBER LOAD
229. 189 198 200 TO 202 UNI GZ 0.015
230. 200 TO 202 CON GZ 1.330
231. 189 198 CON GZ 0.665
232. 125 TO 132 UNI GZ 0.226
233. *WALL LOAD
234. 122 TRAP GZ 0.015 0.036
235. 123 TRAP GZ 0.036 0.0254
236. 124 TRAP GZ 0.0254 0.015
237. 133 TRAP GZ 0.015 0.0254
238. 134 TRAP GZ 0.0254 0.036
239. 135 TRAP GZ 0.036 0.0254
240. 136 TRAP GZ 0.0254 0.015
241. 182 TO 188 190 TO 197 199 UNI GZ 0.015
242. LOAD 4 SEISMIC LOAD X
243. SELFWEIGHT X 0.161
244. MEMBER LOAD
245. 62 TO 67 116 TO 121 UNI GX 0.0242
246. 68 TO 115 UNI GX 0.0483
247. JOINT LOAD
248. 22 24 33 35 44 46 55 57 FX 0.237
249. 66 68 77 79 94 96 111 113 FX 0.237
250. * SECOND FLOOR
251. MEMBER LOAD
252. 189 198 200 TO 202 UNI GX 0.015
253. 200 TO 202 CON GX 1.330
254. 189 198 CON GX 0.665
255. 125 TO 132 UNI GX 0.226
256. *WALL LOAD
257. 122 TRAP GX 0.015 0.036
258. 123 TRAP GX 0.036 0.0254
259. 124 TRAP GX 0.0254 0.015
260. 133 TRAP GX 0.015 0.0254
261. 134 TRAP GX 0.0254 0.036
262. 135 TRAP GX 0.036 0.0254
263. 136 TRAP GX 0.0254 0.015
264. 182 TO 188 190 TO 197 199 UNI GX 0.015
265. PERFORM ANA
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SUPPORT REACTIONS -UNIT MTON METE    STRUCTURE TYPE = SPACE
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 JOINT  LOAD   FORCE-X   FORCE-Y   FORCE-Z     MOM-X     MOM-Y     MOM Z

    1    1       0.06      4.49      0.00      0.00      0.00      0.20
         2       0.02      0.71      0.00      0.00      0.00      0.07
         3       0.00      0.00     -0.07     -0.10      0.02      0.00
         4      -1.27     -0.32      0.00      0.00      0.00      5.68

    2    1       0.00      5.94      0.09      1.16      0.00      0.02
         2       0.00      0.98      0.05      0.58      0.00      0.01
         3       0.00      0.00     -2.01    -21.91      0.00      0.00
         4      -0.07      0.52      0.00      0.00      0.00      0.18

    3    1       0.00      3.25      0.05      0.48      0.00      0.02
         2       0.00      0.40      0.02      0.24      0.00      0.01
         3       0.00      0.00     -1.90    -18.07      0.00      0.00
         4      -0.08     -1.18      0.00      0.00      0.00      0.20

    4    1      -0.05      3.27     -0.01     -0.04      0.00      0.65
         2      -0.02      0.48     -0.01     -0.02      0.00      0.23
         3       0.00      0.00     -0.70     -2.05     -0.01      0.00
         4      -1.31      0.99      0.00      0.00      0.00      5.82

   16    1       4.47      9.13      0.00      0.00      0.00    -16.74
         2       1.29      2.06      0.00      0.00      0.00     -4.82
         3       0.00      0.00     -0.07     -0.10      0.02      0.00
         4      -1.48     -0.51      0.00      0.00      0.00      7.86

   17    1      -4.47      9.40     -0.01     -0.04      0.00     16.74
         2      -1.29      2.02     -0.01     -0.02      0.00      4.82
         3       0.00     -2.94     -0.72     -2.07     -0.01      0.00
         4      -1.52      0.51      0.00      0.00      0.00      7.94

   27    1       4.47      9.45      0.45      0.00      0.00    -16.74
         2       1.29      2.03      0.10      0.00      0.00     -4.82
         3       0.00     -3.45     -1.60     -0.10      0.02      0.01
         4      -1.53     -0.52     -0.03      0.00      0.00      7.99
   28    1      -4.47      9.57     -0.01     -0.04      0.00     16.74
         2      -1.29      2.10     -0.01     -0.02      0.00      4.82
         3       0.00      2.94     -0.72     -2.07     -0.01      0.01
         4      -1.53      0.51      0.00      0.00      0.00      7.99
   38    1       4.47      9.51     -0.46      0.00      0.00    -16.74
         2       1.29      2.08     -0.11      0.00      0.00     -4.82
         3       0.00      3.45     -1.60     -0.10      0.02      0.00
         4      -1.52     -0.50      0.02      0.00      0.00      7.94
```

PROJECT: Detailed Design on Port Reactivation Project in La Union Province	Calc. File No.	Prepared by	R.Martinez
SECTION: Maintenance & Repair Shop	Calc. Index No.	Checked by	A.MORIOKA
SUBJECT: Input for Structural model	Date July-02	Page	16 10 / 75

```
     SUPPORT REACTIONS -UNIT MTON METE     STRUCTURE TYPE = SPACE
     -----------------

  JOINT  LOAD   FORCE-X    FORCE-Y    FORCE-Z     MOM-X      MOM-Y      MOM Z

    39    1      -4.47       9.13      -0.01      -0.04       0.00      16.74
          2      -1.29       2.06      -0.01      -0.02       0.00       4.82
          3       0.00       0.00      -0.68      -2.01      -0.01       0.00
          4      -1.48       0.51       0.00       0.00       0.00       7.86
    49    1       4.47       9.13       0.00       0.00       0.00     -16.74
          2       1.29       2.06       0.00       0.00       0.00      -4.82
          3       0.00       0.00      -0.07      -0.10       0.02       0.00
          4      -1.47      -0.51       0.00       0.00       0.00       7.81
    50    1      -4.47       9.13      -0.01      -0.03       0.00      16.74
          2      -1.29       2.06      -0.01      -0.02       0.00       4.82
          3       0.00       0.00      -0.66      -1.96      -0.01       0.00
          4      -1.47       0.51       0.00       0.00       0.00       7.81
    60    1       4.47       9.13       0.00       0.00       0.00     -16.74
          2       1.29       2.06       0.00       0.00       0.00      -4.82
          3       0.00       0.00      -0.07      -0.11       0.02       0.00
          4      -1.47      -0.51       0.00       0.00       0.00       7.81
    61    1      -4.47       9.13      -0.01      -0.03       0.00      16.74
          2      -1.29       2.06      -0.01      -0.02       0.00       4.82
          3       0.00       0.00      -0.64      -1.93      -0.01       0.00
          4      -1.47       0.51       0.00       0.00       0.00       7.81
    71    1       4.47       9.13       0.00       0.00       0.00     -16.74
          2       1.29       2.06       0.00       0.00       0.00      -4.82
          3       0.00       0.00      -0.07      -0.11       0.02       0.00
          4      -1.47      -0.51       0.00       0.00       0.00       7.81
    72    1      -4.47       9.13      -0.01      -0.03       0.00      16.74
          2      -1.29       2.06       0.00      -0.02       0.00       4.82
          3       0.00       0.00      -0.63      -1.91      -0.01       0.00
          4      -1.47       0.51       0.00       0.00       0.00       7.81
    82    1      -0.68      10.46       0.52       0.00       0.00       0.90
          2      -0.20       3.82       0.20       0.00       0.00       0.27
          3       0.03      -3.86      -1.96      -0.11       0.02      -0.02
          4      -5.75      -2.44      -0.13       0.00       0.00      23.45
    83    1      -0.01      20.25       1.08       2.21       0.00       0.01
          2       0.00       8.42       0.54       1.11       0.00       0.00
          3       0.00      -6.63      -5.40     -24.08       0.00       0.00
          4      -0.22       2.71       0.00       0.00      -0.01       0.69
    84    1       0.00      12.77       0.46       2.38       0.00       0.00
          2       0.00       6.13       0.23       1.20       0.00       0.00
          3       0.00      -2.33      -4.53     -23.37       0.00       0.00
          4      -0.15       0.00       0.00       0.00       0.00       0.57
```

PROJECT: Detailed Design on Port Reactivation Project in La Union Province	Calc. File No.		Prepared by	R.Martinez
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```
    SUPPORT REACTIONS -UNIT MTON METE    STRUCTURE TYPE = SPACE
    -----------------

  JOINT  LOAD   FORCE-X    FORCE-Y   FORCE-Z     MOM-X     MOM-Y     MOM Z

    85     1       0.01      20.23      1.06      2.13      0.00     -0.01
           2       0.00       8.41      0.54      1.07      0.00      0.00
           3       0.00      -6.61     -5.40    -24.05      0.00      0.00
           4      -0.22      -2.71      0.00      0.00     -0.01      0.69
    86     1       0.68      10.21     -0.01     -0.03      0.00     -0.89
           2       0.20       3.86      0.00     -0.02      0.00     -0.27
           3      -0.03      -0.12     -0.63     -1.90     -0.01      0.04
           4      -5.74       2.45      0.00      0.00      0.00     23.44
    99     1      -0.08      10.52     -0.61      0.00      0.00      0.08
           2      -0.03       3.87     -0.23      0.00      0.00      0.03
           3      -0.01       3.85     -1.95     -0.11      0.02      0.00
           4      -5.80      -2.50      0.14      0.00      0.00     23.68
   100     1       0.00      18.15     -0.84     -0.96      0.00      0.00
           2       0.00       7.73     -0.42     -0.48      0.00      0.00
           3       0.00       6.58     -5.42    -24.11      0.00      0.00
           4      -0.22       2.75      0.00      0.00      0.01      0.70
   101     1       0.00      19.59     -0.83      0.26      0.00      0.00
           2       0.00       8.43     -0.42      0.13      0.00      0.00
           3       0.00       2.44     -2.75    -20.47      0.00      0.00
           4      -0.20       0.00      0.00      0.00      0.01      0.67
   102     1       0.00      18.17     -0.86     -1.04      0.00      0.00
           2       0.00       7.74     -0.43     -0.52      0.00      0.00
           3       0.00       6.56     -5.42    -24.08      0.00      0.00
           4      -0.22      -2.75      0.00      0.00      0.01      0.70
   103     1       0.08      10.42     -0.01     -0.03      0.00     -0.08
           2       0.03       3.82      0.00     -0.02      0.00     -0.03
           3       0.01       0.11     -0.64     -1.89     -0.01     -0.01
           4      -5.80       2.49      0.00      0.00      0.00     23.68
   116     1       0.07       2.86      0.00      0.00      0.00     -0.16
           2       0.00       0.33      0.00      0.00      0.00     -0.02
           3       0.00       0.00     -0.07     -0.11      0.02      0.00
           4      -0.72      -0.71      0.00      0.00      0.00      3.26
   117     1       0.05       4.00      0.00      0.03      0.00     -0.09
           2       0.00       0.66      0.00      0.01      0.00     -0.01
           3       0.00       0.00     -0.30     -1.31      0.00      0.00
           4      -0.49       0.66      0.00      0.00      0.00      1.96
```

PROJECT: Detailed Design on Port Reactivation Project in La Union Province	Calc. File No.		Prepared by	R.Martinez
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```
     SUPPORT REACTIONS -UNIT MTON METE    STRUCTURE TYPE = SPACE
     -----------------

   JOINT  LOAD   FORCE-X    FORCE-Y    FORCE-Z      MOM-X      MOM-Y      MOM Z

    118     1       0.00       4.20      -0.01       0.03       0.00       0.00
            2       0.00       0.58       0.00       0.01       0.00       0.00
            3       0.00       0.00      -0.28      -1.51       0.00       0.00
            4      -0.49       0.01       0.00       0.00       0.00       1.95
    119     1      -0.05       4.00       0.00       0.03       0.00       0.09
            2       0.00       0.66       0.00       0.01       0.00       0.01
            3       0.00       0.00      -0.31      -1.33       0.00       0.00
            4      -0.49      -0.66       0.00       0.00       0.00       1.96
    120     1      -0.07       3.21      -0.01      -0.03       0.00       0.16
            2       0.00       0.33       0.00      -0.02       0.00       0.02
            3       0.00       0.00      -0.63      -1.88      -0.01       0.00
            4      -0.74       0.70       0.00       0.00       0.00       3.27
```

PROJECT: Detailed Design on Port Reactivation Project in La Union Province	Calc. File No.		Prepared by	R.Martinez
SECTION: Maintenance & Repair Shop	Calc. Index No.		Checked by	A.MORIOKA
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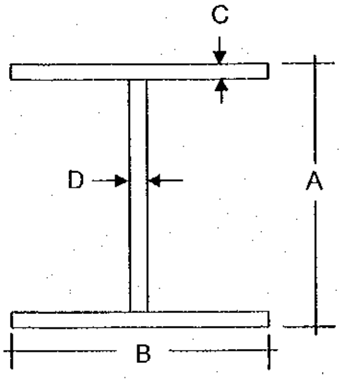
DESIGN FOR FRAMES, AXIS 2 TO 7

BEAMS

STEEL DESIGN



Beam type = **W24x84**

A = 24.1 in

B = 9.02 in

C = 0.77 in

D = 0.47 in

Area = 24.494 in²

Yc = 12.050 in

I = 2340.55 in4

S = 194.24 in³

Fy = 36 ksi

Pd = 6.70 ton

P_L = 1.93 ton

Md = 19.93 ton-m

M_L = 5.74 ton-m

P/A 54.61

Md / S = 626.15

M_L / S = 180.33

Stress = 861.09 kg/cm²

Allowable stress = 0.6 Fy = 1512.00 kg/cm² **o.k.!!**

- **Shear**

Vdead = 5170 kg

Vlive = 1470 kg

Max. Shear = 6640 kg

Fv = V / (h tw) = 90.86 kg/cm²

0.4 Fy = 1008.00 kg/cm² **o.k.!!**

- Deflection

Span = 24.00 m

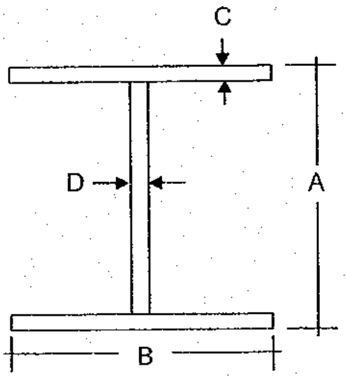
δ admi.= L/500 = 4.80 cm

δ dead = 2.23 cm

δ Total = 2.87 cm o.k!!

δ live = 0.64 cm

COLUMNS



Column type = W24x84

A = 24.1 in

B = 9.02 in

C = 0.77 in

D = 0.470 in

Area = 24.494 in²

I = 2340.55 in4

Yc = 12.050 in

S = 194.24 in³

Fy = 36 ksi

Md = 19.87 ton-m

Pd = 8.55 ton

Md = 19.87 ton-m

Ps = 2.06 ton

Ms = 5.74 ton-m

Reaction From Crane:

Pd = 12.14 ton

Distance from Col. Axis = 0.43 m

Additional Md = 5.22 ton-m

PROJECT: Detailed Design on Port Reactivation Project in La Union Province	Calc. File No.		Prepared by	R.Martinez
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Pd = 9.13 ton

P_L = 2.06 ton

P_S = 1.00 ton

Md = 16.74 ton-m

M_L = 4.82 ton-m

M_S = 7.81 ton-m

P/A(d+L) 147.63

0.75 P/A(d+L+s) 115.47

Md+ L/S = 841.36

0.75(Ms+d+L/S)= 815.05

Fy = 36 ksi

988.99 kg/cm²

0.6 Fy = 1512.00 kg/cm² **o.k.!!**

- Shear

Vdead = 4470 kg

Vlive = 1300 kg

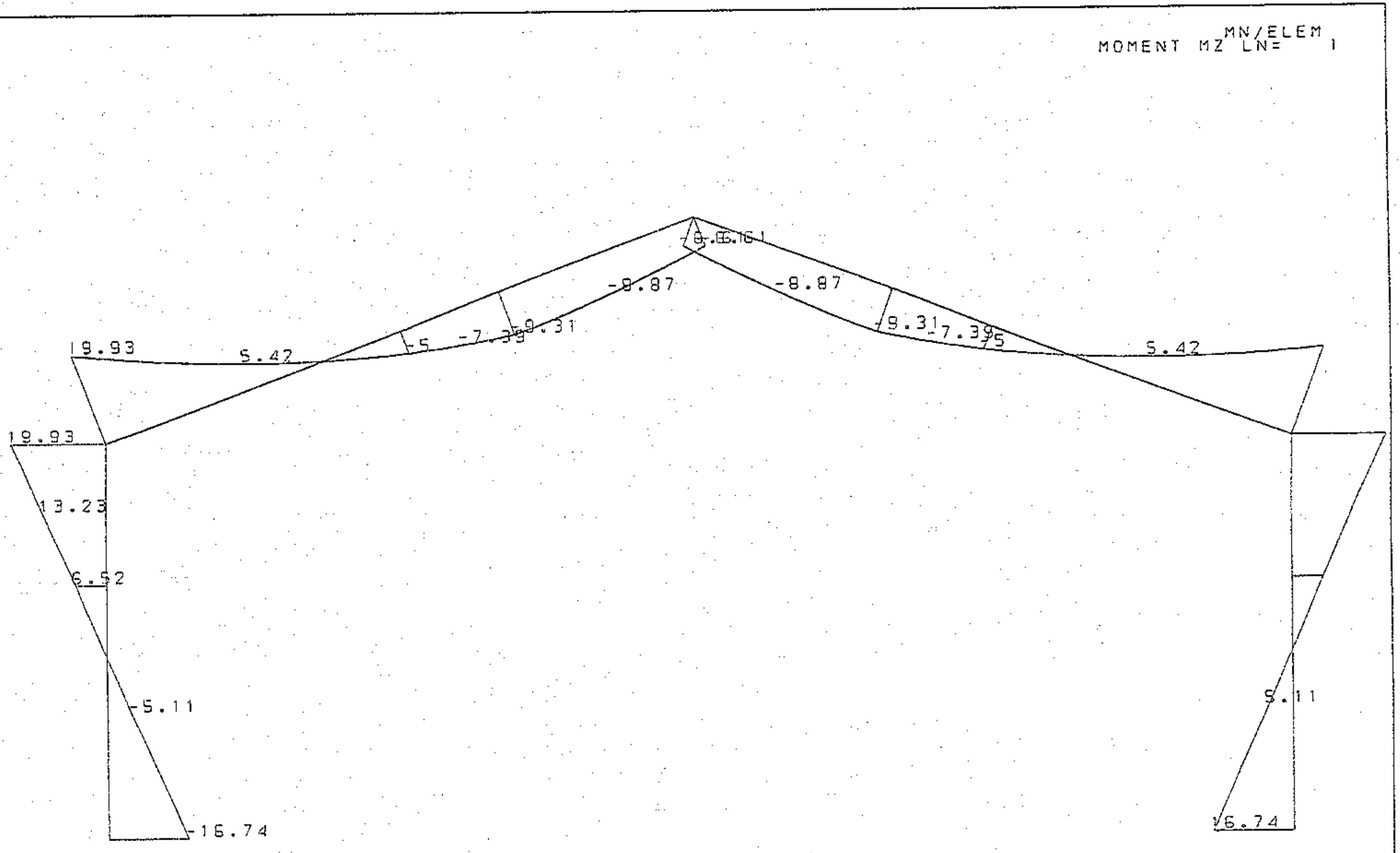
Max. Shear = 5770 kg

Fv = V / (h tw) = 78.96 kg/cm²

0.4 Fy = 1008.00 kg/cm² **o.k.!!**

STRUCTURE DATA

TYPE = SPACE
NJ = 132
NM = 218
NE = 0
NS = 31
NL = 4
XMAX= 24.0
YMAX= 12.7
ZMAX= 54.0



J=132,M=218 Maximum= 19.93 UNIT MET MTO

S T A A D P O S T - P L O T (REV: 21.1W) DATE: JUL 5. 2002

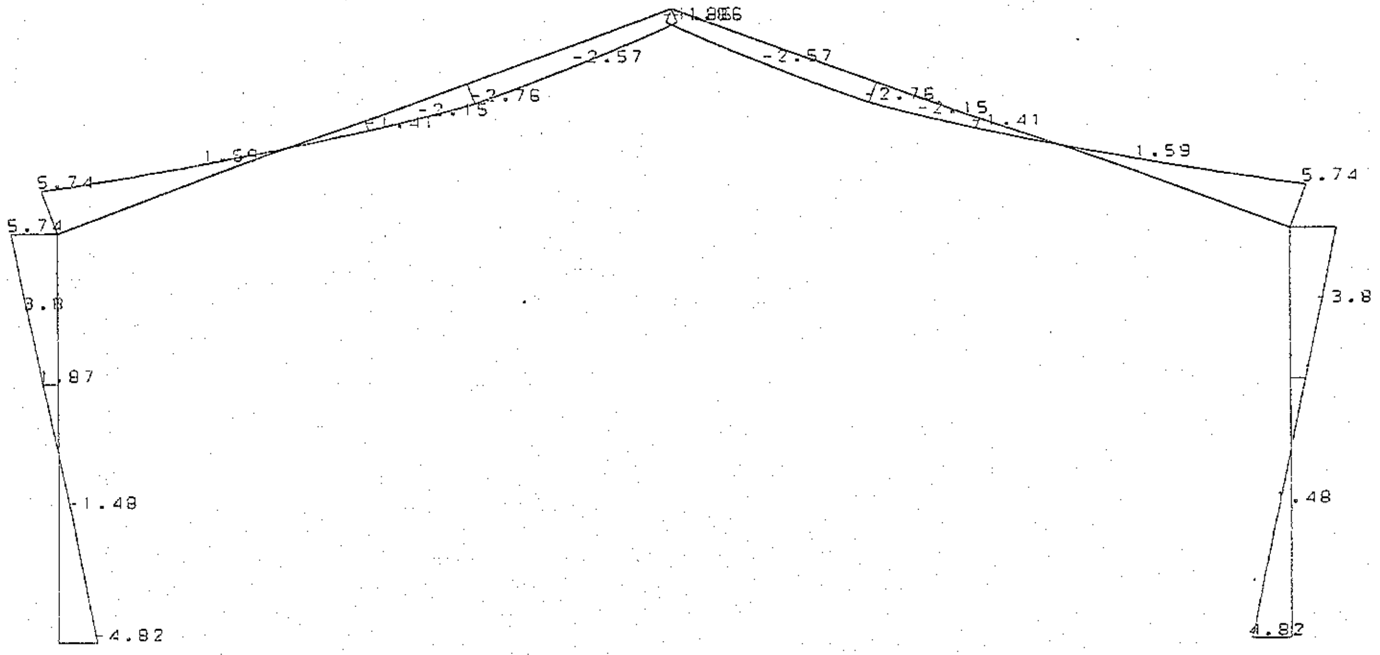
TITLE: MAINTENANCE & REPAIR SHOP

CALCULATION

Detailed Design
on Port Reactivation Project
in La Union Province

CALC FILE No.:		
CALC INDEX No.:		PAGE 22
	INITIAL	DATE
PREPARED BY	R.M.G.	JULY/02
CHECKED BY	A.M.	JULY/02

MOMENT MZ MN/ELEM LN= 2



STRUCTURE DATA
TYPE = SPACE
NJ = 132
NM = 218
NE = 0
NS = 31
NL = 4
XMAX= 24.0
YMAX= 12.7
ZMAX= 54.0

J=132,M=218 Maximum= 5.74

UNIT MET MTO

S T A A D P O S T - P L O T (REV: 21.1W)

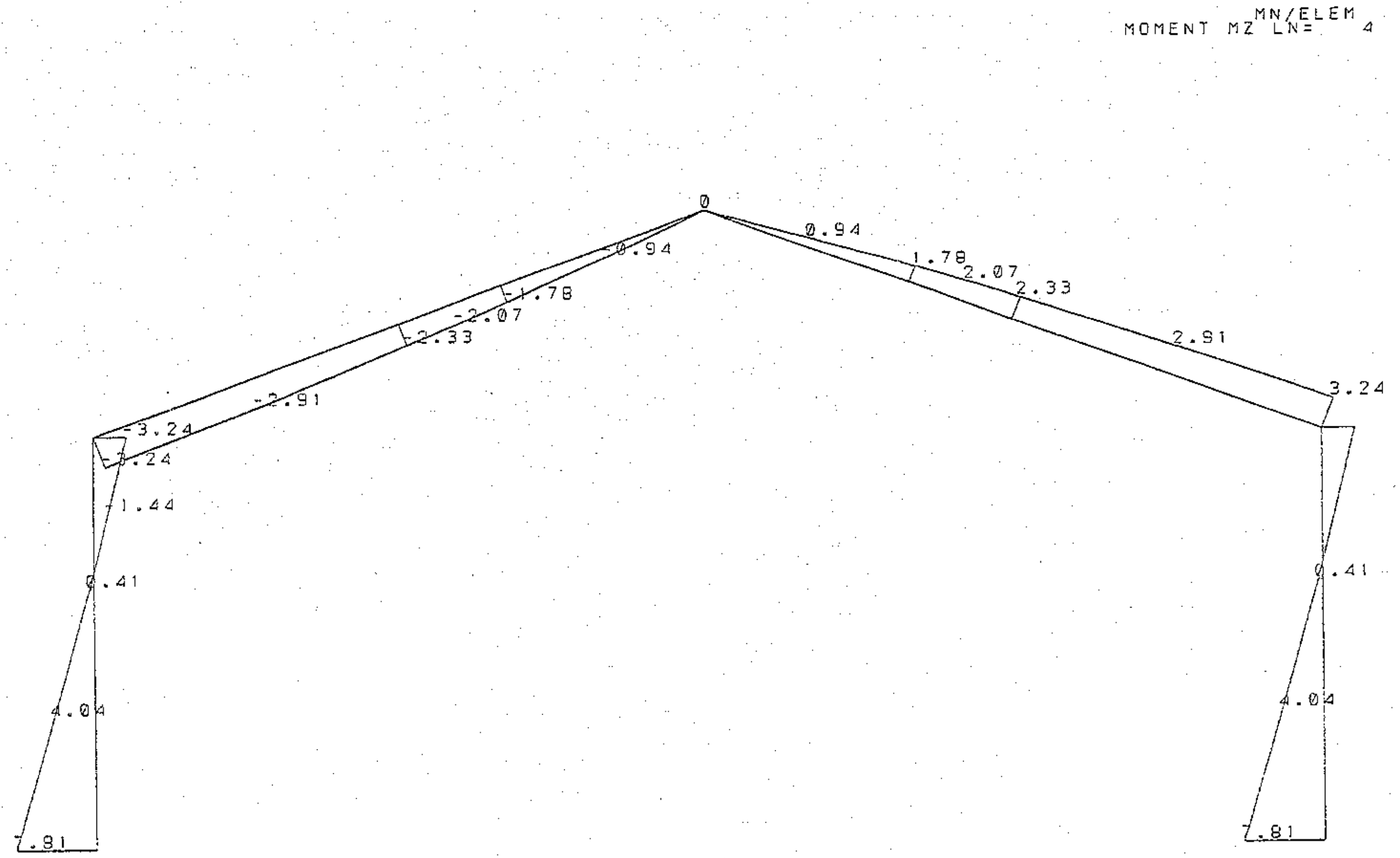
TITLE: MAINTENANCE & REPAIR SHOP

DATE: JUL 5, 2002

CALCULATION		
Detailed Design on Port Reactivation Project In La Union Province		
CALC FILE No.:		
CALC INDEX No.:		PAGE 23
	INITIAL	DATE
PREPARED BY	R.M.G.	JULY/02
CHECKED BY	A. M.	JULY/02

STRUCTURE DATA

TYPE = SPACE
NJ = 132
NM = 218
NE = 0
NS = 31
NL = 4
XMAX= 24.0
YMAX= 12.7
ZMAX= 54.0



J=132,M=218 Maximum= 7.81

UNIT MET MTO

STAAD POST - PLOT (REV: 21.1W)

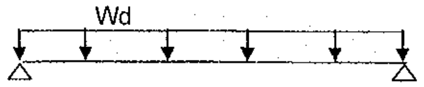
DATE: JUL 5, 2002

TITLE: MAINTENANCE & REPAIR SHOP

CALCULATION		
Detailed Design on Port Reactivation Project in La Union Province		
CALC FILE No.:		
CALC INDEX No.:	PAGE 24	
	INITIAL	DATE
PREPARED BY	R.M.G	JULY/02
CHECKED BY	A.M.	JULY/02

SECOND FLOOR BEAMS

- Beams axis 8 & 9 and Sub-beams between axis.



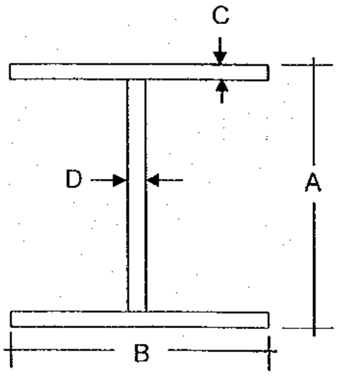
L = 6.00 m

Wd1 = 1305.0 kg/m

Wd2 = Wwall+selfw. = 168.58 kg/m

Wd = 1473.58 kg/m

W_L = 750.0 kg/m



Beam type = **W10x54**

A = 10.09 in

B = 10.03 in

C = 0.615 in

D = 0.370 in

Area = 15.62 in^2

I = 298.72 in4

Yc = 5.05 in

S = 59.21 in^3

Fy = 36 ksi

Md = 6.63 ton-m

M_L = 3.38 ton-m

Axial load
- Pd = 0.00 ton
- P_L = 0.00 ton

P/A 0.00

Md / S = 683.41

M_L / S = 347.83

} 1031.24 kg/cm^2

0.6 Fy = 1512.00 kg/cm^2 **o.k.!!**

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- Shear

Max. Shear = 6670.7 kg

$F_v = V / (h\ t_w) =$ 276.96 kg/cm²

0.4 Fy = 1008.00 kg/cm² **o.k.!!**

- Deflection

δ admi.= L/360 = 1.67 cm

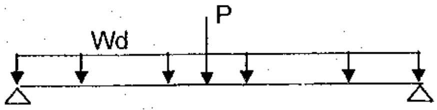
E = 2.04E+10 kg/m²

δ dead = 0.98 cm

δ Total = 1.48 cm o.k!!

δ live = 0.50 cm

- Beams axis A and E (between axis 8&9)

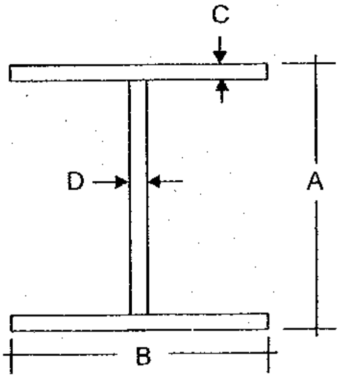


L = 6.00 m

Pd = 4420.7 kg

PL = 2250 kg

Wd = Wwall+selfw. = 167.00 kg/m



Beam type = **W14x53**

A = 13.92 in

B = 8.06 in

C = 0.66 in

D = 0.370 in

Area = 15.301 in²

Yc = 6.960 in

I = 529.73 in4

S = 76.11 in³

PROJECT: Detailed Design on Port Reactivation Project in La Union Province	Calc. File No.		Prepared by	R.Martinez
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Fy = 36 ksi

Md = 7.38 ton-m

Pd = 0.00 ton

M_L = 3.38 ton-m

P_L = 0.00 ton

P/A 0.00

Md / S = 591.92

M_L / S = 270.60

862.52 kg/cm²

0.6 Fy = 1512.00 kg/cm² **o.k.!!**

- Shear

Max. Shear = 6670.7 kg

Fv = V / (h tw) = 200.75 kg/cm²

0.4 Fy = 1008.00 kg/cm² **o.k.!!**

- Deflection

δ admi.= L/360 = 1.67 cm

E = 2.04E+10 kg/m²

δ dead = 0.49 cm

δ Total = 0.72 cm o.k!!

δ live = 0.23 cm

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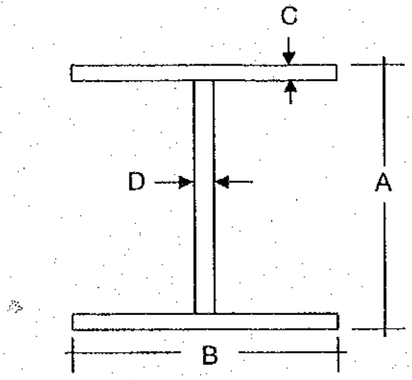
- Beams axis B to D (between axis 8&9)



Beam type = **W14x53**

A = 13.92 in

B = 8.06 in

C = 0.66 in

D = 0.370 in

Area = 15.301 in^2

Yc = 6.960 in

I = 529.73 in4

S = 76.11 in^3

Fy = 36 ksi

Pd = 0.46 ton

P_L = 0.23 ton

Md = 9.47 ton-m (From STAAD III)

M_L = 4.89 ton-m (From STAAD III)

$$\left.\begin{array}{ll} P/A & 6.98 \\ Md / S = & 759.28 \\ M_L / S = & 392.07 \end{array}\right\} \quad 1158.33 \text{ kg/cm}^2$$

0.6 Fy = 1512.00 kg/cm² **o.k.!!**

- Shear

Max. Shear = 8800.0 kg

Fv = V / (h tw) = 264.83 kg/cm²

0.4 Fy = 1008.00 kg/cm² **o.k.!!**

- Deflection

δ admi.= L/360 = 1.67 cm

E = 2.04E+10 kg/m²

δ dead = 0.55 cm

δ Total = 0.83 cm o.k!!

δ live = 0.28 cm

PROJECT: Detailed Design on Port Reactivation Project in La Union Province	Calc. File No.		Prepared by	R.Martinez
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DESIGN FOR ROOF BEAMS

- Sub-Beams between numerical axis.

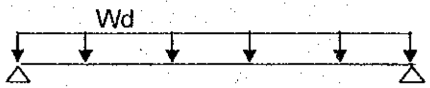
Tributary Width = 3.00 m

Dead Load = 50 kg/m²

Live load = 20 kg/m²

Wd = 150.0 kg/m

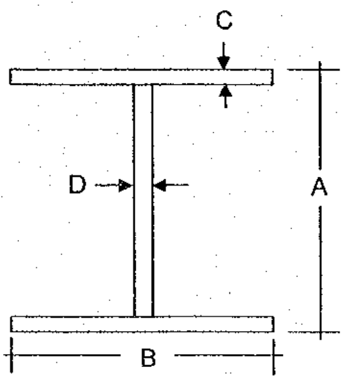
WL = 60.0 kg/m



L = 6.00 m

Wd1 = 150.0 kg/m
Wd2 = selfweight. = 29.27 kg/m
Wd = 179.27 kg/m

WL = 60.0 kg/m



Beam type = **W6x20**

A = 6.2 in

B = 6.02 in

C = 0.365 in

D = 0.260 in

Area = 5.82 in²

I = 41.00 in4

Yc = 3.100 in

S = 13.23 in³

Fy = 36 ksi

Md = 0.81 ton-m

ML = 0.27 ton-m

Axial load
Pd = 0.00 ton
PL = 0.00 ton

P/A 0.00
Md / S = 372.21
ML / S = 124.58

496.79 kg/cm²

0.6 Fy = 1512.00 kg/cm² **o.k.!!**

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- Shear

Max. Shear = 717.8 kg

Fv = V / (h tw) = 69.02 kg/cm²

0.4 Fy = 1008.00 kg/cm² **o.k.!!**

- Deflection

δ admi.= L/360 = 1.67 cm

E = 2.04E+10 kg/m²

δ dead = 0.87 cm

δ Total = 1.16 cm o.k!!

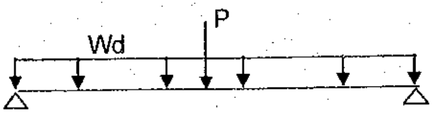
δ live = 0.29 cm

- Beams axis A to E

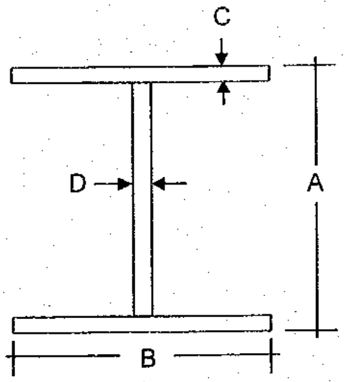
Pd = 1075.6 kg

PL = 360 kg

Wselfw. = 31.25 kg/m



L = 6.00 m



Beam type = **W8x21**

A = 8.28 in

B = 5.27 in

C = 0.4 in

D = 0.250 in

Area = 6.086 in²

Yc = 4.140 in

I = 74.22 in4

S = 17.93 in³

Fy = 36 ksi

Md = 1.75 ton-m

Pd = 0.00 ton

ML = 0.54 ton-m

PL = 0.00 ton

$$\left.\begin{array}{ll} P/A & 0.00 \\ Md / S = & 597.05 \\ M_L / S = & 183.80 \end{array}\right\} \quad 780.86 \ \text{kg/cm}^2 \qquad 0.6\,Fy = 1512.00 \ \text{kg/cm}^2 \quad \textbf{o.k.!!}$$

- Shear

Max. Shear = 1529.4 kg

Fv = V / (h tw) = 114.52 kg/cm²

0.4 Fy = 1008.00 kg/cm² **o.k.!!**

- Deflection

δ admi.= L/360 = 1.67 cm

E = 2.04E+10 kg/m²

δ dead = 0.85 cm

δ Total = 1.11 cm o.k!!

δ live = 0.26 cm

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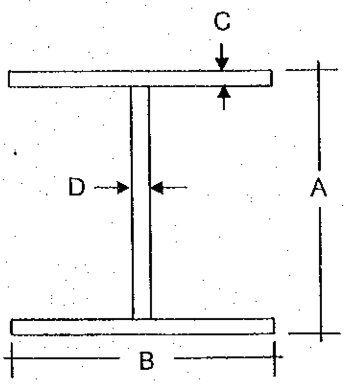
2nd FLOOR COLUMNS

- Columns A8, A9, E8 and E9



Column type = W24x84

A = 24.10 in

B = 9.02 in

C = 0.77 in

D = 0.47 in

Area = 24.494 in^2

I = 2340.55 in4

Yc = 12.050 in

S = 194.24 in^3

Pd = 10.30 ton

Md = 2.62 ton-m

PL = 3.90 ton

ML = 0.80 ton-m

Ps = 2.50 ton

Ms = 23.68 ton-m

Fy = 36 ksi

P/A(d+L) 89.86

P/A(d+L+s) 105.68

Md+ L/S = 107.45

Ms+d+L/S= 851.41

957.09 kg/cm²

0.6 Fy = 1512.00 kg/cm² **o.k.!!**

- Shear

Vdead = 1680 kg

Vlive = 530 kg

Vseismic = 5640 kg

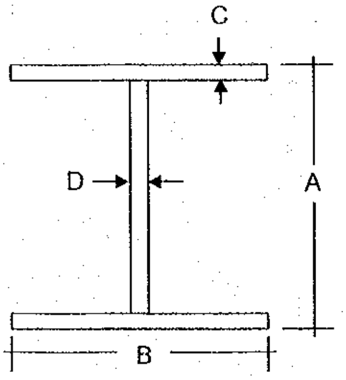
Max. Shear = 5887.5 kg

Fv = V / (h tw) = 80.57 kg/cm²

0.4 Fy = 1008.00 kg/cm² **o.k.!!**

- Columns BCD8-9

1)



Column type = W21x68

A = 21.13 in

B = 8.27 in

C = 0.685 in

D = 0.430 in

Area = 20.000 in^2

I = 1480.00 in4

Yc = 10.565 in

S = 140.09 in^3

Pd = 19.60 ton

Md = 4.57 ton-m

P$_L$ = 8.43 ton

M$_L$ = 2.31 ton-m

Ps = 2.44 ton

Ms = 6.37 ton-m

Fy = 36 ksi

P/A(d+L) 217.23

P/A(d+L+s) 236.14

Md+ L/S = 299.71

Ms+d+L/S= 577.19

813.34 kg/cm^2

0.6 Fy = 1512.00 kg/cm^2 **o.k.!!**

- Shear

Vdead = 830 kg

Vlive = 420 kg

Vseismic = 2750 kg

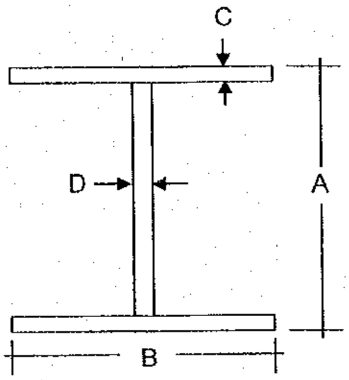
Max. Shear = 1250 kg

Fv = V / (h tw) = 21.32 kg/cm^2

0.4 Fy = 1008.00 kg/cm^2 **o.k.!!**

- Columns BCD8-9

2)



Column type = **W21x68**

A = 21.13 in

B = 8.27 in

C = 0.685 in

D = 0.430 in

Area = 20.000 in^2

I = 1480.00 in4

Yc = 10.565 in

S = 140.09 in^3

P_d = 12.77 ton

M_d = 2.38 ton-m

P_L = 6.31 ton

M_L = 1.20 ton-m

P_s = 2.33 ton

M_s = 23.37 ton-m

Fy = 36 ksi

P/A(d+L) 147.87

P/A(d+L+s) 165.93

Md+ L/S = 155.95

Ms+d+L/S= 1173.99

1339.92 kg/cm^2

0.6 Fy = 1512.00 kg/cm^2 **o.k.!!**

- Shear

Vdead = 830 kg

Vlive = 420 kg

Vseismic = 2750 kg

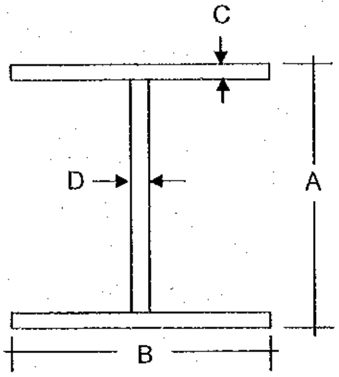
Max. Shear = 1250 kg

Fv = V / (h tw) = 21.32 kg/cm^2

0.4 Fy = 1008.00 kg/cm^2 **o.k.!!**

- Columns BCD8-9

3)



Column type = W21x68

A = 21.13 in

B = 8.27 in

C = 0.685 in

D = 0.430 in

Area = 20.000 in²

Yc = 10.565 in

I = 1480.00 in4

S = 140.09 in³

Pd = 20.25 ton

PL = 8.42 ton

Ps = 6.63 ton

Md = 2.21 ton-m

ML = 1.11 ton-m

Ms = 24.08 ton-m

P/A(d+L) 222.19

P/A(d+L+s) 273.58

Md+ L/S = 144.63

Ms+d+L/S= 1193.60

Fy = 36 ksi

1467.17 kg/cm²

0.6 Fy = 1512.00 kg/cm² **o.k.!!**

- Shear

Vdead = 830 kg

Vlive = 420 kg

Vseismic = 2750 kg

Max. Shear = 1250 kg

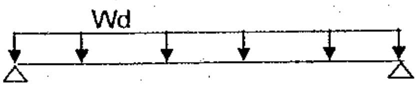
Fv = V / (h tw) = 21.32 kg/cm²

0.4 Fy = 1008.00 kg/cm² **o.k.!!**

2nd Beam B9 **lateral using**

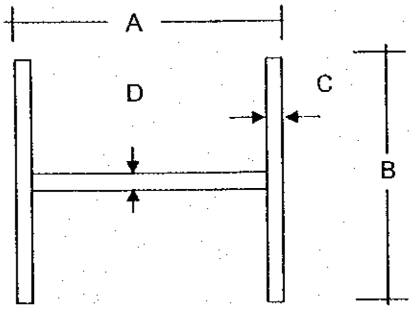
wind load 65 kg/m2

Tributary Width = 5.25 m



L = 12.00 m

W= 341.25 kg/m



Beam type = **W10x60**

A = 10.22 in

B = 10.08 in

C = 0.68 in

D = 0.420 in

Lateral use

Area = 17.600 in²

Yc = 5.110 in

Fy = 36 ksi

I = 341.00 in4

S = 66.73 in³

Md = 6.14 ton-m

Md / S = 561.71

ML / S = 0.00

561.71 kg/cm²

0.6 Fy = 1512.00 kg/cm² **o.k.!!**

- Shear

Max. Shear = 2047.5 kg

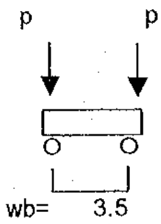
Fv = V / (h tw) = 73.94 kg/cm²

0.4 Fy = 1008.00 kg/cm² **o.k.!!**

- Deflection

E = 2.0E+10 kg/m²

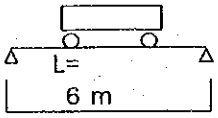
δ dead = 3.18 cm



1. Load Condition

max wheel weight p= 6.0 t

impact factor
(pendant-operated crane)
virtical a= 1.1
lateral b= 0.2



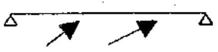
2. Stress
2.1 virtical
stress by wheel

Rmax1= p a(2-wb/L)= 9.35 t
Mmax1= a p(L-wb/2)2/(2L)= 9.93 tm

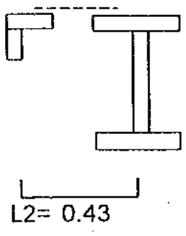
stress by girder self-weight
q= 0.93 t/m

Rmax2= q L/2= 2.79 t
Mmax2= q L2/8= 4.19 tm

R1= Rmax1+Rmax2= 12.14 t
M1= Mmax1+Mmax2= 14.12 tm

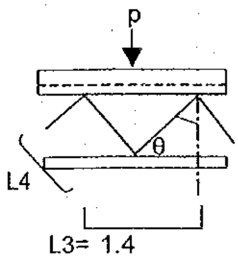


2.2 lateral
wheel
Q2= b Rmax/a= 1.70 t
M2= b Mmax/a= 1.81 tm



axial force by M2

N2= M2/L2= 4.20 t



upper flange bend

M3= p b L3/4= 0.42 tm

3. Design of runway-girder

W21x62	A36	
Fy	2.53	t/cm2
hight	533.1	mm
wide	209.3	mm
web t	10.16	mm
flange t	15.62	mm
Jx	55400	cm4
Zx	2080	cm3
Fv	1.01	t/cm2

flange structural characteristic

Af	32.69	cm2
Zf	114.04	cm3
If	1193.5	cm4
r	6.04	cm
K	0.65	
KL3/r	15	
Fa	1.47	t/cm2
Fb=0.66F	1.67	t/cm2

upper flange

σc= N2/Af= 0.13 t/cm2

σb= M1/Z+M3/ 1.05 t/cm2

σc/Fa+σb/Fb= 0.71 OK

lower flange

σb= M1/Z= 0.68 OK

shear

v= R1/Aw= 0.24 OK

deflection (d <1/1000)

d1= (L-wb)(L2+(L+wb)2)a p/(48EI)=

0.37 cm

self-weight d2= 5q L3/(384E I)=

0.13 cm

d= d1+d2 0.51 cm

d/L= 7/8269 OK

4. Back -girder

chord

L-4x7/16	A36	
A=	19	cm2
r=	1.98	cm
K	1	
KL3/r	71	
Fa	1.15	t/cm2

σc= N2/A= 0.22 t/cm2

OK

lattice

Q5= 0.02 M2/L2= 0.08 t

Q6= Q2+Q5= 1.78 t

θ= 1.91

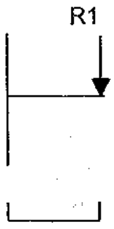
N6= Q6 cosθ= 3.41 t

L-3x1/4	A36	
A=	8.727	cm2
r=	1.48	cm
K	1	
L4=	0.82	m
KL4/r	56	
Fa	1.25	t/cm2

σc= N6/A= 0.39 t/cm2

OK

5. Cantilever beam supporting crane girder



L7= 0.43

M7= R1 L7= 5.22 tm

W18x76		
Fy	2.53	t/cm2
I=	55400	cm4
Zx=	2390	cm3
F b=0.66	1.67	t/cm2

σb= M7/Zx= 0.22 t/cm2

OK

d= 0.003 cm

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first floor weight

	Portion	unit weight	L or A	
DL				
	1-A			
	cover concrete	1.08 t/m	2.10 m	2.27 t
	C.B	0.29 t/m2	6.51 m2	1.91 t
	Slab	0.45 t/m2	4.50 m2	2.03 t
	Beam	0.59 t/m	4.50 m	2.65 t
				8.85 t
	1-B			
	C.B	0.29 t/m2	12.60 m2	3.69 t
	Slab	0.45 t/m2	9.00 m2	4.05 t
	Beam	0.59 t/m	6.00 m	3.53 t
		0.252 t/m	1.5 m	0.38 t
				11.65 t
	1-C			
	cover concrete	1.08 t/m	2.10 m	2.27 t
		0.45 t/m	1.05 m	0.47 t
	C.B	0.29 t/m2	11.13 m2	3.26 t
	Slab	0.45 t/m2	9.00 m2	4.05 t
	Beam	0.59 t/m	7.50 m	4.41 t
				14.46 t
	1-D			
	cover concrete	1.08 t/m	2.10 m	2.27 t
		0.45 t/m	2.10 m	0.95 t
	C.B	0.29 t/m2	10.71 m2	3.14 t
	Slab	0.45 t/m2	6.72 m2	3.02 t
	Beam	0.59 t/m	7.12 m	4.19 t
				13.56 t
	1-E			
	cover concrete	1.08 t/m	2.10 m	2.27 t
		0.45 t/m	1.05 m	0.47 t
	C.B	0.29 t/m2	4.41 m2	1.29 t
	Slab	0.45 t/m2	4.50 m2	2.03 t
	Beam	0.59 t/m	4.50 m	2.65 t
				8.70 t

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DL	Portion	unit weight	L or A	
	1/2-A			
	cover concrete	0.45 t/m	2.10 m	0.95 t
	C.B	0.29 t/m2	5.46 m2	1.60 t
	Slab	0.45 t/m2	4.50 m2	2.03 t
	Beam	0.59 t/m	6.00 m	3.53 t
				8.10 t
	B-1/2,7/8 C-3/4,7/8 D-3/4,7/8			
	Slab	0.45 t/m2	18.00 m2	8.10 t
	Beam	0.59 t/m	9.00 m	5.29 t
				13.39 t
	C-1/2			
	Slab	0.45 t/m2	18.00 m2	8.10 t
	Beam	0.59 t/m	6.00 m	3.53 t
	Pit Wall	0.96 t/m	6.00 m	5.76 t
	Add concrete	1.73 t		1.73
				19.12 t
	D-1/2 1, 2 axis side, D-2/3 1,2 axis side			
	Slab	0.45 t/m2	11.22 m2	5.05 t
	Beam	0.59 t/m	1.12 m	0.66 t
	Pit Wall	0.96 t/m	6.00 m	5.76 t
				11.47 t
	E-1/2			
	Slab	0.45 t/m2	9.00 m2	4.05 t
	Beam	0.59 t/m	3.00 m	1.76 t
	Pit Wall	0.96 t/m	6.00 m2	5.76 t
				11.57 t

DL	Portion	unit weight	L or A	
	2,3,4-A 7-A			
	cover concrete	1.08 t/m	2.10 m	2.27 t
	C.B	0.29 t/m2	5.25 m2	1.54 t
	Slab	0.45 t/m2	9.00 m2	4.05 t
	Beam	0.59 t/m	6.00 m	3.53 t
				11.38 t
	E-3			
	cover concrete	1.08 t/m	2.10 m	2.27 t
	C.B	0.29 t/m2	2.63 m2	0.77 t
	Slab	0.45 t/m2	9.00 m2	4.05 t
	Beam	0.59 t/m	6.00 m	3.53 t
				10.62 t
	E-4/5			
	Slab	0.45 t/m2	9.00 m2	4.05 t
	Beam	0.59 t/m	6.00 m	3.53 t
				7.58 t
	B,C,D 8,9			
	Cover concrete	1.08 t/m	2.10 m	2.27 t
	CB	0.29 t/m2	11.55 m	3.38 t
	Slab	0.45 t/m2	18.00 m	8.10 t
	Beam	0.59 t/m	9.00 m	5.29 t
				19.04 t
	2-D			
	Slab	0.45 t/m2	13.44 m2	6.05 t
	Beam	0.59 t/m	8.24 m	4.85 t
				10.89 t

first floor weight

	Portion	unit weight		L or A			
LL							
	Corner	2.00	t/m2	4.50	m	9.00	t
	Side	2.00	t/m2	9.00	m	18.00	t
	Middle	2.00	t/m2	18.00	m	36.00	t
	Side Office	0.35	t/m2	9.00	m	3.15	t
	Middle Office	0.35	t/m2	18.00	m	6.30	t

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Total Weight

	1		2		3		4		
	4.5		9.1		9.5		9.5		
A	0.7		2.1		2.0		2.1		
	8.9	8.1	11.4	8.1	11.4	8.1	11.4	8.1	
	9.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	
	13.4	8.1	20.5	8.1	20.9	8.1	20.9	8.1	
	9.7	18.0	20.1	18.0	20.0	18.0	20.1	18.0	
	23.1	**26.1**	**40.6**	**26.1**	**40.9**	**26.1**	**41.0**	**26.1**	
	5		6		7		8		
	9.1		9.1		9.1		10.4		
A	2.1		2.1		2.1		3.8		
	10.6	7.6	10.6	8.1	11.4	8.1	11.4	8.1	
	18.0	18.0	18.0	18.0	18.0	18.0	10.6	3.2	
	19.7	7.6	19.7	8.1	20.5	8.1	21.8	8.1	
	20.1	18.0	20.1	18.0	20.1	18.0	14.4	3.2	
	39.8	**25.6**	**39.8**	**26.1**	**40.6**	**26.1**	**36.2**	**11.3**	
	9		10						
	10.5		2.9						Upper Frame DL
A	3.9		0.3						Upper Frame LL
	11.4	8.1	8.9						1st Floor DL
	10.6	18.0	9.0						1st Floor LL
	21.9	8.1	11.8						DL
	14.5	18.0	9.3						LL
	36.4	**26.1**	**21.1**						TL
	1		2		3		4		
B									
	11.7	13.4	13.4	13.4	13.4	13.4	13.4	13.4	
	18.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	
	11.7	13.4	13.4	13.4	13.4	13.4	13.4	13.4	
	18.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	
	29.7	**49.4**	**49.4**	**49.4**	**49.4**	**49.4**	**49.4**	**49.4**	
	5		6		7		8		
							19.2		
B							7.9		
	13.4	13.4	13.4	13.4	13.4	13.4	19.0	13.4	
	36.0	36.0	36.0	36.0	36.0	36.0	21.2	6.3	
	13.4	13.4	13.4	13.4	13.4	13.4	38.2	13.4	
	36.0	36.0	36.0	36.0	36.0	36.0	29.1	6.3	
	49.4	**49.4**	**49.4**	**49.4**	**49.4**	**49.4**	**67.3**	**19.7**	

	9		10					
	18.1		4.0					
B	7.7		0.7					
	19.0	13.4	14.5					
	21.2	36.0	18.0					
	37.1	13.4	18.5					
	28.9	36.0	18.7					
	66.0	**49.4**	**37.2**					
	1		2		3		4	
	5.9							
C	1.0							
	14.5	19.1	13.4	19.1	13.4	13.4	13.4	13.4
	18.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0
	20.4	19.1	13.4	19.1	13.4	13.4	13.4	13.4
	19.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0
	39.4	**55.1**	**49.4**	**55.1**	**49.4**	**49.4**	**49.4**	**49.4**
	5		6		7		8	
							15.0	
C							7.3	
	13.4	13.4	13.4	13.4	13.4	13.4	19.0	13.4
	36.0	36.0	36.0	36.0	36.0	36.0	21.2	6.3
	13.4	13.4	13.4	13.4	13.4	13.4	34.0	13.4
	36.0	36.0	36.0	36.0	36.0	36.0	28.5	6.3
	49.4	**49.4**	**49.4**	**49.4**	**49.4**	**49.4**	**62.5**	**19.7**
	9		10					
	19.6		4.2					
C	8.4		0.6					
	19.0	13.4	14.5					
	21.2	36.0	18.0					
	38.6	13.4	18.7					
	29.6	36.0	18.6					
	68.2	**49.4**	**37.3**					

	1		2		3		4	
	3.3		3.3					
D	0.4		0.4					
	13.6	***11.5***	10.9	***11.5***	13.4	13.4	13.4	13.4
	13.4	22.4	27.0	22.4	31.4	36.0	36.0	36.0
	16.9	11.5	14.2	11.5	13.4	13.4	13.4	13.4
	13.8	22.4	27.4	22.4	31.4	36.0	36.0	36.0
	30.7	**33.9**	**41.6**	**33.9**	**44.8**	**49.4**	**49.4**	**49.4**

	5		6		7		8	
							19.2	
D							7.9	
	13.4	13.4	13.4	13.4	13.4	13.4	19.0	13.4
	36.0	36.0	36.0	36.0	36.0	36.0	21.2	6.3
	13.4	13.4	13.4	13.4	13.4	13.4	38.2	13.4
	36.0	36.0	36.0	36.0	36.0	36.0	29.1	6.3
	49.4	**49.4**	**49.4**	**49.4**	**49.4**	**49.4**	**67.3**	**19.7**

	9		10
	18.2		4.0
D	7.7		0.7
	19.0	13.4	14.5
	21.2	36.0	18.0
	37.2	13.4	18.5
	28.9	36.0	18.7
	66.1	**49.4**	**37.2**

	1		2		3		4	
	3.3		9.4		9.6		9.1	
E	0.5		2.0		2.1		2.1	
	8.7	11.6	10.6	11.6	10.6	8.1	10.6	7.6
	9.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0
	12.0	11.6	20.0	11.6	20.2	8.1	19.7	7.6
	9.5	18.0	20.0	18.0	20.1	18.0	20.1	18.0
	21.5	**29.6**	**40.0**	**29.6**	**40.3**	**26.1**	**39.8**	**25.6**

	5		6		7		8	
	9.1		9.1		9.1		10.2	
E	2.1		2.1		2.1		3.9	
	10.6	8.1	10.6	7.6	10.6	8.1	11.4	8.1
	18.0	18.0	18.0	18.0	18.0	18.0	10.6	3.2
	19.7	8.1	19.7	7.6	19.7	8.1	21.6	8.1
	20.1	18.0	20.1	18.0	20.1	18.0	14.5	3.2
	39.8	**26.1**	**39.8**	**25.6**	**39.8**	**26.1**	**36.1**	**11.3**

	9		10
	10.4		3.2
E	3.8		0.3
	10.6	7.6	8.7
	10.6	18.0	9.0
	21.0	7.6	11.9
	14.4	18.0	9.3
	35.4	**25.6**	**21.2**

Size(cm)	Pile Bearing Capacity (ton)
40	47.4
45	60.0
50	74.0

Number of Pile

	1		2		3		4	
	23.1	26.1	40.6	26.1	40.9	26.1	41.0	26.1
A	2-40	1-40	2-40	1-40	2-40	1-40	2-40	1-40

	5		6		7		8	
	39.8	25.6	39.8	26.1	40.6	26.1	36.2	11.3
A	2-40	1-40	2-40	1-40	2-40	1-40	2-40	1-40

	9		10
	36.4	26.1	21.1
A	2-40	1-40	2-40

	1		2		3		4	
	29.7	49.4	49.4	49.4	49.4	49.4	49.4	49.4
B	1-40	1-45	1-45	1-45	1-45	1-45	1-45	1-45

	5		6		7		8	
	49.4	49.4	49.4	49.4	49.4	49.4	67.3	19.7
B	1-45	1-45	1-45	1-45	1-45	1-45	2-40	1-40

	9		10
	66.0	49.4	37.2
B	2-40	1-45	1-45

upper liine Total Weight
lower line Number and Size of pile

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	1		2		3		4	
	39.4	55.1	49.4	55.1	49.4	49.4	49.4	49.4
C	1-45	1-45	1-45	1-45	1-45	1-45	1-45	1-45
	5		6		7		8	
	49.4	49.4	49.4	49.4	49.4	49.4	62.5	19.7
C	1-45	1-45	1-45	1-45	1-45	1-45	2-40	1-40
	9		10					
	68.2	49.4	37.3					
C	2-40	1-45	1-45					
	1		2		3		4	
	30.7	33.9	41.6	33.9	44.8	49.4	49.4	49.4
D	1-45	1-40	1-40	1-40	1-45	1-45	1-45	1-45
	5		6		7		8	
	49.4	49.4	49.4	49.4	49.4	49.4	67.3	19.7
D	1-45	1-45	1-45	1-45	1-45	1-45	2-40	1-40
	9		10					
	66.1	49.4	37.2					
D	2-40	1-45	1-45					
	1		2		3		4	
	21.5	29.6	40.0	29.6	40.3	26.1	39.8	25.6
E	2-40	1-40	2-40	1-40	2-40	1-40	2-40	1-40
	5		6		7		8	
	39.8	26.1	39.8	25.6	39.8	26.1	36.1	11.3
E	2-40	1-40	2-40	1-40	2-40	1-40	2-40	1-40
	9		10					
	35.4	25.6	21.2					
E	2-40	1-40	2-40					

PILE SEISMIC STRESS

Based on chung equation

mark	size (cm)	length (m)	I (cm4)	kh (kg/cm3)	(cm-1) (cm-1)	L	I 3
P1	79	4	3.25E+06	1.902	0.00249	1.0	0.050
P2	44	4	3.12E+05	2.950	0.00431	1.7	0.025

	N of piles	nI 3	Q (t)	Q (t/n)	y0 (cm)	M0 (t m)	Mmax (t m)	lm (m)
	56	2.814	45.7	0.8	0.0	1.6	0.3	6.3
	6	0.150	2.4	0.4	0.0	0.5	0.1	3.6
Σ=	62	2.964	48.1					

Young's Modulus, E = 3.00E+05 kg/cm2

Seismic force, Q = 48.1 t

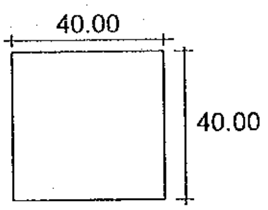
N = 9

E0 = 63

40 x 40		
L (cm)	M (t m)	Q (t)
0	1.6	0.8
-50	1.3	0.7
-100	0.9	0.6
-150	0.6	0.5
-200	0.4	0.4
-250	0.2	0.4
-300	0.0	0.3
-350	-0.1	0.2
-400	-0.2	0.2
-450	-0.2	0.1
-500	-0.3	0.1
-550	-0.3	0.0
-600	-0.3	0.0
-650	-0.3	0.0
-700	-0.3	0.0
-750	-0.3	0.0

45 x 45		
L (cm)	M (t m)	Q (t)
0	0.5	0.4
-50	0.3	0.3
-100	0.2	0.2
-150	0.0	0.2
-200	0.0	0.1
-250	-0.1	0.1
-300	-0.1	0.0
-350	-0.1	0.0
-400	-0.1	0.0
-450	-0.1	0.0
-500	-0.1	0.0
-550	-0.1	0.0
-600	0.0	0.0
-650	0.0	0.0
-700	0.0	0.0
-750	0.0	0.0

PILE DESIGN



f'c = 350.00 kg/cm²

At release, f'c = 280.00 kg/cm²

Section Area = 1600 cm²

Section Inertia = 213333.33 cm4

- Prestressing Force

Cables.
Uncoated seven wire stress relieved strands.
ϕ = 12.7 mm. Area = 92.90 mm.

Ultimate Strenght, Fpu = 17,500.0 kg/cm²

\# of strands to use = 6

Prestressing force, Po = 0.70 Fpu = 68.28 ton

Allowable stress

At service
0.4 f'c = 140 kg/cm²

At release
0.4 f'c = 112 kg/cm²

a) Stress at release

Axial Load, Pa = 0.00 ton

Excentricity, e = 0.00 cm

Moment, Ma = 0.00 ton-m

c = 20.00 cm

(Pa+Po) / A ± (Po e c / I + Ma c / I)

42.68 ± 0.00

Stress 1 = 42.68 kg/cm² < 0.4f'c o.k!!!

Stress 2 = 42.68 kg/cm² < 0.4f'c o.k!!!

b) Stress at Service

Axial Load, Pa = 47.40 ton

Excentricity, e = 0.00 cm

Moment, Ma = 1.64 ton-m

Prestress force, Pe = 58.04 cm (15% losses)

(Pa+Pe) / A ± (Pe e c / I + Ma c / I)

65.90 ± 15.34

Stress 1 = 81.23 kg/cm² < 0.4f'c o.k!!!

Stress 2 = 50.56 kg/cm² < 0.4f'c o.k!!!

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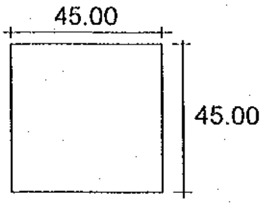
PILE DESIGN



f'c = 350.00 kg/cm²

At release, f'c = 280.00 kg/cm²

Section Area = 2025 cm²

Section Inertia = 341718.8 cm4

- Prestressing Force

Cables.
Uncoated seven wire stress relieved strands.
ϕ = 12.7 mm. Area = 92.90 mm.

Ultimate Strenght, Fpu = 17,500.0 kg/cm²

# of strands to use = 6

Prestressing force, Po = 0.70 Fpu = 68.28 ton

Allowable stress

At service
0.4 f'c = 140 kg/cm²

At release
0.4 f'c = 112 kg/cm²

a) Stress at release

Axial Load, Pa = 0.00 ton

Excentricity, e = 0.00 cm

Moment, Ma = 0.00 ton-m

c = 22.50 cm

(Pa+Po) / A ± (Po e c / I + Ma c / I)

33.72 ± 0.00

Stress 1 = 33.72 kg/cm² < 0.4f'c o.k!!!

Stress 2 = 33.72 kg/cm² < 0.4f'c o.k!!!

b) Stress at Service

Axial Load, Pa = 47.40 ton

Excentricity, e = 0.00 cm

Moment, Ma = 0.47 ton-m

Prestress force, Pe = 58.04 cm (15% losses)

(Pa+Pe) / A ± (Pe e c / I + Ma c / I)

52.07 ± 3.11

Stress 1 = 55.17 kg/cm² < 0.4f'c o.k!!!

Stress 2 = 48.96 kg/cm² < 0.4f'c o.k!!!

PROJECT: Detailed Design on Port Reactivation Project in La Union Province	Calc. File No.		Prepared by R.Martinez
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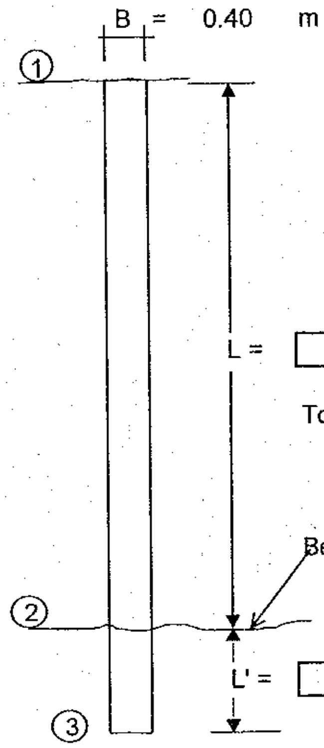
BEARING CAPACITY OF SQUARE DRIVEN CONCRETE PILES

B = 0.40 m

20xB = 8.00 m

Side dimension = 0.40 m



L = 3 m

Top Soil

Bearing Layer

L' = 1 m

	Properties In Top Soil:		Properties In Bearing Stratum:	
N of hits by SPT =	8	N	50	N
Ø =	29.80	°	42.39	°
γ =	1.430	ton/m³	1.840	ton/m³
Nq =	21		145	
δ =	22.35	°	31.79	°
KHc =	1		1	

$\phi = \sqrt{12N} + 20$

Factor of safety (F.S.) = 3

Pressure due to soil:

P1 = 0.00 ton/m³
P2 = 4.29 ton/m³
P3 = 6.13 ton/m³

Qult = Qt + Qf

- Tip Resistance (Qt)

Qp = PtxNqxAt Pt = P3 = 6.13 ton/m²

Pile Area = 0.160 m² **Qp = 142.29 ton**

- Friction Capacity (Qf) Consider Friction ? N Y/N

Qf = Σ(KHc)xPoxTAN(δ)xS

S1 = 2BLD S1 = 2.40 m² Po1 = (P1 + P2)/2

S2 = 2BL'D S2 = 0.80 m² Po2 = (P2 + P3)/2

Po1 = 2.148 ton/mt² Po2 = 5.213 ton/m² **Qf = 0.00 ton**

Qult = Qt + Qf Qult = 142.29 ton

Qadm = Qult / F.S. **Qadm = 47.43 ton**

PROJECT: Detailed Design on Port Reactivation Project in La Union Province	Calc. File No.		Prepared by	R.Martinez
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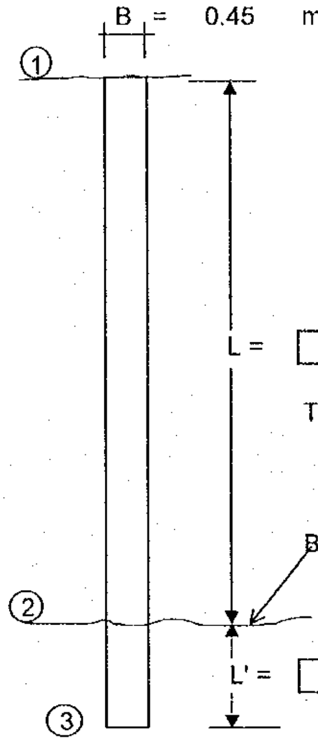
BEARING CAPACITY OF SQUARE DRIVEN CONCRETE PILES



B = 0.45 m 20xB = 9.00 m

Side dimension = 0.45 m

	Properties In Top Soil:		Properties In Bearing Stratum:	
N of hits by SPT =	8	N	50	N
$\phi = \sqrt{12N} + 20$				
Ø =	29.80	°	44.49	°
γ =	1.430	ton/m³	1.840	ton/m³
Nq =	21		145	
δ =	22.35	°	33.37	°
KHc =	1		1	

L = 3 m

Top Soil

L' = 1 m

Factor of safety (F.S.) = 3

Pressure due to soil:

P1 = 0.00 ton/m³
P2 = 4.29 ton/m³
P3 = 6.13 ton/m³

Qult = Qt + Qf

- Tip Resistance (Qt)

Qp = PtxNqxAt Pt = P3 = 6.13 ton/m²

Pile Area = 0.203 m² **Qp = 179.99 ton**

- Friction Capacity (Qf) Consider Friction ? n Y/N

Qf = Σ(KHc)xPoxTAN(δ)xS

S1 = 2BLD S1 = 2.70 m² Po1 = (P1 + P2)/2

S2 = 2BL'D S2 = 0.90 m² Po2 = (P2 + P3)/2

Po1 = 2.145 ton/mt² Po2 = 5.210 ton/m² **Qf = 0.00 ton**

Qult = Qt + Qf Qult = 179.99 ton

Qadm = Qult / F.S. **Qadm = 60.00 ton**

PROJECT: Detailed Design on Port Reactivation Project in La Union Province	Calc. File No.		Prepared by	H.WATANABE
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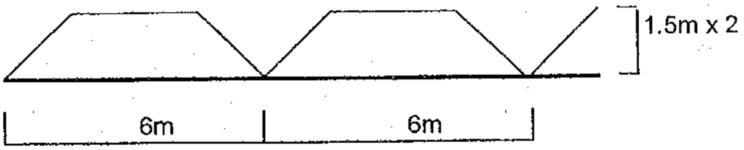
FB-1

Load Condition 1



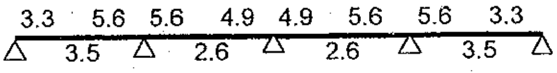
DL 0.45t/m2x2 0.45t/m2x2

self weight=0.5t/m

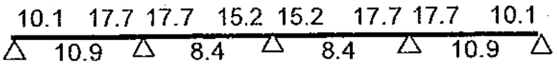
LL 2t/m2x2 2.0t/m2x2

Stress Result

DL



LL



PROJECT: Detailed Design on Port Reactivation Project in La Union Province	Calc. File No.	Prepared by	H.WATANABE
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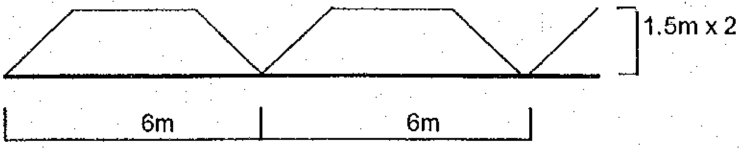
FB-1

Load Condition 2



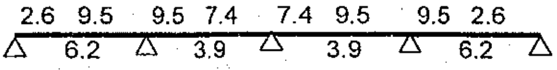
DL 0.45t/m2x2 0.45t/m2x2

self weight=0.6t/m wall weight= 0293*2.5+0.03*6=0.9t/m

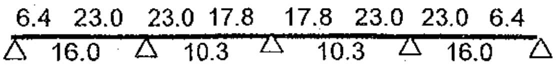
LL 2t/m2x2 2.0t/m2x2

Stress Result

DL

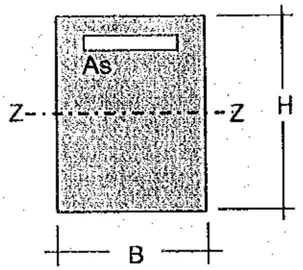


LL



FOUNDATION BEAM **FB-1**

OUTER END



H = 85.00 cm

b = 35.00 cm

f'c = 210 kg/cm^2

fy = 4200 kg/cm^2

Forces and Moments, from Structural Analysis (ton , m) :

TYPE OF LOAD	MOMENT Mz-z
Dead Load	2.60
Live Load	6.40
Seismic x	0.00
Seismic y	23.80

COMBINATION	Mu z-z
C1=1.4 DL+1.7 LL	14.52
= 0.75(1.4DL+1.7LL+1.87S	10.89
= 0.75(1.4DL+1.7LL+1.87S	44.27

Force for design: Mu z-z = 44.30 ton-m

d = 77.46 cm Clear cover = 5.00 cm

$fy^2/1.7bf'c\ As^2$ - $fyd\ As$ + Mu/ϕ = $\phi = 0.90$

1411.76 As^2 325332 4922222.2 = 0 As = 16.28 cm^2

Asmin = (4/3)Asreq :

(4/3)Asreq = 21.71 cm^2
(14/fy) b d = 9.04 cm^2 } Asmin = 9.04 cm^2

Asmax : ρb = 0.0345 Asmax (0.75ρb) = 70.07 cm^2

As = 16.28 cm^2 o.k!! As < Amax

Bar denomination, N = 8 Bar Area (Av) = 5.07 cm^2

Number of bars = 3.21 **Use 4- N 8** 4-D25

Minimun Base Required:

Max. bars per layer = 4 Minimum Base = 32.86 cm

PROJECT: Detailed Design on Port Reactivation Project in La Union Province	Calc. File No.		Prepared by H.WATANABE
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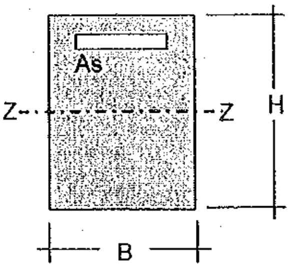
FOUNDATION BEAM **FB-1**

INNER END



H = 85.00 cm

b = 35.00 cm

f'c = 210 kg/cm²

fy = 4200 kg/cm²

Forces and Moments, from Structural Analysis (ton , m) :

TYPE OF LOAD	MOMENT Mz-z
Dead Load	9.50
Live Load	23.00
Seismic x	0.00
Seismic y	0.00

COMBINATION	Mu z-z
C1=1.4 DL+1.7 LL	52.40
= 0.75(1.4DL+1.7LL+1.87S	39.30
= 0.75(1.4DL+1.7LL+1.87S	39.30

Force for design: Mu z-z = 52.40 ton-m

d = 77.46 cm   Clear cover = 5.00 cm

$fy^2/1.7bf'c\ As^2 - fyd\ As + Mu/\phi =$ $\phi = 0.90$

$1411.76\ As^2\ 325332\ \ 5822222.2 = 0$ As = 19.56 cm²

Asmin = (4/3)Asreq :

(4/3)Asreq = 26.07 cm²
(14/fy) b d = 9.04 cm²   Asmin = 9.04 cm²

Asmax : ρb = 0.0345   Asmax (0.75ρb) = 70.07 cm²

As = 19.56 cm² o.k!! As < Amax

Bar denomination, N = 8   Bar Area (Av) = 5.07 cm²

Number of bars = 3.86   **Use 4- N 8**   4/2-D25

Minimun Base Required:

Max. bars per layer = 4   Minimum Base = 32.86 cm

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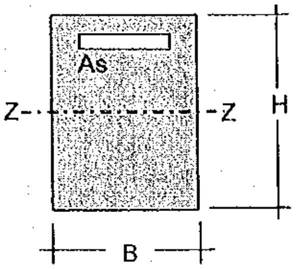
FOUNDATION BEAM FB-1

CENTER



H = 65.00 cm

b = 30.00 cm

f'c = 210 kg/cm²

fy = 4200 kg/cm²

Forces and Moments, from Structural Analysis (ton , m) :

TYPE OF LOAD	MOMENT Mz-z
Dead Load	6.20
Live Load	16.00
Seismic x	0.00
Seismic y	0.00

COMBINATION	Mu z-z
C1=1.4 DL+1.7 LL	35.88
= 0.75(1.4DL+1.7LL+1.87S	26.91
= 0.75(1.4DL+1.7LL+1.87S	26.91

Force for design: Mu z-z = 35.88 ton-m

d = 57.46 cm Clear cover = 5.00 cm

$fy^2/1.7bf'c\,As^2$ - fyd As + Mu/ϕ = $\phi = 0.90$

1647.06 As^2 241332 3986666.7 = 0 As = 18.98 cm²

Asmin = (4/3)Asreq :

$$\left.\begin{array}{ll} (4/3)Asreq = & 25.30 \ cm^2 \\ (14/fy)\ b\ d = & 5.75 \ cm^2 \end{array}\right\} \quad Asmin = 5.75 \ cm^2$$

Asmax : ρb = 0.0345 Asmax (0.75ρb) = 44.55 cm²

As = 18.98 cm² o.k!! As < Amax

Bar denomination, N = 8 Bar Area (Av) = 5.07 cm²

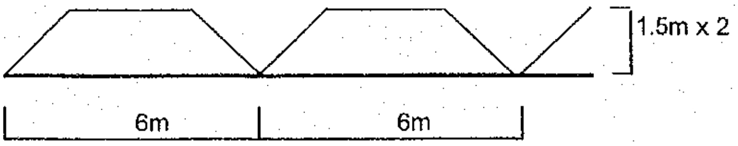
Number of bars = 3.75 **Use 4 - N8** 4/2-D25

Minimun Base Required:

Max. bars per layer = 4 Minimum Base = 32.86 cm increase Base!!!

FB-2

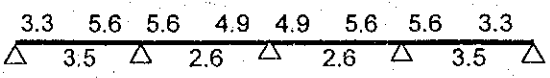
Load Condition



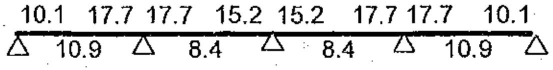
DL	0.45t/m2x2		0.45t/m2x2
		self weight=0.5t/m	
LL	2t/m2x2		2.0t/m2x2

Stress Result

DL



LL



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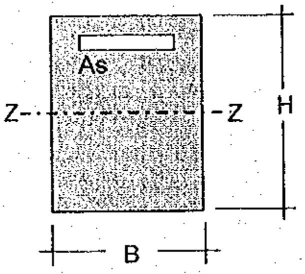
FOUNDATION BEAM **FB-2**

OUTER END



H = 65.00 cm

b = 30.00 cm

f'c = 210 kg/cm²

fy = 4200 kg/cm²

Forces and Moments, from Structural Analysis (ton , m) :

TYPE OF LOAD	MOMENT Mz-z
Dead Load	3.30
Live Load	10.10
Seismic x	0.00
Seismic y	0.00

COMBINATION	Mu z-z
C1=1.4 DL+1.7 LL	21.79
= 0.75(1.4DL+1.7LL+1.87S	16.34
= 0.75(1.4DL+1.7LL+1.87S	16.34

Force for design: Mu z-z = 21.79 ton-m

d = 57.46 cm Clear cover = 5.00 cm

$fy^2/1.7bf'c\,As^2 - fyd\,As + Mu/\phi =$ $\phi. = 0.90$

1647.06 As^2 241332 2421111.1 = 0 As = 10.83 cm²

Asmin = (4/3)Asreq :

(4/3)Asreq = 14.44 cm²
(14/fy) b d = 5.75 cm²
} Asmin = 5.75 cm²

Asmax : ρb = 0.0345 Asmax (0.75ρb) = 44.55 cm²

As = 10.83 cm² o.k!! As < Amax

Bar denomination, N = 8 Bar Area (Av) = 5.07 cm²

Number of bars = 2.14 **Use 3 - N8** 3-D25

Minimun Base Required:

Max. bars per layer = 3 Minimum Base = 27.78 cm

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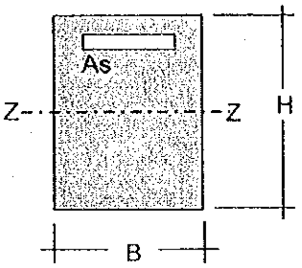
FOUNDATION BEAM **FB-2**

INNER END



H = 65.00 cm

b = 30.00 cm

f'c = 210 kg/cm²

fy = 4200 kg/cm²

Forces and Moments, from Structural Analysis (ton , m) :

TYPE OF LOAD	MOMENT Mz-z
Dead Load	5.60
Live Load	17.70
Seismic x	0.00
Seismic y	0.00

COMBINATION	Mu z-z
C1=1.4 DL+1.7 LL	37.93
= 0.75(1.4DL+1.7LL+1.87S	28.45
= 0.75(1.4DL+1.7LL+1.87S	28.45

Force for design: Mu z-z = 37.93 ton-m

d = 57.46 cm Clear cover = 5.00 cm

$fy^2/1.7bf'c\ As^2$ - fyd As + Mu/ϕ = ϕ = 0.90

1647.06 As^2 241332 4214444.4 = 0 As = 20.27 cm²

Asmin = (4/3)Asreq :

(4/3)Asreq = 27.02 cm²
(14/fy) b d = 5.75 cm² Asmin = 5.75 cm²

Asmax : ρb = 0.0345 Asmax (0.75ρb) = 44.55 cm²

As = 20.27 cm² o.k!! As < Amax

Bar denomination, N = 8 Bar Area (Av) = 5.07 cm²

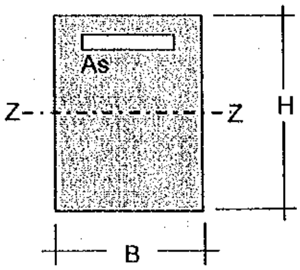
Number of bars = 4.00 **Use 4 - N8** 3/2-D25

Minimun Base Required:

Max. bars per layer = 3 Minimum Base = 27.78 cm

FOUNDATION BEAM FB-2

CENTER



H = 65.00 cm

b = 30.00 cm

f'c = 210 kg/cm²

fy = 4200 kg/cm²

Forces and Moments, from Structural Analysis (ton , m) :

TYPE OF LOAD	MOMENT Mz-z
Dead Load	3.50
Live Load	10.90
Seismic x	0.00
Seismic y	0.00

COMBINATION	Mu z-z
C1=1.4 DL+1.7 LL	23.43
= 0.75(1.4DL+1.7LL+1.87S	17.57
= 0.75(1.4DL+1.7LL+1.87S	17.57

Force for design: Mu z-z = 23.43 ton-m

d = 57.46 cm Clear cover = 5.00 cm

$fy^2/1.7bf'c\ As^2$ - fyd As + Mu/ϕ = ϕ = 0.90

1647.06 As^2 241332 2603333.3 = 0 As = 11.73 cm²

Asmin = (4/3)Asreq :

(4/3)Asreq = 15.63 cm²
(14/fy) b d = 5.75 cm² } Asmin = 5.75 cm²

Asmax : ρb = 0.0345 Asmax (0.75ρb) = 44.55 cm²

As = 11.73 cm² o.k!! As < Amax

Bar denomination, N = 8 Bar Area (Av) = 5.07 cm²

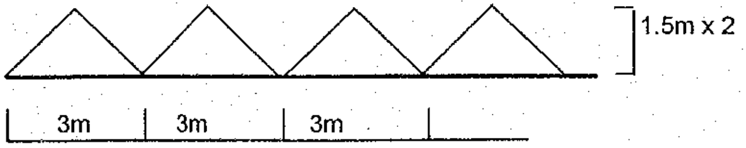
Number of bars = 2.31 **Use 3 - N8** 3/2-D25

Minimun Base Required:

Max. bars per layer = 3 Minimum Base = 27.78 cm

FB-3

Load Condition



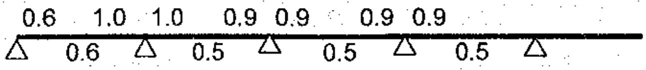
DL 0.45t/m2x2 0.45t/m2x2

self weight=0.5t/m

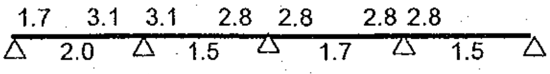
LL 2t/m2x2 2.0t/m2x2

Stress Result

DL



LL



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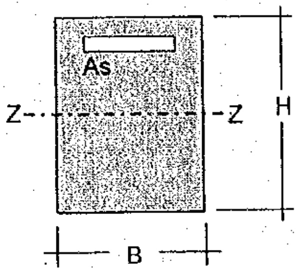
FOUNDATION BEAM **FB-3**

OUTER END



H = 50.00 cm

b = 30.00 cm

f'c = 210 kg/cm²

fy = 4200 kg/cm²

Forces and Moments, from Structural Analysis (ton , m) :

TYPE OF LOAD	MOMENT Mz-z
Dead Load	0.60
Live Load	1.70
Seismic x	0.00
Seismic y	0.00

COMBINATION	Mu z-z
C1=1.4 DL+1.7 LL	3.73
= 0.75(1.4DL+1.7LL+1.87S	2.80
= 0.75(1.4DL+1.7LL+1.87S	2.80

Force for design: Mu z-z = 3.70 ton-m

d = 42.46 cm Clear cover = 5.00 cm

$fy^2/1.7bf'c\ As^2\ -\ fyd\ As\ +\ Mu/\phi\ =$ $\phi = 0.90$

$1647.06\ As^2 -178332 \quad 411111.11 = 0$ As = 2.36 cm²

Asmin = (4/3)Asreq :

(4/3)Asreq = 3.14 cm²
(14/fy) b d = 4.25 cm²
Asmin = 3.14 cm²

Asmax : ρb = 0.0345 Asmax (0.75ρb) = 32.92 cm²

As = 3.14 cm² o.k!! As < Amax

Bar denomination, N = 8 Bar Area (Av) = 5.07 cm²

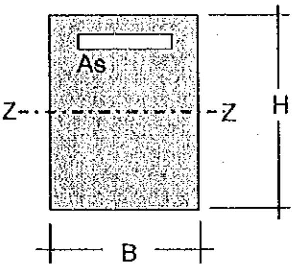
Number of bars = 0.62 **Use 1 - N8** 3-D25

Minimun Base Required:

Max. bars per layer = 3 Minimum Base = 27.78 cm

FOUNDATION BEAM FB-3

INNER END



H = 50.00 cm

b = 30.00 cm

f'c = 210 kg/cm^2

fy = 4200 kg/cm^2

Forces and Moments, from Structural Analysis (ton , m) :

TYPE OF LOAD	MOMENT Mz-z
Dead Load	1.00
Live Load	3.10
Seismic x	0.00
Seismic y	0.00

COMBINATION	Mu z-z
C1=1.4 DL+1.7 LL	6.67
= 0.75(1.4DL+1.7LL+1.87S	5.00
= 0.75(1.4DL+1.7LL+1.87S	5.00

Force for design: Mu z-z = 6.67 ton-m

d = 42.46 cm Clear cover = 5.00 cm

$fy^2/1.7bf'c\ As^2 - fyd\ As + Mu/\phi =$ $\phi = 0.90$

1647.06 As^2 -178332 741111.11 =0 As = 4.33 cm^2

Asmin = (4/3)Asreq :

(4/3)Asreq = 5.77 cm^2
(14/fy) b d = 4.25 cm^2 } Asmin = 4.25 cm^2

Asmax : ρb = 0.0345 Asmax (0.75ρb) = 32.92 cm^2

As = 4.33 cm^2 o.k!! As < Amax

Bar denomination, N = 8 Bar Area (Av) = 5.07 cm^2

Number of bars = 0.85 **Use 1 - N8** 3-D25

Minimun Base Required:

Max. bars per layer = 3 Minimum Base = 27.78 cm

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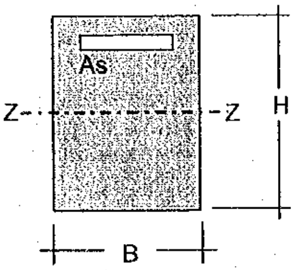
FOUNDATION BEAM **FB-3**

CENTER



H = 50.00 cm

b = 30.00 cm

f'c = 210 kg/cm²

fy = 4200 kg/cm²

Forces and Moments, from Structural Analysis (ton , m) :

TYPE OF LOAD	MOMENT Mz-z
Dead Load	0.60
Live Load	2.00
Seismic x	0.00
Seismic y	0.00

COMBINATION	Mu z-z
C1=1.4 DL+1.7 LL	4.24
= 0.75(1.4DL+1.7LL+1.87S	3.18
= 0.75(1.4DL+1.7LL+1.87S	3.18

Force for design: Mu z-z = 4.24 ton-m

d = 42.46 cm Clear cover = 5.00 cm

$fy^2/1.7bf'c\ As^2 - fyd\ As + Mu/\phi =$ $\phi = 0.90$

1647.06 As^2 178332 471111.11 = 0 As = 2.71 cm²

Asmin = (4/3)Asreq :

(4/3)Asreq = 3.61 cm²
(14/fy) b d = 4.25 cm² Asmin = 3.61 cm²

Asmax : ρb = 0.0345 Asmax (0.75ρb) = 32.92 cm²

As = 3.61 cm² o.k!! As < Amax

Bar denomination, N = 8 Bar Area (Av) = 5.07 cm²

Number of bars = 0.71 **Use 1 - N8** 3-D25

Minimun Base Required:

Max. bars per layer = 3 Minimum Base = 27.78 cm

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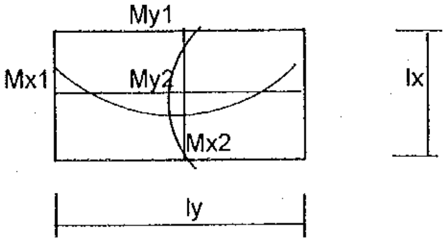
Slab S1



lx= 2.7 m

ly= 5.7 m

2.1

t= 18 cm

coefficient of bend (thioretical result fix end)

$Mx1/(w\ lx^2)$ = 0.083

$Mx2/(w\ lx^2)$ = 0.041

$My1/(w\ lx^2)$ = 0.058

$My2/(w\ lx^2)$ = 0.020

d= 13.35 cm

fc= 210 kg/cm2

fy= 4200 kg/cm2

wDL= 0.472 t/m2

wLL= 2.000 t/m2

DL		LL	
Mx1=	0.29 tm/m	Mx1=	1.21 tm/m
Mx2=	0.14 tm/m	Mx2=	0.60 tm/m
My1=	0.20 tm/m	My1=	0.85 tm/m
My2=	0.07 tm/m	My2=	0.29 tm/m

1.4DL+1.7LL			fy2/1.7bfc'	fyd	Mu/f		
Mx1=	2.46	tm/m	494.1	56070	273007.6	As=	5.10 cm²/m
Mx2=	1.21	tm/m	494.1	56070	134859.2	As=	2.46 cm²/m
My1=	1.72	tm/m	494.1	56070	190776.4	As=	3.51 cm²/m
My2=	0.59	tm/m	494.1	56070	65784.96	As=	1.19 cm²/m

	Short Span			Long Span		
	Use Bar	Area cm2	Pitch cm	Use Bar	Area cm2	Pitch cm
End	4	1.27	24.8	3.4	0.99	28.2
Center	3.4	0.99	40.3	3	0.71	60.1

Thickness (mm)	Location	Shorter Side (Direction)				Longer Side (Direction)			
		Edge Strip		Middle Strip		Edge Strip		Middle Strip	
		End	Center	End	Center	End	Center	End	Center
S1	Top	D13-@200			-	D10,D13-@250			-
180	Bottom	D10,D13-@200				D10-@250			

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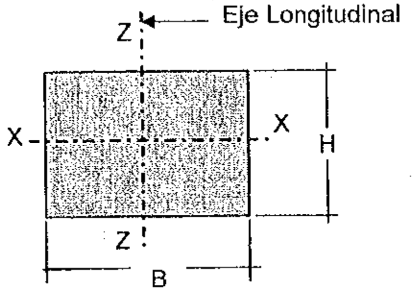
C1

COLUMN DESIGN



H = 0.90 m

B = 0.50 m

f 'c = 280 kg/cm²

fy = 4200 kg/cm²

Area = 4,500 cm²

Inertia z = 3,037,500 cm^4

Inertia Y = 937,500 cm^4

. Forces and Moments

From Structural Analisis (ton , m) :

0.72

TYPE OF LOAD	AXIAL	MOMENT		SHEAR	
	P	Mz-z	Mx-x	Vx	Vz
Dead Load	10.44	0.00	0.89	0.52	0.67
Live Load	3.81	0.00	0.27	0.20	0.20
Seismic Load x	-3.85	0.11	0.02	1.96	0.03
Seismic Load z	-2.47	0.00	23.84	0.13	5.86

COMB.	Pu	Mu z-z	Mu x-x	Vu x	Vu z
C1	21.09	0.00	1.71	1.07	1.28
C2	10.42	3.15	---	4.34	---
C3	12.36	---	34.77	---	9.99

C1 = 1.4 DL + 1.7 LL
C2 = 0.75(1.4DL + 1.7LL + 1.87SLy)
C3 = 0.75(1.4DL + 1.7LL + 1.87SLz)

Forces for design.

Pu z = 12.36 ton

Pu x = 10.42 ton

Mu x-x = 34.77 ton-m

Mu z-z = 3.15 ton-m

Vu z = 4.34 ton

Vu x = 9.99 ton

Ortogonal Combination

Mx = 100%EQX + 30%EQZ   Mz = 100%EQZ + 30%EQX

$Mx = Mx + Mz(H/B)\left(\frac{1-\beta}{\beta}\right) \quad \beta = 0.65 \qquad Mz = Mz + Mx(B/H)\left(\frac{1-\beta}{\beta}\right) \quad \beta = 0.65$

Slenderness.

iF klu/r > 22   Consider Slenderness .

k = 2.0   lu = $\boxed{1.9}$ m   r = (Inetia/Area)^½

Y Direction

r = 0.144 m   klu/r = 26.327 > 22 Consider slenderness

Z Direction

r = 0.260 m   klu/r = 14.626 < 22 No considerar

Slenderness

$Mc = \delta bMb + \delta sMs$

δb = cm/(1 - Pu/ϕ cm = 1.0

$Pc = \pi^2EI / (klu)^2$ E = 2526713 ton/m²

Pu = Axial Force = 21.09 ton

X Dir. :	Z Dir. :
Inertia = 0.0094 m²	Inertia = 0.0304 m²
Pc = 16190.56 ton	Pc = 52457.4 ton
δb = 1.001	δb = 1.000

Mu x-x = 3.16 ton-m

Mu z-z = 34.78 ton-m

- Design by flexure and Axial load

Z Direction : $\phi = 0.70$

Gross Area (Ag) = 0.45 m^2 = 697.57 in^2

h = 0.50 m = 19.69 in

P = 10.42 ton = 22.97 kips

M = 3.16 ton-m = 274.10 kips-in

Pu/Ag = 0.03 Mu/Agh = 0.02

From the Load-Moment strength interaction diagram R4-60.90, the ρ value is:

$\rho = \boxed{1}$ % As =Ag x ρ = 45.00 cm^2

Bar denomination = $\boxed{8}$ Bar area = 5.07 cm^2

Quantity of bars = 8.88

Use 10 N 8

X Direction : $\phi = 0.7$

Gross Area (Ag) = 0.45 m^2 = 697.57 in^2

h = 0.90 m = 35.43 in

P = 12.36 ton = 27.24 kips

M = 34.78 ton = 3018.85 kips-in

Pu/Ag = 0.04 Mu/Agh = 0.12

From the Load-Moment strength interaction diagram R4-60.90, the ρ value is:

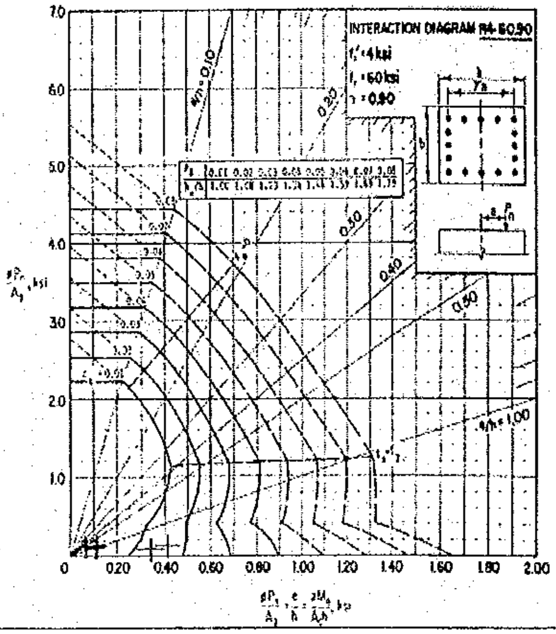
$\rho = \boxed{1}$ % As = Ag x ρ = 45.00 cm^2

Bar Denomination = $\boxed{8}$ Bar area = 5.07 cm^2

Quantity of bars = 8.88

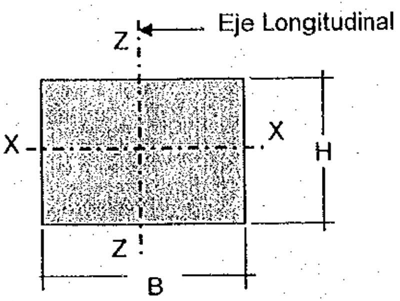
Use 10 N 8

COLUMNS 7.4.4—Load-moment strength interaction diagram for R4-60.90 columns



C2

COLUMN DESIGN



H = 0.80 m

B = 0.46 m

f 'c = 280 kg/cm²

fy = 4200 kg/cm²

Area = 3,680 cm²

Inertia z = 1,962,667 cm^4

Inertia Y = 648,907 cm^4

Forces and Moments

From Structural Analisis (ton , m) :

0.72

TYPE OF LOAD	AXIAL	MOMENT		SHEAR	
	P	Mz-z	Mx-x	Vx	Vz
Dead Load	14.97	0.00	2.34	0.00	0.45
Live Load	7.25	0.00	1.18	0.00	0.23
Seismic Load x	0.00	0.58	0.00	0.00	0.00
Seismic Load z	-2.35	0.00	23.81	0.15	4.62

COMB.	Pu	Mu z-z	Mu x-x	Vu x	Vu z
C1	33.28	0.00	5.28	0.00	1.02
C2	24.96	3.92	---	0.66	---
C3	21.67	---	37.58	---	7.25

C1 = 1.4 DL + 1.7 LL

C2 = 0.75(1.4DL + 1.7LL + 1.87SLy)

C3 = 0.75(1.4DL + 1.7LL + 1.87SLz)

Forces for design.

Pu z = 21.67 ton

Pu x = 24.96 ton

Mu x-x = 37.58 ton-m

Mu z-z = 3.92 ton-m

Vu z = 0.66 ton

Vu x = 7.25 ton

Ortogonal Combination

Mx = 100%EQX + 30%EQZ   Mz = 100%EQZ + 30%EQX

$Mx = Mx + Mz(H/B)\left(\frac{1-\beta}{\beta}\right)$ $\beta = 0.65$ $Mz = Mz + Mx(B/H)\left(\frac{1-\beta}{\beta}\right)$ $\beta = 0.65$

Slenderness.

iF klu/r > 22   Consider Slenderness .

k = 2.0   lu = $\boxed{1.9}$ m   r = (Inetia/Area)^½

Y Direction

r = 0.133 m   klu/r = 28.616 > 22 Consider slenderness

Z Direction

r = 0.231 m   klu/r = 16.454 < 22 No considerar

<u>Slenderness</u>

Mc = δbMb + δsMs

δb = cm/(1 - Pu/ϕ   cm = 1.0

Pc = π^2EI / $(klu)^2$ E = 2526713 ton/m^2

Pu = Axial Force = 33.28 ton

X Dir. :	Z Dir. :
Inertia = 0.0065 m^2	Inertia = 0.0196 m^2
Pc = 11206.57 ton	Pc = 33895.1 ton
δb = 1.003	δb = 1.001

Mu x-x = 3.93 ton-m

Mu z-z = 37.62 ton-m

- Design by flexure and Axial load

Z Direction : $\phi = 0.70$

Gross Area (Ag) = 0.37 m² = 570.46 in²

h = 0.46 m = 18.11 in

P = 24.96 ton = 55.03 kips

M = 3.93 ton-m = 340.92 kips-in

Pu/Ag = 0.10 **Mu/Agh = 0.03**

From the Load-Moment strength interaction diagram R4-60.90, the ρ value is:

ρ = 1 % As =Ag x ρ = 36.80 cm²

Bar denomination = 8 Bar area = 5.07 cm²

Quantity of bars = 7.26

Use 8 N 8

X Direction : $\phi = 0.7$

Gross Area (Ag) = 0.37 m² = 570.46 in²

h = 0.80 m = 31.50 in

P = 21.67 ton = 47.77 kips

M = 37.62 ton = 3265.23 kips-in

Pu/Ag = 0.08 **Mu/Agh = 0.18**

From the Load-Moment strength interaction diagram R4-60.90, the ρ value is:

ρ ? 1 % As = Ag x ρ = 36.80 cm²

Bar Denomination = 8 Bar area = 5.07 cm²

Quantity of bars = 7.26

Use 8 N 8

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COLUMNS 7.4.4—Load-moment strength interaction diagram for R4-60.90 columns