of cheap transportation in the development of these mineral resources which come from surely only a few of the treasure spots in the unknown north. There is also the possibility of building up along the great valley with its water powers, its varied mineral deposits, and its wealth of timber, a manufacturing region unequalled on the continent. To this valley, which has raw material in such abundance tributary to it, cheap power and cheap transportation are necessary, and with the advance in the demand for power for heavy manufacturing and the growth of the world demand for every staple, there seems little doubt that the Canadian people is economically justified in developing the Ottawa waterway. Its power supply will not be greatly in excess of the demand by the time that construction is complete, and the traffic of the Georgian Bay Canal, in my judgment, will be created mainly on or close to the canal, and will be of a volume to justify its construction. Holding such opinions, it is waste of words for me to discuss the statistics of quantity, distance, and cost of operation, which would ordinarily be the determining factors in such an undertaking. It is not necessary that a great public improvement shall earn interest on its cost. Neither the Intercolonial Railway nor the Canadian Canal system have as yet ever done so, but the wisdom of building both these great works at public expense, in spite of all the minor errors of planning and administration, has never been questioned. They were essential to the welfare of the country that built them, and in a minor measure the same is true of the projected Georgian Bay Ship Canal.

EXPERIENCE OF CONTRACTOR vs. QUALITY OF WORK.

Leonard C. Wason.*

There is scarcely a field or building operations in which at first glance it seems simpler for the relatively inexperienced to do satisfactory work than in the use of concrete. Here are simple materials—sand, gravel and cement—mixed by crude labor, usually handled in a crude way, and frequently used only to obtain a relatively crude result in the form of foundations, walls, footings, and the like.

But even here experience counts for much, particularly in view of the fact that work improperly done, is often excessively expensive to remove and replace. With the rapid increase in the use of reinforced concrete the absolute necessity of practical experience and thorough technical supervision is daily becoming more apparent. With few exceptions the failures of concrete are traceable to ignorance on the part of the designer and the contractor—all too frequently to the latter.

Mr. Leonard C. Wason, president of the Aberthaw Construction Company, of Boston, Mass., one of the pioneers in the use of reinforced concrete in this country, points out with special emphasis some of the principal reasons why reinforced concrete should not be handled by unskilled labor. They are briefly:

1. Because the plans may be incorrectly read. Hence knowledge and experience are absolutely necessary.

2. Because the wrong reinforcement may be used. It is an easy matter to make an error of an eighth of an inch in the selection of bars—this may mean a decrease of 25 to 50 per cent. in strength. When made up frames are used error is equally liable in their selection.

3. Because the reinforcement may be wrongly placed. To the unskilled a matter of an inch or two difference in the level of a bar in floor or beam seems but a small matter. But in the case of a four-inch floor the placing of bars two inches instead of 3⁄4 inches from the bottom may reduce the strength one-half. Bars in columns are easily mis-set with disastrous results.

4. Because materials for concrete may not be suitable, both in quality and relative size of the aggregates. The difference between concrete made with clean sharp sand and

* President of the Aberthaw Construction Company.

that with poor material may be equivalent to a loss of 50 per cent. in strength with the latter. Proper judgment—based on experience—is necessary in the use of different kinds of cement.

5. Because the concrete is improperly mixed and used. Errors are always liable to occur in the proportions used. The mixing may not be thorough, the batch may be too dry, it may not be properly tamped, the forms may be removed too soon.

Evidently the handling of reinforced concrete work is not such a simple matter after all. It is a work in which the experience of the contractor is the best evidence of the quality of the work.

CAS TESTS.

The Department of Chemical Engineering at the University of Wisconsin, in charge of Professor Charles F. Burgess, has been carrying on an extensive series of tests of the various methods for measuring the heating values of gas, in order to enable the State Railroad Commission to determine a standard gas for fuel and illuminating purposes. The calorimeters of various types, made both in this country and abroad, and used to test the heating values of gas, have been thoroughly tested. It was discovered that one type of instrument extensively used and sold gave heating values from Io to 20 per cent. higher than the gases measured actually contained, and that erronious results were being obtained in gas producer and gas engine work where these instruments were found in use.

One of the most marked defects in the calorimeter outfits was found due to inaccurate thermometers. The various users of gas calorimeters in Wisconsin may have these defects remedied by the university experts. The Department of Chemical Engineering has just made the announcement that it is in a position to calibrate accurately such calorimeter thermometers as may be sent to it by users in Wisconsin. The State Railroad Commission, through the co-operation of this department, offers this service free of charge to public service companies in this State.

Investigation work along this line is to be continued, and the Chemical Engineering Department is co-operating with the Railroad Commission and the Committee of the American Gas Institute in prosecuting this research work. Not only are the properties of gaseous fuels being studied at the university laboratories, but solid and liquid fuels are also receiving attention.

Wisconsin has the record of being the first State to perscribe a heating value as the standard for gas for fuel and illuminating purposes. Investigation showed that over ninety per cent. of the gas is used for the heat that it is capable of developing. The old candle-power standard is, therefore, wholly inadequate. It is predicted that the universal standard of the future will be that based upon heat unit. A recent report of the Public Utility Commission of New York suggests that an investigation is under way looking toward a change of standard in that State.

Professor Burgess has been assisted in his work by Professors J. L. Dickerman and O. L. Kowalke in co-operation with a committee appointed by the American Gas Institute, consisting of R. B. Brown, of Milwaukee; J. B. Klump, of Philadelphia, and Professor Burgess.

The Grand Trunk Pacific has so far this year placed orders for additional equipment as follows: Ten colonist cars, five parlor cafe cars, sixteen first-class coaches, eight sleeping cars, eight second-class coaches and three dining cars. This makes an aggregate of fifty new cars that will be placed in service in the coming summer on the new transcontinental line between Port Arthur and Edmonton.