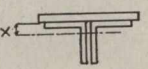
Stress and Section Diagrams.—Such diagrams are convenient for reference on bridge plans, indicating graphically the bending moments and shears along the length of the span, and the flange and web sections which correspond. Fig. 4 shows a complete form, and needs little explanation. The two shear diagrams represent the change in web shear as the train passes over the bridge in either direction, the live load and impact shear changing, while the dead load shears remain unchanged. These curves determine the required web section and the web flange rivet spacing.

Table I.

DISTANCE OF CENTRES OF GRAVITY OF PLATE GIRDER FLANGES FROM BACK OF ANGLES

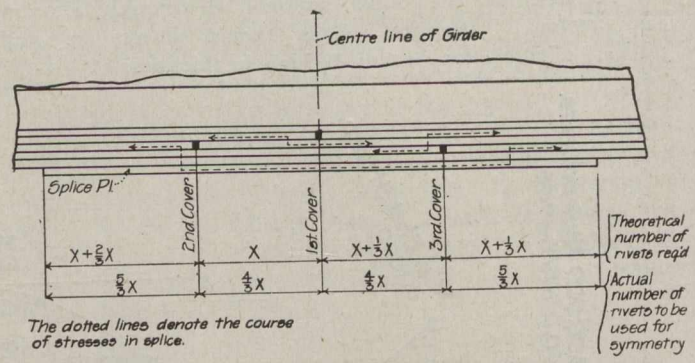
Flange Area does not include ⅛ of web
Net Area – 2-6"x6"x⅝" Ls 4-⅞"Φ rivets off
2-8"x8" Ls 6-⅞"Φ rivets off
Cover Pls. 2-⅞"Φ rivets off



2-Ls-6"x6"x⅝"				2-Ls-6"x6"x11/16"			
Cover Pls.	x (ins.)	Gross Area sq. ins.	Net Area sq. ins.	Cover Pls.	x (ins.)	Gross Area sq. ins.	Net Area sq. ins.
None	1·73	14·22	11·72	None	1·75	15·56	12·81
14"x⅜"	1·21	19·47	16·22	14"x⅜"	1·26	20·81	17·31
14"x7/16"	1·14	20·35	16·97	14"x7/16"	1·19	21·69	18·07
14"x½"	1·07	21·22	17·72	14"x½"	1·13	22·56	18·81
14"x9/16"	1·01	22·10	18·47	14"x9/16"	1·07	23·43	19·56
14"x⅝"	·95	22·97	19·22	14"x⅝"	1·01	24·31	20·31
14"x11/16"	·89	23·85	19·97	14"x11/16"	·95	25·18	21·06
14"x¾"	·83	24·72	20·72	14"x¾"	·89	26·06	21·81
14"x7/8"	·73	26·47	22·22	14"x7/8"	·79	27·81	2331
14"x1"	·63	28·22	23·72	14"x1"	·68	29·56	24·81
14"x1⅛"	·53	29·97	25·22	14"x1⅛"	·59	31·31	26·31
14"x1¼"	·43	31·72	26·72	14"x1¼"	·49	33·06	27·81
14"x1⅜"	·34	33·47	28·22	14"x1⅜"	·40	34·81	29·31
14"x1½"	·25	35·22	29·72	14"x1½"	·31	36·56	30·81
14"x1⅝"	·16	36·97	31·22	14"x1⅝"	·23	38·31	32·31
14"x1¾"	·08	38·72	32·72	14"x1¾"	·14	40·06	33·81
14"x1⅞"	b. of Ls	40·47	34·20	14"x1⅞"	·06	41·81	35·31
14"x2"	out	42·22	35·72	14"x2"	out	43·56	36·81
2-Ls-8"x8"x11/16"				2-Ls-8"x8"x¾"			
None	2·25	21·06	16·93	None	2·28	22·88	18·38
18"x⅜"	1·66	27·81	22·93	20"x1¾"	·37	57·88	49·88
18"x½"	1·50	30·06	24·93	20"x1⅞"	·28	60·38	52·13
18"x⅝"	1·36	32·31	26·93	20"x2"	·19	62·88	54·38
18"x¾"	1·23	34·56	28·93	20"x2⅛"	·11	65·38	56·63
18"x⅞"	1·10	36·81	30·93	20"x2¼"	·03	67·88	58·88
18"x1"	·98	39·06	32·93	20"x2⅜"	out	70·38	61·13
18"x1⅛"	·87	41·31	34·93	20"x2½"	out	72·88	63·38
18"x1¼"	·76	43·56	36·93	20"x2¾"	out	77·88	67·88
18"x1⅜"	·66	45·81	38·93	20"x3"	out	82·88	72·38
18"x1½"	·56	48·06	40·93	18"x1½"	·64	49·88	42·38
18"x1⅝"	·47	50·31	42·93	18"x1⅝"	·55	52·13	44·38
18"x1¾"	·38	52·56	44·93	18"x1¾"	·46	54·38	46·38
18"x1⅞"	·29	54·81	46·93	18"x1⅞"	·37	56·63	48·38
18"x2"	·20	57·06	48·93	18"x2"	·28	58·88	50·38
18"x2⅛"	·11	59·31	50·93	18"x2⅛"	·19	61·13	52·38
18"x2¼"	·03	61·56	52·93	18"x2¼"	·10	63·38	54·38
18"x2⅜"	out	63·81	54·93	18"x2⅜"	·02	65·63	56·38
18"x2½"	out	66·06	56·93	18"x2½"	out	67·88	58·38
18"x2¾"	out	70·56	60·93	18"x2¾"	out	72·38	62·38
18"x3"	out	75·06	64·93	18"x3"	out	76·88	66·38

The bending moment diagram determines the required flange areas and the length of cover plates. These plates are made to pass beyond the curve far enough to develop the strength of the plate in rivet connections. When the flange rivet spacing is less than 2½ inches, staggered, it is considered that two extra rivet holes are deducted from the net flange area, which explains the drop in the area lines shown in the diagram. Where web and flange splices are necessary this diagram is convenient for reference in getting out detail drawings.

The Design of Trough Floors.—The computation is different from that of regular plate girders, as the section is determined by their net moment of inertia, as in the case of a solid beam. When the troughs run parallel to the line of



Number of rivets required to splice cover plate = X Add ⅓ for each intervening plate

Theoretical number of rivets required = 5X + ⅓X
Number of rivets required for symmetry = 6X

Fig. 5.—Flange Splice.

track, the axle loads are assumed to be distributed in a width of nine feet, which is the length of the ties, and this decides the amount of load carried on each trough. When the troughs run normal to the line of track, the axle load should be considered distributed over three ties of nine feet in length. A minimum thickness of 7/16 inch is recommended in trough floors to resist rust, and the surface to be covered with concrete should be left unpainted in order that the concrete will adhere better.

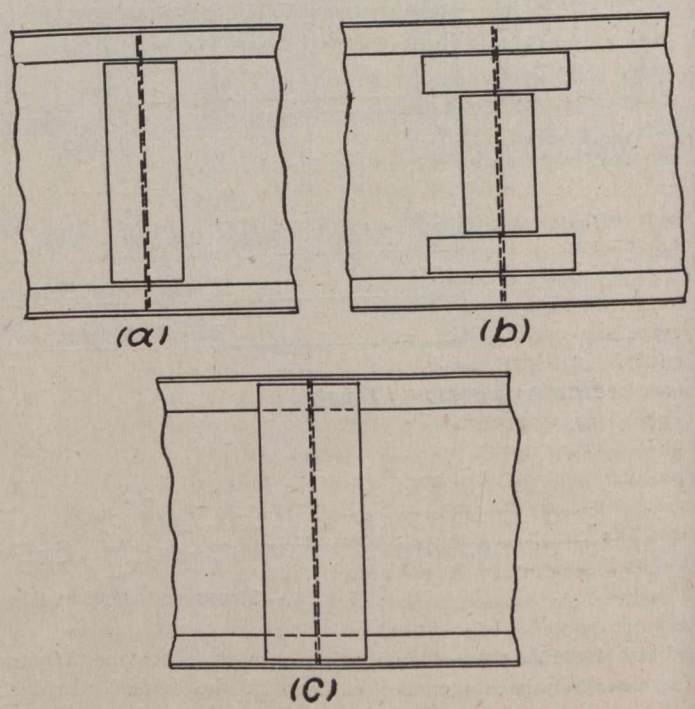


Fig. 6.—Plate Girder Web Splices.

Fabrication of Sections.—The details in connection with the framing of the various sections of a bridge may be the cause of its failure, as the strength of a structure is measured by the strength of its weakest point. It is necessary for the detailer to have an intelligent grasp of the action of stress through rivets and sections and he must keep in mind the sizes and maximum lengths of material that can be procured from the mills. He must be familiar with shop practices and erection methods, and must also consider the conditions of exposure of the bridge in actual service.