beyond the natural life of the wood it may be advisable, in order to keep down heavy maintenance expenses, to use a preservative treatment.

Bridges may be built of timber to serve any purpose required and will last many years. They can not be so economically maintained as bridges of reinforced concrete, but so long as it is not practical to make use of reinforced concrete, the timber structure will be the one to build, but it must be borne in mind that it should rest on permanent foundations.

In timber construction the most durable timber should be used that can be obtained locally. The general type of temporary construction is the trestle.

The more available timbers with a fibre stress of 1,600 lbs. per square inch include long-leaf pine, white oak, and Douglas fir. In the 1,400-lb. class is included Pacific post oak, Western larch and tamarack; in the 1,200-lb. class bald cypress, Norway pine, and hemlock, and with a fibre stress of 1,000 lbs. per square inch red spruce, chestnut, and red cedar. Piles used should be yellow pine, cypress, white oak, or some equally durable species.

Construction Under Present Conditions

In meeting the present-day conditions limiting the construction of bridges, local supplies of material and labor will be the determining factors. In general, the decision as to construction should be as follows:—

Keep large structures in service by repair, whenever it is possible.

Put temporary spans on permanent substructures.

Put in temporary trestles where it can be done.

Small structures should be made permanent.

Where large structures are destroyed and must be replaced to keep the road open or where emergency use requires the building of a new crossing, making temporary pile trestle structures if the nature of the stream does not make this type impracticable. Where temporary structures are not advisable, timber structures may be protected so as to be more or less permanent.

SUGGESTED SPECIFICATIONS FOR CAST IRON PIPES FOR WATER AND GAS MAINS*

SOCKET and spigot pipes, with both plain and turned-and-bored joints, have been standardized up to 48 in. diameter in lengths of 8 ft. from 3 in. to 12 in. diameter and lengths of 12 ft. from 4 in. to 48 in. diameter. Flanged pipes and special castings have not been standardized above 24 in. diameter as the demand for such is very limited and the conditions under which they are to be used frequently call for special designs.

Division Into Classes

There are to be 4 classes of pipes, A, B, C and D, varying in thickness to withstand the respective test pressures of 200, 400, 600 and 800 ft. head of water, while it is recommended that the working pressure shall not exceed one-half of the test pressures.

Class A pipes are only intended for gas or other purposes where the working pressures are low.

The special castings have been divided into two classes only, so designed that one pattern suits Classes A and B pipes, and the other, Classes C and D. pipes. By this means the number of standards for specials has been halved.

*Abstract of report submitted by a committee of the Institution of Water Engineers, England.

The standards have been so designed that pipes and specials of all classes up to 10 in. diameter can be jointed together and leave a sufficient lead space for caulking Above 10 in. diameter the pipes of Classes A and B can be interchanged, as also can those of Classes C and D.

Constancy of External Diameter

In order to render the pipes and castings interchangeable it was necessary to standardize the external diameter and allow the internal diameter to vary slightly with the thickness and describe it as the nominal diameter or bore. This has had the effect of enormously reducing the number of patterns, as those for the barrel and socket, of any group remain the same throughout.

The variations are really trifling, thus a pipe of 3 in. nominal bore may vary between 3.00 in. and 2.96 in. diameter and a 48-in. pipe between 48.00 and 48.44 in. diameter according to its thickness or class. In practice this can have no measurable or important effect as, in the first place, it has not been the practice to split inches of diameter, and, in the second place, it is exceedingly doubtful whether, in any pipe-line, the relationship between the actual and theoretical discharge may not vary to an extent greater than would be produced by the small differences in diameter in the proposed standards. In any case it is simply a matter for calculation for those who profess to work within such narrow limits.

Strength and Testing of Cast Iron

The tensile strength has been fixed at the minimum of 9½ tons per sq. in., and the traverse strength, on the standard of 2 in. by 1 in. bar with supports 36 in. apart, at the minimum of 28 cwt. and deflection of .33 in. The forms and dimensions of the test bars are illustrated in an appendix to the specification.

Variations in Thickness, Length and Weight

The tolerances above and below the normal thickness, length and weight, have been fixed, but, after much consideration, it was decided not to introduce into a technical specification any clauses touching the question of the actual weight to be paid for by the purchaser, this being considered as a purely commercial matter, which would more properly be dealt with as a clause in the "General Conditions of Contract" or "Agreement."

It may, however, be observed that the system of payment at a price "per pipe or casting" is the simplest, and entails no calculation as to the deduction to be made for individual pipes or castings being heavier than the maxima weights specified, while all light-weight pipes would be rejected upon inspection.

Casting Pipes

The enquiry showed that many current specifications provided for the heating of both the pipes before coating, and the composition itself; to unsuitable temperatures, such as would volatilize the lighter oils, and thus continuously change the consistency of the composition.

Marking and Weighing

Provision is made for using standard forms of identification markings, including the brand mark of the Engineering Standards Committee, and for weighing and registering the weights of all pipes and castings.

Makers' Certificate

To meet cases where pipes or castings are bought from stock, or where the purchaser does not employ an inspector, provision is made for the issue, upon demand, of the Makers' Certificates, based upon the tests of the