

Highway Materials Research Laboratory
132 Graham Avenue, Lexington 29, Kentucky

December 7, 1951

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TO: D. V. Terrell
Director of Research

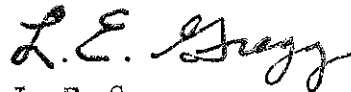
In the interim since our report last year concerning Observations on Seal Coats, Tack Coats, and Penetration Macadam Construction in 1950, the Research Laboratory has kept records on most of the fifteen projects represented in that study. The attached report includes the data that have been assembled during the first year of use, and it also contains an account of a combined project on seal coats with different bituminous materials put down in sections on a road in Washington County this year. Finally, because of the similarity and the interest expressed by the Division of Design, there is in this report a section dealing with the blade spreading of a hot mix binder course to improve the pavement contour in high-type resurfacing.

Both the tack coats and the penetration macadam have shown little, except that the hard winter of 1950-51 did not cause an appreciable amount of damage. From any standpoint, these are performing satisfactorily after a year of use even though there are, for example, failures extraneous to the tacks in several places and also a few base failures in the road surfaced with penetration macadam. In contrast, failures on the projects sealed last year have been very extensive, but it appears that practically all of this can be attributed to inadequate pavement thickness and the extreme depth of frost penetration. At any rate, on many of these projects the pavement restoration in patches, half soles, and even new seals has been so great that there is little possibility for making any further evaluation of the seal coats placed in 1950.

One outstanding point among the observations with the seals was the fallacy of placing a heavy application of NAC-8 and chips over a traffic bound road as an initial treatment. In some instances, this treatment hardly got started into the winter before it was necessary to resume maintenance of the road as a traffic-bound surface. Almost invariably, the amount of material required for maintenance and bituminous restoration in the spring exceeded the amount of material placed by contract in the sealing operation the preceeding fall. There is a possibility that such a treatment would have survived a less severe winter, but it is hardly possible that anything this light could have survived long - particularly at points where the seal was practically placed on a soil subgrade.

The blade spreading operation - which is something we have discussed before as a means of improving riding qualities of flexible pavements - worked out well, particularly in view of the fact that this was the first attempt. In his account of the work, Mr. Collier has described the significant operations and sequence of operations in such a way that this report should be a good source of reference for anyone working with this procedure in the future. In my opinion, blade spreading has definite possibilities for eliminating a great deal of water-bound base irregularities before the final surface is placed on a new high-type flexible pavement, and I hope to work out a project where it can be tried during the coming construction season.

Respectfully submitted,



L. E. Gregg
Assistant Director of Research

Copies to: Research Committee
Mack Galbreath (4)

Commonwealth of Kentucky
Department of Highways

OBSERVATION ON SEAL COATS, TACK COATS, PENETRATION
MACADAM, AND BLADE SPREAD HOT MIX IN 1951

by

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Highway Materials Research Laboratory
132 Graham Avenue, Lexington 29, Kentucky

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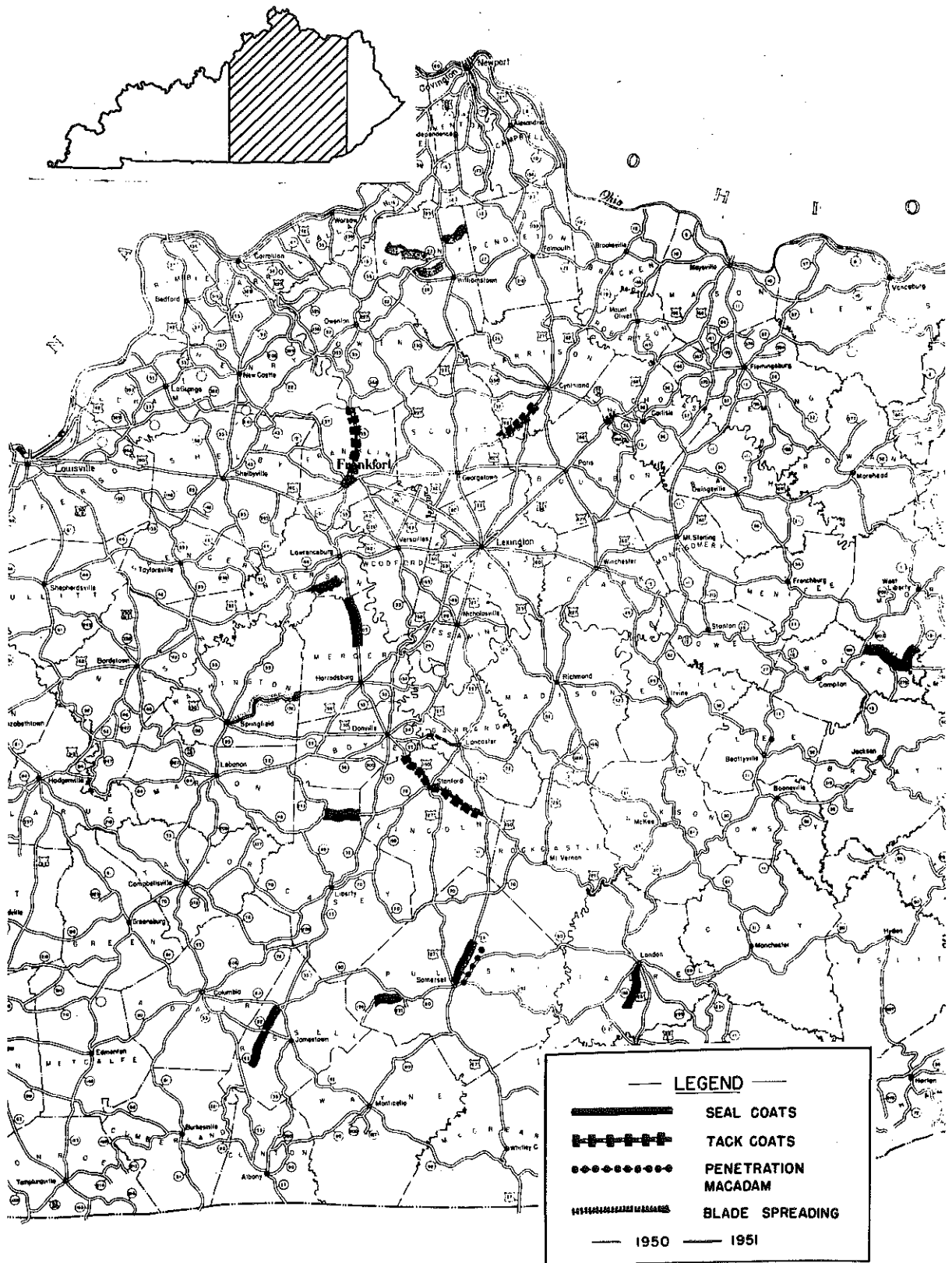


Fig. 1 - Project Locations

INTRODUCTION

During the 1950 construction season the Research Division observed the construction of several types of seal coats, a few tack coats and a penetration macadam pavement. A report, covering mostly construction practices on these projects, was submitted to the Research Committee at the February meeting in 1951. The report is titled "Observations on Seal Coats, Tack Coats, and Penetration Macadam Construction in 1950," and dated January, 1951.

A follow-up of most of these projects is submitted here. The performance of the seals was greatly influenced by failure of the bases during the very severe winter of 1950-51. Considerable frost action in many sections of the state caused failure in the lighter designed pavements.

Because of the many variations experienced when an analysis is made of different seal materials over different type surfaces with varying subgrade conditions, it was decided to set up a project and vary the materials within the limits of a given road. Such a project, including five prominent types of bituminous seal coat materials, was placed in Washington County during 1951. The quantities were not varied and the seals were placed over a fairly uniform pavement. A report of observations during construction is submitted here.

Also, during 1951 a blade spread hot mix binder course in Nicholas County was observed. This method of application of a leveling course over a surface very irregular in both crown and grade was evaluated not only from the standpoint of improvements in the contour of the finished pavement but, also, from the standpoint of feasibility in construction procedures.

SEAL COATS

1950 Construction

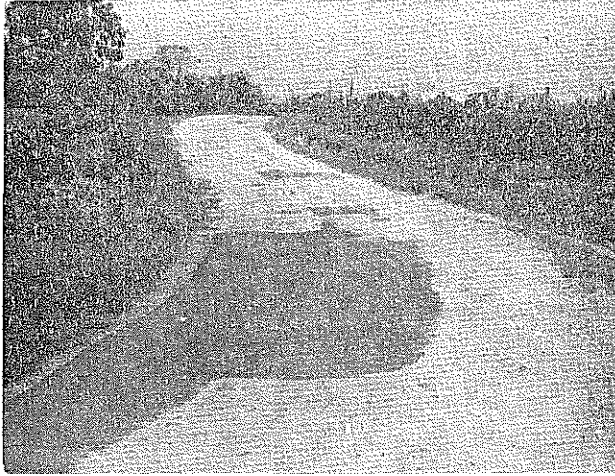
Grant County, RH Group 4 (1950) was a project using RS-2 with crushed gravel. This group which consisted of three rural highways totaling 21 miles in length was over a very light bituminous pavement. Sealing began September 2, 1950, and the project was completed some time during the month of September. This pavement failed during the past year and required very heavy maintenance as shown in Fig. 2. There was hardly enough of the seal remaining for an evaluation. Some of the better sections had only pot-hole types of failures which required only filling with cold patch. Those portions of seal that remained uncovered looked fair. No slick or fat spots were noted. The pavement was inspected November 1, 1951.

Russell County, SP 104-138 (1950) was a 10.142 mile road mix that received an A-2 seal of 0.25 gallons RS-2 and 20 pounds of No. 9 stone per square yard. The road mix was very porous, with the result that a quart of RS-2 was not enough material to seal the openings. Sealing was delayed to October 30, and was finished about November 15, 1950. The over all appearance of the seal coat was poor.

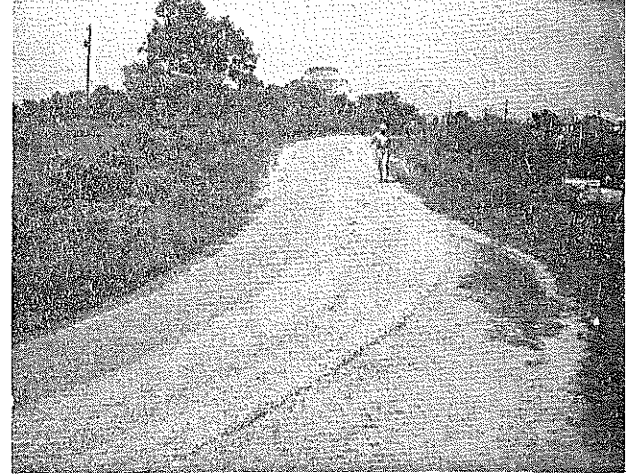
Some sections of this road had to be "half-soled" this year, and there are several places where water has softened the subgrade and caused break-up of the pavement. There are indications at some places that the water came down through the partially sealed pavement.

The road was definitely not fat or slick on November 5, 1951, and was in fact dry and very rough textured.

Pulaski County, SP 100-75 (1950) an emulsion seal using RS-2 was placed over a new penetration macadam that had been constructed with RS-1. The



Summer 1950 Before Seal



After Seal 1950



November 1951



Folsom-Dry Ridge November 1951

Fig. 2. Grant County RH Group 4 (1950). The top photos and lower left were taken on the Dry Ridge-Northcut Road. The average performance of that portion of the project is shown. Many "Base" failures were in evidence. The lower right photo was taken on the Dry Ridge-Folsom Road and shows the heavy maintenance required because of base failure. Very little of the original seal coat was left.

Table 1. Summary of Seal Projects

Project	Length (Mile)	Bit. Mat. (Gallons)	Aggr. lb/sy.	Road Condition	Distributor	Spreader	Drag or Broom	Roller	Aggr. App.	Pct. Aggr. Retd.
1950										
Grant RHG 4	21.0	0.25 RS-2	20 cru. Grav. #9	Broken & Patched	Cir. Bar.	Tailgate	Ch. Lk. Fence	Pneum. Tired	Very Wet	50
Russell SP 104-138	10.1	0.25 RS-2	20 #9 Stone	New Open Roadmix	Non-Cir. Bar	Tailgate	Ch. Lk. Fence	10-ton Smooth	Damp	50
Pulaski SP 100-75	7.1	0.45 RS-2	15 # 9 Stone	New Pen. Macadam	Dbl. Cir. Bar	Buckeye Box	Ch. Lk. Fence	8-ton Smooth	Wet	90 ⁺
Pulaski SP 100-75	0.9	0.25 RS-2	20 #9 Stone	Old Bit.	Dbl. Cir. Bar	Buckeye Box	Ch. Lk. Fence	8-ton Smooth	Wet	90 ⁺
Morgan & Wolfe (88-98)(119-23)	11.1	0.25 RC-5	20 #9 Stone	New Open Roadmix	Cir. Bar	Buckeye Box	Barbed Wire	10-ton Smooth	Very Wet	50
Anderson SP 3-291	7.3	0.40 NAC-8	30 #8 Stone	Traffic Bound	Cir. Bar	Buckeye Box	Ch. Lk. Fence	10-ton Smooth	Damp	60
Casey SP 23-201	5.7	0.40 NAC-8	30 #8 Stone	Traffic Bound	Cir. Bar	Buckeye Box	Ch. Lk. Fence	10-ton Smooth	Damp	80 ⁺
Laurel SPG 47	3.6	0.40 NAC-8	30 #8 Stone	Traffic Bnd.&Bit.	Dbl. Cir. Bar	Buckeye Box	Ch. Lk. Fence	10-ton Smooth	Damp	80
Pulaski SP 100-215	4.7	0.40 NAC-8	30 #8 Stone	Traffic Bound	Dbl. Cir. Bar	Buckeye Box	Ch. Lk. Fence	10-ton Smooth	Damp	80
Mercer SPG 16	8.3	0.07 RC-2	10 Rock Asphalt	Class F Binder	Dbl. Cir. Bar	Agr. Lime Spreader	Shaker Screen	Traffic Only	-	85 ⁺
1951										
Wash. MPG4 115-29-D I	3.86	0.25 RS-2	20 #9 Stone	Patched & Broken	Dbl. Cir. Bar	Buckeye Box	Ch. Lk. Fence	Pneum. Tired	Very Wet	70-80
Wash. MPG4 115-29-D II	2.98	0.25 RC-4	20 #9 Stone	Patched & Broken	Dbl. Cir. Bar	Buckeye Box	Ch. Lk. Fence	Pneum. Tired	Very Wet	60-70
Wash. MPG4 115-29-D III	3.50	0.25 PAC-9	20 #9 Stone	Patched & Broken	Dbl. Cir. Bar	Buckeye Box	Ch. Lk. Fence	Pneum. Tired	Very Wet	70-80
Wash. MPG4 115-29-D IV	3.03	0.25 RT-10	20 #9 Stone	Patched	Dbl. Cir. Bar	Buckeye Box	Ch. Lk. Fence	Pneum. Tired	Wet to Dry	70-80
Wash. MPG4 115-29-D V	2.35	0.25 NAC-8	20 #9 Stone	Patched	Dbl. Cir. Bar	Buckeye Box	Ch. Lk. Fence	Pneum. Tired	Dry	70-80

general appearance of the seal after a year of use is excellent. The surface is dense but not fat and slick.

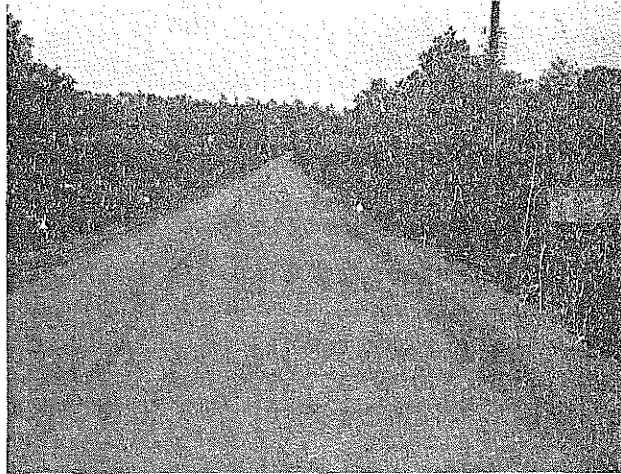
Fig. 3 shows a section of this pavement photographed in October, 1950, January, 1951, and October, 1951. The closeup shows some of the No. 4 size stone of the penetration mat. The small stone showing is No. 9 that was used for the seal cover.

The seal seems to be adequate and performing properly .

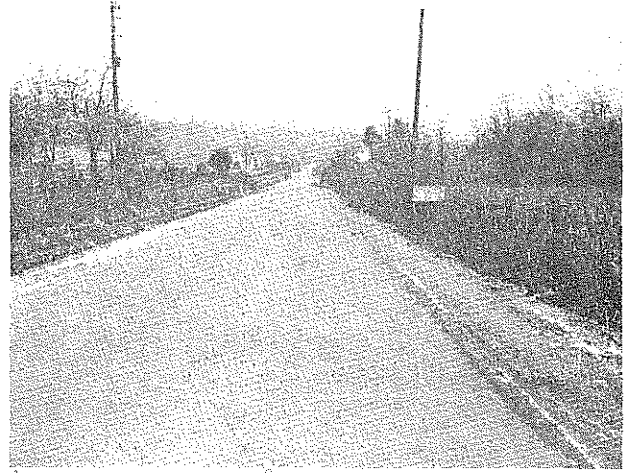
Morgan and Wolfe Counties, SP 88-98 and 119-23 (1950) was a new road mix sealed with RC-5, the sealing operation being carried out in the early part of November, 1950. This project is typical of a seal coat using an asphalt cut-back and wet aggregate. The cover stone is at least 75% gone from the surface. It is, however, much in evidence along the shoulders. Some areas, especially curves are almost devoid of aggregate. What might be called an average section is practically bare in the wheel tracks, but retains some cover stone in other areas. These sections are well sealed but, of course, must be slick in wet weather.

Some sections received additional rolling, and these seem to be in better condition than others. The controlling factor for aggregate retention seems to be the moisture content of the cover stone.

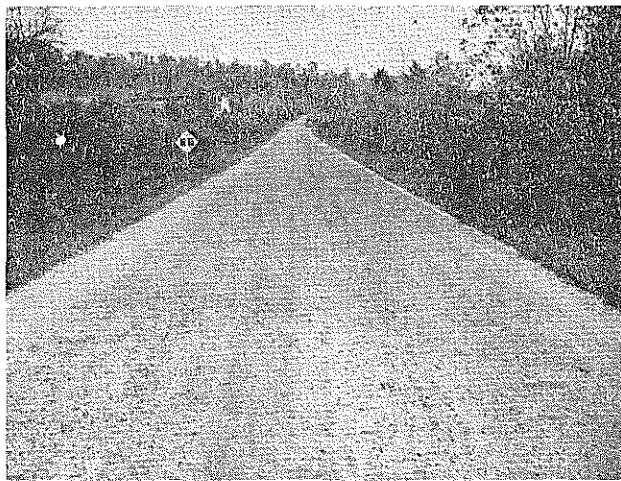
Anderson County, SP 3-291 (1950) was 7.5 miles in length. The seal was placed over a traffic bound base with 0.5 gallon of RT-2 per square yard for prime. After the tar had set up, 0.4 gallon of NAC-8 was applied for the treatment. Thirty pounds of No. 8 Limestone was used for cover. This seal coat was started the last week in July and completed the first week in August, 1950.



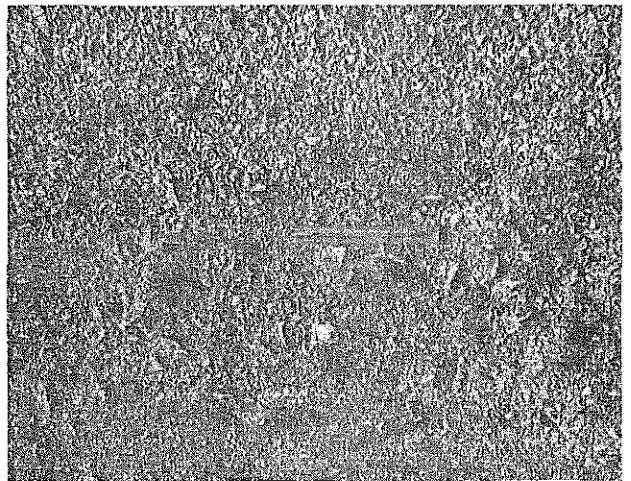
October 1950



January 1951



October 1951



Closeup October 1951

Fig. 3. Pulaski County SP 100-75 (1950). - These photos of the surface of the penetration macadam project were taken in test section No 1. The right lane was given an extra half gallon of RS-1 Emulsified Asphalt. The seal coat consisted of 0.45 gal. of RS-2 with 15 pounds of No. 9 limestone. The seal coat performance has been excellent throughout the project.

The road was inspected on January 26, 1951, and at that time there were five or six sections of from 100 to 500 feet in length that had re-verted to traffic bound. Extra stone was applied to these sections. The road was beginning to check and show base failures especially at the edges.

Another inspection was made October 22, 1951. At that time the road was being maintained throughout as a bituminous surface. Very heavy main-tenance had been performed on the western half of the road near Hickory Grove. Full width patches were very common.

That portion of the road that was given a double application seal near the Calvert Distrilleries at the east end of the project looked good. The same quantities of materials were used but applied in a double application seal. Two-tenths gallon of NAC-8 and 15 pounds of No. 8 stone were used each time.

It appears that more material has been placed by maintenance than was applied during sealing this very light type surface.

Casey County, SP 23-201 (1950) called for a road mix type of operation making use of the existing floater. A NAC-8 seal was placed over the mix, during the first week of August, 1950. After more than a year of use the seal looked good over most of the road. A section about 0.3 mile in length near the Lincoln County line was skin patched or sealed again in late 1951. A few pot holes were present on the eastern end of the project.

The road was very fat and slick appearing after construction and it is believed that extra cover stone has been placed particularly on the east side of the major hill on the project.

The general appearance of the road is good.

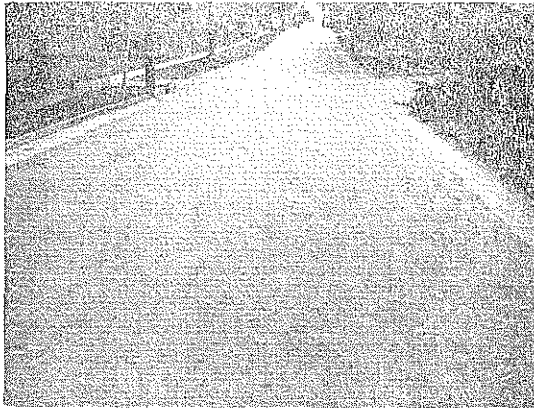
Laurel County, SP Group 47 (1950) was another NAC-8 seal, the work being carried out between September 26-28, 1950. Approximately one half of the project was placed over traffic bound base that was primed with 0.5 gallon of RT-2 per square yard. Two city streets were included. Fig. 4 shows six photographs taken on this project. The top two are of Sublemity Street. No. 9 stone was used for cover on that street only. No. 8 stone was used on College Street and the remainder of the project.

At the present the seal is good over the paved sections but the traffic bound part of the road did not hold together. One section has just recently (October, 1951) had an application of tar. Other sections are patched.

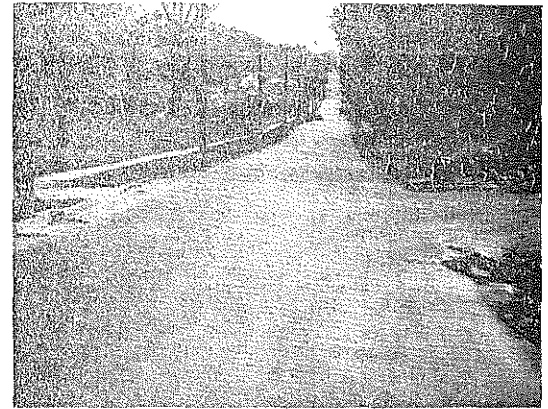
Pulaski County, SP 100-215 (1950) was an NAC-8 seal over traffic bound base. Sealing of the road was carried out about the middle of September, 1950. The road was inspected in January, 1951, and it was found at that time that many base failures were beginning to show. Fig. 5 shows four photographs taken at various times on this project. The upper photographs show the location that was noted in Fig. 8 of the January, 1951, report on this project. This section has held up a little better than the average for the project. Only pot-hole patches were required here. The two bottom photos show the heavy maintenance that has been required for most of the road. New full width patches were used for many places.

This type seal appeared to be too light an application for this road. Maintenance quantities have exceeded the original applications.

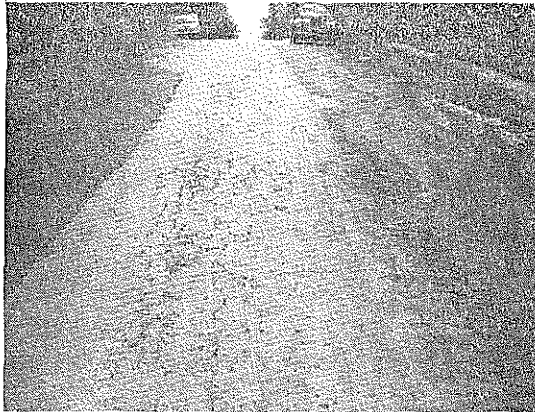
Mercer County, SP Group 16 (1950) was a plant mix Class F Type Binder with a rock asphalt spinner seal applied in June, 1950. There are several base failures particularly at the edge of the pavement, some of which started



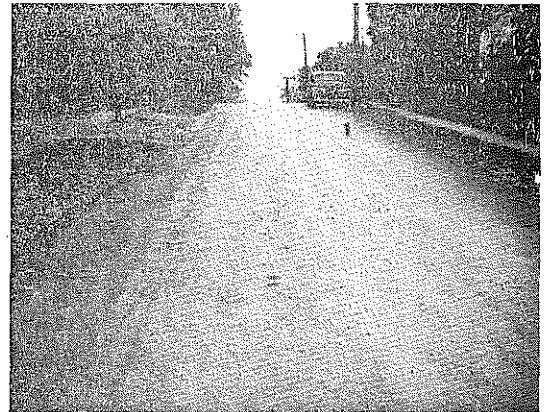
September 1950 Before Sealing



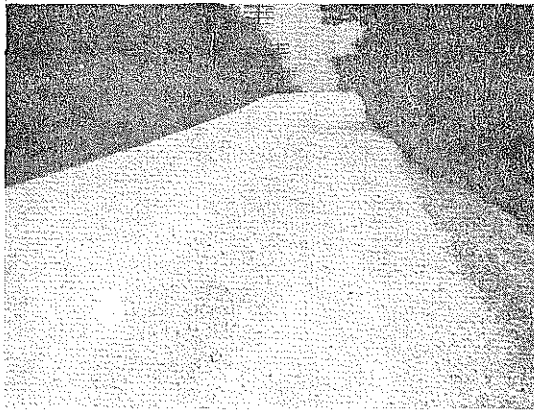
October 1951



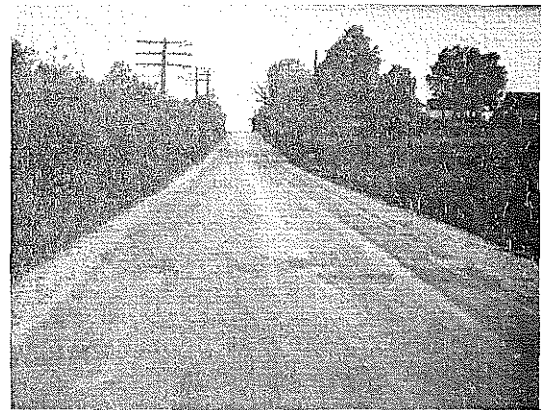
September 1950 Before Sealing



October 1951

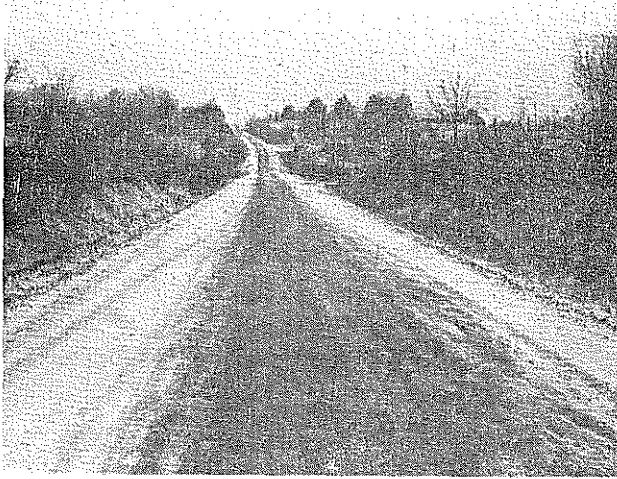


September 1950 After Sealing



October 1951

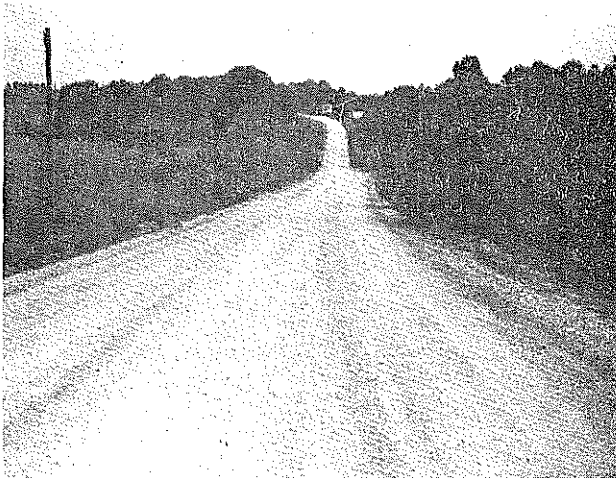
Fig. 4. Laurel County SP Group 47 (1950). This NAC-8 seal had both urban and rural sections. The top photos are of Sublemity Street in London and had No. 9 stone for chips. The middle photos are of College Street and had No. 8 stone cover. The bottom photos are rural sections and the portion in the foreground was placed over traffic bound base.



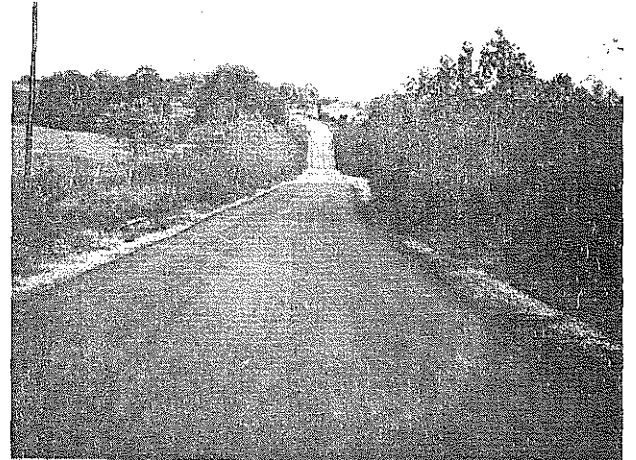
January 1951



October 1951



September 1950



October 1951

Fig. 5. Pulaski County SP 100-215 (1950). These two sets of photos show what happened to the very light NAC-8 seal (initial treatment) during one year. The road is being maintained as a bituminous pavement. The maintenance has been quite heavy as shown by the full width patches in the lower right photo. The light portion of pavement in the distance is the original seal

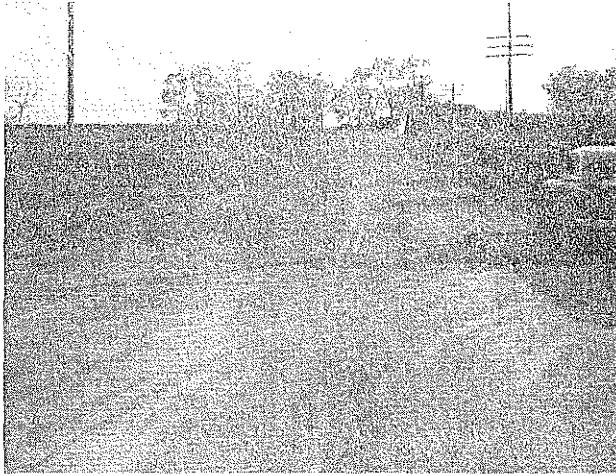
immediately after resurfacing. The rock asphalt is considerably thinner than it was when it was placed. This can be noted in the two bottom photos in Fig. 6. The rock asphalt is still very effective as a seal but has lost the appearance of a rock asphalt surface. The aggregate of the Class F mix is showing through the seal.

1951 Construction

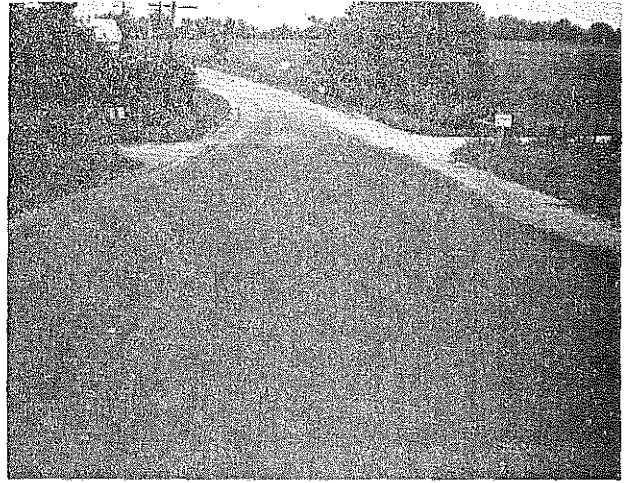
Nelson & Washington Counties, MP Group 4 (1951) was in part an experimental project involving the use of five different bituminous materials in approximately equal amounts. The project extended from the east city limits of Springfield to the Mercer County Line, a distance of 15.7 miles on Ky, 152.

The highway was entirely rural with the exception of the two small communities of Mackville and Thompsonville. Although the average width of the road was 18 feet it varied to such an extent that it was necessary to change the width of application frequently. This is illustrated in Fig. 7(b). The old pavement was in fair condition, having an obvious dry, cracked appearance and numerous chuck holes which were patched prior to seal treatment. In numerous sections the edges were patched for long distances. Sealing operations on the road started on September 19, and were completed on October 8. Weather conditions during the construction period were good although cool weather (50°-60°F.) was experienced during the first week and the last day or so of work.

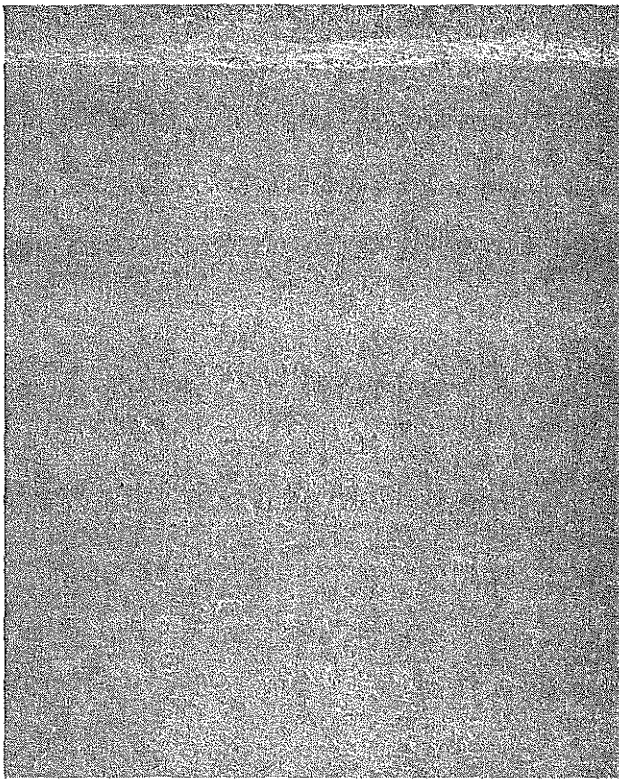
The bituminous materials were placed in the following order: RS-2, RC-4, PAC-9, RT-10 and NAC-8. Work progressed from the Mercer County Line toward Springfield with about 8,000 gallons of each bituminous material



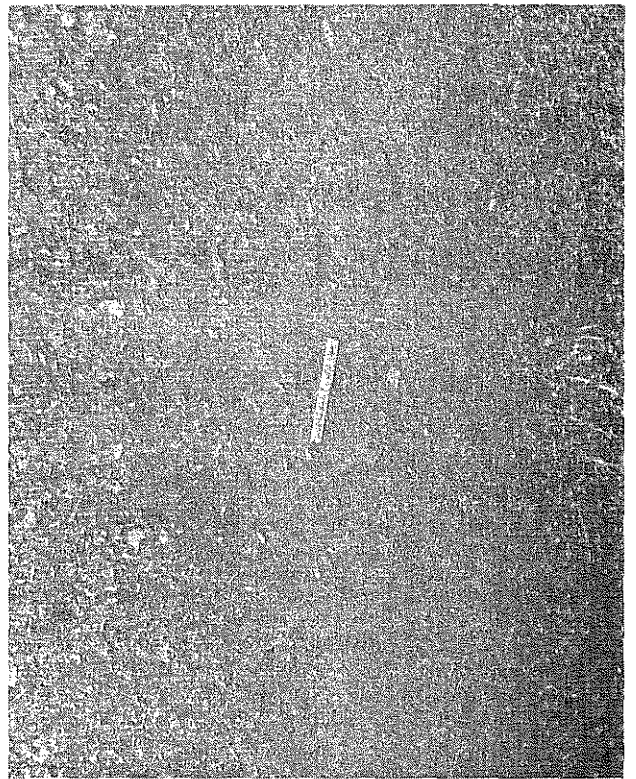
Anderson County Line 1951



Anderson County Line 1950

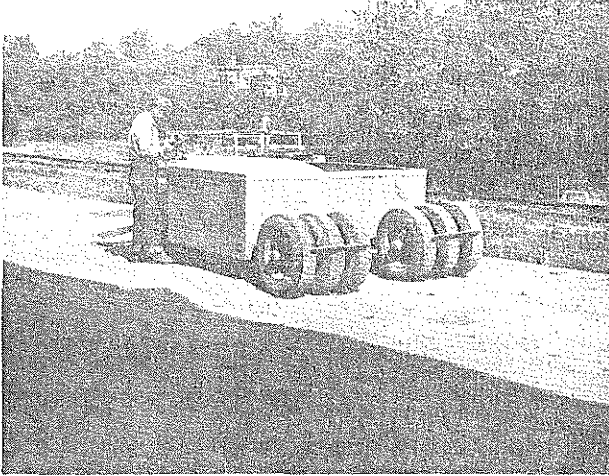


Surface 1950



Surface 1951

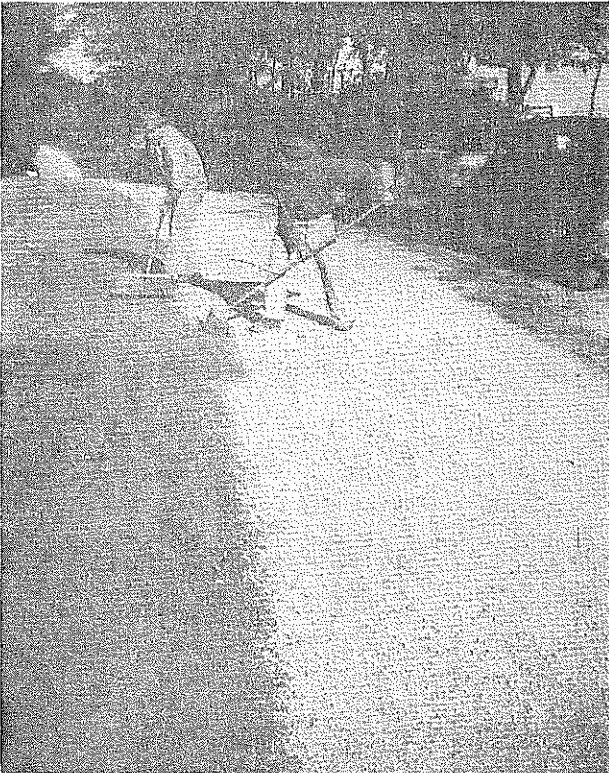
Fig. 6 - Mercer County SP Group 16 (1950). Top right photo is looking north. Note lumps of Rock Asphalt. Top left photo is looking south at same location. Lumps have disappeared. Bottom photos show close up of seal texture.



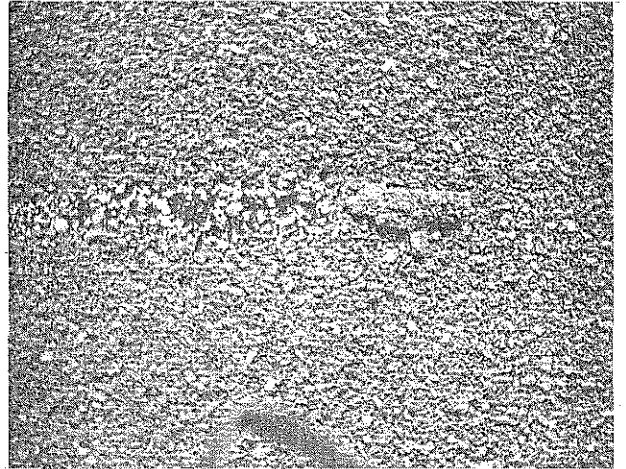
(a)
Rubber-tired roller used on all sections of Experimental Seal Project (weight 5 to 6 tons).



(b)
Spreading damp stone (note overlap caused by variable road width).



(c)
Hand brooming made necessary by dampness in stone.



(d)
Near view of surface showing "lumping" caused by dirt and moisture in aggregate.

Fig. 7

Seal Coat Construction 1951, Washington County

being used. The rate of application was set at 0.25 gallon per square yard.

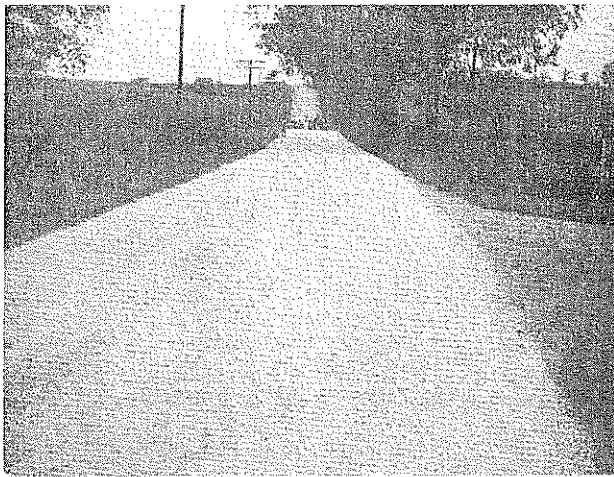
Most of the aggregate (No. 9 crushed limestone) came from stockpiles at a quarry in Springfield, but these stockpiles were depleted before the job was finished and inasmuch as the aggregate plant at Springfield was broken down, it was necessary to get approximately 500 tons of stone from a plant at Lebanon to complete the project.

The stone from Springfield which was invariably wet, clumpy, and generally in poor condition was used throughout the RS-2, RC-4 and PAC-9 sections, and it also extended into the RT-10 section. In contrast, the stone from Lebanon was always dry, distinctly clean and white, and consistently well graded. The rate of application was 20 pounds per square yard on all sections.

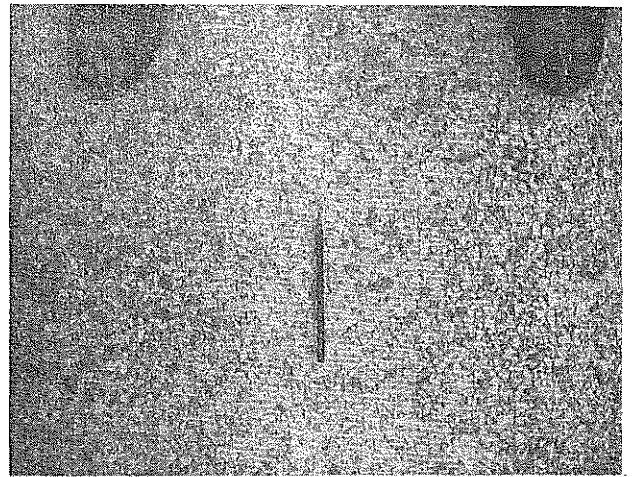
Fig. 7(b and c) illustrates various phases of placing the aggregate. Also, parts b, c, and d in Fig. 7 show the damp and often clumpy condition of the aggregate which hampered the spreading of this stone with the Buckeye Spreader Box. Hand brooms used immediately after applying the stone helped considerably to give the road a uniform layer of aggregate. Fig. 8(a) shows the difference that was apparent when dry aggregate was used. Undoubtedly, the differences in aggregate should be given careful consideration in future evaluations of the different sections.

Surplus quantities of NAC-8 and stone remaining when the road was completely covered, were used for a second application in one lane for a distance of approximately 150 feet. This double application is in the west-bound lane about 0.8 mile from the city limits of Springfield. Fig. 8(d) illustrates the finished surface conditions at that point.

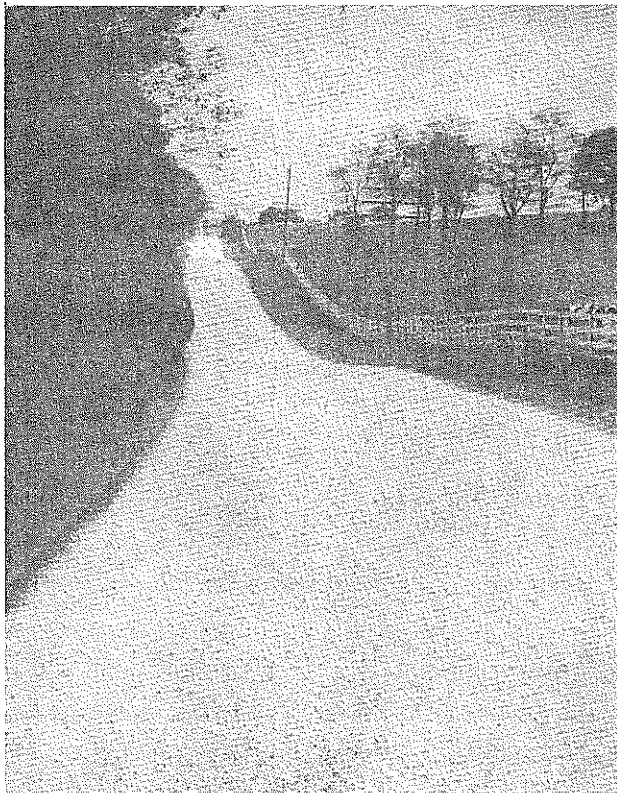
The same equipment was used on all sections of the project and in general the same method of application was followed. One unusual piece of equipment



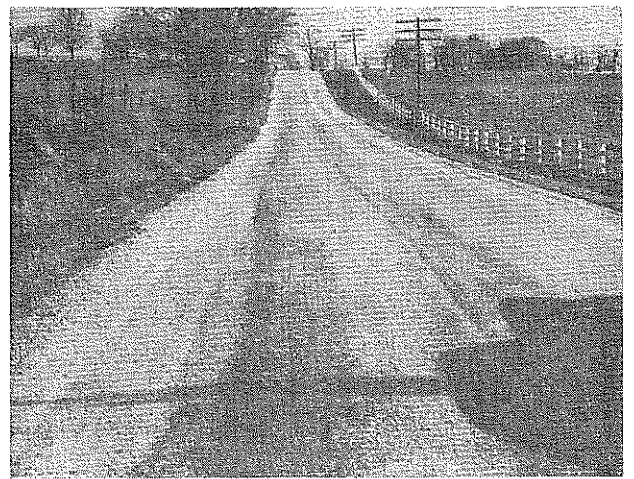
(a)
Dry stone after spreading on RT-10 Section of Experimental Seal Project.



(b)
Surface texture of dry stone after dragging and rolling operations.



(c)
Finished surface NAC-8 Section of Experimental Seal Project.



(d)
NAC-8 double application after one month of use.

Fig. 8

was the rubber tired roller shown in Fig. 7(a). The average weight of this roller was between five and six tons.

Table 1 contains pertinent data relating to the project. Signs have been placed on the right of way at points where the bituminous materials change. The signs are set parallel to the center line of the roadway. Fig. 9 is a group of photographs showing the condition of the surface at a certain point in each of the five sections about one month after the work was completed.

TACK COATS

1950 Construction

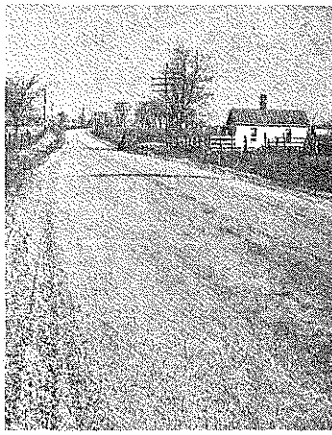
Garrard and Lincoln Counties, SP Group 29 (1950) was a PAC-5 tack project. The road was inspected November 16, 1950. No fat spots were noted. There was no evidence of any tack failure. The one mile section with no tack was in excellent condition. A photographic record was made.

Harrison County, SP Group 41 (1950) was a project that made use of RS-1 for tack. This road has numerous edge and base failures. It was not possible to associate any of these failures with the tack coat. No specific tack failures were noted.

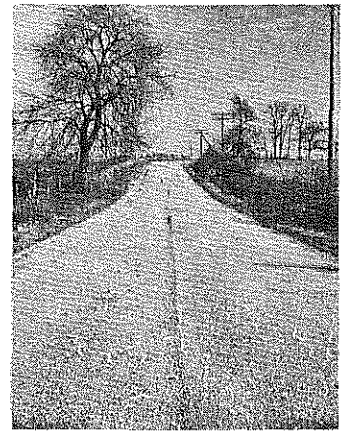
PENETRATION MACADAM

1950 Construction

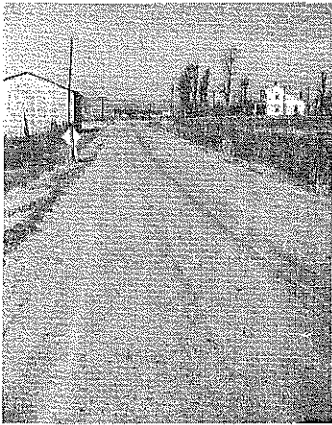
Pulaski County, SP 100-75 (1950) was a penetration macadam using emulsion for the bituminous material. An inspection of this project was made in January, 1951, and again in October, 1951.



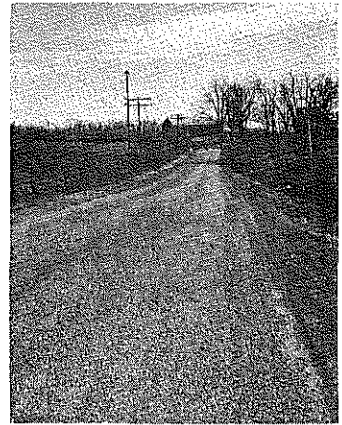
NAC-8 (a) Section



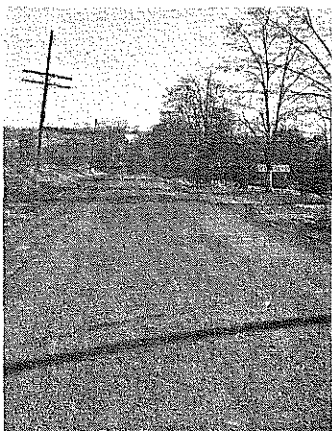
RT-10 (b) Section



PAC-9 (c) Section



RC-4 (d) Section



RS-2 (e) Section

Looking eastward from Springfield toward Harrodsburg into each successive section as indicated. November 29, 1951

Fig. 9
Seal Coat Construction 1951, Washington County

A few base failures have occurred noticeably in the east or north-bound traffic lane. A failure is noted in Fig. 10. Ledge rock was just below the surface, and this led water under the pavement. This condition was noticed before construction but it was not feasible to remedy the situation at that time. The pavement cracked and broke up during construction as shown by the lower left photograph.

It is highly desirable to patch the failures just after they occur. This type surface is very susceptible to raveling if a failure gets under way. The road has had excellent maintenance.

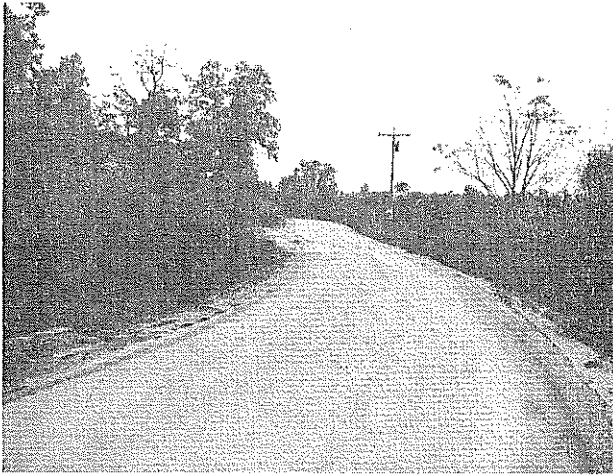
This penetration macadam project looks excellent after having been in service a little over a year. It appears to be an excellent initial treatment for an old traffic bound base.

BLADE SPREAD HOT MIX

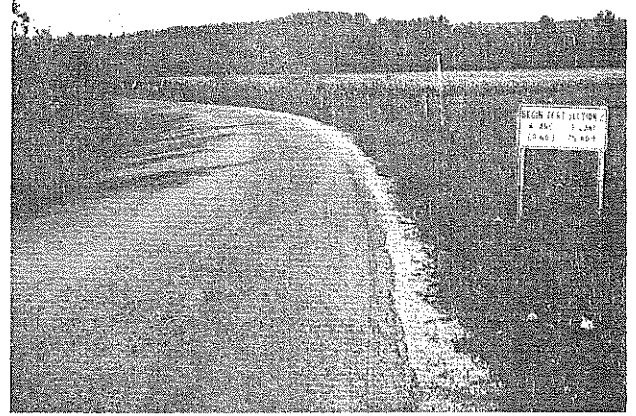
1951 Construction

Nicholas County, SP Group 21 (1951) was a widening and resurfacing project with a Class I binder and Type B surface. The binder, serving as a leveling or wedge course, was spread, shaped, and finished by a power patrol grader in lieu of a mechanical spreader or paver. The surface was laid by a Barber-Greene Finisher.

This project (SP 91-139-35A) contained a section of the Paris-Maysville Road, US 68, in Nicholas County - beginning at the Bourbon County line, near Millersburg and extending 1.546 miles northeast. The original surface was a road mix bituminous type of construction, highly irregular in cross-section and having very poor riding qualities. The crown, at some locations, was as great as seven-or eight-tenths of one foot in ten feet.



October 1950



October 1951



October 1950



January 1951

Fig. 10. Pulaski County SP 100-75 (1950). The overall appearance of this penetration macadam road is excellent. The photos in Fig. 3 are from this project also. The upper photos were taken at approximately the same location in test section No. 2. The lower photos are of a failure caused by ledge rock being left about 6" below the pavement surface. The section failed before completion of the paving. It was not feasible to remedy this situation during construction. A few failures mostly in the east lane have occurred. The general condition is excellent.

The original contract called for the construction of a pavement width of 18 feet. Since the base was adequate to support a 20-foot pavement, permission was granted to overrun the quantities for building the additional width.

The contractor started laying the binder in the north-bound lane on October 1, beginning at the Bourbon County line, proceeding to the end of the project and working back to the beginning in the remaining lane. The material was delivered by truck from the plant located near Flemingsburg - some 30 to 35 miles from the project.

Two men supervised the general distribution of the mix which was "tailgated" from the trucks. One dumper proceeded with the distribution of the material in "spot" applications over portions of the old surface requiring more than the average quantities for eliminating the irregularities. In accomplishing this, the low spots were not marked on the pavement but rather the man supervising this spread rode with each truck and specifically located the points where material was to be dumped. Sometimes an entire truck load was required in a single low spot, but in many instances a portion of a load was dumped, the bed lowered, and the truck passed forward or backward to one or more other low spots before dumping the remainder of the load. This was then spread by the grader. These operations are illustrated in Figs. 13 and 14.

The second dumper followed this operation, having his truck "tailgated" continuous runs of the mix. This was followed directly by the grader. Care was exercised against unloading more material than the grader could readily handle. In some cases, where it seemed advisable, an additional pass was made and shaped to improve the uniformity of the grade before the first

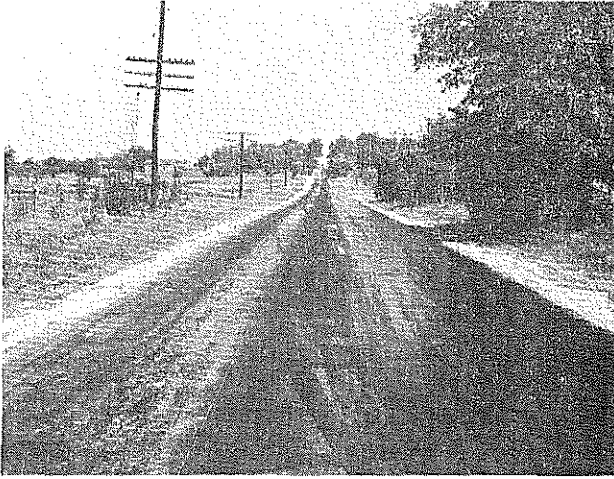


Fig. 11. Original surface, looking north from Station 47+00. A prime coat had been applied to the right lane.

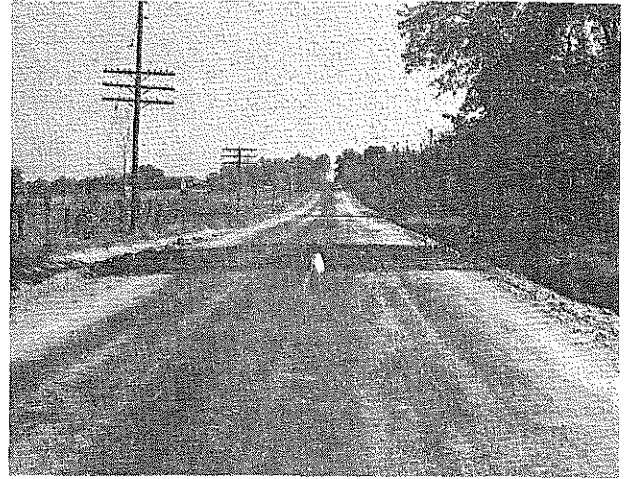


Fig. 12. Finished surface, looking north from Station 47+00. Shoulder construction had not been completed.



Fig. 13. Distributing by "tailgating", Class I Binder Material on half-width construction.

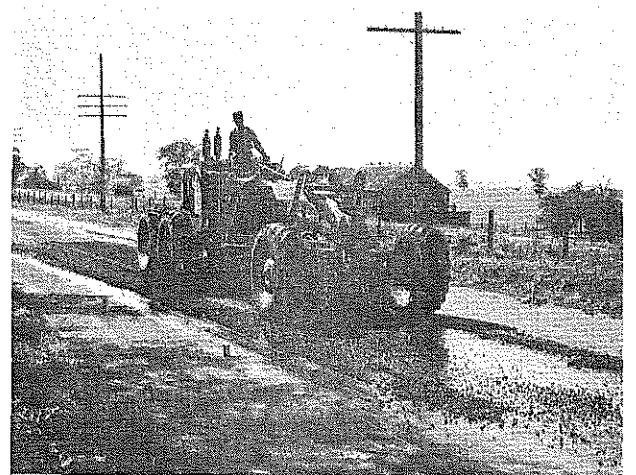


Fig. 14. Blade spreading a "spot" application of the "hot-mix" material over a portion of the old surface requiring more than a normal amount of the material to eliminate the irregularities.

course was rolled. Because of the depth required in many places, most of the binder was constructed in two or more courses. Efforts were made to improve the grade as much as possible in the first course.

As a means of control, elevation markings were set on offset-line stakes for checking the crown section at each hundred-foot station (Fig. 17). This was done by stretching a line between the centerline and the elevation marking. Although, such control was effective only at the given locations, and even though the effectiveness was reduced by centerline grade irregularities, it appeared to be a worthwhile effort. To obtain the greatest improvement in grade and cross-section, the prime requisite was careful visual inspection by all personnel concerned.

The courses were not laid in any well defined sections, such as by jointing, but were joined by long wedge-like overlaps. The length of the paving operations varied, but were such as to provide more or less continuous operations by the rollers and to maintain a convenient traveling distance of the grader. Attached to the grader blade was a device for aligning the edges (Fig. 15).

Measurements with an armored thermometer on the job indicated that practically all the mix was delivered at normal temperatures (260°-280°F.). When the mix was delivered at this temperature it could be spread and shaped without difficulty, but once the material was unloaded little delay could be allowed before it was spread and shaped.

Although the patrol grader could transfer considerable quantities of material over a short distance, its efficiency was reduced rapidly with increases in the distance that the material was carried. At the beginning of the project, precautions against application of an excessive quantity

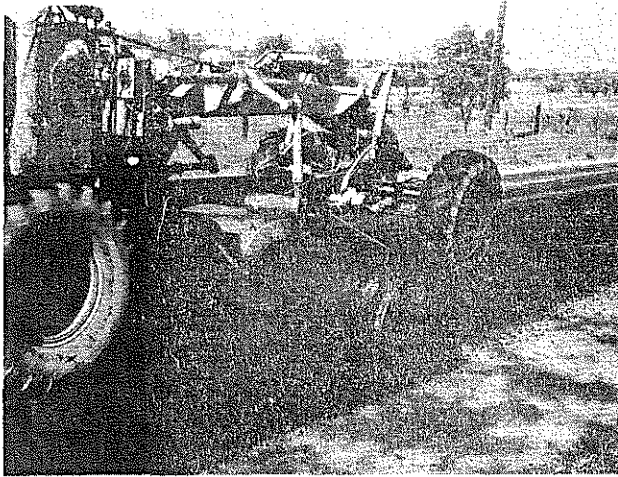


Fig. 15. Shaping and aligning the edge of the binder course prior to rolling.

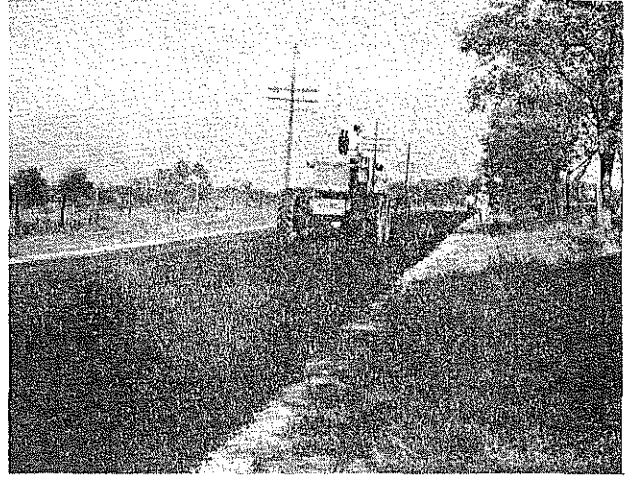


Fig. 16. Spreading and shaping a second run of binder material to improve the finished section.

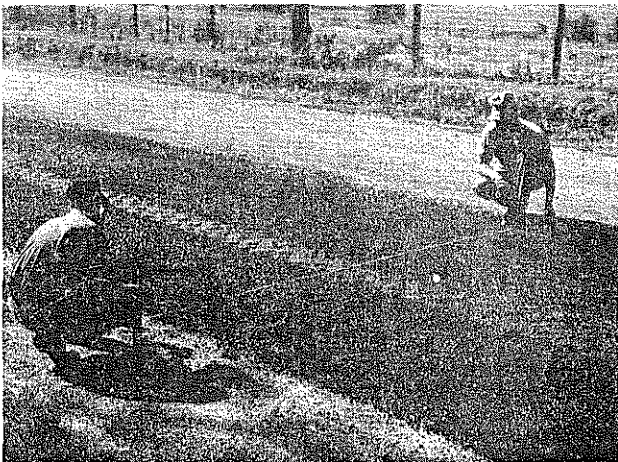


Fig. 17. Checking the crown section. A line was stretched between center-line and elevation mark on the offset line stake.

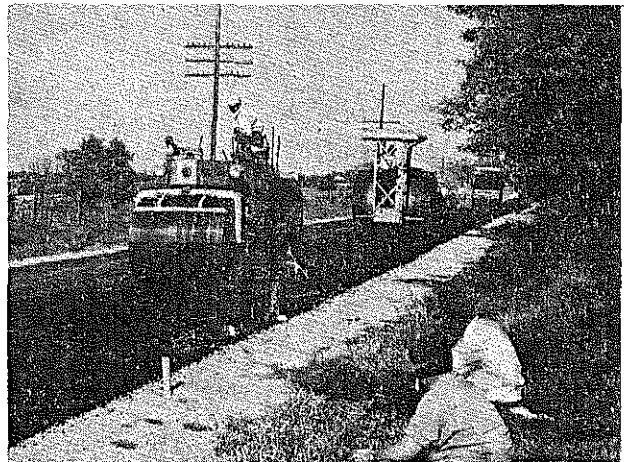


Fig. 18. Rolling the Class I Binder. The three wheeled roller was followed by the tandem roller, for both the binder and surface courses.

of material were not sufficient to prevent poor distribution at several spots in the north-bound lane. As a result, some of the sections of the road were finished concave or "dished" toward the centerline. This was improved as the work progressed, and the south-bound lane in general was considerably more consistent in cross-section than was the north-bound lane.

Cross sections of the original surface, the binder course, and the final surface, were taken within two selected 100-foot sections: between Stations 21 + 00 and 22 + 00, and between Stations 39 + 00 and 40 + 00. These cross sections are plotted in Figs. 19 and 20. Elevations were read at intervals of 2 feet over 20 feet of cross-section and the sections were established at intervals of 5 feet longitudinally. These two locations were selected as being representative of the original condition over most of the project before resurfacing was started. On the other hand, the condition of the finished surface (flat crown) at these two locations was not representative of the whole project. Although the crown of the finished surface shown in the cross sections does not conform with the standards, the irregularities are magnified by the exaggerated scale.

Random checking proved that a reasonable amount of crown was constructed over most of the length. This is illustrated by the cross-sections of the final surface plotted in Fig. 21. For these, readings were taken at the centerline and edges of the pavement at intervals of 0.2 mile throughout the total length of the project. The shape of the section at 0.1 mile from the beginning was probably influenced by an easement to the preceding super-elevated curve. That at 1.3 miles lies in a three- to four-hundred foot

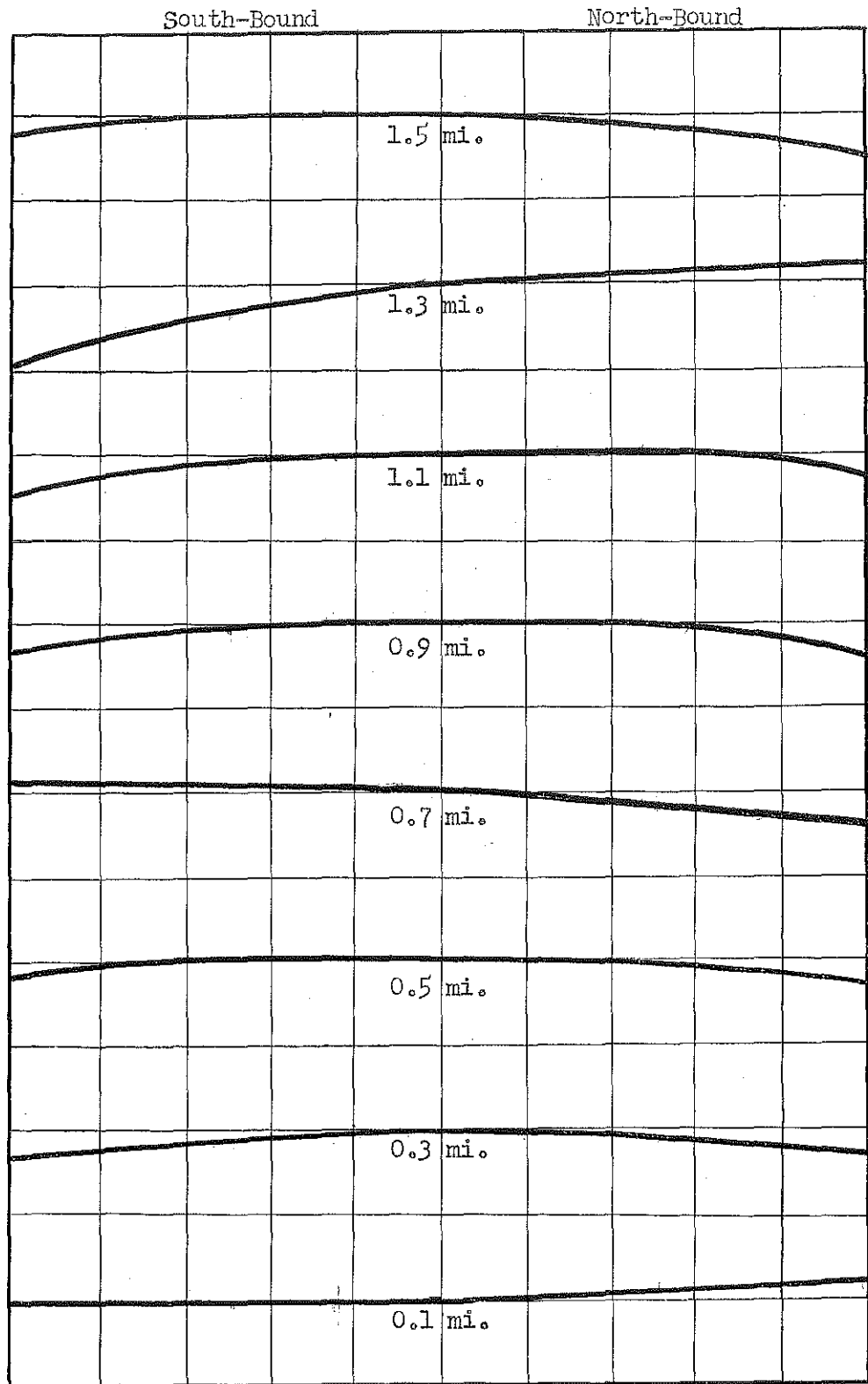


Fig. 21 - Cross-sections of completed surface taken at intervals of 0.2 mile as a random check on the crown section.

Blade Spread Hot Mix, U.S. 68, Nicholas County

section of roadway in which the right lane of the original surface was relatively high. Only a very minimum of the binder material - patchwork more or less - was laid on the right lane at this point.

CONCLUSIONS

Seal Coats (1950)

1. The aggregate retention of RS-2 has been good regardless of whether wet gravel or wet stone was used.
2. The quantity of 0.25 gallon of RS-2 was not enough to effectively seal a new open graded road mix.
3. Forty-five hundredths gallon of RS-2 with 15 pounds of No. 9 Limestone over the penetration macadam was a very effective seal.
4. The stone retention of the RC-5 seal has been very poor while the sealing qualities of the bituminous material has been good. The loss of aggregate can be attributed to the excessive moisture content of the cover stone.
5. As an initial treatment the 0.4 gallon of NAC-8 with 30 pounds of No. 8 stone was inadequate but proved to be effective over existing pavements.
6. The rock asphalt spinner seal lost the appearance of a rock asphalt surface but retained the qualities of a good seal. More recent work indicates that a greater amount of the rock asphalt could be retained if a 10-ton smooth wheel roller was employed during construction instead of depending on traffic for compaction.

Seal Coats (1951)

7. In this particular operation, the condition of the stone placed on the road had far more influence on the retention of cover than did the differences

among the bituminous materials. Of the four bituminous materials to which wet aggregate was applied, RC-4 was definitely handicapped most by this condition and RS-2 probably the least. Both PAC-9 and RT-10 appeared satisfactory despite the wet stone.

8. Poor distribution of wet stone can be partially overcome by brooming the stone for complete coverage. However, the distribution is not uniform, the aggregate loss is increased, and the advantage of a mechanical spreader box is lost when stone is wet and dirty.

9. The rubber tired roller was useful where the underlying pavement was irregular to the point of being "rutted". The tires were able to reach the low places because of the suspension of the wheels.

10. The original condition of the pavement should be taken into account when judging future performance of the seal treatments, because of the possibility of bleeding from patches placed just prior to the sealing operations.

Tack Coats

11. An absence of any tack failures on the tack projects for the first years service makes any conclusion on performance at this time premature.

Penetration Macadam

12. After more than a year of service, the penetration macadam appears to be an excellent initial treatment for an old traffic-bound base.

13. Immediate maintenance of localized failures is essential to prevent rapid spreading of the failures.

Blade Spread Hot Mix

14. A hot mix binder course can be satisfactorily spread and shaped with a motor patrol grader over a highly irregular base. Probably this can be done

with greater facility by a patrol grader than by the conventional mechanical spreader, finisher or paver. The greatest advantage of a patrol grader is its maneuverability, which permits speedy shifting back and forth over the length of the operations; thus, providing better control over the amount and the number of applications of the material toward obtaining the desired uniformity of grade and cross section.

15. Marked deviations from the desired crown - particularly concave or dished sections - can be avoided, or at least minimized, when the high edges are detected in advance and part of the excess material shifted to the center of the road. The overall depth is increased only slightly by this maneuver, and the change in centerline grade is insignificant as compared with the improvement brought about by maintaining the crown.

The practical elimination of dished sections on the Nicholas County project after experience was gained during the first day of construction, indicates the advantage of care in the placement of materials.

16. Some advantage can be gained by establishing on the offset stakes, crown elevations relative to the existing centerline elevation. Although this offers a limited amount of aid toward controlling the grade, at least the shape of the crown at that station can be maintained by use of a string line stretched between the two elevations.

17. An established grade, calculated from the centerline profile and with elevations set accordingly, could be an additional advantage. Logically this could rank in importance with establishing the alignment, especially for surfaces of the higher types.

18. The personnel needed to carry on this method of construction to a satisfactory completion are, in the probable order of their importance; a skilled