Allowance for plant after 6 months 12,000 Charged to power installation 13,882

Detail of Pipe-Line for Long Lake 60-in. I.D.

U.S. Feet. gauge. 500 3/16 166 1/4 166 5/16 166 3/8 166 7/16 170 1/2 331 5/8	Thick- ness, inches. 0.178 0.250 0.312 0.375 0.437 0.300 0.825	Safe lead. 139 185 231 277 323 370 462	Safe pres- sure. 60 80 100 120 140 160 200	Weight per ft. 150.25 197.50 244.00 291.25 337.75 385.00 478.75	Total weight. 75,125 32,785 40,504 48,347 56,066 65,450 158,466
355 3/4	0.750	555	240	572.50	191,787
T + 1					666,530

Velocity when carrying 300 sec.-ft., 8 ft. per second;

loss per 100 ft., 0.225. Weight of two lines, 1,337,060 lb.; and estimated cost erected is 7c. per pound.

The steel of which the above pipe is made will have an ultimate tensile strength of 60,000 lb. per square inch. Thickness of pipe is figured from the formula:

Diam. in inches × pounds pressure

2 × 10,000

which takes care of the efficiency of joints and allows a sufficient factor of safety. The weight of above pipe is obtained from the formula: weight in pounds per foot (12.5 times diameter in inches times thickness in inches) plus 10 lb. This weight takes care of laps, rivets, asphaltum, paint, etc.

RECLAMATION PROJECT IN CHINA.

It has been announced that the Chinese Government has authorized the issue of \$20,000,000 of bonds for the future prevention of floods in the Huai River Valley in China, and that the J. G. White Engineering Corporation has been designated to undertake the construction of the works.

The project will require approximately six years to complete, and employment will be given to about 100,000 men. It will involve dredging the channel of the river and the Grand Canal; constructing dams and reservoirs to keep the Huai in its proper course, and to impound its surplus water and divert the streams flowing into the Huai, which, at the time of floods, greatly increase its overflow. The Huai River, for the greater part of its length, flows between banks that are elevated above the surrounding country, and in times past the river in overflowing its banks, has changed the geography of an entire province over night. During one of the flood periods, the Yellow River, which is a tributary to the Huai, switched the location of its mouth a distance of about 700 miles. Government records show that floods in this district have reduced the average number of crops from two in one year to two in five years.

Maps have been published recently at Tacoma, Wash., which shows that surveys for three railroads, starting at Grays Harbor and extending north into Olympic Peninsula, have been completed, the roads varying from about 110 to 125 miles in length. One survey was made for the Northern Pacific, one for the Union Pacific and one for the Chicago, Milwaukee and St. Paul Railway. The three surveys all parallel the coast and all touch the Quiniault Reservation.

PLANT, HIGHWAY AND LABORATORY INSPEC-TION OF BITUMINOUS MATERIALS.*

By Francis P. Smith, Ph.B.,

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BROADLY speaking, a comprehensive system of inspection of bituminous materials and pavements or roadways made from them may be subdivided as follows:—

- 1. Preliminary inspection of raw materials;
- 2. Inspection of materials and processes during construction work;

3. Inspection of finished work.

Preliminary Inspection of Raw Materials .-- These are, or should be, assembled by the contractor sufficiently in advance of starting the work to permit of their being tested. They usually consist of refined asphalt or asphalt cement; residuum flux; crushed stone or gravel; sand; and filler. All of these materials should be sampled from deliveries actually on hand on the work. Except where the manufacture of the material is inspected at the refinery, this rule should never be departed from in the case of the bituminous materials themselves; i.e., the refined asphalt or asphalt cement and the residuum flux. In the case of the materials which constitute the mineral aggregate of the pavement or roadway, contractors are often unable to judge themselves whether or not a particular material passes the requirements of the specifications and before placing their order for them they frequently submit samples obtained from different dealers for approval. In the case of crushed stone or gravel, these samples usually fairly represent the kind of material which will be delivered. This is also true in the case of filler. With sands, however, samples submitted by the dealers frequently vary very greatly from actual deliveries. It often happens that the selection of sand has not been given sufficient attention or has been deferred until the last moment, with the result that no really suitable samples are submitted. In such cases it is frequently to the interest of all parties concerned, although perhaps not strictly the duty of the inspector, to personally visit and examine available sources of sand in the immediate neighborhood. In this way much better material may often be obtained than would otherwise be the case.

Sand and gravel banks are usually stratified and where the deposit has been made from comparatively still water the lower stratas will usually contain coarser material than the upper stratas. In every case the sand dealer should be impressed with the necessity of carefully stripping the top of the bank to remove deposits of clay, loam, etc., as this material is undesirable and will usually ball up in the heating drums. Where the stratas vary considerably and can not be dug separately, it will be necessary to take an average sample of the run of the face of the bank in order to determine what will be the composition and character of the average output of the deposit. In certain cases it is necessary to select definite stratas and have all the sand taken from them. In other cases the sand is dredged from river or creek beds and in order to obtain a satisfactory supply, it is sometimes necessary to go on board a dredge with a set of screens and a sand scale and sample the sand obtained from

*Public lecture delivered before the graduate students in Highway Engineering, at Columbia University on January 29th, 1914.