

Report I
on
Research Project B-9
Bituminous Construction with Sandstone Aggregate
Johnson County Proj. S.P. 58-37-1

January 14, 1943

On April 28th detailed notes were made on each station of this project, and it was decided that samples should be taken to represent each type of surface on the project. Seventeen samples were selected as representative of the different types of mixes, and on May 6th and 7th samples fifteen inches in diameter were drilled from this project. These samples were selected to represent the variations in gradings and bitumen content.

It should be noted that these samples are representative only of the immediate area from which they were taken. This report includes inspection notes made on the immediate area surrounding the samples, on May 6th and July 24th.

At the time the May 6th inspection was made there had not been sufficient hot weather to forecast the behavior of this pavement during extremely hot weather.

The July 24th inspection was made after several weeks of very warm weather, and for this reason the notes for the two inspections do not agree in all cases.

A table is included in this report giving complete gradings and bitumen content on each sample.

Test results on this representative samples should prove to be of great help in evaluating the different mixes, and should be used as a guide for designing sandstone mixes in the future.

Inspection on February 4th of the sections represented by the seventeen samples revealed very little change since the previous inspection. All sections containing a high percentage of asphalt were non-skid and very satisfactory for this season of the year. Careful observations during different seasons of the year lead to conclusions that any asphalt content above 9.5% is too high, and below 8.5% the mix is deficient in bitumen.

Gradings of the seventeen samples are very difficult to analyze. Pitting of the surface is definitely related to the amount of large particles exposed in the surface. Indications are that all aggregate used in surfaces should pass a No. 4 sieve. Temperature of the mix at the time of laying is an important factor in keeping large particles below the wearing surface.

The use of a vibrating type finishing machine should improve this type surface.

TABLE NO. I

Gradation and Bitumen Content of Samples from Various Sections of the
Experimental Road on Kentucky Route 40 (S.P. 58-37) in Johnson County

Sample No.	Location	Bitumen Content Percent	Gradation Percentage Passing Sieves No.											
			1/2"	3/8"	#4	#8	#10	#16	#20	#40	#50	#80	#100	#200
1	Sta. 4 + 00 5'L. of C.L.	10.44	100.	99.7	77.5	44.4	41.4	35.6	33.7	31.0	28.9	19.1	14.1	5.8
2	Sta. 5 + 50 6'L. of C.L.	9.43	-	100.	76.8	46.2	42.4	37.1	35.2	30.5	28.0	18.6	13.9	6.1
3	Sta. 4 + 00 4'R. of C.L.	8.31	95.7	92.7	68.4	53.3	50.0	43.4	41.0	37.4	34.4	21.9	14.2	5.5
4	Sta. 8 + 14 8'R. of C.L.	9.0	100.	97.1	79.4	50.1	47.0	40.1	38.1	34.5	31.7	21.7	14.0	7.0
5	Sta. 8 + 65 8'R. of C.L.	9.78	100.	98.3	82.7	52.5	49.3	42.0	39.4	35.6	33.0	22.6	14.5	7.0
6	Sta. 14 + 35 8'R. of C.L.	9.4	100.	98.8	76.8	41.1	37.8	31.4	30.9	28.5	26.4	17.9	13.4	6.4
7	Sta. 26 + 00 6'L. of C.L.	8.23	100.	99.2	73.4	42.1	39.1	33.5	31.8	29.1	26.5	17.0	11.1	5.2
8	Sta. 32 + 58 6'L. of C.L.	10.1	99.1	97.4	79.0	49.2	46.4	40.2	38.1	34.7	30.7	19.2	8.0	4.2
9	Sta. 35 + 00 6'L. of C.L.	9.88	96.	91.1	79.2	41.4	38.4	32.8	27.1	24.8	22.6	15.2	11.0	5.0
10	Sta. 45 + 92 6'L. of C.L.	10.39	100.	96.7	72.9	45.6	43.0	37.6	35.0	32.0	27.9	18.3	12.9	6.7
11	Sta. 46 + 04 5'L. of C.L.	8.58	100.	88.3	51.3	38.3	36.8	33.0	31.5	28.5	25.4	15.5	9.8	5.3
12	Sta. 53 + 00 6'R. of C.L.	8.86	100.	92.3	60.2	44.9	43.1	38.4	36.5	33.3	30.2	19.8	14.3	7.0
13	Sta. 62 + 35 4'L. of C.L.	8.42	100.	92.9	53.8	41.4	39.9	36.1	34.6	31.8	28.8	18.8	12.6	6.9
14	Sta. 100 + 06 3'L. of C.L.	7.2	100.	94.7	68.5	51.0	48.6	43.1	41.0	36.9	32.5	19.5	12.1	7.6
15	Sta. 99 + 80 6'L. of C.L.	7.45	100.	95.0	66.8	49.6	47.4	41.9	39.8	35.9	31.6	19.6	12.1	6.8
16	Sta. 154 + 32 3'R. of C.L.	7.25	100.	92.9	58.2	40.1	38.3	34.2	32.8	30.2	27.1	16.9	10.6	5.0
17	Sta. 121 + 90 9'L. of C.L.	8.72	100.	90.6	63.1	47.0	45.3	40.6	38.7	34.8	30.1	17.9	10.4	4.4

Sample No. 1

Location - Station 4 + 00, 5 ft. left of center line.

General Remarks - The surface represented by this sample is in excellent condition. The only possible criticism would be that the asphalt content is too high. So far this surface has been very resistant to wear.

May 6th Inspection:

Texture - Closed, reasonably uniform, fine particles predominate.

Pitting - Very, very slight.

Bitumen Content - The area represented by this sample appears to contain an excess amount of asphalt. However, no bleeding or shoving can be observed.

July 24th Inspection:

Surface represented by this sample shows considerable wrinkling during hot weather, which confirms opinion that the asphalt content should be lower. However, the surface is still satisfactory and does not show any tendency to shove, and is a very non-skid surface.

Sample No. 2

Location - Station 5 + 50, 6 ft. left of center line.

General Remarks - This sample represents a very satisfactory surface and it appears to have an excellent grading, and is very close to the correct bitumen content.

May 6th Inspection:

Texture - Closed, reasonably uniform, fine particles predominate.

Pitting - Very slight.

Bitumen Content - The surface represented by this sample indicates that the bitumen content is very satisfactory, and from all indications does not contain either a deficiency or an excess.

July 24th Inspection:

Surface shows very little change from the May 6th inspection, except that during very hot weather it shows very, very slight wrinkling, which indicates very slight excess asphalt.

Sample No. 3

Location - Station 4 + 00, 4 ft. right of center line.

General Remarks - This sample is similar to Samples 1 and 2, but is not considered as good. It represents a very satisfactory surface.

May 6th Inspection:

Texture - Closed, but large particles predominate over fines.
 Pitting - Very slight, but too much to be desirable.
 Bitumen Content - The surface represented by this sample appears to be slightly deficient in bitumen content. This appearance may be due to slight pitting of the large particles.

July 24th Inspection:

Surface represented by this sample is satisfactory. Asphalt content appears to be sufficient, and possibly contains a slight excess of asphalt.

Sample No. 4

Location - Station 8 + 44, 8 ft. right of center line.

General Remarks - This sample represents a very satisfactory surface.

May 6th Inspection:

Texture - Closed, fines predominate over large particles.
 Pitting - Not pitted to any great extent, not detrimental.
 Bitumen Content - Appears to be very satisfactory.

July 24th Inspection:

The surface represented by this material is now showing slight wrinkling, which indicates a slight excess bitumen content. However, it is still a very satisfactory surface.

Sample No. 5

Location - Station 8 + 65, 8 ft. right of center line.
 (Notes under sample No. 4 apply to Sample No. 5, No. 5 taken as check sample on No. 4).

Sample No. 6

Location - Station 4 + 35, 8 ft. right of center line.

General Remarks - This sample represents a uniform and desirable type of pavement, but less large particles would be desirable.

May 6th Inspection:

Texture - Closed, fines predominate but too much large aggregate, 3/8" size, is exposed.
 Pitting - Slight, but slightly more than is shown in previous samples due to 3/8" size stone.
 Bitumen Content - Very satisfactory.

July 24th Inspection:

Surface represented by this sample when inspected in hot weather is still very satisfactory. The asphalt content appears to be satisfactory.

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Sample No. 7

Location - Station 26 + 00, 6 ft. left of center line.

General Remarks - This sample represents a uniform condition from Station 25 + 00, and continues on left side. The surface has pitted some but is very good, to date.

May 6th Inspection:

Texture - Closed, but very slightly open. Fine particles represent the highest points of the pavement.

Appearance generally not very good.

Pitting - Fairly deep on large particles.

Bitumen Content - Appears to be slightly deficient.

July 24th Inspection:

The texture appears to have closed slightly since the last inspection, May 6th, and the asphalt content appears to be very close to correct. The surface in general is very good.

Sample No. 8

Location - Station 32 + 58, 6 ft. left of center line.

General Remarks - This sample represents a surface that is free from wear, but is very high in asphalt content and is bleeding. Shows some movement under traffic, however, it is non-skid. It probably will shove under traffic in the future.

May 6th Inspection:

Texture - Very closed.

Pitting - None.

Bitumen Content - It is very evident that this mix contains excess asphalt as small wrinkles and bleeding may be observed in some areas. However, it is still a very non-skid surface and does not show any movement under traffic.

July 24th Inspection:

The surface represented by this sample is now wrinkling very badly and shows slight movement under traffic. However, it is still a very non-skid surface and would be considered reasonably satisfactory.

Sample No. 9

Location - Station 35 + 00, 6 ft. left of center line.

(Remarks under Sample No. 8 apply to this sample as it was taken as a check on Sample No. 8).

Sample No. 10

Location - Station 45 + 92, 6 ft. left of center line.

General Remarks - This sample represents a surface very similar to that represented by Samples 8 and 9.

May 6th Inspection:

Texture - Very closed.

Pitting - None.

Bitumen Content - Due to wrinkling and some bleeding it is very evident that this sample contains an excess amount of asphalt.

July 24th Inspection:

The surface represented by this sample is now wrinkling badly and shows considerable bleeding and movement under traffic. It is very evident that the asphalt content should be reduced in this surface.

Sample No. 11

Location - Station 46 + 04, 5 ft. left of center line.

General Remarks - This sample represents a surface that is too open and is showing some wear. Not considered a satisfactory surface.

May 6th Inspection:

Texture - Fairly open, not very desirable.

Pitting - Considerable pitting is taking place in the surface represented by this sample, probably due to deficiency in fines.

Bitumen Content - Appears to be deficient.

July 24th Inspection:

Asphalt content still appears to be deficient. However, the surface looks much better in hot weather than it did at the time of the May inspection. It is still pitting very badly and the texture is too open, also shows considerable wear. This surface, however, will probably improve with age.

Sample No. 12

Location - Station 53 + 00, 6 ft. right of center line.

General Remarks - This sample represents a surface that is deficient in fines, but is considered satisfactory.

May 6th Inspection:

Texture - Slightly open, deficiency in fine particles.

Pitting - Very slight.

Bitumen Content - Appears to be very satisfactory since large particles are well coated and show very slight pitting.

July 24th Inspection:

Hot weather has changed the appearance of the surface represented by this sample considerably, as it now appears to

have an excess bitumen content and slight wrinkling may be noted in small areas. The texture appears to have closed up some since the last inspection.

Sample No. 13

Location - Station 62 + 35, 4 ft. left of center line.

General Remarks - This sample represents a section of surface that is showing poor durability due to wear. It is not a satisfactory grading.

May 6th Inspection:

Texture - Too open. Large particles, sizes 1/2" to 3/8" predominate.

Pitting - Very bad. Definitely more than should have developed for this period of service.

Bitumen Content - In general this surface appears to be deficient in asphalt.

July 24th Inspection:

The bitumen content of this surface appears to be satisfactory at this time. However, the surface is still pitting slightly, but in all other respects it is very satisfactory.

Sample No. 14

Location - Station 100 + 06, 3 ft. left of center line.

General Remarks - This sample was taken to represent a general condition of bad wear in a strip two to three feet wide on left of center line from Station 80 + 00 to Station 100 + 00. The mix does not contain sufficient fines to protect the large particles.

May 6th Inspection:

Texture - Very open.

Pitting - Very bad. Shows considerable wear due to pitting of large particles.

Bitumen Content - Very difficult to judge, probably too lean.

July 24th Inspection.

The surface represented by this sample is very definitely deficient in asphalt and is still pitting badly. Texture is too open.

Sample No. 15

Location - 99 + 80, 6 ft. left of center line.

General Remarks - This sample was taken to compare difference in grading between this reasonably satisfactory surface and the surface represented by Sample No. 14.

May 6th Inspection:

Texture - Slightly open.
Pitting - Practically none.
Bitumen Content - Appears to be very satisfactory.

July 24th Inspection:

This surface shows very little change since the May 6th Inspection.

Sample No. 16

Location - Station 154 + 32, 3 ft. right of center line.

General Remarks - This sample was selected to represent an undesirable open texture which appears deficient in bitumen. Section begins at Station 152 + 25 and extends to near the end of the project, on the right side.

May 6th Inspection:

Texture - Open.
Pitting - Fairly bad, shows some wear.
Bitumen Content - Appears to be deficient.

July 24th Inspection:

At this inspection, it is very evident that the surface represented by this sample does not contain sufficient asphalt, also the texture is too open.

Sample No. 17

Location - Station 121 + 90, 9 ft. left of center line.

General Remarks - This sample was taken to represent a type of surface where large particles are the tire contact points, being the high points of the surface. The large particles have not pitted and the surface does not show any wear.

May 6th Inspection:

Texture - Open.
Pitting - None.
Bitumen Content - Very satisfactory.

July 24th Inspection:

This surface shows very little change since the May 6th inspection except that it appears to contain very slight excess of asphalt.