

The slip to driving wheels was also taken into account, as well as the slew to hind wheels on curves.

The serious problem presented by the motor truck upon roads which have not been constructed to carry them, was also considered, and it was emphasized that more attention be paid to the construction of the foundation. The effect of traction engines on faulty roads was also brought out.

The author, in dealing with the effect of horses on the road surface, referred to the types of shoes used and showed that the damage to the surface under ordinary conditions was considerable. The grooving of the road, due to the tendency of all traffic to keep in one line, was likewise given consideration.

The author stated that such problems as these formed the most pressing phase of road investigation of to-day, and that attention should be concentrated upon the needs of mechanical traffic, but horse traffic was still such an important factor that its requirements should not be lost sight of. He then referred as follows to the construction of traffic roads:—

Roads adjacent to the larger cities require a heavier type of construction with a more durable surface, to carry the larger number of vehicles, more heavily loaded, and moving rapidly. The more frequent and faster traffic demands the resistant surface; and added to this the heavily loaded vehicles require a stronger form of foundation.

With a waterbound macadam road it has been found that the traffic now using some of our roads not only wears the surface of the road, but produces a movement among the stones themselves at some depth below the surface, causing a rocking action of the stones and producing a rubbing which gradually wears off the angles of the stones until they are of a rounded shape and have no interlocking to resist movement among themselves. This is the main cause of the excessive mud on macadam roads, and it is also the main cause of the destruction of roads. It was to meet this interstitial wear, and to confine it, so far as possible, to the surface, that the bituminous-bound road has been introduced.

One of the earliest endeavors to meet this interstitial wear, and to confine it to the surface, was the treating of existing road surface, with a painting of tar.

Then came tar-macadam, which consisted of crushed stone of various sizes, thoroughly heated, then coated with tar, mixed by machinery or by hand, and then laid on the road and rolled.

Another method which is used extensively in Britain is tarred furnace slag; the tar being applied when slag is hot, thus ensuring penetration.

While the perfect road to suit all conditions and circumstances has not yet been devised, bituminous roadways approach nearest to the theoretical and practical type of road.

The points to be aimed at in modern road construction may be summarized as follows:—

(1) The travelled portion of road should be built on a foundation of sufficient strength to carry the weight of the traffic and to distribute the pressure of the wheels over the subsoil as to avoid any depressions.

(2) Upon this foundation there should be a wearing surface so constructed as to minimize the abrasive action of the traffic, and also be quite impervious to water. It is universally agreed that water is even a greater enemy to a road than traffic.

(3) It has been found that the bituminous mixtures now employed in all modern road construction tend to prevent the interstitial wear of the stones by interposing a resilient substance between the stones.

(4) In addition to this, the modern road, constructed with this bituminous binder, gives a slight elasticity or resilient action in the road, and this slight elasticity is very helpful to the present form of traffic.

The surface of road should be smooth, and at the same time have a sufficient roughness or "grip" to prevent its being slippery.

(5) Excessive camber should be avoided, as it tends to divert the traffic on to the crown of road.

The requirements of a modern road may be summed up as follows:—

(1) It should be sufficiently wide to meet the traffic requirements, but must not be extravagantly costly in its first construction.

(2) The foundation must be sufficiently strong to bear the weight of traffic, and the surface must be durable and require the least possible amount of repairs at low cost.

(3) The road should be safe, firm, hard and at the same time resilient, with an even surface, and yet give sufficient foothold for horses.

(4) It should be as noiseless as possible, and should be incapable of gathering any dust or mud. The surface should be so constructed that water cannot penetrate; and that camber be as flat as possible, compatible with the speedy draining off of the water falling on surface.

(5) There should be no possibility of interstitial movement among the stones of which the road is constructed.

The following is a statement showing the amount of traffic, in the author's opinion, certain roads should carry:

Average daily traffic—12-hour day.

Class of road.	Light vehicles.	Heavy 1-horse vehicles.	Heavy 2-horse vehicles.	Motor cars.	Total.
A good gravel road will wear reasonably well and will be economical with	80	45	25	150	300
Requires to be oiled with				over 150	
Gravel road coated with either hot or heavy cold oil, $\frac{1}{2}$ gal. per sq. yd. (cold oil must be used yearly)	100	70	40	500	710
Waterbound macadam will stand with	150	200	70	not over 100	520
				at high speed	
Macadam, with a dust layer will stand				350	
Macadam with tar carpet coat will be economical with ..	300	100	50	1,200	1,650
(Will stand at least 30 motor trucks, perhaps more.)					
Waterbound macadam with a good surface coating of tar will stand with	100	60	40	1,800	2,000