Comparative Studies of Combinations of Treated and Untreated Bases and Subbases for Flexible Pavements

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New Mexico's experimental Project No. F-051-1 (8) was constructed to compare "upside down" stabilization with other base construction. The term was applied to the design because it called for the subbase material to be treated with cement.

Nine experimental sections were constructed. The objective was to determine the effect of subbase stabilization compared to base course stabilization and the effect of a lower cement content in the base. Of particular interest is possible degradation of the mineral aggregates in all sections. The treated subbase sections should eliminate intrusion of subgrade soils into the base.

Through periodic inspections and check testing it is hoped that better knowledge can be obtained to determine which design provides the best protection for future distortion and roughness. An attempt will be made to evaluate the various designs relative to costs and serviceability.

● THROUGHOUT NEW MEXICO there has been a growing conviction that a subbase treated to obtain greater stability will solve many road construction problems. New Mexico's experimental Project F-051-1 (8) was constructed to compare "upside down" stabilization with other base construction. The term was applied to the design because it called for the subbase material to be treated with cement. The concept of building with great strength directly over weak subgrade soils reverses the accepted principle of building stability gradually upward for flexible base construction.

The basic design feature of placing untreated base materials over a rigid subbase was incorporated into several projects rebuilt in 1954. Several old concrete pavements in the vicinity of Albuquerque had become so cracked and distorted that reconstruction was necessary. The old pavements were covered with 6 in. of untreated base material compacted and reshaped to typical section. Over the reshaped section 2 in. of asphaltic hot plant mixed surfacing were placed. After six years of heavy traffic the surfaces remain in remarkably good condition. No reflective cracking has developed and string line checks show little rutting or distortion. Prior to 1954, old concrete pavements were overlayed with asphaltic mixtures. The pavements continu to pump under traffic, and distortion rapidly developed. Usually within a year the crack patterns of the old concrete reflected through the asphaltic surface.

In 1958, New Mexico commenced to use cement extensively to treat base course a gregates. Pattern cracking which appeared in the surface course caused much concern among road builders.

INTERSTATE 010-1 (8) 6, ROAD FORKS—EAST

On one New Mexico Project, I-010-1 (8) 6, Road Forks—East, the contractor became alarmed when, after having completed approximately one-half the length of the project, pattern cracking appeared in the plant mixed surface course. He requested permission to change his operations and process the cement in the subbase aggregat He pointed out good reasons for the change: immediate protection of the subgrade fr urface moisture, better compaction of the untreated base because of a firmer foun-lation, reflective cracking in the surface course alleviated by a cushioning interme-liate layer, and in all probability a smoother-riding road. In New Mexico practically ll cement treatments are processed by road mix methods. The time specified to rocess, compact, and shape the treated materials did not permit the necessary blade ork to obtain the smoothness desired for surface course placement.

The New Mexico Highway Department had previously used variations of the upside own construction on urban projects where subgrade conditions were unfavorable to ood construction. Unstable subgrade soils caused by leaky water pipes and poor rainage were bridged by treating the subbase with cement. In all cases performance nder traffic appeared to be satisfactory. Because of the reasons stated by the con-ractor and the Department's previous experience, he was given permission to treat e subbase instead of the base.

Without any planning or much forethought all the features of an experimental pro-ect were born. The contractor, in the interest of better flexible base construction, greed to construct other variations of base and subbase stabilization at no additional ost to the state. Variations paired were (a) untreated base and subbase; (b) base ourse treated with $1\frac{1}{2}$ percent cement and subbase treated with 3 percent cement; d (c) base course treated with $1\frac{1}{2}$ percent cement placed over an untreated subbase. hroughout the project 3 in. of asphaltic plant mixed surfacing were laid, except for e section of the interstate connection where $1\frac{1}{2}$ in. of plant mix were placed over an treated base and a subbase treated with 3 percent cement.

PRELIMINARY DISCUSSIONS, F-051-1 (8)

The materials and testing laboratory recommended the upside down design for sev-al projects. One of the projects so recommended was located on US 64 north of nta Fe, between Tesuque and Pojoaque. Samples taken from the subgrade soils ere found to be loaded with mica on which water acted rapidly and caused a greater ss of stability than normally expected for the soils encountered. It was thought that ment stabilization of the subbase would prevent any intrusion of the micaceous ma-rials into the base.

Bureau of Public Roads engineers pointed out that the limited use of the design did t provide enough background for standard application. Following normal procedure ey requested further justification and documentation before approval could be given r its use. Several conferences ensued and the facets of the design were discussed some detail.

The discussions disclosed opinions which differed on whether or not reflective acking was a forerunner of distress. Several engineers believed that cracking was desirable but thought it could be alleviated by reducing the amount of cement used. hers thought that cement would be of little benefit unless slab strength were devel-ed. Ideas about the upside down design centered on the untreated base course layer. e engineer felt strongly that the aggregates should be of top quality, well-graded, l the fines sandy and nonplastic. Samples tested from one of the Albuquerque pro-ts, reconstructed in 1954, had plastic indexes ranging from five to seven. The ne engineer pointed out that the dynamic forces from moving loads were more or s confined within a granular layer and could be causing degradation of the aggre-es which may have caused the material to be plastic. Project records showed ne plasticity, but the issue was not clear.

Another engineer introduced the subject of asphalt. He believed that asphaltic-ated materials would perform equally as well as cement-treated aggregates. Up-e down or right side up, reflective cracking would not be a problem. No one, so as is known, brought up the subject of lime. However, some conjecture developed ut the need of treating either base or subbase aggregates. Where was the proof any benefits existed? One thing was certain: Factual information supported by entific data were not available for many of the ideas expressed.

INFORMATION ABOUT EXPERIMENTAL SECTIONS

Eventually, treatment of the subbase with cement was chosen for the basic structural design of Project F-051-1 (8), but included were experimental sections each 2,000 ft long to make comparative studies of treated and untreated bases and subbases. The make-up of each experimental section was restricted to those discussed and about which the proponents seemed to have strong convictions. It might be said that the experimental Project F-051-1 (8) came about because of differences of opinion among engineers and a desire to know the truth.

It was agreed to construct each section to full stabilization, which in New Mexico is determined by the relationship between the traffic index and the California R. Values. Credit for gravel equivalent thickness of 1½ times was taken for both the asphalt and cement stabiliza-

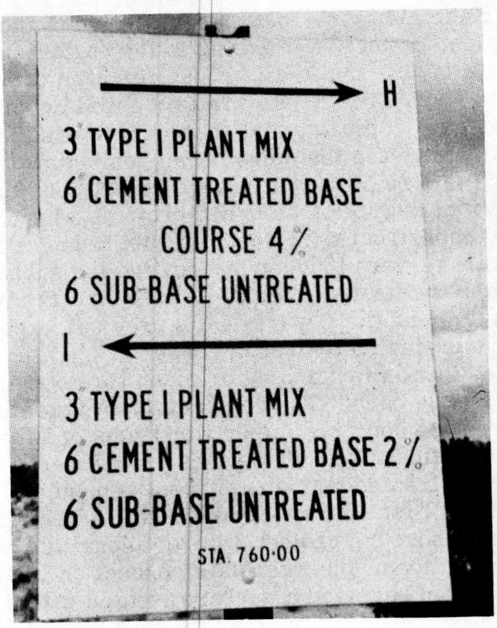


Figure 1. Information sign for Section H.

Figure 2. Station 360+00, longitudinal cracking 1 ft in from inner edge of passing lane, eastbound roadway, August 16, 1960.

ion where 4 percent additives were used and for the asphaltic surface course. No credit was taken for the Class C stabilization in the section using 2 percent cement.

The same company which built I-010-1 (8) 6, Road Forks—East, was awarded the ontract. The company tried earnestly to comply with each letter of the specifica- ions. R. L. Baker, project engineer, supervised the work. John Jaramillo, labor- tory technician from the central laboratory, inspected the work, lifted the samples, nd compiled the records. All record samples were taken after the work was com- leted and tested in the central laboratory. The top 6 in. of subgrade, the subbase, nd the base courses were specified to be compacted to a minimum of 95 percent mod- fied Proctor density. Density tests of the completed work show that compactions vell above the minimum requirements were generally obtained.

Because of plastic and nonplastic requirements, two separate material pits were esignated for production of mineral aggregates for base, subbase, and surface con- truction. One was located in the Pojoaque River, from which the nonplastic base nd surface course materials were obtained. The other was from a hill deposit which ontained natural fines compatible to obtain plastic indexes ranging from three to six.

To assist inspection of this project there are signs at the beginning and end of each esign change with information giving the stations and how each section is constructed Fig. 1). There are nine experimental test sections designated by letters A, B, C, D, , F, G, H, I. Section A is the control section and is typical of both right and left nes throughout the project, excepting the comparative experimental group B through

All the comparative sections were constructed on the northbound lane.

The contractor's superintendent was asked which of the experimental sections he ad found the easiest to construct. He replied that he preferred either the asphalt-

re 3. Station 460+00, $\frac{1}{4}$-in. rutting in outer wheel path of traffic lane, east-bound roadway, August 16, 1960.

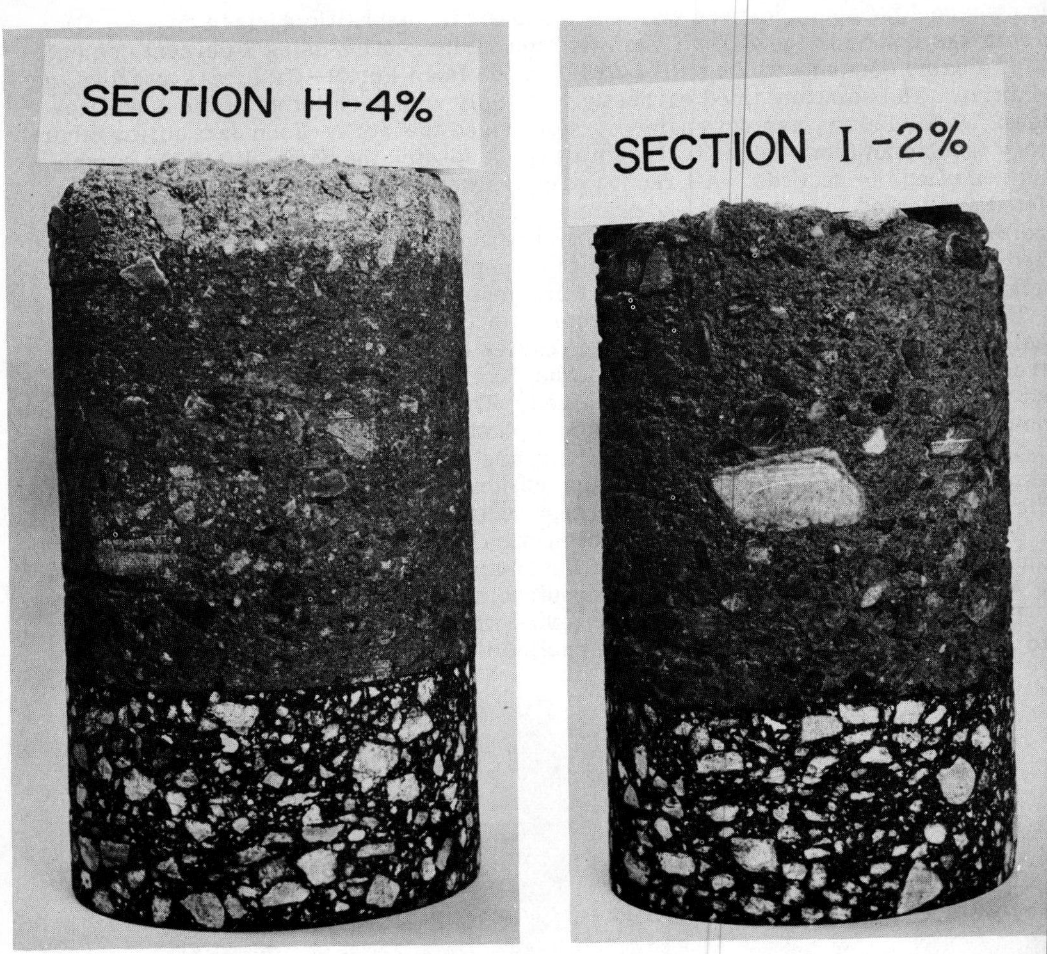


Figure 4. Cores taken from experimental project Sections H and I.

treated base or the upside down construction having a three to six plastic index in the intermediate layer. The sandy nonplastic material was difficult to hold to the typical section.

INSPECTION COMMENTS, F-051-1 (8)

On August 15, 1960, the first official examination of the completed experimental sections was made (Figs. 2 and 3). Observing the tests were W. L. Eager and L. H. Miller from the Bureau of Public Roads; and C. W. Johnson, and John J. Plese from the New Mexico State Highway Department.

Road roughnesses were measured with the Regional Bureau of Public Roads roughness indicator through the experimental sections. It was desired to obtain initial roughness readings before any change had occurred through traffic or natural conditions. All of the sections gave good readings, although there is some indication that sections which have treated base course materials immediately under the mat are rougher than other sections. These results will be compared with future tests durin the life of the experimental work. Tabulation of the results obtained are attached to the Appendices of this paper.

String line checks were made on each section to determine if any rutting had deve oped from contractor's trucks hauling over the completed work. No rutting was four

on any of the experimental sections on F-051-1 (8), Tesuque-Pojoaque.
The only surface cracks found were in Sections H and I, where the base was treated with cement immediately under the mat. Section H was treated with 4 percent cement and Section I was treated with 2 percent cement (Fig. 4). Transverse and pattern cracking were noted in both sections, but none were thought to be damaging as yet. The best indication of what to expect came from a previous survey of regularly-spaced transverse shoulder cracks where the plant mix was laid 1½ in. thick. One hundred and thirty-six transverse cracks were found in Section H, where 4 percent cement was used. One hundred and thirty-seven cracks were found in the shoulder of Section I, where 2 percent cement was used.
On November 10, 1960, Benkelman beam deflections were measured at three separate locations of each experimental section. Using 10,800-lb wheel loads the average results ranged from 14.4 to 24.0 thousandths of an inch, which was considered good. As could be expected, readings were higher for Sections E and F, where neither the base nor subbase were treated.

INSPECTION COMMENTS, I-010-1 (8) 6

After one year of heavy traffic, rutting n the surface had developed to a depth of ¼ in. on the Road Forks—East Project, -010-1 (8) 6. No pronounced differences ould be perceived in the upside down or onventional stabilizations. Longitudinal racks about 1 ft from the paved shoulder re pronounced in the passing lane from tation 326+15 to station 600+00, where e base was stabilized with 3 percent ceent. From station 600+00 to station 00+00, where the subbase was treated ith cement, the longitudinal cracks were cated in the paved shoulder about 2 ft er, relative to the other crack position. ongitudinal cracks and rutting appear to more associated with soil and moisre conditions than with the design of se and subbase courses. The road from tion 326+15 to station 800+00 traverses a shallow lake with alternately dry and wet cles (Fig. 5). Summer traffic seemed to have closed up most of the transverse rective cracking from the cement-treated base. These cracks will no doubt tend to en up during colder weather. Roughness readings (tabulated in the Appendices) were mewhat rougher than the initial readings recorded on F-051-1 (8). Inasmuch as ughness measurements were not taken immediately after construction on I-010-1 (8) it is not known if traffic and weathering contribute to roughness.
Information about design requirements and tests data covering compaction densities, ughness measurements, and Benkelman beam readings for both I-010-1 (8) 6 and F-1-1 (8), experimental projects is in the Appendices.

Figure 5. Typical high shrinkage clay soil in bed of dry lake, August 16, 1960.

OBJECTIVES

The objectives of the comparative sections were to determine the effect of subbase bilization and the effects of other design variations.
Through periodic inspections and check testing it is hoped that better knowledge can obtained to determine which design provides the best protection from future distor-n and roughness. Of particular interest is possible degradation of the mineral aggates in all sections. It is felt that the treated subbase sections should eliminate rusion of subgrade soils into the base and therefore provide a good opportunity to

determine if degradation is actually taking place. Assuming that it does take place, it would be desirable to know the rate and amount of degradation that can be expected before distress in the surface is indicated. Because reflective cracking has provoked so much discussion, the Department hopes to determine if this defect contributes to distortion and roughness developing in the riding surface.

Although economy was not considered in the original planning, everyone is interested in contract and maintenance costs. An attempt will be made to evaluate the various designs relative to costs and serviceability in the hope that a guide can be established to determine which is the best bargain for the money expended.

ACKNOWLEDGMENTS

The writer wishes to acknowledge the valuable assistance rendered by O.G. Betancourt, of the central laboratory, in the preparation of this paper.

Appendix A

F-058-1 (8) TESUQUE-POJOAQUE

EXPERIMENTAL PROJECT TEST SECTIONS

PROJECT F-051-1 (8) TESUQUE – POJOAQUE

B. O. P. STA. 387+96 E.O.P. STA. 819+00
Test sections begin at Sta. 600+00 and end at Sta. 780+00

TEST SECTIONS: A, B, C, D, E, F, G, H, I.

Note: Section A is typical of both right and left lanes for the entire project, excluding test sections B through I.

#1 - Cement-treated base course produced from Pit No. 58-126-S.

#2 - Untreated base course and asphalt-treated base course produced from Pit No. 58-124-S (non-plastic material)

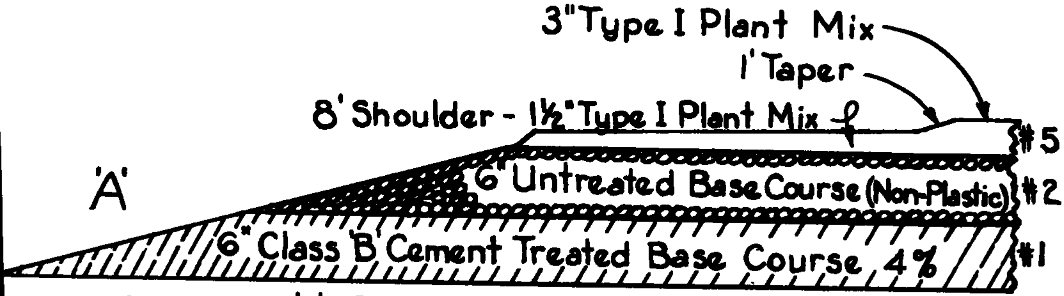
#3 - Untreated base course with P.I. from 3 to 6 produced from Pit. No. 58-126-S.

#4 - Subbase controlled gradation produced from Pit No. 58-124-S and Pit No. 58-126-S.

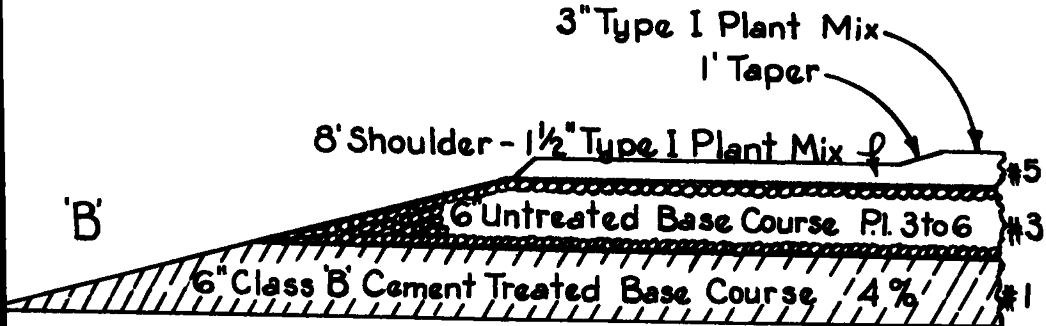
#5)
#6) Plant mix and mineral aggregate for shoulder treatment produced from Pit No. 58-124-S.

RECOMMENDED SPECIFICATIONS FOR SURFACING AGGREGATES· % PASSING

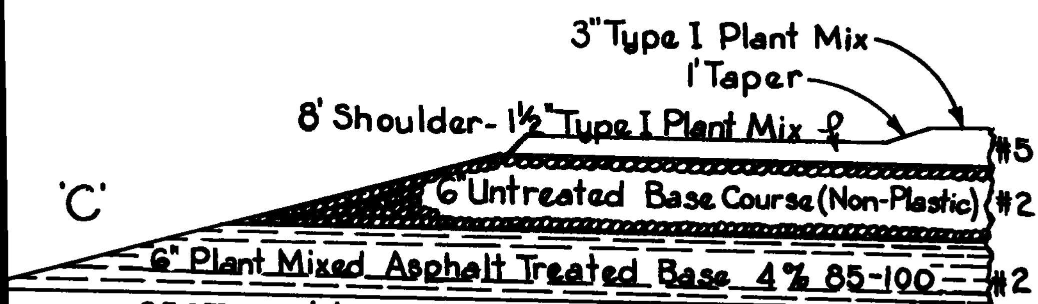
Sieve Size	#1 Base Course Cement Treated	#2 Base Course Untreated & Asphalt-Treated	#3 Base Course Untreated P.I 3 to 6	#4 Subbase Controlled Gradation	#5 Plant Mix Type I *B*	#6 Mineral Agg. Shoulder Treatment.
2"				100		
1"	100	100	100	70-100		
3/4"	85-100	80-100	80-100		100	
5/8"						100
1/2"					70-100	
3/8"					55-85	
No. 4	40-70	30-60	30-60	30-55	40-65	0-20
No. 10	30-55	20-45	20-45	20-40	30-50	0-4
No. 40					15-30	
No. 80					8-20	
No. 200	6-15	4-12	4-12	4-12	4-9	
L. L.	25 or less	Sandy	25 or less	35 or less	Sandy	
P. I.	6 or less	Non-Plastic	3 to 6	6 or less	Nonplastic	
L.A.Wear	50 or less	50 or less	50 or less	—	40 or less	40 or less



SECTION 'A' STA. 600+00 To 620+00 Rt. Lane

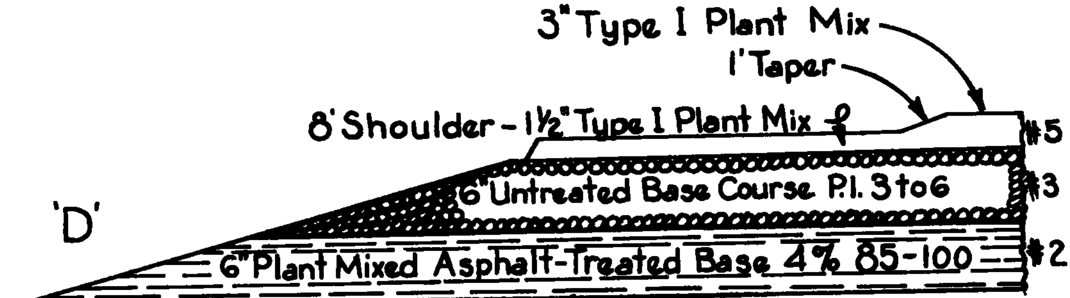


SECTION 'B' STA. 620+00 To 640+00 Rt. Lane



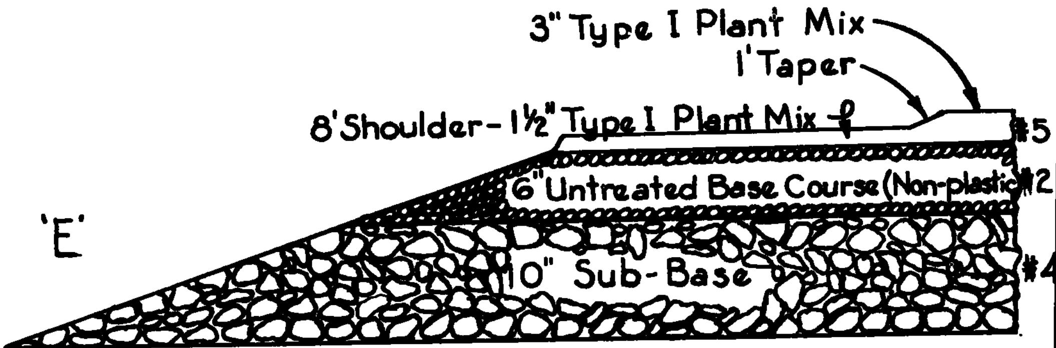
SECTION 'C' STA. 640+00 To 660+00 Rt. Lane

'D'



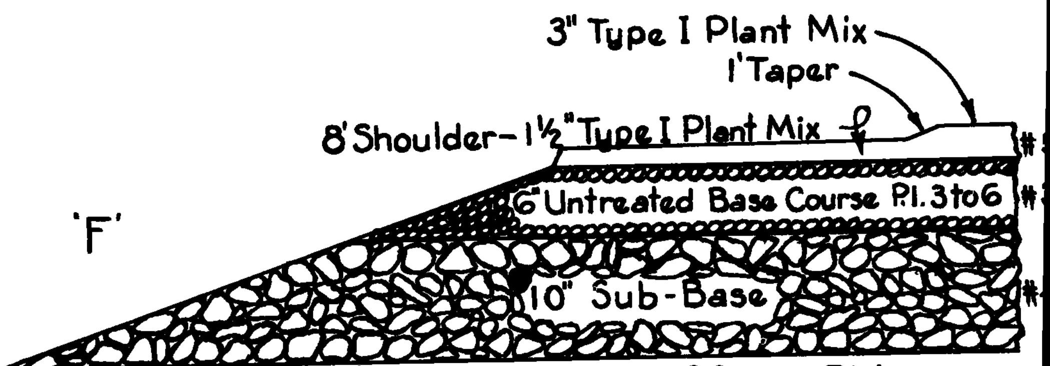
SECTION 'D' STA. 660+00 To 680+00 Rt. Lane

'E'

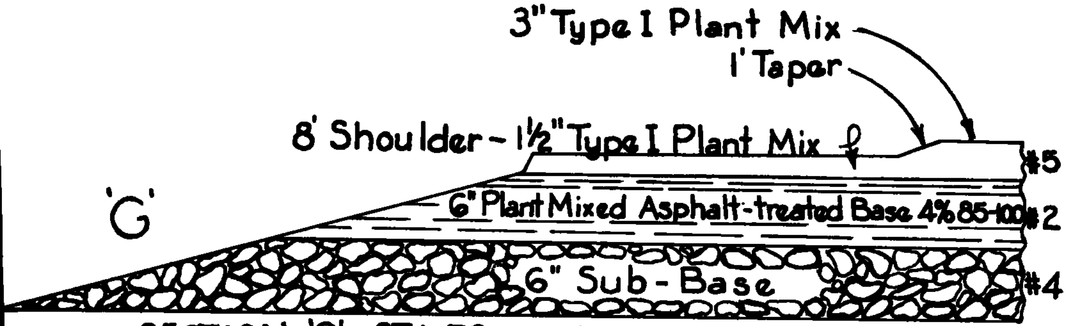


SECTION 'E' STA. 680+00 To 700+00 Rt. Lane

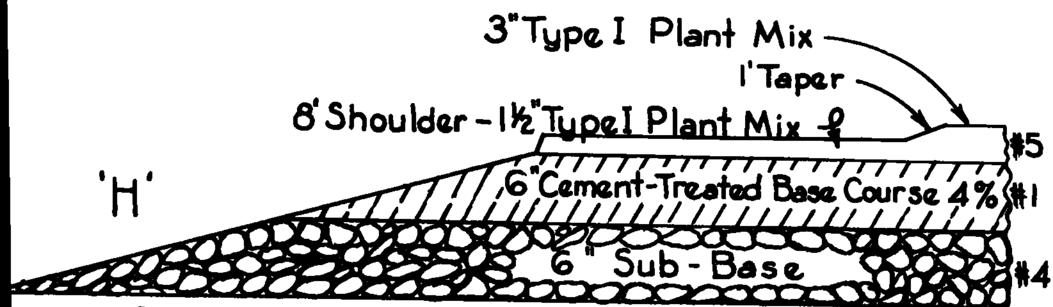
'F'



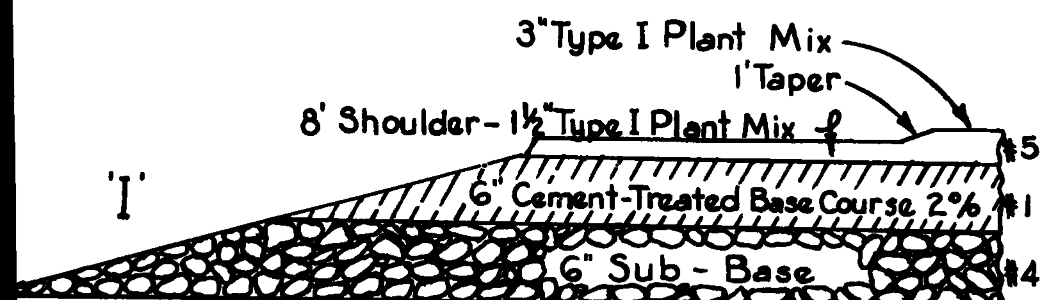
SECTION 'F' STA. 700+00 To 720+00 Rt. Lane



SECTION 'G' STA. 720+00 To 740+00 Rt. Lane



SECTION 'H' STA. 740+00 To 760+00 Rt. Lane



SECTION 'I' STA. 760+00 To 780+00 Rt. Lane

AVERAGE DENSITIES OBTAINED DURING CONSTRUCTION
New Mexico Project F-051-1 (8)

	MODIFIED PROCTOR				Plant Mixed Surface Course			
	Average Densities				% Theo. Density		% Lab. Density	
Section	Subgrade	Treated Base	Treated Base	Untreated Base	Bottom Course	Top Course	Bottom Course	Top Course
A	97.1	97.0[a]	-------	97.9	95.6	95.6	100.6	98.7
B	99.7	98.2[a]	-------	103.2	95.5	96.8	100.2	101.2
C	98.8	91.8[b]	100.5[c]	101.1	97.1	95.3	99.3	100.1
D	96.3	91.7[b]	99.2[c]	98.7	97.1	96.1	96.9	100.5
E	97.9	99.5[d]	-------	98.5	95.9	95.7	95.2	99.4
F	99.6	98.7[d]	-------	99.8	96.8	96.4	100.0	99.6
G	97.0	92.3[b]	99.2[c]	98.2[d]	96.6	95.4	99.98	98.2
H	96.4	99.5[d]	96.0[a]	-------	97.2	96.3	99.4	99.3
I	97.3	99.6[d]	96.5[a]	-------	97.6	95.7	98.6	99.3

[a]cement-treated base

[b]asphalt-treated base; % theo. density

[c]asphalt-treated base; % lab. density

[d]subbase

Subgrade, subbase, untreated base, and cement-treated base: modified proctor density. Asphalt-treated base and plant mixed surfacing· Marshall hammer, 75 blows on each side.

SUMMARY OF SURFACE ROUGHNESS MEASUREMENTS
New Mexico Project F-051-1(8)

Tesuque-Pojoaque

August 15, 1960

				Roughness		
	Station to			Going North (1)		Going So
Sect.	Station	Subbase	Base	In/Sect.	In/Mi.	In/Sect.
A	600-620	6" CTB - 4%	6" Untreated No PI	16	42	18
B	620-640	6" CTB - 4%	6" Untreated 3-6 PI	18	47	20
C	640-660	6" ATB - 4%	6" Untreated No PI	18	47	20
D	660-680	6" ATB - 4%	6" Untreated 3-6 PI	18	47	20
E	680-700	10" Subbase (2")	6" Untreated No PI	21	55	19
F	700-720	10" Subbase (2")	6" Untreated 3-6 PI	19	50	23
G	720-740	6" Subbase (2")	6" ATB - 4%	21	55	24
H	740-760	6" Subbase (2")	6" CTB - 4%	23	61	24
I	760-780	6" Subbase (2")	6" CTB - 2%	21	55	21

NOTES:
3" Type One plant mix, 2 courses, on all sections
CTB = Cement Treated Base
ATB = Asphalt Treated Base
(1) = Outside or traffic lane
(2) = Inside or passing lane
Subbase = 2" maximum size, PI 6 or less

BENKELMAN BEAM TEST RESULTS
Project No. F-051-1(8)
Tesuque to Pojoaque

Date: 11-8-60 & 11-9-60
Wheel Load: L = 10810, R = 10800
Surface: 3" Plant Mix
Experimental Section: Sta. 600+00 to 780+00

All Tests Made in Driving Lane of North Bound Lane.

Station	Experimental Test Section	Deflection in Thousandth of an Inch Low	High	Average	Cut or fill section
601+00	A	8	12	10.4	Cut
610+00	A	12	18	16.4	Fill
617+00	A	12	24	16.6	Cut
622+00	B	18	22	19.3	Fill
625+75	B	16	22	19.7	Fill
635+00	B	14	22	18.8	Cut
643+00	C	16	22	19.0	Cut
650+50	C	16	20	17.3	Cut
657+74	C	12	16	14.3	Cut
663+00	D	12	16	14.0	Cut to fill
668+00	D	14	20	16.7	Cut
674+83	D	20	24	22.4	Cut
682+00	E	24	32	28.4	Cut
688+50	E	20	22	20.4	Fill
696+00	E	22	24	23.2	Grade
703+00	F	22	28	25.4	Fill
710+00	F	20	24	22.0	Fill
716+00	F	20	26	23.4	Fill
722+00	G	16	20	17.0	Cut
730+50	G	18	20	19.6	Fill
736+11	G	14	16	15.6	Fill
742+84	H	14	22	19.7	Fill
749+25	H	16	20	17.6	Cut
757+00	H	6	10	7.0	Cut
763+60	I	12	16	14.2	Cut
772+50	I	12	14	13.0	Cut
778+44	I	22	26	24.0	Fill

Appendix B

I-010-1 (8) 6 ROAD FORKS—EAST

EXPERIMENTAL PROJECT TEST SECTIONS

PROJECT I-010-1 (8)6 — ROAD FORKS - EAST

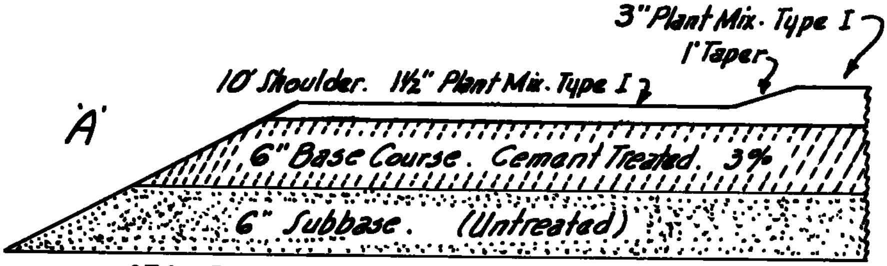
B.O.P. STA. 326+15.47 — E.O.P. STA. 1088+28.4

TEST SECTIONS A, B, C, D, E, F, G, H.

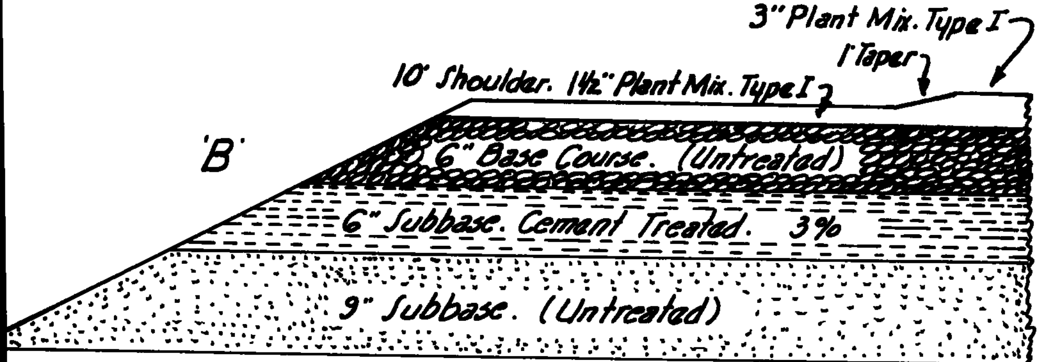
Subbase Material produced from Pit No. 58-29-S.

Base course, plant mix, and surface treatment aggregate produced from Pit No. 58-G2-S.

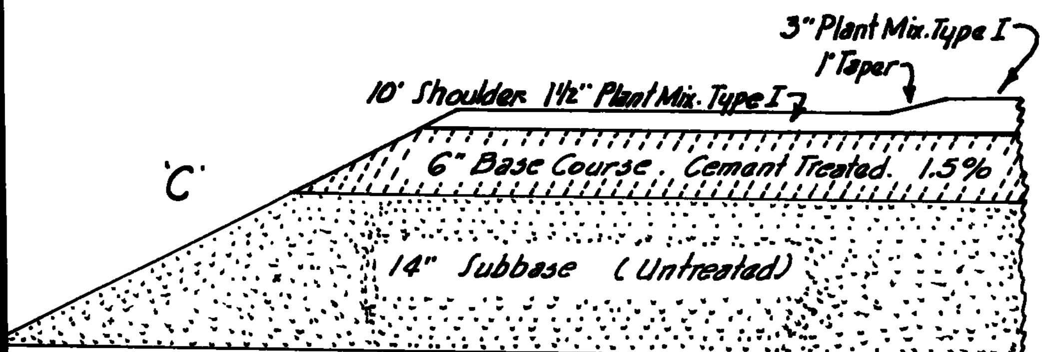
RECOMMENDED SPECIFICATIONS FOR SURFACING AGGREGATES: % PASSING						
Sieve Size	Subbase Controlled Gradation	Base Course	Mineral Agg. Plant Mix Type I	Mineral Agg. Surface Treat.	Mineral Aggregate Surface Treatment Connectio	
					1st. Course	2nd Cours
2"	100					
1"		100				
3/4"		80 - 100	100		100	
5/8"				100		
1/2"			75 - 100			100
3/8"			67 - 85		0 - 25	
No. 4	25 - 70	30 - 60	50 - 65	0 - 20		0 - 20
No. 10	20 - 55	20 - 45	34 - 47	0 - 4	0 - 4	0 - 4
No. 40			14 - 24			
No. 80			8 - 16			
No. 200	4 - 15	4 - 12	4 - 8			
L.L.	35 or less	25 or less	Sandy			
P.I.	6 or less	6 or less	Non Plastic			
L.A.Wear	–	50 or less	50 or less	40 or less	40 or less	40 or l



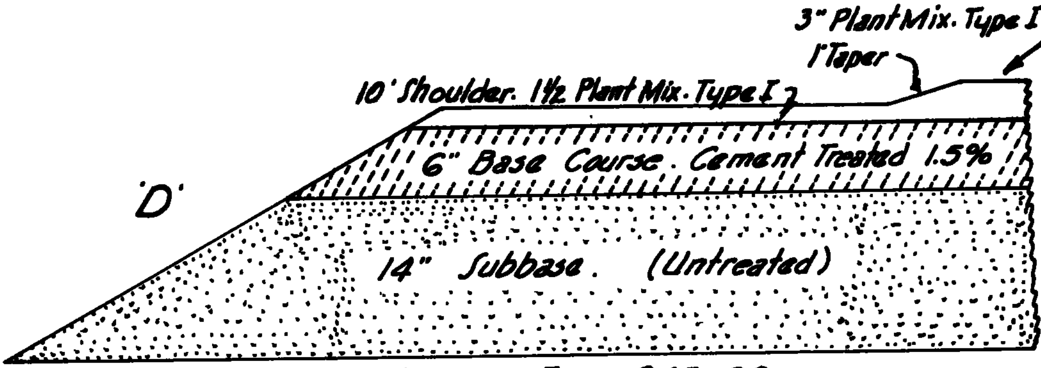
STA. 326+15.47 To 600+00
B.O.P. Proj. I-010-1(8)6



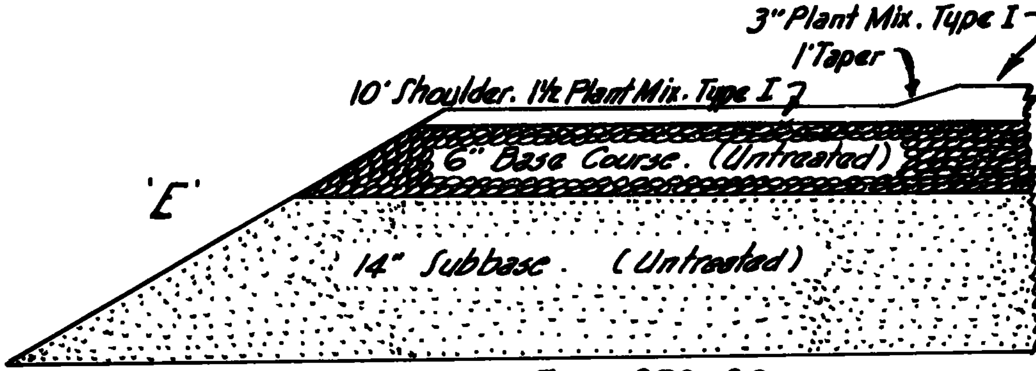
STA. 600+00 To 800+00



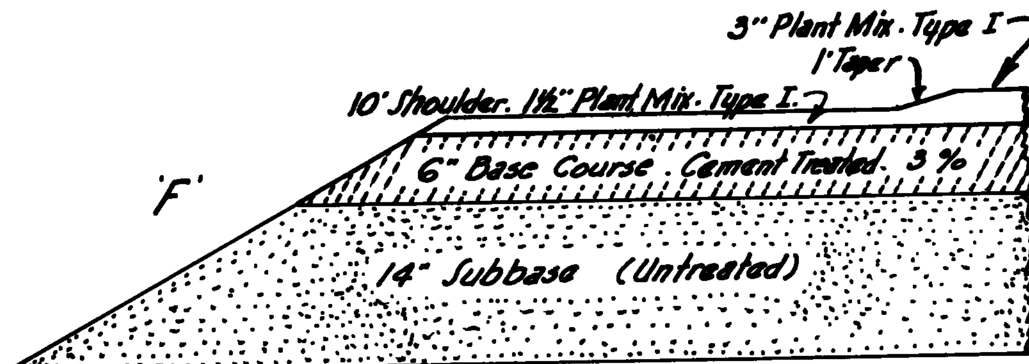
STA. 800+00 To 820+00



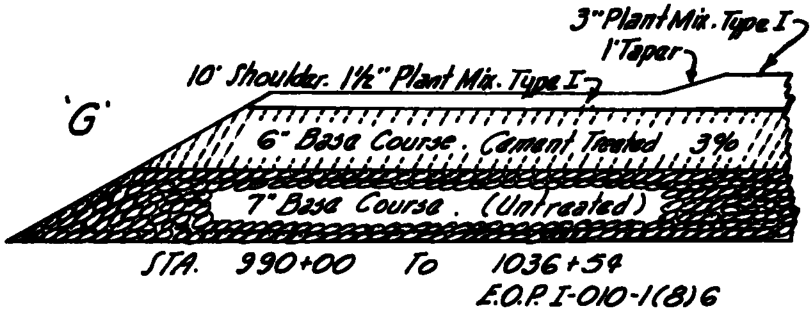
STA. 820+00 To 845+00

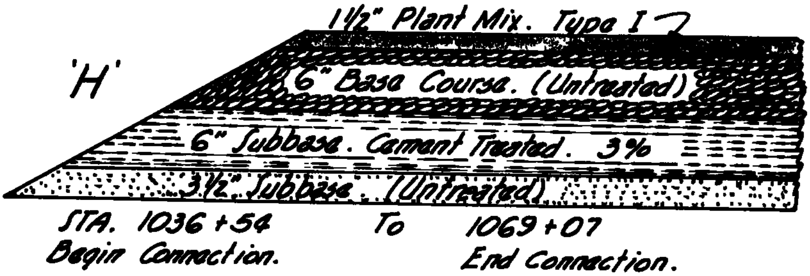


STA. 845+00 To 870+00



STA. 870+00 To 990+00


3" Plant Mix. Type I
1' Taper
10' Shoulder. 1½" Plant Mix. Type I
'G'
6" Base Course. Cement Treated 3%
7" Base Course. (Untreated)
STA. 990+00 To 1036+54
E.O.P. I-010-1(8)6


1½" Plant Mix. Type I
'H'
6" Base Course. (Untreated)
6" Subbase. Cement Treated. 3%
3½" Subbase. (Untreated)
STA. 1036+54 To 1069+07
Begin Connection.
End Connection.

CONDITION SURVEY
New Mexico I-010-1(8)6
Road Forks - East
August 16, 1960

STATION TO STATION	SUBBASE	BASE	RUTTING [a]	Cracking [b] TRANSVERSE	LONGITUDINAL	ROUGHN INCH/M
326+154 to 600	6" Untreated	6" CTB-3%	1/4"	Inner Edge & Shoulders	Inner Edge & Shoulders	64.6
600 to 800	9" Untreated 6" CT - 3%	6" Untreated	3/16"	None	Some Shoulders	62.7
800 to 820	8" Untreated 6" CT - 3%	6" CTB - 1½%	1/8"	None	None	66 2
820 to 845	14" Untreated	6" CTB - 1½%	1/4"	None	None	59.
845 to 870	14" Untreated	6" Untreated	1/4"	None	None	63.
870 to 990	14" Untreated	6" CTB - 3%	3/16"	None	None	68.
990 to 1036+54	7" Untreated	6" CTB - 3%	1/8"	None	None	66.
1036+54 to 1069+07 [c]	3½" Untreated 6" CT - 3%	6" Untreated	1/8"	None	None	78.
1069+07 to 1088+28	2" Untreated 6" CT - 3%	6" Untreated	1/8"	None	None	

a - In outer wheel path - traffic lane.

b - Where cracking marked "none" indicates could not be observed at this time - might be evident in cold weather.

c - 1½" plant mix mat - 3" 2-course plant mix all other sections

BENKELMAN BEAM TEST RESULTS
N. M. Project No. I-010-1 (8) 6,
Road Forks - East

DATE: 11-29-60
Wheel Load L = 10810, R-10800

Station	Experimental Test Section	Deflection in Thousandths of an Inch Low	High	Average	Cut or Fill	Experimental Sections
350+00	A	8	18	13.6	Fill	Lake Bed
390+00	A	24	30	26.8	Fill	
440+00	A	20	26	22.4	Fill	
490+00	A	12	16	14.8	Fill	
560+00	A	14	30	19.6	Fill	
260+00	B	14	22	18.4	Fill	
660+00	B	14	18	16.3	Fill	
700+00	B	18	22	20.0	Fill	
740+00	B	12	16	15.2	Fill	
797+00	B	6	14	10.7	Fill	
805+00	C	6	16	12.8	Grade	Slope
810+00	C	10	14	11.7	Grade	
815+00	C	8	10	8.7	Grade	
825+00	D	12	18	15.0	Grade	
832+00	D	12	20	16.7	Grade	
840+00	D	10	18	14.7	Cut	Rolling Hills
850+00	E	14	18	16.4	Grade	
857+00	E	16	24	20.6	Cut	
865+00	E	18	20	18.0	Fill	
885+00	F	6	10	8.3	Cut	
900+00	F	10	12	11.3	Cut	
951+00	F	10	18	13.2	Grade	
985+00	F	4	8	6.8	Fill	
1005+00	-	8	14	10.0	Fill	
1020+00	-	8	14	12.3	Cut	
1035+00	-	10	14	11.6	Cut	
1045+00	-	18	22	20.0	Cut	
1055+00	-	14	20	17.3	Grade	
1065+50	-	12	18	14.8	Grade	
1074+00	-	10	14	11.6	Grade	
1079+00	-	14	18	16.0	Grade	
1084+00	-	12	16	13.7	Grade	