

increments of about one-twentieth of the total estimated ultimate strength of the two end connections.

The action of clip angle beam connections is so complicated and indeterminate that a close calculation of the stresses is impossible. For this reason, an artificial average stress, computed by considering all forces vertical and neglecting eccentricity is used as a measure of the strength of the connections. The value of the average rivet shear, bolt shear, and web bearing for each beam tested, computed from the ultimate load, are shown in the accompanying table which, along with this description of the tests, form a recent paper in the Cornell Civil Engineer. The values show clearly the great importance of the eccentricity as the more eccentric joints fail at lower average unit stresses.

The final failure of the connections of beams 1a to 6b was due to shearing of the bolts. Special connections show nearly as much strength as the standard, the ultimate strength bearing no direct relation to the number of rivets in the web.

The connections of beams 7a and 8a failed in the web

bearing, the strength of 8a being considerably less than that of 7a, but not in proportion to the number of web rivets because the eccentricity of 7a was greater. In every case the decreased effect of eccentricity of the special connections tended to offset the decrease in the number of rivets.

The special connections on the 15, 12, and 10-inch beams gave very satisfactory results. They are more economical than the corresponding standard connections because they are symmetrical and require fewer rivets. Their strength should be sufficient for all ordinary cases (for which a standard connection must be designed) as they are capable of developing the full flexural capacity of I-beams except for spans so short that the beam web is in danger of buckling. All standard details must be used with caution in exceptional cases.

The 8-inch beam tests indicate the inadvisability of decreasing the number of web rivets in the light connections because the web is the weak point and the connection must be made as stiff as possible to decrease the very high stresses due to eccentricity.

Summary of Tests on Beam Connections.

No.	Beam.	Connec- tion Angles.	No. of Web Rivets.	No. of Flange Bolts.	Web Bearing. Sq. In.	Total Area (Both Ends).		Safe Design Load. ³ Lbs.	Total Max. Load. Lbs.	Maximum Average Stress.		
						Rivet Shear. Sq. In.	Bolt Shear. Sq. In.			Web Bearing. Lbs. per sq. in.	Rivet Shear. Lbs. per sq. in.	Bolt Shear. Lbs. per sq. in.
B1a	15"-42 lb.	6 × 4 × 1/2	6	8	3.69	10.60	7.08	70,800	360,000	97,500	34,000	50,900 ¹
B1b	"	"	"	"	"	"	"	"	368,250	99,800	34,700	52,000 ¹
B2a	"	4 × 4 × 1/2	4	8	2.46	7.08	7.08	"	341,000	138,700	48,200	48,200 ¹
B2b	"	"	"	"	"	"	"	"	354,220	144,000	50,000	50,000 ¹
B3a	12"-31.5 lb.	6 × 4 × 1/2	6	6	3.15	10.60	5.30	53,000	265,000	84,100	25,000	50,000 ¹
B3b	"	"	"	"	"	"	"	"	277,600	88,100	26,200	52,400 ¹
B4a	"	4 × 4 × 1/2	3	6	1.575	5.30	5.30	47,250	254,000	161,200	47,900	47,900 ¹
B4b	"	"	"	"	"	"	"	"	257,000	163,200	48,500	48,500 ¹
B5a	10"-25 lb.	6 × 4 × 7/16	4	6	1.86	7.08	5.30	53,000	257,170	138,200	36,300	48,500 ¹
B5b	"	"	"	"	"	"	"	"	236,700	127,400	33,400	44,700 ¹
B6a	"	4 × 4 × 7/16	3	6	1.395	5.30	5.30	41,850	245,000	175,600	46,300	46,300 ¹
B6b	"	"	"	"	"	"	"	"	246,850	177,000	46,600 ¹	46,600 ¹
B7a	8"-18" lb.	6 × 4 × 7/16	4	4	1.62	7.08	3.54	35,400	132,000	81,500 ¹	18,650	37,300
B7b	"	"	"	"	"	"	"	"	85,000 ²	52,500	12,000	24,000
B8a	"	4 × 4 × 7/16	2	4	.81	3.54	3.54	24,300	117,000	144,400 ¹	33,100	33,100
B8b	"	"	"	"	"	"	"	"	111,300	137,500 ¹	31,450	31,450
B9a	6"-12.25 lb.	6 × 4 × 7/16	2	2	.69	3.54	1.768	17,680	44,000	63,800 ¹	12,430	24,900
B9b	"	"	"	"	"	"	"	"	48,400	70,200 ¹	13,690	27,400

¹ Manner of final failure.

² No failure of connections.

³ Computed from safe web bearing of 30,000 lbs. per sq. in. and safe bolt shear 10,000 lbs. per sq. in.

⁴ No bearing plate under load.

BRITISH COLUMBIA'S MINERAL RESOURCES.

Activity in the mining industry in British Columbia may result in attention being given propositions in the province that are easily worked. Some of these require only a small amount of capital.

There are old lake beds from which crude chemicals can be obtained in large quantities. Infusorial earth of an excellent quality may be had in quantities. Magnesium sulphate, Epsom salts, can be shovelled out which will test 98 per cent. pure and its raw state pass the pure drug act. Glauber's salts are another product. There would be little difficulty in having the owners of these deposits co-operate with people of moderate capital in exploitation. The market for these products is available and prices are strong and have advanced considerably during the past few months.

The fact that there are such deposits available indicate the potentialities of the province.

Inquiry is being made for such ores as antimony, tungsten, molybdenite and manganese zinc. Molybdenite has increased in price from \$600 to \$1,600 per ton. Victoria people control a deposit of this mineral, for which they ask \$35,000.

Attention is being more and more directed to the mineral resources of the province, and while copper mining requires a large amount of capital, there are smaller propositions that will give satisfactory returns.

COAL MINING OR OIL IMPORTS?

Members of the Vancouver board of trade are not unanimous regarding the levying of a duty on crude oil brought into the province for fuel purposes. The suggestion for a duty has come from those interested in coal mines on Vancouver Island and the mainland.

Statistics show that in 1911, 200,000 tons of coal were mined in the Cumberland district of Vancouver Island, and in 1914 only 70,000 tons. The wages paid were about \$1,000,000 and \$300,000 respectively. In 1911, the imports of oil were 7,250,000 gallons, while in 1914 the amount was 110,000,000 gallons.

Independent members of the board argue that the question is altogether one of economics, whereas those knowing the coal mining industry declare a big industry is seriously threatened.