A PROGRESS REPORT ON THE BEAR RIDGE INVESTIGATION OF BASE STABILIZATION USING DEGRADING AGGREGATES

For
State of Idaho
Department of Highways
Materials Section

by
Rex L. Helm
Moscow Laboratory
August 15, 1962

Intra-Department
Correspondence

Project

DEPARTMENT OF HIGHWAYS

TO:

H. L. Day, P. E., Materials Engineer

FROM:

R. L. Helm, Testing Technologist

SUBJECT:

Progress Report on the Bear-Ridge Base Stabilization Project

Enclosed for your consideration is a progress report on the Bear Ridge Base-Stabilization investigation.

This report contains the results of the tests performed under Research Project Number 5. A comparison of current results with the summarized results of previous tests is presented with the thought of comparing the effect of various treatments on the rate of degradation.

The comparisons reveal little major change in the quality of either the treated base or the untreated base material. This is substantiated by the good appearance of the highway. However, there appears to be a small change in the plasticity of some of the fines. This change will become significant if it continues.

Your suggestions and comments will be appreciated.

R. L. Helm
Testing Technologist

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SUMMARY

The purpose of this report is to present a summary of the history of the Bear-Ridge base stabilization investigation and a comparison of the tests which have been made since construction. the current investigation was authorized as Research Project Number 5.

The project, which is located 8 miles south of Deary, Idaho in Palouse hills, is subject to heavy logging trucks and moderate to severe winters. In 1959 the base treatment to compare various treatment methods was instigated when degradation of base material in place was noted in 1958.

Extensive sampling was done at the time of construction. Since construction, visual inspections, Benkelman beam tests, and in place sampling have been performed periodically to evaluate the test sections. This report compares summaries of these tests.

The comparison of test results indicate a possible correlation between the Benkelman beam tests and the base moisture, a compressive strength gain in the lime and cement treated sections, and a slight increase in the plasticity of the fines in the non-rigid sections. No section has proven definitely superior at this date.

It is recommended that the tests be repeated in one to two years or sooner if breakup occurs. It may also be desirable to study moisture versus deflection relationships during winter and spring seasons.

INTRODUCTION

Purpose

As part of the search for knowledge of the identification, construction characteristics and treatment of degrading basalt aggregates, the Bear Ridge base stabilization project was constructed and observations of performance have been made since construction. The purpose of this report is to present a summary of the history of the project and a comparison of the tests which have been made since construction.

Scope

In addition to a comparison of laboratory test results, this report compares the average Benkelman beam deflections for each type of base stabilization. The results of Nuclear moisture probe tests of the in place base material are also given.

Sources of Information

The project files at the Moscow Testing Laboratory furnished data for samples taken prior to and during construction. Current tests were performed at the Moscow Laboratory. Other sources are given in the list of references at the end of this report. Idaho Department of Highway publications were made available by the Boise Materials Laboratory.

Authorization

The current investigation was authorized as Idaho Department of Highways Research Project Number 5 in July 1962.

REVIEW OF PROJECT

Characteristics of the Test Site

The Bear Ridge base stabilization project is located in Latah County on State Highway Number 7, approximately 8 miles south of Deary, Idaho. The terrain consists of gentle hills of Palouse soil cut with deep canyons. One such canyon is at the south end of the test section. The winters are severe with up to 20 inches of frost penetration in unprotected locations. The annual rainfall is between 20 and 30 inches. Basalt outcroppings are the local sources of material.

The annual average daily traffic has increased from 180 in 1941 to 250 in 1961 with about 20% consisting of commercial traffic which includes heavy logging trucks.

A previous contract for constructing the roadway and road-mix surface was let in July, 1958. Base material, which was left exposed to traffic and weather during the following winter, was considered of insufficient quality to allow completion of the oil mat the following spring. Excessive increase in the percentage of fine material over that indicated by production test results was attributed to aggregate degradation.

Construction of Test Project

The construction of a test section as a means to compare the effectiveness of lime, cement, SS-1 asphalt emulsion and special road oil to improve base stability and prevent further degradation was suggested by the Bureau of Public Roads. The contract for treating the base material and laying the road-mix oil mat was let in late July, 1959. The base treatment, which consisted of scarifying 0.4 of the in-place surfacing, mixing with stabilizing agents and relaying, was completed by fall. It was sealed to aid curing. During the winter, traffic was detoured around one mile and one-half of the test section, approximately station 240 to 325, and allowed to travel over the rest of the project. The oil mat was completed the following spring.

The location of the test sections within the project and the thickness and type of ballast are shown in Figure 1. The portion of the project which is considered to be test area runs from Station 238+00 to 351+80.

Construction procedures are described in a previous report on this project by V. S. Muñoz, Jr.

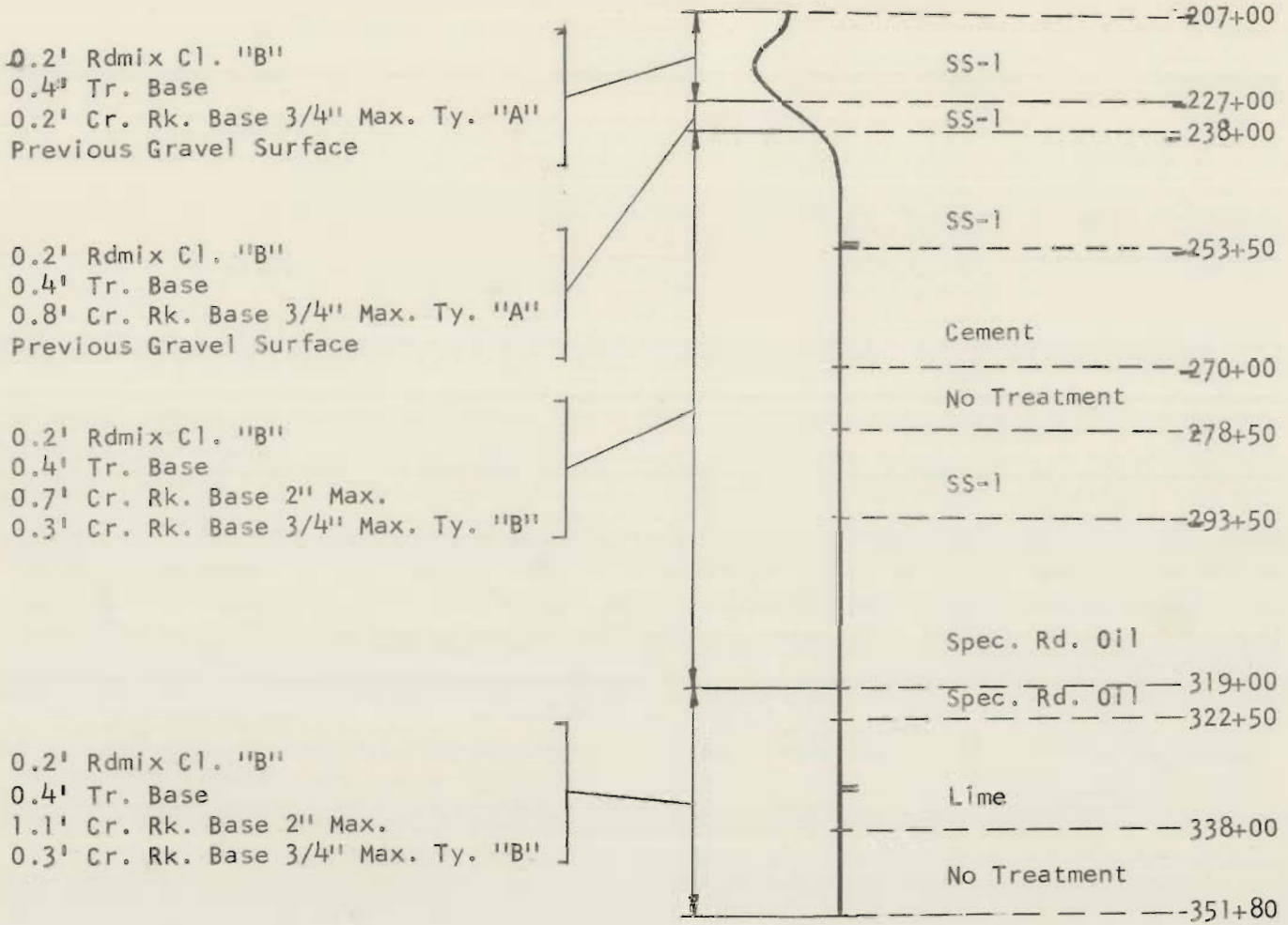

Figure 1. Plan of Test Site

TESTS PERFORMED

Source Investigation

The source, Latah 126, which is located approximately 1200 feet east of Station 285 of the project, consists of basalt of variable quality and degree of alteration. The previous paving contract, No. 2114, contained a provision for exclusion of clay and altered disintegrated stone from the material to be crushed.

Since construction of the test section numerous petrographic studies have been made by the Boise Materials Laboratory. These indicate a wide range of quality from fresh inappreciably altered basalt to greatly altered partially decomposed basalt. The borderline and greatly altered basalt appear to make up about half of the available material. Tests are in progress at the Moscow Laboratory to correlate additional petrographic studies with physical and chemical properties of the material with the aim of better defining critical alteration.

Tests of Materials Placed in Roadway

Prior to construction, samples were taken from the crushed rock base material which had been left in place on the roadway through the winter of 1958-1959. Results for the portion of the samples which were processed at the Moscow Laboratory are summarized in the results section of this report.

During construction of the test sections, extensive testing was carried out in order to establish indices of the quality of the materials being placed for comparison with future test results. A complete list of the tests performed is given in the "Schedule of Minimum Test Requirements" for Project S-4769(6). Portions of these tests which were performed at the Moscow Laboratory and which are pertinent for a comparison with current tests are summarized in the results section.

Periodic visual inspection of the project have been made since its completion in order to detect any signs of weakness which have developed. Benkelman Beam tests have been performed periodically throughout the length of the project in order to detect any changes in the reaction of the roadway to wheel loads. Two series of samples of base material have been taken from the completed project; the first in November, 1960 and the current tests in July, 1962. Three-foot sealed sections of steel pipe with removable caps have been driven vertically at intervals along the centerline of the roadway to provide access for a nuclear moisture probe to check the moisture content of the ballast material.

Compressive strength tests on core samples of the lime and the cement treated abses bases have been made. As the material is firmly cemented, tests for gradation and plasticity changes are not practical at this time. However, they will become desirable if the material breaks down and weak spots are noted in these sections.

Samples of the untreated, emulsion treated and special road oil treated base material were tested for gradation, plasticity, sand equivalent and other mechanical properties. Bituminous material was removed from the emulsion and special road oil treated base samples by the reflux extraction method prior to other tests.

All tests were run according to Idaho test methods with the exception of the water absorption and R-Value test. This test was suggested by John Miller and consists of compacting a sample containing 5% moisture with 140 blows at 250 psi in the kneading compactor, soaking the sample in its mold with water for 14 days at 140°F, determining its moisture content, and testing in the Hveem stabilometer.

Results of tests made since completion of construction are summarized in the results section. Test reports for the current tests, Research Project Number 5, are included in the appendix of this report.

COMPARISON OF RESULTS

Visual Inspection

Cement Stabilized Base. By the fall of 1960, longitudinal cracks had become apparent in the well traveled parts of the roadway. These were attributed to flexural cracking of the cemented base and do not seem detrimental as yet except they may allow water to pass down through the oil mat. Transverse shrinkage or temperature cracks have gradually developed until now they occur throughout most of the section spaced from 20 to 100 feet. All cracks to date have been filled with asphalt cement to prevent water penetration. Soft spots appear to be developing at Station 254+00 in the right lane and at 261+00 in the left lane.

Lime Stabilized Base. The appearance of this section is excellent except for seal coat bleeding at Stations 332+00 to 333+00 in the left lane.

SS-1 Emulsion Stabilized Base. At Station 243+00 traffic tracks appear depressed 1/4 to 3/8 inches. Seal coat is rich at Stations 238+00 right, 249+00 left and 251+00 right. In the second section the seal is rich at Station 290+00 and wheel tracks are depressed 1/2 inch at Station 294+50 in the right outside wheel trach and 5/8 inch at Station 294+50 in the left inside track. In general these sections have an excellent and well sealed appearance.

Special Road Oil. This section appears in excellent condition and well sealed.

No Treatment. All pavement appears excellent and well sealed. There is some subsidence of wheel tracks in places but these are all less the 1/4 inch and appear to be due to loss of seal coat chips.

Benkelman Beam

Table 1 gives a summary of Benkelman beam test results to date. Average and maximum deflections are shown for each test section. The temperature shown is the average temperature of the oil mat during the time the tests were taken.

Nuclear Moisture Probe

Table 2 gives the results of nuclear moisture tests of the base material. These tables give the indicated moisture in pounds per cubic foot for the stations shown at the indicated depths. These moisture contents are based on the hydrogen content of the surrounding soil and were taken from the standard calibration curves supplied with the Nuclear Chicago depth moisture gauge which was used. The values given are uncorrected for the extra thickness of access tube, the hydrogen present in the surface material or the asphalt treated bases, or for the water combined with the lime or cement in those sections.

They are presented here even though they are not true moisture contents because they still provide a means of comparing the sections, can be compared with future tests, and can be adjusted when the proper calibrations are completed if it is felt necessary to do so. Actual moisture content of base material near some of the probe access tubes is also reported in Table 2.

The depths shown were taken from the surface of the oil mat to the effective center of measurement of the nuclear probe.

TABLE 1. BENKELMAN BEAM DEFLECTIONS FOR 15,000 AXLE LOAD (0.001 INCH)

Date	March 15, 1961						July 12, 1962					
	Left Lane			Right Lane			Left Lane			Right Lane		
Section	Ave.	Max.	°F	Ave.	Max.	°F	Ave.	Max.	°F	Ave.	Max.	°F
SS-1 238+50 to 253+50	19	28	68	19	26	50	17	25	85	16	22	72
Cement 253+50 to 270+00	11	24	71	13	22	51	9	9	85	14	17	72
None 270+00 to 278+50	21	26	70	23	28	49	15	19	88	27	28	72
SS-1 278+50 to 293+50	20	32	70	20	26	47	18	21	88	21	26	72
Spec. Oil 293+50 to 322+50	18	28	65	18	28	43	22	31	87	21	38	81
Lime 322+50 to 338+00	15	26	68	15	24	40	13	19	85	13	19	83
None 338+00 to 351+80	20	28	64	20	28	37	8	11	85	10	19	85

TABLE 2. WATER IN POUNDS PER CUBIC FOOT BY NUCLEAR PROBE TESTS UNCORRECTED FOR ACCESS TUBE

Station	262 +00	267 +00	271 +00	277 +00	283 +00	290 +00	304 +00	317 +00	331 +00	337 +00	343 +00	347 +00
May 13, 1961												
Depth 0.5 ft.	9.0	8.4	6.0	6.5	6.7	6.5	6.8	6.4	8.3	7.8	6.3	6.4
1.0 ft.	12.0	9.3	7.3	8.0	8.8	9.0	8.1	8.2	9.7	7.6	8.2	9.7
1.5 ft.	15.7	10.5	8.6	6.5	6.5	9.0	11.0	9.6	9.3	6.0	7.8	8.4
2.0 ft.	18.1	14.3	14.3	6.2	11.7	12.5	13.6	13.3	18.3	7.8	13.3	14.7
2.5 ft.	17.4	16.0	17.0	6.9	14.8	18.8	14.8	15.9	19.2	9.7	13.0	-
June 23, 1961												
Depth 0.5 ft.	7.3	7.2	5.0	5.4	6.9	6.1	6.1	5.5	7.5	7.2	6.1	6.5
1.0 ft.	11.2	9.1	7.5	7.5	8.8	9.1	8.0	8.0	9.5	7.7	8.0	9.3
1.5 ft.	13.4	15.3	8.0	6.3	6.8	8.7	11.3	9.6	9.7	7.0	10.3	8.2
2.0 ft.	18.0	15.8	13.9	6.3	11.7	12.4	13.7	13.7	17.7	7.9	13.5	13.2
2.5 ft.	17.0	-	16.4	6.4	15.0	14.2	16.6	16.2	18.8	9.7	13.1	-
July 25, 1962												
Depth 0.7 ft.	6.8	5.5	4.5	4.9	5.5	6.1	5.0	5.0	5.6	4.9	4.6	5.5
1.2 ft.	5.9	5.5	4.5	4.5	4.5	5.6	5.6	5.4	5.4	5.8	4.5	5.2
1.7 ft.	9.8	8.0	8.6	4.0	4.9	7.0	9.2	8.6	6.8	4.5	8.0	7.3
2.2 ft.	11.5	10.6	10.3	4.0	9.4	9.3	9.8	10.1	10.3	4.7	8.8	-
2.5 ft.	11.3	10.3	13.2	4.0	10.3	-	-	-	-	-	-	-
Moisture in Base(%)	-	-	-	-	4.5	3.8	3.8	5.2	-	-	-	-

Laboratory Tests.

Table 3 and Table 4 show the compressive strengths of samples of lime and of cement taken at the dates shown. The results shown are averages of test results obtained at the Moscow Laboratory for the periods shown.

TABLE 3. LIME TREATED BASE

	90 Day Control	Cores Nov., 1960	Cores July, 1962
Wt./cu. ft.	144.6	148.8	148.2
Compressive Strength (psi)	758	1835	2560

TABLE 4. CEMENT TREATED BASE

	90 Day Control	Cores Nov., 1960	Core July, 1962
Wt./cu. ft.	142.0	147.5	146.4
Compressive Strength (psi)	1216	1228	1940

Tables 5, 6, and 7 show a comparison of the mechanical properties of the untreated, SS-1 emulsion treated and special road oil treated base material. The results shown are averages of test results for samples processed at the Moscow Laboratory. The R-Value and absorption results are for the special test which was previously described in the section on tests performed.

TABLE 5. SPECIAL ROAD OIL TREATED BASE

	Prior to Treatment	As Placed	Nov. 1960	June 1962
Moisture	----	---	---	4.5
Asphalt Per cent	----	2.4	---	3.1
% Passing				
3/4 inch	99	99	100	100
No. 4	53	56	58	60
No. 10	38	40	43	44
No. 40	22	24	25	26
No. 200	12	13	14	13
L.L.	20.7	---	22.2	24.2
P.I.	NP	---	NP	2.9
Stability	----	---	---	40
Modified R-Value	----	---	79	78
% Absorption for R-Value pat.	----	---	6.3	9.3

TABLE 6. SS-1 EMULSION TREATED BASE

	Prior to Treatment	As Placed	Nov. 1960	June 1962
Moisture	----	---	---	4.7
Asphalt	----	2.3	---	1.8
% Passing				
3/4 inch	97	99	100	98
No. 4	55	54	58	54
No. 10	40	38	42	40
No. 40	23	23	25	22
No. 200	12	13	14	10
L.L.	22.2	---	21.8	24.0
P.I.	NP	---	NP	3.0
S.E.	22	---	38	36
Stability	----	---	---	42
Modified R-Value	----	---	76	73
% Absorption for R-Value pat.	----	---	6.5	10.5

TABLE 7. UNTREATED BASE

	As Placed	Nov. 1960	June 1962
Moisture	---	---	10.7
Asphalt	---	---	---
% Passing			
3/4 inch	100	100	99
No. 4	59	59	55
No. 10	42	41	40
No. 40	23	24	21
No. 200	10	13	10
L.L.	17.8	20.4	23.2
P.I.	NP	NP	NP
S.E.	40	55	37
Stability	---	---	---
Modified R-Value	---	81	66
% Absorption for R-Value pat.	---	8.7	11.0

DISCUSSION

The Benkelman beam tests show no appreciable change in average deflection for any of the sections. The maximum deflections found in any section are similarly constant with the exception of the one for the right lane of the special road oil section. The maximum deflection has increased even though the average has no large increase. This may indicate the development of the soft spot even though it was not apparent from visual observation. Its location can be found from the Benkelman beam test results in Appendix B. This suggests the value of future Benkelman beam observations.

The Nuclear probe tests indicate much less moisture in the base material for the 1962 test series than in the 1961 series. This is consistant with the time of the year in which the tests were taken as the subgrade would be expected to be wetter in May and June than late in July. It may be significant to note that most of the average Benkelman beam deflections were also less in July. This suggests the possibility of using moisture

probe observations to determine the time of build up of water in the subgrade in the winter and spring to help in understanding the process of spring breakup to aid in establishing load limit criteria. Future observations will help determine whether this would be practical.

The compressive strength tests indicate a regular increase in the strength of the lime and the cement treated bases. This may not be the entire picture, however, as only the cores which remain intact can be tested. Of the current series only two out of five of the cement and one out of five corings attempted for the lime were useful for strength tests. It would be desirable to run plasticity tests on these bases as soon as soft spots are apparent to establish the plasticity characteristics of the find material. When time permits the material beneath the soft spot noted in visual inspections at stations 254 + 00 and 261 + 00 will be examined.

Little change is noted in the properties of the special road oil, emulsion, and nontreated bases. There is a slight increase in the plasticity of these specimens as shown by the limits tests. For the untreated section there is also a decrease in the special R-Value test results and in the sand equivalent. These tests seem to indicate a slight change in the properties of the fine material. The test series should be repeated after another winter season to see if the change is progressive and to correlate any changes with appearance and Benkelman beam deflections.

CONCLUSIONS AND RECOMMENDATIONS

From the above discussion the following conclusions are drawn:

1. There is the possibility that there is a correlation between the moisture in the base as indicated by the nuclear probe and Benkelman beam deflections.

2. There is a slight change in the plasticity of the fine material in the non-rigid treated base sections.

3. There is no definite superiority in the performance of any section to this date.

The following future investigations are recommended.

1. Investigate the relationship between base moisture and pavement deflection.

2. Carry on the moisture and deflection studies throughout winter and spring periods to study the mechanism of spring softening.

3. Sample the soft portions of the cement treated base to investigate the plasticity of the fine material.

4. Repeat the test series of nuclear probe studies, Benkelman beam tests and field sampling in one or two years, or sooner if any breakup occurs, to maintain a record of base quality.

ACKNOWLEDGMENTS

Appreciation is expressed here for the helpful suggestions of H. L. Day and John Peebles, for the help of John Cosho in assembling Benkelman beam data, to John Miller for locating the nuclear probe readings for 1961, and for the Boise and Moscow materials laboratory crews who aided in obtaining the samples.

DH-811-9-59

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STATE OF IDAHO
DEPARTMENT OF HIGHWAYS
MATERIALS LABORATORY
BOISE, IDAHO

LAB. No. 38152

REPORT OF TESTS ON CONCRETE CYLINDERS

PROJECT Research Project #5 COUNTY Latah

SUBMITTED BY Clark, Hippler & Copley FOR H. L. Day

LAB. No.	38152			
IDENT. No.	CH/99006-1313/			
DATE RECEIVED	July 16, 1962			
QUANTITY REPRESENTED, C.Y.	---			
STATION PLACED	331+00			
PORTION OF STRUCTURE	5' Lt. ℄			
DATE PLACED	Sept., 1959			
AIR, PERCENT	---			
SLUMP, INCHES	---			
ADMIXTURE	---			
CURING CONDITIONS	In Roadway			
SOURCE				
CONCRETE CLASS	Lime Stabilized Base			

	-T-E-S-T-	-R-E-S-U-L-T-S-		
AGE AT TEST, DAYS	35 Mo.			
SIZE: DIAM., INCHES	3.76			
HEIGHT, INCHES	4.5			
WT./C.F., LB.	148.2			
COMPRESSIVE STRENGTH, PSI	2560			
DEFECTS, ENDS				
OTHER				
TYPE OF FRACTURE (CONICAL)	X			
(IF OTHER THAN USUAL CONE)				
TYPE OF FAILURE				
BOND	X			
BOND, SOME AGGREGATE				
BOND AND AGGREGATE				

DATE OF TESTS Aug. 28, 1962

REMARKS

THIS REPORT COVERS ONLY MATERIAL AS REPRESENTED BY THE SAMPLE SUBMITTED AND DOES NOT NECESSARILY COVER ALL MATERIAL FROM THIS SOURCE.

DATE MAILED

H. L. DAY, P. E.
MATERIALS ENGINEER

APPENDIX A

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BOISE, IDAHO

LAB. NO. 38150
38151

REPORT OF TESTS ON CONCRETE CYLINDERS

PROJECT Research Project #5 COUNTY Latah

SUBMITTED BY Clark, Hippler, & Copley FOR H. L. Day

LAB. NO.	38150	38151		
IDENT. NO.	CH/99006-1313	CH/99006-1313		
DATE RECEIVED	July 16, 1962			
QUANTITY REPRESENTED, C.Y.	---	---		
STATION PLACED	262+00	261+00		
PORTION OF STRUCTURE	6" Lt. ℄			
DATE PLACED	Sept., 1959			
AIR, PERCENT	---	---		
SLUMP, INCHES	---	---		
ADMIXTURE	---	---		
CURING CONDITIONS	In Roadway			
SOURCE	---	---		
CONCRETE CLASS	Cement Stabilized Base			
	-T-E-S-T-	-R-E-S-U-L-T-S-		
AGE AT TEST, DAYS	35 Mo.	35 Mo.		
SIZE: DIAM., INCHES	3.88	3.74		
HEIGHT, INCHES	5.0	5.0		
WT./C.F., LB.	143.0	149.7		
COMPRESSIVE STRENGTH, PSI	1480	2400		
DEFECTS, ENDS				
OTHER				
TYPE OF FRACTURE (CONICAL)	X	X		
(IF OTHER THAN USUAL CONE)				
TYPE OF FAILURE				
BOND	X	X		
BOND, SOME AGGREGATE				
BOND AND AGGREGATE				

DATE OF TESTS Aug. 28, 1962

REMARKS

THIS REPORT COVERS ONLY MATERIAL AS REPRESENTED BY THE SAMPLE SUBMITTED AND DOES NOT NECESSARILY COVER ALL MATERIAL FROM THIS SOURCE.

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LAB. No. 37952

REPORT OF TESTS ON MATERIALS FOR GRADATION & EXTRACTION

PROJECT Research #5-007-344 Bear Ridge-Deary COUNTY Latah

SUBMITTED BY S.C. Lall & O.A. Hokanson For R. L. Helm
IDENT. No. SCL&OAH/99006-1313/Special Rd. Oil QUANTITY REPRESENTED ---
SAMPLED FROM Roadway 304+00
SOURCE OF MATERIALS -- PIT No. ---
DATE SAMPLED Aug. 17, 1962 DATE RECEIVED Aug. 17, 1962
TYPE

-T-E-S-T- -R-E-S-U-L-T-S-

MECHANICAL ANALYSIS

TOTAL SAMPLE PERCENT PASSING (BY DRY WEIGHT)

	COLUMN NUMBER (1) ORIGINAL SAMPLE	(2)	(3) Idaho Degradation Before	(4) Idaho Degradation After	SPECS.
1" Sq.					
3/4"Sq.					
5/8"Sq.	100		100	100	
1/2"Sq.	94		83	85	
3/8"Sq.	83		67	68	
No. 4	59		50	52	
No. 6	52		44	46	
No. 10	43		36	38	
No. 20	33		28	30	
No. 30	29		25	28	
No. 40	26		22	25	
No. 50	23		20	23	
No. 100	18		15	20	
No. 200	13		11	16	
Sand Equi.	26			25	
DUST RATIO					

EXTRACTION TEST

	% OF MIX	% OF AGG.
% EXTRACTED	6.86	7.08
% MOIST. & VOL.	3.65	3.77
% ASPHALT	3.21	3.31
MOIST. CONTENT		
STABILITY	36	
WT./C.F. COMPACTED (MIX)	151.4 LB.	
% AIR VOIDS	15.16	
COHESION VALUE		

LL (Extracted Mat'l.) - 24.2
PL (" ") - 18.4
PI (" ") - 5.8

REMARKS: MATERIAL AS REPRESENTED BY THIS SAMPLE IS

S. E. (extracted sample) = 26%. Specific Gravity (extracted mat'l.) = 2.77 and 2.79 Coarse and fine respectively.

Modified R-Value (Mat'l. as sampled) = 78 at 9.3% Moisture.

DATE MAILED Sept. 14, 1962

H. L. DAY, P. E.
MATERIALS ENGINEER

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BOISE, IDAHO

LAB. No. 37290

REPORT OF TESTS ON MATERIALS FOR GRADATION & EXTRACTION

PROJECT Research #5-007-344 Bear Ridge-Deary COUNTY Latah

SUBMITTED BY Dick Sanchez For R. L. Helm
IDENT. No. Special Road Oil (2) DS/99006-1313/ QUANTITY REPRESENTED ---
SAMPLED FROM Roadway Sta. 320+00, 6' Rt. of ℄
SOURCE OF MATERIALS --- PIT No. ---
DATE SAMPLED June 28, 1962 DATE RECEIVED June 28, 1962
TYPE ---

-T-E-S-T- -R-E-S-U-L-T-S-

MECHANICAL ANALYSIS
TOTAL SAMPLE PERCENT PASSING (BY DRY WEIGHT)

	COLUMN NUMBER (1) ORIGINAL SAMPLE	(2)	(3) Idaho Deg. Before test	(4) Idaho Deg. After test	SPECS.
1" Sq.					
3/4"Sq.	100				
5/8"Sq.	98		100	100	
1/2"Sq.	91		83	86	
3/8"Sq.	79		67	67	
No. 4	61		50	52	
No. 6	53		44	45	
No. 10	45		37	38	
No. 20	32		26	28	
No. 30	28		23	26	
No. 40	25		21	24	
No. 50	22		18	22	
No. 100	17		14	19	
No. 200	12		10	16	
Sand Eq.	42			25	
DUST RATIO					

EXTRACTION TEST

	% OF MIX	% OF AGG.
% EXTRACTED	7.70	8.02
% MOIST. & VOL.	4.90	5.15
% ASPHALT	2.80	2.87
MOIST. CONTENT		
STABILITY	44	
WT./C.F. COMPACTED (MIX)		LB.
% AIR VOIDS		
COHESION VALUE		

REMARKS: MATERIAL AS REPRESENTED BY THIS SAMPLE IS

Specific Gravity Coarse - 2.66 Liquid Limit - NV

Specific Gravity fine - 2.86 Plasticity Index - NP

DATE MAILED July 23, 1962

H. L. DAY, P. E.
MATERIALS ENGINEER

DH-805-11-58

DISTRIBUTION:
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STATE OF IDAHO
DEPARTMENT OF HIGHWAYS
MATERIALS LABORATORY
BOISE, IDAHO

LAB. No. 37289

REPORT OF TESTS ON MATERIALS FOR GRADATION & EXTRACTION

PROJECT Special Research #S-007-344 Bear Ridge-Deary COUNTY Latah

SUBMITTED BY Dick Sanchez For R. L. Helm
IDENT. No. SSI(1) DS/99006-1313/ QUANTITY REPRESENTED ---
SAMPLED FROM Roadway Sta. 249+50 6' Rt. of center line
SOURCE OF MATERIALS --- PIT No. ---
DATE SAMPLED June 28, 1962 DATE RECEIVED June 28, 1962
TYPE

-T-E-S-T- -R-E-S-U-L-T-S-

MECHANICAL ANALYSIS

TOTAL SAMPLE PERCENT PASSING (BY DRY WEIGHT)

	COLUMN NUMBER (1) ORIGINAL SAMPLE	(2)	(3) Idaho Deg. Before Test	(4) Idaho Deg. After Test	SPECS.
1" Sq.					
3/4"Sq.	100				
5/8"Sq.	98		100	100	
1/2"Sq.	90		83	85	
3/8"Sq.	76		67	67	
No. 4	55		50	51	
No. 6	48		43	45	
No. 10	40		37	41	
No. 20	29		26	30	
No. 30	25		23	28	
No. 40	22		20	26	
No. 50	19		17	24	
No. 100	13		12	21	
No. 200	9		8	18	
S.E.	55			13	
DUST RATIO					

EXTRACTION TEST

	% OF MIX	% OF AGG.
% EXTRACTED	7.30	7.41
% MOIST. & VOL.	5.89	5.98
% ASPHALT	1.41	1.43
MOIST. CONTENT		
STABILITY	44	
WT./C.F. COMPACTED (MIX)		LB.
% AIR VOIDS		
COHESION VALUE		

REMARKS: MATERIAL AS REPRESENTED BY THIS SAMPLE IS

Specific Gravity Coarse - 2.75 Liquid Limit - NV

Specific Gravity Fine - 2.90 Plasticity Index - NP

DATE MAILED July 23, 1962

H. L. DAY, P. E.
MATERIALS ENGINEER

DH-805-11-58

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BOISE, IDAHO

LAB. No. 37953

REPORT OF TESTS ON MATERIALS FOR GRADATION & EXTRACTION

PROJECT Special Research #5-007-344 Bear Ridge - Deary COUNTY Latah

SUBMITTED BY S.C. Lall & O.A. Hokanson For R. L. Helm
IDENT. No. SCL&OAH/99006-1313/SS-1(#1) QUANTITY REPRESENTED ---
SAMPLED FROM Roadway 283+00
SOURCE OF MATERIALS ---- PIT No. ----
DATE SAMPLED Aug. 17, 1962 DATE RECEIVED Aug. 17, 1962
TYPE

-T-E-S-T- -R-E-S-U-L-T-S-

MECHANICAL ANALYSIS
TOTAL SAMPLE PERCENT PASSING (BY DRY WEIGHT)

	COLUMN NUMBER (1) ORIGINAL SAMPLE	(2)	(3) Idaho Deg. Befor	(4) Idaho Deg. After	SPECS.
1" Sq.	100				
3/4"Sq.	95				
5/8"Sq.	94		100	100	
1/2"Sq.	88		83	84	
3/8"Sq.	76		67	67	
No. 4	53		50	52	
No. 6	47		44	46	
No. 10	41		39	42	
No. 20	29		29	30	
No. 30	26		25	28	
No. 40	23		22	25	
No. 50	20		19	23	
No. 100	15		14	20	
No. 200	10		9	16	
S.E.	27			20	
DUST RATIO					

EXTRACTION TEST

	% OF MIX	% OF AGG.
% EXTRACTED	6.24	6.36
% MOIST. & VOL.	4.38	4.47
% ASPHALT	1.85	1.89
MOIST. CONTENT		
STABILITY	43	
WT./C.F. COMPACTED (MIX)	145.7 LB.	
% AIR VOIDS	15.40	
COHESION VALUE		
L.L. (Extracted Mat'l)	23.2	
P.L. (" ")	19.8	
P.I. (" ")	3.4	

REMARKS: MATERIAL AS REPRESENTED BY THIS SAMPLE IS

S. E. (extracted mat'l) = 27%. Specific Gravity (extracted mat'l.) = 2.73 &2.82 Coarse and fine respectively

Modified R-Value (Material as Sampled) = 71 at 11.0% Moisture

DATE MAILED Sept. 14, 1962

H. L. DAY, P. E.
MATERIALS ENGINEER

DH-805-11-58

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LAB. No. 37954

REPORT OF TESTS ON MATERIALS FOR GRADATION & EXTRACTION

PROJECT Research #S-007-344 Bear Ridge-Deary COUNTY Latah

SUBMITTED BY S.C. Lall & O.A. Hokanson For R. L. Helm
IDENT. No. SCL&OAH/99006-1313/SS-1(#2) QUANTITY REPRESENTED ---
SAMPLED FROM Roadway 290+00
SOURCE OF MATERIALS --- PIT No. ---
DATE SAMPLED Aug. 17, 1962 DATE RECEIVED Aug. 17, 1962
TYPE

-T-E-S-T- -R-E-S-U-L-T-S-

MECHANICAL ANALYSIS
TOTAL SAMPLE PERCENT PASSING (BY DRY WEIGHT)

	COLUMN NUMBER (1) ORIGINAL SAMPLE	(2)	(3) Idaho Degradation Before	(4) Idaho Degradation After	SPECS.
1" Sq.	100				
3/4"Sq.	98				
5/8"Sq.	95		100	100	
1/2"Sq.	89		83	85	
3/8"Sq.	75		67	68	
No. 4	53		50	53	
No. 6	45		42	46	
No. 10	38		36	40	
No. 20	28		26	31	
No. 30	25		24	29	
No. 40	22		21	27	
No. 50	19		18	25	
No. 100	15		14	22	
No. 200	10		9	19	
Sand Equi.	25			14	
DUST RATIO					

EXTRACTION TEST

	% OF MIX	% OF AGG.
% EXTRACTED	5.96	6.10
% MOIST. & VOL.	3.72	3.81
% ASPHALT	2.24	2.29
MOIST. CONTENT		
STABILITY	38	
WT./C.F. COMPACTED (MIX)	144.7 LB.	
% AIR VOIDS	16.28	

COHESION VALUE
LL (Extracted mat'l.) - 24.9*
PL (" ") - 19.3
PI (" ") - 5.6

*Approximate within 1.5%

REMARKS: MATERIAL AS REPRESENTED BY THIS SAMPLE IS

S. E. (extracted mat'l) = 25% Specific Gravity (extracted mat'l) = 2.74 & 2.67

Coarse and fine respectively.

Modified R-Value (Mat'l. as sampled) = 76 at 10.1 % Moisture

DATE MAILED Sept. 14, 1962

H. L. DAY, P. E.
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LAB. No. 37291

REPORT OF TESTS ON MATERIALS FOR GRADATION & EXTRACTION

PROJECT Special Research #S-007-344 Bear Ridge-Deary COUNTY Latah

SUBMITTED BY Dick Sanchez For R. L. Helm
IDENT. No. DS/99006-1313/Base Material (3) QUANTITY REPRESENTED ---
SAMPLED FROM Roadway - Sta. 273+50, 6' Rt. of center line.
SOURCE OF MATERIALS ---- PIT No. ----
DATE SAMPLED June 28, 1962 DATE RECEIVED June 28, 1962
TYPE

-T-E-S-T- -R-E-S-U-L-T-S-

MECHANICAL ANALYSIS
TOTAL SAMPLE PERCENT PASSING (BY DRY WEIGHT)

	COLUMN NUMBER (1) Original Sample	(2)	(3) Idaho Degradation Before	(4) Idaho Degradation After	SPECS.
1" Sq.					
3/4"Sq.	100				
5/8"Sq.	98		100	100	
1/2"Sq.	91		83	87	
3/8"Sq.	76		67	70	
No. 4	52		50	54	
No. 6	45		43	46	
No. 10	37		35	38	
No. 20	27		26	30	
No. 30	23		22	28	
No. 40	20		20	26	
No. 50	18		17	24	
No. 100	14		14	21	
No. 200	10		10	17	
Sand Equi.	37			12	
DUST RATIO					

EXTRACTION TEST

	% OF MIX	% OF AGG.
% EXTRACTED		
% MOIST. & VOL.		
% ASPHALT		
MOIST. CONTENT		
STABILITY		
WT./C.F. COMPACTED (MIX)	LB.	
% AIR VOIDS		
COHESION VALUE		

REMARKS: MATERIAL AS REPRESENTED BY THIS SAMPLE IS

Specific Gravity Coarse - 2.70 Liquid Limit - NV

Specific Gravity Fine - 2.86 Plasticity Index - NP

Percent Moisture - 14.3

DATE MAILED July 23, 1962

H. L. DAY, P. E.
MATERIALS ENGINEER

DH-805-11-58

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BOISE, IDAHO

LAB. No. 37955

REPORT OF TESTS ON MATERIALS FOR GRADATION & EXTRACTION

PROJECT Research #S-007-344 Bear Ridge-Deary COUNTY Latah

SUBMITTED BY S.C. Lall & O.A. Hokanson For R. L. Helm
IDENT. No. SCL&OAH/99006-1313/None QUANTITY REPRESENTED ---
SAMPLED FROM Roadway 275+75
SOURCE OF MATERIALS --- PIT No. ---
DATE SAMPLED Aug. 17, 1962 DATE RECEIVED Aug. 17, 1962
TYPE

-T-E-S-T- -R-E-S-U-L-T-S-

MECHANICAL ANALYSIS
TOTAL SAMPLE PERCENT PASSING (BY DRY WEIGHT)

	COLUMN NUMBER (1) ORIGINAL SAMPLE	(2)	(3) Idaho Degradation Before	(4) Idaho Degradation After	SPECS.
1" Sq.	99				
3/4"Sq.	99				
5/8"Sq.	99		100	100	
1/2"Sq.	93		83	84	
3/8"Sq.	83		67	70	
No. 4	58		50	53	
No. 6	50		43	46	
No. 10	43		37	41	
No. 20	29		25	31	
No. 30	26		22	28	
No. 40	22		19	26	
No. 50	19		16	24	
No. 100	15		13	21	
No. 200	10		9	18	
Sand Equi.	37			15	
DUST RATIO					

EXTRACTION TEST

	% OF MIX	% OF AGG.
% EXTRACTED		
% MOIST. & VOL.		
% ASPHALT		
MOIST. CONTENT		

STABILITY

WT./C.F. COMPACTED (MIX) LB.

% AIR VOIDS

COHESION VALUE

LL - 23.2
PL - NP
PI - NP

REMARKS: MATERIAL AS REPRESENTED BY THIS SAMPLE IS

S. E. - 37% Specific Gravity - 2.72 & 2.64, Coarse and fine Respecitively.

Modified R-Value - 66 at 11.0% Moisture

DATE MAILED Sept. 14, 1962

H. L. DAY, P. E.
MATERIALS ENGINEER

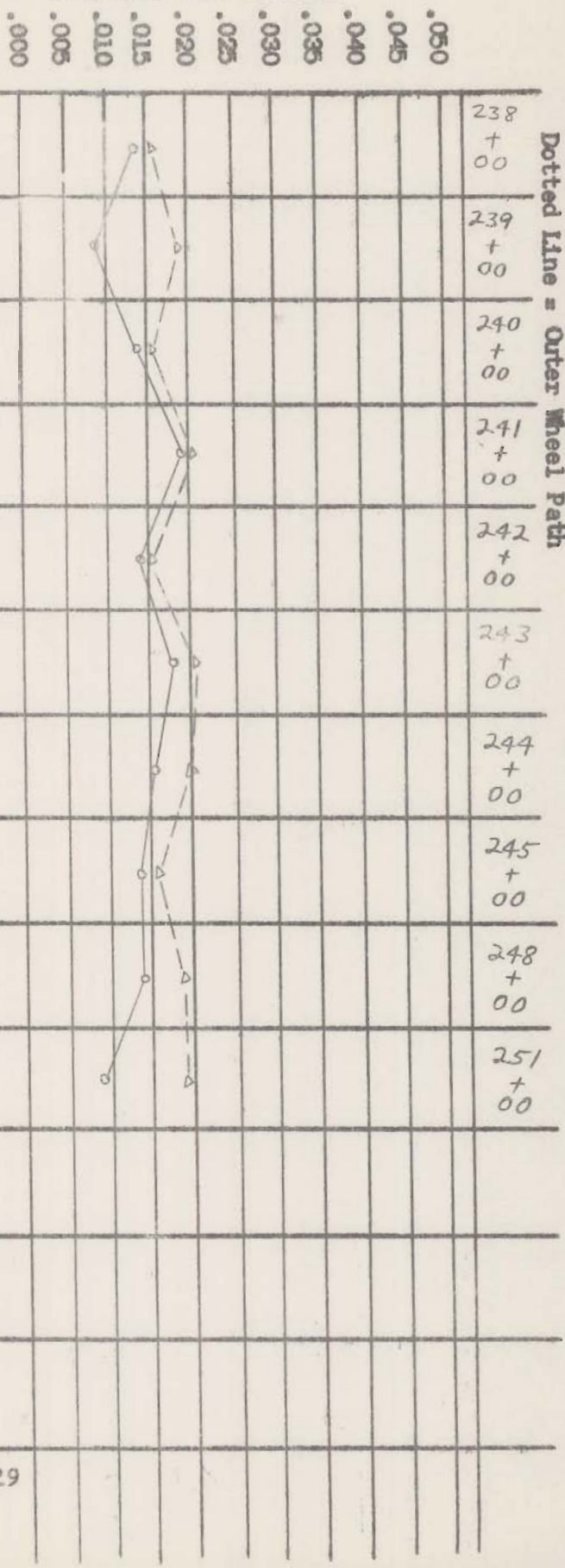
APPENDIX B

STATE OF IDAHO
DEPARTMENT OF HIGHWAYS
Materials Laboratory
Boise, Idaho

Date July 12, 1962 Project Research Proj. 5 or Route Number St. Hwy. 7 Rear Ridge-Deary S-4769(6)

Solid Line = Inner Wheel Path
Dotted Line = Outer Wheel Path

Right (North bound) lane



Pavement Condition and Remarks	
SS-1 Emulsion Tr. Base cut Air 68°F Mat 68°F	238 + 00
cut	239 + 00
Cut	240 + 00
· Fill	241 + 00
"	242 + 00
"	243 + 00
"	244 + 00
"	245 + 00
cut	248 + 00
Fill	251 + 00

STATE OF IDAHO
DEPARTMENT OF HIGHWAYS
Materials Laboratory
Boise, Idaho

S-4769(6)
Date July 12, 1962 Project Research Proj. 5 or Route Number St. Hwy. 7 Bear Ridge-Deary
Solid Line = Inner Wheel Path
Dotted Line = Outer Wheel Path
Right (Northbound) Lane

Deflection in Inches

.000 .005 .010 .015 .020 .025 .030 .035 .040 .045 .050

Pavement Condition and Remarks	
Cement Tr. Base Air 69°F Pavement 68°F	254 + 00
Cut	257 + 00
Fill	260 + 00
"	263 + 00
Cut	266 + 00
"	269 + 00

STATE OF IDAHO
DEPARTMENT OF HIGHWAYS
Materials Laboratory
Boise, Idaho

Date July 12, 1962 Project Research Proj. 5 or Route Number St. Hwy. 7 Bear Ridge-Deary S-4769(6)

Solid Line = Inner Wheel Path
Dotted Line = Outer Wheel Path

Right (North bound) Lane

Deflection in Inches

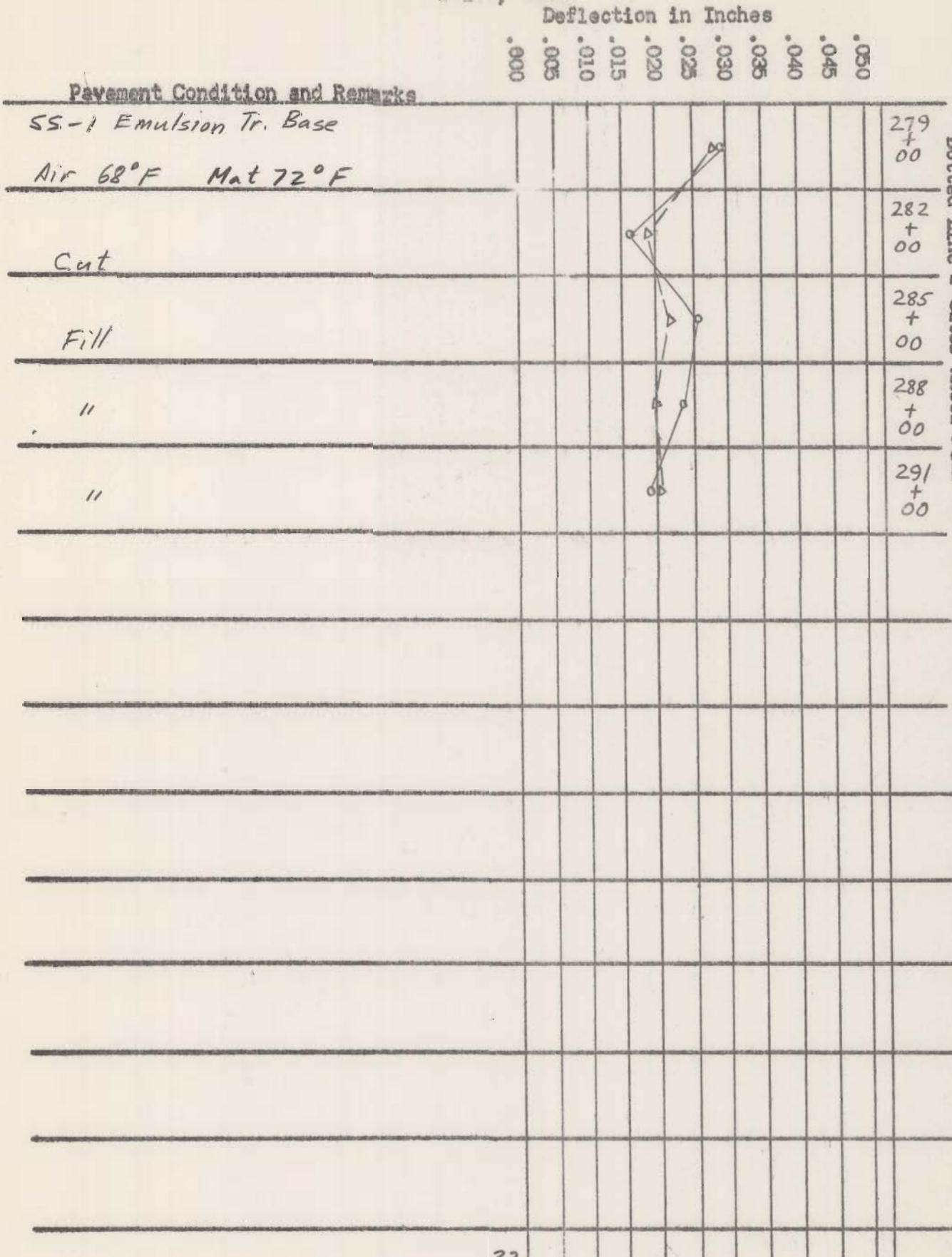
.000	.005	.010	.015	.020	.025	.030	.035	.040	.045	.050	Pavement Condition and Remarks
											No Base Treatment Air 68°F Mat 72°F 272 + 00
											275 + 00 Fill

STATE OF IDAHO
DEPARTMENT OF HIGHWAYS
Materials Laboratory
Boise, Idaho

Date July 12, 1962 Project Research Proj. 5 or Route Number St. Hwy. 7 Rear Ridge-Deary S-4769(6)

Solid Line = Inner Wheel Path
Dotted Line = Outer Wheel Path

Right (Northbound) Lane



STATE OF IDAHO
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Boise, Idaho

Deflection in Inches

.000 .005 .010 .015 .020 .025 .030 .035 .040 .045 .050

S-4769(6)

Date July 12, 1962 Project Research Proj. 5 or Route Number St. Hwy. 7 Rear Ridge-Deary

Solid Line = Inner Wheel Path
Dotted Line = Outer Wheel Path

Right (Northbound) Lane

Pavement Condition and Remarks	
Spec. Rd. Oil Tr. Base Fill Air 70°F Mat 81°F	294 + 00
Fill	297 + 00
"	300 + 00
.Cut	303 + 00
"	306 + 00
Fill	309 + 00
"	312 + 00
"	315 + 00
"	318 + 00
Cut	321 + 00

STATE OF IDAHO
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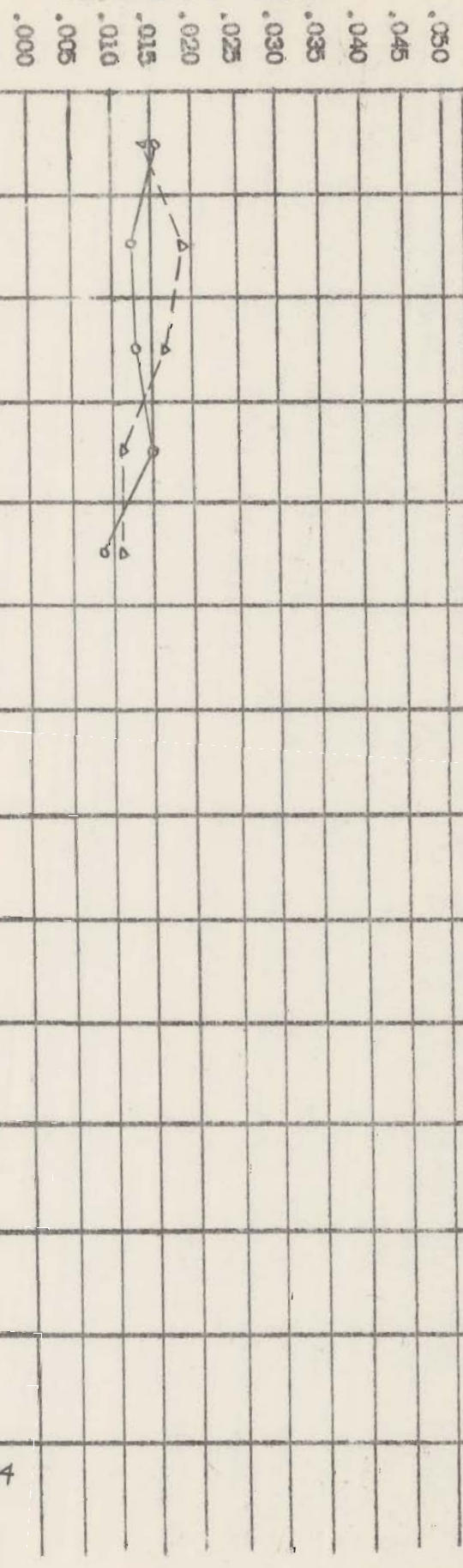
Materials Laboratory
Boise, Idaho

Date July 12, 1962 Project Research Proj. 5 or Route Number St. Hwy. 7 Bear Ridge-Deary S-4769(6)
Solid Line = Inner Wheel Path
Dotted Line = Outer Wheel Path

Right (North bound) Lane



Pavement Condition and Remarks	
Lime Tr. Base Fill Air 80° F Mat. 80° F	324 + 00
"	327 + 00
Cut	330 + 00
"	333 + 00
Fill	336 + 00

STATE OF IDAHO
DEPARTMENT OF HIGHWAYS
Materials Laboratory
Boise, Idaho

S-4769(6)

Date July 12, 1962 Project Research Proj. 5 or Route Number St. Hwy. 7 Bear Ridge-Deary

Solid Line = Inner Wheel Path
Dotted Line = Outer Wheel Path

North bound

Deflection in Inches

.000 .005 .010 .015 .020 .025 .030 .035 .040 .045 .050

Pavement Condition and Remarks	
No Base Treatment Cut Air 86°F Mat 85°F	339 + 00
Fill	342 + 00
"	345 + 00
"	348 + 00

STATE OF IDAHO
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Materials Laboratory
Boise, Idaho

Deflection in Inches

.000 .005 .010 .015 .020 .025 .030 .035 .040 .045 .050

S-4769(6)
Date July 12, 1962 Project Research Proj. 5 or Route Number St. Hwy. 7 Bear Ridge-Deary
Solid Line = Inner Wheel Path
Dotted Line = Outer Wheel Path
Left (South bound) Lane

Pavement Condition and Remarks	
No Treatment	348 + 00
	342 + 00
Lime Tr.	336 + 00
	330 + 00
	324 + 00
Air 83°F Mat 85°F	
SP, Rd. Oil	318 + 00
	312 + 00
	306 + 00
	300 + 00
	294 + 00
	288 + 00
Air 82°F Mat 88°F	
SS-1 Emulsion Tr. Base	282 + 00

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