the original valleys spilling along the ice front and the scouring of the great flood thus let loose, cutting channels which sometimes effected a complete change in the drainage. The old lake west of the Coteau was not long lived and did not complete its drainage channel. The outlet was shifted to east of the Coteau and the Regina plain became a lake basin which was drained to the south-east. Most of the outflow went by way of the Assiniboine and thus was formed the deep channel of the Qu'Appelle which finally drained the lake, leaving a large area of rich alluvium on the upland.

The melting of the ice in the lowlands of the Red river valley created there a long lake which was not as readily drained as were others to the west, since its natural outlet was to the north and was long occupied by the ice dam. For a time this basin spilled at its southern end in Minnesota at Lake Traverse. The outlet here was maintained by a general tipping of the surface; that is, the land rose slightly at the north as the ice load was removed, until other outlets were provided either through or around the ice toward Hudson bay. The surface then gradually fell and on the Manitoba plain its retreat is outlined by regular beaches now on dry land, the more prominent ones being on the eastern slope of the Manitoba escarpment. The Canadian National Railway from Gladstone northward along the foot of these hills is largely built along these natural embankments. Near Winnipeg, a good example of an island shoal in this lake is found in a beach on the top of Stony mountain.

#### Boulders Used in Saskatoon

The benefit of this old lake to the agricultural value of the land of the Red river valley can hardly be measured. At one period it attained a depth over the country around Winnipeg of 560 ft. and its waters received all the groundup material obtained by the trenching of the valleys of the present Pembina, Assiniboine, Souris and Qu'Appelle rivers. This was deposited in the basin, most of it in the southern part, but the plains around Dauphin, Swan and Red Deer lakes also received a generous supply.

The question of the soils thus seems to be intimately connected with the history during glacial times. Much of the soil material carried forward in the ice was derived from the Cretaceous surface to the northeast, and the boulders from the Pre-Cambrian area beyond the Cretaceous terrace. Boulders carried by the ice from the vicinity of Cumberland lake are found near Saskatoon and have been used in the construction of the buildings of the University of Saskatchewan. The Manitoba plain is floored with the debris of the excavation of the valleys entering from the west.

#### PUBLICATIONS RECEIVED

WHITE LEAD: ITS USE IN PAINT .--- By Alvah Horton Sabin. First edition, 1920, published by Jno. Wiley & Sons, Inc., New York; 134 pp., 5 by 7¼ ins., and folded tables of costs, etc.; cloth bound; price, \$1.25.

RUNNING AND MAINTENANCE OF THE MARINE DIESEL ENGINE.-By John Lamb, chief engineer, British Mercantile Marine. Published by Chas. Griffin & Co., Ltd., London, Eng., 4 by 6½ ins., 230 pp.; frontispiece, plates and 106 illustrations; cloth cover; price 8s. 6d.

AMERICAN CIVIL ENGINEERS' HANDBOOK .- By Mansfield Merriman, editor-in-chief, and a board of eighteen associate editors; 4th edition, 1920; thoroughly revised and enlarged; published by Jno. Wiley & Sons, Inc., New York; Chapman & Hall, Ltd., London, Eng.; 1,956 pages, 41/2 by 7 ins., flexible binding; price \$6.00. An appendix on colored paper gives Searles' mathematical tables. A new section by W. A. Del Mar is entirely devoted to electric railways, while anotherby H. W. King-treats of irrigation and drainage. All other sections have been brought up-to-date, and in some cases have been rewritten and enlarged. This edition has nearly 400 more pages than the third edition. On account of the present size of the book, the name has been changed to "handbook" instead of "pocketbook."

## TIME AND COST-KEEPING ON COUNTY ROADS\*

#### BY K. W. MCKAY

# Retiring President, Ontario Good Roads Association

T is said that familiarity breeds contempt, and while comparisons are sometimes odious, it is desirable to have some idea of what road improvement and maintenance is costing in the various counties. From the municipal point of view, provincial subsidies cover up a lot of overcharges, extravagance and mismanagement.

The principle behind all of our municipal legislation is co-operation for the equalization of opportunity and expense. One of the first acts of the parliament of Upper Canada was in reference to statute labor, which is a compulsory system of co-operation in improving roads. This was followed by the toll-road idea, which became unpopular as soon as townships or municipal co-operative areas were established. The tendency in recent years has been to place more responsibility on the counties and the province. The recent grant of federal aid completes the utilization of the expense of highway improvement. Within the next few years, the populous centres of Canada (and Ontario in particular) will be participating in the benefits to be derived from high-class roads. A general demand will then arise for direct contributions from townships or property-owners benefited by the construction of improved highways to a greater extent than is now provided for.

#### **Reasonable Comparison of Costs**

County road expenditures are levied on the equalized values of the local municipalities. The county road superintendents have important duties to perform in the distribution of county levies and provincial subsidies. They should see that both the county and province gets value for moneys expended.

There should at all times be a reasonable comparison in the cost of similar work in different parts of a county, and reports to the provincial department should assist in comparing results throughout the province. Highway improvements is a large undertaking; county superintendents are entrusted with a greater responsibility than any other class of municipal officers. They must adopt every idea leading up to greater efficiency, if they are to retain the public confidence.

A cost system must be one that will appeal to the superintendent. It should not be too elaborate or intricate. Those who have had experience in other fields of work know the importance placed by large contractors on their cost system and the technical staff employed to maintain it.

A foundation for a uniform system of cost-keeping is desirable. The county roads should be divided into patrol districts, which should be subdivided into smaller construction sections, all to be numbered for reference. This classification of the road area should be entered in a suitable book with particulars as to location of culverts, bridges, hills, etc.

Experience suggests that county superintendents may not appreciate the importance of this record, and that the Highways Department should be interested to the extent of supplying uniform books to be completed in duplicate with the assistance of the inspecting engineer or an officer appointed for the purpose.

### Weekly Reports from Foremen

As construction or maintenance work is performed, the superintendent should receive weekly reports from his foremen giving time and how employed, together with particulars that will enable him to determine the following:-

1. Cost per mile for scraping with road grader, split log drag or other implement.

2. Cost of gravel or stone per load delivered on a road, with source of supply, length of haul and wages paid.

3. Cost of weed-cutting. 4. Cost of cleaning ditches.

\*Paper read at the recent conference of county engineers and road superintendents of Ontario.