

With the fall of the Roman Empire came a decline in road construction and for several centuries no further attempt was made to improve highways. The revival of paving came in the building of streets in the larger cities. This was followed by the improvement of the through routes between the centres of population.

It was not until the latter part of the 18th century and the early part of the 19th, that a truly scientific attempt was made at road building. The methods employed during that period are in use to-day, in slightly modified form, in American country and village roads.

The decided change in the mode of transportation on our highways during the last few years has necessitated new methods of construction. The lasting quality of a macadam road depends greatly upon the natural cementing value of the stone composing it. Until the advent of the automobile, the binding material of the surface was distributed by the horses' shoes and blown away by the wind; more binder was then chipped off the stone, com-

are transferred to the base, that base must be in a condition to sustain these loads; that is, it must be dry and thoroughly compacted, and it must not contain any vegetable, perishable or yielding matter.

A proper and lasting sub-base can be secured only by keeping out moisture. Drainage must be established so as to facilitate the flow of water away from the subsoil and even from the side ditches as quickly as possible. The sub-base must be dry, fairly hard and unyielding, or no material placed upon it will prove satisfactory in giving low cost of maintenance and long life.

Upon such a well-prepared sub-base is laid a "foundation for the wearing surface." Experience has demonstrated the fact that concrete makes the best foundation. The concrete must be properly proportioned, well mixed, and laid smooth to conform to the grade of the finished pavement. Concrete properly proportioned and mixed is impervious to water—a most essential feature for a wearing surface foundation." Water cannot penetrate to the carefully prepared sub-base and destroy it, rendering it unfit to sustain traffic. Concrete will not only sustain the pressure imposed upon it by traffic, but will distribute the same over a considerable area, thus much reducing the load to be carried by the sub-soil. This characteristic of concrete makes possible the laying of a pavement upon many sub-soils, the cost of the preparation of which would be prohibitive were concrete not used. A concrete foundation when once laid will give an asset which can be counted on for all time, while a broken stone foundation is necessarily of a more or less temporary nature, owing to its displacement under travel and its disappearance into the soil which supports it. The success of those city streets which have stood so many years with little cost of maintenance under heavy traffic conditions can be traced directly to well-built concrete foundations.

In city and town streets it is frequently necessary to lay or make repairs to pipes. This can easily be accomplished on a concrete street and the concrete can be replaced, leaving the surface in perfect condition.

The traffic upon highways is increasing yearly. Each year highways are subjected to constantly increasing loads. The public demands rapid transportation and quick delivery of its goods; consequently the nature of traffic is rapidly changing from horse-drawn to motor-driven vehicles. Moreover, the public demands that all unimproved highways be surfaced and that these surfaces be kept in good condition. If roads are built in accordance with the ordinary methods of country road construction, under the new conditions of traffic, their life is short and their cost of maintenance is high.

With a little more care in construction, the concrete foundation, which is essential to every wearing surface, can be allowed to take the wear itself, thus giving a permanent pavement of low cost.

This use of concrete as a wearing surface, as well as a foundation, makes possible permanent highways, where otherwise the cost would be beyond the financial resources of many communities.



Fig. 27—Sheridan Road, Highland Park, Lake Co., Ill.
(Built 1914.) Curbs are built monolithic with Pavement

pressed by the steel-tired vehicles and re-formed by absorbing moisture from the atmosphere. The automobile prevents this re-making of the binder. The action of the rear driving-wheels displaces not only the surface binder but the road materials as well, scattering them beyond recovery. When this occurs, rain penetrates the road and softens the base and foundation. The road in turn settles, breaking the bond and thus permitting the loosened stones to be displaced.

In order to prevent these defects a permanent binder, such as cement, must be incorporated with the other road materials. The most exact and economical method of combining cement with the materials at present used in road construction is to mix it with them, forming concrete.

GOOD HIGHWAYS—HOW TO BUILD THEM.

The first and most important essential for a successful pavement is a firm and unyielding sub-base. Since all the loads brought upon the surface