REPORT OF COMMITTEE ON FILLERS AND CUSHION COURSES FOR BRICK AND BLOCK PAVEMENTS

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SYNOPSIS

The Hocking County, Ohio, brick joint filler test pavement which was built in 1935 was again inspected in September, 1937 by the Project Committee It was found that special pitch No 16 and plastic sulfur "type B No 4" were in questionable condition The two blended asphalts, No 5 and No 6, are apparently in excellent condition

A pavement experiment under way on Route 31, near Logan, Ohio, with brick laid longitudinally, is of interest There was far less breakage during rolling than is customarily experienced, the road is noticeably quieter than is the case with transverse bricks, and since the opening of the pavement fast heavy trucks have not caused breakage A psychological effect noticed is that with the bricks laid longitudinally the pavement seems narrower than a similar width having the bricks in transverse position A report on the longitudinal design will be forthcoming next year

Numerous experiments on brick pavements have been conducted by the Ohio State Highway Department and many of these have been reported to the Highway Research Board The most recent work has been done about 45 miles southeast of Columbus, in Hocking and Fairfield Counties, on the Logan-Lancaster Road Data concerning the fillers used on the project are given in Table 1

The construction of the test road was as follows A 6-in base of 1 7½ concrete, using natural sand and gravel aggregates, was laid 20 ft wide including two integral 9-in flush curb headers and one 6-in flush center header A brick surface ¾-in of 3-in vertical fibre paving brick with projecting side and end lugs laid with a wire cut side up was laid on a ¾-in cushion

The base was constructed with impressed transverse contraction joints spaced at 25-ft intervals and a longitudinal key type center joint through the base along one side of the center header There were no joints in the brick surface except in Section No 1 (portland concrete grout filler) where a 3-ply tar paper was used over the contraction and longitudinal joints in the base In addition, this Section had 1-in transverse preformed cork-rubber expansion joints in the brick over some of the contraction joints, spaced at 150-ft intervals

A mastic cushion was used for most of the pavement, however, to enable a further comparison of cushions, two plain sand cushions were also used One with a comparatively fine sand, and the other with a comparatively coarse sand

A calcium chloride solution was used as a filler removal agent on most of the sections, but white-wash was used on part of one section, and a special oil emulsion with plastic-sulfur "type A" White-wash cannot be used as a separating agent with plastic-sulfur fillers

Some difficulties were encountered in the use of some of the fillers

A report made by Mr R R Litehiser after one year's service indicated that fillers No 4, 16, 5, 6 and 3 were apparently satisfactory except that No 3 had an undesirable sulfurous odor Fillers No 18, 12 and 13 had receded into the joints or flowed sufficiently to cause partial failure and filler No 2 had failed badly In September, 1937, two years after its completion, the pavement was again inspected by the Project Committee It was then found that special pitch No 16 and plastic sulfur type "B No 4"

TABLE 1

CONSTRUCTION AND CONDITION SUMMARY

Experimental Brick Filler Project—Logan-Lancaster Road, Hocking-Fairfield Counties, September, 1937

Section No and Length	Cushion	Filler			Principal developments September, 1937
		No	Description	Application	
20[1] 52 ft	Concrete Sand[2]	20	Special Pitch[3], producer designation, F-6	Normal[4], $CaCl_2$ separating agent	Slight exuding in a bubbly formation Shallow checks noted in filler
21[1] 50 ft	Concrete Sand	21	Special Pitch, producer designation, F-7	Normal $CaCl_2$ separating agent	Medium exuding and shallow checks noted in filler
19[1] 59 ft	Concrete Sand	19	Special Pitch, producer designation, F-5	Normal $CaCl_2$ separating agent	Slight exuding and shallow checks noted in filler
16[1] 121 ft	Concrete Sand	16	Special Pitch, producer designation, F-4	Normal $CaCl_2$ separating agent	Practically free from exuding Questionable condition
18[1] 90 ft	First 54 ft Concrete Sand Second 36 ft A C B Mastic	18	Mineral Filled Asphalt 35% to 55% Mineral filler	Normal $CaCl_2$ separating agent	Filler has receded in the joints and has flowed to low side of pavement Holes noted in filler Unsatisfactory
15 95 ft	A C B Mastic	15	Special Pitch, producer designation, Crack and Joint Filler	Normal $CaCl_2$ separating agent	Medium to heavy exuding over entire section
14 94 ft	A C B Mastic	14	Special Pitch, producer designation, Brick Filler	Normal $CaCl_2$ separating agent	Medium to heavy exuding over entire section
12 450 ft	A C B Mastic	12	Natural Lake Asphalt, comparatively low softening point[6] (50°-60°C) and contains 20 to 30% naturally incorporated mineral filler	Slightly difficult to remove $CaCl_2$ separating agent	Filler receded from 1½ to 2 in on high side of pavement and exuded out and over the berm on the low side Unsatisfactory
17 167 ft	A C B Mastic	17	Special Pitch Conforms to the following analysis Softening point, 64°C, bitumen soluble in CS_2, 66%, organic insoluble, 33%, ash, 1%	Difficult to remove Must follow closely after pouring $CaCl_2$ separating agent	Heavy exuding over contraction joint and next to expansion joint in grout section Parts of filler chipped out of joints

TABLE 1—*Continued*

Section No and Length	Cushion	Filler			Principal developments September, 1937
		No	Description	Application	
10 433 ft	First 200 ft A C B Mastic Second 165 ft Concrete Sand Third 68 ft A C B Mastic	10	Asphalt made from a mid-continent crude Higher softening point and lower temperature susceptibility than Std F-1 Softening point, 85° to 96°C Penetration not more than 65	Normal $CaCl_2$ separating agent	Medium to heavy exuding over entire section Amount of exuding not uniform
2 400 ft	A C B Mastic	4	Plastic Sulphur Type "B" premixed combination of approximately 60% asphalt and 40% sulphur	Normal $CaCl_2$ separating agent	Cushion, brick and filler laid in July, 1937, to replace the section shown immediately below
(replaces) 2 400 ft	A C B Mastic	2	Bituminized Grout One part portland cement, two parts special asphalt emulsion and three parts grout sand, by volume	Difficult to get emulsion completely disbursed into mix Excess filler not removed	Large areas where brick are loose and filler is gone Bond loosened between brick and filler and filler crushed Unsatisfactory Replaced in July, 1937, by the above materials
3 450 ft	A C B Mastic	3	Plastic Sulphur Type "A" Two separate parts (sulphur and plasticizing agent, sulphur and powdered silica) were mixed on the job Composition 60% sulphur, 10% plasticizing agent and 30% graded aggregate	Difficult to heat due to non-uniform heat in kettles Temperatures over 320°F appeared harmful Oil emulsion separating agent	No exuding and in good condition with exception of a short section on the east side Filler lifeless and unsatisfactory in this part and an oily exuding has been carried on to the surface Unsatisfactory condition is apparently due to over heating of filler This section has an undesirable odor
9 375 ft	A C B Mastic	9	100% Asphaltic Base Crude Similar to Ohio Highway Asphalt Filler (Std F-1)	Normal $CaCl_2$ separating agent	Medium exuding over entire section Amount of exuding not uniform

TABLE 1—*Continued*

Section No and Length	Cushion	Filler			Principal developments September, 1937
		No	Description	Application	
7 450 ft	A C B Mastic	7	Mastic 60% Ohio Highway Asphalt Filler (Std F-1) and 40% special grout sand (100% pass No 30 sieve and 100% retained on No 100 sieve) by volume Heated separately and mixed on job	Difficult to place due to Segregation Excess filler removed ($CaCl_2$ separating agent) but not reheated	Non-uniform exuding Heavy exuding in joints where sand content is low and no exuding where sand content is high
11 450 ft	A C B Mastic	11	100% Asphaltic Base Crude Lower temperature susceptibility and higher softening point than Std F-1 Softening point, 85° to 96°C Penetration[7], not more than 65	Normal $CaCl_2$ separating agent	Medium to heavy exuding over entire section
13 300 ft	A C B Mastic	13	Pitch (asbestos filled) Conforms to following specification Softening point, 45° to 50°C Bitumen (Sol in CS_2), not less than 70% Organic insoluble, not more than 20% Ash, not less than 7%	Difficult to heat and too viscous to flow into joints Corrected by diluting with 40% hot tar by vol $CaCl_2$ separating agent	Filler has receded into joints and a little has flowed out on curb headers on both sides of pavement Unsatisfactory
1 450 ft	A C B Mastic	16	Special Pitch, producer designation, F-4	Normal $CaCl_2$ separating agent	Cushion, brick and filler laid in July, 1937, to replace the section shown immediately below
(replaces) 1 450 ft	A C B Mastic	1	Portland Cement Grout One part cement and 4 parts grout sand[5] by volume	Squeegeed	Contains areas where brick bond is broken and brick are loose Approximately 10% of brick are loose Replaced in July, 1937, by the above materials
4 450 ft	A C B Mastic	4	Plastic Sulphur Type "B" premixed *combination* of approximately 60% asphalt and 40% sulphur	Normal $CaCl_2$ separating agent	No exuding and no undesirable odor on entire section Questionable condition

TABLE 1—*Continued*

Section No and Length	Cushion	Filler			Principal developments September, 1937
		No	Description	Application	
5 450 ft	A C B Mastic	5	Blended Asphalt Mineral Filled Same as Filler No 6, except that it contains (separately added *in* the process of manufacture) 20 to 30% finely divided mineral matter	Normal $CaCl_2$ separating agent	No exuding on entire section Good condition
6 450 ft	A C B Mastic	6	Blended Asphalt (65% mid-continent base and 35% asphaltic base) low temperature susceptibility type Softening point, 101° to 110°C Penetration not more than 47	Normal $CaCl_2$ separating agent	No exuding on entire section Good condition
8 450 ft	A C B Mastic	8	Asphalt made from a mid-continent crude Meets some specification as Std F-1	Normal $CaCl_2$ separating agent	Heavy exuding prevalent over entire section with increased exuding over contraction joints and low side
A 550 ft	First 150 ft Cushion Sand[8] Second 400 ft Concrete Sand	Std F-1	1934 Ohio Department of Highways Bituminous Filler Softening point, not less than 75°C Penetration, not more than 90	Normal $CaCl_2$ and lime separating agent	Heavy exuding prevalent over entire section

EXPLANATORY NOTES

[1] The first 114 ft (both sides of pavement) and the west side opposite these sections are filled with a mixture of various fillers and are not included in test

[2] Comparatively fine sand, Ohio Department of Highway Specifications, Section M-2 1

[3] Complete specifications on all fillers used are on record at the Ohio State Highway Testing Laboratory

[4] "Normal" indicates that application and removal compared favorably with our standard asphalt

[5] Comparatively fine sand, Ohio Specifications, Section M-2 3

[6] Softening points listed are all for ring and ball method

[7] Penetrations listed are all for 46°C, 50 gr 5 Sec

[8] Comparatively coarse sand, Ohio Specifications, Section M-2 4

were in questionable condition The two blended asphalts, No 5 and No 6, are apparently in excellent condition Fillers 1 and 2 were replaced in July 1937 with Special Pitch No 16 and Plastic Sulphur No 4, because sections 16 and 4 appeared to be in good condition after one year The results of the two-year inspection are given in Table 1

Another experiment is on Route 31 in Ohio, near Logan, where the brick have been laid longitudinally The advantages claimed for this are less broken brick during construction and thereafter, a quieter pavement, no batting, and that the brick will span such transverse cracks as may appear in the base It is too early to make a report on this stretch of pavement which at the present time is highly satisfactory There is however one item to be mentioned which has to do with the psychological effect on the driver rather than with the construction, which is that the pavement seems narrower than a similar one laid with blocks placed transversely The driver, looking down the long rows of bricks to the vanishing point, apparently sees the road narrowing like a wedge It may also be mentioned that at present the pavement is noticeably more quiet than those constructed with bricks laid transversely

When this road was built the inspectors and the roller man reported that there was far less breakage of the bricks during rolling than is customary where they are laid transversely It appears that heavy swift trucks have not been successful in breaking the bricks since the opening of the pavement

There are some new sections of road in Ohio where brick have been laid on powdered asphalt cushions, on Amiesite, and on sand-clay cushions No report is being made on these since they are not yet old enough to merit it The sections are being watched, and as soon as anything definite is learned a report will be forthcoming

Conclusions Two blended asphalts stand out from all the other fillers as being satisfactory after two years' service on a heavy traffic highway Those fillers that caused the sections in which they were placed to fail, have been eliminated from further tests Such sections have been rebuilt, using other fillers

The pavement laid with brick laid longitudinally seems to have some points of superiority over the usual form A report on it will be made next year