

ORGANIZATION AND SYSTEMATIC OPERATION IN ROAD-BUILDING.

The mistake is made in road-building of studying the question solely from a physical and constructive standpoint rather than from one of organization and systematic operation. Where we have bad roads we are disposed to criticise them from a constructive standpoint. If a road fails, we say that it is because it is not well built, because the right material was not used. In this our view is superficial. Organization, system, constant and uninterrupted care, a vigilant road patrol are required for the purpose of immediately detecting and remedying the slightest defect. The cheapest way to care for a road is by never allowing it to get into a bad condition, or to deteriorate in the least. A road properly cared for gets better every year. It improves constantly. This is the way to make a road. The most systematic, the most economical, the most painstaking road-builders are the French. They have better roads, at a less cost, than any other nation. Their results are ideal, both from the standpoint of cost and the character of the roads. They are a people heavily burdened with taxation. With them economy is necessary; it is the saving born of necessity. It is the kind of economy that, among other things, develops the perfect roadway.

In the South most of the roads are macadam, and are altogether pleasanter and more satisfactory for general travel. During all the time of their existence they have been subject to constant inspection and repair as soon as the slightest defect has shown itself. One man with a horse and cart can care for many miles of roadway when he has nothing else to do, and when he undertakes the work before the imperfection is great. When we wait for our roadways to be cut to pieces, to reach an almost impassable stage before we do anything for them, the work of repair is laborious and expensive. With constant inspection there is required only a few shovelfuls of broken stone for each little defect. In France all roads are again subject to the general inspection of a general road officer, who holds his subordinates responsible for results, and makes reports upon the improvement of bridges, drainage and affairs of this character. Any defect, of however slight a character, in any roadway comes about through some one's neglect. Through the perfection of the organization in France, it is entirely possible to place the responsibility. For this reason neglect of duty is a rare occurrence.

The French macadam roads, roads made of broken stone, are of the ideal character, smooth, reasonably permanent and best suited to the comfort of the horses and animals which travel over them. A macadam roadway is in every way ideal when we consider it with respect to the comfort of those who travel over it. It is even a

question in the minds of many engineers if a macadam roadway is not superior in all ways to asphalt, wooden-block, stone-block or other artificial street coverings.

A chief engineer is at the head of each department, and he has several assistant engineers, each in charge of a sub-division called an *arrondissement*. All the roads in these *arrondissements* are visited and examined by them at least quarterly, and oftener if necessary. These engineers in turn have lieutenants, called conductors, who oversee certain lengths of road, which they must look over in detail at least semi-monthly. Under the conductors come the *cantonniers*, who do the manual labor, each one caring for a *canton*, or a stretch about two miles long. Five or six *cantons* are grouped together and their *cantonniers* form a brigade, one of whom is made chief, and has a shorter stretch to care for in order that he may oversee the others. If a piece of road absolutely requires it, one or more laborers, called auxiliaries, are given a *cantonnier* to aid him.

Besides overseeing their roads the conductors give all orders to the chief *cantonniers*, examine their work and report on their conduct, and make written reports to the

engineers twice each month. They keep the accounts of their divisions and report on petitions or new projects. They are obliged to do all their travelling on foot, examine into the smallest details and give the necessary explanations and directions to the *cantonniers*.

The *canton* of the chief *cantonnier* must be the best kept of the brigade, in order to show his superiority over the other men.

These men are nominated by the prefect of the de-

partment according to certain conditions. They must be between twenty-one and forty years old, suffer from no infirmity that interferes with daily labor, have previous experience in workshops appertaining to their work or have worked on the roads in some capacity, possess a certificate of good conduct and be able to read and write.

The *cantonniers* must remain on the roads from sunrise to sundown in winter, and from 5 a. m. to 7 p. m. in summer. They are allowed to build shelters or have movable shelters in which they can seek refuge during storms, but they cannot absent themselves from the roads. Each one has an account-book and a register, and keeps a daily account of his work and the time occupied in each task. At the end of each month the conductor recapitulates the account and sends it to the engineer.

In this way the roads are never without the most careful attention, and expensive and annoying repairs are rendered unnecessary.



A STEAM ROAD ROLLER AT WORK.