PAVEMENT DESIGN AND PERFORMANCE STUDIES

Progress Report No. 4 on Phase A:

Performance Study of Typical Virginia Pavements

by

K. H. McGhee
Highway Research Engineer

(The opinions, findings, and conclusions expressed in this report are those of the author and not necessarily those of the sponsoring agencies.)

Virginia Highway Research Council

(A Cooperative Organization Sponsored Jointly by the Virginia Department of Highways and the University of Virginia)

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Federal Highway Administration

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SUMMARY

The performance of in-service typical Virginia flexible and rigid pavements in all areas of the state is under evaluation. The objectives are to provide a ready reference for designers and field engineers and to provide background information for design improvement. Periodic deflection and roughness tests are conducted along with field inspections. The records maintained on each pavement reflect condition, traffic, construction costs, and major repairs.

Among the major findings of the study to date are:

(1) Cement stabilized subgrades under recently constructed flexible pavements have virtually eliminated rutting and other major distortions,

(2) The cumulative number of trailer trucks and buses sustained by a pavement up to a fixed degree of cracking is directly related to a parameter used to define the shape of the Dynaflect deflection basin, and

(3) Terminal PSI as defined from the AASHO Road Test is too insensitive for use in the evaluation of flexible pavement performance in Virginia.

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INTRODUCTION

In the immediately preceding progress report[1] on this study, F. P. Nichols, former highway research engineer, defined the objectives of the pavement performance study in the following paragraph:

"The Performance Study of Typical Virginia Pavements was begun in 1954 in an attempt to provide, for ready reference, case histories on the behavior of pavements of all major types in all soil areas of the state and subjected to all classes of traffic. It was felt that such a reference would enable those engineers charged with the responsibility for pavement design decisions to give proper consideration to the success or failure of earlier designs in making future design selections."

At the time of that progress report (1965), the efforts to evaluate all types of pavements in all soils areas and under all traffic conditions had resulted in growth of the study to include some 200 projects. With this unwieldy number, it was impractical even for the personnel in charge of the study to adequately keep abreast of the performance of each project. It was, therefore, concluded that pavement designers and field engineers would have difficulty in making use of information from such a massive study.

Upon a recommendation by the Pavement Research Advisory Committee, A. W. Furgiuele, district materials engineer, and C. S. Hughes, highway research engineer, formed a task group charged with the responsibility of reducing the number of projects to a practical minimum and at the same time retaining the objectives of the study. Because of his experience with the study, R. W. Gunn, highway construction inspector, also assisted in the selection of projects.

The projects to be retained in the study were selected according to the following criteria:

(1) To include only very recently or presently used designs,

(2) To include, where possible, both rigid and flexible pavements of interstate standard in each of the eight construction districts, and,

(3) To include pavements representative of a range of traffic volumes in each district.

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*Study divided into Phases in May 1966.

As a further general guide, it was decided that to qualify for future inclusion in the study a project would have to either represent a new design concept in Virginia (such as continuously reinforced concrete pavements or full depth asphalt) or include contrasting designs in the same vicinity.

Within the above framework, fifty-five projects were selected for retention in the study, and additions had increased the number to sixty-three by the end of 1969. Obviously, employment of the restrictions outlined has resulted in the exclusion from the study of projects of particular interest to individuals within the Highway Department. For this reason, the Research Council has maintained complete past records on the original projects and will make these available upon request.

It is the intent of the present progress report to update and make available to operating personnel the information derived from the study through calendar year 1969. Few conclusions are offered because a final report on the study is scheduled for the fall of 1971. The final report will include data collected through the spring of 1971, along with an analysis and discussion of the findings. The continuation of a performance study beyond 1971 will be dependent upon the needs of the Highway Department and on the research funds available for the study.

PERFORMANCE STUDY PROCEDURE

In general, projects selected for inclusion in the performance study are closely observed by Research Council personnel from the time of construction until useful information can no longer be gained, (usually until the second resurfacing). The steps included in the evaluation of each pavement are as outlined below.

1. Procurement of final plans and cross sections, materials descriptions, construction costs and date of acceptance from the contractor.

2. Establishment of easily identified project limits by the use of roadside markers and written descriptions.

3. Initial and periodic, usually semiannual , collection of data reflecting:

   (a) traffic characteristics,

   (b) structural capability as indicated by deflection tests,

   (c) roughness, and

   (d) visual defects such as cracking, rutting, patching, and the presence of settlements.

4. Maintenance of records of major maintenance operations (bituminous concrete overlays, for example), and their costs.

Clearly, the accumulation of the above information requires the cooperation of personnel in nearly every operating division of the Highway Department, so that the study is far more than an undertaking of the Research Council.

Before a meaningful display of information can be presented, it is necessary to outline some of the more subtle features. The following discussion has particular reference to item 3 above.

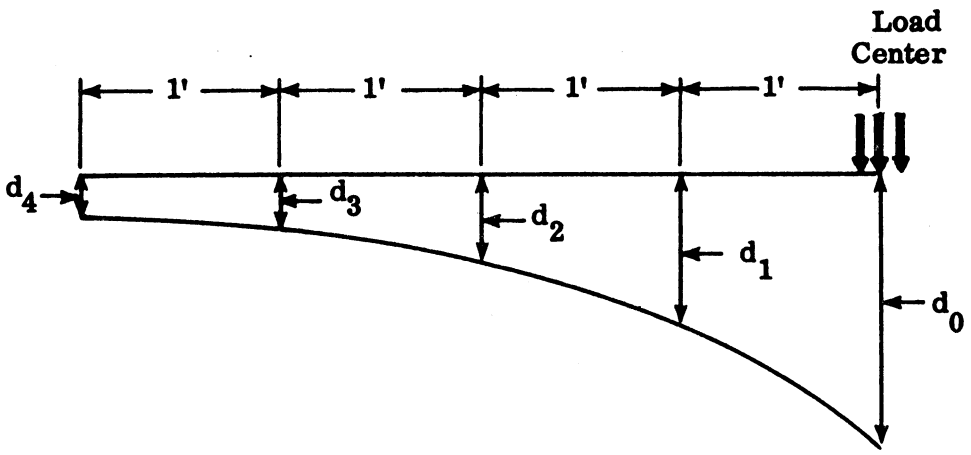
Traffic Characteristics

While Virginia's present design method utilizes the 18 kip equivalency concept defined by AASHO[2], most of the pavements currently in the study were designed on the basis of traffic categories reflecting average daily trailer trucks and buses in both directions (T.T. & B.). Furthermore, T.T. & B. data are routinely collected by the Traffic and Safety Division while 18 kip equivalency determinations are obtained only through weight studies and are too expensive for other than special requirements. For these reasons, only T.T. & B. information is available for the study projects. Efforts to develop a simple correlation between T.T. & B. counts and equivalent 18 kip axle loads have been unsuccessful to date.

Structural Capability

In this, as in the third progress report[1], rebound deflections are used as an indication of the structural capabilities of the various flexible pavement systems. Tests conducted prior to 1966 were performed with Benkelman beams[1] and a truck loaded to 18,000 lb. on its rear axle. In 1966 a Dynaflect was purchased and its results correlated with those from Benkelman beam tests.[3] Since the regression equation (Benkelman Beam = 27.8 Dynaflect) was found to have an excellent correlation coefficient, all tests subsequent to 1966 have been conducted with the much faster and less laborious Dynaflect method.

This method provides for deflection measurements directly at the point of load application and at distances of one, two, three, and four feet from that point. The plot of all five deflections defines the deflection basin as shown in Figure 1. Recent studies[4] have shown that the shape of the deflection basin may be of more importance than the maximum deflection. As a means of interpreting the shape of the basin a bending factor, or a "spreadability", has been defined and is also shown in Figure 1. This factor is the ratio of the average deflection to the maximum, expressed as a percentage. An increase in the factor indicates an ability of the pavement to spread the load over a wider area. Thus, a 65 bending factor indicates a much stiffer pavement than does a 45. The use of a bending factor in assessing flexible pavement performance will be discussed later in this report.



$$\text{Spreadability} = \frac{d_0 + d_1 + d_2 + d_3 + d_4}{5\, d_0} \times 100$$

Figure 1. Dynaflect deflection basin.

Roughness

Road roughness tests utilizing a BPR type roughometer at 20 mph have been conducted on each project throughout the study period. These data also will be discussed later in this report.

Visual Defects

Periodic inspections of the study pavements have resulted in the accumulation of considerable data reflecting various kinds of physical defects, the most common of which is cracking. Other defects noted are rutting, patching, and settlements.

Rutting of flexible pavements, once fairly common in Virginia, seems to have been nearly eliminated over the past few years with the advent of cement and lime stabilization and the resultant more stable subgrades. Rutting is, thus, seldom a factor in performance surveys but is noted as to extent and frequency as are patching and settlements.

To make cracking data more useable, a crack factor (CF) has been defined for flexible pavements and it is determined for each of the study projects at the time of each inspection. To determine the factor, the project is separated into 1,000 ft. sections and each section is surveyed for cracking. Each incidence of cracking has been arbitrarily assigned a value of 15 units and 20 units for longitudinal cracking and

pattern or alligator cracking, respectively. Transverse cracking of flexible pavements is so often related to cement stabilization that its presence is not considered detrimental. Thus, a section with five incidences of pattern cracking would have a crack factor of 100. Similarly, two incidences of longitudinal cracking and one of pattern cracking yield a factor of 50. An upper limit of 100 units per 1,000 ft. section is imposed on the data. After all sections within a project have been surveyed the average crack factor is determined and designated as the factor for the project.

Clearly, the crack factor as used in this study is somewhat arbitrary and would not be adaptable to strict quantitative analysis. It is, however, the opinion of the researchers that the data are useful on a qualitative basis to determine whether or not a project is performing well. For example, other factors being equal, one can say that a crack factor of 5 for a ten-year old project clearly indicates better performance than say a crack factor of 50 for a five-year old project.

Visual defects noted for rigid pavements are transverse and longitudinal cracking, corner breaks, evidences of joint failure, and evidences of pumping. Also noted are surface defects such as scaling and flecking.

DISCUSSION

Project Case Histories

Project case histories follow this discussion section (Appendix A) and are arranged in order by highway district according to the usual district numbering system shown below:

District	Series
Bristol	100
Salem	200
Lynchburg	300
Richmond	400
Suffolk	500
Fredericksburg	600
Culpeper	700
Staunton	800

Thus, project 101 is the first project in the Bristol District while No. 305 is the fifth project in the Lynchburg District. In addition, projects having alphabetical suffixes (304A, 304B, 304C, 304D, for examples) are subsections of the same age and built by the same contractor within a single contract but have different pavement cross sections. Within a district, projects are arranged in ascending order according to route number.

Each data sheet is headed by a project description consisting of route number, county, project limits, completion date, pavement cross section, and the original construction cost per 24 foot lane mile. A projected cost of construction for 1969 (based

on typical unit costs listed in Appendix B) is also included. Final items in the project description consist of a soil area designation and a pavement thickness index (flexible pavements only). These parameters are compatible with Virginia's new pavement design concept, described by Vaswani, and refer to the relative resiliency of the soils in and around the project location and to the equivalent asphaltic concrete thickness of the pavement, respectively. The method is outlined in Appendix C, where a soil area map will be found.

The remainder of the data sheet for a given project is devoted to a summary of performance data including the daily T. T. & B. range to which the pavement has been subjected over its life, deflection data and a crack factor for flexible pavements, and such remarks as are prompted by maintenance records and field inspections. Deflection data collected with the Dynaflect have the maximum deflection and the bending factor listed. Those collected with a Benkelman beam (indicated by asterisks) have been converted to Dynaflect values through use of the previously described regression equation.

Additional performance data, which because of the volume of data are found in Appendix D, are road roughness values (BPR roughometer) and Present Serviceability Indices (PSI) as defined by AASHO [2] and adapted to Virginia conditions. [1]

Performance Evaluation

Present Serviceability Index

Among the various methods of pavement performance evaluation the Present Serviceability Index (PSI) concept defined during the AASHO road test is doubtlessly the most widely used. The parameters employed for flexible pavements are roughness, cracking, patching, and rutting. The dominant quantity in the equations (Appendix D) is roughness, which was apparently the most objectionable factor to rating panels whose opinions formed the basis for the method. In utilizing PSI, performance is commonly defined in terms of the number of 18 kip axle loads required to cause a deterioration in PSI from the initial serviceability index (usually between 4.0 and 5.0) for a new pavement to a terminal index of around 2.0 to 2.5. Some agencies have been able to use the PSI method of evaluation to advantage. Utah [5] for example has recently been able to predict, from Dynaflect deflections, the number of 18 kip axle loads their pavements will sustain before reaching a terminal serviceability index of 2.5.

Virginia has been less fortunate in the use of PSI for performance evaluation purposes. While projects have initial PSI's much as would be expected (see Appendix D), there appears to be little deterioration in the serviceability index of flexible pavements with time or traffic. Thus, projects often are resurfaced at very high PSI values and, because of resurfacing techniques, may have either a lower or a higher PSI after resurfacing.

The difficulty with PSI application in Virginia appears to be in the relative lack of sensitivity of the PSI equation to cracking. Most of Virginia's primary pavements built since the evolution of the PSI concept (about 1960) either have had stabilized subgrades or have been built in good soil areas. Pavements built on unstabilized poor soils have

been for low traffic categories. Experience has shown that these improved design practices have reduced distortions to a minimum. Thus, cracking without an appreciable increase in roughness has become the principal factor contributing to loss of pavement serviceability. Maintenance practices [6] give considerable weight to this cracking and to the engineer's judgement and often result in resurfacing before any public awareness that a pavement is in need of maintenance.

In summary, the PSI concept in its present form, notwithstanding the huge research effort behind its development, has little application to present Virginia flexible pavements. Since most of the rigid pavements are relatively new, it is difficult at this time to assess the applicability of PSI to their evaluation.

Cracking and Bending Factors

The lack of success with PSI means that Virginia has no well accepted quantitative measure of flexible pavement performance. Thus, it has been necessary to establish some definition of failure other than the terminal serviceability index, so the researchers have attempted to relate performance and parameters which received lesser attention in the AASHO evaluation.

For purposes of this discussion, it appears appropriate to consider a flexible pavement to have failed when the cracking factor exceeds 50 units because:

(a) Substantial cracking is indicated at this level,

(b) Cracking progresses rapidly after this level is reached, and

(c) Few pavements are resurfaced at cracking factors below 50 but most are resurfaced within a year or two after reaching that level.

While the cracking factor is more appropriately a qualitative parameter, its use as an index of performance is somewhat supported by Table I and Figure 2 below. The data shown in Table I are for twelve projects on which the researchers have watched the progress of the cracking factor from a low level (often zero) to a value in excess of 50 units. The cracking factor listed in the table is the first in excess of 50 recorded for each project. Also recorded are the cumulative T. T. & B. counts from the date of completion of construction until the cracking factor exceeded 50. The averages of all bending factors measured for a project up to a cracking factor exceeding 50 are listed along with the original bending factor for each project, the soil area in which each project is located, and the age of the project at the time cracking exceeded 50 units. Finally, the initial and terminal serviceability indices are listed for comparison purposes. The flexible pavements not listed in Table I were omitted because they had not reached a 50 crack factor or because they had exceeded that crack factor the first time the bending factor was determined so that insufficient data are available.

TABLE I

CRACKING AND BENDING FACTORS

Project	Soil Area	Cumulative T. T. & B (Millions)	CF	Age, Months	Bending Factor		Serviceability Index	
					Initial	Average	Initial	Terminal
206	1	1.18	51	74	59	58	3.89	4.04
209	1	1.07	54	128	60	57	4.27	4.09
301	1	0.17	54	73	52	49	4.90	4.47
305	1	0.56	75	83	55	54	4.30	4.19
307	2	0.28	83	60	48	48	4.46	4.21
308	1	2.27	62	70	65	60	4.69	4.44
309B	1	2.66	56	87	54	59	4.40	3.85
406	3	3.06	55	73	59	61	4.69	4.07
407	3	0.26	87	72	53	52	4.25	4.01
604	4	0.13	69	99	45	45	3.82	3.89
702	2	0.83	96	92	62	59	4.49	3.96
704	2	0.62	86	75	63	61	4.91	4.23

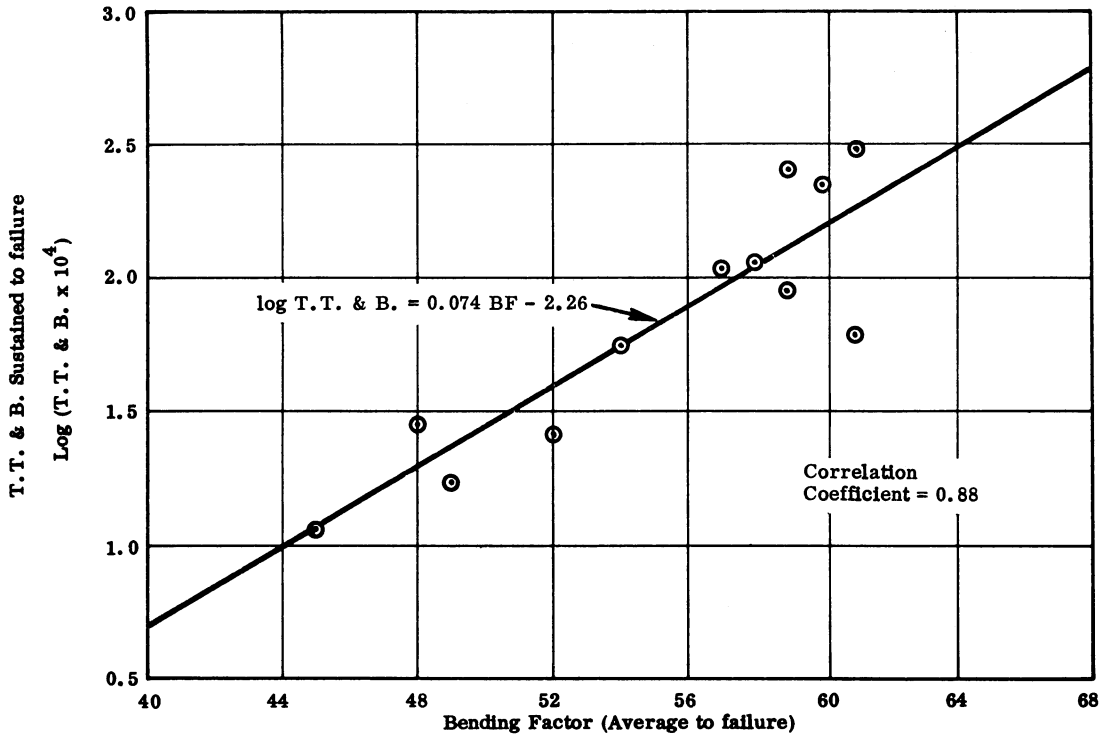


Figure 2. T. T. & B. to failure as a function of bending factor.

As can be noted in Table I, there is usually a slight decrease in the bending factor as a pavement reaches a cracking factor in excess of 50 units. This is no doubt due to a deterioration in the structural integrity of the pavement, which reduces the area over which the deformation is spread. A similar slight decrease in the serviceability index is due to the influence of cracking in the PSI equation and to a small increase in roughness.

Figure 2 shows that there is a good correlation between the accumulated T. T. & B. sustained by a pavement up to substantial cracking and the average bending factor for the pavement up to that level of cracking. Thus, as might be expected, a more rigid pavement can be expected to carry more repetitions of heavy trucks before a failure condition is reached. The above approach to pavement evaluation will be pursued in the analysis of data for the rest of the performance study.

Performance of Typical Pavements

Utilizing the criteria established earlier in this report each of the flexible pavements has been generally rated as to its performance. Based on traffic, age, deflections, roughness, cracking and the general impression of the researchers each project has been rated as excellent, good, fair or poor in performance. There are fairly graphic examples of both good and poor performance in all soil areas except area 5, for which all projects have shown good performance. Certain definite trends which indicate differences in performance have been identified. For example, of eleven good to excellent projects in soil area 1, nine have cement stabilized subgrades, one has cement stabilized crushed stone subbase, and the last an unstabilized stone base. Nine also have a minimum of 7 in. of asphaltic concrete base and surface. A typical poor project in this soil area has 4 to 9 in. of asphalt, 4 to 8 in. of crushed stone, and 12 in. of select material. Others showing relatively poor performance have 3 to $4\frac{1}{2}$ in. of asphalt over a soil cement subgrade but with a layer of select material between.

In soil areas 2 and 3 similar examples of good and poor performance can be cited, with the best performance noted for heavy asphalt over a crushed stone subbase and cement stabilized subgrade.

Projects in soil area 4 are constructed primarily of local materials and have for the most part performed well. Several showing worse performance contain cement stabilized local materials, which appear to have led to excessive cracking of the already shrinkage prone material.

The performance of rigid pavements shows little relationship to soil area at this time. While all rigid pavements seem structurally sound, most show some evidence of poor joint performance which has required early maintenance in several cases. Original sealants have been short-lived as have metal inserts where used. Pumping of some sections could lead to eventual structural failure.

CONCLUSIONS

The conclusions which appear to result from the performance study to this point are:

1. Cement stabilized subgrades are, once again, shown to contribute substantially to the performance of flexible pavements. Recently constructed pavements having stabilized subgrades exhibit vastly superior resistance to rutting and other distortions as compared to most pavements ten or more years old.

2. A crack factor reflecting longitudinal and pattern cracking appears satisfactory for use in the performance evaluation of Virginia flexible pavements.

3. At a fixed degree of cracking, the accumulated trailer trucks and buses sustained by a flexible pavement is directly related to the rigidity of the pavement as determined from analysis of the Dynaflect deflection basin.

4. The terminal PSI as defined from the AASHO Road Test is too insensitive for use with Virginia flexible pavement designs.

ACKNOWLEDGEMENTS

The author gratefully acknowledges the excellent cooperation of numerous resident engineers and field maintenance personnel who have made essential contributions to the conduct of the study through their provision of maintenance records and their assistance in the collection of field data.

C. S. Hughes and Dr. N. K. Vaswani are acknowledged for their conduct of portions of the study and for their technical assistance in other portions. The interest and cooperation shown by R. W. Gunn and G. V. Leake in the collection and analysis of data are sincerely appreciated. Mr. Gunn is to be particularly commended for his development of the bending factor concept utilized in the analysis of deflection data.

The work was conducted under the general direction of Jack H. Dillard and the late Dr. Tilton E. Shelburne, state highway research engineers. The study was financed from HPR funds in cooperation with the U. S. Federal Highway Administration.

REFERENCES

1. Nichols, F. P., Progress Report Number Three, Performance Study of Typical Virginia Pavements, Virginia Highway Research Council, May 1965.

2. Interim Guide for the Design of Flexible Pavement Structures, American Association of State Highway Officials, Washington, D. C., October 1961

3. Hughes, C. S., Regression Equation to Estimate Benkelman Beam Values from Dynaflect Results, Virginia Highway Research Council, July 1967.

4. Vaswani, N. K., A Method for Evaluating the Structural Performance of Subgrades and/or the Overlying Flexible Pavements, Virginia Highway Research Council, August 1970.

5. Nielson, Guy F., and Gordon Peterson, Predicting Performance of Pavements by Deflection Measurements, Utah Department of Highways, September 1969.

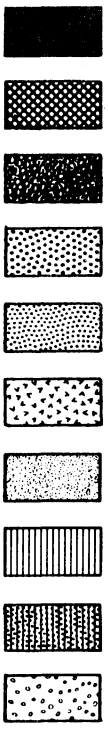
6. Cecchinni, Paul F., Evaluating and Resurfacing Old Pavements in Virginia, Virginia Department of Highways, January 1970.

APPENDICES

APPENDIX A

PROJECT CASE HISTORIES

The case histories tabulated on the following pages have been described in a preceding section of this report. The major components of pavement cross sections have been sketched with the materials indicated according to the following key:



Surface and binder courses, all types; also penetration tops.

Black base courses, H-3 (1) or special sand asphalts.

Water bound macadam bases.

Compacted aggregate bases or subbases (commercial sources).

Compacted aggregates (local pits).

Select material, Type I, commercially crushed.

Select materials, all other types.

In place soil, cement or lime added.

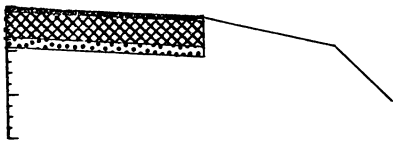
Imported material, cement or lime added.

Portland cement concrete.

101

Project No. 0019 & 0460-092-011
From: 5.136 mi. W. WCL Tazewell
To : 10.310 mi. W. WCL Tazewell
Cost: $39,985 Estimated Cost: $47,609

Completed: 9-17-55
County: Tazewell
Length: 5.174 mi.
Soil Area 5
Thickness Index 8



Surface: 1½" H-2
Base : 5½" H-3(1)
Subbase: 3" B-1 stone

Traffic: 94-180 Tractor-trailers & Buses

Deflection Data

		BF
3-5-67	0.000704	45
4-25-68	0.001000	42
6-9-69	0.001074	41

Crack Factor

5-23-67	92
6-18-68	95
11-17-69	54**

Remarks:

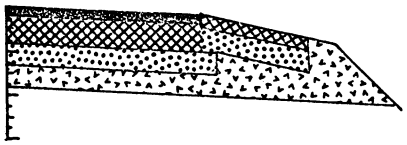
Resurfaced 1961-61 30#/sq. yd. F-4
**Partial resurface 135#/sq. yd. 8-29-69

Bad alligator cracking in areas not recently resurfaced. Occasional major patching. Considering age project has done well. Resurfaced portion in good shape except two isolated patches.

102

Project No. 0081-095-038,P1,P3
From: 0.110 mi. N. Int. Rte. 611
To : 0.036 mi. N. Int. Rte. 11 & 58
Cost: $76,507 - 106,930 Estimated Cost: $137,570 - 203,259

Completed: 6-27-62
County: Washington
Length: 6.304 mi.
Soil Area 5
Thickness Index 13.7-17.9



Surface: ½" F-1
Binder : 1½" H-2
Base : 7½" H-3(1)
Subbase: 6" Cr. Aggr.
Subbase: 6" - 18" S. M. CBR 30

Traffic: 675-1233 Tractor-trailers & Buses

Deflection Data

		BF
5-11-65	0.000827*	
5-2-67	0.000566	58
4-23-68	0.000532	60

Crack Factor

4-24-67	1
6-19-68	1
11-19-69	1

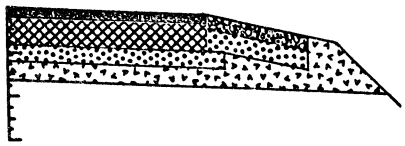
Remarks:

Isolated cracks; otherwise excellent performance.

Project No. 0081-095-009,P401
-038,P402
From: 0.036 mi. N. Int. Rte. 58 & 11
To : 0.397 mi. E. Int. Rte. 80
Cost: $65,789 Estimated Cost: $106,381
After Stage Construction:
Cost: $81,570 Estimated Cost: $123,435

Completed: 8-23-63
County: Washington
Length: 4.623
Soil Area 5
Thickness Index 10.5
After Stage Construction 13.5

891



Surface: 3/4" I-3
Base : 5½" H-3(1)
Subbase: 6" Cr. Aggr.
Subbase: 6" S. M. CBR 30

Traffic: 820-1235 Tractor-trailers & Buses

Deflection Data

		BF
5-13-65	0.001151*	
5-2-67	0.000708	57
4-22-68	0.000874	53

Crack Factor

5-24-67	0
6-19-68	0
11-19-68	0

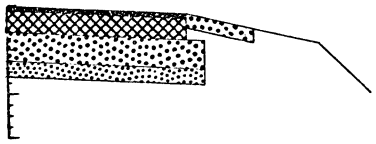
Remarks:

This project was designed for stage construction and 80#/sq. yd. S-5 and 250#/sq. yd. I-2 were added 6-27-67.
Mix in second stage had a brown color.
Resurface in excellent shape, excellent performance.

892

Project No. 0058-017-002-005
From: ECL Galax
To : W. End of bridge over Crooked Run
Cost: $60,298 Estimated Cost: $71,861

Completed: 11-13-57
County: Carroll
Length: 4.820 mi.
Soil Area 1
Thickness Index 10.6



Surface: 1½" I-3
Base : 5½" H-3(1)
Subbase: 8" Cr. Aggr.
Subbase: 4" S. M.

Traffic: 65-110 Tractor-trailers & Buses

Deflection Data

		BF
9-11-57	0.001654*	
4-27-67	0.000711	67
4-11-68	0.000684	72

Crack Factor

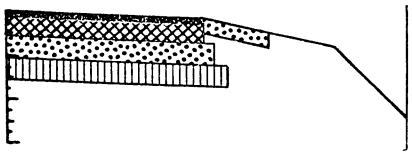
6-28-67	2
7-31-68	3
10-24-69	7

Remarks:

Select material on this project is processed mine tailings from Austinville. This material was also used to strengthen weak spots in subgrade. Project 0058-017-003,C501, P492 east of this project has not performed any better than this project; deflections are similar; appears not to have derived much from stabilization.
Isolated Cracks, Performance excellent.

Project No. 0058-017-003,C501,P402
From: 3.382 mi. W. WCL Hillsville
To : 0.411 mi. W. WCL Hillsville
Cost: $61,565 Estimated Cost: $62,325

Completed: 10-19-62
County: Carroll
Length: 2.951
Soil Area 1
Thickness Index 11.5



Surface: 1½" I-3
Base : 5½" H-3(1)
Subbase: 6" Cr. Aggr.
Subbase: 6" Soil Cement

Traffic: 65-110 Tractor-trailers & Buses

Deflection Data

		BF
4-27-67	0.000794	68
4-11-68	0.000747	74

Crack Factor

6-28-67	6
7-31-68	7
10-23-69	2

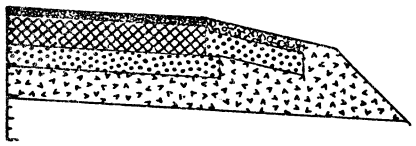
Remarks:

See remarks preceding Project. Excellent Performance

Project No. 0081-011-001
From: 0.843 mi. N NCL Buchanan
To : 0.274 mi. S. of Int. Rte. 610
Cost: $82,579 per mile Estimated Cost: $112,141

Completed: 12-23-60
County: Botetourt
Length: 4.890 mi.
Soil Area 2
Thickness Index 15.25

893



Surface: ½" F-1
Binder : 1½" H-2
Base : 7½" H-3(1)
Subbase: 6" Cr. Aggr.
Subbase: 9" S. M. CBR 10

Traffic: 828-1622 Tractor-trailers & Buses

Deflection Data

		BF
10-4-60	0.000468*	
5-10-62	0.000468*	
4-5-67	0.000520	49
4-18-68	0.000489	53
5-23-69	0.000512	51

Crack Factor

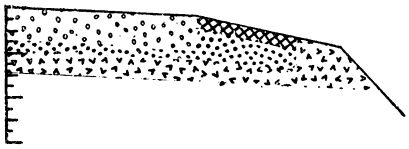
6-27-67	78
6-13-68	83
10-10-68	0** resurface
10-13-69	0

Remarks:

**Resurfaced 10-5-68 100#/sq. yd. S-5. Resurface in good shape, performance fair.

Project No. 0081-011-010,P401
007,P401
From: Roanoke-Botetourt CL
To : 0.280 mi. S. Int. Rte. 651
Cost: $116,899 Estimated Cost: $139,883

Completed: 12-3-64
County: Botetourt
Length: 5.220 mi.
Soil Area 2



Surface: 9" reinforced concrete
L. Course: 2" No. 10
Subbase: 6" S. M. CBR 30
61.5' Jts.

Traffic 900-1595 Tractor-trailers & Buses

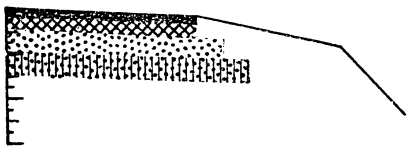
Remarks:

Joints (reasonably) well sealed and in pretty good shape (very little faulting). Intermittent cracking has had some patching.

205

Project No. 0122-009-101,C502
From: 0.121 mi. S. Int. Rte. 24
To : 0.323 mi. S. Int. Rte. 747
Cost: $69,860 Estimated Cost: $67,325

Completed: 8-30-68
County: Bedford
Length: 3.867 mi.
Soil Area 1
Thickness Index 9.1



Surface: 1" S-5
Binder : 1-1/4" I-2
Base : 3" B-3
Subbase: 6" Cr. Aggr.
Subbase: 6" Cement Tr. Cr. Aggr.

Traffic: 35-40 Tractor-trailers & Buses

Deflection Data

		BF
6-5-69	0.000640	64

Crack Factor

10-2-68	0
8-29-69	0

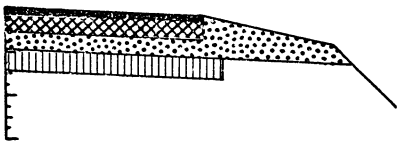
Remarks:

Excellent Condition

206

Project No. 0220-044-019,C5(.
From: 2.197 mi. N. North Carolina State Line
To : 4.508 mi. N. North Carolina State Line
Cost: $67,056 Estimated Cost: $84,728

Completed: 6-25-62
County: Henry
Length: 1.556 mi.
Soil Area 1
Thickness Index 10.8



Surface: 1½" I-3
Base : 5½" H-3(1)
Subbase: 4" Cr. Aggr.
Subbase: 6" Soil Cement

Traffic: 480-743 Tractor-trailers & Buses

Deflection Data

		BF
3-30-66	0.000719*	
4-19-66	0.000576*	
5-4-66	0.000647*	
10-21-66	0.000647*	
10-21-66	0.000585	59
4-21-67	0.000551	58
5-22-68	0.000729	57

Crack Factor

6-29-67	22
10-2-68	51
8-2[illegible]	53

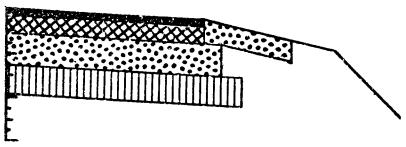
Remarks:

Some wheelpath cracking. Project has performed well. This is last report due to new construction which results in limit changes and resurfacing.

Project No. 0220-044-030
From: 1.342 mi. S. SCL Martinsville
To : 0.144 mi. S. SCL Martinsville
Cost: $76,032 Estimated Cost: $79,786

Completed: 10-29-59
County: Henry
Length: 1.067 mi.
Soil Area 1
Thickness Index 13.0

895



Surface: 1½" I-3
Base : 5½" H-3(1)
Subbase: 8" Cr. Aggr.
Subbase: 8" Soil Cement

Traffic: 455-743 Tractor-trailers & Buses

Deflection Data

		BF
4-28-60	0.002122*	
3-30-66	0.000719*	
4-19-66	0.000755*	
5-4-66	0.000899*	
10-21-66	0.000791*	
10-21-66	0.000852	68
4-21-67	0.000976	70
5-22-68	0.000976	64

Crack Factor

6-29-67	88
10-3-68	49
8-28-69	84

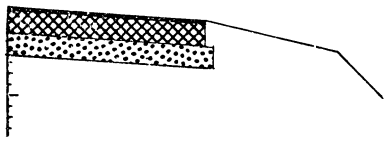
Remarks:

Project North of river in city had severe failures shortly after completion of project. This is shown in high deflections of 4-28-60. There were extensive repairs and 2 resurfacings. We do not have cost and rate of application as this part of project is in city of Martinsville. Recommend termination of project due to inability to secure data and dangerous traffic due to design of Rte. 58 interchange & curves North of river. Load related cracking fairly prevalent in unresurfaced portion, wheelpath alligator cracking. Performance is fair, poor in places.

208

Project No. 0460-009-017
From: 0.667 mi. W. W. End Big Otter River Bridge
To : 0.270 mi. E. of Little Otter River
Cost: $53,011 Estimated Cost: $55,752

Completed: 7-20-55
County: Bedford
Length: 2.472 mi.
Soil Area 1
Thickness Index 9.1



Surface: 1" I-3
Base : 6" H-3(1)
Subbase: 6" Cr. Aggr.

Traffic: 130-332 Tractor-trailers & Buses

Deflection Data

		BF
3-29-66	0.000971*	
4-19-66	0.001295*	
5-3-66	0.001079*	
10-25-66	0.000935*	
10-25-66	0.000782	59
4-24-67	0.001074	51
5-21-68	0.000972	54
6-4-69	0.000918	53

Crack Factor

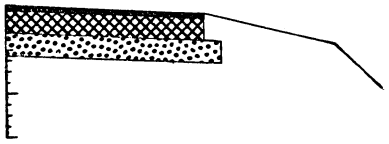
6-16-66	68
6-29-67	83
6-13-68	70
8-27-69	28**

Remarks:

Partial resurface 1968. No M-15 available. **1968 CF reflects patches; 1969 CF reflects partial resurface. Resurface Doing well (some places pushed). Resurface on rest of project 8-13-70. Performance good.

Project No. 0460-009-019
From: 3.154 mi. E. of E. End Bridge over Big Otter River
To : E. End of Bridge over Big Otter River
Cost: $53,222 Estimated Cost: $59,658

Completed: 10-12-56
County: Bedford
Length: 3.154 mi.
Soil Area 1
Thickness Index 9.10



Surface: 1" I-3
Base : 6" H-3(1)
Subbase: 6" Cr. Aggr.

Traffic: 130-332 Tractor-trailers & Buses

Deflection Data

		BF
6-25-57	0.001403*	
3-28-66	0.001187*	
4-18-66	0.001043*	
5-3-66	0.001043*	
10-25-66	0.000863*	
10-25-66	0.000843	60
4-24-67	0.001057	55
5-21-68	0.001095	56
6-4-69	0.000996	59

Crack Factor

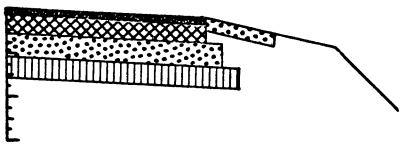
6-16-66	38
6-29-67	54
6-13-68	65
8-27-69	71

Remarks:

General Cracking (some severe), some rutting, some distortion, isolated patches. Performance good.

Project No. 7220-033-032
From: 0.394 mi. N. Rte. 619 (S. of Rocky Mount)
To : 2.350 mi. N. NCL Rocky Mount
Cost: $63,307 Estimated Cost: $73,851

Completed: 12-7-60
County: Franklin
Length: 5.057 mi.
Soil Area 1
Thickness Index 11.5



Surface: 1½" I-3
Base : 5½" H-3(1)
Subbase: 6" Cr. Aggr.
Subbase: 6" Soil Cement

Traffic: 375-635 Tractor-trailers & Buses

Deflection Data

		BF
3-29-66	0.000719*	
4-19-66	0.000719*	
10-24-66	0.000719*	
10-24-66	0.000692	60
4-25-67	0.000702	58
5-22-68	0.000790	60

Crack Factor

6-29-67	5
10-2-68	5

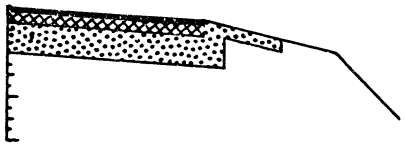
Remarks:

Project partially resurfaced with new construction 1969; project (other part) resurfaced with new construction 1970. Now 4 lane divided: Excellent performance 10 years in bad soil area under fairly heavy traffic. Very minor rutting. Both northern and southern ends have been resurfaced due to new construction.

Project No. 0015-014-101,C502
From: 5.139 mi. N. Buckingham-Prince Edward CL
To : 4.238 mi. S. Int. Rte. 60
Cost: $44,880 Estimated Cost: $55,187

Completed: 7-7-62
County: Buckingham
Length: 5.306 mi.
Soil Area 1
Thickness Index 7.8

897



Surface: 1½" I-3
Base : 3½" H-3(3)
Subbase: 8" Cr. Aggr.

Traffic: 60-90 Tractor-trailers & Buses

Deflection Data

		BF
4-7-66	0.000899*	
4-22-66	0.000863*	
5-9-66	0.001043*	
10-17-66	0.000719*	
11-3-66	0.000755	52
4-11-67	0.000867	49
4-2-68	0.001146	47
3-25-69	0.001114	48
4-15-69	0.000957	54

Crack Factor

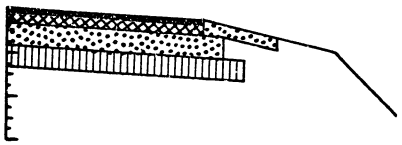
7-10-67	9
8-6-68	54
8-12-69	64

Remarks:

Rides good, substantial alligator cracking. Fair to poor performance.

Project No. 0015-019-101,C2
From: 4.546 mi. N. Mecklenburg CL
To : 0.468 mi. N. Int. Rte. 47 & 360 (Barnes Junction)
Cost: (Light Design) $59,242 Estimated Cost: $64,273
(Heavy Design) $72,494 Estimated Cost: $77,838

Completed: 5-16-61
County: Charlotte
Length: 3.368 mi.
Soil Area 1
Thickness Index:
Light Design 9.0
Heavy Design 12.5



	Light	Heavy
Surface:	1½"	1½" I-3
Base :	3"	5½" H-3(1)
Subbase:	6"	6" Cr. Aggr.
Subbase:	6"	6" Soil Cement

Traffic: Light Design - 43-60 Heavy Design - 80-1180 Tractor-trailers & Buses

Deflection Data

			BF	
			L	H
4-5-61	0.000576*			
4-3-62	0.000576*			
	Light	Heavy		
4-5-66	0.000576*	0.000719*		
4-21-66	0.000612*	0.000540*		
5-6-66	0.000719*	0.000612*		
10-17-66	0.000540*	0.000540*		
10-28-66	0.000760	0.000616	61	61
4-12-67	0.000927	0.000812	57	56
5-7-68	0.000864	0.000730	57	59
5-15-69	0.000954	0.000880	57	63

Crack Factor

8-30-67	56
8-8-68	67
9-17-69	95

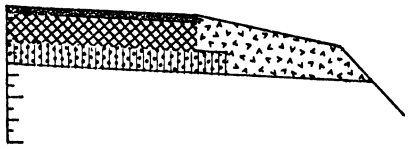
Remarks:

Additional 2½" H-3(1) appears to reduce deflections 9%; however, difference in traffic on two sections make this questionable. Cracking general, fair performance.

898

Project No. 0029-015-101,C501
From: 0.471 mi. S. SCL Lynchburg
To : 2.114 mi. S. SCL Lynchburg
Cost: $111,197 Estimated Cost: $98,166

Completed: 9-14-64
County: Campbell
Length: 1.643 mi.
Soil Area 1
Thickness Index 11.4



Surface: 1½" I-3
Base : 7½" H-3(1)
Subbase: 6" Cement treated Cr. Aggr.

Traffic: 340-410 Tractor-trailers & Buses

Deflection Data

		BF
4-20-65	0.000396*	
4-20-67	0.000449	72
5-9-68	0.000440	73
4-17-69	0.000518	74

Crack Factor

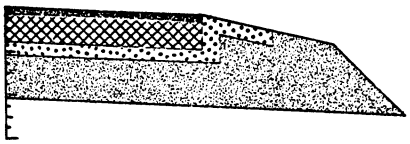
8-28-67	0
8-6-68	0
8-27-69	0

Remarks:

Excellent Performance

Project No. 0058-041-012-033
From: 0.192 mi. W. of Int. Rte. 501
To : 4.570 mi. E. of Turbeville P.O.
Cost: $67,478 Estimated Cost: $88,709

Completed: 1-15-59
County: Halifax
Length: 4.452 mi.
Soil Area 1
Thickness Index 10.4



Surface: 1½" I-3
Base : 7½" H-3(1)
Subbase: 4" Cr. Aggregate
Subbase: 12" S. B. CBR 12

Traffic: 875-1085 Tractor-trailers & Buses

Deflection Data

		BF
2-26-59	0.001331*	
10-29-59	0.002050*	
4-21-60	0.002878*	
3-3-61	0.002921*	
3-29-62	0.002906*	
4-?-64	0.001882*	
4-9-65	0.001863*	
4-19-67	0.001382	50
5-8-68	0.001200	53
5-14-69	0.001242	53

Crack Factor

8-29-67	38
8-7-68	85
10-16-69	100

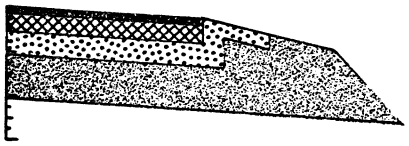
Remarks:

Summer 1963 12' seal tr.
8-30-63 160#/sq. yd. I-3 Poor performance.

304B

Project No. 0058-041-012-033
From: 0.192 mi. W. of Int. Rte. 501
To : 4.570 mi. E. of Turbeville P.O.
Cost: $62,304 Estimated Cost: $83,672

Completed: 1-15-59
County: Halifax
Length: 4.452 mi.
Soil Area 1
Thickness Index 9.1



Surface: 1½" I-3
Base : 5½" H-3(1)
Subbase: 6" Cr. Aggr.
Subbase: 12" S. B. CBR 12

Traffic: 875-1085 Tractor-trailers & Buses

Deflection Data

		BF
2-26-59	0.001007*	
10-26-59	0.001223*	
4-21-60	0.001681*	
3-3-61	0.001547*	
3-29-62	0.001518*	
4-?-64	0.001511*	
4-9-65	0.001302*	
4-19-67	0.001166	46
5-8-68	0.000977	50
5-14-69	0.001007	50

Crack Factor

8-29-67	13
8-7-68	65
10-16-69	74

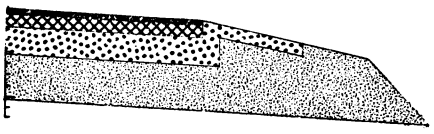
Remarks:

Summer 1963 12' seal over traffic lane
8-30-63 160#/sq. yd. I-3 resurface. Poor performance

304C

Project No. 0058-041-012-033
From: 0.192 mi. W. of Int. Rte. 501
To : 4.570 mi. E. of Turbeville P.O.
Cost: $57,077 Estimated Cost: $78,345

Completed: 1-15-59
County: Halifax
Length: 4.452 mi.
Soil Area 1
Thickness Index 7.8



Surface: 1½" I-3
Base : 3½" H-3(1)
Subbase: 8" Cr. Aggr.
Subbase: 12" S. B. CBR 12

Traffic: 875-1085 Tractor-trailers & Buses

Deflection Data

		BF
2-26-59	0.001799*	
10-26-59	0.001583*	
4-21-60	0.002033*	
3-3-61	0.001964*	
3-29-62	0.001878*	
4-?-64	0.001809*	
4-9-65	0.001518*	
4-19-67	0.001496	49
5-8-68	0.001259	53
5-14-69	0.001326	53

Crack Factor

8-29-67	47
8-7-68	87
10-16-69	99

Remarks:

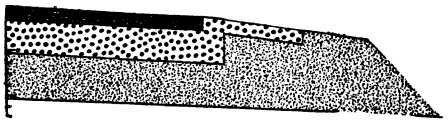
1960 150#/sq. yd. I-3 on portion design C, extensive work on subgrade and base. 1963 12' seal over traffic lane.
8-30-63 160#/sq. yd. I-3 resurface. Poor performance.

900

304D

Project No. 0058-041-012-033
From: 0.192 mi. W. of Int. Rte. 501
To : 4.570 mi. E. of Turbeville P.O.
Cost: $55,018 Estimated Cost: $78,487

Completed: 1-15-59
County: Halifax
Length: 4.452 mi.
Soil Area 1
Thickness Index 7.2



Surface: 1½" I-3
Binder : 2½" H-2
Base : 9" Cr. Aggr.
Subbase: 12" S. B. CBR 12

Traffic: 875-1085 Tractor-trailers & Buses

Deflection Data

		BF
8-26-59	0.001331*	
10-26-59	0.001223*	
4-21-60	0.001831*	
3-3-61	0.001856*	
3-29-62	0.001871*	
4-?-64	0.001554*	
4-9-65	0.001406*	
4-19-67	0.001322	45
5-8-68	0.001163	50
5-14-69	0.001209	49

Crack Factor

8-29-67	28
8-7-68	86
10-16-69	90

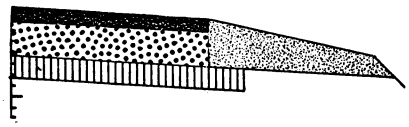
Remarks:

1963 12' seal over traffic lane
8-30-63 160#/sq. yd. I-3 resurfacing. Poor performance.

305

Project No. 0058-071-020
From: 4.353 mi. E. Henry CL
To : 4.524 mi. W. WCL Danville
Cost: $51,005 Estimated Cost: $64,712

Completed: 11-11-61
County: Pittsylvania
Length: 5.457 mi.
Soil Area 1
Thickness Index 9.6



Surface: 1½" I-3
Binder : 2½" H-2
Base : 9" Cr. Aggr.
Subbase: 6" Soil Cement

Traffic: 210-255 Tractor-trailers & Buses

Deflection Data

		BF
4-4-62	0.000827*	
4-27-64	0.001043*	
3-31-66	0.000817*	
4-20-66	0.000791*	
5-4-66	0.000899*	
10-20-66	0.000683*	
10-20-66	0.000896	55
4-24-67	0.001055	54
5-29-68	0.001216	52

Crack Factor

8-28-67	41
10-3-68	75
8-28-69	95

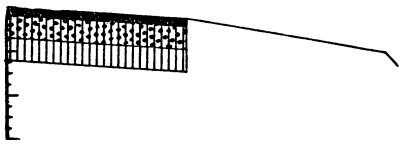
Remarks:

Extensive long cracking WP mostly in traffic lane. Performance - Fair. Western portion of WBL resurfaced August 1970, ending at Rte. 841 in north side.

306

Project No. 0060-024-746,HS-1,IS-1
From: Powhatan County Line
To : 0.063 mi. W. Int. Rte. 622 (Cumberland C.H.)
Cost: $33,898 Estimated Cost: $45,060

Completed: 5-20-48
County: Cumberland
Length: 7.686 mi.
Soil Area 1
Thickness Index 10.9



Surface: 1" F-1
Binder : 1½" H-2
Base : 6" cement treated select material
Subbase: 6" soil cement

901

Traffic: 156-230 Tractor-trailers & Buses

Deflection Data

		BF
5-10-55	0.000468*	
4-9-62	0.000647*	
4-10-67	0.000921	68
5-3-68	0.001051	72
3-31-69	0.000976	72

Crack Factor

7-10-67	77
8-12-68	83

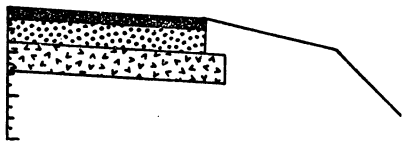
Remarks:

9-15-59 150#/sq. yd. I-3 resurface 7.00/ton
10-21-67 120#/sq. yd. S-5 resurface 7.70/ton
8-19-70 Abundance of transverse cracking, substantial longitudinal cracking (not clearly load related). Sealing cracks has hurt appearance and riding quality. Pavement has performed well. Sealing which was done in summer of 1969 is now ineffective because cracks have come through seal.

307

Project No. 0151-062-101,C501
From: 0.102 mi. S. Rte. 610
To : Int. Rte. 151 at Avon
Cost: $45,619 Estimated Cost: $51,385

Completed: 6-27-62
County: Nelson
Length: 1.598 mi.
Soil Area 2
Thickness Index 6.7



Surface: 1" I-3
Binder : 2" H-2
Base : 6" Cr. Aggr.
Subbase: 8" S.M. CBR 30

Traffic: 110-145 Tractor-trailers & Buses

Deflection Data

		BF
4-14-67	0.001024	48
3-22-68	0.000878	56
3-27-69	0.001009	52

Crack Factor

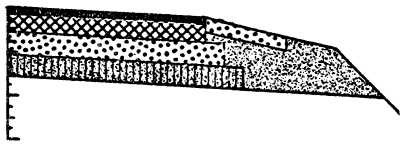
10-18-62	0
6-20-63	0
4-5-65	12
7-6-67	83
8-14-68	94
9-16-69	100

Remarks:

Some patching, 100% cracked. Poor performance.

Project No. 0304-041-002,C501
From: ECL South Boston
To : 0.170 mi. E. Int. Rte. 344 (Foster's Store)
Cost: $57,710 Estimated Cost: $92,453

Completed: 10-6-62
County: Halifax
Length: 6.130 mi.
Soil Area 1
Thickness Index 12.7



Surface: 1½" I-3
Base : 5½" H-3(1)
Subbase: 6" Cr. Aggr.
Subbase: 6" Cement treated select material CBR 15

Traffic: 970-1120 Tractor-trailers & Buses

Deflection Data

		BF
4-30-63	0.000612*	
4-4-66	0.000576*	
4-21-66	0.000504*	
5-6-66	0.000612*	
10-18-66	0.000465*	
10-18-66	0.000592	65
4-19-67	0.000778	58
5-7-68	0.000904	61
5-14-69	0.000817	61

Crack Factor

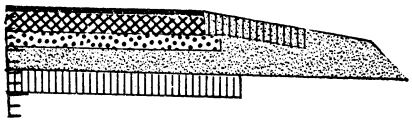
11-2-62	0
7-23-63	0
10-1-65	2
8-29-67	19
8-7-68	62
10-16-69	76

Remarks:

Passing lane cracked in some areas (inside curve). Settlement patch. Cracking; occasional transverse cracking. Fair performance.

Project No. 0360-073-008
-019-002
From: 1.768 mi. W. Charlotte-Prince Edward CL
To : 0.014 mi. W. of W. End Future Virginian R.R. overpass
Cost: $65,842 Estimated Cost: $72,616

Completed: 11-14-62
County: Charlotte and Prince Edward
Length: 5.821 mi.
Soil Area 1
Thickness Index 10.8



Surface: 1½" I-3
Base : 5½" H-3(1)
Subbase: 4" Cr. Aggr.
Subbase: 6" S. M. CBR 20
Subbase: 6" Soil Cement

Traffic: 1015-1220 Tractor-trailers & Buses

Deflection Data

		BF
4-10-62	0.001260*	
4-16-62	0.001607*	
12-5-62	0.000845*	
3-19-63	0.001229*	
4-17-64	0.001379*	
4-6-66	0.001230*	
4-21-66	0.001230*	
11-3-66	0.000893	51
12-13-66	0.000935*	
4-12-67	0.001172	51
5-7-68	0.001277	50
4-21-69	0.001505	49

Crack Factor

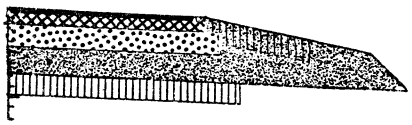
7-12-67	35
8-8-68	60
8-13-69	49

Remarks:

Isolated patching; minor alligator cracking; Longitudinal crkg.; transverse cracks, minor rutting; best performance of four designs.

Project No. 0360-073-008
-019-002
From: 1.768 mi. W. Charlotte-Prince Edward CL
To : 0.014 mi. W. of W. End future Virginian RR overpass
Cost: $69,221 Estimated Cost: $69,353

Completed: 11-14-62
County: Charlotte & Prince Edward
Length: 5.821 mi.
Soil Area 1
Thickness Index 12.9



Surface: 1½" I-3
Base : 3" H-3(1)
Subbase: 6" Cement tr. cr. aggr.
Subbase: 6" S. M. CBR 20
Subbase: 6" Soil cement

Traffic: 1015-1220 Tractor-trailers & Buses

Deflection Data

		BF
4-10-62	0.000659*	
4-16-62	0.000581*	
12-5-62	0.000581*	
3-19-63	0.000695*	
4-17-64	0.000672*	
4-5-65	0.000689*	
4-6-66	0.000773*	
4-21-66	0.000659*	
11-3-66	0.000613	54
12-13-66	0.000576*	
4-12-67	0.000852	57
5-7-68	0.000870	58
4-21-69	0.001003	60

Crack Factor

7-12-67	28
8-8-68	34
8-13-69	56

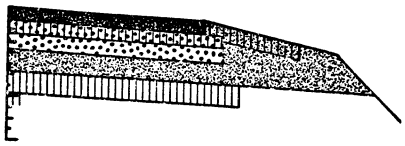
Remarks:

Transverse cracks, alligator & long. cracks; riding surface good; 2nd best performance--would be best except for deterioration in riding qualities due to transverse cracks.

309C

Project No. 0360-073-008
-019-002
From: 1.768 mi. W. Charlotte-Prince Edward CL
To : 0.014 mi. W. of W. End future Virginian RR overpass
Cost: $64,838 Estimated Cost: $68,075

Completed: 11-14-62
County: Charlotte & Prince Edward
Length: 5.821 mi.
Soil Area 1
Thickness Index 10.8



Surface: 1½" I-3
Binder : 1½" H-2
Base : 4" cement tr. cr. aggr.
Subbase: 4" Cr. aggr.
Subbase: 6" S. M. CBR 20
Subbase: 6" soil cement

Traffic: 1015-1220 Tractor-trailers & Buses

Deflection Data

		BF
4-10-62	0.001049*	
4-16-62	0.000581*	
12-5-62	0.000773*	
3-19-63	0.001103*	
4-17-64	0.001121*	
4-5-65	0.001133*	
4-6-66	0.001252*	
4-21-66	0.001115*	
11-3-66	0.001012	50
12-13-66	0.001043*	
4-12-67	0.001176	48
5-7-68	0.001179	49
4-21-69	0.001511	49

Crack Factor

7-12-67	92
8-8-68	99
8-13-69	100

Remarks:

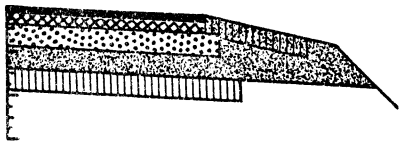
Some patches; transverse cracks; severe alligator cracks; poor riding surface; poor performance.

904

309D

Project No. 0360-073-008
-019-002
From: 1.788 mi. W. Charlotte-Prince Edward CL
To : 0.014 mi. W. of W. end future Virginian RR overpass
Cost: $61,248 Estimated Cost: $69,453

Completed: 11-14-62
County: Charlotte & Prince Edward
Length: 5.821 mi.
Soil Area 1
Thickness Index 9.0



Surface: 1½" I-3
Base : 3" H-3(1)
Subbase: 6" Cr. Aggr.
Subbase: 6½" S. M. CBR 20
Subbase: 6" Soil cement

Traffic: 1015-1220 Tractor-trailers & Buses

Deflection Data

		BF
4-10-62	0.002151*	
4-16-62	0.001727*	
12-5-62	0.001103*	
3-19-63	0.001565*	
4-19-64	0.001463*	
4-5-65	0.001583*	
4-6-66	0.001428*	
4-21-66	0.001263*	
11-3-66	0.001043	48
12-13-66	0.001151*	
4-12-67	0.001346	43
5-7-68	0.001428	43
4-21-69	0.001676	41

Crack Factor

7-12-67	92
8-8-68	95
8-13-69	84

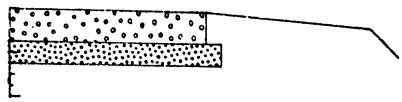
Remarks:

Severe cracking throughout; patched; minor rutting; terminal condition. Poor performance

310

Project No. 0360-285-A2R-1,A1R-1
From: 0.082 mi. E. Nottoway-Prince Edward CL
To : 1.106 mi. E. of Green Bay
Cost: $50,477 Estimated Cost: $87,453

Completed: 12-4-47
County: Prince Edward
Length: 4.630 mi.
Soil Area 1



Surface: 9" Reinf. concrete
Subbase: 6" subgrade tr.

Traffic: 549-1130 Tractor-trailers & Buses

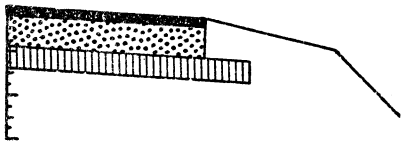
Remarks:

Faulting: Joints in good shape except for faulting; scaling, some cases slabs are covered with plant mix, possibly for sealing; some settlement; isolated joint failures.

311

Project No. 0501-041-102,C501
From: 0.728 mi. N. Volens
To : 3.056 mi. N. Volens
Cost: $49,579 Estimated Cost: $50,144

Completed: 11-16-62
County: Halifax
Length: 2.327 mi.
Soil Area 1
Thickness Index 7.7



Surface: 1" I-3
Binder : 1½" H-2
Base : 8" Cr. Aggr.
Subbase: 6" soil cement

Traffic: 45-70 Tractor-trailers & Buses

Deflection Data

		BF
4-30-63	0.000755*	
4-1-66	0.000935*	
4-20-66	0.000863*	
5-5-66	0.000971*	
10-20-66	0.000863*	
10-20-66	0.000958	54
4-19-67	0.001006	53
5-9-68	0.000985	56
5-15-69	0.001138	56

Crack Factor

8-29-67	17
8-7-68	20
8-26-69	30

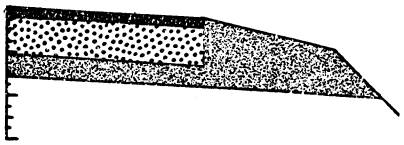
Remarks:

Isolated patches; distortion; rutting occurs in areas of alligator cracking; performance disappointing when compared with other projects 102,C502.

312

Project No. 0501-041-102,C502-104,C501
From: 3.056 mi. N. Volens
To : S. End Staunton River Bridge
Cost: $46,992 Estimated Cost: $55,377

Completed: 8-22-62
County: Halifax
Length: 5.008 mi.
Soil Area 1
Thickness Index 10.0



Surface: 1" I-3
Binder : 1½" H-2
Base : 10" Cr. Aggr.
Subbase: 6" S. M. CBR 12

Traffic: 35-70 Tractor-trailers & Buses

Deflection Data

		BF
4-1-63	0.001079*	
4-1-66	0.001295*	
4-20-66	0.001331*	
5-5-66	0.001403*	
10-20-66	0.001115*	
10-20-66	0.000892	57
4-20-67	0.000995	55
5-8-68	0.001209	54
5-15-69	0.001211	56

Crack Factor

8-29-67	8
8-7-68	12
8-26-69	25

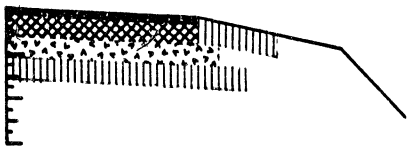
Remarks:

Isolated patches; settlement; distortion in high deflection areas; north & south ends in terminal condition otherwise in good shape. Performance - fair.

313A

Project No. 7360-019-102,C501
From: 2.014 mi. S. Int. Rte. 40
To : 1.263 mi. W. Prince Edward CL
Cost: $70,752 Estimated Cost: $83,435

Completed: 12-31-65
County: Charlotte
Length: 4.486 mi.
Soil Area 1
Thickness Index 11.5



Surface: 1½" I-3
Base : 5½" H-3(1)
Subbase: 6" S. M. Gr. 1
Subbase: 6" Soil cement

Traffic: 835-970 Tractor-trailers & Buses

Deflection Data

		BF
4-5-66	0.000899*	
4-11-67	0.001028	54
5-7-68	0.000974	62
4-21-69	0.001200	57

Crack Factor

7-12-67	2
9-17-69	15

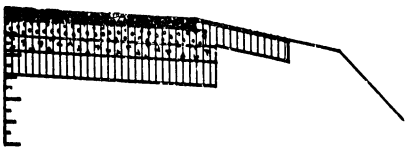
Remarks:

Very minor cracking, performance good.

313B

Project No. 7360-019-102,C501
From: 2.014 mi. S. of Int. Rte. 40
To : 1.263 mi. W. Prince Edward CL
Cost: $73,075 Estimated Cost: $72,769

Completed: 12-31-65
County: Charlotte
Length: 4.486 mi.
Soil Area 1
Thickness Index 13.4



Surface: 1" I-3
Binder : 2" H-2
Base : 4" cement treated cr. aggr.
Subbase: 4" Cr. aggr.
Subbase: 6" Soil cement

Traffic: 835-970 Tractor-trailers & Buses

Deflection Data

		BF
4-5-66	0.000360*	
4-11-67	0.000430	70
5-6-68	0.000419	77
4-21-69	0.000465	74
Passing Lane No Cement in 4" Cr. Aggr.		
4-6-66	0.000899*	
4-11-67	0.000879	50
5-6-68	0.000770	49
4-21-69	0.001056	47

Crack Factor

7-12-67	2
9-17-69	37

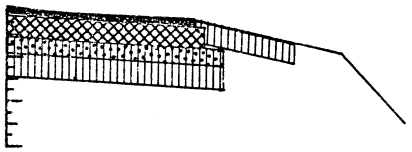
Remarks:

Transverse cracking (traffic lane only) some are pumping. Cement in both lanes on exp. sections E. of Rte. 40. Transverse cracking across both lanes. One mile east of Rte. 40 on EBL--appears to be slab action including obvious pumping. Performance, poor.

907

Project No. 7360-019-102,C501
From: 2.014 mi. S. of Int. Rte. 40
To : 1.263 mi. W. Prince Edward CL
Cost: $72,230 Estimated Cost: $79,152

Completed: 12-31-65
County: Charlotte
Length: 4.486 mi.
Soil Area 1
Thickness Index 13.4



Surface: 1½" I-3
Base : 5½" H-3(1)
Subbase: 4" Ct. aggr.
Subbase: 6" soil cement

Traffic: 835-970 Tractor-trailers & Buses

Deflection Data

		BF
4-5-66	0.000432*	
4-11-67	0.000486	70
5-6-68	0.000436	79
4-21-69	0.000608	77
Passing Lane less Cement in 4" Cr. Aggr.		
4-6-66	0.000576*	
4-11-67	0.000687	63
5-6-68	0.000677	66
4-21-69	0.001050	65

Crack Factor

7-12-67	0
9-17-69	16

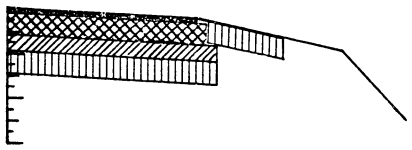
Remarks:

Compare with Design B. Transverse cracking-- occurred after cracks in B section. Non-visible in passing lane even in section E of Rte. 40 which has cement. Performance, fair.

313D

Project No. 7360-019-102,C501
From: 2.014 mi. S. Int. Rte. 40
To : 1.263 mi. W. Prince Edward CL
Cost: $77,141 Estimated Cost: $92,521

Completed: 12-31-65
County: Charlotte
Length: 4.486 mi.
Soil Area 1
Thickness Index 13.4



Surface: 1½" I-3
Base : 5½" H-3(1)
Subbase: 4" B-4 (lean mix)
Subbase: 6" Soil cement

Traffic: 835-970 Tractor-trailers & Buses

Deflection Data

		BF
4-5-66	0.000504*	
4-11-67	0.000568	69
5-6-68	0.000572	76
4-21-69	0.000635	75

Crack Factor

7-12-67	0
9-17-69	11

Remarks:

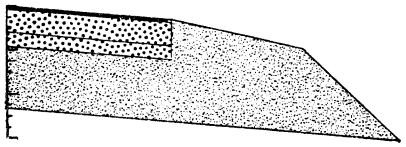
Excellent performance.

908

401

Project No. 0005-018-016
From: 0.041 mi. E. Int. Rte. 155 (Charles City C.H.)
To : 2.272 mi. E. Charles City C.H.
Cost: $28,723 Estimated Cost: $31,347

Completed: 10-30-58
County: Charles City
Length: 2.226 mi.
Soil Area 4
Thickness Index 4.4



Surface: 1½" surface tr.
Base : 6" soil aggr.
Subbase: 4" subgrade tr.
Subbase: 18" select borrow

Traffic: 18-55 Tractor-trailers & Buses

Deflection Data

		BF
4-5-67	0.000842	44
3-20-68	0.001037	38
4-29-69	0.000860	49

Crack Factor

10-26-67	5
9-10-68	15
9-4-69	13

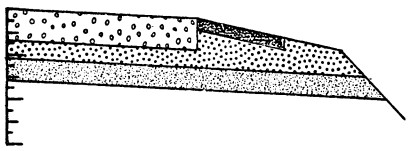
Remarks:

150#/sq. yd. F-1 added 5-23-61. Project in good shape; good riding quality. Excellent Performance

402

Project No. 0064-043-001,C501
From: 0.356 mi. W. Rte. 250 (N. Short Pump)
To : 0.316 mi. W. Parham Road
Cost: $140,818 Estimated Cost: $130,353

Completed: 6-21-67
County: Henrico
Length: 2.756 mi.
Soil Area 3



Surface: 8" Cont. Reinf. Concrete
Subbase: 6" subbase matl. (modified)

Traffic: 210-315 Tractor-trailers & Buses

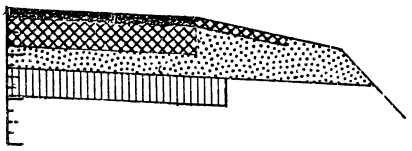
Remarks:

Occasional random cracking appears related to poor batches of concrete. Transverse pattern of approximately 3 ft. spacing is as expected. Several settlements have been bridged by pavement. One or two have been jacked back to grade with no apparent damage to pavement.

403

Project No. 0095-042-003,P401
From: 0.368 mi. N. Int. Rte. 54
To : 4.582 mi. N. Int. Rte. 54
Cost: $75,240 Estimated Cost: $98,187

Completed: 9-11-63
County: Hanover
Length: 4.120 mi.
Soil Area 3 & 4
Thickness Index 14.9



Surface: 1" I-3
Binder : 1½" H-2
Base : 7⅝" H-3(1)
Subbase: 6" subbase matl. Gr. 1
Subbase: 7" soil cement

Traffic: 4,090-6,170 Tractor-trailers & Buses

Deflection Data

		BF
4-4-67	0.000475	56
3-25-68	0.000474	58
4-9-69	0.000540	56

Crack Factor

11-29-67	3
8-15-68	0

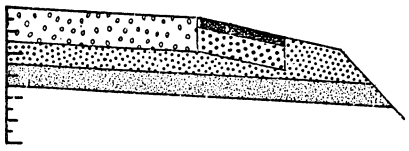
Remarks:

As of June 1970, approximately 12.6 million Tractor-trailers & Buses have used road. Excellent Performance. Trace of crkg.; occasional aggr. plucking.

404

Project No. 0095-042-101,P401
From: Henrico-Hanover CL
To : 0.368 mi. N. Int. Rte. 54
Cost: $101,587 Estimated Cost: $170,950

Completed: 7-15-63
County: Hanover
Length: 5.881 mi.
Soil Area 3 & 4



Surface: 9" Reinf. Concr.
Subbase: 6" Subbase matl. Gr. I
Subbase: 6" S. M. CBR 30

Traffic: 1535-6410 Tractor-trailers & Buses

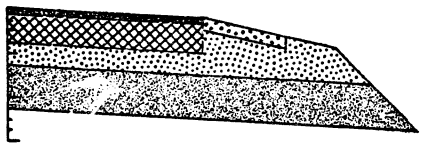
Remarks:

Joints reasonably well sealed: extensive pumping (edge & joint); some faulting of longitudinal joints; surface badly "flecked". Some evidence of frozen dowels; General performance has been good.

405

Project No. 0360-020-031,C1
From: 4.984 mi. W. Int. Rte. 621
To : 1.937 mi. W. Int. Rte. 621
Cost: $61,987 - $70,171 Estimated Cost: $74,765 - $85,003

Completed: 9-4-59
County: Chesterfield
Length: 3.047 mi.
Soil Area 3
Thickness Index 11.1



Surface: 1½" F-1
Base : 7½" H-3(1)
Subbase: 6" subgrade tr.
Subbase: 12"-24" S. M. CBR 20

Traffic: 1153-1440 Tractor-trailers & Buses

Deflection Data

		BF
5-3-65	0.001187*	
4-7-66	0.000741*	
4-26-66	0.000612*	
5-11-66	0.000576*	
10-12-66	0.000504*	
10-27-66	0.000449	66
9-12-67	0.000791	60
3-19-68	0.000876	63
4-22-69	0.000773	65

Crack Factor

9-12-67	34
8-13-68	1
9-18-69	11

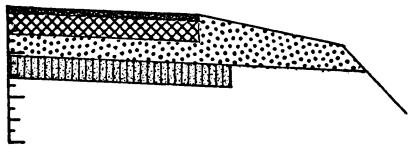
Remarks:

Project resurfaced 10-20-67 150#/sq. yd. S-5 (CF 34). Appears wavy; some alligator cracking; isolated fat spots; fair performance.

406

Project No. 0360-020-031,C502
From: 1.206 mi. E. Amelia CL
To : 4.984 mi. W. Int. Rte. 621
Cost: $78,883 Estimated Cost: $86,824

Completed: 8-5-63
County: Chesterfield
Length: 5.256 mi.
Soil Area 3
Thickness Index 11.5



Surface: 1½" F-1
Base : 5½" H-3(1)
Subbase: 6" subgrade matl. gr. 1
Subbase: 6" cement tr. select matl.

Traffic: 1225-1480 Tractor-trailers & Buses

Deflection Data

		BF
4-30-65	0.000612*	
3-19-68	0.000826	59
4-22-69	0.000776	63

Crack Factor

9-12-67	26
8-13-68	28
9-18-69	55

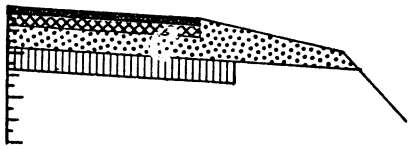
Remarks:

0.4 mi. of project at east end resurfaced 150#/sq. yd. S-5 10-10-67. Some alligator & longitudinal cracking; fair riding quality; appears wavy; performance fair.

911

Project No. 0460-067-008,C501
From: Dinwiddie-Nottoway CL
To : 3.302 mi. W. Dinwiddie-Nottoway CL
Cost: $86,909 Estimated Cost: $77,616

Completed: 8-24-63
County: Nottoway
Length: 3.302 mi.
Soil Area 3
Thickness Index 9.0



Surface: 1½" I-3
Base : 3" H-3(1)
Subbase: 6" subbase matl. gr. 1
Subbase: 6" Lime stabilization

Traffic: 110-185 Tractor-trailers & Buses

Deflection Data

		BF
5-4-64	0.001115*	
4-7-67	0.001095	53
3-19-68	0.001224	50
4-23-69	0.001244	54

Crack Factor

7-21-65	0
8-30-67	12
10-11-68	41
8-29-69	87

Remarks:

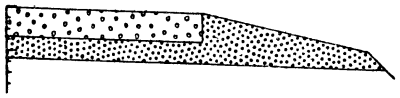
Resurfaced; poor performance.

912

501

Project No. 0013-065-001
From: Int. Rte. 645
To : 0.421 mi. N. Int. Rte. 624
Cost: $60,984 - $67,795 Estimated Cost: $77,442 - $88,804

Completed: 8-28-50
County: Northampton
Length: 2.780 mi.
Soil Area 4



Surface: 8" Reinf. Concrete
Subbase: 6" subgrade tr.
30' jt. spacing

Traffic: 279-415 Tractor-trailers & Buses

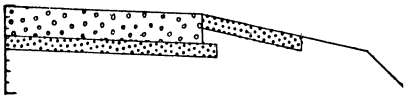
Remarks:

Reflection cracking experiment on this project. 140#/sq. yd. H-2 and 100#/sq. yd. I-3 applied 9-10-63. 2335' of northern end resurfaced 1968.
8-5-70 - Reflection crack experiment: sanding has prevented about 2/3 of reflection cracks. Visible cracks are very fine--probably should not be sealed at this time.

502

Project No. 0013-065-006
From: Int. Rte. 703
To : 0.413 mi. N. Int. Rte. 624
Cost: $80,203 Estimated Cost: $83,894

Completed: 11-21-57
County: Northampton
Length: 2.878 mi.
Soil Area 4



Surface: 8" Reinf. concrete
Subbase: 6" subgrade tr.
50' jt. spacing

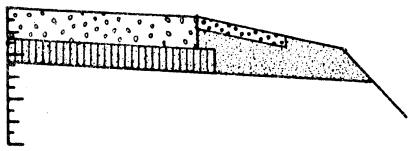
Traffic: 305-415 Tractor-trailers & Buses

Remarks: Occasional blowup, very few joint spalls, occasional frozen dowel, minor faulting, some wear in traffic lane, poorly sealed joints; Project has performed near average.

503

Project No. 0013-065-101,C501
From: 0.284 mi. S. Int. Rte. 184
To : 0.170 mi. N. NCL Cheriton
Cost: $84,533 Estimated Cost: $95,869

Completed: 12-8-65
County: Northampton
Length: 2.627 mi.
Soil Area 4



Surface: 8" plain Cem. Concr.
Subbase: 6" select borrow
20' jt. spacing

Traffic: 360-420 Tractor-trailers & Buses

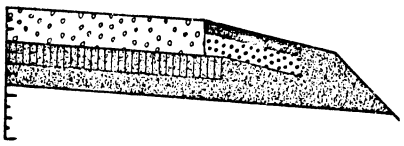
Remarks:

Project is actually 7.901 mi. long, but only southernmost 2.627 mi. in study.
8-5-70 - Minor faulting, isolated joint spalls, rusted unitube, leaky joints, evidence of occasional "frozen" dowels. Project rides good. Some wear in traffic lanes.

504

Project No. 0095-040-012-033
From: North Carolina State Line
To : 3.791 mi. S. Rte. 58
Cost: $83,846 Estimated Cost: $133,362

Completed: 10-26-62
County: Greensville
Length: 7.206 mi.
Soil Area 4



Surface: 9" plain Cem. Concr.
Subbase: 6" cement treated select M.
Subbase: 6" select M.
20' jts.

Traffic: 1210-1820 Tractor-trailers & Buses

Remarks:

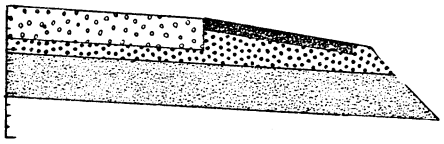
First slip form paver in state. Note major maintenance joints 1969. Riding surface good; new sealant high, all spalls repaired, no faulting: 80% repaired spalls appear in wheel paths. Performance good except for joint spalls.

914

505

Project No. 0095-040-015
From: 0.224 mi. S. Int. Rte. 58
To : 2.329 mi. N. Int. Rte. 58
Cost: $106,075 Estimated Cost: $131,118

Completed: 10-9-58
County: Greensville
Length: 2.493 mi.
Soil Area 4



Surface: 9" Reinf. Concr.
4" Cr. Aggr.
12" Select Matl.
50' jts.

Traffic: 778-1890 Tractor-trailers & Buses

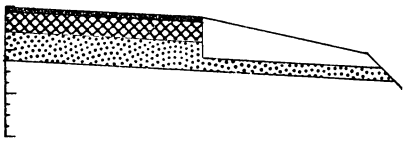
Remarks:

Project has wear in wheel paths; some scaling, joints in good shape: Performance good.

506

Project No. 0301-040-005
From: NCL Emporia
To : 1.019 mi. S. Sussex CL
Cost: $31,680 Estimated Cost: $47,504

Completed: 6-23-55
County: Greensville
Length: 3.950
Soil Area 4
Thickness Index 9.8



Surface: 1½" F-1
5½" sand asphalt
8" subgrade tr.

Traffic: 586-1865 Tractor-trailers & Buses

Deflection Data

		BF
4-29-55	0.001151*	
6-13-57	0.000978*	
4-7-67	0.000782	57
3-18-68	0.000896	57
4-3-69	0.000958	58

Crack Factor

12-19-67	61
10-17-68	59

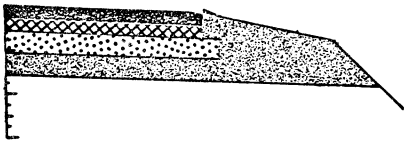
Remarks:

Partial resurface (NBL) June 1963. Partial resurface (SBL) June 1965. Partial resurface (NBL) 1968. Project limits have changed because of I-95 construction due to type of maintenance (partial resurfacings), recommend dropping project from study. Resurface slurry seal 1969 or 70, riding quality poor; transverse cracking easily seen through slurry seal; performance poor.

601

Project No. 0003-048-010
From: 1.210 mi. E. Int. Rte. 676
To : 0.016 mi. W. Int. Rte. 301
Cost: $43,402 - $52,958 Estimated Cost: $44,172 - $59,854

Completed: 10-29-60
County: King George
Length: 1.326 mi.
Soil Area 4
Thickness Index 9.1



Surface: 1½" F-1
Binder : 1½" F-3
Base : 4" F-2
Subbase: 6" Subbase Matl. Gr. 2
Subbase: 0-18" Select Matl.

Traffic: 25-67 Tractor-trailers & Buses

Deflection Data

		BF
5-11-64	0.000827*	
4-3-67	0.000708	52
3-26-68	0.000851	57
4-30-69	0.000689	57

Crack Factor

7-12-65	0
12-4-67	2
4-6-68	11
4-30-69	11

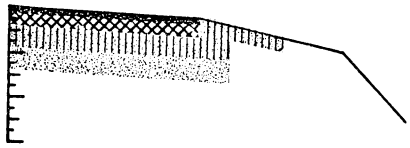
Remarks:

Excellent Performance

602A

Project No. 0003-059-103,C501
0033
From: 0.307 mi. E. Int. Rtes. 3 & 33 (Harmony Village P. O.)
To : 2.044 mi. E. Int. Rtes. 3 & 33 (Hartfield P. O.)
Cost: $60,757 Estimated Cost: $54,907

Completed: 3-4-70
County: Middlesex
Length: 4.818 mi.
Soil Area 4
Thickness Index 11.7



Surface: 1½" S-4
Base : 3" B-1
Subbase: 6" cement tr. select Matl.
Subbase: 6" select matl.

Traffic: 30 Tractor-trailers & Buses

Deflection Data

		BF	
5-6-69	0.001556	37	Select Matl. 12" in place
5-21-69	0.001087	50	with cement added
6-6-69	0.000879	54	with cement added
8-21-70	0.000555	61	complete

Crack Factor

5-26-70	0

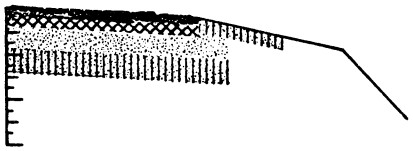
Remarks:

Excellent condition.

602B

Project No. 0003-059-103,C501
0033-
From: 0.307 mi. E. Int. Rtes. 3 & 33 (Harmony Village P.O.)
To : 2.044 mi. E. Int. Rtes. 3 & 33 (Hartfield P. O.)
Cost: $60,757 Estimated Cost: $54,907

Completed: 3-4-70
County: Middlesex
Length: 4.818 mi.
Soil Area 4
Thickness Index 8.10



Surface: 1½" S-4
Base : 3" B-1
Subbase: 6" Select Matl.
Subbase: 6" cement tr. select Matl.

Traffic: 30 Tractor-trailers & Buses

Deflection Data

		BF	
5-6-69	0.001385	39	6" S.M.
5-21-69	0.001195	44	6" S.M. cement added
6-6-69	0.000783	56	6" S.M. over C. Tr. S.M.
8-21-70	0.000624	53	Compl. proj.

Crack Factor

5-26-70	0

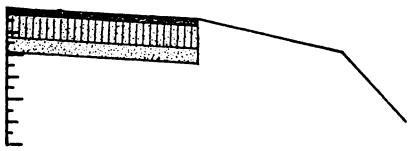
Remarks:

Excellent Condition

603

Project No. 0003-096-103,C501
From: 0.090 mi. E. Int. Rte. 624 (W. of Lerty)
To : 0.111 mi. E. Int. Rte. 204
Cost: $32,419 Estimated Cost: $32,530

Completed: 11-13-64
County: Westmoreland
Length: 2.337 mi.
Soil Area 4
Thickness Index 8.9



Surface: 1½" F-1
Base : 6" cement tr. aggr. base
Subbase: 4" aggr. base

Traffic: 45-80 Tractor-trailers & Buses

Deflection Data

		BF
4-3-67	0.000713	65
3-27-68	0.001122	50
4-3-69	0.000823	60

Crack Factor

12-16-65	49
12-4-67	70
3-27-68	84
4-30-69	82

Remarks:

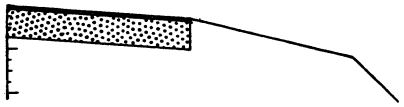
Severe cracking, transverse & longitudinal; poor riding quality, poor performance.

604

Project No. 0030-050-009
From: Int. Rte. 360
To : 0.494 mi. W. of Int. Rte. 611
Cost: $8,131 - $17,661 Estimated Cost: $10,080 - $20,929

Completed: 7-10-61
County: King William
Length: 1.894 mi.
Soil Area 4
Thickness Index 2.80 - 4.80

917



Surface: 2" H-2
Base : 8" Soil Aggr.

Traffic: 25-50 Tractor-trailers & Buses

Deflection Data

		BF
4-27-65	0.001367*	
4-4-67	0.000949	45
3-28-68	0.001088	42
5-5-69	0.000965	47

Crack Factor

6-24-65	0
12-4-67	3
10-7-68	21
10-8-69	69

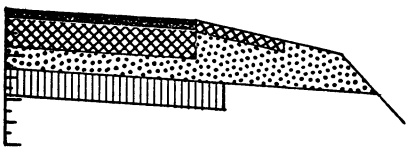
Remarks:

Stage construction 200#/sq. yd. H-2 applied 7-10-61.
Isolated patches; excellent performance (some oxidation?)

605

Project No. 0095-016-002,P401
From: 0.050 mi. N. Hanover CL
To : 3.557 mi. N. Int. Rte. 207
Cost: $76,507 Estimated Cost: $125,025

Completed: 7-26-64
County: Caroline
Length: 6.809 mi.
Soil Area 3 & 4
Thickness Index 14.9



Surface: 1" I-3
Binder : 1½" H-2
Base : 7½" H-3(1)
Subbase: 6" subbase matl.
Subbase: 7" soil cement

Traffic: 4270-6020 Tractor-trailers & Buses

Deflection Data

		BF
5-19-65	0.000612*	
3-27-67	0.000458	68
3-26-68	0.000526	64
4-10-69	0.000573	65

Crack Factor

6-30-65	0
10-11-67	6
9-25-68	25

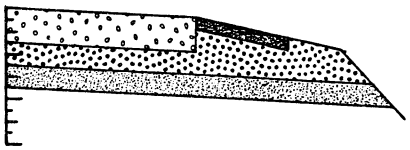
Remarks:

Moderate cracking, not all load related. Resurfaced summer 1970 except for northernmost 3.5 miles of SBL.
Fair performance.

606

Project No. 0095-016-002,P402
From: 3.537 mi. N. Int. Rte. 207
To : Spotsylvania - Carolina CL
Cost: $104,650 Estimated Cost: $143,146

Completed: 8-18-64
County: Caroline
Length: 8.859 mi.
Soil Area 3 & 4



Surface: 9" Reinf. Concr.
Subbase: 6" Subbase matl. Gr. I
Subbase: 6" Select Matl. Gr. I

Traffic: 3760-5250 Tractor-trailers & Buses

Remarks:

Occasional light scaling: Shoulders have had drains placed since construction; occasional pumping; joints fairly well sealed. Excellent Performance

607A

Project No. 0360-050-001-002 (WBL only)
From: Int. Rte. 30
To : E. End Bridge over Moncuin Creek
Cost: $22,662 Estimated Cost: $24,209

Completed: 4-24-57 10-15-65
County: King William
Length: 2.212 mi.
Soil Area 4
Thickness Index 4.5

Surface: 2½" F-1
Base : 6" soil aggr.

Traffic: 59-130 Tractor-trailers & Buses

Deflection Data

		BF
3-28-68	0.000902	49
5-5-69	0.000827	50

Crack Factor

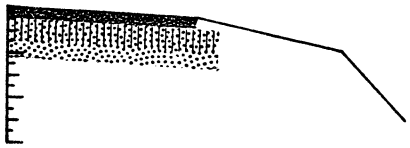
10-7-68	1
10-8-69	1

Remarks:

This project was completed with 6" soil aggregate & 2½" of F-1, 4-24-57; 3" of F-1 was added in 1959 and 1½" F-1 10-15-65. This project was set up to compare with EBL which is cement treated aggregate under plant mix. Isolated transverse cracking; excellent condition.

Project No. 0360-050-104,C501 (EBL only)
From: E. End Bridge over Moncuin Creek
To : Int. Rte. 30
Cost: $38,058 Estimated Cost: $44,130

Completed: 10-26-65
County: King William
Length: .212 mi.
Soil Area 4
Thickness Index 7.40



Surface: 3/4" F-1
Binder : 2½" H-2
Base : 6" cement tr. subbase matl.
Subbase: 4" subbase matl.

Traffic: 59-130 Tractor-trailers & Buses

Deflection Data

		BF
3-28-68	0.000780	56
5-5-69	0.000752	62

Crack Factor

10-7-68	27
10-8-69	6

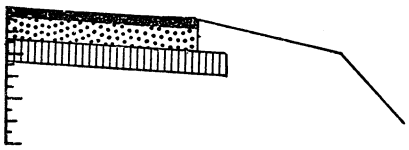
Remarks:

Isolated transverse cracks; excellent condition

701

Project No. 0006-032-101,C501
From: 0.512 mi. W. Int. Rte. 620 (Kidd's Store)
To : 0.093 mi. E. Int. Rte. 640
Cost: $46,094 Estimated Cost: $42,525

Completed: 10-13-64
County: Fluvanna
Length: 1.934 mi.
Soil Area 1
Thickness Index 6.5



Surface: 3/4" I-3
Binder : 1½" H-2
Base : 6" Aggr. Base
Subbase: 6" soil cement

Traffic: 10-24 Tractor-trailers & Buses

Deflection Data

		BF
3-24-67	0.000713	56
4-2-68	0.000767	54
5-27-69	0.000836	57

Crack Factor

3-30-65	0
3-24-67	10
4-2-68	22
9-19-69	43

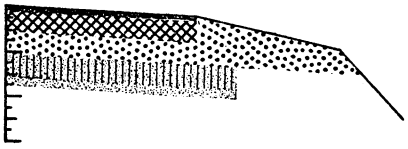
Remarks:

8-19-70 - Substantial alligator cracking; good riding quality. Fair to poor performance.

702

Project No. 0017-030-008
From: 3.123 mi. W. Stafford-Fauquier CL
To : 5.708 mi. W. Stafford-Fauquier CL
Cost: $82,157 Estimated Cost: $95,515

Completed: 10-12-59
County: Fauquier
Length: 2.585 mi.
Soil Area 2
Thickness Index 13.9



Surface: 1½" I-3
Base : 5½" H-3(1)
Subbase: 6" Cr. aggr.
Subbase: 8" cement tr. select borrow

Traffic: 245-310 Tractor-trailers & Buses

Deflection Data

		BF
3-14-61	0.000637*	
5-17-62	0.000647*	
4-26-66	0.000590*	
4-29-66	0.000468*	
5-13-66	0.000504*	
10-?-66	0.000504*	
10-26-66	0.000510	62
3-23-67	0.000665	56
3-28-68	0.000817	52
5-22-69	0.000921	50

Crack Factor

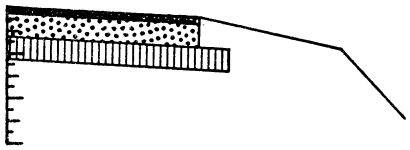
3-15-61	0
7-17-62	0
2-20-64	0
9-22-65	11
6-22-67	96
8-2-68	100
9-23-69	100

Remarks:

Severe cracking throughout; rides good; isolated patching; Performance has been good.

Project No. 0020-068-102,C501
From: 0.485 mi. E. Int. Rte. 522
To : 4.051 mi. E. Int. Rte. 522
Cost: $33,158 Estimated Cost: $39,933

Completed: 12-9-65
County: Orange
Length: 3.566 mi.
Soil Area 2
Thickness Index 6.0



Surface: 1½" I-3
Base : 6" Aggr. base
Subbase: 6" Lime stabilization

Traffic: 60-100 Tractor-trailers & Buses

Deflection Data

		BF
3-31-65	0.001612*	
3-23-67	0.000724	50
3-29-68	0.000889	51
4-8-69	0.000663	55

Crack Factor

6-22-67	13
8-2-68	7
9-19-69	20

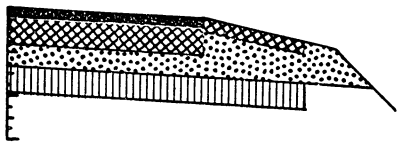
Remarks:

West end of project had extensive rehabilitation shortly after completion; this work done by State forces & changed design at these points. Part of project resurfaced 1968. Transverse cracking in portion rehabilitated with cement stabilized stone; occasional settlement; occasional longitudinal cracking; some patching; severe flushing; poor performance.

704

Project No. 0066-030-001
From: 0.587 mi. W. of Int. Rte. 731
To : 2.489 mi. W. of Int. Rte. 17 at Marshall
Cost: $102,274 Estimated Cost: $137,565

Completed: 6-7-62
County: Fauquier
Length: 3.298 mi.
Soil Area 2
Thickness Index 14.8



Surface: ½" F-1
Binder : 1½" H-2
Base : 7⅝" H-3(1)
Subbase: 6" Cr. Aggr.
Subbase: 8" soil cement

Traffic: 140-405 Tractor-trailers & Buses

Deflection Data

		BF
4-11-66	0.000338*	
4-29-66	0.000252*	
5-13-66	0.000468*	
10-11-66	0.000432*	
10-26-66	0.000331	63
4-22-67	0.000334	64
3-29-68	0.000481	55
5-22-69	0.000552	57

Crack Factor

9-18-62	0
2-6-64	0
9-23-65	0
8-8-66	2
6-21-67	41
9-5-68	86
9-22-69	84

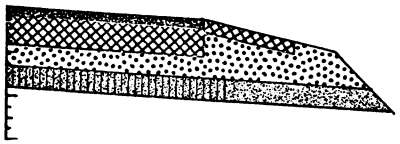
Remarks:

Longitudinal trending cracks not confined to wheelpaths and appear not to be load oriented. Evident in both traffic and passing lanes. Possibly a surface defect. Performance poor.

705

Project No. 0066-076-101,P1
From: Int. Rte. 29 & 211 E. of Gainesville
To : 0.050 mi. W. Int. Rte. 234 (N. of Manassas)
Cost: $88,546 Estimated Cost: $128,631

Completed: 10-3-62
County: Prince William
Length: 3.843 mi.
Soil Area 2
Thickness Index 15.2



Surface: ½" F-1
Binder : 1½" H-2
Base : 7½" H-3(1)
Subbase: 6" Cr. Aggr.
Subbase: 6" Cement tr. S.M.

Traffic: 230-670 Tractor-trailers & Buses

Deflection Data

		BF
5-20-62	0.000791*	
5-4-65	0.000647*	
4-14-66	0.000532*	
4-28-66	0.000504*	
5-12-66	0.000576*	
10-10-66	0.000647*	
10-25-66	0.000459	48
4-22-67	0.000496	49
4-29-68	0.000626	46
6-2-69	0.000729	43

Crack Factor

4-3-62	0
9-24-62	0
4-22-65	90
8-8-66	100
6-21-67	84
9-5-68	99
9-22-69	91

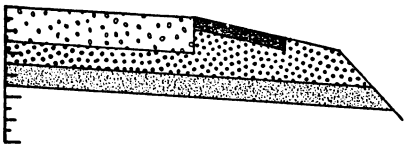
Remarks:

Project limits changed to permit turn arounds for testing. Prince William County only. Resurfaced summer 1970; performance fair.

706

Project No. 0095-029-102,P401
From: 0.080 mi. N. Prince William-Fairfax CL
To : 1.528 mi. N. Prince William-Fairfax CL
Cost: $115,368 Estimated Cost: $170,618

Completed: 9-16-64
County: Fairfax
Length: 1.343 mi.
Soil Area 2



Surface: 9" reinf. conc.
Subbase: 6" subbase matl.
Subbase: 6" S. M.

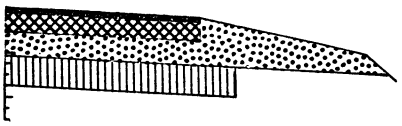
Traffic: 3700-4830 Tractor-trailers & Buses

Remarks:

8-3-70 - Joints poorly sealed, unitube rusted. Considerable faulting of transverse joints. Some joint spalling, mostly small spalls. No evidence of pumping; performance fair.

Project No. 0236-029-007-008
From: 0.230 mi. W. Int. Rte. 244 (Annandale)
To : ECL Fairfax
Cost: $73,392 Estimated Cost: $89,897

Completed: 9-15-60
County: Fairfax
Length: 5.142 mi.
Soil Area 2
Thickness Index 12.3



Surface: 1½" F-1
Base : 5½" H-3(1)
Subbase: 6" Cr. Aggr.
Subbase: 8" soil cement

Traffic: 520-690 Tractor-trailers & Buses

Deflection Data

		BF
3-15-61	0.000540*	
4-15-66	0.000590*	
4-28-66	0.000432*	
5-12-66	0.000504*	
10-10-66	0.000468*	
10-26-66	0.000529	62
4-20-67	0.000574	61
4-30-68	0.000632	62
6-2-69	0.000776	60

Crack Factor

4-12-62	0
6-21-62	0
1-31-64	12
8-10-65	4
8-8-66	15
6-21-67	28
9-19-68	31
9-25-69	24

Remarks:

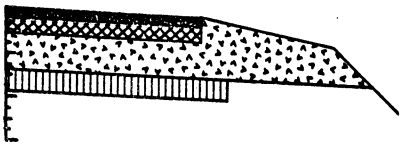
Project limits changed due to expansion CL Fairfax. Occasional transverse cracking. Minor longitudinal cracking; localized alligator cracking. Project has generally done well.

924

801

Project No. 0050-034-101,C501
From: 7.218 mi. W. WCL Winchester
To : 4.247 mi. W. WCL Winchester
Cost: $56,443 - $64,489 Estimated Cost: $83,340 - $95,916

Completed: 9-22-62
County: Frederick
Length: 2.952 mi.
Soil Area 5
Thickness Index 11.4



Surface: ¼" F-4
Binder : 1½" H-2
Base : 5½" H-3(1)
Subbase: 10" Select Matl.
Subbase" 6" Lime stab. (part of proj)

Traffic: 145-220 Tractor-trailers & Buses

Deflection Data

		BF
6-7-62	0.000683*	
5-5-67	0.000535	44
4-30-68	0.000597	43
5-8-69	0.000532	45

Crack Factor

9-19-62	0
10-3-63	0
9-17-65	0
6-8-67	0
8-30-68	0
9-30-69	1

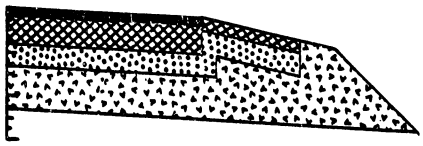
Remarks:

Lime in cuts only. 10% deslicking worn & popped off; occasional long. crack (most appear at center joint), Performance excellent.

802

Project No. 0081-082-021-026
From: 2.057 mi. S. Int. Prop. Rte. 33
To : 3.601 mi. N. Int. Prop. Rte. 33
Cost: $99,792 - $128,462 Estimated Cost: $161,352 - $218,661

Completed: 7-23-60
County: Rockingham
Length: 5.692 mi.
Soil Area 5
Thickness Index 14.0 - 16.40



Surface: ¼" F-1
Binder : 1½" H-2
Base : 7½" H-3(1)
Subbase: 6" Cr. Aggr.
Subbase: 12"-24" S.M.

Traffic: 890-1845 Tractor-trailers & Buses

Deflection Data

		BF
4-12-60	0.000417*	
4-10-64	0.000442*	
5-10-67	0.000309	58
5-2-68	0.000209	57
5-12-69	0.000284	58

Crack Factor

3-13-61	0
3-13-62	0
9-3-63	0
7-7-65	0
6-12-67	3
8-30-68	7
10-3-69	10

Remarks:

Occasional long. crack. Some alligator cracking around Rte. 33 interchange. Severe settlements over structures. Pavement has performed well.

APPENDIX B

UNIT PRICES USED IN ESTIMATING COST TO BUILD IN 1969

The unit prices below were selected after a study of statewide bids for 1969 and reflect averages determined after the exclusion of very small or otherwise unrepresentative projects. Similarly, the costs shown may be somewhat in error where very small or very large quantities are involved and where a given material is in short supply or is very plentiful. Thus, use of the prices shown will yield only an approximation of what a given project would have cost in 1969.

	Item	Unit Cost
Surface or Binder:	Asphaltic Concrete	$8.40/ton
	P.C.C., reinforced, 9" thick	5.85/s.y.
	P.C.C., continuously reinforced, 8" thick	4.95/s.y.
Base:	Asphaltic Concrete	7.00/ton
	Commercial Aggregate (cement treated)	4.30/ton
	Commercial Aggregate	3.80/ton
	Local material	2.00/ton
Subbase:	Commercial Aggregate	3.00/ton
	Local material	2.00/ton
Select Material:	Commercially processed	3.25/c.y.
	Local material	2.00/c.y.
Stabilization:	Portland Cement	5.20/bbl.
	Manipulation	0.35/s.y.

APPENDIX C

RECOMMENDED DESIGN METHOD FOR FLEXIBLE PAVEMENTS IN VIRGINIA

by
N. K. Vaswani
Highway Research Engineer

The sophisticated design techniques developed from the AASHO Road Test results and other investigations necessitated modification of the charts used for the design of flexible pavements in Virginia. The increased knowledge of the materials now used in the construction of flexible pavements in Virginia (e.g., cement treated aggregate, soil cement, and soil lime) also needed to be properly incorporated in the design method.

Investigations* have been carried out and a new design method has been determined. While incorporating the latest design techniques and use of the materials discussed above, this method still permits present construction practices.

From the investigations referred to, the following were determined.

(I) Thickness equivalencies (i.e., the ratio of the strength of one inch of material in the layer to one inch of asphaltic concrete) of the materials in each layer. The values for Virginia are given in Table A-I.

(II) Soil Support Value = SSV = soil resiliency value x design CBR.

On the basis of the investigations, Virginia was divided into five soil classification areas according to the soil resilience properties as shown in Figure (a). The following values were determined for each classification.

Soil Classification	Soil Resiliency Value
1	0.5
2	1.0
3	1.5
4	3.0
5	2.0

*Vaswani, N. K., "AASHO Road Test Findings Applied to Flexible Pavements in Virginia", Virginia Highway Research Council, Charlottesville, Virginia.

TABLE A-I

Soil No.	Material and Location	Notation	a	Value of a
1.	Surface — Asphalt concrete	A.C.	a_1	1.0
2.	Base (a) Cement treated aggregate base material over untreated aggregate base or soil cement or soil lime and under A.C. mat.	CTA	a_{21}	1.0
	(b) Untreated aggregate base material crushed or uncrushed. Spec. No. 20, 21 and 22	Agg.	a_2	0.35
	(c) Select material I directly under A.C. mat and over a subbase of a good quality ($a > 0.2$) subbase.	Agg.	a_3	0.35
3.	Subbase (a) Select material type I, II & III.	Sel. Mat.	a_3	
	1. In Piedmont area		a_3	0.0
	2. In Valley & Ridge area and Coastal Plain		a_3	0.2
	(b) Soil cement or soil lime	S.C.	a_4	0.4
	(c) Cement treated aggregate base directly over subgrade.	CTA	a_{21}	0.6

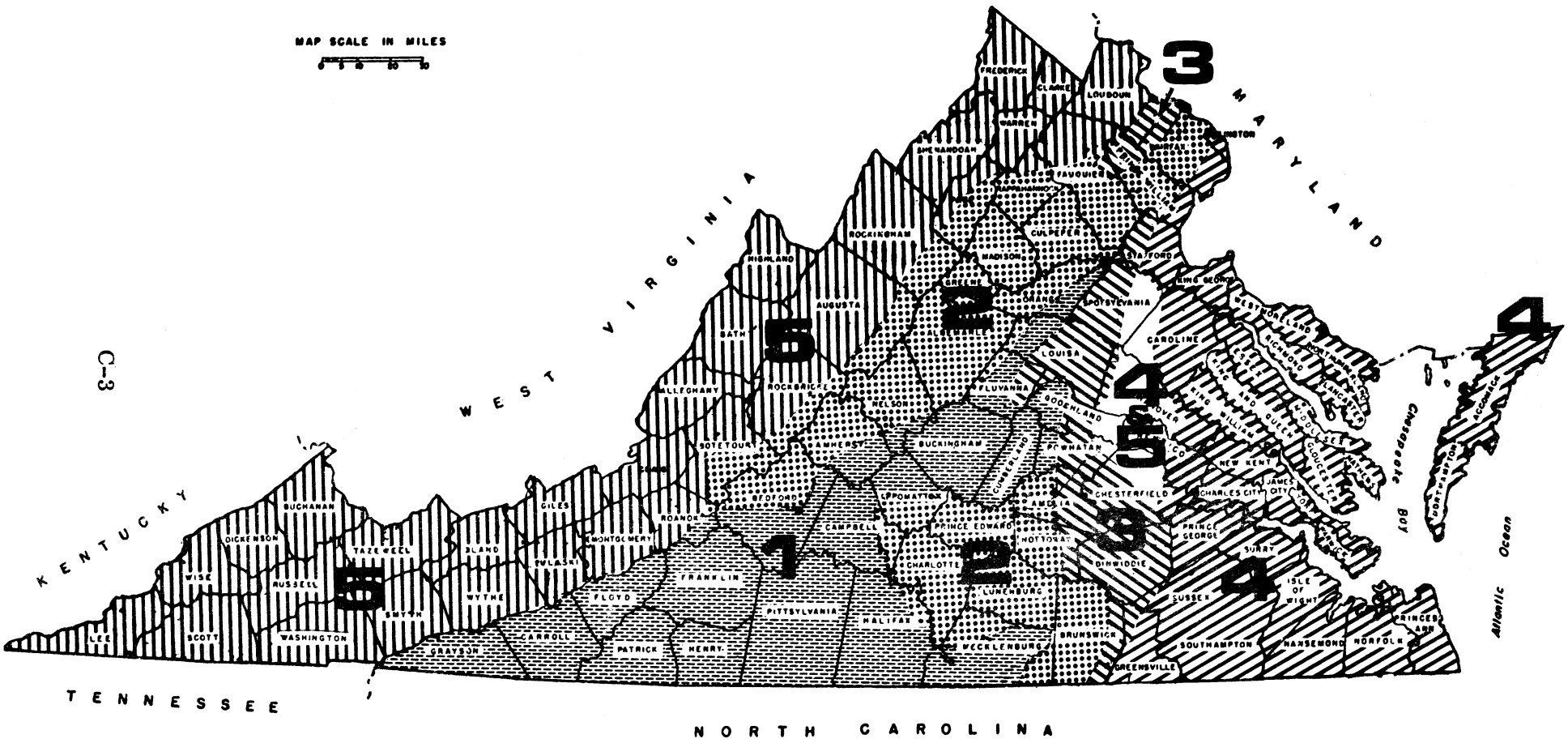


Figure (a). Virginia Soil Resiliency Classification.

930

(III) The design chart is given in Figure (b). This chart is based on design daily traffic in 18-kip equivalents* (L) and on soil support values (SSV). From this chart the thickness index, D, of the pavement can be determined. After the value of D is determined, the thickness of each layer can be determined.

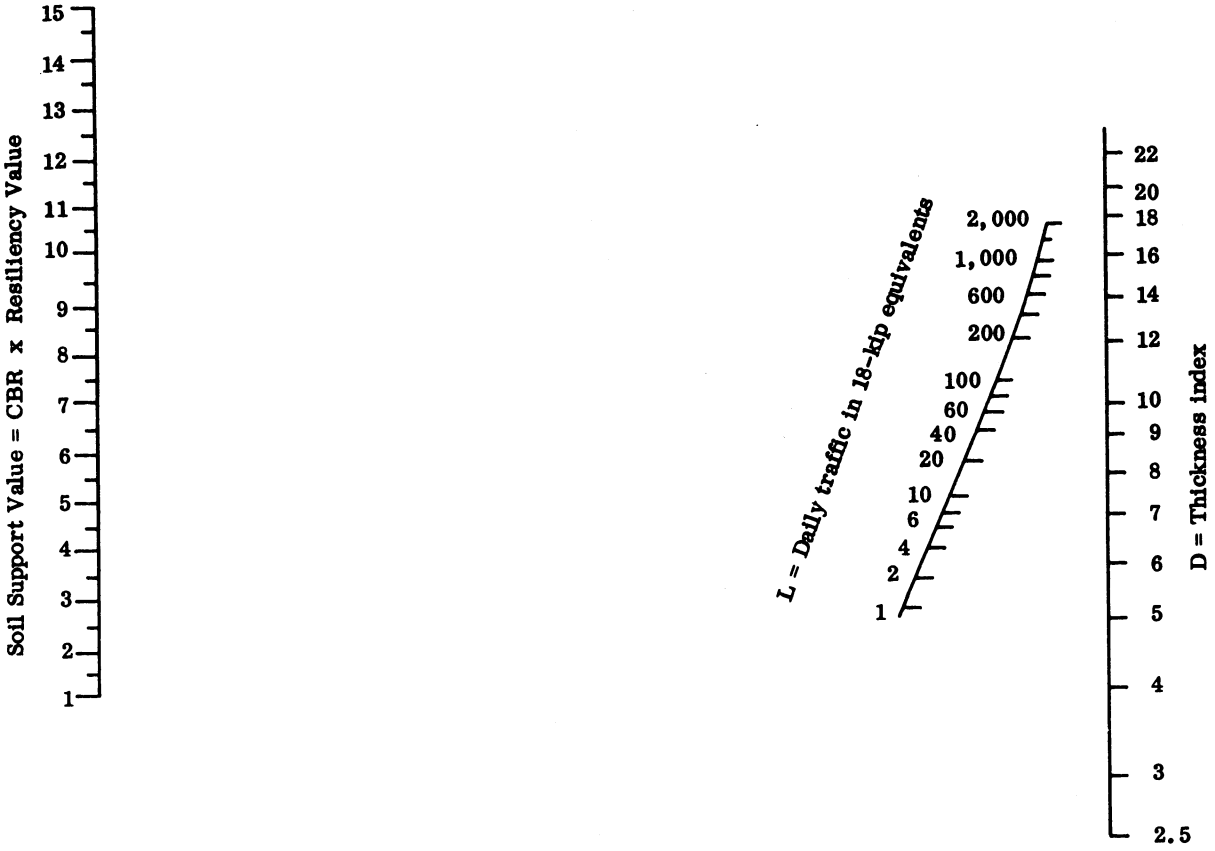


Figure (b). Nomograph correlating soil support value, traffic and thickness equivalencies (based on AASHO equation).

*Daily design traffic in 18-kip equivalents for a road is available from the Traffic and Planning Division of the Virginia Department of Highways.

APPENDIX D

(AFTER F. P. NICHOLS)[1]

COMPUTATIONS OF PRESENT SERVICEABILITY INDEX (PSI) OF VIRGINIA PAVEMENTS

The present serviceability index is an expression devised to indicate a pavement's ability to serve the traffic which uses it at the time of observations. It is computed in Virginia from the results of certain measurements of cracking, patching, and rutting, as defined at the AASHO Road Test, and of riding quality as indicated by the Research Council's Federal Highway Administration type road roughness trailer. The expressions which follow for incorporating the results of these measurements into an index of present serviceability were developed by members of the AASHO Road Test staff in 1961 after Virginia's roughness trailer had been used to measure the roughness of 26 sections of pavement on and near the Ottawa, Illinois test site, and the results correlated with those obtained with the AASHO profilometer. The expression used for rigid pavements is:

$$PSI = 14.30 - 5.15 \log \overline{VR}_{20} - 0.09 - C + P$$

Expressions for flexible pavements are:

$$PSI = 12.54 - 4.49 \log \overline{VR}_{20} - 0.01 - C + P - 1.28 \overline{RD}^2$$

or, if rut depths are not measured,

$$PSI = 12.98 - 4.70 \log \overline{VR}_{20} - 0.01 - C + P$$

where:

PSI	=	present serviceability index
C	=	pronounced cracking in sq.ft. per 1,000 sq.ft. (flexible pavements) or lineal feet per 1,000 sq.ft. (rigid pavements).
P	=	bituminous patching in sq.ft. per 1,000 sq.ft.
$\overline{RD}$	=	mean depth in inches of rutting (depth of depression under a 4-foot straightedge) in both wheel paths.
$\overline{VR}_{20}$	=	roughness in inches per mile as indicated by Virginia trailer at speed of 20 mph.

Data presented on the following pages summarize the roughness of the study pavements through 1969.

SUMMARY OF ROAD ROUGHNESS AND PSI DATA

Project No.	Date	$\overline{VR}_{20}$	PSI	Remarks
101	10-5-56	88-86	—	Difficulty in determining reason for road becoming smoother 1956-58; resurface between 1958-63; 1967 road has CF 92 & PSI 4.39; partial resurface between 1968-69, PSI little change.
	4-24-58	71-75	—	
	8-13-63	59-57	4.63	
	6-8-65	58-57	4.61	
	5-23-67	59-59	4.39	
	6-18-68	69-70	3.97	
	11-17-69	72-75	3.99	
102	10-13-62	60-68	4.43	Long project; data appear fair.
	7-14-63	63-71	4.24	
	11-12-64	60-68	4.43	
	6-9-65	64-73	4.33	
	4-24-67	62-67	4.42	
	6-19-68	74-78	4.10	
	11-19-69	70-73	4.22	
103	10-24-63	79-67	4.20	Resurface between 1965-67; long project.
	6-9-65	85-72	4.06	
	5-24-67	64-57	4.54	
	6-19-68	69-54	4.35	
	11-19-69	63-61	4.49	
201	12-8-61	59-61	4.56	Little change in appearance and R.R.; good data.
	9-11-63	65-67	4.37	
	9-2-65	67-70	4.28	
	6-28-67	61-66	4.44	
	7-31-68	65-70	4.33	
	10-24-69	65-70	4.33	
202	10-17-62	56-55	4.70	Little change in appearance and R.R.; good data.
	9-11-63	58-62	4.57	
	9-2-65	58-60	4.57	
	6-28-67	59-63	4.52	
	7-31-68	60-62	4.52	
	10-23-69	62-64	4.43	
203	3-10-61	72-65	4.30	Project resurfaced 10-5-68; high PSI for resurface; data appear fair.
	12-3-63	76-74	4.12	
	9-16-65	77-75	4.07	
	6-27-67	73-72	4.10	
	6-13-68	79-80	3.87	
	10-10-68	74-65	4.27	
	10-13-69	72-66	4.28	

Project No.	Date	$\overline{VR}_{20}$	PSI	Remarks
204	2-4-65	91-93	4.19	9-14-65 reading appears high.
	9-14-65	98-101	4.01	
	6-27-67	90-92	4.21	
	10-10-68	94-96	3.96	
	10-10-69	96-92	4.04	
205	10-2-68	77-79	4.04	
	8-27-69	76-77	4.08	
206	10-19-62	87-82	3.89	Change in project limits between
	9-12-63	86-85	3.88	1965-67 could account for project
	9-2-65	86-86	3.86	becoming smoother.
	6-29-67	75-76	4.11	
	10-2-68	79-80	4.04	
	8-28-69	82-80	3.95	
207	6-23-60	71-80	4.11	Partial resurface between 1965-67
	9-12-63	92-80	3.83	also prior to 1969 measurements;
	9-2-65	91-83	3.89	data appear good.
	6-29-67	81-81	3.76	
	10-3-68	77-81	3.89	
	8-28-69	84-90	3.67	
208	11-20-60	83-78	3.98	1968 data questionable; project
	6-29-62	84-82	3.92	patched; difficult to evaluate.
	12-2-63	92-86	3.74	
	9-13-65	95-91	3.62	
	6-29-67	91-87	3.72	
	6-13-68	100-98	3.45	
	8-27-69	97-97	3.55	
209	11-20-60	72-67	4.27	Appears to be erratic; no known
	12-2-63	81-78	3.96	reason.
	9-13-65	81-77	3.93	
	6-29-67	74-71	4.09	
	6-13-68	83-80	3.84	
	6-4-69	85-82	3.81	
210	3-14-61	74-79	4.08	Erratic; checking previous listed
	9-12-63	83-83	3.91	projects indicate 1967 readings
	9-9-65	88-85	3.84	low? (June)
	6-29-67	79-74	4.04	
	10-2-68	84-84	3.90	
	8-28-69	87-82	3.89	
301	6-28-62	43-54	4.90	Erratic.
	6-25-63	56-59	4.61	
	10-5-65	55-58	4.70	
	7-10-67	55-59	4.75	
	8-6-68	60-61	4.47	
	8-12-69	60-61	4.48	

Project No.	Date	$\overline{VR}_{20}$	PSI	Remarks
302	12-1-60	65-68	4.35	Data good.
	2-6-63	72-70	4.24	
	10-6-65	73-73	4.17	
	8-3-67	73-72	4.07	
	8-8-68	74-73	4.10	
	9-17-69	74-72	4.00	
303	10-26-64	74	4.15	Data good.
	6-15-65	77	4.07	
	8-28-67	77	4.07	
	8-6-68	81	3.97	
	8-27-69	84	3.90	
304A	5-24-61	74	4.16	Project has never had PSI below 4.00,
	12-26-63	72	4.20	but has been sealed once; resurfaced
	7-20-65	64	4.43	once and there are plans to resurface
	8-29-67	62	4.49	in near future.
	8-7-68	65	4.32	
	10-16-69	65	4.25	
304B	5-24-61	71	4.23	Resurfaced 8-30-63; sealed the summer
	12-26-63	70	4.26	of 1963.
	7-20-65	67	4.34	
	8-29-67	55	4.70	
	8-7-68	60	4.57	
	10-16-69	59	4.49	
304C	5-24-61	73	4.17	Resurfaced 8-30-63; sealed the summer
	12-26-63	71	4.23	of 1963.
	7-20-65	64		
	8-29-67	62	4.42	
	8-7-68	66	4.22	
	10-16-69	65	4.20	
304D	5-24-61	59	4.59	Resurfaced 8-30-63; sealed the summer
	12-26-63	71	4.23	of 1963.
	7-20-65	61		
	8-20-67	59	4.60	
	8-7-68	63	4.37	
	10-16-69	63	4.33	
305	12-8-61	68-69	4.30	Data erratic; part of project to be
	7-23-63	66-66	4.36	resurfaced; high PSI
	7-15-65	62-67	4.34	
	8-28-67	59-66	4.41	
	10-3-68	71-70	4.19	
	8-28-69	69-72	4.00	

Project No.	Date	$\overline{VR}_{20}$	PSI	Remarks
306	9-17-54	72-76		Data show transverse cracking effect on roughness.
	5-8-58	72-75		
	6-25-63	87-95	3.56	
	10-5-65	95-103	3.38	
	7-10-67	97-102	3.27	
	8-12-68	77-76	3.78	
	8-12-69	80-78	3.99	
307	10-18-62	63-63	4.46	Project needs resurface? PSI 4.00.
	6-20-63	63-62	4.44	
	4-5-65	62-67	4.42	
	7-6-67	69-67	4.21	
	8-14-68	67-69	4.13	
	9-16-69	69-64	4.06	
308	11-2-62	56	4.69	Data fair.
	7-23-63	63	4.46	
	10-1-65	57	4.66	
	8-29-67	60	4.55	
	8-7-68	62	4.44	
	10-16-69	63	4.37	
309A	11-8-62	61	4.52	
	1-24-64	69	4.28	
	7-8-65	67	4.34	
	7-12-67	67	4.24	
	8-8-68	70	4.19	
	8-13-69	65	4.34	
309B	11-8-62	65	4.40	Note effect transverse cracking; data good.
	1-21-64	71	4.23	
	7-8-65	70	4.21	
	7-12-67	75	3.93	
	8-8-68	81	3.85	
	8-13-69	92	3.85	
309C	11-8-62	64	4.43	Data appear good.
	1-12-64	73	4.17	
	7-8-65	80	3.85	
	7-12-67	91	3.60	
	8-8-68	99	3.58	
	8-13-69	96	3.41	

Project No.	Date	$\overline{VR}_{20}$	PSI	Remarks
309D	11-8-62	59	4.59	Severe cracking not reflected in R.R.
	1-12-64	68	4.31	
	7-8-65	67	4.34	
	7-12-67	74	4.26	
	8-8-68	75	3.85	
	8-13-69	71	3.93	
310	11-10-54	132-121		Good data.
	5-8-58	119-122		
	11-17-61	123-119		
	1-18-63	124-116		
	6-4-65	137-133		
	9-3-67	141-135	3.19	
	8-13-68	134-131	3.29	
	8-13-69	131-127	3.30	
311	11-5-62	71-70	4.24	
	7-22-63	77-77	4.07	
	12-7-65	82-83	3.92	
	8-29-67	74-79	4.09	
	8-7-68	77-79	4.03	
	8-26-69	77-83	3.95	
312	11-5-62	79-81	4.00	
	7-23-63	78-81	4.01	
	7-20-65	82-86	3.89	
	8-29-67	76-79	4.06	
	8-7-68	79-83	3.96	
	8-26-69	80-83	3.94	
313A	7-12-67	69	4.28	
	8-8-68	74	4.14	
	8-17-69	70	4.26	
313B	7-12-67	68	4.31	
	8-8-68	71	4.14	
	8-17-69	72	4.17	
313C	7-12-67	64	4.43	
	8-8-68	67	4.34	
	8-17-69	68	4.31	
313D	7-12-67	69	4.28	
	8-8-68	70	4.26	
	8-17-69	75	4.12	

Project No.	Date	$\overline{VR}_{20}$	PSI	Remarks
401	7-6-60	166-169		
	8-6-63	67-56	4.55	
	10-25-65	69-59	4.43	
	10-26-67	65-57	4.52	
	9-10-68	69-60	4.41	
	9-4-69	70-59	4.41	
402	10-16-67	81-85	4.42	Data good; probably reflecting
	8-5-68	88-91	4.25	progress of transverse cracks.
	8-4-69	91-93	4.21	
403	7-31-64	65-70	4.32	
	11-29-67	68-73	4.24	
	8-15-68	70-77	4.16	
404	1-28-63	102-112	3.85	
	10-11-65	112-118	3.69	
	11-28-67	109-117	3.73	
	8-15-68	111-118	3.68	
405	11-15-60	47		Project resurfaced 1967; high PSI.
	1-3-64	62	4.41	
	4-28-65	55	4.63	
	9-12-67	60	4.57	
	8-13-68	71	4.23	
	9-18-69	68	4.34	
406	10-10-63	56	4.69	
	4-29-65	50	4.91	
	9-12-67	63	4.46	
	8-13-68	74	4.15	
	9-18-69	74	4.07	
407	10-9-63	68-72	4.25	Project's poor condition not
	7-21-65	75-74	4.12	reflected PSI
	8-30-67	68-64	4.37	
	10-11-68	70-67	4.26	
	8-29-69	72-70	4.01	
501	7-30-58	100		Experimental joints non reflection;
	6-15-61	109		resurfaced 1963, partial resurface
	5-2-62	106		1968.
	2-5-63	111		
	12-5-63	84		
	5-25-65	91		
	12-20-67	89		
	10-23-68	91		

Project No.	Date	VR_{20}	PSI	Remarks
502	6-15-61	92	4.19	
	5-2-62	93	4.16	
	4-5-63	95	4.11	
	5-25-65	102	3.96	
	12-20-67	98	4.05	
	10-23-68	99	3.94	
503	12-8-65	96-90	4.16	
	12-20-67	105-100	3.94	
	10-23-68	108-102	3.87	
504	6-19-62	94-98	4.09	
	1-22-63	91-95	4.15	
	4-22-65	97-104	3.99	
	12-20-67	97-102	4.01	
	10-17-68	97-100	4.00	
505	6-21-61	90-94	4.19	
	6-19-62	86-86	4.34	
	1-13-63	85-84	4.37	
	4-23-65	98-98	4.05	
	4-19-67	93-95	4.14	
	10-16-68	98-96	4.04	
506	5-6-57	85-97	3.74	Erratic results could be from change in limits and spot resurfacing.
	6-19-62	111-102	2.87	
	8-21-63	68-83	3.87	
	5-27-65	69-109	3.56	
	12-19-67	91-87	3.59	
	10-17-68	87-96	3.58	
601	6-2-61	58-51	4.73	Erratic data probably due to bumper strip installation.
	2-25-64	59-66	4.47	
	7-12-65	57-64	4.52	
	12-4-67	70-62	4.37	
	9-26-68	73-63	4.31	
	9-23-69	67-60	4.44	
602A				No data.
602B				No data.
603	12-16-65	69-69	4.11	
	12-4-67	80-80	3.72	
	9-26-68	85-84	3.59	
	9-23-69	81-88	3.54	

Project No.	Date	$\overline{VR}_{20}$	PSI	Remarks
604	6-20-61	163-156		1st reading surface treatment.
	2-17-64	85-90	3.82	
	6-24-65	91-91	3.74	
	12-4-67	88-84	3.88	
	10-7-68	88-85	3.84	
	10-8-69	86-83	3.89	
605	8-30-64	58-67	4.47	Project to be resurfaced; high PSI.
	6-30-65	67-82	4.15	
	10-11-67	59-66	4.47	
	9-25-68	62-68	4.38	
606	7-29-64	120-118	3.61	
	12-14-65	124-120	3.55	
	11-29-67	122-118	3.59	
	9-25-68	121-119	3.57	
607A				Little data.
607B				Little data.
701	11-2-64	66-62	4.37	
	3-30-65	73-66	4.26	
	6-22-67	72-69	4.19	
	8-5-68	74-72	4.14	
	9-19-69	76-74	4.09	
702	3-15-61	61-63	4.49	Data good.
	7-17-62	72-65	4.31	
	2-6-64	72-64	4.23	
	9-22-65	72-65	4.29	
	6-22-67	72-68	3.96	
	8-2-68	75-71	3.87	
	9-23-69	73-69	3.93	
703	7-13-65	93-110	3.56	Rehabilitation and resurfacing cause erratic data.
	6-22-67	92-110	3.43	
	8-2-68	89-97	3.67	
	9-19-68	87-94	3.73	
704	9-18-62	51-49	4.91	
	2-6-64	63-62	4.49	
	9-23-65	63-62	4.49	
	6-21-67	68-66	4.28	
	9-5-68	66-68	4.23	
	9-22-69	67-69	4.18	

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Project No.	Date	$\overline{VR}_{20}$	PSI	Remarks
705	4-3-62	49-49	4.95	Project to be resurfaced 1970.
	9-24-62	45-48	4.97	
	2-6-64	62-66	4.43	
	4-22-65	61-66	4.37	
	6-21-67	58-57	4.38	
	9-5-68	64-71	4.13	
	9-22-69	64-69	4.23	
706	11-5-64	95-94	4.12	
	6-22-67	98-99	4.03	
	9-17-68	101-100	3.98	
707	4-12-61	70	4.26	Data good.
	6-21-62	76	4.10	
	1-31-64	82	3.95	
	8-10-65	91	3.74	
	6-21-67	91	3.74	
	9-19-68	91	3.73	
	9-25-69	93	3.80	
801	9-19-62	49	4.95	
	10-3-63	65	4.40	
	9-17-65	73	4.17	
	6-8-67	71	4.23	
	8-30-68	78	4.04	
	9-30-69	77	4.07	
802	3-13-61	51-52	4.85	To be resurfaced 1970.
	3-13-62	47-47	5.00	
	9-3-63	53-52	4.82	
	7-7-65	54-51	4.81	
	6-12-67	52-52	4.84	
	8-30-68	59-59	4.60	
	10-3-69	59-58	4.60	