

The Present Trend of Highway Development

By PREVOST HUBBARD

(Chemical Engineer and Author "Laboratory Manual of Bituminous Materials".)

It is an almost incomprehensible fact that in building highways systems more weight has not been attached to paving practice in Cities where many of the problems of meeting heavy and varied traffic conditions were successfully solved before such conditions made their appearance on country and suburban highways. In cities the original waterbound macadam and gravel roads have for the most part given way to higher types of construction until to-day they constitute an average of only about 26 per cent. of the total yardage. The three most widely used city types are asphalt, brick and stone block. If we eliminate the waterbound pavements we find that of the higher city types asphalt constitutes about 55 per cent., brick about 19 per cent. and stone block about 14 per cent., giving a total of 88 per cent. for these three types.

In connection with the preponderance of asphalt pavements the present trend of paving practice in the construction of modern brick and stone block pavements is of considerable significance, as it recognizes a principle which just now is attracting a great deal of attention on the part of our highway engineers. I refer to the use of a flexible joint-filler for brick and block pavements as against the rigid grout fillers formerly so popular. Such cities as New York and Philadelphia are now using asphalt fillers for heavy traffic streets paved with stone block and the Paving Brick Manufacturers Association are preferentially recommending asphalt as a filler for their type of pavement. The reason for this lies in the fact that absolute rigidity in a pavement structure is not a desirable characteristic. Service results and comprehensive field tests conducted by the U. S. Bureau of Public Roads have demonstrated that the brick or block pavement with a flexible filler is more resistant to traffic than with a rigid filler. A certain degree of flexibility is highly advantageous in meeting the heavy impact of modern traffic. Such flexibility is an inherent characteristic of bituminous pavements and is imparted to brick and block pavements when asphalt is used as a joint filler.

While in certain sections of the country the experience of our cities appears to have been overlooked, it is a fact that the flexible or semi-flexible types of construction predominate in our country roads and if we consider the total mileage of state, county and municipal highways higher than gravel and macadam considerably more than 50 per cent. may be so classed. By reducing all yardage to a basis of 16 feet width, we estimate that at least 45 per cent. of the mileage of the higher types of pavements are of the hot-mixed asphalt types. The latest available information indicates that last year the total area of asphalt pavements constructed approximated 68,000,000 square yards, which was greater than for any other type. Most of the stone block pavements constructed that year were filled with bituminous material and about 60 per cent. of the brick pavements were similarly filled.

There are, it is true, many advocates of the all-rigid monolithic types of construction and in cer-

tain sections such pavements predominated in last year's work. This is not true, however, of the country, as a whole. Those who favor rigid construction have constantly been obliged to increase the massiveness of design of such pavements and also the amount of reinforcement in an endeavor successfully to meet the destructive action of heavy traffic, while those who have favored the semi-flexible or flexible types have, in general, found that the old standards of design have proven satisfactory. The all-flexible types, such as the black base pavements so extensively adopted in the far western states appear to be the most highly resistant per inch of total thickness, and may therefore be considered the least massive and in this respect the most efficient of the heavy traffic pavements.

It is probable that such pavements will be given considerable attention in the 1922 programme of some of the eastern states owing to the remarkably satisfactory results obtained over a long period of years in the West. Many of these pavements are six inches or less in total thickness.

What we have learned in the last few years about the destructive effect of traffic impact and the resistance to impact offered by semi-flexible and flexible highway structures has a peculiar significance in connection with a great economic problem that of conserving our investment in old roads, particularly gravel and macadam, when it becomes necessary to adopt a higher type of wearing surface. Prior to the careful investigation of this important subject there existed a marked and growing tendency to discredit the use of old gravel and macadam roads for foundations for the higher types and this in spite of many remarkable service records of macadam foundations. For example, in the City of New York, a number of the most heavily travelled streets were constructed years ago on macadam foundations and some are still giving satisfactory service. In 1890 Broadway, between 59th and 79th streets, was paved with asphalt over an old macadam base and for 22 years gave good service. Its replacement at the end of this period was largely due to subway excavations. Seventy-second Street, paved in a similar manner, also gave 22 years of service under increasingly severe traffic conditions and the same is true for a 19 year period for Fifth Avenue between 110th and 120 Street. Lenox Avenue between 110th and 124th Streets was surfaced with asphalt over old macadam in 1904 and is still giving good service. The cost of maintaining this section in 1919—14 years after construction—was only 1 per cent., certainly a remarkable record. Many similar cases might be cited from various localities.

A recent investigation of rolled stone bases for brick pavements was conducted by the U. S. Bureau of Public Roads and A. T. Goldbeck of that Bureau has published a very favorable report on this type of brick construction. All in all it appears that the old waterbound base is again coming into its own.

One reason for much of the former dissatisfaction for such bases was undoubtedly due to a fault

(Continued on page 77).