features are a movable sluice for logs and rubbish, a long measuring weir, and means for heating the gate chambers by hot blast pipes. Test borings having shown solid rock underlying the site, the plain gravity-type dam built of cyclopean masonry was selected, the profile allowing for an assumed ice pressure of 50,000 lbs. per linear foot acting at the overflow weir level. Comparing the size of the dam with the enormous capacity of the reservoir created, the advantages of the location are shown in an extremely favorable light; the quantity of concrete needed is 70,000 cubic yards and the capacity—160,000 million cubic feet—a unit figure of 0.44 cubic yard of concrete per million cubic feet as compared with 4.78 cubic yards of concrete per million cubic feet for the Elephant Butte dam.

With regard to the benefits derived from the construction of this immense reservoir, the 160,000 million cubic feet stored represent a flow of 12,345 sec.-ft. for 150 days or 6,172 sec.-ft. for 300 days. From this additional supply, the present minimum flow of 6,000 sec.-ft. in the river could be raised to 15,000 sec.-ft. at Shawinigan, leaving an over-supply in a very low year. But it was decided to regulate for only 12,000 sec.-ft. flow, in order to allow for loss of water in the long distance of 220 miles over which the water has to flow to Shawinigan and to meet needs for floating logs at times when such water is not needed for power.

Between the reservoir and the mouth of the St. Maurice, there are no less than 17 power sites with heads of from 10 feet to 150 feet, and whose aggregate descents total 800 feet; this figure would be increased to at least 900 feet by the dams erected in developing the various sites. This represents a total capacity of approximately 350,000 theoretical h.p. under present conditions, while it is estimated that some 900,000 h.p. will be available when the flow is regulated from the reservoir. At Shawinigan, Grand'mère, and La Tuque alone, the three sites at present utilized on the St. Maurice, the potentiality will be raised from an aggregate of some 190,000 theoretical horse-power to over 400,000 horse-power.

Provinces Co-operate.—It is gratifying to note that, in practically all the provinces, systematic investigation and adequate regulation of water-powers have been provided for. Nova Scotia joined in this most important work during the past year, when, in accordance with a recommendation of the Committee on Waters and Water-Powers, a co-operative arrangement between the Dominion Water Power Branch and the Provincial Water Power Commission was inaugurated. Much excellent progress has already been made, practically every power-producing river has been covered by reconnaissance investigations, and 25 permanent gauging stations have been established. It is understood that tentative negotiations are under way towards a similar arrangement with New Brunswick.

Standardize Information.—The officials of the various federal and provincial organizations dealing with waters and water-powers are making an effort to co-ordinate, systematize and standardize their work. It is further proposed to publish all hydrographic data throughout the Dominion in a uniform manner, easily accessible to interested parties, as soon as possible after the information is obtained. Under present conditions much valuable information is sometimes buried in voluminous publications or reports dealing with perhaps four or five other subjects, and published a year or two after the data have become available.

THINGS WE DO NOT KNOW ABOUT STRUCTURAL ENGINEERING.*

OMITTING the assumptions relative to the loads, it is apparent that the assumptions which enter the design of a bridge which demand special attention on the part of the designer refer to the following: Secondary stresses; distribution of stress in a member; and distribution of stress in a connection.

Secondary Stresses.—One of the fundamental assumptions in stress analysis is that connections are frictionless hinges. If a truss having frictionless hinges is deflected, the members meeting at a joint are free to rotate relative to each other and no bending stresses are produced in the members. If, however, the connections are rigid, when a truss is deflected the members are not free to rotate relative to each other and bending stresses, known as secondary stresses, are produced. These secondary stresses can be determined mathematically. While all are willing to admit that, theoretically, secondary stresses exist, many, apparently because of the elaborateness of the calculations necessary for their determination, look upon them as something invented by the mathematician for the further torture of the soul of the engineer. The strain-gauge, however, has come to the support of the mathematician and secondary stresses are known to be a reality.

Distribution of Stresses in a Member.—The area of the section required for a member subjected to a known stress is obtained by dividing the total stress by the allowable unit stress for the material. This is virtually equivalent to assuming that the stress is uniformly distributed over the area of a section of the member. Tests show that if an angle is riveted to a gusset plate by means of rivets in one leg only, the full strength of the angle can not be developed. Members of trusses are much larger than the single angles tested, and some portions of the section are a considerable distance from the central point in the connection. Engineers recognize the necessity of attaching the member to the gusset plate over as large a portion of the section as possible.

Distribution of Stresses in Connections.—The discussion of the distribution of stresses in a member is equally pertinent to the distribution of stresses in a connection. If the connection is made up of a number of parts each of which is to take a certain prescribed portion of the total stress, each part must have just sufficient rigidity to enable it to take its portion of the total stress. This condition it is practically impossible to obtain.

In a riveted connection the stress is not uniformly distributed among the rivets. The rivets are distributed over a considerable distance, and the intensity of the stress in the gusset plate at its outer edge is zero, whereas the intensity of the stress in the member at the same point is a maximum. The intensity of the stress in the main member at its end is zero whereas the intensity of the stress in the gusset plate at the same point is a maximum. At some intermediate point the intensity of the stresses in the gusset plate and in the main member are equal. Designate this point as the working point. If the main member is in tension, the portion of the member between the working point and the edge of the gusset plate will elongate more under stress than the corresponding part of the gusset plate and, therefore, the rivets at the edge of the gusset plate will be strained more than the rivets at the working point.

*From a paper by W. M. Wilson, Assistant Professor of Structural Engineering, University of Illinois, before the Western Society of Engineers.