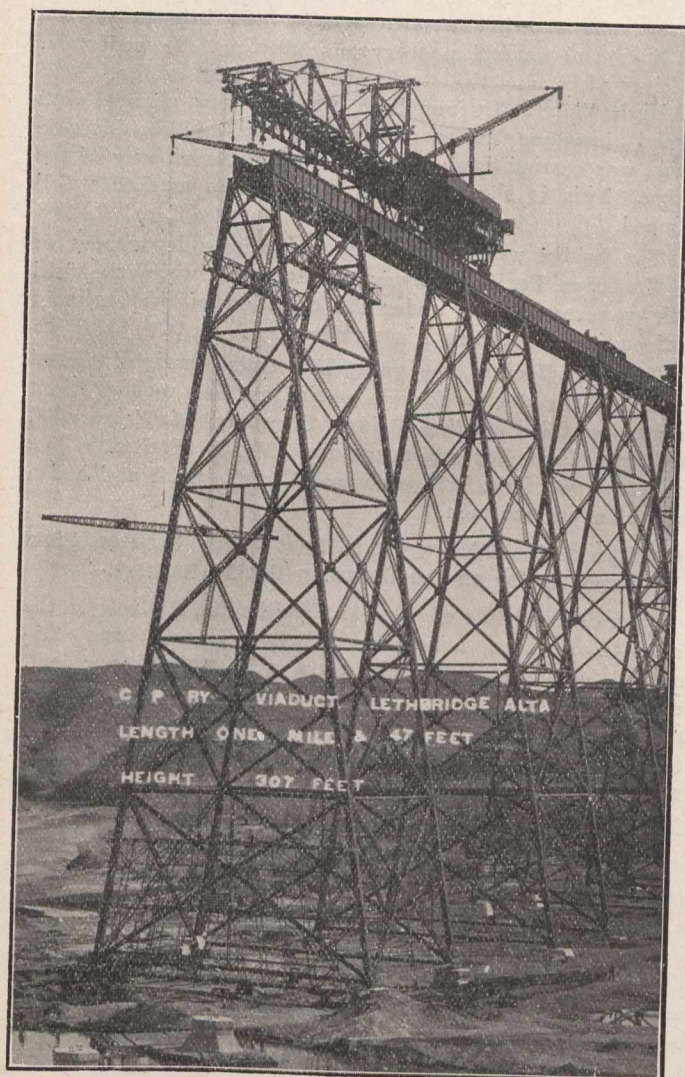


to provide against their binding in the cap-plates. Details are also shown of the shore end of the flanking spans which show how the top flanges are curved.

### Erection.

**Unloading Traveller.**—A material yard was located a short distance east of the eastern end of the bridge, over which was erected a travelling crane, consisting of a standard 125 feet highway span, provided with end wheels, two of which at each end are connected up by gearing and shaft-



ing to standard two-drum hoisting-engine, thus providing for its travelling along the runway. Each end of the crane is provided with a 5-ton 42-foot boom derrick commanding the additional storage area of 40 feet wide by the length of the runway for the storage of lighter class of material, the main area between the crane and the runways being utilized for the storage of girders and heavy columns. The length of the crane runway is 240 feet, and the height 37½ feet.

For lifting 100-foot girders, which weigh about 30 tons each, two sets of three-sheave steel blocks rigged with ¾-inch line were provided, with a capacity of 17 tons each, connected up to a standard double-drum hoisting-engine. Turning of the 100-foot girders end for end is provided for by hooks and beams arranged to swivel on the centre floor beam of a 125-foot crane, such arrangement being desirable in the event of girders reaching the work wrong end first.

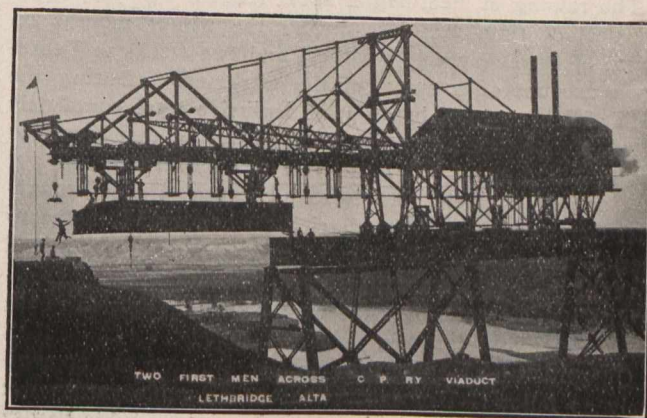
For the purpose of transporting material from the storage yard to the front the contractor is provided with constant use of locomotive and ten flat cars. To facilitate the work of erection a regular programme for the loading of material was arranged. Drawing 637-14 shows the method of loading a pair of 100-foot girders, with their accompanying floor-beams and stringers on two 80,000 lb. capacity 40-foot long flat cars, the girders being loaded at a height to suit convenient picking up by the erection traveller. The 67-ft. 1-inch girders, weighing about 30,000 lb. each, were loaded in a similar manner, as will be seen from

drawing 637-15. The columns were loaded on flat cars with corbels of convenient height for lifting off by the erection traveller.

The main traveller for the erection of this viaduct is a very ponderous machine, built entirely of steel, except for some minor parts, such as the engine-house, and various platforms. (See illustration). It was designed with two principal trusses 207 feet in length, spaced 16 feet apart centre to centre, to suit the spacing of the main girders of the viaduct spans. The cantilever portion of the trusses have a reach of 116 feet, the balancing portion of the trusses being 91 feet in length. The rear end of each balancing truss is carried on a truck with three 24-inch cast-steel wheels, and the forward end is supported on four similar wheels. The rear end of the traveller is counterweighted with 46 tons of steel rails, in addition to the weight of the engine-house, platforms and hoisting machinery contained thereon. The traveller runs on 80-lb. rails on oak planking along the top flanges of the girders, the rails and oak planking being bolted together in sections, so as to facilitate its placing and removal with each movement of the traveller. The weight of the traveller in working condition is 712,000 lb. The clearance under the deck of the traveller was made sufficient to permit the running of flat cars loaded with girders under it. The strains of the traveller were carefully calculated for conditions shown on drawing A-76°, special attention being paid to the matter of wind stresses on account of the very high winds certain to occur during the time of erection, which was estimated to be one year.

A stress-sheet was made up on the expectation that it might be necessary to carry the entire weight of the bottom storey of the bent suspended from the end of the traveller, which would make a total load of 90,000 lb. at the end of the traveller. This estimation is due to the expectation of assembling such bottom storey flat on the ground and then lifting it vertically into position on the piers. This method was later abandoned in favor of placing each item in the bent directly in its final position. To carry out this latter plan it was found desirable to suspend from the end of the traveller the assembling cage indicated on plan 637-23.

The erection traveller is hung with four trolleys hung on two trucks 8 feet apart centre to centre, which trucks extend the whole length of the traveller arm and about two-thirds of the balancing arm. All of the material is taken directly from flat cars run under the rear end of the traveller and handled by these trolleys, each one of which is provided with a 40-ton hydraulic jack of 18-inch stroke, these jacks being used to lift the girders from the cars, as it was undesirable to set the traveller high enough to give head room for block and tackle for this purpose.



**Traveller Placing Girder.**

Girders were run out on flat cars under the traveller, and when transferred to these trolleys they were pulled forward on to the cantilever-arm of the traveller until in a proper position for lowering into place. Lighter material, such as longitudinal bracing, were lowered direct to the ground by wire-rope tackles, and were raised to position in the structure by special 85-ft. swinging booms of 5 tons capacity each, attached to the traveller.