So the old-fashioned place will be relegated to the rear and that community will loom up and be the greatest which with courage and modern methods proceeds boldly to the front.

MAINTENANCE OF CITY STREETS

By Claude Draper, City Engineer,
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The repair of streets is usually made by some worker who is given a shovel and told to, "Fix 'em up, Tony," and Tony "fixes 'em up," not because he wishes to repair the bad spots in the street but because he wishes to get his pay on Saturday night. In other words, the repair proper is often done by men utterly incompetent for this important work.

Street repair with the enormous increase of heavy traffic has become an engineering problem of no little importance and is not a job for Tony. We city officials owe Purdue University and its Annual Road School a debt of gratitude for its splendid program and the many useful things we learn here.

The street commissioner has vastly different problems to meet in maintaining city streets than the county road superintendent. The county roads if supplied with plenty of metal and dragged will be kept in good condition but in the city the street commissioner has crossings, manholes and curb grades to contend with. In Lafayette with its hillside streets, if the street commissioner tried to keep an abundance of gravel on the streets he would have an endless job.

Every year we oil approximately 8 miles of streets. This oiling has saved many of our hillside streets from washing, but oiling is like feminine beauty, it is only skin deep. Oiled streets will soon become full of pot holes. Our street department, during the past season, has been very successful in filling these pot holes with oiled gravel. Early this spring road oil was mixed in the gravel and the holes were filled. We found that this pushed with the first auto traffic and was very disappointing, but our street department did not give up. They mixed up several yards of the material in the city yards and let it lay for several days.

The holes were next squared up, that is, the edges were made vertical and the loose dust was cleaned out. The oiled gravel was then deposited in the hole and well tamped into place with a hand tamp. Traffic was allowed to hit the patches and the next day they were again gone over and worked into place. It was found that after this careful attention it was

difficult to distinguish the patch from the rest of the street. This method is satisfactory only when the potholes are given immediate attention. If the street is neglected until the holes are quite numerous, the only solution then is to scarify, drag, roll and re-oil.

In the maintenance of gravel streets a cost sheet should be kept for each street and when the maintenance cost becomes excessive, on account of heavy traffic, then the street should be paved, or the gravel surface treated, according to its location. Unfortunately it is not always easy to pave the streets that most need it on account of political interference.

When streets are paved it should be the engineer's duty to see that proper widths are specified. It is my opinion that a narrow street is sometimes more expensive than the wider streets because on the narrow streets the traffic must follow certain tracks whereas on wider streets the traffic may be distributed.

Resurfacing with Rock Asphalt

The paved streets develop bad spots and must be repaired. In Lafayette we had several old brick and asphalt streets that were in very bad condition. One street in particular was almost impassable. This street was constructed of two course brick and ran out from the heart of our city to a one-time famous old brewery. If any of you gentlemen remember the volume of business this brewery did you will realize the enormous wear and tear of the steel tired, heavily loaded beer wagons on this none too hard brick pavement. The street had also been literally gutted with trenches for various public utilities connections.

In 1921 a strip of rock asphalt was placed upon this street about 20 feet wide and about 100 feet long. In three years this patch had stood the traffic so well that it was decided to improve the whole street with this same material. In 1924 a contract was awarded for resurfacing Fourth Street from Main Street to Salem Street, a total of seven blocks. In the first two blocks the thickness of rock asphalt was 1½ inches in the middle and 1 inch along the edge. In the remaining blocks the thickness of the rock asphalt was increased in the center until a total thickness of four inches was attained at the end of the job. This increase in thickness was made because the traffic had worn the old crown away in some places until the bricks were worn down to one fourth of their original depth.

The rock asphalt was not laid the entire width of the old pavement, being feather-edged out about five feet from each curb. This saved the property owners considerable expense and also provided more waterway at the curbs. The edges of the rock asphalt have not ravelled and the street today is in

fine condition. There were several mistakes made in laying the rock asphalt on this job which have been eliminated in later jobs and are as follows:

1. The street crown should be built up with binder so that the rock asphalt can be laid on in a sheet of uniform thickness of not to exceed 1½ inches.

2. All holes or depressions on the street should be built up to grade at least thirty days before the rock asphalt is laid and given a good pounding by the traffic. On one street this patching was done so well this year that a committee of residents called and said the surface material should not be placed as the street was then satisfactory to them. Of course this was only part of the resurfacing.

In 1925 we laid two more jobs, Third and Fifth Streets, on old brick pavements. In 1927 one block on South Street, one block on Second Street and about five blocks on Sixth Street were resurfaced.

The Sixth and Second Street resurfacing was done on old sheet asphalt pavements. The sheet asphalt was thoroughly cleaned by washing and scraping off the deposits of oil dropped from parked automobiles. The paint coat was then applied and the rock asphalt, 1½ inches in center thickness and 1 inch on the edge, was then laid. Care should be taken in the resurfacing of asphalt streets to cut off all the bumps clear down to the base as they are usually caused by shoving of the old binder. These bumps should all be taken out and built up to grade with new binder. Care should be taken to find all base failures before resurfacing.

Costs

The following is the cost per square yard of the work that has been done in Lafayette:

Street	*Square Yards*	*Cost per Sq. Yd.*
Fourth	7,445.2	$1.40
Third	1,698.6	1.44
Fifth	1,423.0	1.40
Second	1,197.2	1.36
South	922.0	1.37
Sixth	6,495.5	1.38
Total	19,181.5	Average $1.39½

We have used in Lafayette in the past two years about seven car loads of rock asphalt in street repair work. It has been used to advantage on our old asphalt streets that are now worn so thin that they soon break through with the use of steel chains on the auto tires during the snow period. It has been found by careful examination that these holes or breaks follow directly in the paths of the auto traffic and always show up just after the extended use of the chains on automobiles. A rubber

chain is already on the market and should be substituted for the iron chain.

All our traffic on Main Street travels in the same tracks year in and year out. It cannot deviate from these paths on account of double car tracks and parked cars along each curb. Every spring after the aforesaid tearing up by the auto chains, these paths or tracks are filled with numerous holes.

This summer we tried to get the jump on the holes and in cooperation with the local street railway company we not only filled the holes but resurfaced between the tracks and about two or three feet on either side. This surfacing varies in thickness from ½ to 1½ inches. The space between the tracks and about one foot outside the rail was taken care of by the street railway company and the balance by the city. During the resurfacing one side of a street was blocked at a time.

As soon as a section was rolled it was opened to traffic. This resurface has apparently adhered to the old pavement which was of all descriptions, and to date the resurfacing is in excellent condition. About three carloads of material were required for the job and the expense was about equal to the city and street railway company. The cost per square yard was not determined due to the irregularity of the resurfacing. It is hoped that we now have a sufficient thickness of asphalt that will stand the pound of auto chains and that this spring no holes will appear.

I would also like to take this opportunity to tell of an incident that happened while our Main Street repair job was going on. The repair gang had just opened a block when a tractor came along. Its cleats on the wheels tore the freshly laid asphalt out completely and we found we had no laws to prohibit such a nuisance. The gang luckily was close by and soon had the damage repaired. After several days' traffic the rock asphalt will become hard and will not tear out badly. No asphalt will stand the cleats of a heavy tractor, and their journeys over the city streets should be made on boards or at least wooden clamps should be fastened between the cleats.

In closing I might say that the best way to keep down repair costs is by having competent inspectors on the job at the time of construction. Inspectors should not be given jobs to pay political debts and the engineer in charge should not tolerate such practice.

About seven years ago an alley pavement was put in under one of these "political" inspectors. He was a good old party worker but about all he knew about this concrete job was that it was to be a certain thickness. He informed the contractor that he was there to see that that thickness was obtained. Each time the mixer moved ahead he had the workmen stretch a string from form-board to form-board and he would do the measuring, but on account of his poor eyesight he failed to

notice that the workmen held their fingers under the string. The alley has recently been repaired by the contractor after litigation of two years duration.

INSPECTION AND CONSTRUCTION PRACTICES ON INDIANA CONCRETE ROADS

By J. T. Hallett, Assistant Chief Engineer, In Charge of Roads, Indiana State Highway Commission

Our aim is to get the best possible results using the plans and specifications under which the contract is awarded. On state and federal work the plans and specifications are standardized, resulting in standardized methods of construction and inspection. I desire to spend most of my time discussing these methods.

During the fiscal year of 1927 our department had supervision and inspection on 129 contracts. Of these 58 were state and federal projects on which the specifications were very nearly the same. The remaining 71 were county projects on which state inspection had been asked. They were in a number of different counties and the specifications varied considerably. The only general rule which can be followed in inspecting county work where the specifications vary is to get the best possible results under the existing specifications. This work, therefore, requires considerably more time devoted to supervision than where the methods can be standardized.

Building The Grade

The first operation in building a concrete road and in fact any road is the building of small drainage structures and the making of cuts and fills. I will not dwell on the construction of the drainage structures as they would naturally fall under another heading. I will only mention a few of the most important methods we follow in grade preparation which hold equally as good for other types of roads as for concrete. The project engineer sets substantial stakes on or near the right of way line at each 100-foot station and on each side of the road. These stakes are usually 2 inches square and 18 inches long, dressed on two sides to facilitate the marking of station numbers and distances out from the center line. Elevations are taken on each stake and a grade sheet computed giving the distance of the finished grade above or below each stake. The grade foreman is furnished with copies of the grade sheets with which he can level off and determine the cut or fill at