

on the products shipped from Duluth alone. So confident are the Detroit men of the feasibility of the scheme that they have become members of a company formed by Col. McNaught for the purpose of going into the business. If the Federal Government is disposed to assist in establishing the service, the following offer will be made by the company: It will furnish one-half money necessary to build three steamers & three ice-tugs & operate them, if the Government will complete the necessary lighthouses & contribute as a subsidy enough money to cover the additional expense of a winter boat, & enough money in annual subsidies for a few years to pay the additional cost of insurance for winter navigation.

Electricity for motive power on C.P.R.
—A Rossland paper states that General Superintendent Marpole, of the Pacific Division, & W. Cross, Assistant to the Manager Mechanical Dept. Western lines, recently visited there to confer with the West Kootenay Power & Light Co.'s officials, in reference to securing electric power for operating the railway between West Robson & Rossland.

Concrete Stone Arch Culvert on the L. E. & D. R. R.

Owen McKay, Chief Engineer of the Lake Erie & Detroit River Ry., has furnished plans of a concrete arch culvert of 20 ft. span recently constructed over Little Cedar creek, about 29 miles east of Walkerville. The abutment & wing walls of the culvert stand upon a foundation of 4 rows of live oak piles, spaced $2\frac{1}{2} \times 3$ ft., driven to a depth of about 16 ft. & cut off at an elevation 6 ins. above the lower limit of the concrete work. The abutment walls are 10 ft. high, to the springing line, & $5\frac{1}{2}$ ft. thick at that point, sloping off to a point 2 ft. above the foundation on the back side. The arch has a radius of 10 ft. $7\frac{3}{4}$ ins. at the intrados & a radius of 20 ft. at the extrados, & is 2 ft. thick at the crown; the rise of the arch is 7 ft. The spandrel walls are $2\frac{1}{2}$ ft. thick & extend $1\frac{1}{2}$ ft. above the crown of the arch. The arch is 51 ft. long, face to face, & covering a width of 12 ft. each side of its middle there are 10 curved track rails embedded in the concrete of the arch, as shown at A, fig. 1.

The wing walls are 22 ft. long & open out at an angle of 12° . Up to the springing line

of the arch the face of each wing wall stands vertical, thus permitting it to meet the face of the abutment wall at a vertical corner, & avoiding a re-entrant angle, to obstruct the flow. Above the springing line the wing walls are slightly battered & finished without coping at a slope of 1.7 to 1 from the ground line, which is 6 ft. above foundation. The paving of the culvert is a flat inverted arch of concrete, 12 ins. thick on the center line & 20 ins. thick at the abutment walls. The thickness shown on the plans on page 361 is 8 ins. at the center line, but as the work progressed a soft bottom was found, & the plans were not followed in respect to this detail. The paving extends the entire length of the opening between the wing walls, or 95 ft. from end to end, & is curved at either end with a concrete wall 2 ft. thick & $2\frac{1}{2}$ ft. deep. The distance from the crown of the arch to the base of rail is 11 ft. & the clear height of the opening under the arch, on center line, is $14\frac{1}{2}$ ft. Other dimensions appear in the engravings.

All the masonry of the arch & in the supporting & protecting walls is of concrete. The material of which the arch is composed consists of 1 part of Portland cement to 2 parts of clean, sharp sand & 3 parts of crushed

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