The opening of the canal to the head of Lake Superior would prove to be an incentive of a great further series of canals and waterways through the Lake of the Woods, Lake Winnipeg and Saskatchewan River to Edmonton, so giving Canada a waterborne system right to the very heart of the continent, which would create new business and new activities along the whole route by the enormous electrical power that would be developed by the construction of the canals—power that would in a short time result in the building up of manufactures where success might almost be guaranteed, seeing that they would possess almost the cheapest motive power and transportation that it is possible to make.

THE RED AND BLACK ROADS OF SASKATCHEWAN.

During the fall of 1912, Prof. W. W. Andrews, M.A., LL.D., at the instance of the Provincial Board of Highway Commissioners, conducted laboratory and other investigations into the qualities and possibilities of Saskatchewan clays as materials for road making. The following is a condensed report of Dr. Andrew's work and findings prepared by himself. Having been carried out only on an experimental scale during last summer, it is not possible as yet, of course, to determine just what the practical value of the results described will be. That can be fully determined only when the roads have been subjected to several years of wear and cost of upkeep estimated.

Very little experimental investigation was necessary to establish the fact that at a comparative low temperature the clays of the prairie almost without exception will burn to a porous, gritty material, the properties of which are a direct opposite of the corresponding ones in the clays. The clays are nearly impervious to water, especially when well puddled, the clay clinker is readily porous; the clays are weakest when wet, the clinker is stronger; the clays do not wear to a dust, the clinker will; the clays expand when moistened, the clinker powder shrinks; the clays are adhesive, the burnt clay is not, and the clinker varies in color from reddish yellow through a brown to a bright rouge, great contrast to the slaty colors of clays.

It became evident that if this clay clinker can be produced at a cost sufficiently low, we would have a material which we could use to mix with the clay to counteract its troublesome qualities and which would prove of immense service in making roads in those parts of the province remote from sand and gravel beds. In some parts of the province natural mixtures have been made of sand and clay, and good roads in all seasons of the year are the result—witness many sections in the neighborhood of Estevan and Weyburn in the Duck Lake region. The mixture which has been chosen in this experimental work is one part of raw clay to four parts of clinkers, with the expectation that from untreated portions of the road clay will be carried on by the wheels of vehicles and dropped upon the clinkered section. There is danger that at first muddy wheels will tear up sections of clinker until the road has become properly mixed and compacted through traffic. In such a mixture the clay will keep it dustless and strong during dry weather, and during wet weather the sharp nature of the clinker will hold the wheels up, while at the same time the porosity will permit the excess of moisture to drain out of the road surface very readily. In these respects the clinker will be superior to sand and gravel because it will absorb a larger percentage of moisture before it appears to be wet. Experiments with clay taken from Albert Street, Regina, show that clay containing 30 per cent. of moisture will pack to a tough resistant mass, and observation of traffic showed that at this percentage the clay packed solidly under the wheels.

Experiment also showed that by using good coal the clinker could be produced at an economical rate, and that straw would give sufficient heat for this purpose. It remained to be demonstrated that the straw (the fuel universally abundant throughout the settled portions of the province) can be used for producing clinker at a rate sufficiently cheap. The great handicap to this form of fuel is found in the fact that a fireman needs to be in constant attendance upon a kiln during the burning. How this works out will appear in the analysis of costs at the conclusion of this article.

This much having been done, Mr. A. J. McPherson, chairman of the Board of Highway Commissioners, decided to lay out a piece of experimental road. North Winnipeg Street, Regina, was chosen, where already an experimental stretch of clay and gravel road was being laid down. Mr. J. E. Milne took charge as engineer of the work.

As the designer of the road Prof. W. W. Andrews named it the Red Road of Saskatchewan. First a trench was dug along the centre of the road to an average depth of two or two and one-half feet and a three inch tile laid down, covered to a depth of one inch. The trench was divided in sections six feet long and each section was used as a furnace. This plan had the great advantage that it burnt the sides of the trench, thus producing two porous sheets of burnt clay, extending from the surface down to the tile. It also clinkered the clay covering of the trench and a portion of the road to each side of the trench. Much time and expense was given to this side burning, but while with a steady fuel, left for a few days to burn itself out, the side burning was all that could be desired, we were defeated in our attempts to accomplish this in any adequate way with the straw fuel.

The central underdrain adds very considerably to the first expense of construction, and it has this defect that it weakens the road bed for a year until the filling has settled down. On account of the permanent nature of a well laid underdrain but one-tenth of its cost should be charged against the first cost of the road, and once laid down in proper manner it will last as long as the road is used. Moreover, if it be opened to the side ditches by drains to alternate sides of the road, every two hundred feet or so, the prairie winds all summer long will suck the air through the heart of the road bed and reduce its moisture to at least 13 per cent. This is the percentage of moisture found in clay from a wheel track on Albert Street, Regina, dug from under the snow. At this percentage the clay possesses great compressive strength; if packed it will be almost as hard as marble, when frozen it will shrink but little, and when thawed out will not soften. A road bed dried out and kept dry will in time of rain be capable of absorbing hundreds of tons of water per mile, before it reaches the dangerous limit of 30 per cent. The porous clinker in the surface metalling of the road will permit the water to spread rapidly from the surface into the bone dry bed ready to receive it, and then to the central drain. When a road has been constructed in this way each wheel track becomes a watershed, from which in two directions any excess of water may flow rapidly, to the outside ditches on the one hand and to the central underdrain on the other.

Until a method be found for cheaply calcining the sides of the trench it will be better to dig the trench as narrow as possible and fill it with burnt clinker. One of the firms manufacturing mechanical ditchers is preparing estimates of a machine costing in the neighborhood of $1,500, which will cut a six or eight inch trench to the required depth,