

(2)—Intermediate Development. (Twelve 10,000-h.p. Units.)**Capital Cost of Installation.**

Dam and equipment	\$ 542,000
Embankment (flood protection)	5,000
Ice sluices and roadway	72,000
Power station and equipment	926,000
Hydraulic installation	1,140,000
Electrical installation	1,380,000
Railroad	156,000
Ferry	50,000
Permanent quarters	25,000
Contingencies, 10%	430,000
Engineering and inspection, 5%	236,000
Interest during construction, 5½%	273,000

Total intermediate cost\$5,235,000

Twenty-four-hour power available at 75%

over-all efficiency = 78,500 h.p.

Capital cost per 24-hour h.p. = \$66.69

Capital cost per installed h.p. = 43.62

Annual Cost of Operation.

Interest, sinking fund and depreciation charges:

Interest, 5½% on \$5,235,000\$288,000

Sinking fund, 4% (40-year bonds) 55,000

Depreciation: 1% on permanent works =

\$14,000; 4% on machinery, etc., = \$106,000 120,000

Operation charges: staff = \$27,000; supplies

= \$32,000 59,000

Total annual charge\$522,000

Annual cost per h.p.-year, 24-hour power = \$6.65

Annual cost per h.p.-year, machinery

installed = 4.35

Annual cost per kw. hour = 0.102 cent

Annual cost per kw. hour on basis of

50% load factor = 0.204 cent

(3)—Final Development. (Fourteen 10,000-h.p. Units.)**Capital Cost of Installation.**

Dam and equipment	\$ 542,000
Embankment (flood protection)	5,000
Ice sluices and roadway	72,000
Power station and equipment	1,035,000
Hydraulic installation	1,330,000
Electrical installation	1,610,000
Railroad	156,000
Ferry	50,000
Permanent quarters	25,000
Contingencies, 10%	483,000
Engineering and inspection, 5%	265,000
Interest during construction, 5½%	307,000
Whitemud Falls rock-cut	671,000

Total final cost\$6,551,000

Twenty-four-hour power available at 75%

over-all efficiency = 95,500 h.p.

Capital cost per 24-hour h.p. = \$68.60

Capital cost per installed h.p. = 46.79

Annual Cost of Operation.

Interest, sinking fund and depreciation charges:

Interest, 5½% on \$6,551,000\$360,000

Sinking fund, 4% (40-year bonds) 69,000

Depreciation: 1% on permanent works =

\$15,000; 4% on machinery, etc., = \$123,000 138,000

Operation charges: staff = \$30,000; supplies =

\$38,000 68,000

Total annual charge\$635,000

Annual cost per h.p.-year, 24-hour power = \$6.65

Annual cost per h.p.-year, machinery

installed = 4.54

Annual cost per kw. hour = 0.102 cent

Annual cost per kw. hour on basis of

50% load factor = 0.204 cent

COST OF MAINTAINING NEW YORK STATE HIGHWAYS.*

By Fred W. Sarr,

Deputy Commissioner, New York State Highway Department.

UPON receiving your kind invitation to be with you to-day and address you on the subject of highways, I was at first reluctant to accept same owing to the voluminous and important work which has been before the Commission during the past few months. In finally accepting, however, I did so with the idea in mind of addressing you on the subject of the maintenance and repair of improved highways in the State of New York, which end of highway engineering in that State, I am at present associated with.

The proposition of maintenance of improved highways in New York State is an enormous one, practically ninety millions of dollars having been spent by the State for the construction of roads in the past seventeen years, and yet, with this huge expenditure, the experience gained and the system now in force, the maintenance of highways, even in our great State, is, I might say, still in its infancy. The evolution in the kind of traffic to which our roads are subjected, particularly the adoption of the use of motor trucks carrying very heavy loads, and the general increased traffic necessitates a continuous study of individual cases.

General maintenance is comprised of keeping the paved roadway surfaces in as nearly uniform condition as possible, due regard being had for the relative importance of each particular road and the character of traffic it bears; keeping the earth shoulders smooth and safe for traffic; the drainage system free from obstructions; all structures in good repair and removing obstacles to vision, as brush or overhanging branches.

If the work of maintenance of improved highways is consistently performed throughout successive years, it is certain that the efficient life of such roads will be lengthened, and it would appear as though it could be prolonged almost indefinitely, if year by year the material added to the paved surface be equal or a little in excess of the material which has worn away during the same interval of time. This applies to the macadam type of construction which constitutes the vast bulk of the mileage under maintenance.

Maintenance should commence when construction leaves off, because in order to effectively and economically maintain improved roads it is necessary that the roadway be in a good state of repair at the time the maintenance work begins.

As an illustration of the magnitude of highway construction and maintenance in New York State, there were on April 1, 1915, 5,345 miles of improved and accepted state and county highways, and this mileage was increased as the season advanced, and on December 31, 1915, there were 5,926 miles of improved and accepted highways which has been maintained and repaired.

*Read before the Third Canadian and International Good Roads Congress, March, 1916.