5-1-1993

Experimental Construction 92-34 : Field Trial of Gravel Stabilization Methods - Route 1, Cyr-Van Buren, ME, 1st Interim Report, May 1993

Maine Department of Transportation

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION
TECHNICAL SERVICES DIVISION
RESEARCH & DEVELOPMENT SECTION

DATE MAY 1993

EXPERIMENTAL CONSTRUCTION 92-34

FIELD TRIAL OF GRAVEL STABILIZATION METHODS
ROUTE 1 CYR-VAN BUREN, ME

1ST INTERIM REPORT

INTRODUCTION

This experimental construction project was developed, designed, and inspected by personnel from the University of Maine, Civil Engineering Staff. The experimental project was constructed on and as a part of Project #2586.00 This was a complete reconstruction project 2.2 miles in length. The experimental section contains 6 experimental base types and is 1020 feet in length. The 1020 foot experimental section began at Station 1028+00 and ended at Station 1038+20. The test section consisted of 200 foot segments of soil-cement, asphalt-stabilized, and calcium chloride-stabilized materials, as well as two control sections and one 20 foot untreated section. The stabilized and control sections were located as follows:

Soil-Cement Stabilized	STA 1028+00 to 1030+00
Modified Subbase Control	STA 1030+00 to 1032+00
Asphalt Stabilized Section	STA 1032+00 to 1034+00
Untreated Section	STA 1034+00 to 1034+20
Calcium Chloride Stab. Section	STA 1034+20 to 1036+20
Standard Subbase Control	STA 1036+20 to 1038+20

Work on this project started in September 1990 and was completed in the summer of 1991. A construction report "Experimental Construction 92-34" was written in Dec. 1991 which provided a background of stabilization agents, their uses, advantages and disadvantages. This report also provided preliminary design results as well as test results obtained during the construction phases. In addition to the test results a plan for long term monitoring was also included in Appendix G. Some of the features to be monitored are rutting, and serviceability such as roughness and overall performance. Strength measurements using a Road Rater was also suggested. Most of the evaluations can be performed with the ARAN vehicle and the Road Rater. Long term monitoring of the calcium chloride is specifically mentioned. For this phase they recommend that test pits be dug every 5 years in order to monitor the possible leaching away of the calcium chloride. A revised project monitoring schedule is shown at the end of the report in Table I.

RESULTS

This first Interim report also included initial data and results that were computed after the project and the construction report was completed. The Road Rater deflection data were taken at various stages during the construction period, but the results were not processed until the study was assigned to MDOT personnel for long term monitoring. As a result this report contains more information than an evaluation of the project after one years time.

Cross Section Study.

When the project was completed in the summer of 1992 cross section levels were taken by the UMO personnel to establish a standard reference. Within a very short period of time cross section levels were also taken by MDOT personnel for the purpose of obtaining final quantities for payment.

These two sets of data are within reasonable conformity with each other except for the first cross section at Station 1028+50. This particular cross section shows a difference in elevations of approximately 0.30 feet. As a part of the research study, cross section levels were taken again in the summmer of 1992 after one year's elapsed time. The results of these three surveys are presented in Table II. Data pertaining to elevations and pavement settlements indicate that very little movement has occurred during the 1 year period. The greatest movement appeared to be at the edge of the paved shoulder or 22 feet left or right of centerline. However, even this movement or settlement is less than 1/2 inch. When settlement comparisons were made between original MDOT data and the data 1 year later even less movement was detected.

In order to avoid future confusion, two statements are necessary for clarity. (1) The cross sections shown in the Construction Report 92-34 should read that the elevations of the top layer represent the top of the wearing course and not top of the binder course as stated. (2) For reference work, the elevations of the cross section at Station 1028+50 should be based upon level readings determined by MDOT personnel. The level readings taken by MDOT agree with both sets of data while the UMO data does not agree with either set at this particular location.

Structural Evaluation Using Road-rater Deflections.

Deflection testing or strength measurements were obtained through the use of the road Rater at 4 different times. The first set of data were taken in Sept. 28, 1990 after the base course was completed. The second set of tests were conducted May 21, 1991 after the binder course was applied. The third set of data were taken in August 6, 1991 after the wearing course was applied. The fourth set was taken September 16, 1992 after the structure had been exposed to one year of traffic and environment. The criteria used in developing the structural parameters were as follows A 20 year design life, for a truck traffic rate of 110 18k loads per day, on a "till" type of soil subgrade. The pavement thicknesses in layers were as follows: 3 inches of asphalt concrete base grading B, followed by 1 3/4 inches of grading B binder, followed by 1 1/4 inches of grading C wearing course. The average of four deflection tests per subbase type are presented in Table III.

Examination of the structural information in Table III indicates that the "standard" subbase and the "modified" subbase are performing the same. This might be expected as the only difference is that oversize material in the standard base was scalped away in order to get a modified subbase. The calcium chloride section also appears to be acting similar to the standard and the modified sections. The asphalt stabilized section is slightly stronger than the three granular subbase sections, but significantly weaker than the soil-cement section. The "soil-cement" subbase is performing in a distinctly different manner The deflections are much smaller, it is providing better support, and the computations indicate it is the strongest section. These structural results indicate that in all 5 cases the road is adequately designed.

Visual Evaluation.

In the summer of 1992 the project was inspected and several photographs were taken. The photographs show that three transverse cracks have developed. One crack has developed in the soil-cement section near Station 1029+61, another crack has developed in the modified section near Station 1031+46, a third transverse crack was noted near Station 1034+42 in the calcium-chloride section A fourth crack was noted near Station 1037+89 in the standard section. This fourth crack was detected on the ARAN video tape, it has not been confirmed in the field.

ARAN Results.

ARAN results from data taken August 17, 1992 are presented in Table IV. The format of this table is arranged in such a manner that the right side of the table refers to the northbound lane and the left side of the table refers to the southbound lane. The various sections are listed as they appear on the roadway. As future data are added this table will become wider. These results indicate that very little rutting has occurred. Although the rutting has doubled in the time span of one year it is still very small. The asphalt stabilized base section shows the greatest rutting in the first year, but it was surpassed by the untreated section the second year. The inside wheel path showed more rutting than the outer wheel path. This feature is not uncommon on roads with paved shoulders according to personnel in the office of pavement management.

The lower portion of Table IV shows very limited roughness information. Additional information was taken but could not be processed because of the extremely short sections. The results presented indicate that all sections are "smooth". Smooth is considered as a value between 0 - 190, medium between 190 - 320, and rough as values in excess of 320 inches per mile.

Prepared by:

David W Rand

David Rand

Reviewed by:

Warren T Foster

Warren T. Foster
Research & Development Engineer

Distribution B

Other Available Documents
Construction Report Dec, 1991

TABLE I

TESTING SCHEDULE FOR CYR - VAN BUREN
UMO PROJECT

Year	ARAN Roughness IRI	ARAN Rut	Road Rater	Elev X-Sects	Elev Profile	Crack Survey	$CaCl_2$ Leach
1991	*	*	*				
1992	*	*	*	*	*	*	
1993	*	*	*	*	*	*	
1994	*	*	*				
1995	*	*	*	*	*	*	1995
1996	*	*	*				
1997	*	*	*	*	*	*	
1998	*	*	*				
1999	*	*	*	*	*	*	
2000	*	*	*				2000
2001	*	*	*	*	*	*	
2002	*	*	*				
2003	*	*	*	*	*	*	
2004	*	*	*				
2005	*	*	*	*	*	*	2005
2006	*	*	*				

See Appendix G "Long Term Monitoring Program"

FIELD TRIAL OF
GRAVEL STABILIZATION METHODS

Route 1, Cyr Plantation - Van Buren
Construction Report
Technical Services Division
Experimental Construction Report 92-34
December 1991

TABLE II
ELEVATION CHANGE FROM SETTLEMENTS

			CROSS SECTION ELEVATIONS					DIFFERENCE FROM UMO					DIFFERENCE FROM DOT				
		STA	Lt 22	Lt 12	CL 0	Rt 12	Rt 22	Lt 22	Lt 12	CL 0	Rt 12	Rt 22	Lt 22	Lt 12	CL 0	Rt 12	Rt 22
TOP		UMO	82[illegible]	825 75	826 05	825 75	8 5 25										
Finals	3/91 6/20/92	1028+50 10 Months	82[illegible] 01 82[illegible] 01	825 45 825 43	825 75 825 74	825 51 825 42	825 05 8 5 03	0 23 0 23	0 20 0 32	0 30 0 3[illegible]	0 4 0 7	0 20 0 22	0 00	0 02	0 01	0 03	0 02
TOP		UMO	82[illegible] 81	8_5 20	825 50	25 25	824 75										
Finals	3/91 6/20/92	1029+50 10 Months	824 81 824 79	825 12 825 11	825 41 825 38	825 17 825 17	824 73 824 72	-0 01 0 01	0 07 0 09	0 04 0 1[illegible]	0 08 0 2	0 02 0 02	0 02	0 02	0 03	0.04	0 01
TOP	C	UMO	82[illegible]	824 82	825 50	824 80	824 30										
Finals	3/91 6/20/92	1030+50	824 21 824 32	824 71 824 71	824 39 824 46	824 7[illegible] 824 6[illegible]	824 31 8 4 27	0 02 0 00	0.11 0.11	0 5[illegible] 0 54	0 09 0 11	-0 01 0 03	-0 02	0 00	0 03	0 02	0 04
TOP	C	UMO	82[illegible] 95	824 45	824 75	824 45	824 00										
Finals	3/91 6/30/92	1031+50	824 02 823 99	824 40 824 37	824 66 824 65	824 3[illegible] 824 37	823 96 823 96	-0 07 -0 04	0 05 0 08	0 04 0 10	0 07 0 08	0 04 0 04	0 03	0 03	0 01	0 01	0 00
TOP	C	UMO	823 55	824 00	824 28	824 00	823 55										
Finals	3/91 6/20/92	1032+50	82[illegible] 53 82[illegible] 54	824 04 824 01	824 28 824 28	824 04 824 0[illegible]	823 62 823 60	-0 03 0 01	-0.04 -0 01	0 00 0 00	-0 04 -0 01	-0 07 -0 05	0 04	0 03	0 00	0 03	0 02
TOP	C	UMO	823 30	823 80	823 36	823 65	8 3 25										
Finals	3/91 6/30/92	1033+50	82[illegible] 23 823 23	823 70 823 67	823 36 823 33	823 6[illegible] 823 65	823 22 823 21	0 02 0 07	0 10 0 13	0 00 0 03	-0 03 0 00	0 03 0 04	0 05	0 02	0.03	0 03	0 01
TOP	C	UMO	82[illegible] 95	823 35	823 60	823 28	822 80										
Finals	3/91 6/20/92	1034+50	82[illegible] 90 822 87	823 34 823 31	823 62 823 59	823.34 823 29	822.86 822 82	0 05 0 08	0.01 0.04	-0 0[illegible] 0 01	-0 06 -0 01	-0 06 -0 02	0 03	0 03	0 03	0 05	0.04
TOP	C	UMO	822 55	823 00	823 25	822 90	822 52										
Finals	3/91 6/20/92	1035+50	82[illegible] 54 82[illegible] 52	822 96 822 93	823 26 823 23	822.98 822 92	822 56 822.53	0 01 0 03	0 04 0 07	-0 01 0 02	-0 08 -0 03	-0 04 -0 01	0 02	0 03	0 03	0 05	0.03
TOP	C	UMO	822 25	822 70	822 35	822 60	822 15										
Finals	3/91 6/30/92	1036+50	82[illegible] 22 822 17	822 66 822 65	822 96 822 92	822 66 822.62	822 20 822 19	0 03 0 08	0 04 0.05	-0 01 0 03	-0 06 -0 02	-0 05 -0 04	0 05	0 01	0 04	0.04	0.01
TOP	C	UMO	821 90	822 32	822 55	822 25	821 80										
Finals	3/91 6/30/92	1037+50	821 88 821 86	822 30 822 28	822 58 822 55	822.30 822 27	821 86 821 84	0 02 0.04	0 02 0 04	-0 03 0 00	-0 05 -0 02	-0 06 -0 04	0 02	0 02	0 03	0 03	0 02
TOP	C	UMO	*	*	*	*	*										
Finals	3/91 6/30/92	1038+50	821 52	821 92	822 20	821.92	821 48										

TABLE III
CONSOLIDATED ROAD-RATER RESULTS
@ CYR PLANTATION / VAN BUREN
UMO EXPERIMENTAL BASE STUDY

Thickness	3"	4 3/4"	6"	6"	6"	6"
Date Measured	9/28/90	5/21/91	8/6/91	9/16/92	/	
	DEFLECTION # 1 SENSOR (Mils) (Not temperature corrected)					
STANDARD B	4.49	3 55	2.04	1.47		
MOD SUBBASE	4.15	3.83	2.01	1.44		
ASPH STAB B	4.18	2.79	1.60	1.24		
$CaCl_2$ STAB	4.21	3.20	2.05	1.54		
SOIL CEMENT	2 30	2.52	1.37	1.05		
**	**COMPUTED SUBGRADE VALUE (ksi)**					
STANDARD B	1.33	2.00	5 93	18.70		
MOD SUBBASE	1.77	1.46	5.20	16.88		
ASPH STAB B	1.69	3.37	9.43	20.10		
$CaCl_2$ STAB	1.86	2.68	5.84	16.68		
SOIL CEMENT	8.70	4.27	15.92	20.83		
**	**EFFECTIVE PAVEMENT THICKNESS (Inches)**					
STANDARD B	0 00	2.14	5.41	4.00		
MOD SUBBASE	0.00	1.49	5.57	4.13		
ASPH STAB B	0.00	2.48	5.62	4.74		
$CaCl_2$ STAB	0.03	2.77	5.71	4.14		
SOIL CEMENT	2.41	2.96	5 42	5.49		
**	**PAVEMENT REQUIRED (Inches)**					
STANDARD B	9.30	7.54	3.89	1.09		
MOD SUBBASE	8.39	8 33	4.07	1.09		
ASPH STAB B	8 47	5.45	2.43	0.85		
$CaCl_2$ STAB	8 51	6.56	3.93	1.48		
SOIL CEMENT	2 98	4.65	1.31	0.58		
**	**OVERLAY REQUIRED (Inches)**					
STANDARD B	9.30	5.40	-1.52	-2.91		
MOD SUBBASE	8 39	6.84	-1 50	-3.03		
ASPH STAB B	8.47	2.97	-3.19	-3.90		
$CaCl_2$ STAB	8.48	3.79	-1.78	-2.66		
SOIL CEMENT	0.57	1.69	-4.11	-4.90		

** Temperature corrected deflections were used in Calculations

TABLE IV

PHYSICAL PROPERTIES

ARAN RUTS IN INCHES

BASE TYPE	Southbound 1993 Outer	1993 Inner	1992 Outer	1992 Inner	1991 Outer	1991 Inner	Northbound 1991 Inner	1991 Outer	1992 Inner	1992 Outer	1993 Inner	1993 Outer
Standard Base			0 090	0 040	Missing	Missing	0 050	0.063	0 075	0 033		
CaCl2			0 033	0 010	"	"	0 050	0 088	0 115	0 054		
Untreated B			0 000	0 000	"	"	0 000	0.100	0 200	0 100		
Asph Stab B			0.067	0.025	"	"	0.088	0.038	0 175	0.075		
Mod Subbase			0.092	0 025	"	"	0 050	0.038	0.108	0.003		
Soil Cement			0 083	0 033	"	"	0 098	0 038	0 145	0 091		

INTERNATIONAL ROUGHNESS INDEX

BASE TYPE	1993 Outer	1993 Inner	1992 Outer	1992 Inner	1991 Outer	1991 Inner	1991 Inner	1991 Outer	1992 Inner	1992 Outer	1993 Inner	1993 Outer
Standard Base				Missing		Missing	42.23		Missing			
CaCl2				"		"	47.09		"			
Untreated B				"		"	Missing		"			
Asph Stab B				"		"	70.97		"			
Mod Subbase				"		"	58 09		"			
Soil Cement				"		"	55 67		"			