



THE PAPUA NEW GUINEA UNIVERSITY OF TECHNOLOGY

EXAMINATION QUESTION PAPER MASTER

PROFORMA

Semester: ONE (1) Academic Year: 2021

A. DEPARTMENT SECTION

I ACCEPT THAT THIS EXAMINATION PAPER SATISFACTORILY EXAMINES

Subject Code: CE401 Title: STRUCTURAL DESIGN

Number of Questions: 3 Number of Pages: 14

1. Subject Examiner: PROF. YAIP TELUE  
Signature: \_\_\_\_\_ Date:    /   /   

2. Subject Co-Examiner: MR. KASADIUM  
Signature: \_\_\_\_\_ Date: 09/06/21

3. Departmental Examinations Co-ordinator: Checked: YES  NO  (Please tick)  
Signature: \_\_\_\_\_ Date: 09/06/21

4. Head of Department and Chief Examiner: Checked: YES  NO  (Please tick)  
Comments: \_\_\_\_\_

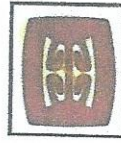
Signature: Rsuba Date: 09/06/2021

B. EXAMINATIONS OFFICE SECTION

Examination Masters Received: YES  NO

5. Examinations Officer Signature: \_\_\_\_\_ Date: \_\_\_\_\_

6. Witness Signature: \_\_\_\_\_ Date: \_\_\_\_\_



**THE PNG UNIVERSITY OF TECHNOLOGY  
FIRST SEMESTER EXAMINATION – 2021  
CIVIL ENGINEERING – 4<sup>TH</sup> YEAR DEGREE**

**CE 401 STRUCTURAL DESIGN**

**VENUE: SLT**

**THURSDAY 10<sup>th</sup> JUNE 2021 – 8:20 AM**

**TOTAL MARKS: 82.5**

**TIME ALLOWED: 3.0 HOURS**

**INFORMATION FOR STUDENTS**

1. You have 10 minutes to read the paper. You must not begin writing during this time.
2. There are THREE (3) questions in this paper. Answer all THREE (3) questions.
3. Answer all questions in the answer books and graph papers provided. No other written material will be accepted.
4. Calculators, drawing equipment, ONESTEEL Hot Rolled Steel, Tables and Reinforcement Tables are permitted in the examination room. Other notes, Mobile Phones, Mobile Devices, Laptops and textbooks are also allowed.
5. **WRITE YOUR NAME CLEARLY ON THE FRONT PAGE – DO IT NOW**
6. Marks for each Question are as indicated.

You are required to design or determine the following:

(a) The size of the continuous fillet weld (CFW using E48XX electrodes) connecting the walkway beam to the end plate as shown in Section A-A of Figure 1.

(15 Marks)

(Note: The weld strengths are given in Table 1).

(b) The size of 10/M??? (grade 8.8/TB) bolts connecting the end plate to the flange of the 250 UC 89 column. The bolts are spaced and positioned as shown in Section A-A. Assume that the threads are included in the shear plane. Please use the bolt capacities of grade 8.8/S bolts given in Table 2.

(15 Marks)

**Table 1: Design Capacities of Equal Leg Fillet Welds (SP Category)**

$$k_r = 1.0, \phi = 0.8$$

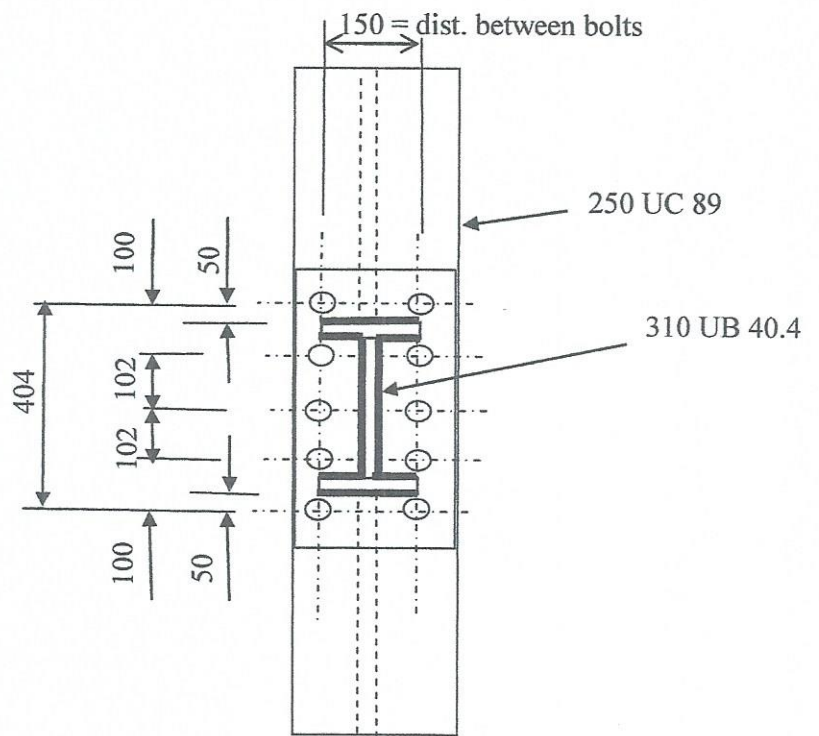
Leg Length, $t_w$ (mm)	Throat thickness, $t_t$ (mm)	Design Capacity per unit length for E41XX electrodes (kN/mm) (= $\phi V_w$ )	Design Capacity per unit length for E48XX electrodes (kN/mm) (= $\phi V_w$ )
3	2.12	0.42	0.49
4	2.82	0.56	0.65
5	3.54	0.70	0.81
6	4.24	0.83	0.98
8	5.65	1.11	1.30
10	7.07	1.39	1.63
12	8.49	1.67	1.96

**Table 2: Capacities of Grade 8.8/S, 8.8/TB, 8.8/TF Bolts**

$$f_{uf} = 830 \text{ MPa}, \phi = 0.8$$

Bolt Size	Shear Capacity for threads excluded from shear plane. $\phi V_{fx}$ (kN)	Shear Capacity for threads included in the shear plane. $\phi V_{fn}$ (kN)	Axial Tension $\phi N_{tf}$ (kN)
M16	82.7	59.3	104
M20	129	92.6	163
M24	186	133	234
M30	291	214	373





SECTION A-A

12.5 Marks)

$$y_1 =$$

$$y_2 =$$

$$y_3 =$$

$$y_4 =$$

$$\sum y^2 = n(y_1^2 + y_2^2 + y_3^2 + y_4^2)$$

$$N_{tr}^* = \frac{M^* y_1}{\sum y^2}$$

$$V_f^* = V^*/\text{total no of bolts.}$$

Interaction Equation

$$\left( \frac{V_f^*}{\phi V_f} \right)^2 + \left( \frac{N_{tr}^*}{\phi N_{tr}} \right)^2 \leq 1.0$$

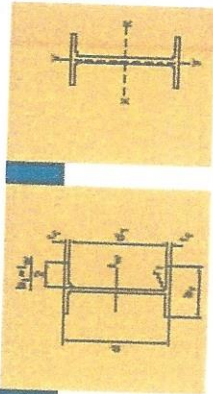
**QUESTION THREE**

A square footing carries a dead load of 800 kN including self weight of the footing (un-factored) and 600 kN of live load (un-factored). Design a suitable isolated square footing for the 400 mm square column if the allowable bearing pressure of the soil is 200 kPa. The concrete shall have a minimum  $f'_c$  of 25 MPa and cover to the reinforcement shall be 65 mm. N bars (grade 500) shall be used to reinforce the footing. Draw a neat sketch showing the reinforcement in the footing. (Please use load factors of 1.2 for Dead Load and 1.5 for Live Load).

(25 Marks)

**END OF PAPER**

# ONESTEEL - UNIVERSAL BEAMS

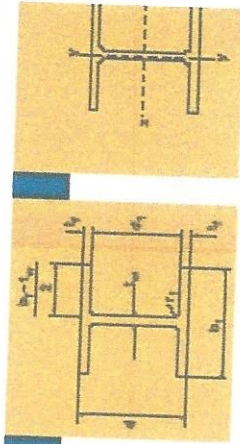


## Universal Beams

Table 15 Universal Beams — Dimensions and Properties

Designation	Depth of Section		Web		Flange		Depth of Section	Area of Section	About x-x		About y-y		Torsion Constant	Weight per Unit Length	Designation					
	mm	in.	mm	in.	mm	in.			mm <sup>2</sup>	mm <sup>4</sup>	mm <sup>4</sup>	mm <sup>4</sup>				mm <sup>4</sup>				
610 UB 135	612	239	10.6	11.9	14.0	512	48.1	5.54	16000	986	230	3800	2.40	30.3	343	576	426	1800	3450	610 UB 125
113	607	238	10.5	11.8	13.9	511	47.7	5.51	15900	975	229	3790	2.38	30.1	342	574	425	1790	3440	610 UB 113
101	602	236	10.4	11.7	13.8	510	47.2	5.48	15800	964	228	3780	2.36	29.9	341	572	424	1780	3430	610 UB 101
530 UB 92.4	533	209	15.6	10.7	14.0	502	40.2	6.37	11800	554	209	2170	2.17	22.8	239	355	44.0	775	1500	530 UB 82.4
82.0	528	208	15.2	10.6	13.9	502	39.8	6.34	11700	543	208	2160	2.15	22.6	238	354	43.9	774	1490	530 UB 72.4
490 UB 92.1	480	191	16.0	9.9	11.4	428	43.3	5.66	10600	372	170	1840	1.80	18.6	195	303	42.2	701	910	480 UB 82.1
74.6	475	190	14.5	9.1	11.4	428	41.1	5.24	9300	336	169	1650	1.68	17.5	271	41.8	45.0	815	610	480 UB 74.6
67.1	474	190	12.7	8.5	11.4	428	50.4	7.15	9900	206	190	1850	1.85	14.5	153	238	41.2	378	708	480 UB 67.1
430 UB 50.7	456	178	12.8	7.8	11.4	381	48.8	6.65	7640	116	169	1500	1.60	12.1	135	202	30.7	337	467	430 UB 50.7
53.7	453	178	12.0	7.5	11.4	381	50.1	7.82	6900	109	170	1400	1.65	10.3	115	170	30.6	294	384	430 UB 53.7
390 UB 36.7	390	172	13.0	0.0	11.4	333	41.6	6.31	7240	161	200	1000	1.40	11.0	120	179	30.0	330	330	390 UB 36.7
50.7	388	171	12.5	7.3	11.4	333	45.6	7.12	6400	142	208	900	1.40	10.0	112	173	30.5	241	284	390 UB 50.7
41.7	382	171	0.7	6.9	11.4	333	48.2	8.46	5700	121	209	777	1.46	8.10	94.7	146	37.6	161	237	410
330 UB 46.2	330	165	11.8	6.7	11.4	284	42.3	6.75	5930	100	200	700	1.30	10.0	109	166	30.0	233	107	330 UB 46.2
40.4	324	165	10.2	6.1	11.4	284	46.5	7.79	5210	86.4	200	633	1.20	7.85	92.7	142	38.3	157	165	330 UB 40.4
32.0	320	160	8.0	5.5	13.0	280	51.3	8.07	4090	63.2	204	415	1.24	4.42	59.3	91.8	32.9	86.5	92.9	320
259 UB 37.3	256	146	10.0	6.4	8.0	234	38.6	6.40	4750	55.7	169	456	1.08	5.66	72.5	170	34.5	150	85.2	259 UB 37.3
37.3	252	146	8.5	6.1	8.0	234	38.4	6.13	4070	44.5	169	405	1.05	4.87	61.2	142	33.4	89.3	65.9	31.4
25.7	249	124	8.0	5.0	12.0	232	46.4	7.44	3270	35.4	169	310	1.04	2.55	41.1	63.6	27.9	67.4	36.7	25.7
200 UB 22.8	207	134	0.6	6.3	8.0	169	29.8	6.65	3820	24.1	169	216	0.72	3.86	57.5	18.4	31.8	105	37.6	200 UB 22.8
22.8	203	133	7.8	5.8	8.0	169	28.3	6.15	3320	21.6	169	202	0.70	3.06	46.1	17.0	30.8	62.7	29.2	25.4
18.2	202	133	7.0	5.0	8.0	169	31.5	6.14	2870	21.0	169	208	0.71	2.75	41.3	16.4	31.0	45.0	28.0	22.3
18.2	198	130	7.0	4.5	11.0	164	40.0	6.75	2330	15.8	169	180	0.68	1.14	23.0	26.7	22.1	38.6	10.4	18.2
180 UB 22.2	179	130	10.0	6.0	8.0	150	26.5	4.30	3800	13.3	171	106	1.22	2.1	21.1	42.3	30.8	81.6	87.1	180 UB 22.2
22.2	181	130	8.0	5.0	8.0	150	31.8	5.31	3000	12.1	139	157	0.875	2.17	33.7	30.6	41.8	60.0	41.8	18.1
16.1	173	120	7.0	4.5	8.0	150	38.3	6.11	2040	10.6	123	139	0.720	0.653	10.0	29.4	20.4	31.3	5.88	16.1
150 UB 18.0	155	75	0.5	6.0	8.0	136	22.7	3.63	2300	9.06	117	135	0.628	0.672	17.9	28.2	17.1	60.5	35.6	150 UB 18.0
18.0	150	75	7.0	5.0	8.0	136	27.2	5.00	1780	6.86	88.8	102	0.611	0.486	13.2	20.8	16.6	28.1	25.3	14.0





### Universal Columns

Table 17 Universal Columns — Dimensions and Properties

Designation	Depth of Section		Web Thickness	Root Radius	Flange Radius	Depth of Flanges	Depth of Section	Area of Section	About x-axis		About y-axis		Tension Constant	Warping Constant	Designation					
	d	d <sub>1</sub>							I <sub>x</sub>	S <sub>x</sub>	I <sub>y</sub>	S <sub>y</sub>				J				
kg/m	mm	mm	mm	mm	mm	mm	mm <sup>2</sup>	10 <sup>8</sup> mm <sup>4</sup>	10 <sup>3</sup> mm <sup>3</sup>	10 <sup>8</sup> mm <sup>4</sup>	10 <sup>3</sup> mm <sup>3</sup>	mm	mm	10 <sup>6</sup> mm <sup>6</sup>						
310 UC 138	327	311	25.0	15.7	16.5	277	17.7	5.91	20160	388	2330	3650	139	12.5	807	1230	189	3810	2880	310 UC 138
137	321	309	21.7	13.8	16.5	277	20.1	6.80	17500	329	2050	2300	137	10.7	691	1050	182	2520	2300	137
95.8	315	307	18.7	11.9	16.5	277	23.3	7.89	15000	277	1760	2180	136	9.0	588	803	175	1630	1680	137
	308	305	15.4	9.9	16.5	277	28.0	9.58	12400	225	1450	1800	134	7.2	478	725	168	1028	1560	137
250 UC 82.5	265	256	17.3	10.5	14.0	235	21.5	7.70	11400	145	1100	1230	112	48.4	370	575	65.2	1040	713	250 UC 82.5
72.9	254	254	14.2	8.6	14.0	235	26.2	8.64	9020	114	897	922	111	38.8	306	463	64.5	586	557	72.9
200 UC 52.5	230	206	14.2	9.3	11.4	181	19.5	6.80	7620	61.3	584	656	89.7	20.4	199	303	51.7	477	195	200 UC 52.5
52.2	206	204	12.5	8.0	11.4	181	22.7	7.84	6680	52.8	512	570	82.1	17.7	174	264	51.5	325	166	52.2
46.2	203	203	11.0	7.3	11.4	181	24.8	8.90	5000	43.0	451	500	89.2	15.3	151	230	51.0	228	142	46.2
150 UC 37.2	162	154	11.5	8.1	8.0	139	17.1	6.34	4730	22.2	274	310	68.4	7.01	91.0	130	38.5	107	30.6	150 UC 37.2
30.0	158	153	9.4	6.6	8.0	139	21.0	7.70	3860	17.6	223	250	67.5	5.82	73.4	112	36.1	100	30.8	30.0
23.4	152	152	6.8	6.1	8.0	139	22.8	10.7	2880	12.6	166	184	65.1	3.98	52.4	80.2	36.6	50.2	21.1	23.4
100 UC 14.8	97	99	7.0	5.0	10.0	83.0	16.6	6.71	1880	3.18	65.6	74.4	41.1	1.14	22.9	36.2	24.5	34.9	2.30	100 UC 14.8

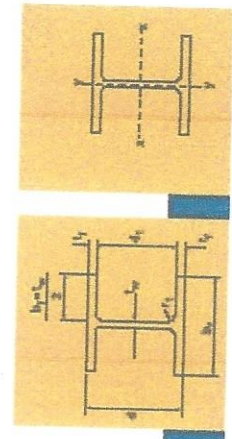
# Universal Columns

Table 18 Universal Columns — Properties for Assessing Section Capacity

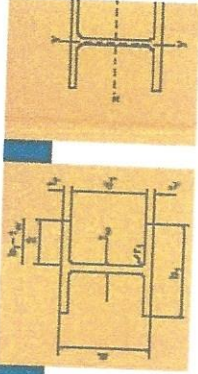
Designation	YIELD STRESS		FORM FACTOR		ABOUT Y-AXIS		YIELD STRESS		FORM FACTOR		ABOUT X-AXIS		Designation
	Range $f_y$ MPa	Web $f_w$ MPa	Factor $k$	Factor $k_y$	Compact- ness $Z_{yy}$ 10 <sup>3</sup> mm <sup>3</sup>	Compact- ness $Z_{xx}$ 10 <sup>3</sup> mm <sup>3</sup>	Range $f_y$ MPa	Web $f_w$ MPa	Factor $k$	Factor $k_x$	Compact- ness $Z_{yy}$ 10 <sup>3</sup> mm <sup>3</sup>	Compact- ness $Z_{xx}$ 10 <sup>3</sup> mm <sup>3</sup>	
310 UC 158	280	300	1.00	1.00	C	C	340	340	1.00	1.00	C	C	310 UC 158
137	280	300	1.00	1.00	C	C	340	340	1.00	1.00	C	C	137
118	280	300	1.00	1.00	C	C	340	340	1.00	1.00	C	C	118
96.8	300	320	1.00	1.00	N	N	340	360	1.00	1.00	N	N	96.8
250 UC 89.5	280	300	1.00	1.00	C	C	340	360	1.00	1.00	C	C	250 UC 89.5
72.9	300	320	1.00	1.00	N	N	340	360	1.00	1.00	N	N	72.9
200 UC 59.5	300	320	1.00	1.00	C	C	340	360	1.00	1.00	C	C	200 UC 59.5
52.2	300	320	1.00	1.00	C	C	340	360	1.00	1.00	C	C	52.2
46.2	300	320	1.00	1.00	N	N	340	360	1.00	1.00	N	N	46.2
150 UC 37.2	300	320	1.00	1.00	C	C	340	360	1.00	1.00	C	C	150 UC 37.2
30.0	320	320	1.00	1.00	C	C	360	360	1.00	1.00	N	N	30.0
23.4	320	320	1.00	1.00	N	N	360	360	1.00	1.00	N	N	23.4
100 UC 14.8	320	320	1.00	1.00	C	C	360	360	1.00	1.00	C	C	100 UC 14.8

\* 300PLUS replaced Grade 350 as the base grade for these sections in 1994.  
 300PLUS hot rolled sections are produced to exceed the minimum requirements of AS/NZS 3678:2000.

- For 300PLUS sections the torsion strength  $\phi_t$  is 4.0 MPa.
- For Grade 350 sections the torsion strength  $\phi_t$  is 4.0 MPa.
- C: Compact Section; N: Non-compact Section; S: Slender Section.







### Universal Columns

Table 17 Universal Columns — Dimensions and Properties

Designation	Depth of Section		Flange		Web		Depth between Flanges		Dist. between Flanges		d <sub>1</sub>	d <sub>2</sub>	d <sub>3</sub>	d <sub>4</sub>	d <sub>5</sub>	d <sub>6</sub>	d <sub>7</sub>	d <sub>8</sub>	d <sub>9</sub>	d <sub>10</sub>	d <sub>11</sub>	d <sub>12</sub>	d <sub>13</sub>	d <sub>14</sub>	d <sub>15</sub>	d <sub>16</sub>	d <sub>17</sub>	d <sub>18</sub>	d <sub>19</sub>	d <sub>20</sub>	d <sub>21</sub>	d <sub>22</sub>	d <sub>23</sub>	d <sub>24</sub>	d <sub>25</sub>	d <sub>26</sub>	d <sub>27</sub>	d <sub>28</sub>	d <sub>29</sub>	d <sub>30</sub>	d <sub>31</sub>	d <sub>32</sub>	d <sub>33</sub>	d <sub>34</sub>	d <sub>35</sub>	d <sub>36</sub>	d <sub>37</sub>	d <sub>38</sub>	d <sub>39</sub>	d <sub>40</sub>	d <sub>41</sub>	d <sub>42</sub>	d <sub>43</sub>	d <sub>44</sub>	d <sub>45</sub>	d <sub>46</sub>	d <sub>47</sub>	d <sub>48</sub>	d <sub>49</sub>	d <sub>50</sub>	d <sub>51</sub>	d <sub>52</sub>	d <sub>53</sub>	d <sub>54</sub>	d <sub>55</sub>	d <sub>56</sub>	d <sub>57</sub>	d <sub>58</sub>	d <sub>59</sub>	d <sub>60</sub>	d <sub>61</sub>	d <sub>62</sub>	d <sub>63</sub>	d <sub>64</sub>	d <sub>65</sub>	d <sub>66</sub>	d <sub>67</sub>	d <sub>68</sub>	d <sub>69</sub>	d <sub>70</sub>	d <sub>71</sub>	d <sub>72</sub>	d <sub>73</sub>	d <sub>74</sub>	d <sub>75</sub>	d <sub>76</sub>	d <sub>77</sub>	d <sub>78</sub>	d <sub>79</sub>	d <sub>80</sub>	d <sub>81</sub>	d <sub>82</sub>	d <sub>83</sub>	d <sub>84</sub>	d <sub>85</sub>	d <sub>86</sub>	d <sub>87</sub>	d <sub>88</sub>	d <sub>89</sub>	d <sub>90</sub>	d <sub>91</sub>	d <sub>92</sub>	d <sub>93</sub>	d <sub>94</sub>	d <sub>95</sub>	d <sub>96</sub>	d <sub>97</sub>	d <sub>98</sub>	d <sub>99</sub>	d <sub>100</sub>	d <sub>101</sub>	d <sub>102</sub>	d <sub>103</sub>	d <sub>104</sub>	d <sub>105</sub>	d <sub>106</sub>	d <sub>107</sub>	d <sub>108</sub>	d <sub>109</sub>	d <sub>110</sub>	d <sub>111</sub>	d <sub>112</sub>	d <sub>113</sub>	d <sub>114</sub>	d <sub>115</sub>	d <sub>116</sub>	d <sub>117</sub>	d <sub>118</sub>	d <sub>119</sub>	d <sub>120</sub>	d <sub>121</sub>	d <sub>122</sub>	d <sub>123</sub>	d <sub>124</sub>	d <sub>125</sub>	d <sub>126</sub>	d <sub>127</sub>	d <sub>128</sub>	d <sub>129</sub>	d <sub>130</sub>	d <sub>131</sub>	d <sub>132</sub>	d <sub>133</sub>	d <sub>134</sub>	d <sub>135</sub>	d <sub>136</sub>	d <sub>137</sub>	d <sub>138</sub>	d <sub>139</sub>	d <sub>140</sub>	d <sub>141</sub>	d <sub>142</sub>	d <sub>143</sub>	d <sub>144</sub>	d <sub>145</sub>	d <sub>146</sub>	d <sub>147</sub>	d <sub>148</sub>	d <sub>149</sub>	d <sub>150</sub>	d <sub>151</sub>	d <sub>152</sub>	d <sub>153</sub>	d <sub>154</sub>	d <sub>155</sub>	d <sub>156</sub>	d <sub>157</sub>	d <sub>158</sub>	d <sub>159</sub>	d <sub>160</sub>	d <sub>161</sub>	d <sub>162</sub>	d <sub>163</sub>	d <sub>164</sub>	d <sub>165</sub>	d <sub>166</sub>	d <sub>167</sub>	d <sub>168</sub>	d <sub>169</sub>	d <sub>170</sub>	d <sub>171</sub>	d <sub>172</sub>	d <sub>173</sub>	d <sub>174</sub>	d <sub>175</sub>	d <sub>176</sub>	d <sub>177</sub>	d <sub>178</sub>	d <sub>179</sub>	d <sub>180</sub>	d <sub>181</sub>	d <sub>182</sub>	d <sub>183</sub>	d <sub>184</sub>	d <sub>185</sub>	d <sub>186</sub>	d <sub>187</sub>	d <sub>188</sub>	d <sub>189</sub>	d <sub>190</sub>	d <sub>191</sub>	d <sub>192</sub>	d <sub>193</sub>	d <sub>194</sub>	d <sub>195</sub>	d <sub>196</sub>	d <sub>197</sub>	d <sub>198</sub>	d <sub>199</sub>	d <sub>200</sub>	d <sub>201</sub>	d <sub>202</sub>	d <sub>203</sub>	d <sub>204</sub>	d <sub>205</sub>	d <sub>206</sub>	d <sub>207</sub>	d <sub>208</sub>	d <sub>209</sub>	d <sub>210</sub>	d <sub>211</sub>	d <sub>212</sub>	d <sub>213</sub>	d <sub>214</sub>	d <sub>215</sub>	d <sub>216</sub>	d <sub>217</sub>	d <sub>218</sub>	d <sub>219</sub>	d <sub>220</sub>	d <sub>221</sub>	d <sub>222</sub>	d <sub>223</sub>	d <sub>224</sub>	d <sub>225</sub>	d <sub>226</sub>	d <sub>227</sub>	d <sub>228</sub>	d <sub>229</sub>	d <sub>230</sub>	d <sub>231</sub>	d <sub>232</sub>	d <sub>233</sub>	d <sub>234</sub>	d <sub>235</sub>	d <sub>236</sub>	d <sub>237</sub>	d <sub>238</sub>	d <sub>239</sub>	d <sub>240</sub>	d <sub>241</sub>	d <sub>242</sub>	d <sub>243</sub>	d <sub>244</sub>	d <sub>245</sub>	d <sub>246</sub>	d <sub>247</sub>	d <sub>248</sub>	d <sub>249</sub>	d <sub>250</sub>	d <sub>251</sub>	d <sub>252</sub>	d <sub>253</sub>	d <sub>254</sub>	d <sub>255</sub>	d <sub>256</sub>	d <sub>257</sub>	d <sub>258</sub>	d <sub>259</sub>	d <sub>260</sub>	d <sub>261</sub>	d <sub>262</sub>	d <sub>263</sub>	d <sub>264</sub>	d <sub>265</sub>	d <sub>266</sub>	d <sub>267</sub>	d <sub>268</sub>	d <sub>269</sub>	d <sub>270</sub>	d <sub>271</sub>	d <sub>272</sub>	d <sub>273</sub>	d <sub>274</sub>	d <sub>275</sub>	d <sub>276</sub>	d <sub>277</sub>	d <sub>278</sub>	d <sub>279</sub>	d <sub>280</sub>	d <sub>281</sub>	d <sub>282</sub>	d <sub>283</sub>	d <sub>284</sub>	d <sub>285</sub>	d <sub>286</sub>	d <sub>287</sub>	d <sub>288</sub>	d <sub>289</sub>	d <sub>290</sub>	d <sub>291</sub>	d <sub>292</sub>	d <sub>293</sub>	d <sub>294</sub>	d <sub>295</sub>	d <sub>296</sub>	d <sub>297</sub>	d <sub>298</sub>	d <sub>299</sub>	d <sub>300</sub>	d <sub>301</sub>	d <sub>302</sub>	d <sub>303</sub>	d <sub>304</sub>	d <sub>305</sub>	d <sub>306</sub>	d <sub>307</sub>	d <sub>308</sub>	d <sub>309</sub>	d <sub>310</sub>	d <sub>311</sub>	d <sub>312</sub>	d <sub>313</sub>	d <sub>314</sub>	d <sub>315</sub>	d <sub>316</sub>	d <sub>317</sub>	d <sub>318</sub>	d <sub>319</sub>	d <sub>320</sub>	d <sub>321</sub>	d <sub>322</sub>	d <sub>323</sub>	d <sub>324</sub>	d <sub>325</sub>	d <sub>326</sub>	d <sub>327</sub>	d <sub>328</sub>	d <sub>329</sub>	d <sub>330</sub>	d <sub>331</sub>	d <sub>332</sub>	d <sub>333</sub>	d <sub>334</sub>	d <sub>335</sub>	d <sub>336</sub>	d <sub>337</sub>	d <sub>338</sub>	d <sub>339</sub>	d <sub>340</sub>	d <sub>341</sub>	d <sub>342</sub>	d <sub>343</sub>	d <sub>344</sub>	d <sub>345</sub>	d <sub>346</sub>	d <sub>347</sub>	d <sub>348</sub>	d <sub>349</sub>	d <sub>350</sub>	d <sub>351</sub>	d <sub>352</sub>	d <sub>353</sub>	d <sub>354</sub>	d <sub>355</sub>	d <sub>356</sub>	d <sub>357</sub>	d <sub>358</sub>	d <sub>359</sub>	d <sub>360</sub>	d <sub>361</sub>	d <sub>362</sub>	d <sub>363</sub>	d <sub>364</sub>	d <sub>365</sub>	d <sub>366</sub>	d <sub>367</sub>	d <sub>368</sub>	d <sub>369</sub>	d <sub>370</sub>	d <sub>371</sub>	d <sub>372</sub>	d <sub>373</sub>	d <sub>374</sub>	d <sub>375</sub>	d <sub>376</sub>	d <sub>377</sub>	d <sub>378</sub>	d <sub>379</sub>	d <sub>380</sub>	d <sub>381</sub>	d <sub>382</sub>	d <sub>383</sub>	d <sub>384</sub>	d <sub>385</sub>	d <sub>386</sub>	d <sub>387</sub>	d <sub>388</sub>	d <sub>389</sub>	d <sub>390</sub>	d <sub>391</sub>	d <sub>392</sub>	d <sub>393</sub>	d <sub>394</sub>	d <sub>395</sub>	d <sub>396</sub>	d <sub>397</sub>	d <sub>398</sub>	d <sub>399</sub>	d <sub>400</sub>	d <sub>401</sub>	d <sub>402</sub>	d <sub>403</sub>	d <sub>404</sub>	d <sub>405</sub>	d <sub>406</sub>	d <sub>407</sub>	d <sub>408</sub>	d <sub>409</sub>	d <sub>410</sub>	d <sub>411</sub>	d <sub>412</sub>	d <sub>413</sub>	d <sub>414</sub>	d <sub>415</sub>	d <sub>416</sub>	d <sub>417</sub>	d <sub>418</sub>	d <sub>419</sub>	d <sub>420</sub>	d <sub>421</sub>	d <sub>422</sub>	d <sub>423</sub>	d <sub>424</sub>	d <sub>425</sub>	d <sub>426</sub>	d <sub>427</sub>	d <sub>428</sub>	d <sub>429</sub>	d <sub>430</sub>	d <sub>431</sub>	d <sub>432</sub>	d <sub>433</sub>	d <sub>434</sub>	d <sub>435</sub>	d <sub>436</sub>	d <sub>437</sub>	d <sub>438</sub>	d <sub>439</sub>	d <sub>440</sub>	d <sub>441</sub>	d <sub>442</sub>	d <sub>443</sub>	d <sub>444</sub>	d <sub>445</sub>	d <sub>446</sub>	d <sub>447</sub>	d <sub>448</sub>	d <sub>449</sub>	d <sub>450</sub>	d <sub>451</sub>	d <sub>452</sub>	d <sub>453</sub>	d <sub>454</sub>	d <sub>455</sub>	d <sub>456</sub>	d <sub>457</sub>	d <sub>458</sub>	d <sub>459</sub>	d <sub>460</sub>	d <sub>461</sub>	d <sub>462</sub>	d <sub>463</sub>	d <sub>464</sub>	d <sub>465</sub>	d <sub>466</sub>	d <sub>467</sub>	d <sub>468</sub>	d <sub>469</sub>	d <sub>470</sub>	d <sub>471</sub>	d <sub>472</sub>	d <sub>473</sub>	d <sub>474</sub>	d <sub>475</sub>	d <sub>476</sub>	d <sub>477</sub>	d <sub>478</sub>	d <sub>479</sub>	d <sub>480</sub>	d <sub>481</sub>	d <sub>482</sub>	d <sub>483</sub>	d <sub>484</sub>	d <sub>485</sub>	d <sub>486</sub>	d <sub>487</sub>	d <sub>488</sub>	d <sub>489</sub>	d <sub>490</sub>	d <sub>491</sub>	d <sub>492</sub>	d <sub>493</sub>	d <sub>494</sub>	d <sub>495</sub>	d <sub>496</sub>	d <sub>497</sub>	d <sub>498</sub>	d <sub>499</sub>	d <sub>500</sub>	d <sub>501</sub>	d <sub>502</sub>	d <sub>503</sub>	d <sub>504</sub>	d <sub>505</sub>	d <sub>506</sub>	d <sub>507</sub>	d <sub>508</sub>	d <sub>509</sub>	d <sub>510</sub>	d <sub>511</sub>	d <sub>512</sub>	d <sub>513</sub>	d <sub>514</sub>	d <sub>515</sub>	d <sub>516</sub>	d <sub>517</sub>	d <sub>518</sub>	d <sub>519</sub>	d <sub>520</sub>	d <sub>521</sub>	d <sub>522</sub>	d <sub>523</sub>	d <sub>524</sub>	d <sub>525</sub>	d <sub>526</sub>	d <sub>527</sub>	d <sub>528</sub>	d <sub>529</sub>	d <sub>530</sub>	d <sub>531</sub>	d <sub>532</sub>	d <sub>533</sub>	d <sub>534</sub>	d <sub>535</sub>	d <sub>536</sub>	d <sub>537</sub>	d <sub>538</sub>	d <sub>539</sub>	d <sub>540</sub>	d <sub>541</sub>	d <sub>542</sub>	d <sub>543</sub>	d <sub>544</sub>	d <sub>545</sub>	d <sub>546</sub>	d <sub>547</sub>	d <sub>548</sub>	d <sub>549</sub>	d <sub>550</sub>	d <sub>551</sub>	d <sub>552</sub>	d <sub>553</sub>	d <sub>554</sub>	d <sub>555</sub>	d <sub>556</sub>	d <sub>557</sub>	d <sub>558</sub>	d <sub>559</sub>	d <sub>560</sub>	d <sub>561</sub>	d <sub>562</sub>	d <sub>563</sub>	d <sub>564</sub>	d <sub>565</sub>	d <sub>566</sub>	d <sub>567</sub>	d <sub>568</sub>	d <sub>569</sub>	d <sub>570</sub>	d <sub>571</sub>	d <sub>572</sub>	d <sub>573</sub>	d <sub>574</sub>	d <sub>575</sub>	d <sub>576</sub>	d <sub>577</sub>	d <sub>578</sub>	d <sub>579</sub>	d <sub>580</sub>	d <sub>581</sub>	d <sub>582</sub>	d <sub>583</sub>	d <sub>584</sub>	d <sub>585</sub>	d <sub>586</sub>	d <sub>587</sub>	d <sub>588</sub>	d <sub>589</sub>	d <sub>590</sub>	d <sub>591</sub>	d <sub>592</sub>	d <sub>593</sub>	d <sub>594</sub>	d <sub>595</sub>	d <sub>596</sub>	d <sub>597</sub>	d <sub>598</sub>	d <sub>599</sub>	d <sub>600</sub>	d <sub>601</sub>	d <sub>602</sub>	d <sub>603</sub>	d <sub>604</sub>	d <sub>605</sub>	d <sub>606</sub>	d <sub>607</sub>	d <sub>608</sub>	d <sub>609</sub>	d <sub>610</sub>	d <sub>611</sub>	d <sub>612</sub>	d <sub>613</sub>	d <sub>614</sub>	d <sub>615</sub>	d <sub>616</sub>	d <sub>617</sub>	d <sub>618</sub>	d <sub>619</sub>	d <sub>620</sub>	d <sub>621</sub>	d <sub>622</sub>	d <sub>623</sub>	d <sub>624</sub>	d <sub>625</sub>	d <sub>626</sub>	d <sub>627</sub>	d <sub>628</sub>	d <sub>629</sub>	d <sub>630</sub>	d <sub>631</sub>	d <sub>632</sub>	d <sub>633</sub>	d <sub>634</sub>	d <sub>635</sub>	d <sub>636</sub>	d <sub>637</sub>	d <sub>638</sub>	d <sub>639</sub>	d <sub>640</sub>	d <sub>641</sub>	d <sub>642</sub>	d <sub>643</sub>	d <sub>644</sub>	d <sub>645</sub>	d <sub>646</sub>	d <sub>647</sub>	d <sub>648</sub>	d <sub>649</sub>	d <sub>650</sub>	d <sub>651</sub>	d <sub>652</sub>	d <sub>653</sub>	d <sub>654</sub>	d <sub>655</sub>	d <sub>656</sub>	d <sub>657</sub>	d <sub>658</sub>	d <sub>659</sub>	d <sub>660</sub>	d <sub>661</sub>	d <sub>662</sub>	d <sub>663</sub>	d <sub>664</sub>	d <sub>665</sub>	d <sub>666</sub>	d <sub>667</sub>	d <sub>668</sub>	d <sub>669</sub>	d <sub>670</sub>	d <sub>671</sub>	d <sub>672</sub>	d <sub>673</sub>	d <sub>674</sub>
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# ONESTEEL REINFORCEMENT DATA

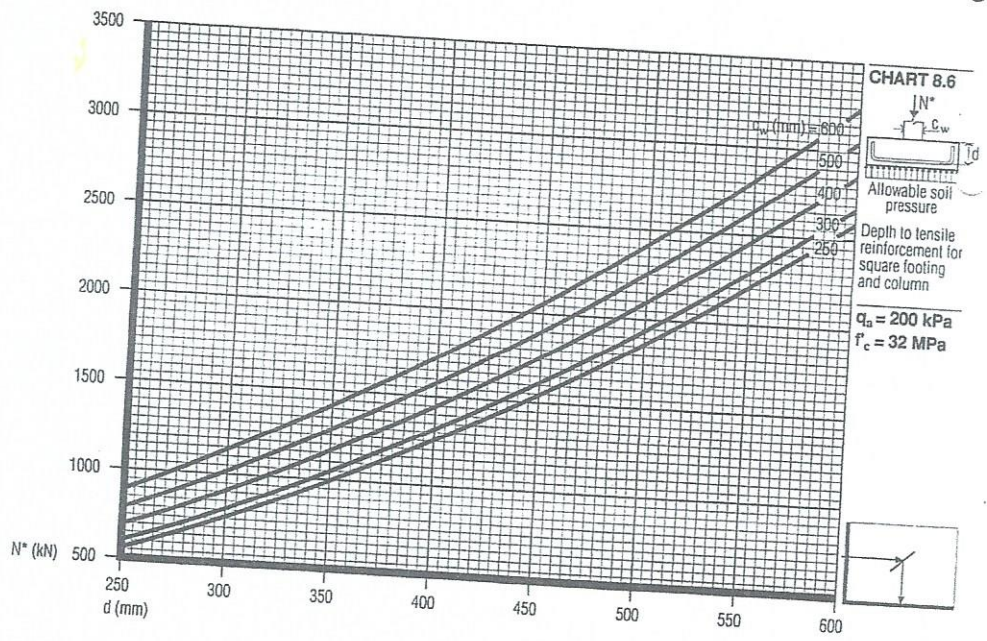
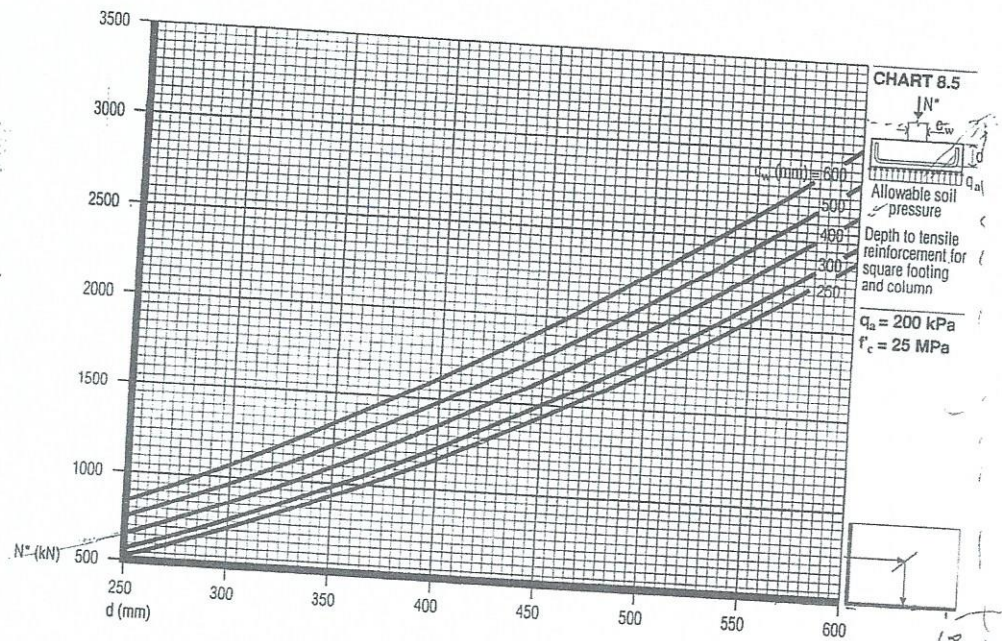
Bar Area (mm <sup>2</sup> )	Bar Area (mm <sup>2</sup> /m) Mass (kg/m <sup>2</sup> )								
	78.5	113	201	314	452	616	804	1020	1260
Bar Size (mm)	10	12	16	20	24	28	32	36	40
Bar Spacing (mm)	10	12	16	20	24	28	32	36	40
50	1570	2260	4020	6280	-	-	-	-	-
60	1308	1883	3350	5233	7533	10267	-	-	-
70	1121	1614	2871	4486	6457	8800	11486	14571	18000
80	981	1413	2513	3925	5650	7700	10050	12750	15750
90	872	1256	2233	3489	5022	6844	8933	11333	14000
100	785	1130	2010	3140	4520	6160	8040	10200	12600
110	714	1027	1827	2855	4109	5600	7309	9273	11455
120	654	942	1675	2617	3767	5133	6700	8500	10500
130	604	869	1546	2415	3477	4738	6185	7846	9692
140	561	807	1436	2243	3229	4400	5743	7286	9000
150	523	753	1340	2093	3013	4107	5360	6800	8400
160	491	706	1256	1963	2825	3850	5025	6375	7875
170	462	665	1182	1847	2659	3624	4729	6000	7412
180	436	628	1117	1744	2511	3422	4467	5667	7000
190	413	595	1058	1653	2379	3242	4232	5368	6632
200	393	565	1005	1570	2260	3080	4020	5100	6300
220	357	514	914	1427	2055	2800	3655	4636	5727
240	327	471	838	1308	1883	2567	3350	4250	5250
250	314	452	804	1256	1808	2464	3216	4080	5040
260	302	435	773	1208	1738	2369	3092	3923	4846
280	280	404	718	1121	1614	2200	2871	3643	4500
300	262	377	670	1047	1507	2053	2680	3400	4200
	2.1	3.0	5.3	8.2	11.8	16.1	21.0	26.7	33.0



## ONESTEEL MESH (FABRIC)

Product Code	Longitudinal Wires				Cross Wires			Sheet mass kg/m <sup>2</sup>
	size mm	spacing mm	area mm <sup>2</sup> /m	area lapped mm <sup>2</sup> /m	size mm	spacing mm	area mm <sup>2</sup> /m	
RL1218	11.90	100	1112	1222	7.60	200	227	10.5
RL1118	10.70	100	899	988	7.60	200	227	8.8
RL1018	9.50	100	709	779	7.60	200	227	7.3
RL918	8.60	100	581	638	7.60	200	227	6.3
RL818	7.60	100	454	499	7.60	200	227	5.3
RL718	6.75	100	358	393	7.60	200	227	4.6
SL102	9.50	200	354	374	9.50	200	354	5.6
SL92	8.60	200	290	305	8.60	200	290	4.6
SL82	7.60	200	227	239	7.60	200	227	3.6
SL72	6.75	200	179	189	6.75	200	179	2.8
SL62	6.00	200	141	149	6.00	200	141	2.2
SL52	4.77	200	89	101	5.00	200	98	1.5
SL63	6.00	300	94	101	6.00	300	94	1.5
SL53	4.77	300	60	72	5.00	300	65	1.0
SL81	7.60	100	454	499	7.60	100	454	7.1





8.8