known as Class "C" for embankments from 20 to 40 ft. high. The amount of reinforcement and the thickness of the walls are both increased in the class "C" design.

In 1906 Prof. Arthur N. Talbot, of the University of Illinois, tested to destruction several sections of 48-in. and 36-in. reinforced concrete culvert pipe. The results of these tests, which were made under laboratory conditions of bedding and loading, are recorded in Bulletin No. 22 of the University of Illinois. This bulletin recommends certain formulae for the design of reinforced concrete pipe which are pretty generally accepted.

More roads use head walls on one or both ends of the concrete pipe culverts than do not use them. The bell and spigot continues to be the more popular type of joint, while the roads are pretty evenly divided on the question of cementing the joints. All of the joints, no matter of what type or whether cemented or not, seem to be pretty uniformly satisfactory.

The length of time the pipe should cure before shipping shows a very considerable variation ranging in air from 10 days to 60 days, while some roads do not install pipe that is less than 90 days old, although they ship after pipe has cured 60 days. While there have been a few failures of pipe in place and a considerable number have been broken in handling, many of these are due either to poor concrete or to the pipe being used too green. If a rich, dense concrete, which is allowed to cure a reasonable length of time, is provided in reinforced concrete pipe which are intelligently designed and installed, we believe that the railroads should feel perfectly safe in adopting this construction wherever it seems desirable to do so.

NOVEMBER 4th MEETING, CANADIAN SOCIETY OF CIVIL ENGINEERS.

The Cedars Rapids Development.

Mr. Henry Holgate, consulting engineer, Montreal, delivered a paper on the Cedars Rapids Power Plant at the monthly meeting of the Canadian Society of Civil Engineers, held at Montreal, November 4th, 1915. Mr. S. P. Brown, vice-chairman of the General Section, was in the chair. Mr. Holgate announced that his paper was merely a curtain-raiser, and that it would be followed by papers by Mr. Julian C. Smith and Mr. R. M. Wilson, who would discuss the engineering features of the development much more fully.

"Nature," said Mr. Holgate, "has regulated the flow of the St. Lawrence River far better than man could possibly do. It is one of the finest examples existent of uniform regulation, despite the enormous watersheds which it drains."

The Coteau Rapids, near Montreal, are followed by the Cedars Rapids, which have a fall of 32 ft. The total fall between Lake St. Francis and Lake St. Louis is 8½ ft., the distance being about 11 miles. This whole stretch of the river is in Canada, with the exception of a small portion of Lake St. Francis, which is in New York State. As it is a navigable river and forms a boundary, the International Joint Waterways Commission had to be consulted in regard to the application of the power company for right to divert a part of the flow. The Canadian Government would not grant a charter to the company until this Commission reported favorably on the project.

The Cedars Rapids Manufacturing and Power Co. was incorporated in 1904, the Act of Incorporation being amended in 1909. Power was given to expropriate land. About 1½ miles of the north shore of the St. Lawrence was expropriated and 40 landowners were settled with. Three islands in the river were expropriated, $1,700 being offered for one of them, $200 for the second and $2,800 for the third, this being at the rate of about $100 an acre. Two of the arbitrators agreed with this offer, but one signed a minority report setting value upon the islands at $80,000, $34,000 and $62,000 respectively. An appeal was made to the Superior Court to set aside the award, and the Chief Justice allowed the appeal, substituting the larger sums excepting in the case of one property, which he directed to be submitted to new arbitration.

In February, 1914, the Privy Council reviewed the case and reversed the Chief Justice's decision in the case of one island. Regarding the other two, the Privy Council directed that they be submitted again to the arbitrators for the hearing of further evidence. The view of the owners of the islands was that they were vital to the undertaking and should share in the profits. The company offered value upon the basis of agricultural land only. The Privy Council said that the value to be paid should be the value to the owner at the date of taking the property and not the value to the taker. They further said that the value to the owner consisted of all advantages which the land possessed, either present or future. In other words, value merely as agricultural land should not be taken, because value of the islands to a possible hydro-electric enterprise must be considered, but that this value must not be determined by taking a proportional part of the whole value of the immediate undertaking.

In other words, the Privy Council viewed it as a question of probability vs. realized probability, the value of the land being much less if a hydro-electric undertaking were considered merely as probable, than the amounts claimed by the owners on account of the fact that the probability had been realized and that the way had been paved for the actual carrying out of a hydro-electric scheme involving ownership of the islands. The Privy Council viewed the value of the islands as the amount for which they could probably have been sold by auction without the Cedars Company having acquired its powers, but with the probability of some company acquiring such powers.

An agreement was made in 1909 with the Dominion Government and plans were approved permitting 50,000 cu. ft. per second of water to pass through the Cedars plant. Permission also had to be obtained from the province of Quebec, as the bed of a river belongs to the Crown, and the Crown is represented by the Province. The agreement gave the right to construct a structure in the river bed, with the stipulation that navigation be not interfered with. A lease of the necessary portion of the river bed was obtained for 99 years, and the company agreed to pay for the water diverted at a fixed rate per horse-power, the rate to be increased as the output of the plant increases. The approval of the Federal Government was also necessary on account of the river being navigable and a boundary.

The lowest water on record was in 1895, when 185,000 cu. ft. per second flowed from Lake Ontario. With the addition of the water that drained into the river below Lake Ontario, probably 190,000 sec.-ft. passed the rapids. Of this amount 102,000 sec.-ft. passed through the main channel, and 80,000 through the channel which is being used as a headrace by the Cedars Co. As only