pear to warrant the use of a more scientifically built and expensive pavement.

The Post Road from New York to Boston, Mass., through Massachusetts, as well as the Providence-Narragansett Pier (Shore Road) road, have a number of sections constructed of asphalt macadam which have been down for five years, and are giving splendid service, without maintenance to date.

Bituminous Concrete

This type of pavements is one that has gained popularity in recent years, by reason of its simplicity of construction, long life, cheapness and ease with which it is repaired.

The American Society of Civil Engineers defines a bituminous concrete pavement as follows:----

"A bituminous concrete pavement is one having a wearing course composed of stone, gravel, sand or slag, or a combination thereof, and bitumious material incorporated by mixing methods."

The binding materials used in the construction of bituminous concrete pavements are asphalts, water-gas tars and coal tars. The original bitumious concrete pavements were laid in England using tar as the binding medium. In the early seventies and eighties, various types of bituminous concrete pavements were laid in the United States with varying results. In 1904 bituminous concrete was adopted as standard by a number of state highway boards and cities. Since then marked progress has been made in the development of the many kinds of bituminous concrete pavements, and since 1910, the majority of the larger cities and highway boards have adopted some form or other of bituminous concrete as a standard type of construction. Each year brought out new types and methods of construction, but to-day the bituminous concrete pavement has passed the experimental stage and is now recognized by road builders as one of the most economical types of construction, both in first and annual maintenance costs.

Bitulithic and Warrenite

Under the heading of Bituminous Concrete are a large number of different pavements which have been used and have given excellent results. Among those more commonly used are the "Bitulithic," "Warrenite," "Amiesite," "Topeka," "Filbertine," "Bitoslag," and what is termed, the "Open Mix Specification." The principal differences in the specifications is the character of the mineral aggregate and the class of bituminous material entering into the composition of the wearing surface. I shall not attempt to go into the details of the various specifications of the different types except in a general way, in an endeavor to bring out the more important difference.

"Bitulithic" specifications require an aggregate composed of broken stone, all passing the 1½-in. screen and retained in a 10-mesh screen. To this is added a certain amount of limestone dust and asphalt cement of the proper consistency which will, when mixed, give maximum density and a minimum percentage of voids.

"Warrenite" is another type of bituminous concrete, closely resembling the "bitulithic," and largely used on highway construction. Its composition is a modification of the "bitulithic" mixture.

The "Filbertine" and the "Washington" mixture very closely resemble one another. Both are composed of a mixture of approximately % stone and ½ sand, 5% of limestone dust, and from 6 to 8% of bitumen. The "Washington" mixture uses a stone graded from 1¼ inches down to ¼-inch, while the "Filbertine" uses from ¾-inch down to ¼-inch. A considerable amount of this type of bituminous concrete was laid in Washington during the years 1910 and 1914, and has given excellent results.

Topeka Mixture and Bitoslag

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The "Topeka" mixture is one of the most popular types of bituminous concrete, more closely resembling sheet asphalt than any of the others. A lesser percentage and smaller size stone is used in this mixture than in the other types of bituminous concrete.

Bitumen-7 to 10%.							
Pass	200	mesh	screen	from	5	to	11%.
Page	40	mesh	screen	from	18	to	30%.
Dogg	10	mesh	screen	from	25	to	35%.
Dogg	1/	moch	screen	from	8	to	22%.
Pass	74	mesn	garoon	logg	that	n 1	0%
Pass	1/2	mesn	screen	1000	or and	COT.	A CONTRACT

These requirements cover the size of the stone, sand and limestone entering into the finished mixture. This type of pavement is laid largely on highways and residential streets and is particularly popular because of the excellent foothold it affords for horses.

"Bitoslag" is a mixture very similar to the "Topeka," except that crushed slag is used instead of stone, the slag entering the mixture, all passing a ¹/₄-inch screen.

"Open Mix" and "Amiesite"

There are many variations of the "Open Mix Specifications," but no matter what type, it can readily be seen by comparing specifications, that the main differences are in the size and grading of the mineral aggregate, and the amount of bitument used. One specification for the "Open Mix" is as follows:—

"The stone to be 'run of the crusher' passing a one-inch and retained on a ¹/₈-inch screen. One cubic yard to be mixed with from 18 to 20 gallons of bitumen."

"Amiesite" is another type of bituminous concrete, but differs from the others in that it is mixed at a factory and shipped by rail, if necessary, to the site of the work and laid cold. The specifications for this mixture are as follows:--

88 to 92% pass a 2-inch and retained on 1/4-inch screen.

- 4 to 6% of filler.
- $\frac{1}{2}$ to 1% of lime.
- $\frac{1}{2}$ to 1% of liquified.
- 4 to 6% of asphalt.

A considerable amount of "Amiesite" has been laid in New Jersey and Pennsylvania, and was laid in the following manner:—

"The first course consisting of the 2-inch material, was laid on the prepared foundation, and just sufficiently rolled to bring it out to the proper contour of the street. The second course consisting of the smaller-sized stone was then spread. The pavement was then thoroughly rolled, after which stone chips were spread and the pavement again rolled. In some instances a seal coat is applied before spreading the stone chips."

Crushed trap rock, hard limestone and slag have been the most successful materials used in bituminous concrete mixtures, though gravel, shells and other rock have also given good results. The majority of engineers, however, prefer a hard limestone, believing that bituminous materials adhere better to crushed limestone than other materials.

Most Suitable Penetration

All types of asphalts and tars have been used in the construction of bituminous concrete. It has been found that a penetration of from 50 to 60 at 77 degrees F. is the most suitable for the more heavily travelled streets or roads, and from 60 to 70 for the lighter.

Bituminous concrete mixtures are used for both rssurfacing and new construction, the wearing surface varying from 2 to 3 inches.

In new construction, bituminous concrete is laid on either cement concrete or broken stone foundation. A cement concrete foundation six inches thick, composed of a 1:3:6 mixture is recommended for very heavy traffic; broken stone for suburban, or lighter traffic; a Telford foundation is recommended in low flat country where drainage is poor.

In resurfacing the macadam roads, bituminous concrete has proven very satisfactory. For worn-out brick and concrete streets, it is the most satisfactory remedy.

The method generally used for resurfacing old brick or concrete surfaces, is to first thoroughly clean the surface of