concrete, and also for a surplus which was used to cover and protect the newly laid concrete.

The gravel used on the work was supplied from the St. Clair River at Point Edward and was delivered by scows operating with a clam shell. The price paid was 45 cents per cubic yard, delivered on the dock. At the same time a storehouse was built at a convenient spot on the side of the road, to store cement and lime to be used for the concrete pavement.

When sufficient gravel had been hauled to keep the concrete mixer going for two weeks, a gasoline concrete mixer was installed in front of the storehouse, and a large concrete pavement mixer was moved to the road. The gasoline mixer was used to mix the cement and hydrated lime. Ten per cent. by bulk of lime was used. The machine used for this work was rented from a local contractor and was operated by seven men and a foreman who also ran the engine. The lime was kept in the storehouse and the cement was hauled from the car directly to the machine, where it was mixed with the lime, rebagged and either placed in the storehouse to be kept as a reserve supply, or hauled directly to the concrete mixer. Ordinarily a car of cement was mixed with the necessary lime in a day and a half.

When the larger concrete mixer was fitted up satisfactorily, the superintendent suspended grading operations temporarily and devoted his attention to the concrete work. The manner of carrying on this work was as follows:

A 1¼-inch iron water main was connected to the town's hydrant and laid in the gutter. This pipe was provided with tees and plugs at about every 150 feet. Shut-off valves were also inserted in the pipe line at several convenient places. By providing 100 feet of 1-inch rubber hose which was attached to the pipe by means of the tees, a constant supply of water was available at any point and at any and all times for moistening the subgrade, mixing the concrete, and for keeping the finished concrete wet while it was setting.

Ordinarily 20 men and 1 team in addition to the engineer were required to operate the machine. The men were arranged as follows: 1 superintendent, 1 working foreman, 1 team delivering cement-lime mixture, 1 man handling cement at mixer, 8 gravel shovellers, 2 men wheeling gravel to mixer, 1 engineer, 1 fireman, 1 man dumping bucket, 2 men shovelling concrete and operating first template, 2 concrete finishers, 2 extra men for watering concrete, removing forms, greasing expansion joint strips, and covering concrete with gravel.

The two concrete finishers also operated the box template and set the wooden curbs or concrete forms.

Stakes 25 feet apart were driven to line and grade daily by the engineer in charge. Lines were stretched on the top of these stakes by the finishers, and intermediate stakes approximately 4 feet apart were driven to support the curbs.

As the concrete hardened, it was covered with the excess gravel which had been hauled for that purpose, and shovelled outside of the concrete forms. This gravel when kept damp protected the concrete from the hot sun and prevented it from drying out too rapidly.

As the concrete work advanced, it was deemed advisable to continue the grading under an additional subforeman. The hauling of gravel was also resumed, and the engineer for the concrete mixer operated the road-roller after hours in the evenings. This did away with the necessity of hiring an extra engineer whose time would not be fully occupied.

When the concreting was finished and the concrete had been allowed from ten days to two weeks to set, the gravel covering was shovelled off and the expansion joints, which were 30 feet apart, were cleaned out. The joints were then half filled with building sand and the remainder filled to overflowing with paving pitch. This pitch was applied by means of a portable tar kettle to heat it and a cone-shaped ladle with a ½-inch runner at the bottom. This runner could be regulated by a plug at the end of an iron rod leading up to the handle of the ladle.

As the concrete pavement was only 16 feet wide and the traffic quite heavy, gravel shoulders 4 feet wide were added at each side. As water-washed gravel was used, it was found necessary to bond it by raking limestone screenings into it.

The prices paid for labor were somewhat high owing to local conditions, and were as follows:

Foremen	$2.50 to $4.00 per day.
Engineers	40 cents per hour.
Laborers	25 cents per hour.
Teams	55 cents per hour.

Hydrated lime was first used in a short experimental section of concrete pavement at Windsor, constructed by the Highways Department in 1912; and this material was used throughout the work in Sarnia. The lime was obtained from the Central Prison Farm at Guelph, where it is manufactured by prison labor. Hydrated lime has been previously employed in making waterproof concrete, and its value in this regard is well known. The effect of the lime is to act as a void filler, at the same time increasing the plastic and flowing qualities of the mortar. In this way a denser mixture results, tending, it is believed, to a tougher, better wearing, and more uniform quality of concrete, making a mortar which adheres more strongly to the stone, and lessening the danger from incomplete mixing and tamping.

Recent tests have shown also that the expansion of concrete is due more to the presence of moisture than to change of temperature. The denser concrete, it is believed, will have less tendency to movement due to expansion and contraction than one in which hydrated lime is not used, and it is probable that the liability to transverse cracks in the pavement is thereby lessened.

Use in pavements is a severe test of the durability of any material. Spread in a thin layer over the soil, it is fully exposed to the destructive influences of climatic and weather conditions—extremes of frost and heat, snow, slush and rain—combined with the wear of narrow steel tires, iron-shod horses, and the bending, crushing effect of heavy loads. The use of hydrated lime at Windsor and Sarnia should do much to determine whether the practical benefit of hydrated lime is equal to its theoretical value.

The unit cost per square yard of concrete was as follows: Grading and ditching, $0.155; mixing lime and cement, $0.084; hydrated lime (29 tons), $0.022; cement (3,462½ bbls.), $0.367; gravel (3,117½ cu. yds.), $0.294; labor on concrete, $0.200; expansion joints, $0.011; drainage, $0.111; gravel shoulders, $0.187; supervision, $0.057; tools and sundries, $0.054. Unit cost per square yard, $1.542.

The report, to which we are indebted for the above data, was prepared under the direction of Mr. W. A. McLean, Commissioner of Highways for Ontario.