

% of the total distance between miles 5.4 & 50.5.

The following is a list of all trestles:

No. of trestles.	No. of bents.	Total length, ft.	Greatest central height, ft.	Average centre height, ft.
5 to 9.....	9.....	1215.....	36.....	26
10 ".....	14.....	2895.....	66.....	35
15 ".....	19.....	2700.....	83.....	57
20 ".....	24.....	1620.....	92.....	58
25 ".....	29.....	2475.....	120.....	58
30 ".....	34.....	975.....	128.....	126
35 ".....	39.....	555.....	90.....	90
40 ".....	44.....	nil.....
45 ".....	49.....	705.....	170.....	170
Totals.....	49.....	13,140		

In the design & construction of these trestles, strength, rigidity & durability have been objects sought for & obtained. They are excellent structures in every detail. Most of the trestles are built over rocky gulches, & in these cases the best possible foundations were obtained, namely, mud-sills resting on solid rock. In earth & soft material it was found, in some cases, advantageous to use piles 10 ins. in diameter at the small end, & 14 ins. at the large end. These were driven with a 2,000 lbs. hammer, having a free fall of 20 ft. for the end blow, the maximum penetration under the last 5 blows not exceeding 5 ins. Pile foundations are used for 10 trestles, one pile under each post. In the substructures all bents are 15 ft. apart, centre to centre. Caps

are 12 by 12 ins. by 14 ft., & are secured to posts by $\frac{3}{4}$ in. drift-bolts 21 ins. long. In single deck trestles there are 2 vertical posts & 2 raking posts, each 12 by 12 ins. Sway braces & wales are 3 by 10 ins., & are bolted at the ends through posts $\frac{3}{4}$ by 18 $\frac{1}{2}$ in. screw bolts, & spiked to intermediate posts, $\frac{1}{2}$ by 7 in. boat spikes. Longitudinals 8 by 10 ins. are placed above wales & sills & are screwed at the ends by $\frac{3}{4}$ in. screwbolts, 21 $\frac{1}{2}$ ins. long. In double-decked trestles the same design & scantling of timber are retained. The sill of the upper deck is separated from the cap of the lower deck by 8 longitudinal 8 by 12 ins. Connecting the lower half of each deck are 4 longitudinal diagonal braces 6 by 10 inches. In 3 deck trestles & upwards the same design & dimensions are retained. The number of posts is increased as follows:

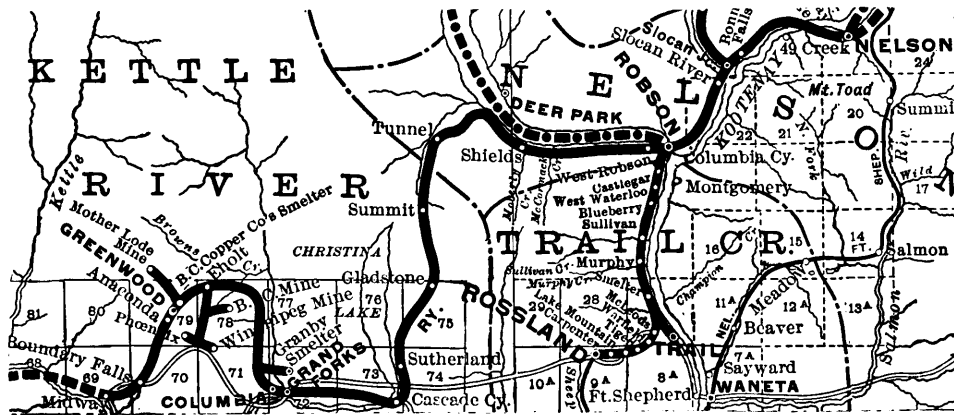
Upper deck, 2 uprights and 2 raking posts.	
Second " " " "	4
Third " " " "	4
Fourth " " " "	6
Fifth " " " "	6
Sixth " " " "	8

External raking posts batter at the rate of 3 ins. to 1 ft., internal raking posts at the rate of 2 $\frac{1}{2}$ ins. to 1 ft.

There is one exception to the style & dimensions mentioned above. This occurs at mile 27, & is known as Porcupine Trestle. It is stated that timbers of the required length could not be obtained within a reasonable distance. The posts were, therefore, reduced from 30 ft. in length to 18 ft., thus rendering 10 decks necessary. This structure is not as finished in appearance as its neighbors. The posts in the various decks are, upper & second decks, 4; 3rd, 4th, 5th & 6th decks, 7; 8th, 9th & 10th decks, 8. Longitudinals & diagonals, 8 by 10 ins., connect each bent. In one important feature this trestle differs from all others. The customary cap & sill between decks has been dispensed with, & a single timber substituted. It is claimed by the officials that the reduction in weight thus obtained

is an advantage, & a strong & rigid trestle has been obtained. Whether this is the case or not can only be determined by a careful investigation of the forces affecting the structure. The change effected is an innovation & contrary to usual practice. In appearance the structure is stable, but no opinion can be passed without calculations, & for that purpose a detail plan is necessary. The trestle superstructures are unusually strong. There are 8 stringers of Douglas fir, 30 ft. by 8 ins. by 16 ins., breaking joint, & bolted together by $\frac{3}{4}$ -inch screw bolts, 25 $\frac{1}{2}$ ins. long. Ties are 8 ins. by 8 ins. by 12 ft., spaced 4 ins. apart & spiked to stringers by boat spikes, $\frac{1}{2}$ -in. by 12 ins. Guard rails are double. The outside rail is 8 by 8 ins., bolted to every fourth tie by $\frac{3}{4}$ -in. screw bolts, 18 $\frac{1}{2}$ ins. long. The inside rail is parallel to the outside rail, except for 20 ft. at the ends, where it flares outwards to a junction with the outside rail. It is secured to the ties at intervals of 3 ft. by means of lag screws, $\frac{5}{8}$ by 8 in. On curves the superstructure is canted to the required elevation by increasing the length of the outside posts of the superstructure. All washers are of cast-iron, $\frac{5}{8}$ -inch by 3 ins. by 1 $\frac{1}{2}$ ins.

Timber Howe truss bridges have been constructed, or are in course of construction, at the following points:



THE COLUMBIA AND WESTERN RAILWAY.

Mile 8 $\frac{1}{2}$, McCormack Creek.—This is a Howe truss deck span of 150 ft., supported on frame timber abutments, consisting of 24, 12 by 12 ins. posts resting on solid rock. Rail level is about 190 ft. above the creek. The approaches consist of 21 trestle bents. The total distance covered by the bridge & its approaches is 490 ft.

Mile 11, Moberley Creek.—This also is a Howe truss deck span of 150 ft., supported on frame timber abutments, consisting of 24, 12 by 12 ins. posts resting on solid rock. Rail level is about 160 ft. above the creek. The approaches consist of 32 trestle bents. The total distance covered by the bridge & its approaches is 660 ft.

Mile 41 $\frac{1}{2}$.—A timber trestle about 100 feet long was originally constructed. A small snow-slide, however, occurred & swept away the central bents. It is now proposed to erect a small through truss in place of the trestle, & false-work for this purpose has been placed in position.

Mile 53 $\frac{1}{2}$, Kettle River, 1st crossing.—At this point it is proposed to construct 2 Howe truss deck spans, each 150 ft., supported on frame timber abutments & pier, each abutment having 24 posts & the pier 28 posts. All posts will be supported on piles driven until a 2,500 lb. hammer, with a fall of 25 ft., will cause 1 in. only of penetration. Piles will be enclosed in rock-filled caissons. The approaches are trestle bents, & are already constructed. The east approach consists of 62 bents, & the west of 19 bents. Rail level is

about 80 ft. above water level, & the whole structure covers a distance of 1,570 ft.

Mile 55, Kettle River, 2nd crossing.—At this point there has been constructed a Howe truss through span of 130 ft., the east end resting on solid rock, & the west end on a frame timber abutment consisting of 24, 12 by 12 ins. posts on solid rock foundation. Rail level is about 60 ft. above river level, & the whole structure covers a distance of 140 ft.

Mile 64 $\frac{1}{2}$, Kettle River, 3rd crossing.—At this point it is proposed to construct a Howe truss through span of 150 ft., supported on frame timber abutments, each consisting of 24 posts, 12 by 12 ins. The east abutment will rest on a rock-filled crib on solid rock foundation, & the west abutment on piles enclosed in a rock-filled caisson. The approaches are constructed, & consist of 12 trestle bents on piles. Rail level is about 30 ft. above river level, & the whole structure, when completed, will cover a distance of 360 ft.

Mile 67, Kettle River, 4th crossing.—Here it is proposed to construct two Howe truss through spans, one of 150 ft. & one of 100 ft. resting on pile abutments & pier. Each abutment will consist of 24 piles, & the pier of 28 piles, placed in rock-filled crib caissons. The approaches are built, & consist of about 80 pile trestle bents. Rail level is about 12 ft. above river level, & the whole structure, when

completed, will cover about 1,470 ft.

The total combined length of bridges & approaches will be about 4,655 ft. Bridges built & proposed to be built are in accordance with the C. P. R. Co.'s standard plans, which have met with much approval, the only changes made being the substitution of steel clamp-plates & increasing the depth of the lower chords from 15 to 17 ins. in 100-ft. spans & 18 to 19 ins. in 150-ft. spans. The workmanship

in all complete bridges is excellent. Ties are of cedar, hemlock, tamarac & fir, both hewn & sawn. They are laid 24 ins. from centre to centre; faces are from 7 ins. to 8 in. width, & the thickness uniformly 7 in. In place of brackets, Servis tie plates are spiked to every tie on all curves of 6 degrees & upwards, holding the track in perfect gauge.

Track laying has been excellently done, the ties & rails presenting to the eye uniform straight lines & curves, without depressions, except at the few points where embankments have sagged. All curves have been eased off at both ends, & the outer rails elevated for velocities varying according to the retardation due to the curve & the particular grade on which the curve is situated. Rails break joint & are provided with the full complement of spikes, bolts, & angle plates.

Rails are of two kinds. Steel rails, 56 & 60 lbs. a yard, used on portions of the main line of the C. P. R., have been relaid between West Robson & mile 5 & on the switchback at Bull Dog Tunnel, & also between the first crossing of Kettle River & Grand Forks, a total distance of 17.4 miles. The remaining 50 miles are laid with heavy new steel rails, 73 lbs. a yard. These rails are according to a design of the C. P. R. Co., & are extremely flat-headed. The 56 & 60-lbs. rails are provided with 4-hole angle plates, pierced for $\frac{3}{4}$ -in. by $\frac{3}{4}$ -in. bolts. Nuts are hexagonal, & lock-washers are positive & national. The 73-lbs. rails are provided with 4-hole angle