

| | |
|---|--------------|
| Per cent. of bitumen soluble in CS ₂ , air temperature (total bitumen) | 99.92 |
| Organic matter insoluble | .06 |
| Inorganic matter | .02 |
| | <hr/> 100.00 |

Experiment No. 2, Section No. 6—Fluid Residual Petroleum.

This section is 24.3 ft. in length. The concrete aggregate for this experiment was composed of 1½:2:4 mixture of cement, sand and broken stone. The same oil as described in experiment No. 1 was added to the extent of 10 per cent. by weight of the cement, after a mortar of the cement and sand had been prepared and before the broken stone was mixed in. The stone in this and the following experiments consisted of crushed trap ranging from 1½ ins. to ½ in. in diameter.

The mixture was laid to a depth of 2½ in. over the prepared foundation and tamped until the mortar flushed to the surface and filled all voids. The resulting surface was not troweled, but was purposely left somewhat rough. While rolling an adjoining section the next day, the roller was run over this surface, causing slight cracks to develop in places. When last inspected, on January 31, however, no evidence of these cracks could be found.

Experiment No. 3, Section No. 5—Fluid Residual Petroleum.

Section No. 5 is 45 ft. in length. In this and the following experiments the concrete was first prepared in a "bug" mixer. The sand or stone screenings, or both, as the case might be, were first placed in the mixer and the mixer was then driven to the stone pile, so that the cement and fine aggregate were mixed dry. Here the proper proportions of broken stone, water and oil were added and, after the machine had been driven about 500 ft., the concrete was dumped upon a board. As it was not thoroughly mixed, it was then turned twice by hand before shovelling it upon the road. After it had been placed in position, it was raked with the back of steel rakes to the desired grade and crown.

In this experiment the same oil as described in experiment No. 1 was used to the extent of 10 per cent. by weight of the cement, and an attempt was made to use stone screenings in place of sand. The first batch was composed of cement, stone screenings and broken trap rock, in the proportions 1½:2:4. As the voids of this mixture were not well filled, the proportions were changed to 1½:3:4 for the remainder of this section. Tamping failed to bring the mortar uniformly to the surface, so the section was rolled with this object in view. As this did not produce the desired result, a cement grout similar to that used in experiment No. 1 was poured over the first 20 ft. of this section adjoining section 6 and "broomed" in. The remaining 25 ft. of the section were thoroughly tamped and troweled off with the back of a shovel.

Experiment No. 4, Section No. 4—Fluid Residual Petroleum.

Section No. 4 is 37 ft. in length. As the screenings used in experiment No. 3 did not produce as dense an aggregate as desirable, it was thought well to replace a part of them with sand. The proportion of 1½:1:2:4: of cement, sand, screenings and broken stone was then decided upon for this experiment. This aggregate was also used in the three succeeding experiments. The same oil as described in experiment No. 1 was used in this experiment to the extent of 15 per cent. by weight of the cement. The concrete was laid and tamped in the manner previously described and finished off with the back of a shovel.

Experiment No. 5, Section No. 3—Cut-Back Petroleum Residue.

Section No. 3 is 68 ft. in length. This experiment was identical in every respect with experiment No. 4, except that a different oil product was used to the extent of 15 per cent. by weight of the cement. The properties of this oil are given in Table II.

TABLE II.—ANALYSIS OF CUT-BACK PETROLEUM RESIDUE* USED IN EXPERIMENT NO. 5—OIL-CEMENT CONCRETE.

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| Specific gravity 25°/25° C..... | 0.962 |
| Flash point C., open-cup method | 35° |
| Burning point °C., open-cup method | 170° |
| Per cent. in loss at 163° C., 5 hrs., (20 grams) | 13.23 |
| Penetration of residue† (N. 2 N. 5 seconds 100 grams, 25° C.) | 116° |
| Per cent. of fixed carbon | 8.90 |
| | <hr/> |
| Per cent. of bitumen soluble in CS ₂ , air temperature (total bitumen) | 99.85 |
| Organic matter insoluble | .12 |
| Inorganic matter | .03 |
| | <hr/> 100.00 |

* Viscous, fluid, sticky; too soft for penetration determination.

† Semi-solid, sticky.

After laying, no difference between this section and section No. 4 could be noticed, except that the surface of the latter was slightly lighter in color.

Experiment No. 6, Section No. 2—Cut-Back Petroleum Residue.

Section No. 2 is 72.4 ft. in length. The experiment is identical with experiment No. 5, with the exception that the cut-back oil was used to the extent of 10 per cent. by weight of the cement instead of 15 per cent.

Experiment No. 7, Section No. 1—Plain Cement Concrete.

Section No. 1 is 39.4 ft. in length. In this experiment the cement concrete was prepared and laid in exactly the same manner as sections Nos. 3, 4, 5 and 6, except that no oil was used in the mixture. This was done for the purpose of comparing ordinary Portland cement concrete with the oil cement concretes.

Summary.

In the work described it was found that the concrete could be handled best when made sufficiently wet for the mortar to flush to the surface upon tamping, but not so wet that it would not hold its shape after being tamped. The best surface finish was obtained by troweling the wet concrete with the back of a flat No. 2 shovel until smooth and uniform.

All of the sections were closed to traffic for at least seven days after being laid and they were sprinkled with water daily during this time. A thin layer of sand was spread over part of the surface and a thin layer of stone screenings ranging from ½ in. to dust was spread over the remainder.

When last inspected, on January 31, all of these sections were in excellent condition, although the street was covered with a slight coat of mud brought in from other roads. No important difference between the sections could be seen at that time and a considerable period of time will probably be required to determine what practical differences, if any, do exist. The materials and cost data for these experiments are given in Table III.