ARIZONA DEPARTMENT OF TRANSPORTATION

REPORT NUMBER: FHWA/ AZ - 80/157

ENVIRONMENTAL FACTOR DETERMINATION FROM IN-PLACE TEMPERATURE AND MOISTURE MEASUREMENTS UNDER ARIZONA PAVEMENTS

Prepared by:
George Way, Assistant Engineer of Materials
Pavement Management Branch

September 1980
Final Report

Prepared for:
U.S. Department of Transportation
Federal Highway Administration
Arizona Division

ENVIRONMENTAL FACTOR DETERMINATION FROM IN-PLACE TEMPERATURE AND MOISTURE MEASUREMENTS UNDER ARIZONA PAVEMENTS

PREPARED BY

GEORGE B. WAY
ARIZONA DEPARTMENT OF TRANSPORTATION

Prepared in cooperation with the U.S. Department of Transportation, Federal Highway Administration.

Technical Report Documentation Page

1. Report No. FHWA/AZ-80/157	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Environmental Factor Determination from in-place Temperature and Moisture Measurements under Arizona Pavements		5. Report Date August, 1980
		6. Performing Organization Code
7. Author(s) George B. Way		8. Performing Organization Report No.
9. Performing Organization Name and Address Arizona Department of Transportation Research Section 206 South 17th Ave Phoenix, Az 85007		10. Work Unit No. (TRAIS)
		11. Contract or Grant No. HPR-1-18(157)
12. Sponsoring Agency Name and Address Arizona Department of Transportation		13. Type of Report and Period Covered
		14. Sponsoring Agency Code
15. Supplementary Notes		

16. Abstract

Thirty-seven sites were selected and monitored for five years for temperature, moisture and deflection. From this monitoring, plus detailed materials sampling and testing at each site, a myriad of information was found. In general, subgrade materials do become wetter after the surface paving is completed. Base materials experience long term drying and densification. Significant freezing takes place in the higher elevations of Arizona. Deflection measurements using the dynaflect indicated little if any correlation to temperature; however, a very good correlation was found with percent cracking divided by AC pavement thickness. In addition, dynaflect deflections seem to be influenced the most by the subgrade deflection which is directly related to the weight percent moisture content. Bound surface layers reduce the subgrade deflection; but as cracking takes place, the deflection increases until it reaches the subgrade value. Plate bearing deflections indicate the worth of unbound bases whereas the dynaflect does not.

In terms of pavement performance, the AASHTO interium guidelines for design do not appear to have either increased the actual pavement life or improved design reliability. On the average, AASHTO designs do perform for 20 years; however, a very large variance in pavement performance exists.

17. Key Words Temperature, Moisture, Deflection Cracking, Performance, Asphaltic Concrete, Concrete	18. Distribution Statement No restrictions - this report is available to the public through NTIS, Springfield, VA 22161

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified		

ABSTRACT

Thirty-seven sites were selected and monitored for five years for temperature, moisture and deflection. From this monitoring, plus detailed materials sampling and testing at each site, a myriad of information was found. In general, subgrade materials do become wetter after the surface paving is completed. Base materials experience long term drying and densification. Significant freezing takes place in the higher elevations of Arizona. Deflection measurements using the dynaflect indicated little if any correlation to temperature; however, a very good correlation was found with percent cracking divided by AC pavement thickness. In addition, dynaflect deflections seem to be influenced the most by the subgrade deflection which is directly related to the weight percent moisture content. Bound surface layers reduce the subgrade deflection; but as cracking takes place, the deflection increases until it reaches the subgrade value. Plate bearing deflections indicate the worth of unbound bases whereas the dynaflect does not.

In terms of pavement performance, the AASHTO interim guidelines for design do not appear to have either increased the actual pavement life or improved design reliability. On the average, AASHTO designs do perform for 20 years; however, a very large variance in pavement performance exists.

FORWARD AND MISCELLANEOUS THOUGHTS

This report represents a compilation of a very large amount of data. To analyze and interpret this data, the author has relied on statistical inference. Reported correlations had to be not only significant but also reasonable in an engineering sense. In other words, reasonable cause and effect had to exist before a correlation was accepted. The author avoided using multiple regression analysis because of a fear that an unreasonable but perfectly good correlation might arise; therefore, it is possible that other researchers might want to investigate multiple relationships.

In order to achieve a readable report, no laboratory test numbers are given in the text. Generally, the AASHTO Test Procedure was followed except in a few cases. The following list gives the test number for each test mentioned in the report.

LABORATORY TESTS

AASHTO TEST NUMBER	TEST NAME
T 87	Dry Preparation of Disturbed Soil
T 88	Hydrometer
T 89	Liquid Limit
T 90	Plastic Limit and Plasticity Index
T 99	Proctor Moisture Density
T 100	Specific Gravity of Soils
T 190	R Value Test
T 203	Auger Borings
T 204	Density of Soil In-Place by the Drive Cylinder Method
T 205	In-Place Desity, Rubber Balloon, Volumeter
T 207	Thin Walled Tube Sampling of Soils
T 222	Nonrepetitive Static Plate Load Test of Soils and Flexible Pavement Components
T 224	Correction for Coarse Particles in the Soil Compaction Test

AASHTO TEST NUMBER	TEST NAME
T 49	Penetration of Bituminous Materials
T 72	Saybolt Viscosity
T 179	Effect of Heat and Air on Asphalt Materials (Thin-Film Oven Test)
T 201	Kinematic Viscosity of Asphalts
T 202	Absolute Viscosity of Asphalts
T 209	Maximum Specific Gravity of Bituminous Paving Mixtures
T 22	Compressive Strength of Cylinder Concrete
T 176	Sand Equivalent

ARIZONA TEST NUMBER	TEST NAME
Arizona 209	Moisture Content, Oven Dry
Arizona 210a	Specific Gravity and Absorption of Coarse Aggregates
Arizona 236	Ph and Minimum Resistivity of Soils

OTHER RESEARCH TESTS

Viscosity at 77°F	-	Micro-Viscosity Test
% Asphaltenes, N, A1, A2 and P	-	Rostler Asphalt Analysis
Vanadium	-	Atomic Absorption Test
Permeability	-	Constant Head

The author wishes to thank a number of people who contributed advise and help in the preparation and conduction of this project. They are:

Douglas Forstie, Senior Laboratory Engineer
Harold "Knobby" Walsh, Geotechnical Engineer
Marshall Christenson, Materials Technician
Bobby Rogers, Research Technician
Walter Chase, Materials Technician
Eugene Poluianov, Materials Technician
Pavement Evaluation (Dave Allocco in particular)
District IV, Holbrook, Materials Staff (Frank Adair in particular)
District V, Flagstaff, Materials Staff (Art Norte in particular)
Rowan Peters, Assistant Engineer of Materials
Edward Burgin, Assistant Engineer, Contracts and Specifications
John Eisenberg, Management Analysis Statistics
Gene R. Morris, Engineer of Research

To each of them, thank you for being there when the volumeter froze solid; the soil auger broke (just about every time); the plate bearing jack stuck just after digging a hole in the pavement; construction ripped up the Lupton conduit -- twice; the dynaflect wouldn't work; soil samples were lost. These are referred to as field problems and, although they did occur, in retrospect, they represent that ingredient which made this project challenging and fun.

Some may argue that these sites do not represent the entire state. Sites were selected for safety, convenience and different environments. In addition, and most importantly in five years of monitoring, which included traffic control for each and every deflection and moisture reading, not one accident occurred.

In summary, this has been a tough report to write, primarily because of the volume of data. Since so much information was collected on each site (about 20 ring binders worth) the author suggests that these 37 sites become a set available to future work and continue to be monitored on a less frequent (annual) basis. In addition, the future construction activities be kept track of for future investigations.

TABLE OF CONTENTS

	PAGE NO.
INTRODUCTION	1 - 2
SITE SELECTION	2 - 9
SURFACING THICKNESS AND FREQUENCY	10 - 11
AS CONSTRUCTED MATERIALS	12 - 18
GEOMETRICS	19 - 22
TRAFFIC	22 - 23
FIELD SAMPLE TEST RESULTS	24
ASPHALT AGING	24 - 25
ASPHALT CONTENT	26
ASPHALTIC CONCRETE DENSITY, VOIDS AND COMPACTION	26 - 29
BITUMINOUS TREATED BASE (BTB) DENSITY, VOIDS AND COMPACTION	30
CEMENT TREATED BASE	30
AGGREGATE BASE (AB), SELECT MATERIAL (SM), SUBGRADE SEAL (SGS) AND SUBGRADE	30 - 40
TEMPERATURE	40 - 45
MOISTURE	45 - 57
DEFLECTION	58 - 59
ANALYSIS OF DYNAFLECT DEFLECTION	59 - 68
PLATE BEARING ANALYSIS	69 - 74
PERFORMANCE	74 - 79
DISCUSSION	80
FINDINGS	80 - 83
CONCLUSION	84
RECOMMENDATIONS	85 - 86
REFERENCES	87

TABLE OF CONTENTS

		PAGE NO.
APPENDIX		
A	CONSTRUCTION MATERIALS TEST	88 - 97
B	FIELD SAMPLE MATERIALS TEST	98 - 104
C	AVERAGE MONTHLY TEMPERATURES	105 - 111
D	MOISTURE READINGS OVER TIME AT VARIOUS DEPTHS	112 - 138
E	DYNAFLECT DEFLECTION	139 - 149
F	PLATE BEARING TESTS	150 - 163
G	PERFORMANCE MEASUREMENTS	164 - 166

LIST OF TABLES

TABLE NO. (TEXT)	PAGE NO.
1. SITE DESCRIPTION	5 - 9
2. TRAFFIC, ADT AND ADL	23
3. NUMBER OF PROJECTS AT VARIOUS AIR VOID LEVELS . .	28
4. VOIDS FILLED WITH ASPHALT	29
5. COMPACTION GAIN OR LOSS OVER TIME	34
6. R VALUE CORRELATION	38
7. -2 MICRON CORRELATION	40
8. JANUARY AVERAGE MONTHLY LOW TEMPERATURE, 0°F. . .	41
9. JULY AVERAGE MONTHLY HIGH TEMPERATURE, 0°F. . . .	42
10. AVERAGE ANNUAL NUMBER OF FREEZE THAW CYCLES . . .	43
11. AVERAGE ANNUAL TOTAL HOURS OF FREEZING OR BELOW .	44
12. AVERAGE PERCENT MOISTURE BY LOCATION AND DEPTH . .	48
13. STANDARD DEVIATION OF MOISTURE BY LOCATION AND DEPTH	49
14. EQUILIBRIUM MOISTURE CORRELATION	55
15. GENERALIZED EQUILIBRIUM MOISTURE EQUATION	56
16. DYNAFLECT DEFLECTION VERSUS ADOT PAVEMENT MID-DEPTH TEMPERATURE	63
17. BEFORE AND AFTER OVERLAY DEFLECTION	64
18. CORRELATION BETWEEN NEIGHBORING DYNAFLECT GEOPHONES	67
19. REDUCTION IN SUBGRADE DEFLECTION DUE TO BASE AND SURFACING LAYERS	73
20. AVERAGE NUMBER OF YEARS OF PERFORMANCE TO LEVEL OF DISTRESS	78

LIST OF ILLUSTRATIONS

FIGURE NO. (TEXT) PAGE NO.

1. SITE LOCATION 3
2. MATERIALS DESCRIPTION AT TIME OF CONSTRUCTION . . . 13 - 18
3. GEOMETRIC SITE DESCRIPTION . . . . 19 - 22
4. MASTER TRAFFIC GROWTH CURVE 22
5. RATIO OF AGED TO UNAGED PENETRATION VERSUS TIME . . 25
6. TIME VERSUS RATE OF CHANGE OF VISCOSITY AT 140°F . 25
7. EXTRACTION VERSUS CONSTRUCTION ASPHALT CONTENT . . 26
8. FIELD VERSUS CONSTRUCTION HVEEM T.I. AC DENSITY . . 27
9. MAXIMUM THEORETICAL AC DENSITY VERSUS HVEEM T.I. AC DENSITY 27
10. DENSITY OF AC CORES, TWO OR MORE YEARS AFTER CONSTRUCTION, VERSUS DENSITY AT TIME OF CONSTRUCTION 29
11. CONSTRUCTION PROCTOR MAXIMUM DRY DENSITY VERSUS SAMPLED PROCTOR MAXIMUM DRY DENSITY 31
12. AB, SM AND SGS FIELD DRY DENSITY AT CONSTRUCTION VERSUS CONSTRUCTION PROCTOR MAXIMUM DRY DENSITY . . 31
13. AB AND SM DENSITY CHANGE OVER TIME 33
14. AB AND SM MOISTURE CHANGE OVER TIME 33
15. CHANGE IN SGS AND SUBGRADE DRY DENSITY WITH TIME . 34
16. SGS AND SUBGRADE CHANGE IN PERCENT MOISTURE WITH TIME 35
17. HVEEM R VALUE DRY DENSITY VERSUS T-99 PROCTOR MAXIMUM DRY DENSITY 36
18. HVEEM R VALUE PERCENT MOSTURE VERSUS T-99 OPTIMUM MOISTURE 37
19. T-99 PROCTOR MAXIMUM DRY DENSITY VERSUS T-99 OPTIMUM PERCENT MOISTURE 37
20. ADOT MATERIALS SERVICES SOIL STRENGTH CORRELATION CHART 39

LIST OF ILLUSTRATIONS

FIGURE NO. (TEXT) PAGE NO.

21. OVEN DRY WEIGHT PERCENT MOISTURE VERSUS NUCLEAR VOLUME PERCENT MOISTURE 46

22. ACTUAL WEIGHT PERCENT VERSUS CALCULATED WEIGHT PERCENT MOISTURE 47

23. ELEVATION 50

24. AVERAGE RAINFALL 51

25. CLIMATOLOGICAL ZONES 52

26. FREEZING INDEX 53

27. EQUILIBRIUM MOISTURE VERSUS RATIO OF REGIONAL FACTOR TO SOIL SUPPORT 57

28. PERCENT CRACKING CORRELATION TO AASHTO CLASS 2 AND 3 CRACKING 75

ENVIRONMENTAL FACTOR DETERMINATION FROM IN-PLACE TEMPERATURE AND MOISTURE MEASUREMENTS UNDER ARIZONA PAVEMENTS - PHASE II

INTRODUCTION

Arizona, at present, uses the AASHTO Interim Guide (1) equations to determine thickness of structural layers (flexible and rigid) for new highway construction. Inputs to these equations are based on past experience and have been empirically developed. In the future, Arizona intends to adopt a systems approach to design of both flexible and rigid pavements. Various systems for design and management have been proposed by Monismith, Hudson and Deacon (2), NCHRP 139 (3) and HRB Special Report 126 (4) to name a few. All of these systems call for several inputs including traffic, environment, construction, structural capacity and maintenance schedule. The long term, five-year objective of this study was to quantify the environmental inputs and relate them to structural characteristics.

In order to meet the objective, a plan of measurement and monitoring over the five-year period was adopted. The execution of this plan involved three phases.

1. Selection of suitable highway projects and specific sites representative of the different climatological zones, soils and traffic. Such projects also cover a large time span of construction from 1941 to 1975. Specific history about each project would be researched to determine what was built and when.

2. After site selection, sampling would be conducted at each site to determine in-place properties, index properties and materials characteristics. Samples were taken as part of five separate operations spanning several years. These included:

    A. Installation of aluminum tubes for nuclear depth moisture installation. Soil samples for moisture, grading and plasticity index (PI).

    B. Drive sampling with a Dames and Moore sampler to obtain samples for in-place density, moisture and shear test.

    C. Installation of thermistors and soil moisture wafers at recording sites to record temperature and moisture. In addition, in-place densities were taken with a volumeter and soil samples for moisture, PI and gradation were also taken.

D. Plate bearing tests were conducted at most sites on the surface, base and subgrade layers. In addition, a set of dynaflect deflections were performed immediately before the plate bearing test. In-place density of the base and subgrade layer was conducted with a volumeter. Following this, soil samples were taken to be tested for PI, grading, proctor moisture density, specific gravity, sand equivalent hydrometer analysis, R value, pH, resistivity and permeability.

E. Cores of asphaltic concrete were removed to obtain the modulus of resiliency of the AC at various temperatures. Also, asphalt content and asphalt properties such as penetration at 77° F, absolute viscosity @ 140° F, microvisosity at 77° F and Rostler analysis were determined.

3. In addition to the single point in time measurements and samples, long-term pavement performance measurements were taken. These included dynaflect deflection, Mays ride meter roughness, rut depth and cracking and patching. Also, changes in moisture were monitored with both the nuclear and the soil moisture wafer devices. Temperature measurements were automatically recorded every other hour on a daily basis.

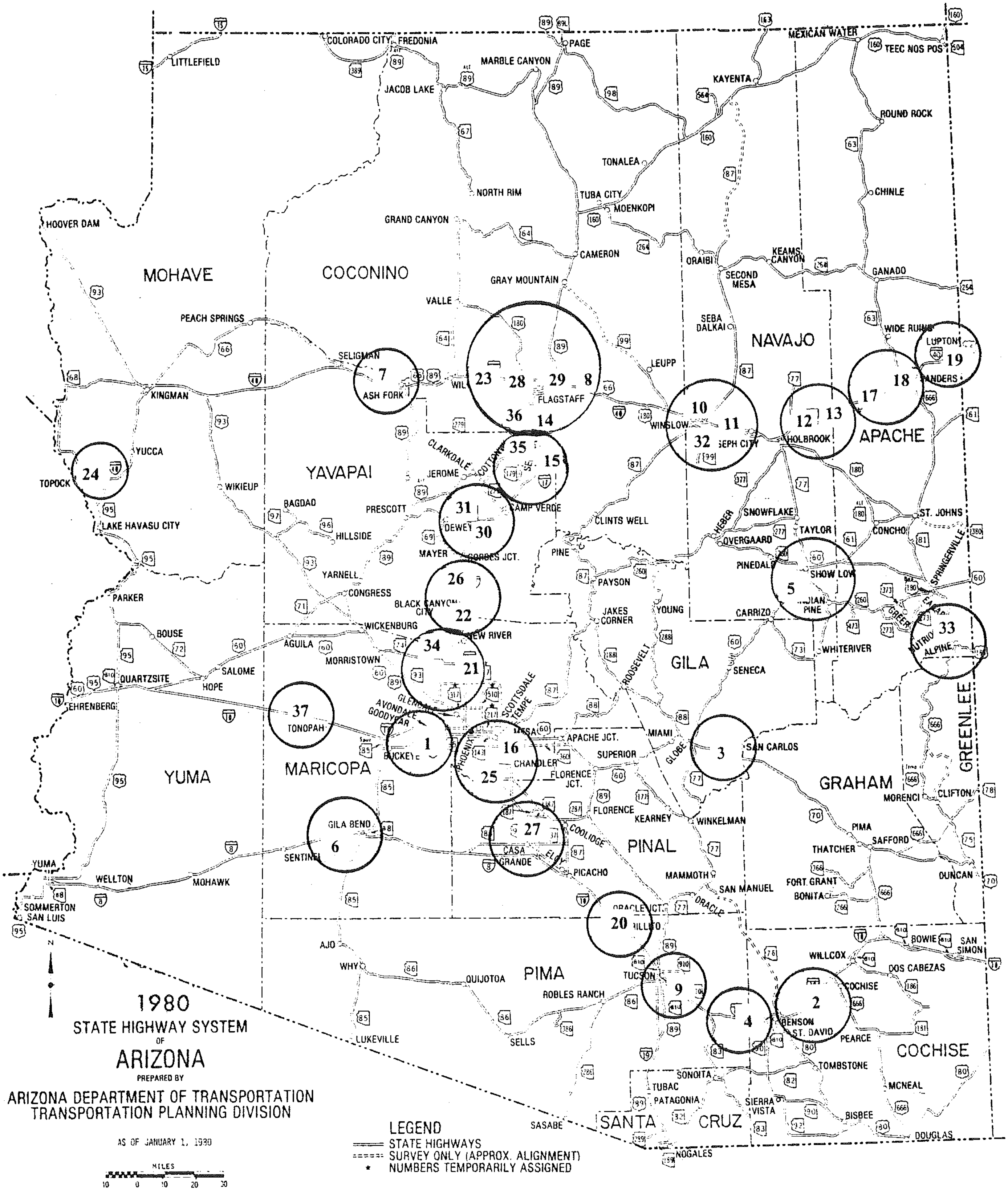
The above information will be fully displayed and reviewed. From this, the analysis section will extract the meaning of the above data in terms for predictive models and expected performance.

SITE SELECTION

Sites were selected during Phase I (5) to accommodate either the nuclear depth moisture or continuous recording facilities. Phase I (5) describes the entire temperature and moisture installation procedure. Figure 1 gives a map showing the 37 selected sites. Table 1 gives detailed information about each site. Sites are listed in chronological order by date of construction. Each site is numbered and this number will be used in all tables and figures where site information is given. Table 1 describes those features which are thought to be fixed or unchanging with time after construction. These include:

Site number
Site name
Route number
Direction
Mile post (MP) location
Station
Project number
Date built of first project
Elevation in feet and meters
Geological area
Topography, vegetation and drainage
Date built of all major construction activities
Thickness in inches of all structural layers above subgrade

FIGURE 1



MOHAVE
COCONINO
YAVAPAI
NAVAJO
APACHE
YUMA
MARICOPA
GILA
GRAHAM
GREENLEE
PINAL
PIMA
COCHISE
SANTA CRUZ
FLAGSTAFF
KINGMAN
PRESCOTT
WINSLOW
HOLBROOK
SHOW LOW
SAN CARLOS
GILA BEND
CASA GRANDE
TUCSON
BENSON
NOGALES
1980
STATE HIGHWAY SYSTEM
OF
ARIZONA
PREPARED BY
ARIZONA DEPARTMENT OF TRANSPORTATION
TRANSPORTATION PLANNING DIVISION
AS OF JANUARY 1, 1980
LEGEND
STATE HIGHWAYS
SURVEY ONLY (APPROX. ALIGNMENT)
NUMBERS TEMPORARILY ASSIGNED
MILES

Layers are abbreviated and mean the following:

ACFC - Plant mixed seal coat or plant mixed asphaltic concrete finishing course or plant mixed asphaltic concrete friction course.

Seal Coat - Layer consisting of an asphaltic emulsion plus chips

AC - Plant mixed asphaltic concrete

PCCP - Concrete

BTB - Bituminous treated base, also plant mixed

CTB - Cement treated base

AB - Aggregate base

SM - Select material

SGS - Subgrade seal

TABLE I

SITE GENERAL DESCRIPTION

SITE NUMBER AND NAME EXACT LOCATION AND PROJECT NUMBER	DATE BUILT	ELEV. FT. (METERS)	GEOLOGY	TOPOGRAPHY VEGETATION DRAINAGE	DATE BUILT	THICKNESS IN INCHES*									
						ACFC	SEAL COAT	AC	PCCP	BTB	BSB	CTB	AB	SM	SGS
1. Avondale	1936	994	Qs	Flat	1936			2.0	6.0						
Buckeye — 91st Ave.		(303)	Alluvial	Irrigated land on both	12/1956		.3	2.0					4.0	8.0	
I 40 EB, MP 183.75			Sediments with some	sides of road; no curb	8/1974	.5		1.5							
STA 1235+00 S371 (1)			caliche	slow infiltration	11/1977	.5									
2. Sybil Rd. T.I.	1940	4010	QTs Old Valley	Rolling Hills	1940						2.0				
I 10 WB, MP 311		(1222)	Fill Deposit	Desert Grass	7/1960		.3	3.0					3.0	9.0	
STA 283+26 - I 10-6 (9)				Slow Infiltration	10/1975	.5		1.3							
3. Cutter	1941	3209	Qs	Flat	1941						2.0		3.0		6.0
US 70, MP 258.65		(978)	Alluvial	Desert Salt Bush	1964		.3								
STA 84+72			sediments	Creosote Bush	1970		.3								
FLH 13A-1				Slow Infiltration	1974		.3								
4. Benson	1942	4186	Qs	Flat	1942						2.0		3.0	12.0	
I 10 WB, MP 300.07		(1276)	Alluvial	Desert	6/1965	.5		4.0							
STA 2159			Sediments with some	Grass	9/1975	.5		1.5							
SNFA I 8C-D (4)			caliche	Slow Infiltration											
5. Show Low	1946	6384	Ks	Rolling Hills	1946		.3	4.0					4.0	15.5	
US 60, MP 337.74		(1946)	Limestone	Ponderosa Pine	1972		.3								
STA 21+50			shale & limestone	Slow Infiltration	1975		.3								
FH 30 A-3															
6. Gila Bend	5/1955	720	Qfp	Flat	1955			2.0					4.0	4.0	
I 8 EB, MP 112.8		(223)	Alluvial	Desert Salt Bush	1970	.8		4.0							
STA 489+70			sediment some caliche	Creosote Bush	1972		.3								
FI-56 (3)				Slow Infiltration	1976	.5									
7. Ash Fork	1956	5139	QTb	Flat	1/1956						2.5		4.0	11.0	
I 40 WB, MP 144.54		(1567)	Basalt & Andesite	Short grass	11/1964	.5		1.5		1.5					
ING 80 (18)			Clay Cap with	Slow Infiltration	1969		.3								
STA 190+43			Rock beneath												
8. Winona	7/1969	6160	Qb Basalt, Cinders and	Foot Hills Pinyon	1957		.3				4.0		3.0	9.0	
I 40 WB, MP 212.60		(1876)	Silt Mixed	Juniper	7/1969	.8		3.5							
STA 821+15 - I 40-4 (69)				Slow Infiltration	6/1977	.5		2.0							

*1 INCH = .0254 METERS

TABLE I (Con't.)

SITE NUMBER AND NAME EXACT LOCATION AND PROJECT NUMBER	DATE BUILT	ELEV. FT. (METERS)	GEOLOGY	TOPOGRAPHY VEGETATION DRAINAGE	DATE BUILT	THICKNESS IN INCHES*									
						ACFC	SEAL COAT	AC	PCCP	BTB	BSB	CTB	AB	SM	SGS
9. Wilmot Rd. T.I. I 10 EB, MP 270 STA 474+97 — I 10-5 (12)	12/1957	2790 (850)	Qw Younger Alluvial Deposit Intermittent Stream Channel	Flat Valley Floor Desert — Creosote & Salt Bush Very Slow Infiltration	12/1957		.3	2.5					4.0	9.0	
10. Winslow I 40 EB, MP 260.21 STA 286 I 40-4 (90)	7/1958	4897 (1493)	Qs Alluvial sediment	Flat, one mile from Little Colorado River; Short grass Slow Infiltration	7/1958		.3	3.5		3.0				15.0	
					9/1971	.5		1.3							
					6/1975		.3								
11. Minnetonka I 40 EB, MP 261.78 STA 369+00	7/1958	4884 (1489)	Sand and Clay		7/1958		.3	3.5		3.0				15.0	
					9/1971			2.0							
					6/1975		.3								
12. Dead River #1 Navajo Co. Line to Pinta I 40 EB, MP 316.68 STA 500+00 - I 40-5 (38)	7/1960	5568 (1697)	Trc Dessicated Clay Shales of Chinle Formation very Expansive	Flat Upper Plateau Short Grass Slow Infiltration	7/1960		.3	4.0				6.0		4.0	
					11/1973	.5		2.0							
13. Dead River #2 I 40 EB, MP 317.06 STA 520+00	7/1960	5610 (1710)			7/1960		.3	4.0				6.0		4.0	
					11/1973	.5		3.5							
14. Flagstaff N.B. I 17 NB, MP 337 STA 7215+80	8/1960	6958 (2121)	Pk Kaibab Limestone	Rolling Hills Ponderosa Pines Slow Infiltration	8/1960						1.0		6.0	10.0	12.0
					9/1966		.3	3.5							
					1974	.5									
15. Sedona T.I. I 17 NB, MP 298.54 STA 5171+42 — I 17-2 (20)	8/1960	3814 (1163)	QTs Older Valley Fill	Foothills to Mogollon Rim Pinyon-Juniper Very Slow Infiltration	8/1960		.3	4.0		3.8			3.0	15.0	6.0
16. Tempe US 60, MP 172 STA 37+00 Non F 022-3 (61)C	1/1961	1188 (362)	TKs sedimentary conglomerate	Curb & gutter, park with Eucalytus trees on one side Slow Infiltration	1/1961	.5		2.5					6.0	6.0	
					6/1974	.5									

*1 INCH = .0254 METERS

TABLE I (Con't.)

SITE NUMBER AND NAME EXACT LOCATION AND PROJECT NUMBER	DATE BUILT	ELEV. FT. (METERS)	GEOLOGY	TOPOGRAPHY VEGETATION DRAINAGE	DATE BUILT	THICKNESS IN INCHES*									
						ACFC	SEAL COAT	AC	PCCP	BTB	BSB	CTB	AB	SM	SGS
17. Crazy Creek #1 I 40 EB, MP 322.72 STA 819+50—I 40-5 (14)	9/1961	5599 (1707)	TRc Dessiccated Clay Shales of Chinle Formation very Expansive	Flat Upper Plateau Short Grass Slow Infiltration	9/1961		.3	4.0				6.0		6.0	
					10/1975	.5		2.50							
18. Crazy Creek #2 I 40 EB, MP 323.78 STA 875+00	9/1961	S636 (1718)			9/1961		.3	4.0				6.0		6.0	
					10/1975	.5		3.0							
19. Lupton I 40 WB, MP 359 STA 2871+50 I 40-5 (29)	1/1963	6184 (1885)	Jsr Sandstone	Mountains rushing up out of flat plateau Pinyon & Juniper High Infiltration	1/1963		.3	4.0				6.0		21.0	
					10/1975	.5		2.0							
20. Marana T.I. I 10 EB, MP 235 STA 429+85—I 10-4 (27)	7/1963	1950 (594)	Qs Younger Alluvial Deposit Surficial Valley Fill. Undiffertiated	Flat Valley Floor Irrigated Land Slow Infiltration	7/1963		.3	3.0				6.0	4.0	5.0	
21. Upper Deer Valley I 17 NB, MP 223 STA 1170+47—I 17-1 (56)	7/1964	1639 (500)	Qp Younger Alluvial Deposit. Flood Plan and Playas	Flat Valley Floor Desert Creosote & Salt Bush Slow Infiltration	7/1964	.5		3.0					4.0	22.0	
22. Agua Fria River I 17 NB, MP 243 STA 2215+—I 17-1 (59)	8/1964	2000 (610)	QTs Older Valley Fill	Foothills. Leading to Plateau Desert Palo Verde & Cacti Slow Infiltration	8/1964	.5		3.5					4.0	24.0	
23. Bellemont I 40 EB, MP 186.5 STA 1689+30—I40-3 (22)	10/1965	7139 (2176)	QTb Basalt, Cinders and Clay Mixed	Rolling. Ponderosa Pine Slow Infiltration	10/1965					2.0			4.0	9.0	6.0
24. Topock I 40 WB, MP .42 STA 23+85 I 40-1 (8)	6/1966	488 (149)	gm Granite Gneiss	Rolling Hills Desert Salt Bush Creosote Bush Slow Infiltration	6/1966	.5		3.5					4.0	9.0	

*1 INCH = .0254 METERS

TABLE I (Con't.)

SITE NUMBER AND NAME EXACT LOCATION AND PROJECT NUMBER	DATE BUILT	ELEV. FT. (METERS)	GEOLOGY	TOPOGRAPHY VEGETATION DRAINAGE	DATE BUILT	THICKNESS IN INCHES*									
						ACFC	SEAL COAT	AC	PCCP	BTB	BSB	CTB	AB	SM	SGS
25. Williams Field T.I. I 10 EB, MP 160 STA 788+27—I 10-3 (56)	12/1966	1209 (367)	Qfp Alluvial Fan and Rock Sediment	Flat Valley Floor Irrigated Land Slow Infiltration	12/1966	.5		3.5					4.0	15.0	
26. Sunset Point I 17 NB, MP 251.41 STA 2660—I 17-1 (55)	4/1967	3354 (1022)	QTb Basic Volcanic and Intrusive Rocks	Flat Plateau Chaparral Very Slow Infiltration	4/1967			5.0		3.0			2.0	17.0	6.0
27. Casa Grande T.I. I 10 EB, MP 196 STA 2684+08—I 10-3 (59)	3/1968	1486 (438)	Qs Younger Alluvial Deposit. Surficial Valley Fill. Undiffertiated	Flat Valley Floor Irrigated Land Slow Infiltration	3/1968	.5		5.5					4.0	18.0	
28. Woody Mtn. T.I. I 40 EB, MP 192.85 STA 2032— I 40-3 (32)	10/1968	7086 (2160)	Qb Basalt, Cinders and Clay Mixed	Rolling. Ponderosa Pine Slow Infiltration	10/1968				8.0			6.0			6.0
29. Cosnino I 40 EB, MP 206.42 STA 494+76 I 40-4 (69)	6/1969	6496 (1980)	Pk Kaibab Limestone	Rolling Hills Ponderosa Pine & Juniper Slow Infiltration	6/1969				8.0			6.0			5.0
30. Cherry Rd. T.I. I 17 NB, MP 275 STA 3884+16—I 17-2 (62)	10/1969	4442 (1354)	QTb Basic Volcanic and Intrusive Rocks	Rolling Hills Chaparral Very Slow Infiltration	10/1969			5.3		4.7			4.0	21.0	6.0
					7/1976	.5									
31. Cienga Creek SR 169, MP 14.58 STA 770+00—S 447 (2)	8/1971	4460 (1359)	QTb Basalt	Plateau cut by washes Oak and chaparral Very Slow Infiltration	8/1971	G & D									
32. Winslow Bypass I 40 EB, MP 257.78 STA 3215+00—I 40-4 (61)	9/1971	4861 (1482)	Qs River Sand	Flat Upper Plateau Short Grass Slow Infiltration		G & D									

*1 INCH = .0254 METERS

TABLE I (Con't.)

SITE NUMBER AND NAME EXACT LOCATION AND PROJECT NUMBER	DATE BUILT	ELEV. FT. (METERS)	GEOLOGY	TOPOGRAPHY VEGETATION DRAINAGE	DATE BUILT	THICKNESS IN INCHES*									
						ACFC	SEAL COAT	AC	PCCP	BTB	BSB	CTB	AB	SM	SGS
33. Alpine US 180, MP 425.5 STA 1220+00 EDA F051-2 (9)	9/1973	8061 (2458)	Ts Sandstone Silt & Gravel	Mountainous Ponderosa Pine Slow Infiltration	9/1973			6.8						7.0	
34. Lake Pleasant SR 74, MP 23.44 STA 1238+S 434 (3)	10/1973	1693 (516)	Qfp Alluvial Fan and Rock Sediment Caliche	Rolling Hills. Desert Creosote and Salt Bush Very Slow Infiltration	1973	G & D									
35. Kachina Blvd. I 17 SB, MP 334.57 STA 7086+50—I 17-2 (35)	7/1974	6780 (2067)	Pk Kaibab Limestone	Rolling Mogollon Rim Ponderosa Pine Slow Infiltration	7/1974				8.0			6.0			6.0
36. Flagstaff Airport T.I. I 17 SB, MP 337 STA 7215+80—I 17-2 (35)	7/1974	6958 (2121)	Pk Kaibab Limestone	Rolling Hills Ponderosa Pine Slow Infiltration	7/1974				8.0			6.0			6.0
37. Tonopah I 10 EB, MP 100.67 STA 5309+06—I 10-2 (13)	2/1975	1098 (335)	Qfp Alluvial Fan and Rock Sediment	Flat Valley Floor Desert Creosote & Salt Brush Slow Infiltration	2/1975	.5		125						5.0	

*1 INCH = .0254 METERS

SURFACING THICKNESS AND FREQUENCY

Considering all the layers above the subgrade to be structural layers, several trends can be observed.

TRENDS IN AC STRUCTURAL LAYERS

YEARS	AVERAGE TOTAL INCHES OF THICKNESS ABOVE SUBGRADE	AVERAGE AC THICKNESS INCHES	AVERAGE PERCENTAGE AC OF TOTAL
1940-1946	16	2.5	16
1955-1958	16	3.3	21
1960-1961	21	3.9	19
1963-1966	24	3.6	15
1967-1969	34	8.0	24
1973-1975	16	9.7	61
1 Inch = .0254 Meters			

From 1940 to 1958, AC new construction remained relatively constant. About 1958, the interstate program began in earnest. Initially, both base and surfacing courses increased slightly. In 1963, the AASHTO interim design guidelines were adopted. Although AC surface thickness increased dramatically from 1963 to 1969, base course thickness also increased, thus keeping the ratio of AC to total about 20 percent. Since, 1970, base thickness has declined rapidly to the point where the newer sections are virtually full depth, with very thick (more than 10 inches of AC) AC surfacings becoming quite common.

Concrete new construction from 1968 to 1974 remained constant with a section of 8 inches PCCP, 6 inches CTB and 6 inches SGS being virtually a standard. Since 1976, concrete sections became thicker with 11 or more inches of PCCP with no CTB or SGS.

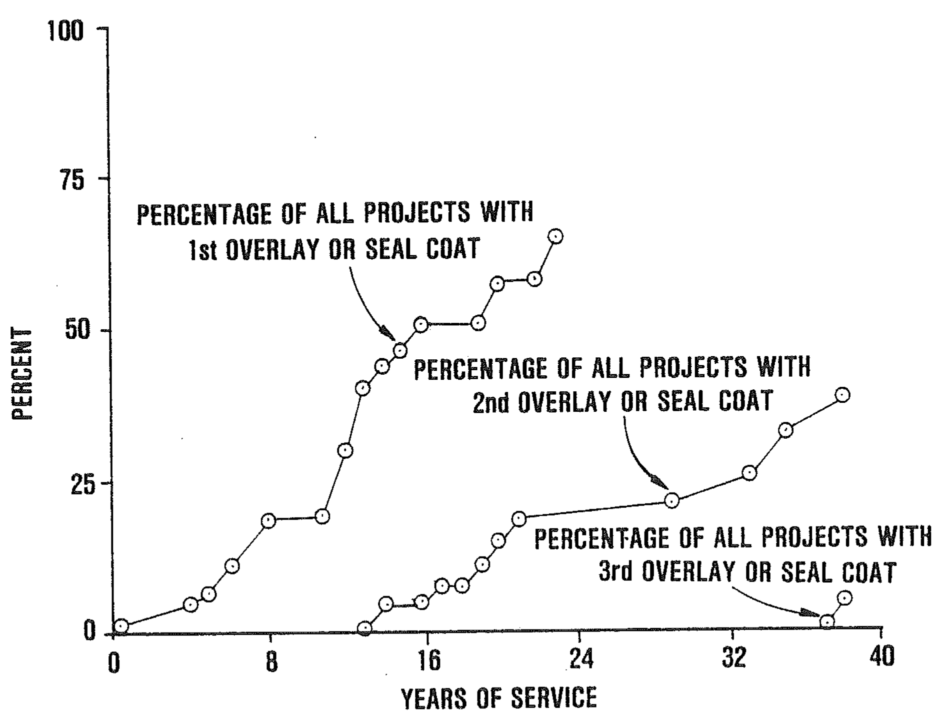
Overlay frequency for AC pavements is described below:

FREQUENCY OF OVERLAYS

YEARS OF ORIGINAL CONSTRUCTION	NO. OF PROJ.	NUMBER OF OVERLAYS	NUMBER OF SEAL COATS	TOTAL NUMBER OF OVERLAYS & SEAL COATS	AVERAGE CUMULATIVE THICKNESS OF OVERLAY & SEAL COAT
1936-1955	6	8	6	14	3.8
1956-1960	6	7	2	9	3.3
1960-1963	5	3	0	3	6.0
1964-1966	5	1	0	1	2.5
1967-1975	5	1	0	1	.5
1 Inch = .0254 Meters					

The figure below describes the historical process of overlaying or seal coating.

Generally, one-half of all AC projects were overlaid or seal coated by the 16th year. Of these projects, about one-half had received a second overlay or seal coat by the 33rd year.



AS CONSTRUCTED MATERIALS

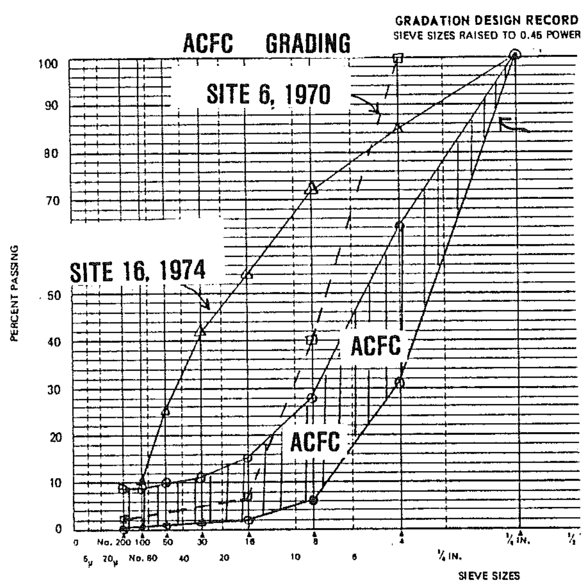
Old construction files were examined to find a description of the materials used in each layer. Appendix A contains the following information by material type in chronological order, cross-referenced to the site number. The table below is a summary of what is in Appendix A.

APPENDIX A CONTENT

MATERIAL TYPE	BY TABLES A-1 THRU A-24			
	GRADING	ASPHALT CONTENT AND PROPERTIES	COMPACTION DATA PI AND SAND EQUIVALENT	% CEMENT SLUMP % AIR 28 DAY STRENGTH
ACFC	A-1	A-2	--	--
Seal Coat	A-3	A-4	--	--
AC	A-5	A-6	A-7	--
PCCP	A-8	--	--	A-9
BTB	A-10	A-11	A-12	--
CTB	A-13	--	A-14	--
AB	A-15	--	A-16	--
SM	A-17	--	A-18	--
SGS	A-17	--	A-18	--
SUBGRADE	A-19	--	A-20	--

Information on these tables has been condensed into eleven graphs on Figure 2. From this figure, it can be seen that a wide variety of materials has been incorporated into the highway structure. Generally, surfacing materials such as ACFC or seal coats tend to be uniformly graded chips, whereas AC, BTB, PCCP, CTB and AB are well graded. All these layers are made up of very clean material with the PI generally non-plastic (NP). Select and subgrade seal are also well graded, but have PI's up to 9. Subgrades varied from somewhat well graded to very fine. Virtually all subgrades had more than 68 percent passing the #4 sieve. PI's ranged from NP to 52.

FIGURE 2



ACFC 1961-1977

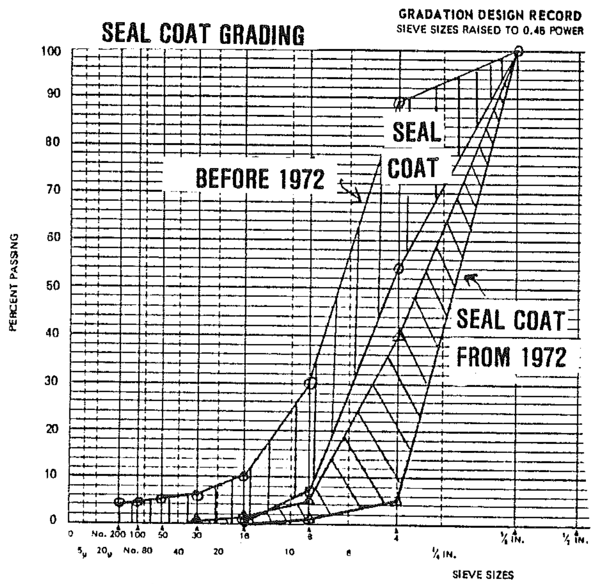
% ASPHALT 4.2-7.2

ASPHALT 85/100
AR 4000
AR 2000

% ASPHALT FOR CINDERS

7, 1964 }
10,1971 } 11.0

FIGURE 2



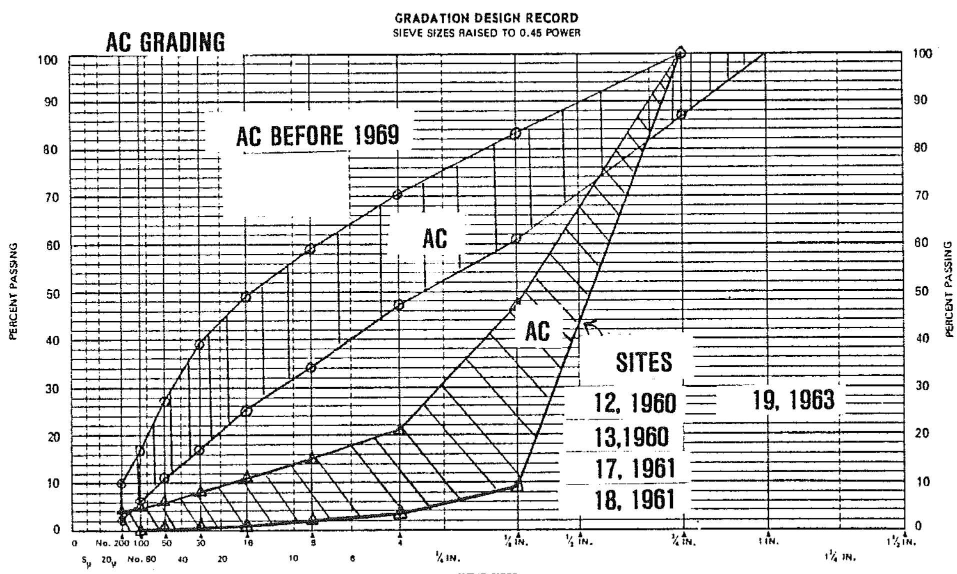
SEAL COATS 1956-1975

EMULSIONS GRADE B
RS-2
RS-K
SS-1H
CRS-2H

ASPHALT AR 2000

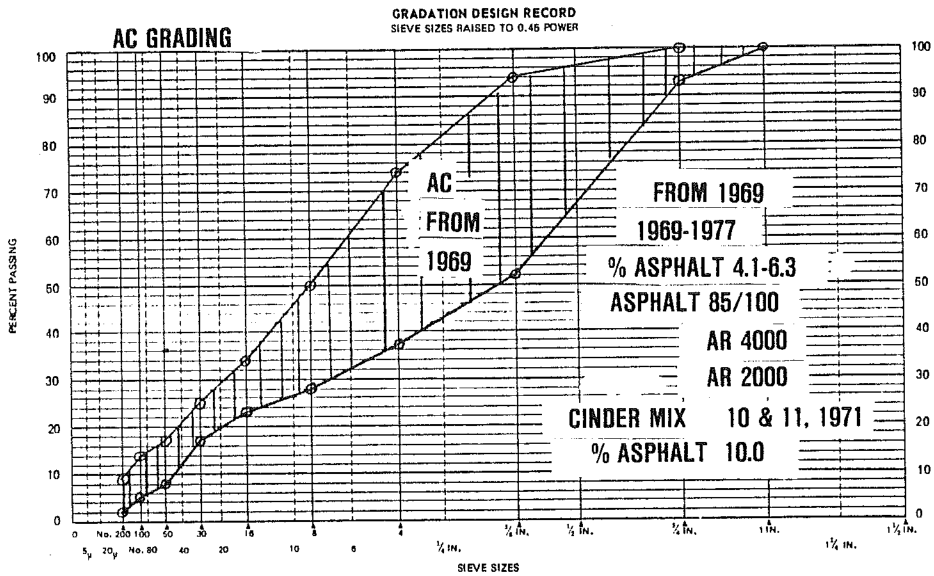
EMULSION APPLICATION
.35 - .40 GAL/YD²

CHIP APPLICATION
18-25 LBS/YD²



1955-1968	CINDER MIX	SITES 12, 13, 1960
% ASPHALT 3.5-7.9	% ASPHALT 11.3	17 & 18, 1961
ASPHALT SC-6, 85/100 120/150, 200/3000		19 , 1963
		% ASPHALT 3.1-3.9
		ASPHALT 85/100

FIGURE 2


GRADATION DESIGN RECORD
SIEVE SIZES RAISED TO 0.45 POWER
AC GRADING
AC
FROM
1969
FROM 1969
1969-1977
% ASPHALT 4.1-6.3
ASPHALT 85/100
AR 4000
AR 2000
CINDER MIX 10 & 11, 1971
% ASPHALT 10.0
PERCENT PASSING
SIEVE SIZES

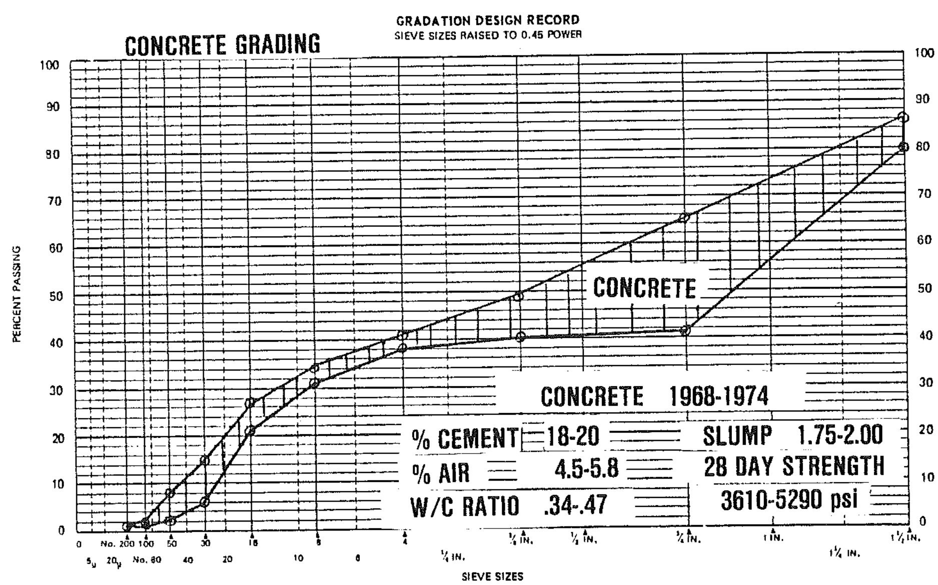
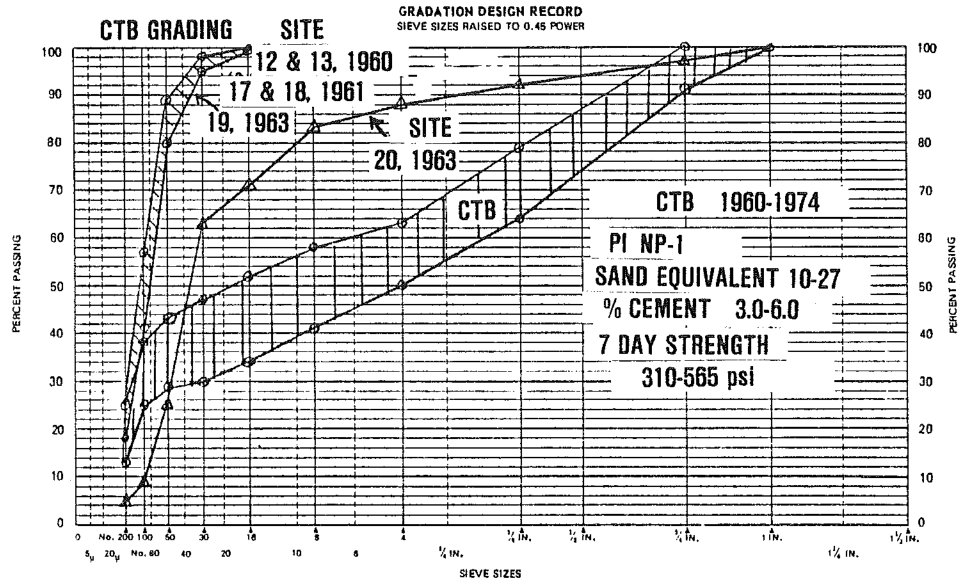

GRADATION DESIGN RECORD
SIEVE SIZES RAISED TO 0.45 POWER
CONCRETE GRADING
CONCRETE
CONCRETE 1968-1974
% CEMENT 18-20
% AIR 4.5-5.8
W/C RATIO .34-.47
SLUMP 1.75-2.00
28 DAY STRENGTH
3610-5290 psi
PERCENT PASSING
SIEVE SIZES

FIGURE 2


GRADATION DESIGN RECORD
SIEVE SIZES RAISED TO 0.45 POWER
CTB GRADING SITE
12 & 13, 1960
17 & 18, 1961
19, 1963
SITE
20, 1963
CTB
CTB 1960-1974
PI NP-1
SAND EQUIVALENT 10-27
% CEMENT 3.0-6.0
7 DAY STRENGTH
310-565 psi
PERCENT PASSING
SIEVE SIZES

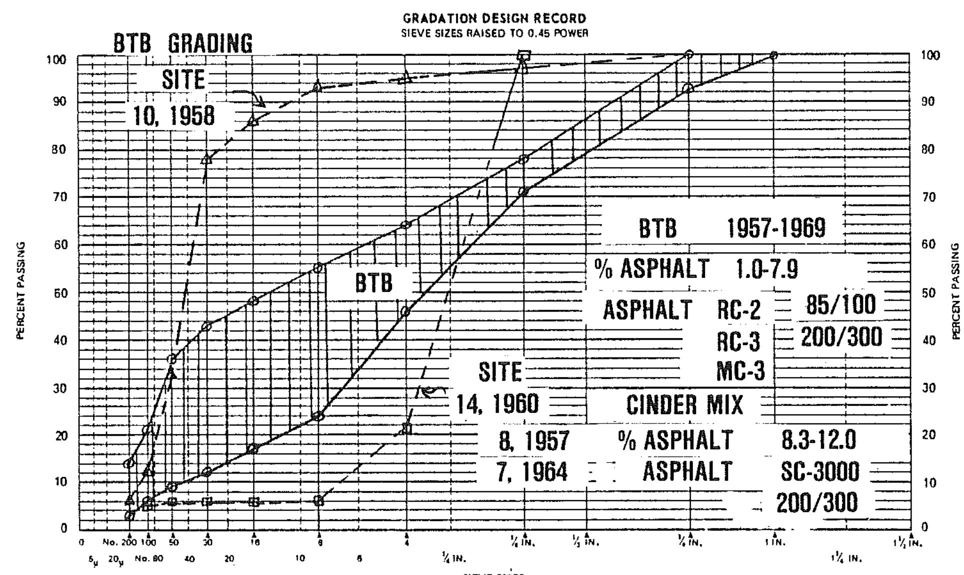
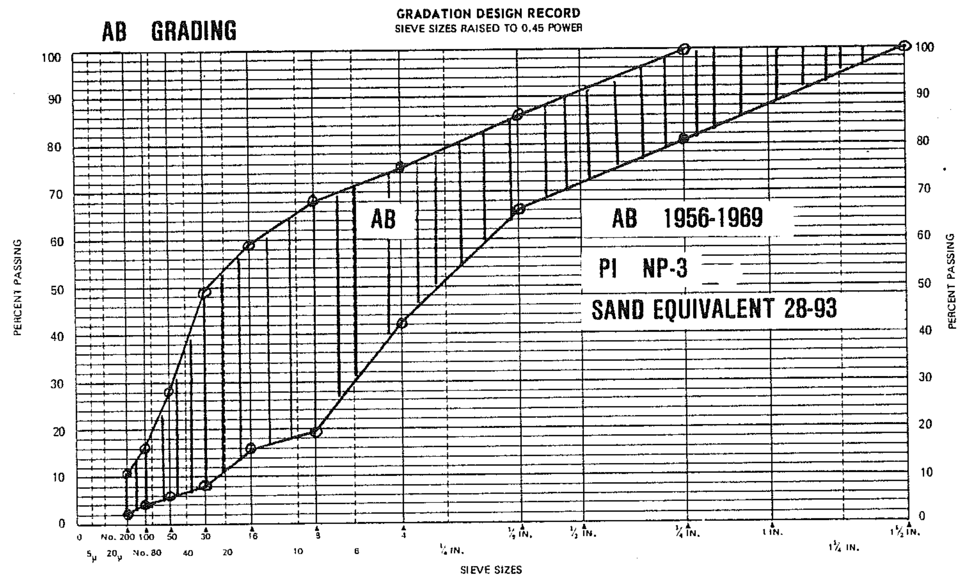

GRADATION DESIGN RECORD
SIEVE SIZES RAISED TO 0.45 POWER
BTB GRADING
SITE
10, 1958
BTB
BTB 1957-1969
% ASPHALT 1.0-7.9
ASPHALT RC-2 85/100
RC-3 200/300
MC-3
SITE
14, 1960
8, 1957
7, 1964
CINDER MIX
% ASPHALT 8.3-12.0
ASPHALT SC-3000
200/300
PERCENT PASSING
SIEVE SIZES

FIGURE 2


AB GRADING
GRADATION DESIGN RECORD
SIEVE SIZES RAISED TO 0.45 POWER
AB
AB 1956-1969
PI NP-3
SAND EQUIVALENT 28-93
PERCENT PASSING
SIEVE SIZES

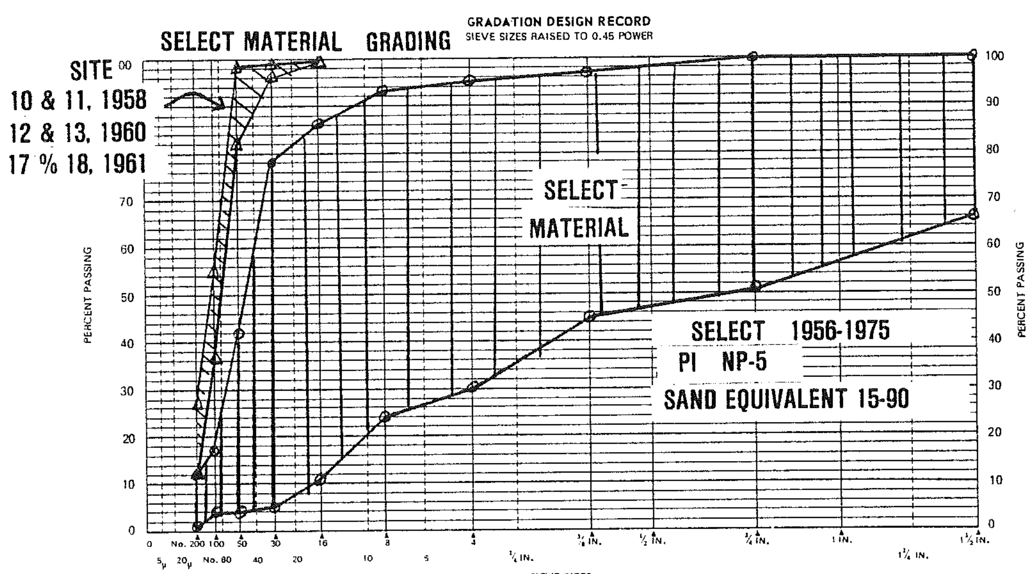
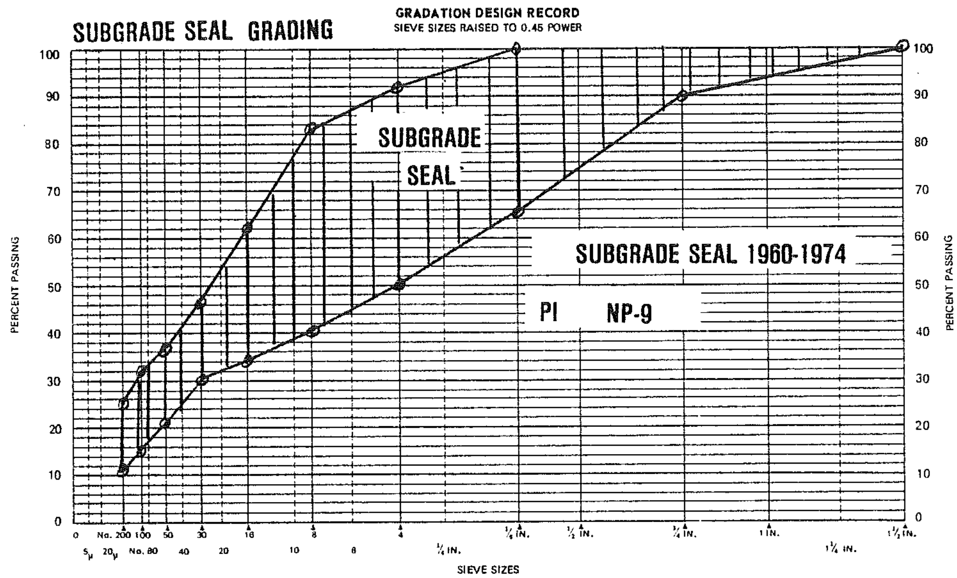
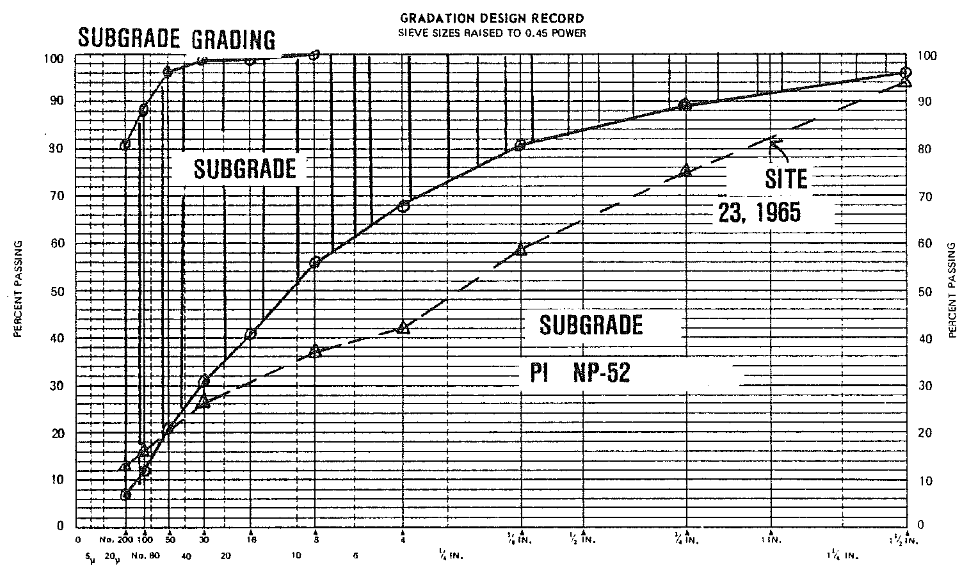

SELECT MATERIAL GRADING
GRADATION DESIGN RECORD
SIEVE SIZES RAISED TO 0.45 POWER
SITE
10 & 11, 1958
12 & 13, 1960
17 % 18, 1961
SELECT
MATERIAL
SELECT 1956-1975
PI NP-5
SAND EQUIVALENT 15-90
PERCENT PASSING
SIEVE SIZES

FIGURE 2


SUBGRADE SEAL GRADING
GRADATION DESIGN RECORD
SIEVE SIZES RAISED TO 0.45 POWER
SUBGRADE SEAL
SUBGRADE SEAL 1960-1974
PI NP-9
PERCENT PASSING
SIEVE SIZES


SUBGRADE GRADING
GRADATION DESIGN RECORD
SIEVE SIZES RAISED TO 0.45 POWER
SUBGRADE
SITE 23, 1965
SUBGRADE
PI NP-52
PERCENT PASSING
SIEVE SIZES

GEOMETRICS

Figure 3 contains a series of drawings depicting the cross sectional view descriptive of each site's geometry - cut, fill, urban or side hill cut.

FIGURE 3

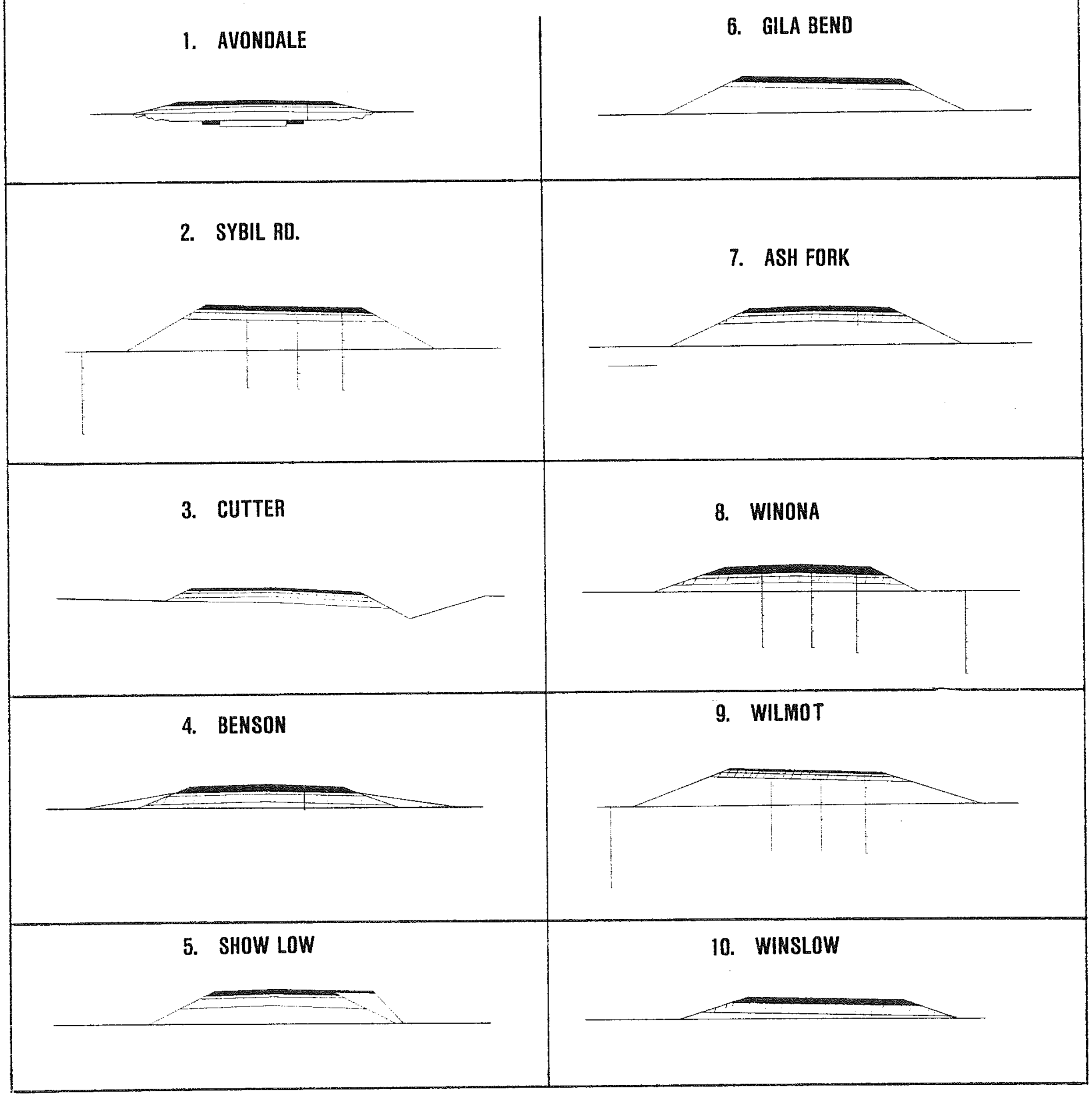


FIGURE 3

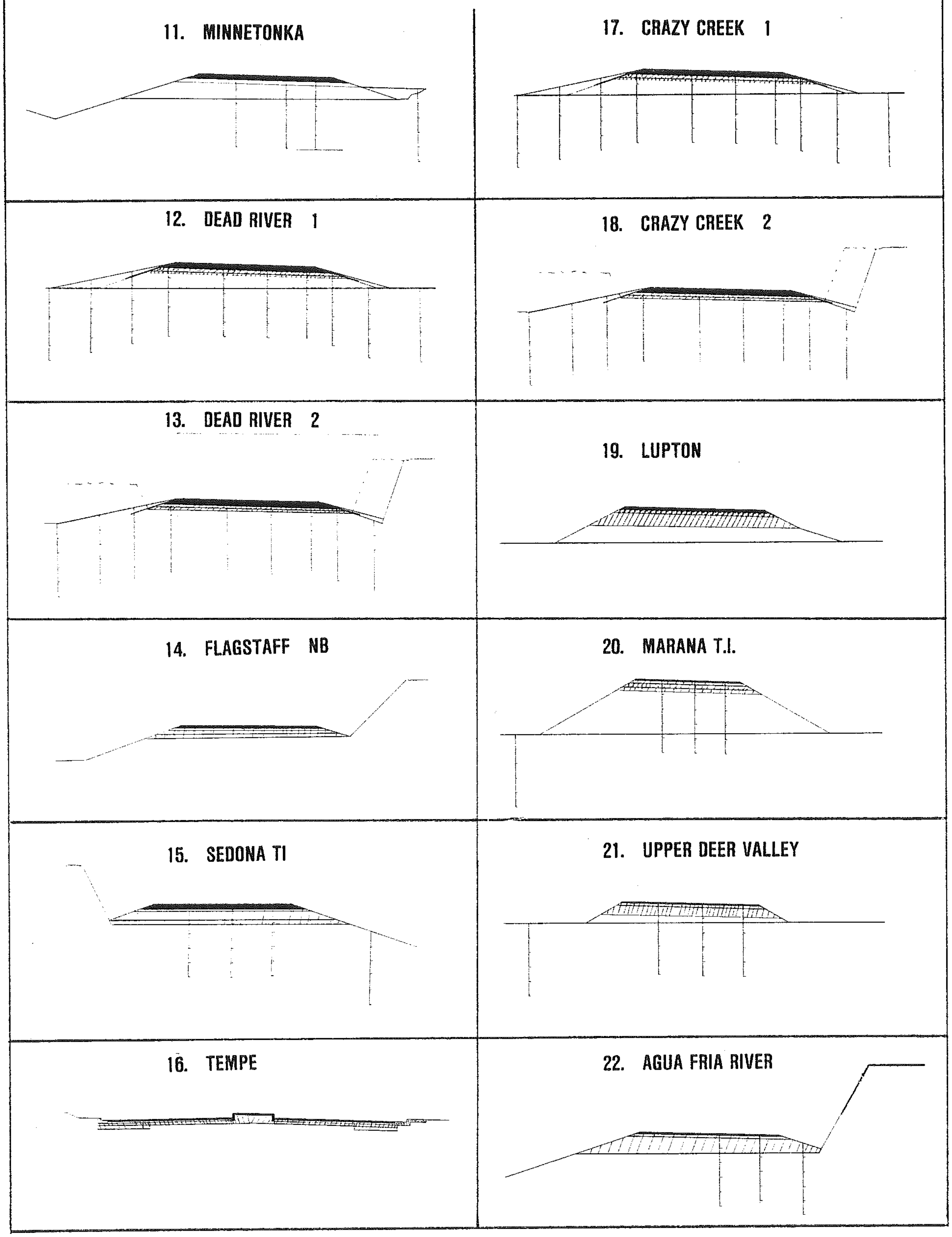

11. MINNETONKA
17. CRAZY CREEK 1
12. DEAD RIVER 1
18. CRAZY CREEK 2
13. DEAD RIVER 2
19. LUPTON
14. FLAGSTAFF NB
20. MARANA T.I.
15. SEDONA TI
21. UPPER DEER VALLEY
16. TEMPE
22. AGUA FRIA RIVER

FIGURE 3

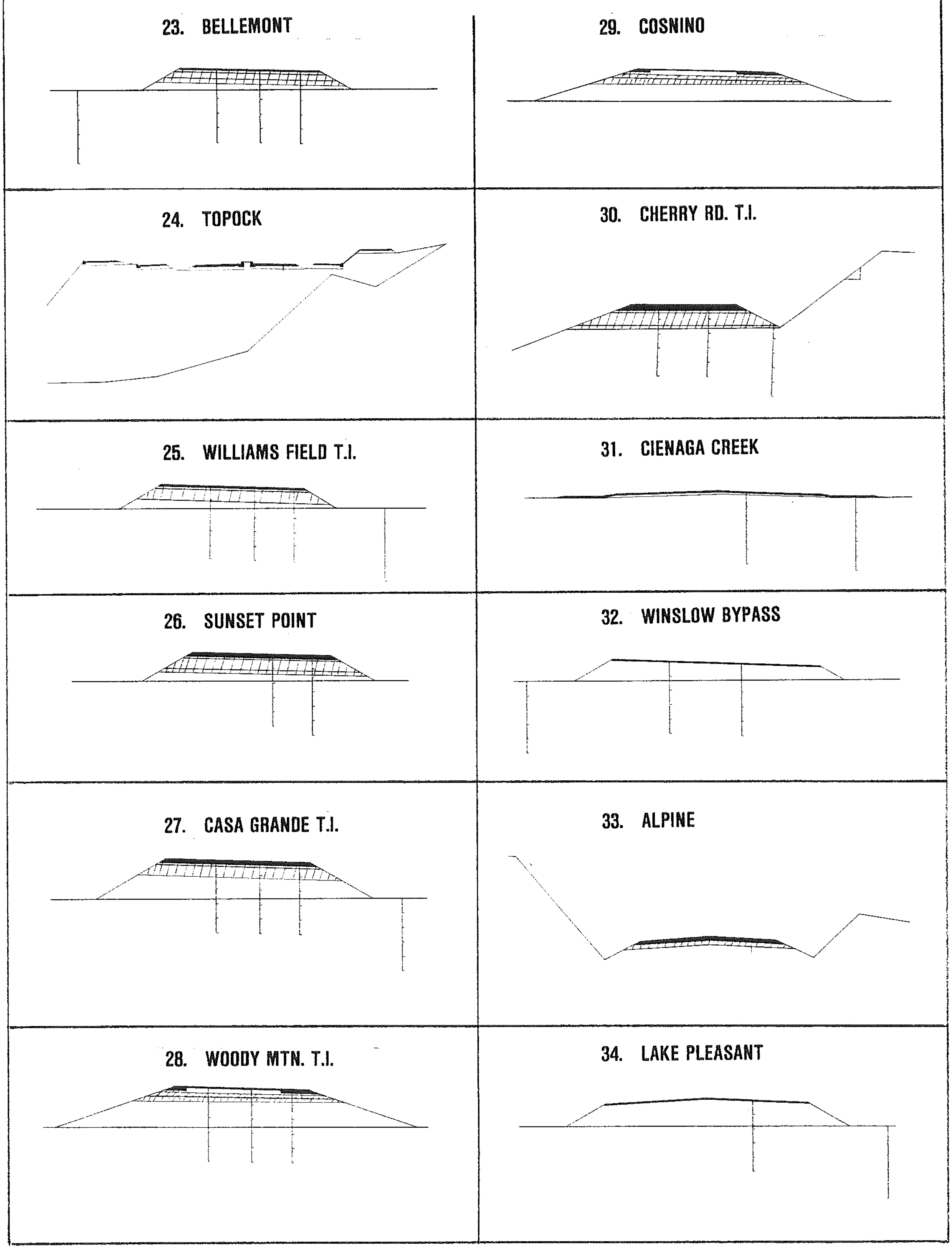
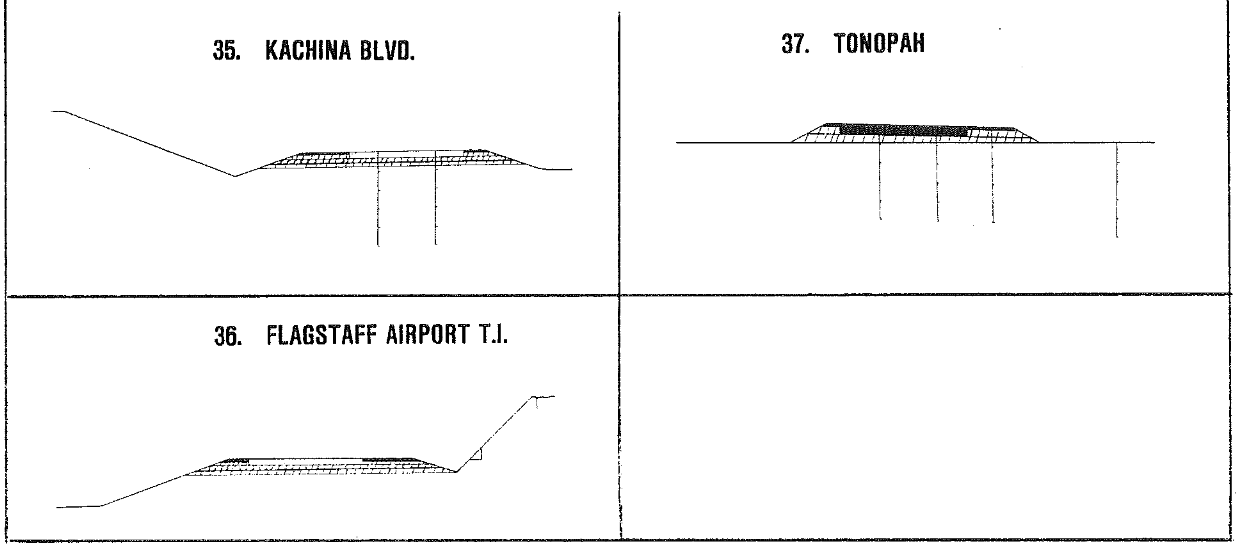

23. BELLEMONT
29. COSNINO
24. TOPOCK
30. CHERRY RD. T.I.
25. WILLIAMS FIELD T.I.
31. CIENAGA CREEK
26. SUNSET POINT
32. WINSLOW BYPASS
27. CASA GRANDE T.I.
33. ALPINE
28. WOODY MTN. T.I.
34. LAKE PLEASANT

FIGURE 3



TRAFFIC

The 18 kip single axle equivalent one-way traffic for each site was determined. Many sites have very similar traffic loadings, due to their being on the same route within close proximity to one another and the lack of virtually any additional on or off traffic. Table 2 gives the current 1978 ADT, percent trucks and 18 kip loading for 1978. In addition, the cumulative 18 kip loading between activities is given for each site. As an example, for site #1 the 18 kip cumulative traffic from the first event (1936) to the second event (12/1956) is given in the event #1 column. Event #2 represents the 12/1956 to 8/1974 cumulative 18 kip traffic and the event #3 column represents the cumulative 18 kip traffic from 8/1974 to 3/1979. The cumulative traffic was derived by developing a master curve for yearly equivalent single axle 18 kip loads as shown below on Figure 4.

By knowing the 18 kip traffic in 1978, it was possible to apply the derived factor for any year and calculate the 18 kip loading for that year. In this way, the cumulative traffic could be calculated for any time period. Since 1948, the 18 kip loading has doubled about every eight years.

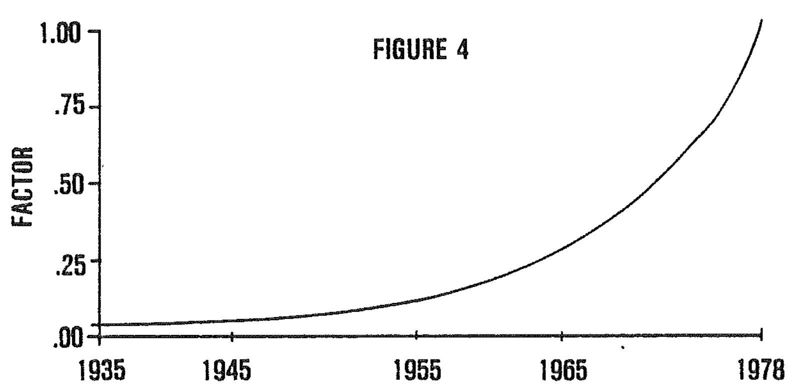


TABLE 2

TRAFFIC

SITE NO.	1978; ONE WAY ADT	% TRUCKS	18 kips	CUMULATIVE 18 kip EVENT #1-2	EVENT #2-3	EVENT #3-4	EVENT #4-5
1	8,000	45.0	333,000	555,000	2,282,000	1,082,000	
2	4,562	35.4	234,000	505,000	1,950,000	606,000	
3	1,458	47.0	29,000	96,000	61,000	65,000	96,000
4	6,032	34.3	245,000	649,000	1,243,000	635,000	
5	835	50.0	18,000	140,000	34,000	47,000	
6	4,816	41.7	186,000	803,000	185,000	492,000	333,000
7	3,857	37.4	272,000	488,000	480,000	1,749,000	
8	5,777	33.8	288,000	917,000	1,423,000	288,000	
9	7,915	35.3	353,000	3,042,000			
10	5,817	35.3	308,000	1,445,000	582,000	767,000	
11	5,817	35.3	308,000	1,445,000	582,000	767,000	
12	5,057	34.2	286,000	1,662,000	950,000		
13	5,057	34.2	286,000	1,662,000	950,000		
14	3,680	33.8	139,000	204,000	545,000	462,000	
15	4,125	33.8	156,000	1,400,000			
16	16,500	33.0	247,000	1,365,000	820,000		
17	5,058	34.2	286,000	2,002,000	512,000		
18	5,058	34.2	286,000	2,002,000	512,000		
19	5,058	34.2	286,000	1,897,000	512,000		
20	8,525	34.8	395,000	3,227,000			
21	6,688	30.1	187,000	1,473,000			
22	5,760	30.1	159,000	1,252,000			
23	6,510	36.4	287,000	2,077,000			
24	3,258	39.5	230,000	1,666,000			
25	10,570	35.3	417,000	2,858,000			
26	5,760	30.1	159,000	1,090,000			
27	5,760	32.0	240,000	1,849,000			
28	5,410	36.4	287,000	1,834,000	287,000		
29	5,778	33.8	288,000	1,840,000			
30	4,630	33.8	200,000	924,000	372,000		
31	175	36.0	3,000	3,000			
32	0	0	0				
33	578	50.0	43,000	172,000			
34	0	0	0				
35	3,680	33.8	139,000	461,000			
36	3,680	33.8	139,000	461,000			
37	4,335	26.8	186,000	483,000			

FIELD SAMPLE TEST RESULTS

During the course of developing sites and conducting plate bearing tests, samples of the in-place materials were taken and tested in a manner consistent with previously reported construction test results in Appendix A. Accordingly, Appendix B contains the test results of field samples as shown below.

This set of data was developed to help understand the meaning of moisture, deflection and performance measurements; however, by knowing the materials properties at the time of construction and at some time in the future, it is possible to test for the influence of time on the materials.

APPENDIX B CONTENT

MATERIAL TYPE	BY TABLES B-1 THROUGH B-14		
	GRADING	ASPHALT CONTENT AND PROPERTIES	COMPACTION DATA PI AND SAND EQUIVALENT AND R VALUE
AC	--	B-1	B-2
BTB	--	B-3	B-4
CTB	--	--	B-5
AB	B-6	--	B-7 & 8
SM	B-9	--	B-10 & 11
SGS	B-9	--	B-10 & 11
SUBGRADE	B-12	--	B-13 & 14

ASPHALT AGING

Due to asphalts biodegradable nature, it ages and changes properties with continued exposure to sunlight, heat and oxygen. By knowing the asphalts penetration at 77°F before construction (Table A-6) and the penetration at some future time (Table B-1), it was possible to derive the ratio of aged to unaged penetration and plot this relationship on Figure 5.

As can be seen, the penetration falls to one-half its original value in about one year, and by two years it is one-fourth its original value. From two years on, the rate of aging slows, so that it takes about eight years to reach one-eighth of the original value. A similar aging curve was derived for the absolute viscosity at 140° F, as shown on Figure 6. For viscosity, the aging rate is much faster than for penetration because the viscosity is free to increase without limit, whereas penetration is bound to a zero penetration. With this rapid aging asphaltic concrete pavements in Arizona would tend to become very stiff.

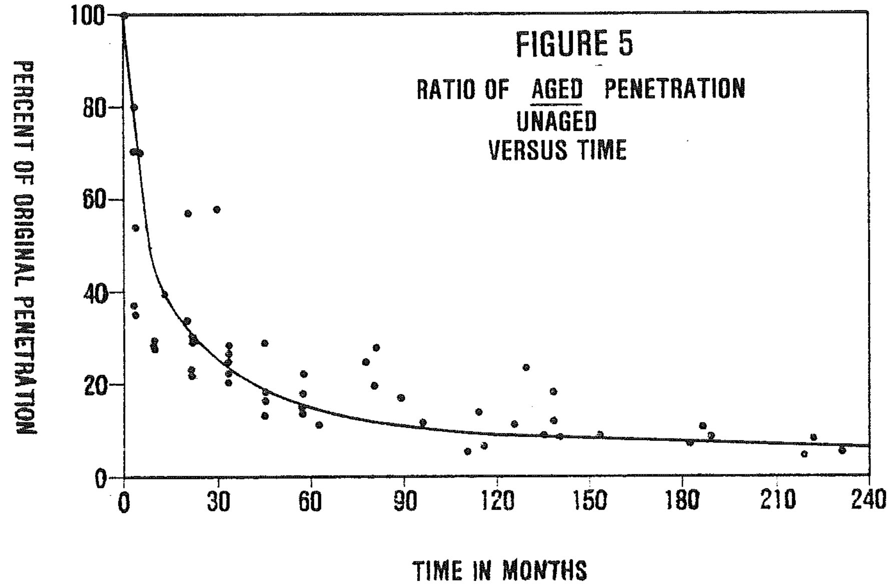
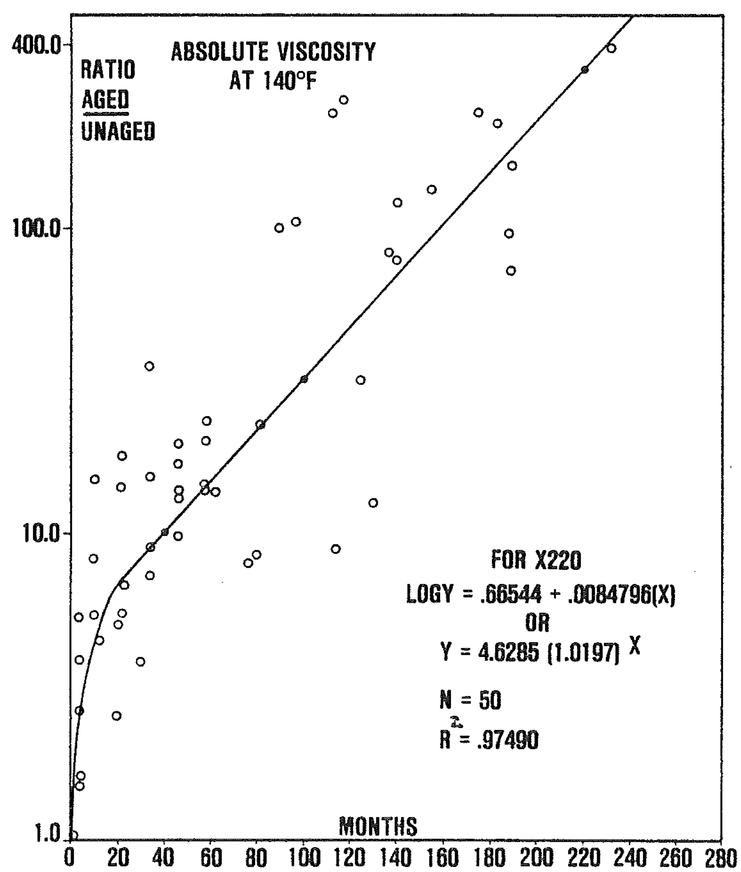


FIGURE 6

TIME VERSUS RATE OF CHANGE

OF VISCOSITY AT 140°F

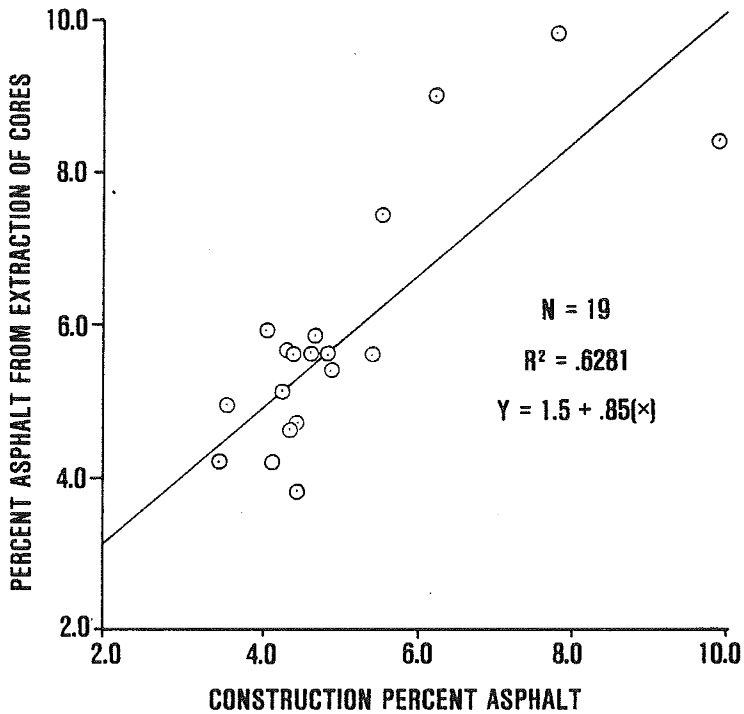


ASPHALT CONTENT

By knowing the asphalt content at construction (Table A-7) and the field asphalt (Table B-2), it was possible to determine the relationship below (Figure 7).

The extracted cores tended to contain more asphalt than at construction. This could be due to either the extraction test or applications of tack coat and flush coats, which have gradually increased the total asphalt content.

FIGURE 7



ASPHALTIC CONCRETE DENSITY, VOIDS AND COMPACTION

In reviewing the construction files, it was very difficult to obtain both the field density and the maximum theoretical density (Rice method). However, laboratory Hveem densities (T.I. compactor) for most project mixes was available. As an estimate, the T.I. densities were plotted versus the construction field density (Figure 8).

As can be seen, the field density is generally four pounds per cubic foot (64 kg/m) less than the T.I. compactor density. Applying this relationship to Table A-7, it was possible to calculate the most likely field density, as indicated by starred (*) values. Likewise, it was possible to estimate the maximum theoretical densities (MTD) by plotting the measured MTD from Table B-2 versus the T.I. compactor density (Table A-7) as shown in Figure 9.

FIGURE 8

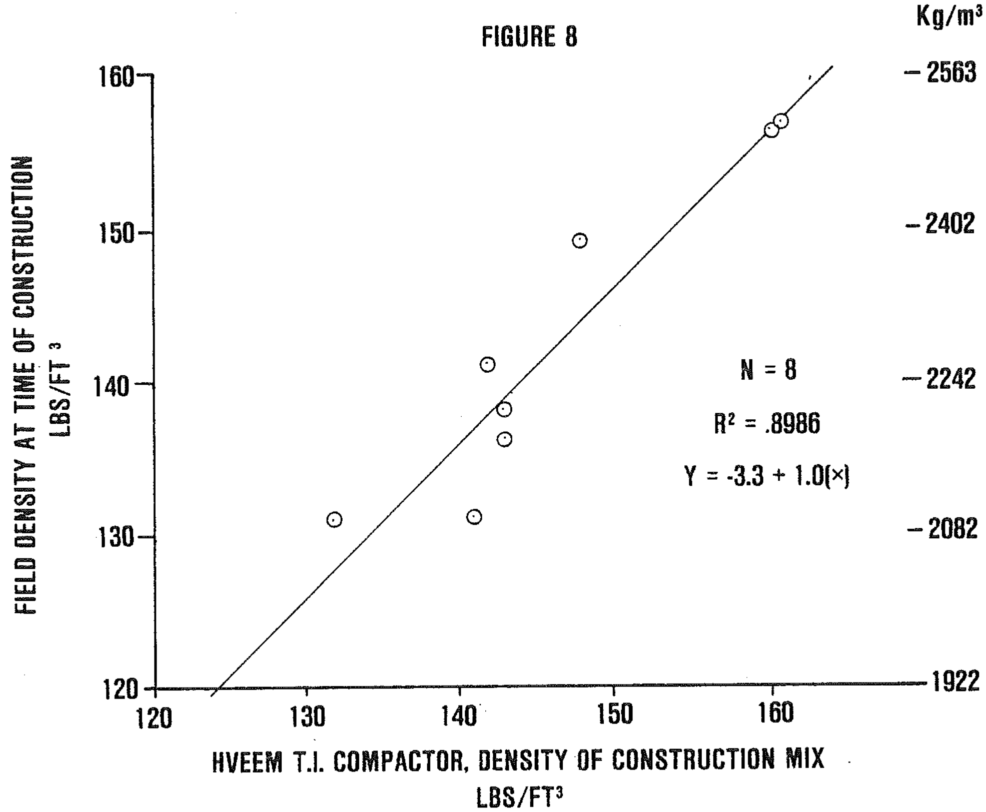
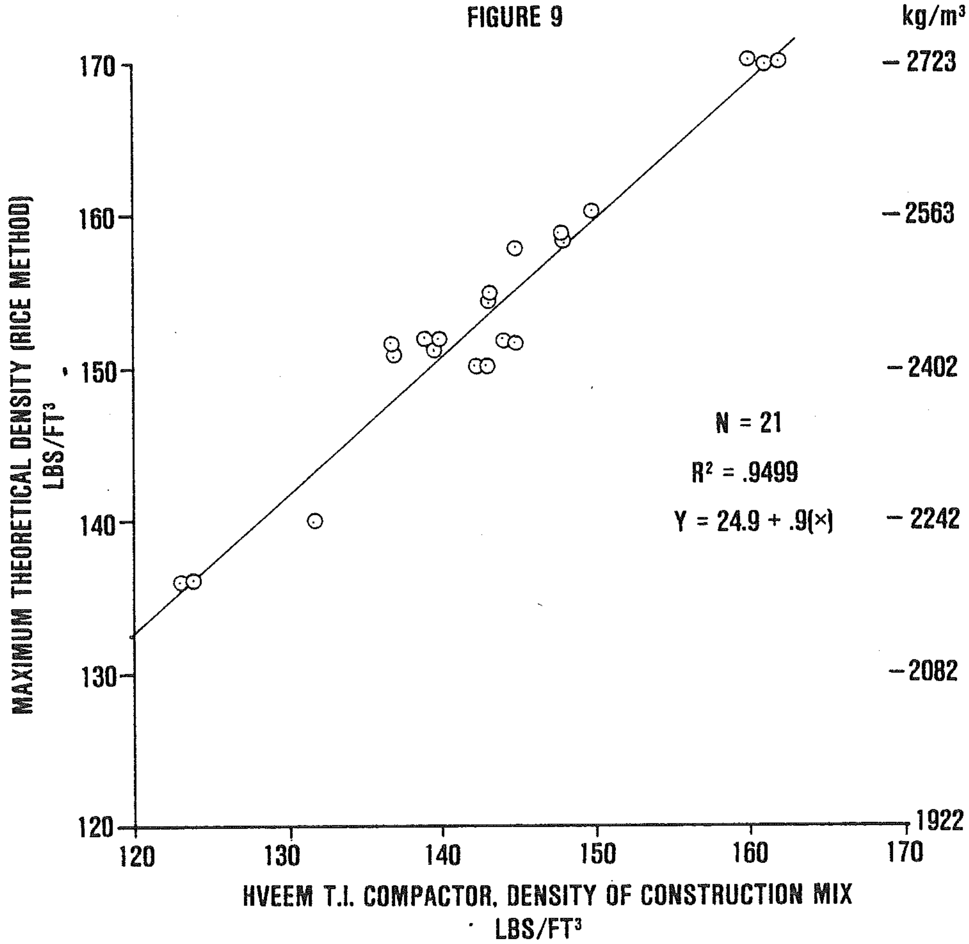


FIGURE 9



Generally, the MTD is ten (160) to twelve (192) pounds per cubic foot (kg/m^3) heavier than the T.I. compactor density. By applying the Figure 9 relationship, it was possible to calculate the expected MTD for all projects with a T.I. compaction density. Figure 10 shows the density of AC after traffic has compacted it compared to the construction density.

The density of the AC after two or more years of traffic increases dramatically for those very low density mixes, but very little for high density mixes. The explanation for this is that low density mixes are cinder mixes. This type of aggregate is a very rough surfaced material, which does not readily compact. Higher density mixes are combinations of virtually all crushed aggregate and sand. These mixes can be readily compacted to a very high density at time of construction due to the aggregate interlock. Additional densification of these high density mixes is virtually impossible, since the aggregate would begin to break down thus reducing the density.

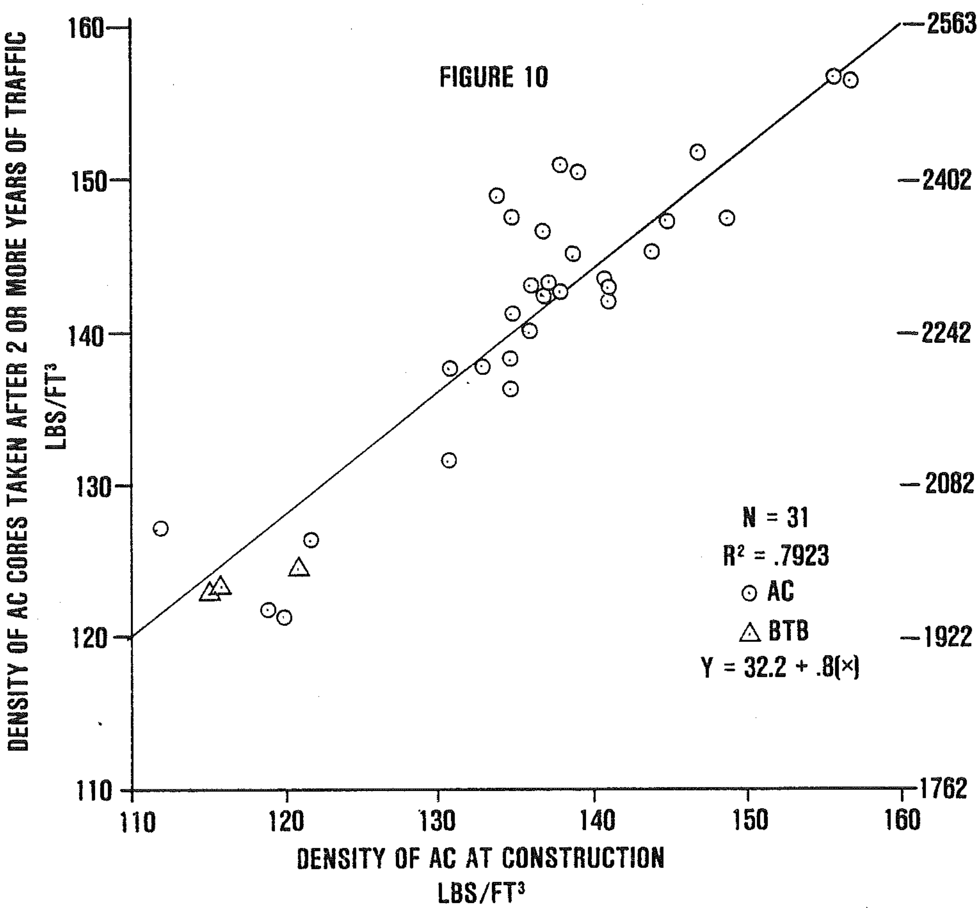
Air voids are an important consideration to the design of AC mixes. Beginning in 1969, compaction controls were placed on AC so that at the time of construction the compaction would be 92 percent with respect to the MTD. In this way air voids would be approximately eight percent at time of construction. After traffic, additional densification would take place, thus lowering the air voids to a design value of 4-6 percent. Of the 15 projects built since 1969, seven of them were constructed with less than eight percent voids and these projects have attained the 4-6 percent air voids design target under traffic. Table 3 shows the degree of success in attaining the 4-6 design value.

TABLE 3

NUMBER OF PROJECTS AT VARIOUS AIR VOID LEVELS

	1956-1968 NO AC COMPACTION CONTROL		1969-1977 AC COMPACTION CONTROL	
	VOIDS AT CONSTRUCTION	VOIDS AFTER MORE THAN 2 YEARS	VOIDS AT CONSTRUCTION	VOIDS AFTER MORE THAN 2 YEARS
0-2.0	0	4	0	2
2.1-4.0	0	1	0	0
4.1-6.0	0	2	2	3
6.1-8.0	1	6	6	5
8.1-10.0	11	6	3	2
>10.0	7	0	4	2

FIGURE 10



Evidently mixes built since 1969 have not experienced the degree of compaction gain as those built before 1969. This is probably a direct result of the compaction control specification. With projects now required to achieve at least 92 percent compaction at time of construction, the level of air voids at construction has been reduced. In addition, contractors have found new methods of achieving higher degrees of compaction with fewer roller passes by using big rollers and vibratory rollers. This emphasis on compaction at construction has led to an AC product in the field which does not generally experience much additional traffic compaction. More importantly, the 4-6 percent design air void level has been achieved only about 20 percent of the time.

Interestingly, the voids filled at time of construction had gradually tended to increase as shown below on Table 4.

TABLE 4

VOIDS FILLED WITH ASPHALT

	AVERAGE	HIGH	LOW
1955-1961	46.2	55.0	39.4
1962-1969	53.4	64.5	42.0
1970-1975	57.2	64.1	48.7

BITUMINOUS TREATED BASE (BTB) DENSITY, VOIDS AND COMPACTION

By using Figures 8 and 9, it was possible to estimate the field density at the time of construction and the MTD value for the BTB materials shown in Table A-12. The MTD was calculated according to the Figure 9 equation; however, 20 lbs/ft^3 (320 kg/m^3) were added to the calculated value to give a value more closely in line with site 23/1965 and the value obtained from the specific gravity of the aggregate and asphalt. The four BTB density tests shown on Figure 10 indicate that the long term densification of BTB is very similar to AC. Generally, the BTB mixes had air voids of about 22 percent at construction, and about 19 percent after two or more years of traffic.

CEMENT TREATED BASE

Reviewing Tables A-14 and B-5, it can be seen that the field dry density at time of construction averaged 98 percent of the proctor maximum density. Using this value, it was possible to estimate the four missing field densities. After two or more years under traffic, the field dry densities average about 11 lbs/ft^3 (176 kg/m^3) heavier, or about 106 percent of the proctor maximum density. Only site 28, Woody Mountain, showed considerable decompaction. Field moisture at time of construction averaged 94 percent of the proctor optimum moisture, and this value was used to estimate the remaining four moistures. After many years in the field, CTB moisutres averaged 119 percent of the field moistures at construction, or about 2 percent wetter by weight.

AGGREGATE BASE (AB), SELECT MATERIAL (SM), SUBGRADE SEAL (SGS) AND SUBGRADE

Tables A-16, A-18, and A-20 indicated many missing proctor and field density-moisture data at time of construction. As an estimating process, those sites where actual proctor construction data could be found were used to verify the hypothesis that field samples taken at a later date could represent the proctor density and moisture at the time of construction. Figure 11 shows the proctor dry density from sample locations taken off of Tables B-8, B-11 and B-14 compared to the actual constructin proctor dry density.

As can be seen, the dashed regression line is very close to the line of equality, thus it is reasonable to assume that the sampled proctor dry density can be used to estimate the construction value. This was done, and the starred (*) values in Tables A-16, A-18 and A-20 represent the estimated construction values. A similar approach was taken for the proctor optimum moisture, which gave the following results:

$N=18$
$R^2=.5989$

OPTIMUM % MOISTURE = 1.15 + .87 (SAMPLED OPTIMUM % MOISTURE) @ CONSTRUCTION

Although the correlation is not as good, the slope of the regression line places it very close to the line of equality; thus, the sampled proctor optimum percent moisture was used to estimate the proctor percent moisture at time of construction as indicated by the starred values (*) in Tables A-16, A-18 and A-20. To estimate the field density at time of construction, the construction proctor dry density was plotted on Figure 12 versus the field dry density for AB, SM and SGS. As can be seen, field densities were about two #/ft^3 (32 kg/m^3) heavier than the proctor, or about 101 to 103 percent compaction. This was expected since historically construction specifications have called for AB, SM and SGS acceptance compaction of 100 percent or more. A similar approach was taken for subgrade densities. Results of this analysis indicated the following:

N=10
R^2 =.8733

SUBGRADE FIELD DRY DENSITY @ CONSTRUCTION = 1.71 + .96 (SUBGRADE PROCTOR MAXIMUM DRY DENSITY @ CONSTRUCTION)

This corresponds to a field density about three #/ft^3 (48 kg/m^3) less than the proctor or about a 97 percent compaction. Again this agrees very closely to the subgrade compaction specification of 95 percent or more of the proctor maximum density.

FIGURE 11

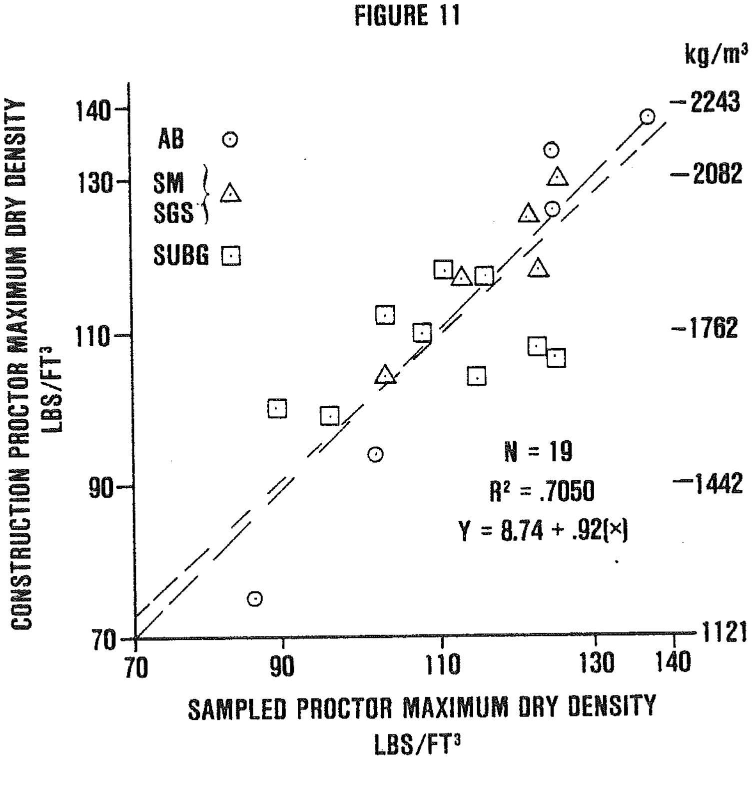
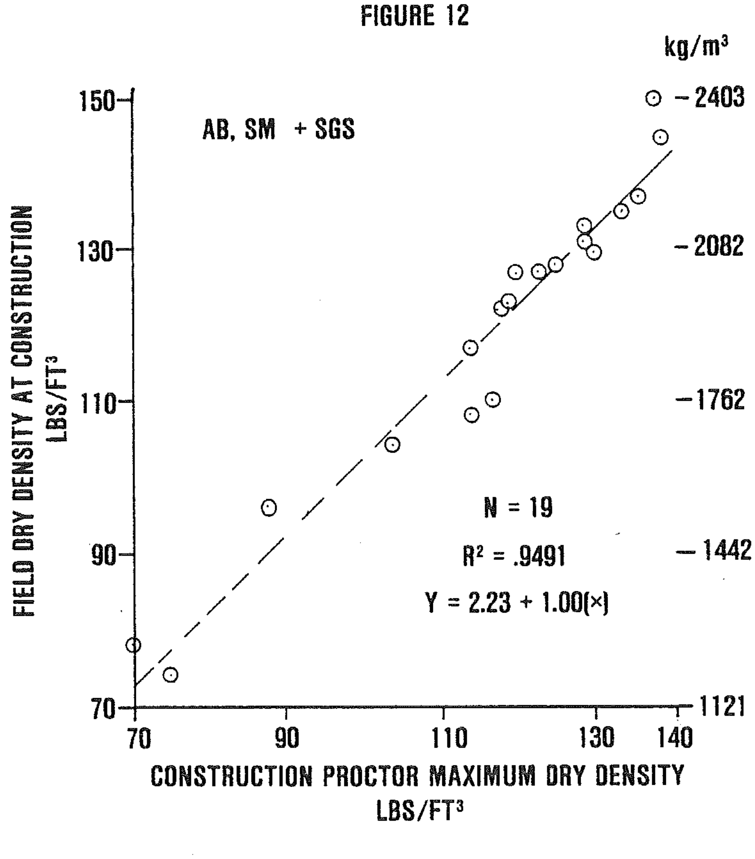


FIGURE 12



A similar approach was taken to estimate the field moisture at time of construction for the base and subgrade materials. Results of this study gave the following:

FIELD PERCENT MOISTURE

@ CONSTRUCTION = A + B*(PROCTOR OPTIMUM PERCENT MOISTURE @ CONSTRUCTION)

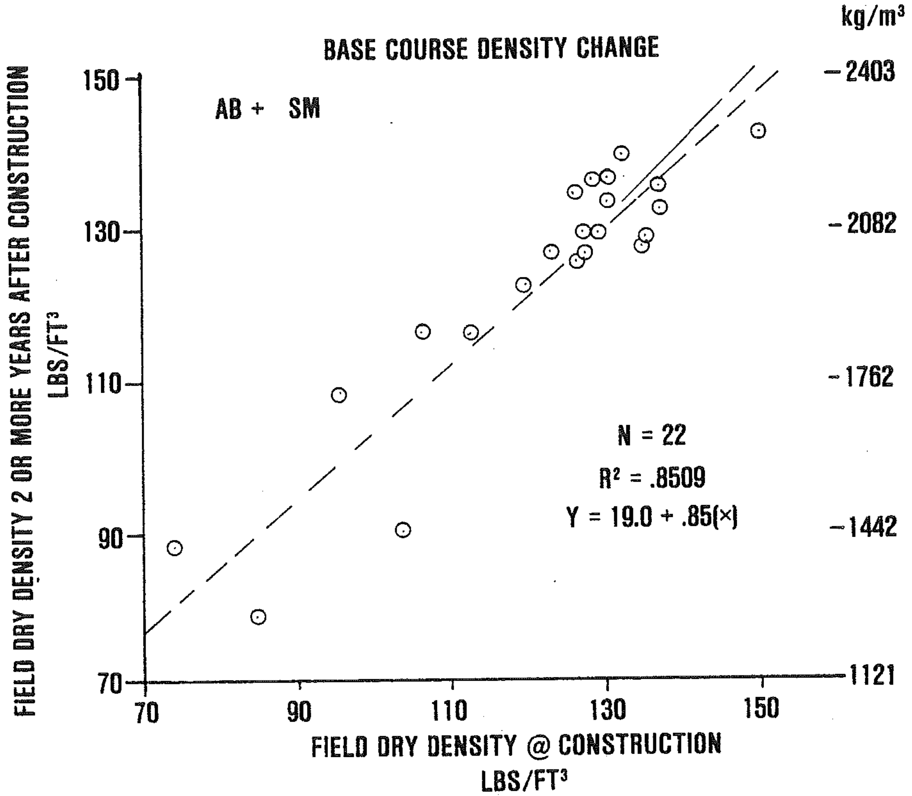
BASE	SUBGRADE
AB-SM-SGS	
N = 19	N = 10
R^2 = .7916	R^2 = .1716
A = -3.3	A = .5
B = 1.0	B = .16

For base materials, the field moisture at construction was generally about 3.3 percent dryer than the proctor optimum moisture. This relationship was surprising since there is no specification control on base course moisture content. The subgrade estimate has considerable scatter; however, the equation does predict field moistures of 1.5 percent to over 6.0 percent dryer than optimum. Even though the correlation is poor, the equation was used to estimate field moisture since no other estimating process was available.

By using the above estimating process, field dry densities and moisture content at time of construction were calculated from the proctor maximum dry density and optimum moisture and are displayed in Tables A-16, A-18 and A-20 with starred values (*). Since field density and moisture at construction and at a later date are available, it was possible to examine the long term changes in density and moisture. During this analysis, it became apparent that AB and SM should be grouped together, and SGS and subgrade should be grouped together since they tended to change both density and moisture in a similar manner. The reason for this is that AB and SM historically have been very similar in grading. Likewise SGS has tended to be closer to the subgrade than the SM grading.

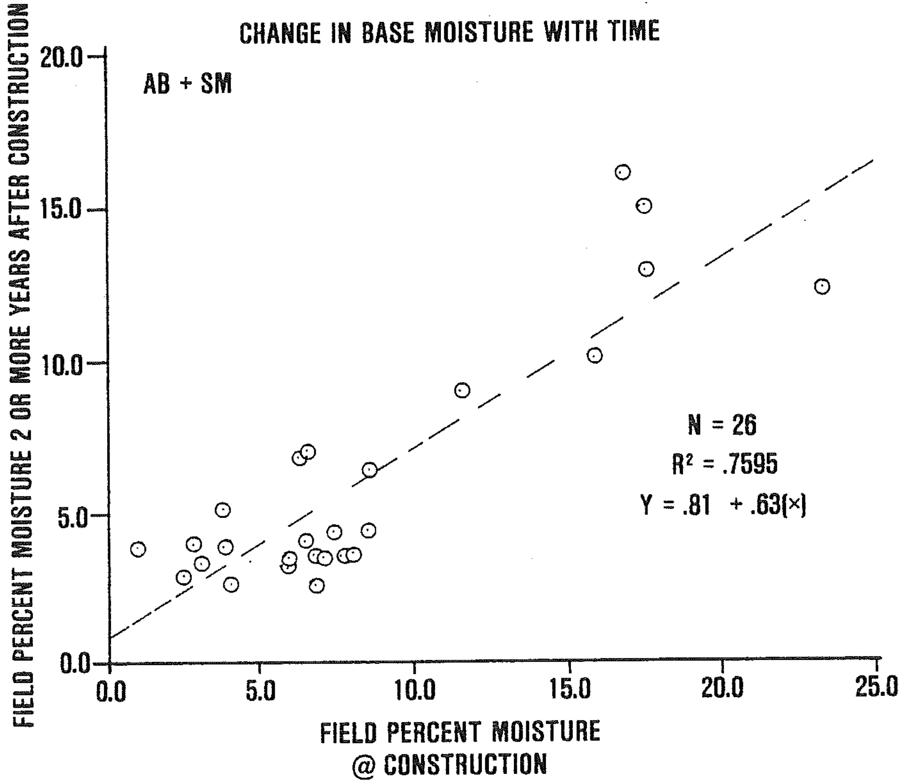
As Figure 13 shows, for AB-SM with dry densities below about 125 $\#/ft^3$, the after construction dry densities increased raising the percent compaction up to about 110 percent of the maximum proctor dry density. AB-SM above about 125 $\#/ft^3$ needed to decrease in density, reducing the compaction to about 99 percent of the proctor maximum dry density. This relationship is very similar to the AC densification under traffic. That is, the low density bases are aggregates with a very rough surface which do not readily compact. Under traffic these materials slowly compact, thus raising their density. The higher density bases are composed of virtually all crushed aggregate, which readily compact under heavy loading; however, keeping this aggregate together or increasing its density without a lubricating agent such as apshalt is very difficult.

FIGURE 13



The AB-SM moisture content changed with time as shown on Figure 14.

FIGURE 14

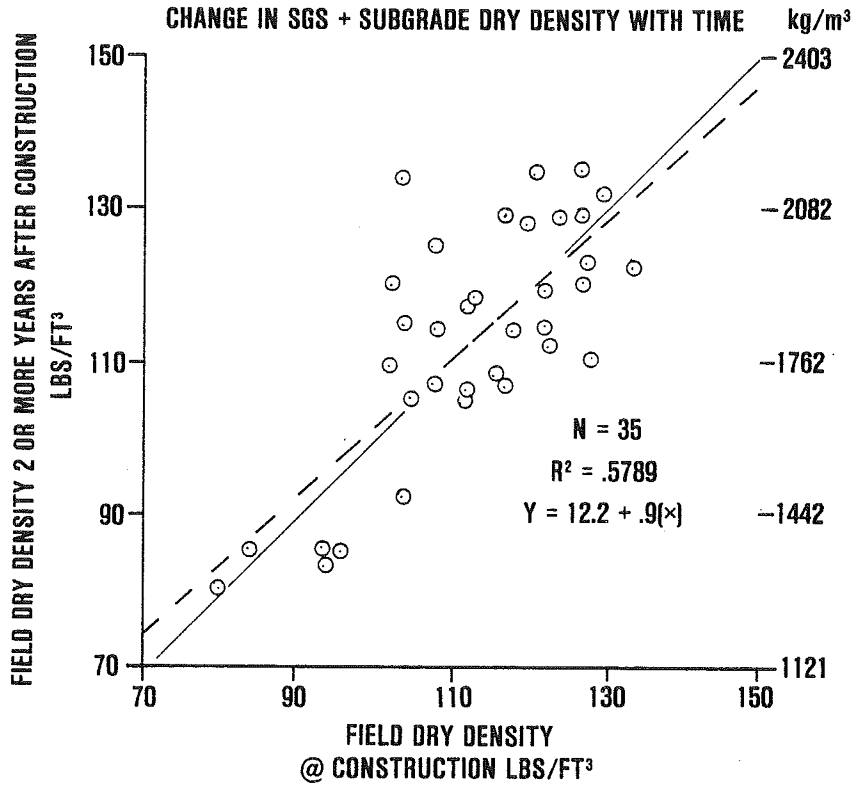


As can be seen, the AB-SM tend to become dryer with time. Since at construction their moisture content is generally about 3.0 percent dryer than optimum, the long term moisture condition is from 3.0 percent to as much as 10 percent below optimum.

Figure 15 shows the change in subgrade dry density with time.

FIGURE 15

CHANGE IN SGS + SUBGRADE DRY DENSITY WITH TIME



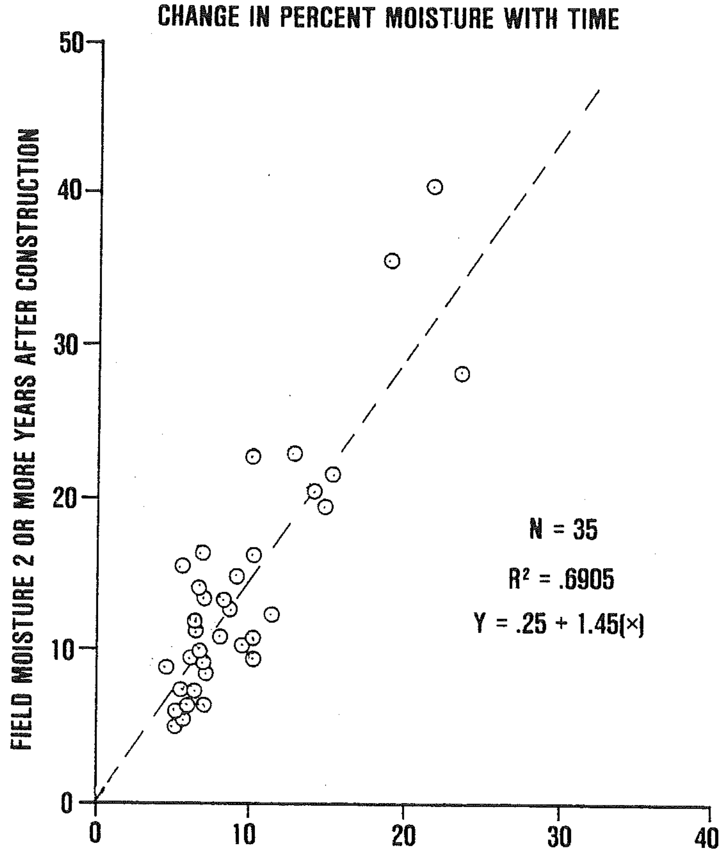
The SGS-SUBGRADE material tended to densify in a manner similar to the base material. That is, subgrades originally compacted below about 120 #/ft^3 increased in density, whereas those above 120 #/ft^3 tended to slightly decrease. Just as importantly, it can be seen that a large number of SGS and subgrades decreased in density over time. To appreciate this fact, Table 5 shows the comparison of dry densities for both base and subgrade materials. Although the proportion of base and subgrade materials decreasing in density is very close, the SGS and subgrade materials have experienced a greater degree of decompaction.

TABLE 5	AB-SM	SGS-SUBGRADE
NUMBER OF SITES	22	35
PERCENT OF SITES BELOW CONSTRUCTION DENSITY	45%	49%
AVERAGE PERCENT OF PROCTOR MAX. DENSITY FOR SITES BELOW CONSTRUCTION DENSITY	97.1%	90.8%

Figure 16 shows the changes in SGS and subgrade moisture content with time. Of the 35 observations, only 4 showed lower moisture two years or more after construction. The average loss in moisture for these 4 cases was only .6 of the percent below the construction moisture. Without a doubt, subgrade moistures do increase with time and those subgrades with high optimum moisture values experience the greatest amount of moisture increase.

FIGURE 16

SGS + SUBGRADE
CHANGE IN PERCENT MOISTURE WITH TIME



Another way of seeing this is to compare the two year post construction field moisture to the optimum moisture for both base and subgrade cases.

	AB-SM	SGS-SUBGRADE
	N = 26	N = 35
AVERAGE PERCENT OF OPTIMUM MOISTURE	47.9%*	88% **

* NO FIELD MOISTURES ABOVE OPTIMUM
**10 FIELD MOISTURES ABOVE OPTIMUM

To conduct a pavement design, the subgrade materials are characterized by the Hveem R-value test at 300 psi to determine the soil support. Generally the R-value density and moisture are considered to represent the worst condition. During the field sampling phase, a sufficient quantity of base and subgrade were sampled in order to perform an R-value test. Figure 17 is a plot of the R-value dry density versus the proctor T-99 dry density for both base and subgrade materials. Essentially, the T-99 proctor maximum density is equal to the Hveem R-value 300 psi dry density. Figure 18 shows the relationship between the T-99 proctor optimum moisture and the R-value 300 psi moisture. Again the Hveem R-value moisture is essentially equal to the proctor optimum moisture. An examination of the relationship between the proctor maximum density and the optimum moisture (Figure 19) showed that the two values are strongly correlated. Considerable attempts were made to see if R value correlated with grading, dry density or moisture content.

FIGURE 17

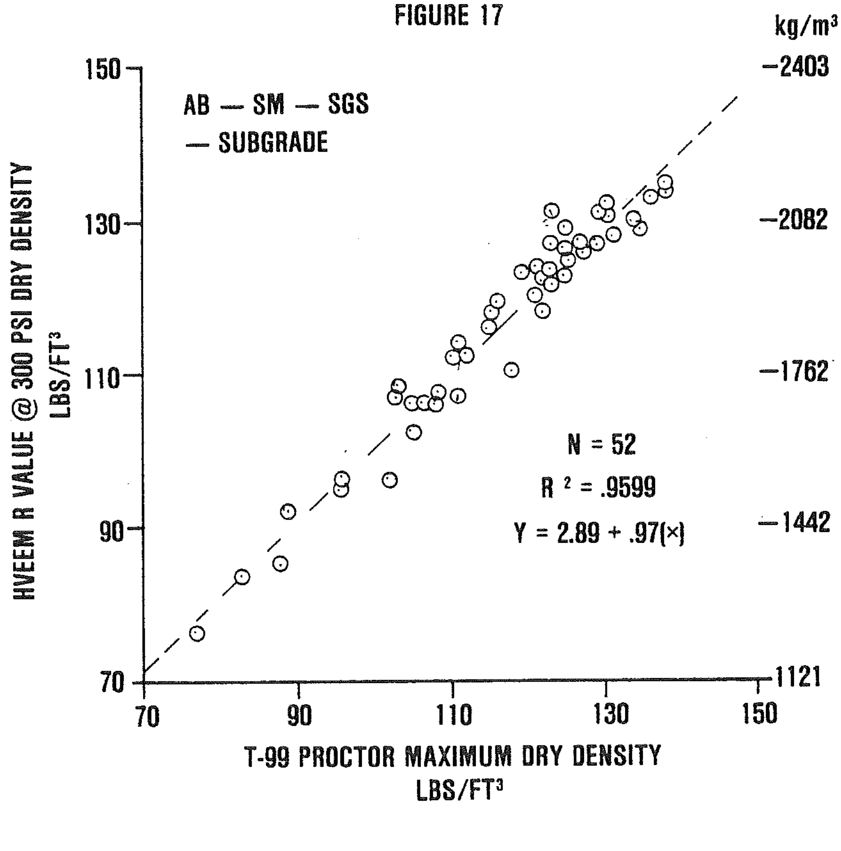


FIGURE 18

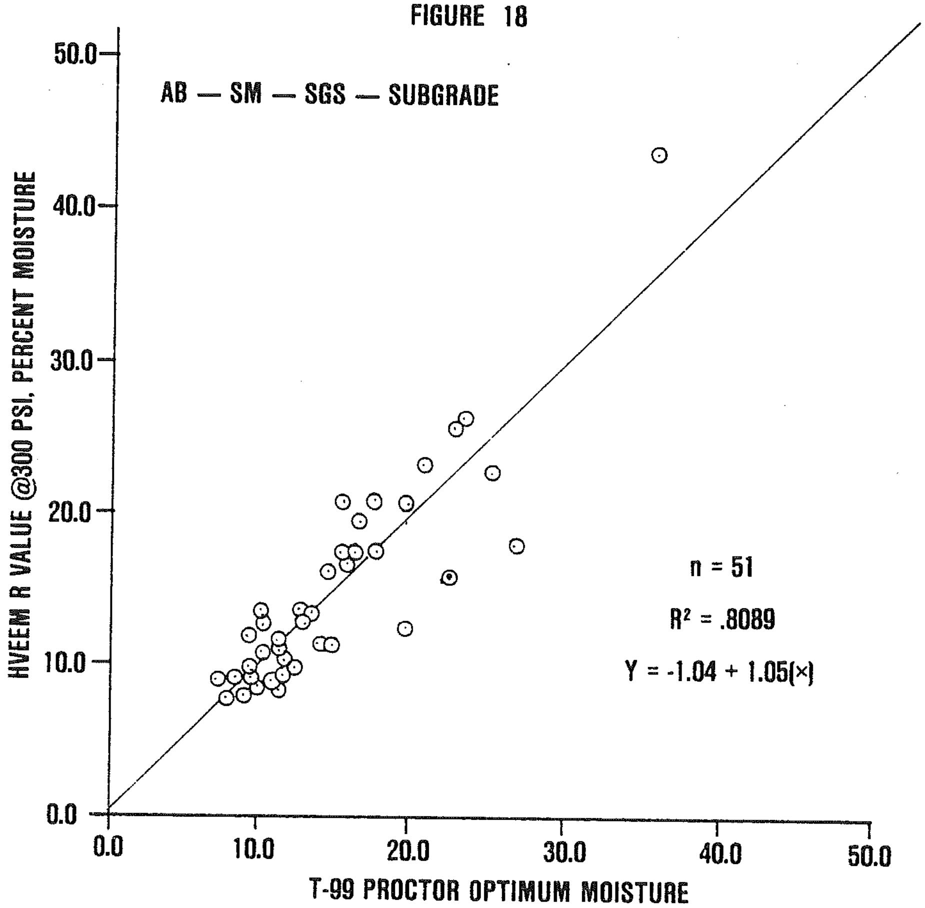
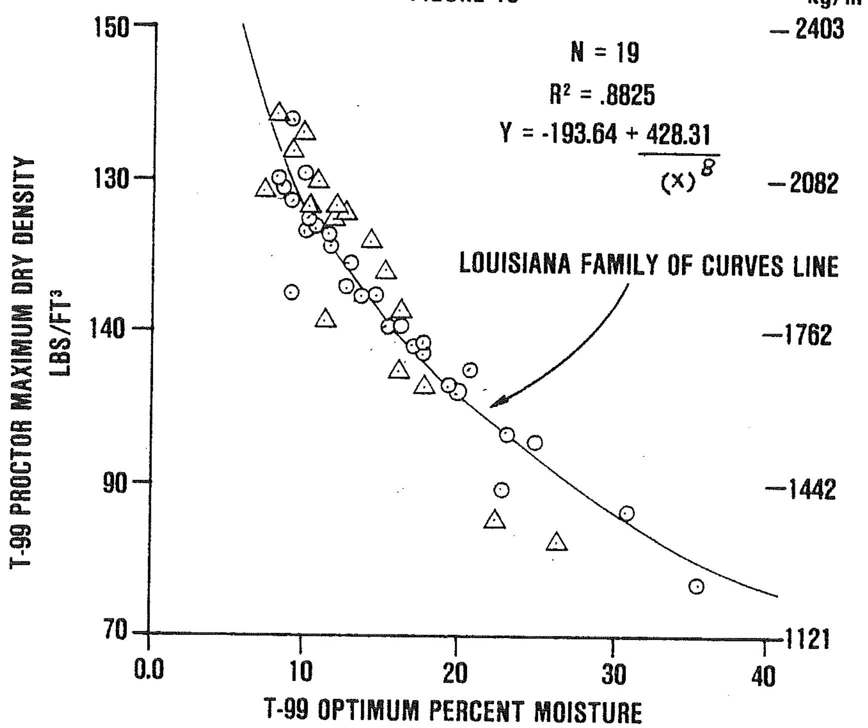


FIGURE 19



Tables B-12, B-13 and B-14 were used to correlate grading, clay content and moisture content to R value. Historically, ADOT has kept a computer file of all R value tests. At present, 2500 test results are in this file. From the file data, a correlation between R value and the variables PI and percent passing the 200 sieve (-200) has been created, Figure 20. Using this figure, it is possible to estimate the R value from the PI and -200s. The correlation between the predicted and actual R value was quite good.

ACTUAL R VALUE @ 300 PSI = -2.95 + 1.11 (PREDICTED R VALUE)

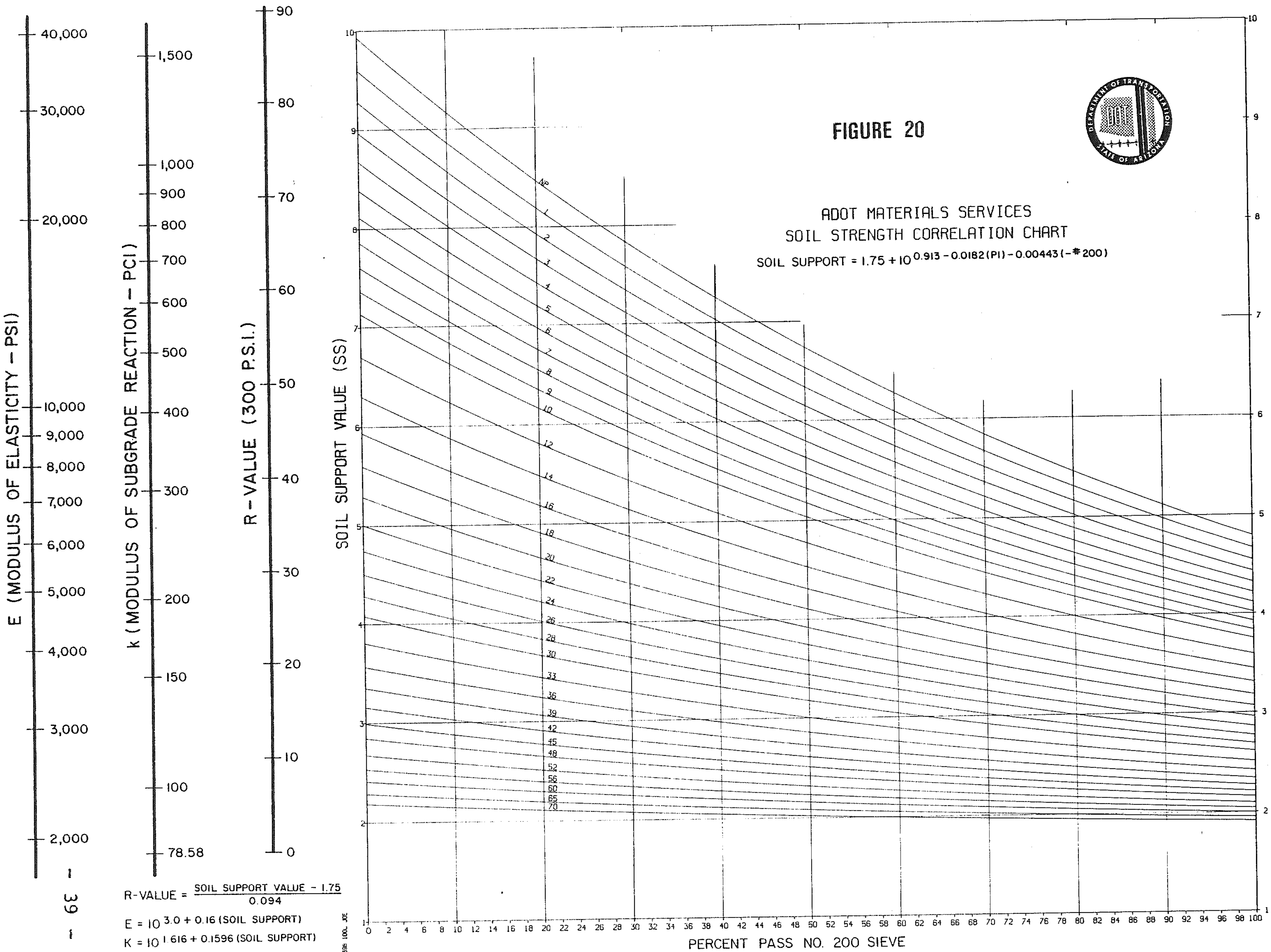
$N = 30 \quad R^2 = .8081$

The above correlation set a standard by which other variables could be examined. For this study, several individual variables were examined for their correlation to R value. Table 6 gives results of this work.

TABLE 6

R VALUE AT 300 PSI IS VARIABLE Y

VARIABLE X	EQUATION FORM	# OF OBSERVATIONS N	CORRELATION R^2	A	B
PASS 2 MICRON (% CLAY)	$Y = A + B*(X)$	30	.7025	76.91	-2.43
PASS 200 (-200)	$Y = A + B*(X)$	30	.6906	87.38	-1.07
PI	$Y = A + B*(X)^{-1/4}$	30	.6740	-25.11	107.57
PROCTOR OPTIMUM % MOISTURE	$Y = A + B*(X)^{-1/2}$	30	.3216	-38.86	319.32
PROCTOR MAXIMUM DENSITY	$Y = A + B*(X)$	30	.2669	-66.44	.99
SAND EQUIVALENT	$Y = A + B\sqrt{X}$	30	.7424	-13.61	16.43



$$\text{R-VALUE} = \frac{\text{SOIL SUPPORT VALUE} - 1.75}{0.094}$$

$$E = 10^{3.0 + 0.16\,(\text{SOIL SUPPORT})}$$

$$K = 10^{1.616 + 0.1596\,(\text{SOIL SUPPORT})}$$

As can be seen in Table 6, the R value test appears to be better related to gradation and in particular tests that describe the clay content of the material. Interestingly, both the -200 and PI are very well related to the minus 2 micron (clay) material as shown on Table 7. This relationship would help explain the reason why both -200 and PI relate so well to the R value.

TABLE 7

Y VARIABLE IS -2 MICRON (CLAY)

X VARIABLE	EQUATION FORM	N	R^2	A	B
-200	Y = A+BX	33	.8435	-2.87	.40
PI	Y = A+BX	29	.7412	-2.61	1.13

In summary, this section has dealt with changes in materials properties, compaction or configuration with time. All layers of materials have experienced changes with time. Many of these long term changes are predictable. In the next section, short term day to day, month to month changes in temperature, moisture and deflection will be examined.

MONITORING OF TEMPERATURE, MOISTURE AND DEFLECTION

TEMPERATURE

In the Phase I report (5), the temperature installation and measurement process was fully described. Essentially, thermistors were used to measure the temperature of various layers of material. Temperature measurements were taken every other hour at 14 selected sites ranging in elevation from 488 feet (149) meters) to 8063 feet (2458 meters) above sea level. Over a three year duration, approximately 700,000 temperature readings were automatically recorded. It would be impossible to display each individual reading within this report. To suitably handle the large body of information, tables and figures of meaningful values have been assembled. Appendix C contains monthly temperature tables for various depths of surface, 3 inch (.0762 m), 9 inch (.2286 m), 15 inch (.3810 m), 24 inch (.6096 M) and 30 inch (.7620 m). Table 1C gives the average monthly temperature, Table 2C shows the average monthly high temperature and Table 3C is the average monthly low temperature. Since designers are often interested in extreme conditions, Table 8 shows the average monthly low temperature for January and Table 9 shows the average monthly high temperature for July by depth.

As can be seen, temperature is generally related to elevation. Those locations below 3500 feet (1067 m) are very warm in the summer. Asphalt at the surface of the pavement would experience temperatures above 140°F (60°C) on a regular basis during the summer. Above 3500 feet (1067 m), temperatures drop off considerably. For these higher elevations, freezing temperatures are common. Table 10 shows the average annual number of freeze thaw cycles per depth, and Table 11 gives the average total hours of freezing.

TABLE 8

JANUARY AVERAGE MONTHLY LOW TEMPERATURE, ^{o}F

FOR 1975, 1976, 1977, 1978

SITE	ELEV	AIR	SURFACE	3 INCH	9 INCH	15 INCH	24 INCH	30 INCH
24	488	37	46	48	52	59	58	60
6	720	38	48	50	53	57	57	61
1	994	36	47	49	51	56	56	58
16	1188	35	46	46	50	57	55	57
3	3209	28	41	42	45	55	52	53
4	4186	30	37	39	41	46	48	49
10	4897	19	27	27	43	52	41	47
7	5139	21	22	29	38	37	42	40
19	6184	15	20	27	34	39	40	39
5	6384	18	15	21	32	41	35	36
29	6496	17	26	26	31	36	36	34
14	6958	15	18	26	30	34	35	35
36	6958	15	21	29	34	39	39	34
33	8061	10	12	21	30	31	32	33

1 FOOT = .3048 METERS; $^{o}F = 32 + 1.8\ (^{o}C)$

TABLE 9

JULY AVERAGE MONTHLY HIGH TEMPERATURE, °F

FOR 1975, 1976, 1977, 1978

SITE	ELEV	AIR	SURFACE	3 INCH	9 INCH	15 INCH	24 INCH	30 INCH
24	488	109	168	144	139	114	101	101
6	730	109	167	145	141	115	107	101
1	994	107	146	128	124	111	106	101
16	1188	104	145	128	121	110	102	100
3	3209	100	139	127	120	109	100	100
4	4186	96	132	120	113	100	99	90
10	4897	94	120	112	101	95	93	83
7	5138	92	105	90	93	91	82	83
19	6184	92	103	96	88	86	83	80
5	6384	86	107	95	80	80	80	73
29	6496	84	99	90	85	77	74	71
14	6958	81	96	85	80	69	66	70
36	6958	81	92	81	79	72	68	66
33	8063	79	91	79	75	70	65	64

1 FOOT = .3048 METERS; °F = 32 + 1.8 (°C)

TABLE 10

AVERAGE ANNUAL NUMBER OF FREEZE THAW CYCLES: 1975, 1976, 1977, 1978

1 INCH = .0254 M ; 1 FOOT = .3048 M

SITE	ELEV	1/4"	3"	9"	15"	24"	30"
24	488'	2	0	0	0	0	0
6	730	2	0	0	0	0	0
1	994	2	0	0	0	0	0
16	1188	3	0	0	0	0	0
3	3209	30	15	4	1	0	0
4	4186	49	18	10	3	1	0
10	4897	78	70	37	8	6	0
7	5138	65	37	25	9	4	0
19	6184	39	24	12	11	5	0
5	6384	143	67	39	15	6	0
29	6496	56	46	32	21	10	0
14	6958	89	68	28	20	7	0
36	6958	121	91	24	8	6	0
33	8063	126	114	25	14	5	1

TABLE 11

AVERAGE ANNUAL TOTAL HOURS OF FREEZING OR BELOW FOR 1975, 1976, 1977, 1978

SITE	ELEV	1/4"	3"	9"	15"	24"	30"
24	488'	7	0	0	0	0	0
6	730	6	0	0	0	0	0
1	994	8	0	0	0	0	0
16	1188	10	0	0	0	0	0
3	3209	126	89	62	15	0	0
4	4186	310	189	126	32	10	0
10	4897	880	832	490	248	72	0
7	5138	652	380	330	211	61	0
19	6184	412	318	286	212	77	0
5	6384	2410	2147	1573	615	96	0
29	6496	980	692	396	315	81	0
14	6958	1160	715	468	416	91	0
36	6958	1914	1464	276	60	55	0
33	8063	2212	2020	1222	568	394	15

1 INCH = .0254 M, 1 FOOT = .3048 M

Considerable freezing can and does take place in Arizona. For elevation above 3500 feet (1067 m) and freezing index above 100, pavement distress associated with freezing and thawing should be anticipated and considered in the design process.

The above tables should serve as a good guide to existing pavement temperatures. Estimates of future temperatures can be drawn from these tables.

MOISTURE

Unlike temperature, which is reasonably predictable from year to year, moisture has always been thought of as very unpredictable. Two approaches to monitoring moisture are nuclear depth moisture and moisture cells. The Phase I report (5) describes these devices and their installation. It was intended that the nuclear depth moisture gauge would monitor changes in layers of soil at least 2 feet (.61M) in thickness, wheras the moisture cells or wafers would monitor discrete layers such as pavement, base course and top of subgrade.

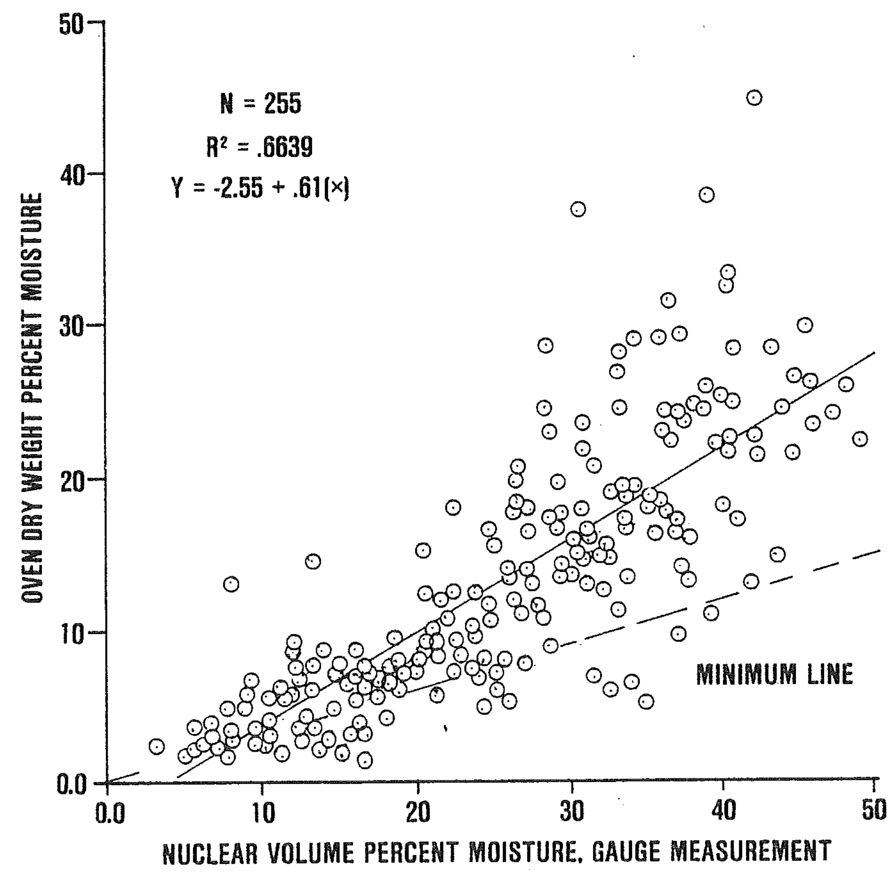
Appendix D, and Tables 4D, 5D, 6D and 7D give the weight percent moisture measured by both methods for four locations, which include the shoulder or median, distress lane, travel lane and passing lane. Readings at depths of 2 (.05M), 8 (.20M), 14 (.36M), 24 (.61M), 48 (.1.22M), 72 (1.83M), 96 (.2.44M) and 120 (3.05M) inches are shown. The 2, 8, 14 and some 24 inch values were determined from samples and readings of the Bouyoucous moisture meter. Some 24 inch readings, plus all 48, 72, 96 and 120 inch depths, were taken with a Troxler nuclear depth moisture gauge. To determine the weight percent moisture, it was necessary to relate meter reading to percent moisture from soil samples. The process of calibration was described in the first report (5). During the course of the project it became apparent that a correction in the calculated moisture derived from nuclear readings was necessary. Figure 21 is a plot of weight percent moisture versus the initial nuclear reading for all sites, derived from Table D-1, Appendix D. As this figure demonstrates, there is a relationship between the two values; however, the slope of the line is rather steep. If this line were used to derive in place weight percent moisture from nuclear readings, rather large values would be calculated. To avoid this, a conservative approach was taken by plotting the minimum line. This line represents a very conservative estimate of the expected change in moisture for change in nuclear readings. An initial formula for all nuclear depth readings was derived in the following fashion:

> Given travel lane aluminum tube installation, the 2 foot initial nuclear reading = 30.0 and the 2 foot oven dry moisture = 15.0% by weight.

The relationship would be:

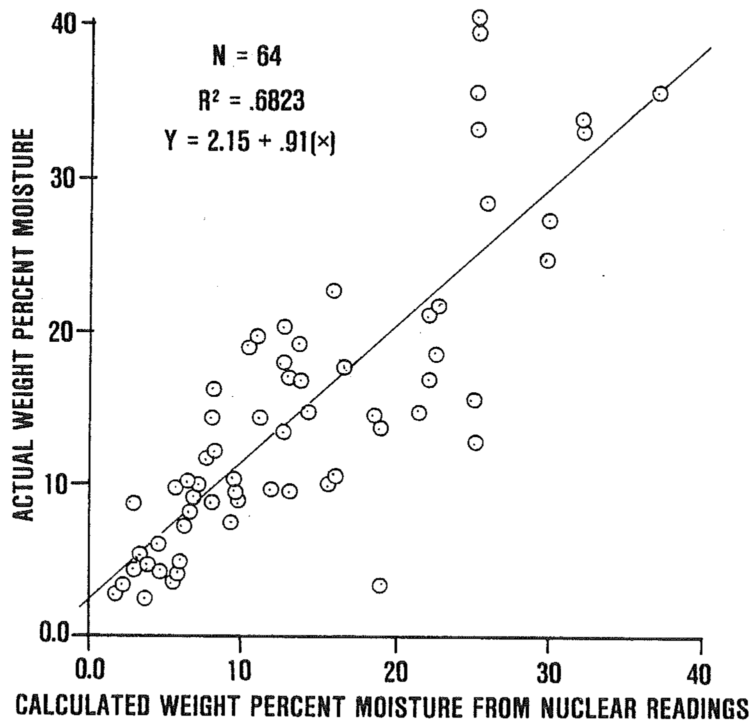
> % Oven Dry = A + B (Nuclear reading) moisture, where B = .3 = slope of the very conservation moisture line.

FIGURE 21



In this way, if a future reading of 30.0 were obtained with the nuclear device, the calculated percent moisutre would be 15.0%, just as it was initially. In addition, as nuclear readings changed, the rate of change of the weight percent moisture would be 3 percent by weight for each 10 percent by nuclear for all cases. In this way, all site and depth values could be unbiasedly compressed. To check the validity of this method, soil samples were taken at various times at the two and four foot depths and tested for percent moisture and plotted against the calculated values. Figure 22 was derived from this data, as shown on Table D-2.

FIGURE 22



This figure shows good correlation between the calculated weight percent moisture and the actual moisture. Considering the fact that samples were taken two to ten feet away from the aluminum tubes, this is extremely good agreement. The slope of line is very close to the line of equality. This approach of using a conservative approach to the slope of the moisture line seems to have worked even better than expected, since the correlation line does not appear to be unduly biased.

Given Tables 4D, 5D, 6D and 7D, it was possible to examine the moisture content of the embankment and subgrade layers. Table 12 shows the average weight percent moisture content for various depths.

TABLE 12

OVERALL GRAND AVERAGE OF PERCENT MOISTURE BY WEIGHT: ALL NUCLEAR SITES: ALL READINGS

	UNCOVERED SOIL NEXT TO HIGHWAY	DISTRESS LANE	TRAVEL LANE	PASSING LANE
2 Feet	9.9	13.8	12.4	11.4
4 Feet	11.1	16.1	16.5	14.8
6 Feet	12.4	15.0	17.1	15.7
8 Feet	11.2	14.5	17.4	13.2
10 Feet	15.4	16.9	15.3	15.1

As can be seen, the average moisture content under the highway is considerably greater than the normal soil moisture next to the highway. All nuclear sites were located on interstate highways with transverse slopes of .015 ft/ft or .020 ft/st and the two foot (.6m) moisture content decreases across the road (distress, travel and passing lane) as the elevation increases. Interestingly, three out of four of the highest moisture contents occurred in the travel lane at the four, six and eight foot (1.2, 1.8, 2.4 m) depths. The average moisture contents at various depths on Tables 4D, 5D, 6D and 7D are probably representative of an equilibrium moisture condition. If this is true, how much do they vary? Table 13 gives the average standard deviation of moisture content by depth and location. This value was derived by adding the variances and dividing by the number of cases to create an average variance, which became the standard deviation by taking the square root.

As expected, the uncovered soil experiences greater fluctuation in moisture than the covered locations under the highway.

TABLE 13

OVERALL AVERAGE STANDARD DEVIATION OF PERCENT MOISTURE BY WEIGHT; ALL NUCLEAR SITES, ALL READINGS

	UNCOVERED SOIL NEXT TO HIGHWAY	DISTRESS LANE	TRAVEL LANE	PASSING LANE
2 Feet	1.3	.9	.8	.8
4 Feet	1.0	.9	.8	.5
6 Feet	.8	.8	.8	.7
8 Feet	.8	.5	.8	.6
10 Feet	.6	.5	.7	.6

With the knowledge of an equilibrium moisture content expressed by the five-year average and the variability, two questions arise. Can the equilibrium moisture for the travel lane at various depths be predicted and can the seasonal moisture content above or below the equilibrium be estimated? The travel lane was selected to derive a prediction equation because it generally experiences the largest proportion of loads, most serious distress and greatest need for maintenance. In predicting the various layers moisture content, some information about the location and the materials properties will be needed. Historically, ADOT has kept design and construction files of what materials were used to build the highway. Generally, this information is expressed as the -200, PI, calculated R value or soil support value for most miles of highway within the ADOT system. In addition to this, the highway elevation (Figure 23), average annual rainfall (Figure 24), climatic zone (Figure 25) and freezing index (Figure 26) exist as possible additional variables. From the elevation, rainfall and climatic zone, a regional factor value representative of the effect of climate on

FIGURE 23

GENERALIZED RELIEF

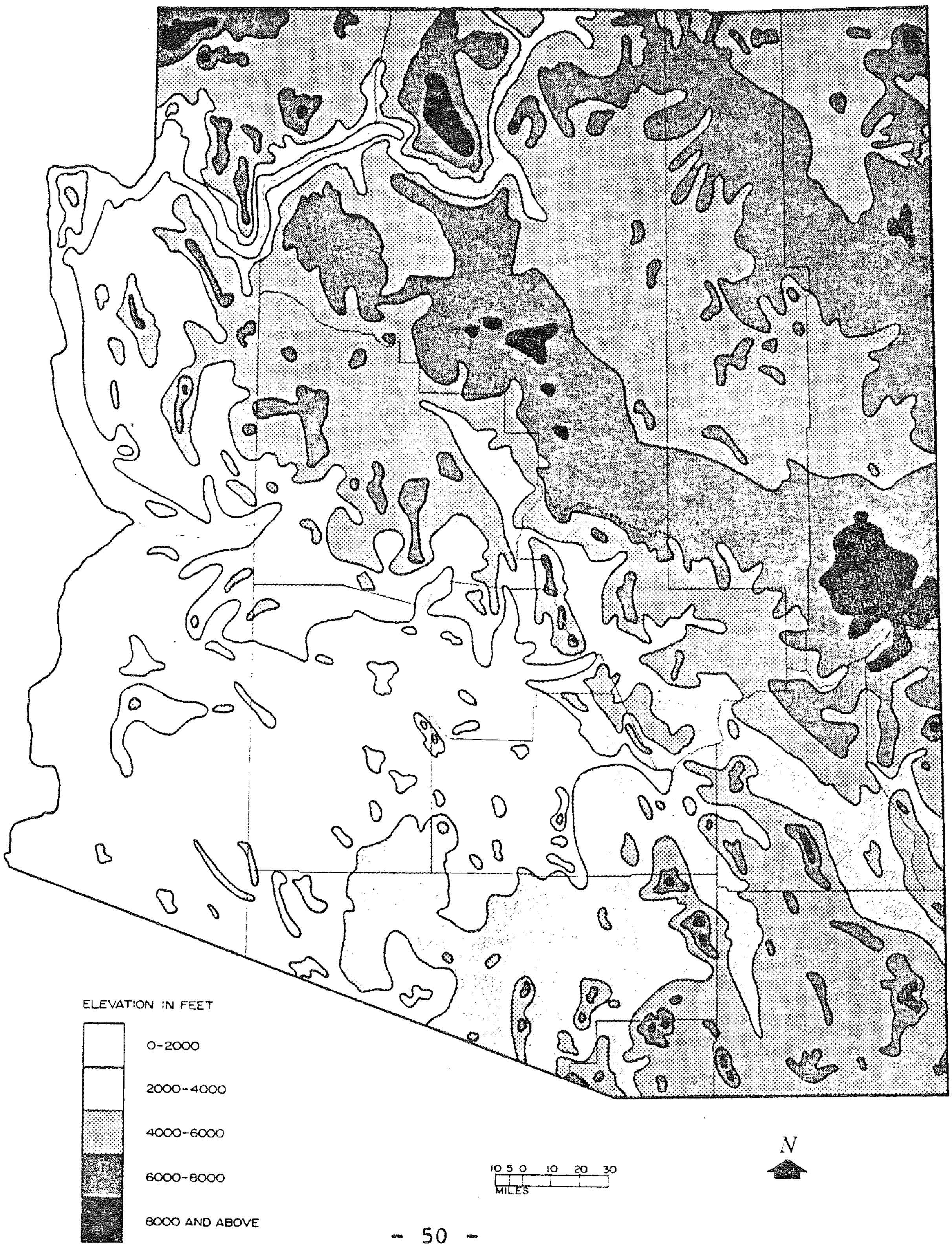
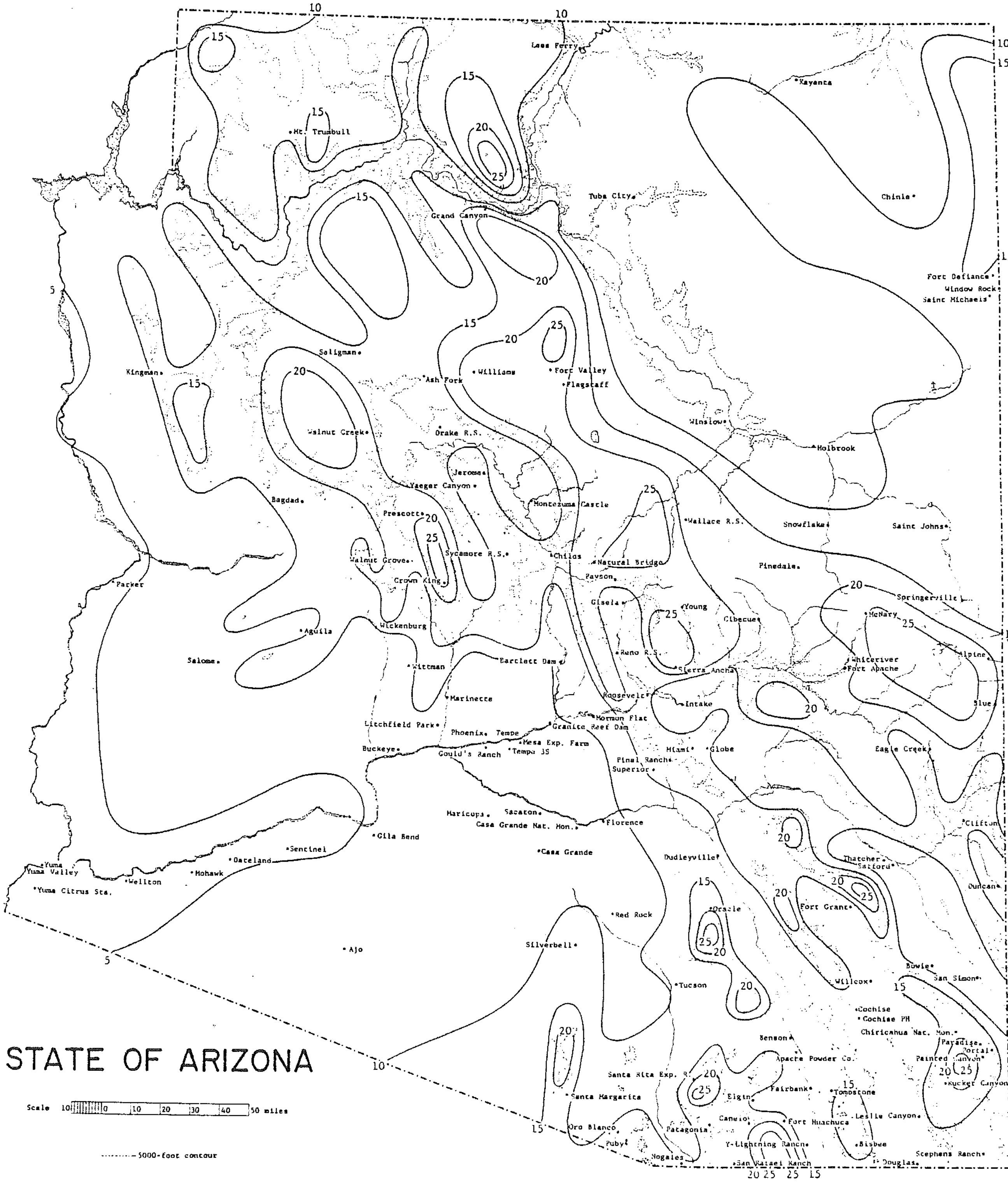
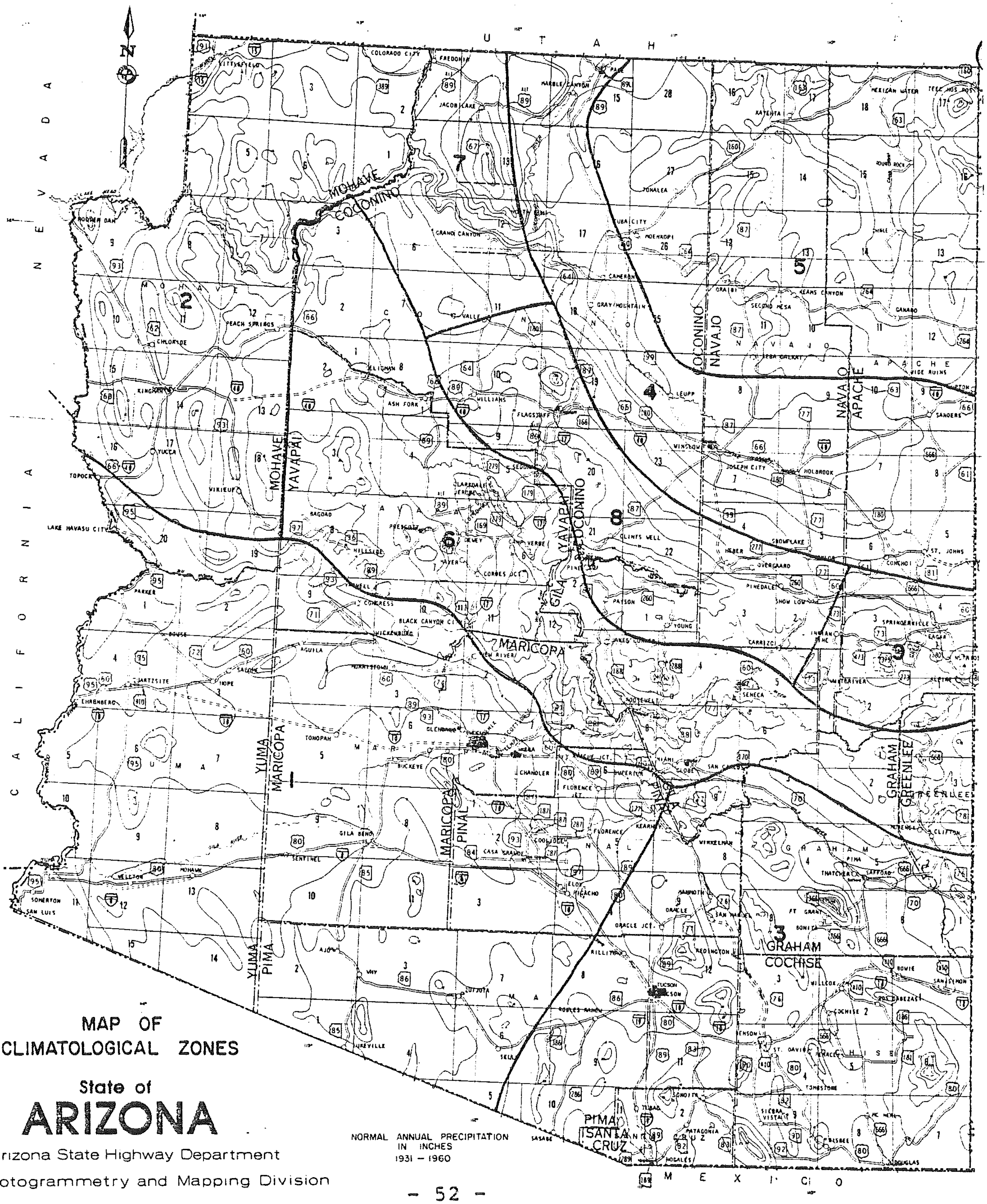


FIGURE 24



Average annual precipitation (in inches) in Arizona.

FIGURE 25



MAP OF CLIMATOLOGICAL ZONES

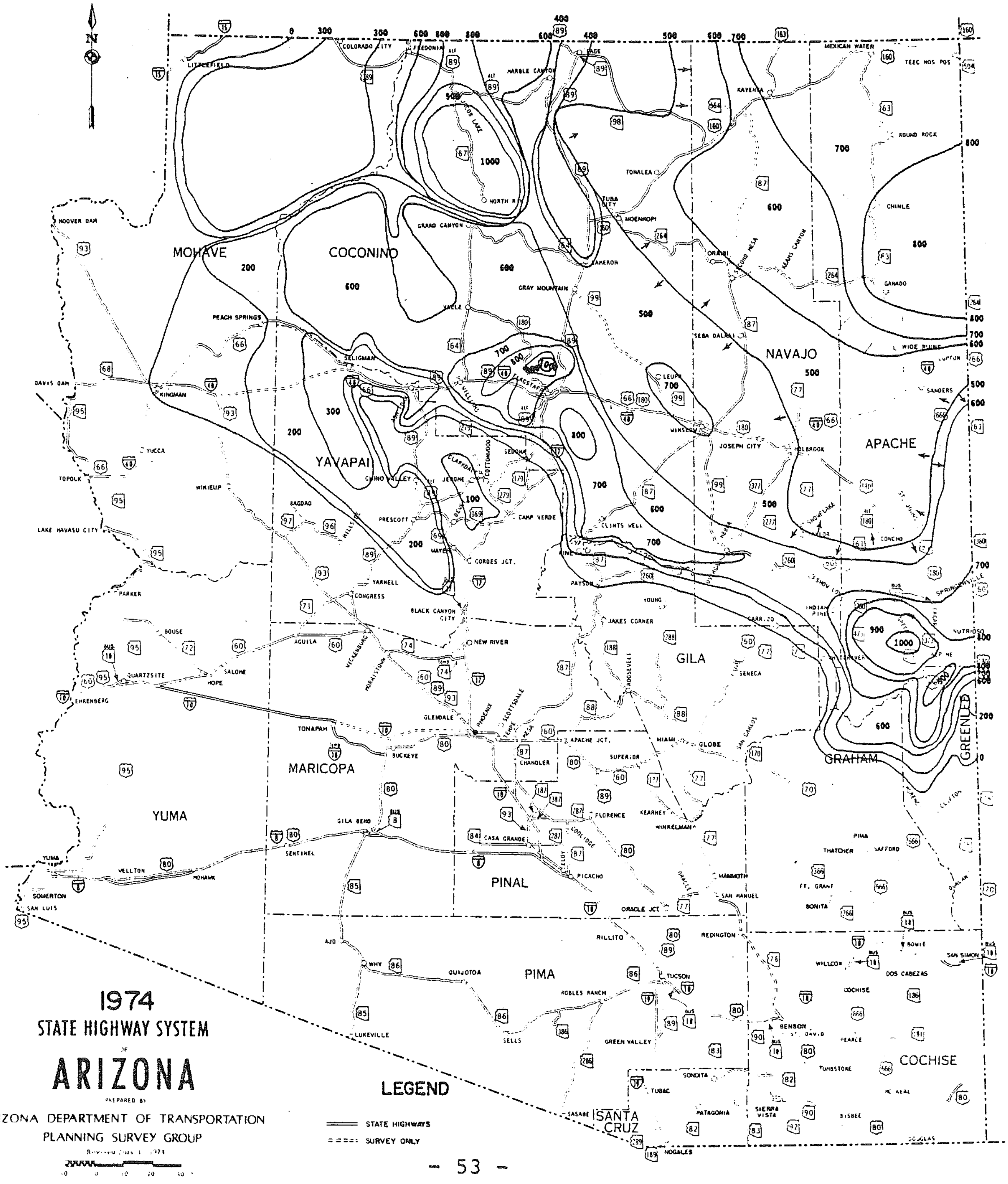
State of ARIZONA

Arizona State Highway Department

Photogrammetry and Mapping Division

FIGURE 26

FREEZING INDEX
MAP OF ARIZONA
BASE YEARS 1931-1970



highway performance is also calculated. Generally, the subgrade location will occur within the two-foot (.6m) to four-foot (1.2m) depth below the pavement surfacing. By using Table 6D for the two-foot (.6m) and four-foot (.12m) depths, it was possible to accumulate the equilibrium moisture for virtually all the subgrades as well as the various other factos, including tbe -200, PI, elevation, average annual rainfall, regional factor, soil support, and several other factors which would not normally be known, including T-99 proctor optimum moisture, liquid limit, plastic limit and sand equivalent. Table 14 gives the correlation between the quilibrium moisture and the above variables. Many of the variables represent material index properties that routinely would not be known. That is, T-99 proctor maximum density and optimum moisture would not normally be known for most soils in Arizona. The term regional factor divided by soil support was created since this value would be known for virtually all miles of highways in Arizona. Fortunately, this interaction value, which combines several factors, including rainfall, elevation, climate zone, PI, -200 and/or R value at 300 psi, gave the highest correlation to the long-term equilibrium moisture. Such a value can serve as an excellent predictor of subgrade soil moisture under Arizona highways. Thus, the equilibrium moisture content can be predicted using readily available file data.

TABLE 14

Y = Equilibrium Moisture = Dependent Variable

X = Independent Variable

X	FUNCTION	# OF OBSERVATIONS	R^2	A	B
Regional Factor/ Soil Support	Y=A+BX	31	.6471	6.83	14.40
T-99 Proctor Max. Density	Y=A+BX	26	.6434	52.97	-.35
T-99 Optimum Moisture	Y=A+BX	26	.6243	2.47	.71
PI	Y=A+BX	31	.5265	9.09	.35
Estimated % Moisture @ Const.	Y=A+BX	28	.5058	4.85	.89
R Value % Moisture @ 300 psi	Y=A+BX	26	.5044	4.35	.51
Sand Equivalent	Y=A+B/X	18	.5043	3.03	30.54
Soil Support	Y=A+BX	31	.4811	25.24	-2.05
Liquid Limit	Y=A+BX	25	.4545	4.59	.29
-2 Micron-% Clay	Y=A+BX	28	.4141	7.77	.44
-200	Y=A+BX	31	.4055	5.82	.19
Regional Factor	Y=A+BX	31	.2486	6.55	3.02
R Value @ 300 psi Average Annual Inches Rainfall	Y=A+BX	31	.2097	6.31	.55
Average Yearly Temperature	Y=A+BX	31	.1324	26.56	-.2333
Elevation	Y=A+BX	31	.1162	9.26	.0009
% Cracking	Y=A+BX	31	.0670	11.99	.0678

Using the regional factor, soil support ratio (RF/SS) additional layers wer examined to determine their relationship. Results of this work gave the following.

TABLE 15

Y = Equilibrium Moisture = Dependent Variable

X = Regional Factor/Soil Support

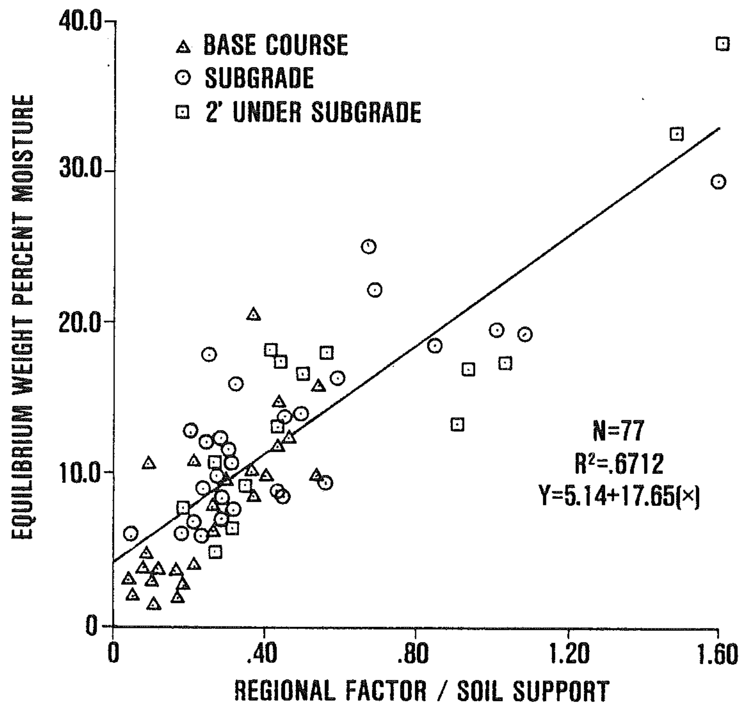
$Y = A+B(X)$

Y	N	R^2	A	B
Base Course Moisture	27	.5409	2.56	24.36
Subgrade moisture	31	.6471	6.83	14.40
Two Feet Under Subgrade	19	.6668	5.88	17.81
General Equation All Three Depths	77	.6712	5.14	17.65

Base course layers included aggregate base, select material, subgrade seal and cement-treated base. Their PI and -200 values were used to estimate the soil support value.

FIGURE 27

EQUILIBRIUM MOISTURE VS. RATIO OF REGIONAL FACTOR TO SOIL SUPPORT



As can be seen, the generalized equation can be used just as well for all soil and aggregate materials from the top of the base course to two feet below subgrade for the travel lane. In-place, long-term equilibrium moisture can be estimated or predicted from the ratio of regional factor to soil support.

To predict the moisture variability, a similar approach was taken. The same set of variables was examined and found to have extremely small correlation values; generally less than .03, or virturally random. The only exception to this was percent cracking, which gave the following for subgrade materials:

$$N = 29 \qquad R^2 = .2858$$

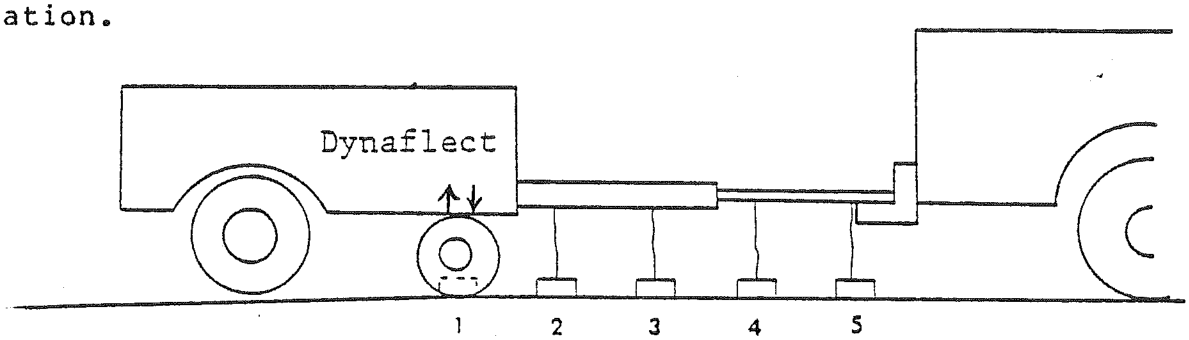
$$\text{Equilibrium Moisture Variance} = .83+.03 \left(\text{Average Percent Cracking}\right)$$

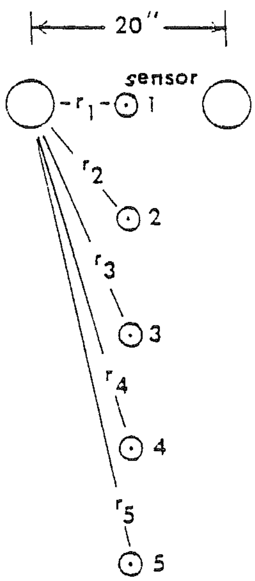
Considering the rather low correlation, it would be acceptable to use Table 13 as a reasonalbe prediction of moisture variability. For subgrade materials, moisture changes would be expected to fluctuate ± 2.5 percent away from the equilibrium value. For base courses, the variability would be slightly higher, at about ± 3.0 percent moisture.

To more fully understand the role that base and subgrade moisture plays in highway performance, detailed deflection studies have been performed at each site.

DEFLECTION

Deflection measurements were taken at each site at two to three month intervals. The location of these measurements are shown below in relation to the moisture and temperature measuring location.





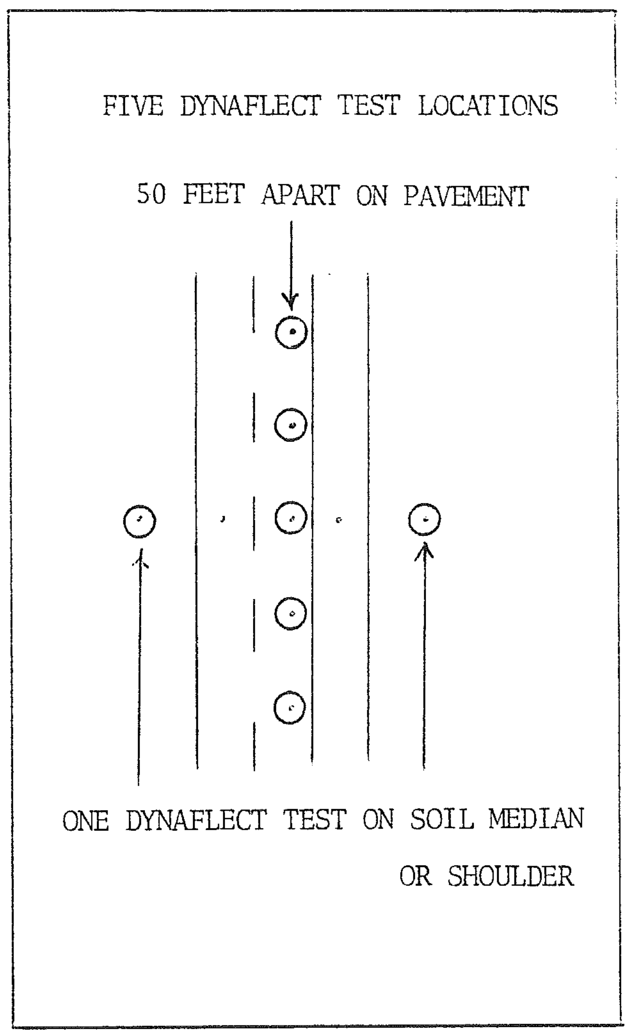
r_1 = 10.0"

r_2 = 15.6"

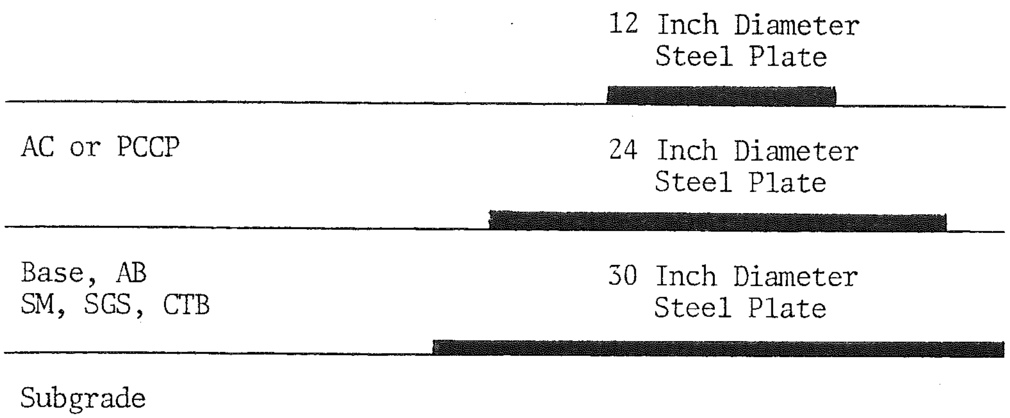
r_3 = 26.0"

r_4 = 37.4"

r_5 = 49.0"



To insure that the same location was tested each time, markers were painted on paved surfaces and stakes were placed on soil and triangulated to benchmarks. In 1975 and 1976, plate bearing tests were performed along with dynaflect tests at most sites. Plate bearing tests were performed as shown below.



To accomplish this testing, test pits were dug in the pavement. At the same time, in-place densities were taken using the volumeter. In addition, samples were taken for moisture content, grading, PI, sand equivalent, R value, proctor T-99 density and moisture, resistivity, soluble salts. Virtually all this test information is reflected in Appendix B.

DYNAFLECT DEFLECTION

Appendix E contains results of all dynaflect deflection testing on Tables 1E through 37E. Tables are in order of increasing site number; thus, Table 1E is for site number one. Table 10E is not shown since all deflections were taken at site 11, approximately one-half mile (805m) away. Temperatures for site 11 were recorded at site 10. For those sites where deflections were taken on both the travel lane and the adjacent median or shoulder, two tables are given. As an example, Table 21E shows deflections for the travel lane, where as Table 21E-M shows deflections for the adjacent median. Each table shows the site number, name, average number of readings take at each time and thickness of layers. In addition, the date tested, air temperature and surface temperature are shown. The pavement mid-depth temperature, as well as approximate depth, was determined by inspecting the large temperature history file and represents either the exact temperature for recording sites or an interpolated temperature for neighboring sites. Dynaflect deflections are shown in thousandths of an inch. That is a tabled value of 1.00 equals .001" (.0254mm) of deflection; likewise, .05 equals .00005" (.0013 mm). Deflection measurements were taken at the standard locations; however, the distances represented are the radial distance from the center of the load wheel to the center of the geophone. During 1975 and 1976, special tests were performed at most sites. This special test involved placing a geophone as close to the force wheel as possible, which equaled a 4" (.10m) radial distance. The dynaflect illustration graphically depicts the geophone configuration. The deflections shown represent the average of either four or five readings and are the true mechanical readings without correction factors of any kind. The 10" (.25 m) coefficient of variation values, shown as percentages, represent the 10" (.25 m) standard deviation divided by the average 10" (.25m) deflection and represent the degree of variability in the four or five readings. At the bottom of each table, the average, standard deviation and coefficient of variation are calculated for all measurements.

ANALYSIS OF DYNAFLECT DEFLECTIONS

Arizona has taken thousands of dynaflect deflection measurements as part of its Pavement Inventory process. Deflections are routinely corrected for temperature using the Asphalt Institute method. This method involves obtaining average air temperatures for five days previous to the day of test. This method has meant considerable additional work and delays in trying to obtain this information. To help reduce the work, data collected as part of this study were examined to see if just surface temperature could be used to predict the Asphalt Institute average temperature. As part of this study, the previous five-day average temperature values were obtained and the Asphalt Institute average temperature routinely calculated. Three separate correlations were performed which included:

1.	ADOT measured mid-depth pavement temperature (ADOT)	VS.	Measured surface temperature (ST)
2.	Asphalt Institute average pavement temperature (AI)	VS.	ADOT measured mid-depth pavement temperature (ADOT)
3.	Asphalt Institute average pavement temperature (AI)	VS.	Measured surface temperature (ST)

In all, 442 values were involved in each correlation; results of these correlations are shown below.

Equation Y = A+BX

	Y	X	# OF OBSERVATIONS	R^2	A	B
1.	ADOT	ST	442	.9727	.73	.94
2.	AI	ADOT	442	.9593	3.21	.97
3.	AI	ST	442	.9398	7.01	.88

As expected, the surface temperature is most closely related to the actual mid-depth temperature. Although surface temperature is not as closely related to the Asphalt Institute average pavement temperature, the correlation is very good and can be used to replace the Ashalt Institute procedure which is very time consuming.

In addition to correcting for temperature, Arizona has used the temperature correction chart presented in the Asphalt Institute Overlay Manual to correct or adjust the dynaflect deflection. The chart presently in use is called Figure III-4 Temperature Adjustment Factors for Benkelman Beam deflection. Since this chart was created from Benkelman Beam deflection at various temperatures, it is possible it may not be well suited to the Dynaflect. These two deflection devices are quite different in both the time of loading and magnitude of load as shown below.

	Live Load In Pounds	Time of Loading In Miles per Hour
Benkelman Beam	18,000	1-2
Dynaflect	1,000	55

Since the modulus of asphalt-bound layers and soil subgrades generally are related not only to temperature but also load size and/or time of loading, it is indeed possible that the temperature correction chart for the dynaflect deflection would be different from the Benkelman Beam. To test this hypothesis, actual dynaflect deflections were plotted versus temperature for all locations and the correlation was determined. Table 16 shows results of this work by increasing site number, grouped by asphalt-bound layers, concrete and soil. As can be seen, only three asphaltic concrete sites out of 29, or 10 percent, show a significant correlation to temperature. Concrete and soil locations showed no significant correlation to temperature as would be expected. It would appear that a temperature correction for dynaflect deflections is not necessary. Since an argument can be made for some temperature correction, a suggested relationship would be the following:

Adjustment Factor = 1.175 - .0025 (Mean Pavement Temperature)

NOTE: FACTOR EQUALS 1.00 AT 70°F.

This formula was derived by calculating the average slope for asphaltic concrete pavements on Table 16.

TABLE 16

DYNAFLECT DEFLECTION IN MILS OF AN INCH
VERSUS
ADOT PAVEMENT MID-DEPTH TEMPERATURE

Y = A+BX
Y = Dynaflect Deflection
X = ADOT Mid-Depth Temperature

Asphaltic Concrete

SITE #	N	R^2	A	B
1	11	.1617	.9	+.0059
2	8	.0789	1.0	+.0022
3	12	.1753	1.9	+.0091
4	7	.5711	1.0	+.0020
5	12	.0424	1.8	+.0043
6	14	.8106*	.1	+.0044
7	10	.0189	1.7	+.0054
8	14	.0599	2.2	-.0051
9	15	.0266	1.3	+.0022
11	14	.0990	1.8	+.0067
12	12	.7066*	.6	+.0068
13	12	.5871*	.3	+.0061
14	6	.1287	1.0	+.0018
15	15	.0281	1.2	-.0015
16	11	.0485	.9	-.0005
17	5	.7506	1.8	-.0091
18	5	.2542	1.3	-.0031
19	5	.4446	.9	+.0021
20	15	.0034	1.2	-.0009
21	15	.0955	1.3	-.0024
22	15	.2290	1.4	+.0039
23	15	.2290	1.4	+.0105
24	12	.0469	.8	-.0007
25	15	.0955	1.3	-.0024
26	15	.2379	.6	+.0058
27	16	.0001	1.3	-.0030
30	14	.1846	.3	+.0030
33	11	.2856	.6	+.0080
37	12	.2727	.2	+.0026

CONCRETE

SITE #	N	R^2	A	B
28	12	.1975	.3	+.0097
29	13	.3009	.9	-.0056
35	14	.4236	.1	+.0053
36	14	.026	.2	+.0019

Deflection on Top of Soil

SITE #	N	R^2	A	B
20	11	.0732	2.4	-.0086
21	10	.1791	2.0	-.0045
25	10	.2589	2.3	-.0093
31	13	.0031	1.7	+.0012
32	10	.2443	1.3	+.0092
34	12	.0010	.7	+.0005

*Significant Correlation at the .05 level.

During this project, several sites were overlayed, thus affording the opportunity to examine whether such overlays do indeed reduce the deflection. Oftentimes, it is suggested that deflections be taken just before and just after overlay. Table 17 gives results of this type of analysis, except that besides the before and after deflection, an average deflection before and after overlay

TABLE 17

BEFORE AND AFTER OVERLAY DEFLECTIONS

SITE #		OVERALY THICKNESS	10% DEFLECTION JUST BEFORE AND AFTER	N	AVERAGE DEFLECTION 10"	16"	26"	37"	49"
18	Before	---	.83	5	1.09	.89	.62	.45	.30
18	After	3.5"	.59	6	.73	.62	.49	.38	.29
17	Before	---	.86	5	1.27	.99	.70	.52	.36
17	After	3.0"	.80	6	.95	.81	.63	.48	.37
19	Before	---	1.07	5	1.06	.88	.63	.47	.34
19	After	2.5"	.64	6	.78	.67	.56	.43	.33
4	Before	---	1.19	7	1.12	.68	.38	.22	.15
4	After	2.0"	.74	6	.84	.62	.34	.22	.15
2	Before	---	1.58	8	1.21	.60	.23	.13	.09
2	After	1.8"	1.16	7	1.12	.68	.28	.14	.10
6	Before	---	.33	8	.44	.33	.22	.16	.11
6	After	.5"	.34	6	.42	.31	.20	.14	.10

was also computed. As can be seen, the deflection did go down after overlay. Correlation of overlay thickness to reduction in deflection and after overlay showed that the reduction factor derived from the average deflection before and after overlay were far superior to the point values just before and after overlay as shown below.

$$\text{\% Reduction in Deflection} = \frac{\text{Deflection Before - Deflection After Overlay}}{\text{Deflection Before}} \times 100$$

Y = A+BX   Y = % Reduction   X = Overlay Thickness In Inches

Assumed that for X = 0, Y = 0

	N	R^2	A	B
% Reduction From 10" Deflection Just Before and After Overlay	6	.3651	4.43	7.59
% Reduction From Average 10" Deflection Before and After Overlay	6	.8485*	- .44	9.33

Reviewing the average deflection data indicated that the neighboring geophones were related to each other. Deflection test results were grouped according to the surfacing of AC, soil and concrete. The 10 inch (.25m) geophone was correlated to the 16 inch (.41m) geophone, likewise the 16 inch (.41m) was correlated to the 26 inch (.66m) geophone and so on. Table 18 shows results of this correlation. These results strongly indicate that the shape of the deflection basin is a function of the type of structure, particularly the surface structure.

The first geophone or 10" (.25m) geophone would appear to be a primary importance to understanding the meaning of the dynaflect deflections. Examining the soil site deflection data indicated that the 10" (.25m) geophone was most closely correlated to the top two foot (.61m) weight percent moisture. The following relationship was found.

$$\text{10" DEFLECTION IN MILS OF AN INCH} = 1.1627 + .0361 * \left[\text{Weight \% Moisture}\right]$$

$$N = 6; \quad R^2 = .5693$$

Although the correlation is not significant the resultant equation represented a first approximation. Reviewing those existing AC sites it became evident that those sites #3, 5, 7, 8, 9, 23 experiencing 30 or more percent cracking had 10" (.25m) deflection at or above the predicted subgrade deflection. Thus these additional six sites with surfacing were included with the soil sites giving the relationship below.

$$\text{10" DEFLECTION IN MILES OF AN INCH} = 1.2323 + .0368 * \left[\text{WEIGHT \% MOISTURE}\right]$$

$$N = 12: \quad R^2 = .6020^*$$

The above relationship is significant at the .05 confidence level and is very close to the first equation, thus indicating that the second equation can be used as an estimate of soil or subgrade dynaflect 10" (.25m) deflection.

TABLE 18

CORRELATION BETWEEN NEIGHBORING DYNAFLECT GEOPHONES; AVERAGE DEFLECTION AT EACH SITE Y = A + BX

1 INCH = .0254 METERS

Y	X	N	R^2	A	B
ASPHALTIC CONCRETE SITES					
16"	10"	26	.8804**	.1580	.5244
26"	16"	26	.7313**	.0517	.5097
37"	26"	26	.8926**	-.0263	.7039
49"	37"	26	.9706**	-.0157	.7510
SOIL SITES					
16"	10"	6	.6163	-.1491	.6068
26"	16"	6	.8874*	-.1625	.7613
37"	26"	6	.9796**	-.0725	.8391
49"	37"	6	.9916**	-.0381	.8777
CONCRETE SITES					
16"	10"	4	.9998**	-.0136	.9458
26"	16"	4	.9969**	.0211	.8141
37"	26"	4	.9976**	-.0004	.8106
49"	37"	4	.9962**	.0054	.7709

After evaluating the deflection on soil or soil like structures the AC sites were examined. Attempts were made to correlate the 10 inch (.25) dynaflect deflection to many variables including equilibrium weight percent moisture, regional factor divided by soil support, inches of AC pavement, inches of base, percent cracking and total thickness of AC and base. The 10" (.25m) deflection appeared to be most closely related to the thickness of AC and the percent cracking. Using these two variables together created the highest correlation giving the following relationship.

$$\text{10" DEFLECTION IN MILS OF} = 1.1954 + .6164 * \text{LOG}\left[\frac{\text{\% CRACKING} + 1}{\text{INCHES OF AC PAVEMENT}}\right] \qquad N = 26; \quad R^2 = .6630^{**}$$

This correlation is significant at the .01 confidence level. The equation form indicates that as the percent cracking of a given thickness of pavement increases, the deflection also increases. This increase continues until the subgrade deflection is reached at which time the deflection remains relatively constant. The above relationships indicate that the 10 inch (.25m) dynaflect deflection is related to the structure, subgrade condition, pavement thickness and percent cracking. Many correlations using the base course thickness were tried, however, the base course did not appear to improve the correlation. This would indicate that the dynaflect is somewhat insensitive to the reduction in deflection caused by the base course. Another possiblility is that the reduction in deflection due to the base course is so small in comparison to the subgrade and pavement contribution that the dynfalect is incapable of detecting it. The role of the base course on deflection will be explored in the plate bearing analysis.

The development of the soil subgrade and AC pavement deflection equations makes it possible to observe the potential reduction in subgrade deflection due to the slab effect of the AC surfacing. By calculating the subgrade deflection from each AC sites equilibrium weight percent moisture and the surface deflection on top of the uncracked AC for each site, it was possible to calculate the percent reduction in subgrade deflection and relate it to the thickness of AC. The following relationship was found.

$$\text{PERCENT REDUCTION IN SUBGRADE} = 30.0951 + 3.8986 * \left[\text{INCHES OF AC SURFACING WHERE AC} \quad 2.5"\right] \qquad N = 26 \quad R^2 = .5877^{**}$$

Thus as the uncracked AC thickness increases the subgrade deflection would continue to decrease. Extrapolation above or below the limits of AC thickness reported here would be dangerous since it appears only reasonable to believe that an AC thickness decreases the surfacing effect in reduction would tend to go to zero. Likewise as the AC thickness increases the author would expect to see the percent reduction tend to flatten out.

PLATE BEARING ANALYSIS

Plate bearing tests were conducted in December, 1975 and May to November, 1796. The December, 1975 tests were performed by using a very large (60,000 pound, 267 kn) load frame mounted on an oversize mobil trailer. This work was primarily done to determine the suitability of the equipment to perform tests on the highway. Historically, it has been used to test bridge foundations. After two weeks of testing it became evident that such a large piece of equipment would be too cumbersome to use in a highway testing application. With this in mind, separate plate testing equipment was purchased and modified to perform tests in a pit. Modification included welding three large nuts to the 24 inch (.61m) and 30 inch (.76m) plates. Threaded rods with flat plate washers were assembled in such a way that they could be threaded into the large size plates. In this way it was possible to place the plates into the pits and still be able to read the deflection dials at surface level. A special steel outrigger was attached to the rear of a standard size dump truck. The dump truck was filled with cold patching material, which was used to refill the pit.

The testing operation involved the following steps:

1. Close off the travel lane.
2. Select 4 foot (1.22m) by 4 foot (1.22m) test pit site.
3. Perform dynaflect tests at center of the pit site.
4. Read moisture and/or temperature gauges.
5. Perform 12 inch (.30m) plate bearing test on the surface of the highway.
6. Jackhammer out the surfacing.
7. Perform 24 inch (.61m) plate bearing test on top of the base course.
8. Perform an in place volumeter density test and take samples for moisture content.
9. Excavate base and remove samples for laboratory tests.
10. Continue excavation to subgrade level and repeat operation, except subgrade tested with a 30 inch (.76m) plate.
11. Refill the hole with remaining subgrade, base and surfacing materials. Use cold patch to finish top two to four inches (.05 to.10m).

For purposes of safety it was mandatory that the hole be refilled by the end of the work day.

Results of the December 1975 testing are shown in Appendix F, on tables 6F-1 to 34F-1. The table numbers coincide with the site numbers. The 1976 test results are also shown in Appendix F., Tables 2F-2 to 37F-2. Each table gives the site number, name, layers and thickness, date of test, surface temperature. Deflections at each load are shown as well as the rebound deflection. For this case rebound deflection refers to the dial reading after the live load was completely removed. The R2 value is the correlation between the deflection and the live load psi value for a simple linear equation of Y=A + BX. B refers to the slope of the line in terms of psi divided by inches of deflection. For purposes of examining the deflection it was assumed that the best fit line passed through the origin and had a slope of B. Besides the plate bearing results, the dynaflect deflection at the center of the pit is also shown.

Initially, plate bearing deflections were examined in a manner similar to the dynaflect analysis. Those sites where soil or subgrade material were tested with a 30 inch (.76m) plate were correlated to other variables such as moisture, dry density, etc. To do this the 10 psi (69 k Pa) deflection was calculated by dividing the slope B into 10 psi (69 k Pa). Attempts were made to correlate these values to several variables. As in the case of the dynaflect the plate bearing deflection correlated better with weight percent moisture at the time of test. The relationship is the following:

SOIL OR SUBGRADE
30" PLATE BEARING = .0263 + .0023* [WEIGHT PERCENT MOISTURE]
DEFLECTION AT
10 psi N = 34 R^2 = .3943*

Since it was not possible to perform dynaflect tests on top of the subgrade, the previously determined relationship between subgrade weight percent moisture and dynaflect deflection was used to estimate the 10 inch (.25m) dynaflect deflection and correlate it to the 30 inch (.76m) plate bearing deflection at 10 psi (69 k Pa). The relationship is the following:

SOIL OR SUBGRADE
DEFLECTION OF 30" PLATE = .0318 + .0537* [CALCULATED + ACTUAL DYNAFLECT 10" DEFLECTION AT EQUIVALENT MOISTURE]
BEARING DEFLECTION AT
10 psi N = 33 R^2 = .3750*

To obtain this value both the calculated dynaflect deflection and tested values were used. For those sites where there was a very large difference (greater than 15 percent), between the average moisture and the moisture at time of test, these three tests were removed from the correlation. The reason for the removal stemmed from the uncertainty about whether the same exact site was tested on the soil by both the plate bearing and dynaflect.

Both the plate bearing and dynaflect deflections were related to the subgrade moisture content and equations were developed for both tests. Correlating these two relationships gave the following:

$$\text{SOIL OR SUBGRADE DEFLECTION OF 30'' PLATE BEARING DEFLECTION AT 10 psi} = -.0502 + .0622*\left[\text{DYNAFLECT 10'' DEFLECTION ON SUBGRADE}\right]$$

This equation is very similar to the one found in the previous correlation using actual data.

Besides the subgrade deflection, AC surfacing deflection was also examined. The 12 inch (.30m) plate bearing deflection at 80 psi (552 kPa) was correlated to the 10" dynaflect deflection on top of the AC. The relationship below was found.

$$\text{12'' PLATE BEARING DEFLECTION ON TOP OF AC AT 80 psi} = .0107 + .0188*\left[\text{10'' DYNAFLECT DEFLECTION ON TOP OF AC IN MILS OF AN INCH}\right]$$

$N = 34$ $R^2 = .5793^{**}$

This relationship would indicate that both the dynaflect and plate bearing tests are measuring the same degree of support capability on top of the AC surface. Reviewing the plate bearing data, the magnitude of the 12 inch (.30m) surface deflection appeared to be related better to the percent cracking, inches of AC ratio than to other comparible variables. The relationship, as shown below, was not as strong as the dynaflect correlation, nor as significant.

$$\text{12'' PLATE BEARING DEFLECTION ON TOP OF AC AT 80 psi} = .0312 + .0099*\left[\frac{\text{\% CRACKING + 1}}{\text{INCHES OF AC}}\right]$$

$N = 32$ $R^2 = .3448$

The plate bearing evidently is not as sensitive to surfacing effects or bound layer effects as the dynaflect. Indeed, the purpose of performing the plate bearing test was to sort out layer effects on deflection.

Besides the above dynaflect tests it would be important to examine how much each layer contributed to reducing the plate bearing subgrade deflection. Since different size plates were used to test each layer it was necessary to convert a 30 inch (.76m) plate to a 24 inch (.61m) and 12 inch (.30m) plate deflection. To do this the 1975 plate deflection using different size plates was used to determine the effect of plate size. According to Yoder (10) effect of plate size is related to the unit load on a plate for a constant amount of deflection and the perimeter over area ratio (P/A) by the following formula.

$$\text{UNIT LOAD ON A PLATE AT CONSTANT DEFLECTION} = n + m*\left[\frac{\text{Perimeter of plate}}{\text{Area of plate}}\right]$$

Using ths formula approach it was possible to determine the unit load at the .050 inch (.0013) deflection for each of the three plate sizes shown on tables 6F-1 to 37F-1 and solve for n and m. Solutions for each site are different, however, the average n and m values were the following:

$n = -50 \qquad m = 673$

Since the P/A ratio is a constant for each plate, the following values would be obtained for a constant deflection of .050 inches (.0013m) and the corresponding unit load would be as follows:

Plate Diameter	Unit Load	B or Slope of Line; Unit Load / .050"	Factor
12"	174	3480	2.81
18"	100	2000	2.50
24"	62	1240	1.55
30"	40	800	1.00

The table above shows that as the plate diameter increases in size, the unit load necessary to obtain the same deflection decreases. Likewise, the slope of the unit load/deflection line, previously called B, decreases. Using these calculated values it was possible to create a set of factors such that given the slope of the 30 inch (.76) plate it would be possible to estimate the equivalent slope on the same material if a different (smaller) size plate were employed. With this knowledge it was possible to estimate the reduction in plate bearing deflection that can be attributed to those layers above the subgrade. Table 19 shows these reductions for each site. Layers are ordered from the top layer just below the plate to the bottom layer just above subgrade or base. As can be seen, most base and surfacing layers reduced the subgrade deflection. Evidently for sites 24, 25 and 37 the base material was no better able to reduce deflection than the subgrade. Thus, the base was equal in worth to the subgrade. All three sites are located in the desert region and the supporting subgrades are of good quality. Indeed, site 24 has the highest slope B value of 510. Likewise, some surfacings have a negative effect on reducing deflection. For sites 14, 17 and 20 the surfacing layers above the base did not reduce the subgrade deflection more than the base. Both site 17 and 20 have CTB base layers which by themselves reduced the deflection substantially. Site 14 has considerable cracking of the surface and a very thick section of base material on a rather low deflection subgrade. With this screening in mind an attempt was made to determine how much each layer contributed to reducing the subgrade deflection. No reliable correlations could be determined so the following table of ranges of reduction was developed.

Layers	Range of Thickness	Range of Reduction in subgrade deflection
AB, SM, SGS	7" - 31"	19 - 71
CTB, SM, SGS	10" - 27"	13 - 87
AC, AB, CTB, SM	16.3"- 33.8"	35 - 83
AC, AB, SM, SGS	11.9"- 33.3"	59 - 92
PccP, CTB, SM	18.0"- 20.0"	93 - 99

TABLE 19

Reduction Subgrade Deflection due to the base course and surfacing as determined by plate bearing test.

Site	Thickness and type of base	% Reduction due to base	Thickness and type of surfacing	% Reduction due to base & Surfacing
2	3" AB, 9" SM	54	7.1"AC	92
3	3" AB, 6" SGS	50	2.9"AC	72
4	3" AB, 12" SM	56	8.5"AC	86
5	4" AB, 15.5" SM	39	4.9"AC	81
6	4" AB, 4" SM	68	7.6"AC	86
7	4" AB, 11" SM	66	6.3"AC	79
8	3" AB, 9" SM	44	8.6"AC	64
9	4" AB, 9" SM	25	3.0"AC	61
11	15" SM	47	9.1"AC	83
12	6" CTB, 4" SM	65	6.8"AC	83
14	6" AB, 10" SM, 12" SGS	38	5.3"AC	36
15	3" AB, 15" SM, 6" SGS	46	8.1"AC	80
17	6" CTB, 6" SM	83	7.3"AC	35
19	6" CTB, 21" SM	58	6.8"AC	84
20	6" CTB, 5" SM	87	3.3"AC, 4" AB	82
21	4" AB, 22" SM	58	3.5"AC	87
22	4" AB, 24" SM	40	4.0"AC	88
23	4" AB, 9" SM, 6" SGS	49	2.0"AC	85
24	4" AB, 9" SM	-6	4.0"AC	63
25	4" AB, 15" SM	-72	4.0"AC	59
26	2" AB, 17" SM, 6" SGS	70	8.0"AC	88
27	4" AB, 18" SM	58	6.0"AC	88
28	6" CTB, 6" SGS	13	8.0" PccP	96
29	6" CTB, 5" SGS	34	8.0"PccP	93
30	4" AB, 21" SM, 6" SGS	71	10.5" AC	90
33	7" SM	19	6.8" AC	74
35	6" CTB, 6"SGS	76	8.0" PccP	99
37	5" SM	-4	13.0" AC	71

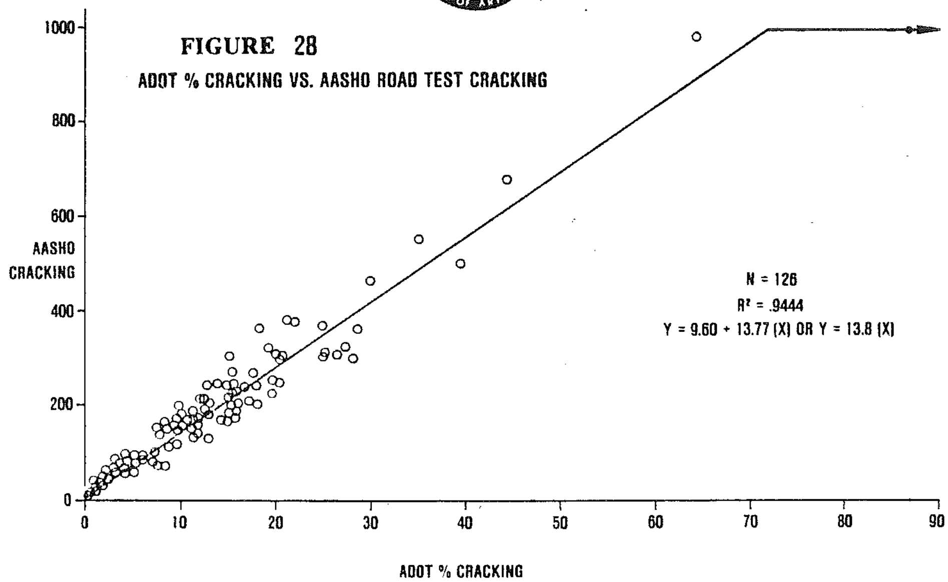
This table shows that substantial reduction in subgrade deflection can be atributed to the base course according to the plate bearing test. It should be recalled that the dynaflect shows little reduction in subgrade deflection due to the base course. This is probably an outgrowth of the mode of testing. In the plate bearing test, greater and greater static loads are applied and the deflection measured. During this process the substantial frictional forces present in the unbound base are mobilized thus giving the appearance of strength. Most of this strength or stiffness is a direct result of confinement and friction. During the dynaflect test, a steady oscillating load, smaller than the plate bearing is applied. This load is probably too small and too transient to mobilize very much of the internal frictional resistance present in the unbound base course. As such, very little reduction in subgrade deflection is attributed to the base course when the dynaflect is used.

The table would also indicate that concrete and CTB structures are capable of achieving more reduction in subgrade deflection than other structures. Interestingly the placing of AC on top of CTB can actually appear as detrimental since the reduction in subgrade deflection is reduced. If this is true it would strongly indicate that the final surfacing in such a system should be as thin as possible, since it is not adding to the support capability already achieved.

In the dynaflect testing the ratio of percent cracking to inches of AC appeared to be strongly related to the magnitude of the deflection. For plate bearing tests this relationship was not found to significantly correlate. This is further evidence of the mobilization of frictional resistance in the plate bearing test and lack of it in the dynaflect test. Since the dynaflect loading is applied to a very small area it is dependent upon the surfaces ability to distribute the stress. As the surface cracks up it begins to look more and more like the unbound base, thus more of the deflection comes from the subgrade. In the plate bearing test, as the amount of cracking is reached the surface begins to look like the base, however, the plate bearing test can mobilize enough frictional resistance even in unbound materials to indicate a reduced deflection. To understand more fully the meaning of the above, performance measurements will be examined.

PERFORMANCE

During the course of this study surface distress data on each site was collected. These measurements included the percent cracking, roughness and rut depth. Percent cracking was determined by estimating the amount of cracking by comparing visual observation to a set of standard photos. This method has been reported in several references (6) (6) (8) and the data is displayed in Table 1G. Roughness was measured using a Mays Ride Meter and is reported in inches of roughness per mile on Table 2G. Rut depth was measured using a four foot straight edge and is reported in Table 3G. From these three measurements it was possible to calculate the present serviceability index (PSI) for each site. To accomplish this the Mays Ride Meter data was



related to the slope variance by taking the Arizona ride index (Figure 16)and setting it equal to PSI. Other terms in the PSI equation were set to zero thus slope variance could be estimated for Arizona's roughness data. In report (8) a method was developed to relate AASHTO road test cracking to Arizona's percent cracking. Figure 28 shows results of this work and gives a relationship in which percent cracking multiplied by 13.8 equals AASHTO lineal feet plus class 2 and 3 area of cracking in 1000 square feet (92.9m2) of pavement. To do this 26 photos were examined and both the AASHTO cracking and percent cracking were determined for each photo. Using the AASHTO slope variance and cracking relationships it was possible to calculate the PSI. Table 4G shows the calculated PSI of each site. Generally, performance is considered the rate of change of surface distress as a function of traffic loading. Table 5G gives the relationship between PSI, cracking, roughness, rut depth and traffic in terms of cumulative 18 kip (80kn)loads. The values shown represent the slope of the distress traffic correlation.

The larger the number (positively or negatively) the faster the rate of change and the quicker an undesirable level of distress will be reached. Besides site number there is a years of service field which indicats the particular structure under study. Those sites built 30 or 40 years ago represent rather complex structures and only one period of service was selected. Generally seal coats and ACFC's were not considered to have much influence on performance. Some sites due to their complex structure, history or lack of change in a particular distress measurement could not be given a performance slope value. The slopes on Table 5G do not by themselves truly represent performance. Rather the number of years to a particular level of distress is the best measure of performance since this represents the target the designer and builder were using to create the particular structure. Table 6G gives the number of years to various levels of distress. The levels selected were:

Percent cracking	= 20 percent
Roughness	= 256 inches/mile
Rut Depth	= .50 inch
PSI	= 2.5

The years shown in parenthesis are the extrapolated number of years to a given distress condition, however, those very large values have been reduced to more realistic values. All extrapolations of more than 40 years (approximate length of time under study) were reduced to 40 years. Reduced values were used in all future calculations. The average years to the selected levels of distress are:

20 percent cracking	20 years
256 roughness	25 "
.5" rut depth	27 "
2.5 PSI	19 "

Those highways built since 1962 used the AASHTO interim guidelines (1) and were built to last approximately 20 years before a PSI of 2.5 would be reached. Sites number 19 through 22, 24 through 30, 33 and 35 through 37 were designed and constructed by the AASHTO interim guidelines (1) to last 20 years. The table below gives a score of how closely these projects will come to the 20 year target.

PROJECTS DESIGNED BY AASHTO DESIGN GUIDELINES

	DESIGN + CONSTRUCTION PERFORMANCE TARGET IN YEARS	NUMBER OF PROJECTS THAT REACHED 2.5 PSI WITHIN TARGET	LESS THAN 20 YEARS	MORE THAN 20 YEARS
	20 ± 1	1	1	
	20 ± 2	3	2	1
	20 ± 3	5	4	
	20 ± 4	6	5	
	20 ± 5	6	5	
	20 ± 6	7	6	
	20 ± 7	8	7	
	20 ± 8	9	8	
	20 ± 9	10	9	
	20 ± 10	11	10	
TOTAL	0 to 110	15	12	3

As can be seen, approximately 50 percent of the projects will fall between 13 and 22 years, 75 percent will fall between 10 and 22 years and all projects will last somewhere between 9 and 40 years.

As can be seen, approximately 50 percent of the projects will fall between 13 and 22 years, 75 percent will fall between 10 and 22 years and all projects will last somewhere between 9 and 40 years.

This analysis assumed that years of performance less than 20 was acceptable, however, another arguement would be that those highways designed by AASHTO should last 20 or more years. If this approach were taken, only three projects out of 15 or 20 percent would last beyond 20 years. What about those projects designed and built before AASHTO? How would their performance compare to those built after AASHTO?

PROJECTS DESIGNED AND BUILT BEFORE AASHTO

DESIGN & CONSTRUCTION PERFORMANCE TARGET IN YEARS	NUMBER OF PROJECTS THAT REACHED 2.5 PSI WITHIN TARGET	LESS THAN 20 YEARS	MORE THAN 20 YEARS
20 ± 1	1		1
20 ± 2	3	2	
20 ± 3			
20 ± 4			
20 ± 5			
20 ± 6	4	3	
20 ± 7	7	6	
20 ± 8	8	7	
20 ± 9			
20 ± 10	10	8	1
TOTAL 12 to 174	14	8	6

Sites 1 through 5, 7, 9 and 12 through 18 were used to create the above table. Interestingly, 50% of the projects fall between 13 and 21 years which is very close to the AASHTO design and 75 percent fell between 10 and 21 years again very close to the AASHTO performance. Those projects lasting more than 20 years represented 43 percent of the total or about double that obtained using AASHTO. From just this cursory analysis, it would appear that pre and post AASHTO usage has had little impact on performance. This is not to say AASHTO is bad, indeed such performance figures presented here might represent the best that is possible under any system. Since the AASHTO method is dependent upon traffic loading, is there any relationship between years of performance and level of loading? In this project four levels of 18 kip (80kn) loading occurred as shown on Table 20. The average number of years for each form of distress is shown in the table below for the four levels of 18 kip (80kn) loading.

TABLE 20

1978 18 kip LOADING	AVERAGE NUMBER OF YEARS OF PERFORMANCE TO LEVEL OF DISTRESS # OF SITES	% CRACKING	ROUGHNESS	RUT DEPTH	PSI
100,000	3	24	33	33	31
100-200,000	9	30	28	24	22
200-300,000	13	20	21	31	17
300,000+	4	12	26	29	18

Sites number 6, 8, 10, 11, 23, 31, 32 and 34 were not considered since they represent overlays built since 1963, stage construction or grade and drain projects. These same sites were not considered in the previous analysis. This very rough analysis would indicate that as traffic goes up the year to 20 percent cracking, 256 inches/mile roughness, .5 inch rut depth and 2.5 PSI go down.

Besides traffic it is possible that some systematic change in performance has taken place with time. To investigate this possibility the year that a site was constructed was examined in relation to its performance. Sites were grouped into several categories as shown below.

YEAR BUILT	AVERAGE NUMBER OF YEARS OF PERFORMANCE TO LEVEL OF DISTRESS # OF SITES	% CRACKING	ROUGHNESS	RUT DEPTH	PSI
1940-1957	4	12	33	35	28
1958-1962	7	20	23	37	19
1963-1968	12	23	27	26	19
1969+	6	40*	22	14	17

* ONLY ONE SITE

The above numbers are consistent with material property trends examined early in the report. Surfacing thickness has increased with time and in addition the voids filled with asphalt have increased with time (Table 4). The net result of this would be to increase the cracking performance life and decrease the rut depth performance life. For average PSI and roughness the average time to distress is becoming shorter.

Time trends are indicative of systematic changes outside the influence of the design equations. Such actions as use of drum dryer plants, reduction in hot plant temperature, change in the asphalt specifications, concrete highways and testing may also be contributing to the observed time trends.

Besides traffic and time, location of the site in terms of region, soil support and subgrade moisture might also be of importance. The table below shows the average effect of these three factors on performance.

AVERAGE NUMBER OF YEARS OF PERFORMANCE TO UNACCEPTABLE LEVEL OF DISTRESS						
REGIONAL FACTOR		# OF SITES	% CRACKING	ROUGHNESS	RUT DEPTH	PSI
0 - 1.7	Desert	10	23	29	27	19
1.8 - 2.7	Transition	12	20	29	32	28
2.8+	Mountains	6	24	17	23	13

AVERAGE NUMBER OF YEARS OF PERFORMANCE TO UNACCEPTABLE LEVEL OF DISTRESS					
SOIL SUPPORT	# OF SITES	% CRACKING	ROUGHNESS	RUT DEPTH	PSI
0 - 3.3	3	24	24	30	19
3.4 - 6.6	14	22	26	27	19
6.7 - 10.0	11	20	26	31	22

AVERAGE NUMBER OF YEARS OF PERFORMANCE TO UNACCEPTABLE LEVEL OF DISTRESS					
SUBGRADE-MOISTURE	# OF SITES	% CRACKING	ROUGHNESS	RUT DEPTH	PSI
0 - 10.0	11	25	31	27	24
10.0 - 18.0	10	19	22	29	17
18.1 +	6	20	25	31	20

Regional factor, soil support and equilibrium moisture are all very interrelated as shown in this report. Separating them out individually does not indicate any special trends, which reinforces their interrelationship. Evidently time has had the greatest systematic influence on performance. Traffic seems to be next in influence. Subgrade moisture and soil support are also important. Subgrade moisture above 10.0 percent generally reduces the percent cracking, roughness and PSI life.

This review of performance was not meant to develop a new method of design or construction but rather to demonstrate to the reader what kind of performance really occurs. Some of the relative relationships observed are examples of the complexity of relating performance to any variable or group of variables. Undoubtedly, the design and construction of highways has been an evolutionary process, with a mixture of engineering, economics and marketing. Historically, engineers have found solace in the fact that problem highways can always be overlayed thus solving the problem. In reality, highway problems can, and often are, rooted in the subgrade materials an the environment.

DISCUSSION

This project has looked at a myriad of factors that influence the highway's performance. A variety of relationships have been found which should be of use to the highway designer and builder. During this project a large number of miles of highway were intensively observed, monitored and tested. Throughout this process a set of impressions about highway design, construction and performance have been accumulated. Highway design in Arizona was and is an empirical process which currently uses the AASHTO interim guidelines (1). These guidelines are based on the premise of a 20 year design life. As has been shown, designing and building a highway that lasts 20 years before a 2.5 PSI is reached is very difficult and occurs probably less than 50 percent of the time. It would be easy to blame AASHTO, however, even pre-AASHTO projects performed similarly. It would be easy to blame the designers, however, most of today's highways in Arizona have been built in a rush. When the interstate program began, the size of Arizona's program exploded. The main concern was quantity of miles of highway. Only very recently has it been possible to even determine the level of performance. It would be easy to blame the construction operation, but here again the rapid growth of highways and the tremendous changes in specifications as well as contractor capability has also had a very large influence. As an observation, it appears that the real problem resides in the process of feedback. No means existed then or now to translate experience, good or bad, from the field back to the designers and on to the builders. Not that such communication does not exist, rather it has oftentimes been shunted in the belief that one side is right and other side is wrong or that no problem existed. Now is an excellent time to examine the design, construction process in depth. New methods of testing materials and design are currently available and were demonstrated at the 4th International Conference on Pavement Design (9). It is suggested that these methods be given an opportunity.

FINDINGS

The following finding have been drawn from this project.

1. Asphalt ages rapidly in Arizona. The percent of penetration decreases 50 percent in one year, 75 percent in two years and reaches a relatively stable level within three years. Viscosity increases in a similar manner.

2. Field asphalt content is generally more than the amount at construction, due to the application of tack coats, flush coats and seal coats.

3. The field density of AC mixes at time of construction is generally four pounds per cubic foor (64 kg/m^3) less than the Hveem T.I. laboratory compactor density.

4. The maximum theoretical density of AC mixes is generally ten to twelve pounds per cubic foot (160 to 192 Kg/m^3) heavier than the Hveem T.I. compactor density.

7. AC mixes designed since 1969 were to be in the 4-6 percent air void level after two years of traffic. Only about 20 percent of the projects sampled in this study actually achieved the 4-6 percent level, the bulk of them having voids greater than 6 percent.

8. BTB mixes performed similarly to AC mixes in terms of densification. Generally the BTB mixes had air voids of about 22 percent after two or more years of traffic.

9. CTB mixes densified under traffic reaching about 106 percent of the maximum proctor density. The moisture of the CTB increased after construction to approximately 2 percent wetter by weight two or more years after construction.

10. At time of construction the unbound base course (AB, SM, SGS) has a density which is about 102 percent of the maximum proctor density. After two or more years under traffic, the base course density increase, such that low density materials increase to about 110 percent of the proctor maximum density, whereas high density materials increase to about 99 percent. This is very consistent with the densification of AC mixes.

11. At time of construction the base course moisture is about 3.3. percent dryer than the optimum moisture. With time the AB and SM base course layers generally become dryer. Thus after two or more years under traffic the base course can be from 3.0 to 10.0 percent dryer than optimum.

12. Subgrade densities are about 97 percent of the proctor maximum dry density at time of construction. After two or more years under traffic subgrades generally slightly increase in density, although a large number of projects decreased in density to about 91 percent of the proctor maximum density.

13. Subgrade moisture at time of construction is generally about 1 to 6 percent dryer than optimum. Two or more years under traffic the field moisture increased dramatically above the construction moisture. The average subgrade moisture was about 90 percent of optimum, with 10 sites with moisture above optimum. Subgrade moistures do indeed increase with time.

14. The Hveem R value density at 300 psi is virtually the same as the proctor maximum dry density of subgrade soil. In addition, the R value moisture is virtually the same as the proctor optimum moisture.

15. The T-99 proctor maximum dry density and optimum percent moisture are very well related and the relationship in Arizona is virtually identical to the Louisiana family of curves line.

16. The R value test is related to the -2 micron (clay) fraction of a soil sample. In addition the -200 and PI are very well related to the -2 micron material. This helps explain why both the -200 and PI are so well related to the R value.

17. The temperature of the air, pavement surface and layers under the surface were determined. It was found that these temperatures are very well related to elevation. In addition, considerable freezing and freeze thaw occurs in Northern Arizona.

18. Moisture of the subgrade under the highway is generally more (as much as 4 to 5 percent by weight) than the natural soil moisture.

19. Subgrade moisture varies less over time than the natural moisture.

20. Subgrade moisture can be predicted reasonably well from the ratio of regional factors to soil support or the T-99 proctor maximum density.

21. The pavement surface temperature can be used to estimate the pavement mid-depth temperature.

22. The dynaflect deflection of AC surfaces does not appear to be very well related to the temperature of the AC.

23. AC overlays do reduce the dynaflect deflection, however, the use of the average deflection taken over several time periods will reveal this reduction much better.

24. Neighboring geophones used in the dynaflect deflection are very well related to each other. These relationships would strongly indicate that the dynaflect deflection basin is related to the type of structure.

25. The deflection of the first dynaflect geophone (10 inch geophone) is related to the subgrade moisture. Better than any of the other four geophones.

26. The 10 inch geophone deflection when taken on top of an AC pavement is related to the ratio of the percent cracking divided by the inches of AC thickness.

27. The dynaflect evidently does not register the effect of the unbound base. This could be due to the dynaflect size of loading or area of loading. In this sense the dynaflect does not mobilize sufficient stress in the base course to indicate its true value in reducing deflection.

28. The percent reduction in subgrade dynaflect deflection decreases as a function of the AC surfacing thickness.

29. The deflection of a 30 inch plate on subgrade was found to be related to the moisture content. From this, the 30 inch plate bearing and dynaflect deflection of the subgrade were related to each other.

30. 12 inch plate bearing deflections on top of an AC pavement are very well related to the 10 inch geophone dynaflect deflection on top of the AC.

31. The plate bearing test, unlike the dynaflect, indicated a very large reduction in subgrade deflection due to the unbound base course. This is reasonable since the plate bearing plate size and load are of sufficient magnitude to mobilize considerable stress in the base layer.

32. Those projects designed using the AASHTO road test equations do not appear to be performing any differently than those designed and built before the AASHTO road test. In general 50 percent of those projects designed and built after AASHTO road test took 13 to 22 years to reach the 2.5 PSI level. 75 percent of these projects reached the 2.5 PSI level between 10 and 22 years. Pre-AASHTO projects performed in a similar manner.

33. Although traffic is an important part of the AASHTO design, large difference in performance still have occurred due to different traffic levels.

34. Systematic evolutionary changes in the highway specifications, construction techniques and materials over time have all contributed to a change in performance. These actions are outside of the purview of the AASHTO design equiations.

35. Regional factor, soil support and equilibrium subgrade moisture all contribute to different levels of performance and are interrelated. Moisture contents above 10.0 percent can contribute to shortening the life of the pavement.

CONCLUSION

This project was created to determine temperature and moisture conditions in Arizona pavements. Several valuable relationships have been found which should be of use to designers, builders and maintenance forces. Methods have been determined to estimate both temperature and moisture.

Regional factor and soil support were both found to be interrelated to the future equilibrium moisture content. Since moisture content is likewise related to the in place dry density as well as the subgrade deflection it takes on great importance. Thus equilibrium subgrade moisture can be said to be the environmental factor since it constitutes the net results of the forces of nature and man. Historically, ADOT has sampled the top six inches (.15m) of the subgrade soil as subgrade. In this study the top two to four feet (.61 to 1.22m) acted more as the true subgrade.

Unbound base course materials have historically been of good quality. Typically, they have densified and dried out under traffic. Such base courses represent material that can readily benefit by the introduction of the binder material which would further reduce deflection by both the plate bearing ad dynaflect test.

AC and concrete surface courses can reduce the subgrade deflection, however, their long term performance can be seriously impaired if they are improperly designed. Historically, AC mixes have become richer in asphalt and lower in voids filled with asphalt. The results has been a shift from cracking to rutting distress. This might not be bad if relatively thin AC pavements (5 inches or less) were being built, however, when very thick AC pavemets (10 inches or more) are being built it could be quite damaging. Concrete pavements generally experience little or no rutting and very little cracking, therefore, most of their distress is derived from roughness. Concrete pavements are rough and become rougher all too soon. Evidently the independent slabs are moving in relation to each other. Reduction in the movement would be of great help in improving the performance of these pavements.

Overall the AASHTO design equation has done little better in providing 20 year pavements than the pre-AASHTO equation. This lends credence to the belief that forces outside of the design equation can seriously reduce future performance. These outside elements involve specifications, construction and contractor capability.

Generally one half of all AC pavement are overlaid or seal coated by the 16th year. Of these projects about one half receive a second overlay or seal coat by the 33rd year.

RECOMMENDATIONS

It is recommended that:

* The environmental factor be used to estimate the future pavement subgrade moisture and dry density. These values be run as part of the R value test as the most likely future worst condition.

* The subgrade be redefined to mean the top two feet of the subgrade soil. Efforts should be made to incorporate the highest density material possible within this layer, since this will reduce the long term moisture content.

* Compaction levels for the subgrade be raised to 100 percent of T-99 proctor as this also will increase density thus reducing the moisture.

* The dynaflect deflection not be corrected for temperature or if a temperature correction is desirable for other reasons, use the equation in the report.

* Freezing index, freeze thaw cycles and depth of frost penetration should be considered in the design and testing process. In particular aggregates and mixes should be tested to determine their suitability to the action of freezing and thawing. In addition for those regions of the state experiencing freezing and thawing this should be considered in the AC stripping test.

* Recycling of pavements has become quite popular, however, the underlying unbound base courses offer a clean, durable and well graded material suitable for either cement treated, lime fly ash treated, bituminous treated or emulsion treated base. Use of this material for this purpose would improve the overall support capabilities of the structure.

* AC designs should be matched to the thickness of the pavement. For thin pavements (less than 5 inches) high binder content and low voids filled are desirable, however, for thick pavements (more than 5 inches), lower binder content and lower voids filled or structures containing both BTB and AC is recommended.

* Concrete pavements become rough too quickly. ADOT should continue to examine both design and construction techniques in particular some form of joint control which could be used to reduce the roughness. If this is not possible and only aggregate interlock can be used to keep joints from moving, the aggregate should be of a quality to resist the action of freeze thaw as well as other forces.

* The AASHTO design method as practiced in Arizona should be totally reexamined.

* The greatest impact on highway performance has come from outside the design equation. Review of specifications, construction and contract administration should take place to determine inconsistencies. A practical example would be the relationship betwen R value and the proctor maximum density. Altghough the R value test is supposedly emulating the worst possible field condition it has the same dry density as the proctor maximum density. For subgrade soils only 95 percent of the proctor maximum density is needed to meet specifications and considered good, even though it is 5 percent below the R value test density which is considered the worst condition. Another example would be designing for the worst soil support and then allowing materials of this quality to be used, rather than designing to improve subgrade quality.

* New design methods and laboratory tests using principles of mechanics have been presented at the 4th International Conference on Pavement Design. These methods should be given a trial application on future projects to see if they are capable of improving the reliability of pavement design and construction.

REFERENCES

1. "AASHTO Interim Guide for Design of Pavement Structures 1972"

2. "Structural Design of Asphaltic Concrete Pavements to Prevent Fatigue Cracking" Highway Research Board Special Report 140, 1973.

3. "Flexible Pavment Design and Management System Formulation", Hudson, W. R. and F. F. McCullough, Materials Research and Development, Inc., NCHRP 139, 1973.

4. "Structural Design of Asphaltic Concrete Pavement Systems", Proceedings of a Workshop held December 7-10, 1970, Austin, Texas, HRB Special Report 126.

5. "Environmental Factor Determination from In-Place Temperature and Moisture Measurements Under Arizona Pavements" Way, G. B., Arizona Department of Transportation, June 1975.

6. "Prevention of Reflective Cracking in Arizona Minnetonka-East (A Cased Study)", Way, G. B., May 1976, Arizona Department of Transportation.

7. "Test on Treatments for Reflective Cracking", Way, G. B., Transportation Research Record 126

8. "Prevention of Reflective Cracking Minnetonka-East (1979 Addendum Report", Way, G. B., August, 1979, Arizona Department of Transportation.

9. "Fourth International Conference Structural Design of Asphalt Pavements", Volume I, Proceedings, August 22-26, 1977, The University of Michigan

Appendix A

Construction Materials Tests

TABLE A-1

ACFC

ASPHALTIC CONCRETE FINISHING COURSE

SIEVE ANALYSIS

SIEVE SIZE	1½"	3/4"	3/8"	4	8	16	30	50	100	200	
INCHES	1.5	.75	.375	.187	.0937	.0469	.0234	.0117	.0059	.0029	
MICRONS	38100	19000	9510	4760	2380	1190	595	297	149	74	
MILLIMETER	38.1	19.0	9.51	4.76	2.38	1.19	.595	.297	.149	.074	
SITE											
16,1961	100	100	100	60	18	7	5	4	2	2	
21,1964	100	100	100	64	28	8	4	3	2	1	
22,1964	100	100	100	45	13	4	2	2	2	1	
7,1964	100	100	100	40	14	7	5	5	4	3	
4,1965	100	100	100	57	18	9	5	3	2	1	
24,1966	100	100	100	61	17	7	5	3	2	1	
25,1966	100	100	100	56	24	15	9	6	4	3	
27,1968	100	100	100	61	16	4	3	3	3	3	
8,1969	100	100	100	51	21	13	11	10	9	7	
6,1970	100	100	100	85	72	54	42	25	10	5	*
10,1971	100	100	100	40	10	8	5	3	2	2	
12,1973	100	100	100	53	14	2	0	0	0	0	
13,1973	100	100	100	53	14	3	1	1	1	1	
14,1974	100	100	100	54	18	9	4	2	1	1	
1,1974	100	100	100	47	15	10	7	5	3	2	
16,1974	100	100	100	100	40	6	5	4	3	2	*
37,1975	100	100	100	51	16	8	5	4	3	2	
4,1975	100	100	100	38	10	5	3	2	1	0	
2,1975	100	100	100	55	16	2	2	2	2	2	
18,1975	100	100	100	41	11	9	6	4	3	3	
19,1975	100	100	100	42	10	8	6	4	3	2	
20,1975	100	100	100	51	12	9	6	4	3	2	
6,1976	100	100	100	33	7	3	2	1	1	1	*
30,1976	100	100	100	62	18	9	7	5	5	4	
8,1977	100	100	100	58	21	13	11	11	10	9	

TABLE A-2

ACFC

ASPHALTIC CONCRETE FINISHING COURSE 75 MIN. RTFO

SITE	% ASPHALT BY WEIGHT	ASPHALT TYPE	PEN. AT 77° F	PEN. AT 39.2° F	ABS. VISC. 140° F POISE	KIN. VISC. 275° F POISE	PEN. AT 77° F	VISC. 140° F	KIN. VISC. 275° F
16,1961	5.5	85/100	98	25	—	2.0	48	—	5HR
21,1964	5.6	85/100	93	—	1,015	2.1	50	—	5HR
22,1964	4.2	85/100	88	42	—	2.0	52	—	5HR
7,1964	11.0	85/100	90	30	—	2.7	48	—	5HR
4,1965	5.9	85/100	90	56	1,108	2.4	47	—	5HR
24,1966	5.8	85/100	92	40	819	1.6	51	—	5HR
25,1966	5.8	85/100	91	29	1,301	2.0	53	2,515	2.7
27,1968	5.5	85/100	89	26	1,165	2.8	47	2,421	3.4
8,1969	6.5	85/100	97	30	1,072	2.0	60	—	—
6,1970	6.7	85/100	83	34	1,208	2.5	57	2,342	—
10,1971	11.0	85/100	103	22	1,018	2.1	40	2,669	—
12,1973	4.5	85/100	98	25	594	2.0	65	904	2.4
13,1973	3.5	85/100	98	25	594	2.0	65	904	2.4
14,1974	6.4	AR4000	53	15	1,898	2.7	35	3,809	4.4
1,1974	5.8	AR4000	55	16	2,044	2.6	37	3,527	—
16,1974	5.1	AR4000	98	28	1,447	3.5	53	4,403	5.8
37,1975	5.9	AR4000	58	21	1,819	2.5	33	3,584	3.5
4,1975	5.3	AR2000	107	31	774	2.3	62	1,952	3.3
2,1975	6.0	AR2000	107	31	774	2.3	62	1,952	3.3
18,1975	5.9	AR2000	93	25	1,051	1.9	60	1,954	2.7
19,1975	6.1	AR2000	83	24	1,184	2.0	55	2,258	2.7
20,1975	6.5	AR2000	106	34	860	1.8	68	1,648	2.4
6,1976	5.5	AR2000	88	25	1,070	2.0	57	2,000	—
30,1976	6.5	AR2000	102	—	823	—	55	2,060	3.1
1,1977	7.2	AR4000		—		—	—	4,060	—
8,1977	5.9	AR2000	87	—	1,060	—	60	1,330	2.4

TABLE A-3

SEAL COATS

SIEVE ANALYSIS

SIEVE SIZE	1½"	3/4"	3/8"	4	8	16	30	50	100	200	CHIP TYPE	CHIP APPLICATION LBS/YD²
INCHES	1.5	.75	.375	.187	.0937	.0469	.0234	.0117	.0059	.0029		
MICRONS	38100	19000	9510	4760	2380	1190	595	297	149	74		
MILLIMETER	38.1	19.0	9.51	4.76	2.38	1.19	.595	.297	.149	.074		
SITE												
5,1946											—	—
1,1956	100	100	100	71	28	10	4	1	0	0	SPECIAL B	20
8,1957	100	100	100	64	24	10	6	4	3	2	B	18
9,1957	100	100	100	64	23	6	3	2	1	1	B	25
10,1958	100	100	97	21	4	2	2	2	1	1	SPECIAL B	20
11,1958	100	100	97	21	4	2	2	2	1	1	SPECIAL B	20
12,1960	100	100	100	68	18	5	3	3	3	3	B	22
13,1960	100	100	100	66	19	6	4	3	2	2	B	22
2,1960	100	100	100	69	21	1	11	1	1	1	D	22
16,1960	100	100	100	56	21	3	1	1	1	1	D	22
17,1961	100	100	100	89	30	5	3	3	2	2	E	22
18,1961	100	100	100	89	30	5	3	3	2	2	E	22
19,1963	100	100	100	69	25	10	6	5	4	3	D	20
3,1964											—	—
20,1964	100	100	100	54	12	1	1	1	1	1	D	20
14,1966	100	100	100	80	16	2	1	1	1	1	D	20
7,1969											CM-8 SLURRY SEAL	16
3,1970											—	—
5,1972	100	100	98	5	3	3	3	2	1	1	CM-10	23 *
3,1974	100	100	100	40	5	3	2	2	2	1	CM-11	32 *
5,1975	100	100	100	18	5	3	3	2	2	1	CM-11	22 *
10,1975	100	100	100	28	1	0	0	0	0	0	CM-11	32
11,1975	100	100	100	28	1	0	0	0	0	0	CM-11	32

TABLE A-4

SEAL COAT

SITE	EMULSION TYPE	APPLICATION GAL/YD²	% ASPH. BY WT. IN EMULSION	PEN. AT 77° F	VISC. AT 77° F SAYBOLT	VISC. AT 122° F SAYBOLT	VISC. AT 140° F ABS.	75 MIN. RTFO PEN. AT 77° F	75 MIN. RTFO VISC. AT 140° F ABS.
5,1946	—								
1,1956	GRADE B	.35	60			80			
8,1957	—	.35	—			—			
9,1957	GRADE B	.35	61			76			
10,1958	GRADE B	.35	64			112			
11,1958	GRADE B	.35	62			78			
12,1960	RS-2	.35	65	91		210			
13,1960	RS-2	.35	65	91		210			
2,1960	RS-K	.35	—			129			
16,1960	RS-2	.35	—	113		152			
17,1961	RS-2	.45	64	121		128			
18,1961	RS-2	.45	64	121		128			
19,1963	RS-2	.37	63			128			
3,1964	—								
20,1964	RS-2	.30	61			126			
14,1966	RS-2	.30	66			186			
7,1969	SS-1H	SLURRY SEAL							
3,1970	—								
5,1972	CRS-2H	.40	73		75	LATEX EMULSION			
3,1974	AR2000	.45	100	105	—	ASPHALT RUBBER	351		
5,1975	AR2000	.25	100	95	—	—	—	56	1,818
10,1975		.45	100			ASPHALT RUBBER			
11,1975		.45	100			ASPHALT RUBBER			

TABLE A-5

AC

ASPHALTIC CONCRETE

SIEVE ANALYSIS

SIEVE SIZE	1½"	3/4"	3/8"	4	8	16	30	50	100	200
INCHES	1.5	.75	.375	.187	.0937	.0469	.0234	.0117	.0059	.0029
MICRONS	38100	19000	9510	4760	2380	1190	595	297	149	74
MILLIMETER	38.1	19.0	9.51	4.76	2.38	1.19	.595	.297	.149	.074
SITE										
5,1946	—									
6,1955	—									
1,1956	100	89	65	56	51	47	36	18	6	2
9,1957	100	97	70	56	46	33	22	12	7	4
10,1958	100	100	81	62	49	41	30	27	17	8
11,1958	100	100	81	62	49	41	30	27	17	8
12,1960	100	100	39	15	8	5	4	3	2	2
13,1960	100	98	34	10	5	3	3	3	2	2
2,1960	100	100	80	57	46	34	27	18	12	9
15,1960	100	99	70	53	47	33	30	22	13	7
16,1961	100	100	68	54	46	38	26	14	7	4
17,1961	100	96	47	21	15	11	8	6	5	4
18,1961	100	96	39	19	14	10	7	5	4	4
19,1963	100	87	9	3	2	1	1	1	1	1 *
20,1963	100	99	78	60	51	39	26	14	6	3
21,1964	100	98	61	47	39	30	21	14	9	6
22,1964	100	96	67	49	36	25	17	11	7	6
7,1964	100	100	74	49	34	25	20	16	12	9
4,1965	100	97	71	55	44	36	28	18	10	6
24,1966	100	97	83	70	59	49	39	26	14	8 *
14,1966	100	98	80	60	46	35	27	19	12	7
25,1966	100	96	69	52	41	29	20	13	8	5
26,1967	100	97	68	51	41	32	24	15	9	6
27,1968	100	96	71	55	39	28	20	13	8	4
*8,1969	100	100	72	51	42	32	25	18	14	9
30,1969	100	100	74	55	44	31	20	13	9	7
6,1970	100	97	78	61	44	31	20	10	6	4
10,1971	100	100	92	74	46	30	20	13	8	5
11,1971	100	100	92	74	46	30	20	13	8	5
33,1973	100	96	67	45	32	23	17	13	9	7
12,1973	100	93	57	41	34	28	22	16	9	3
13,1973	100	98	62	43	35	28	22	16	10	5
1,1974	100	97	58	42	32	25	17	10	5	3
37,1975	100	96	69	54	44	34	22	16	9	5
4,1975	100	100	94	72	56	38	23	13	8	6
2,1975	100	100	93	68	50	32	22	14	8	4
17,1975	100	96	67	51	39	31	25	17	10	5
18,1975	100	96	52	37	28	23	18	12	7	4
19,1975	100	96	59	39	32	27	24	17	9	4
8,1977	100	98	75	60	46	34	24	16	11	8

TABLE A-6

AC

ASPHALTIC CONCRETE

SITE	% ASPHALT BY WEIGHT	ASPHALT TYPE	PEN. AT 77° F	PEN. AT 39.2° F	ABS. VISC. 140° F	KIN. VISC. 275° F	75 MIN. RTFO PEN. AT 77° F	75 MIN. RTFO VISC. 140° F	KIN. VISC. 275° F
5,1946	—								
6,1955	4.5	SC-6							
1,1956	3.6	150/200	159						
9,1957	3.5	120/150	129						
10,1958	4.5	200/300	217						
11,1958	4.5	200/300	217						
12,1960	3.1	85/100	91	31		2.7	50		5 HR.
13,1960	3.4	85/100	91	31		2.7	50		5 HR.
2,1960	5.3	120/150	145	50		2.5	70		5 HR.
15,1960	4.4	120/150	132	34		2.0	64		5 HR.
16,1961	4.2	85/100	98	25		2.0	64		5 HR.
17,1961	3.9	85/100	95	26		1.9	46		5 HR.
18,1961	3.7	85/100	86	27		1.9	47		5 HR.
19,1963	3.7	85/100	99	33		3.2	55		5 HR.
20,1963	4.9	85/100	93						
21,1964	4.1	85/100	93		1,015	2.1	50		5 HR.
22,1964	4.5	120/150	128	46	520	1.7	61		5 HR.
7,1964	7.9	200/300	234	64		3.0	115		5 HR.
4,1965	5.0	120/150	124	77	813	2.1	60		5 HR.
24,1966	5.5	85/100	92	40	819	1.6	51		5 HR.
14,1966	11.3	120/150	140	33	861	1.5	66	1,786	2.0
25,1966	4.3	85/100	91	29	1,301	2.0	53	2,515	2.7
26,1967	4.4	85/100	89	38	1,062	2.1	48		
27,1968	4.7	85/100	89	26	1,165	2.8	47	2,421	3.4
8,1969	5.6	85/100	97	30	1,072	2.0	60		
30,1969	4.7	85/100	94	28	887	2.0	46	1,665	2.5
6,1970	4.7	85/100	83	34	1,208	2.5	57	2,342	
10,1971	10.0	85/100	103	22	1,018	2.1	40	2,669	
11,1971	10.0	85/100	103	22	1,018	2.1	40	2,669	
33,1973	6.3	85/100	96	32	794	2.8	57	1,755	
12,1973	4.6	85/100	98	25	594	2.0	65	904	2.4
13,1973	4.7	85/100	98	25	594	2.0	65	904	2.4
1,1974	4.5	AR4000	55	16	2,044	2.6	37	3,527	3.5
37,1975	4.9	AR4000	58	21	1,819	2.5	33	3,584	3.4
4,1975	5.4	AR2000	107	31	774	2.3	62	1,830	3.3
2,1975	5.3	AR2000	107	31	774	2.3	62	1,482	
17,1975	4.4	AR2000	81	28	1,178	2.2	52	2,231	2.9
18,1975	4.1	AR2000	93	25	1,051	1.9	60	1,954	2.7
19,1975	4.7	AR2000	106	34	860	1.8	68	1,648	2.4
8,1977	5.8	AR2000	87	—	1,060	—	60	1,830	2.4

TABLE A-7

AC

ASPHALTIC CONCRETE

(*) VALUES CALCULATED

SITE	% ASPHALT	MAXIMUM DENSITY RICE METHOD	FIELD DENSITY	T.I. COMPACTOR HVEEM DENSITY	T.I. COMPACTOR HVEEM COHESION	T.I. COMPACTOR HVEEM STABILITY	FIELD % AIR VOIDS	FIELD VMA	FIELD VOIDS FILLED
5,1946	—	128.9							
6,1955	4.5	151.4							
1,1956	3.6	150.0*	135*	139	38	39	10.0*	17.6*	43.2
9,1957	3.5	151.9	135*	139	60	43	11.1*	18.5*	40.0
10,1958	4.5	151.8*	137*	141	66	43	9.8*	19.3*	49.2
11,1958	4.5	151.8*	137*	141	66	43	9.8*	19.3*	49.2
12,1960	3.1	150.0*	135*	139	49	39	10.0*	16.5*	39.4
13,1960	3.4	150.0*	135*	139	50	37	10.0*	17.2*	41.9
2,1960	5.3	153.6*	139*	143	165	36	9.5*	18.7*	49.2
15,1960	4.4	160.1	147*	151	120	40	8.2*	18.2*	55.0
16,1961	4.2	154.0	139*	143	61	29	9.7*	18.8*	48.4
17,1961	3.9			—	—	—			
18,1961	3.7			—	—	—			
19,1963	3.7			—	—	—			
20,1963	4.9	150.7	131	140	80	33	13.1	23.0*	43.0
21,1964	4.1	154.6	136	143	144	53	12.0	20.7*	42.0
22,1964	4.5	157.9	141*	145	150	50	10.7*	20.6*	48.1
7,1964	7.9	138.3*	122*	126	157	48	11.8*	26.6*	55.6
4,1965	5.0	151.8*	137*	141	137	41	9.8*	22.7*	56.8
24,1966	5.5	151.7	133*	137	73	36	12.3*	23.7*	48.1
14,1966	11.3	129.3*	112*	116	284	45	13.4*	32.5*	58.8
25,1966	4.3	151.4	141*	145	160	40	6.9*	16.3*	57.7
26,1967	4.4	158.1	144*	148	173	38	8.9*	18.8*	52.7
27,1968	4.7	150.0*	135*	139	65	35	10.0*	19.9*	49.8
8,1969	5.6	140.0	131	132	188	48	6.4	17.8	64.0
30,1969	4.7	158.5	149	148	181	42	6.0	16.9	64.5
6,1970	4.7	149.1*	134*	138	84	30	10.1*	19.9*	49.3
10,1971	10.0	136.0	119*	123	66	43	12.5*	30.6*	59.2
11,1971	10.0	136.0	120*	124	65	47	11.8*	30.0*	60.7
33,1973	6.3	151.8	136*	140	159	45	10.4*	23.6*	55.9
12,1973	4.6	170.0	158*	162	78	47	7.1*	18.4*	61.4
13,1973	4.7	170.0	158*	162	78	47	7.1*	18.4*	61.4
1,1974	4.5	152.7*	138*	142	133	46	9.6*	18.7*	48.7
37,1975	4.9	150.0	141	142	82	36	6.0	16.7*	64.1
4,1975	5.4	152.0	140*	144	120	44	7.9*	19.6*	59.7
2,1975	5.3	150.0	138	143	128	39	8.0*	19.3*	58.6
17,1975	4.4	170.0	156	160	83	43	8.2*	17.7*	53.7
18,1975	4.1	170.0	157	161	105	40	7.7*	17.7*	56.5
19,1975	4.7	159.0	145	149	205	48	8.8*	19.4*	54.6
8,1977	5.8	151.0		137	221	49			

TABLE A-8

PCCP

PORTLAND CEMENT CONCRETE

SIEVE ANALYSIS

SIEVE SIZE	2½"	2"	1½"	3/4"	3/8"	4	8	16	30	50	100	200
INCHES	2.5	2.0	1.5	.75	.375	.187	.0937	.0469	.0234	.0117	.0059	.0029
MICRONS			38100	19000	9510	4760	2380	1190	595	297	149	74
MILLIMETER			38.1	19.0	9.51	4.76	2.38	1.19	.595	.297	.149	.074
SITE												
28,1968	100	98	86	65	49	41	34	25	15	8	2	1
29,1969	100	99	84	51	40	38	31	27	6	2	1	1
35,1974	100	95	80	41	41	41	32	21	11	4	2	1
36,1974	100	95	80	41	41	41	32	21	11	4	2	1

TABLE A-9

PCCP

PORTLAND CEMENT CONCRETE

	LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTIC INDEX PI	FINE AGG. SAND EQUIV. SE	% CEMENT CEMENT / DRY AGG.	SLUMP	% AIR	WATER CEMENT RATIO pH ARIZ.	28 DAY COMPRESSIVE STRENGTH PSI
AASHO	T-89	T-90	T-90	T-176					
SITE									
28,1968				65	20	2.00	4.5	.34	4,170
29,1969				83	19	2.00	5.8	.49	4,140
35,1974				75	18	1.75	4.8	.47	5,290
36,1974				75	18	2.00	5.0	.47	3,610

TABLE A-10

BTB

BITUMINOUS TREATED BASE

SIEVE ANALYSIS

SIEVE SIZE	1½"	3/4"	3/8"	4	8	16	30	50	100	200
INCHES	1.5	.75	.375	.187	.0937	.0469	.0234	.0117	.0059	.0029
MICRONS	38100	19000	9510	4760	2380	1190	595	297	149	74
MILLIMETER	38.1	19.0	9.51	4.76	2.38	1.19	.595	.297	.149	.074
SITE										
2,1940	—									
3,1941	—									
4,1942	—									
7,1956	—									
8,1957	100	100	74	46	24	17	12	9	6	4
10,1958	100	100	97	95	93	86	78	33	11	6 *
11,1958	100	100	97	95	93	86	78	33	11	6
14,1960	100	100	100	21	6	6	6	6	5	3 *
15,1960	100	93	72	62	55	48	43	36	21	14
7,1964	100	100	76	52	34	25	20	16	13	10
23,1965	100	100	78	54	37	27	21	15	10	6
26,1967	100	98	74	52	38	28	21	16	10	6
30,1969	100	97	78	64	49	36	26	20	12	6

TABLE A-11

BTB

BITUMINOUS TREATED BASE

SITE	% ASPHALT BY WEIGHT	ASPHALT TYPE	PEN. AT 77° F	PEN. AT 39.2° F	ABS. VISC. 140° F	KIN. VISC. 275° F	75 MIN. RTFO PEN. AT 77° F	75 MIN. RTFO VISC. 140° F	KIN. VISC. 275° F
2,1940									
3,1941									
4,1942									
7,1956									
8,1957	12.0	200/300							
10,1958	3.3	RC-3			8.0				
11,1958	3.3	RC-3			8.0				
14,1960	1.0	RC-2	97						
15,1960	3.3	MC-3	204		3.0				
7,1964	8.3	SC-3000			3.7				
23,1965	7.9	200/300	222	65		2.2	95		5 HR.
26,1967	4.5	85/100							
30,1969	4.1	85/100	94	28	887	2.0	46	1,665	2.5

TABLE A-12

BTB

BITUMINOUS TREATED BASE

(*) VALUES CALCULATED

SITE	% ASPHALT	MAXIMUM DENSITY RICE METHOD	FIELD DENSITY	T.I. COMPACTOR HVEEM DENSITY	T.I. COMPACTOR HVEEM COHESION	T.I. COMPACTOR HVEEM STABILITY	FIELD % AIR VOIDS	FIELD VMA
2,1940								
3,1941	4.4*	148.7						
4,1942		151.7						
7,1956								
8,1957	12.0	151*	115*	118			23.8	44.9
10,1958	3.3	157*	121*	124	105	20	22.9	29.2
11,1958	3.3	157*	121*	124	105	20	22.9	29.2
14,1960								
15,1960	3.3							
7,1964	8.0	155*	122*	125	109	37	21.3	36.3
23,1965	7.9	149.0	116*	119	74	40	22.1	32.9
26,1967	4.5							
30,1969	4.1							

TABLE A-13

CTB

CEMENT TREATED BASE

SIEVE ANALYSIS

SIEVE SIZE	1½"	3/4"	3/8"	4	8	16	30	50	100	200
INCHES	1.5	.75	.375	.187	.0937	.0469	.0234	.0117	.0059	.0029
MICRONS	38100	19000	9510	4760	2380	1190	595	297	149	74
MILLIMETER	38.1	19.0	9.51	4.76	2.38	1.19	.595	.297	.149	.074
SITE										
12,1960	100	100	100	100	100	100	98	88	46	22
13,1960	100	100	100	100	100	100	98	88	46	22
17,1961	100	100	100	100	100	100	95	80	41	20
18,1961	100	100	100	100	100	100	93	81	40	19
19,1963	100	100	100	100	100	99	95	81	46	13
20,1963	100	96	92	88	82	71	53	25	9	5
28,1968	100	95	76	63	58	52	47	43	38	25
29,1969	100	100	79	57	48	39	34	30	26	20
35,1974	100	92	70	52	42	34	31	29	28	19
36,1974	100	91	63	50	41	35	31	29	26	18

TABLE A-14

CTB

CEMENT TREATED BASE

	LIQUID LIMIT LL	PLASTIC INDEX PI	SAND EQUIV. SE	PERCENT CEMENT BY WEIGHT OF DRY AGGREGATE	7 DAY COMPRESSIVE STRENGTH PSI	PROCTOR MAX. DRY DENSITY	DRY FIELD DENSITY	PROCTOR OPTIMUM MOISTURE	FIELD MOISTURE
AASHO	T-89	T-90	T-176			T-99		T-99	
SITE									
12,1960	21	1	10	6.0	382	166	114	- 13.7	13.0
13,1960	21	1	10	6.0	434	115	110	14.0	12.0
17,1961	—	NP	—	6.0	543	114	111*	13.0	12.2
18,1961	—	NP	—	6.0	539	113	111*	13.2	12.4
19,1963	—	NP	27	6.0	310				
20,1963	—	NP		4.0	—				
28,1968	—	NP	24	4.0	382	120	117*	11.4	10.7
29,1968	18	1	19	3.0	450	129	126*	7.1	6.7
35,1974	—	NP	20	4.5	510	122	118	11.5	10.7
36,1974	—	NP	27	4.5	565	119	121	11.4	11.7

TABLE A-15

AGGREGATE BASE

SIEVE ANALYSIS

SIEVE SIZE	1½"	3/4"	3/8"	4	8	16	30	50	100	200
INCHES	1.5	.75	.375	.187	.0937	.0469	.0234	.0117	.0059	.0029
MICRONS	38100	19000	9510	4760	2380	1190	595	297	149	74
MILLIMETER	38.1	19.0	9.51	4.76	2.38	1.19	.595	.297	.149	.074
SITE										
3,1941	—									
4,1942	—									
5,1946	—									
6,1955	—									
7,1956	100	95	77	42	19	16	8	6	4	3
1,1956	100	89	68	60	57	52	39	21	11	7
9,1957	100	93	77	66	55	40	26	12	6	4
8,1957	100	94	82	60	45	34	25	16	8	4
2,1960	100	98	68	49	33	19	13	8	5	4
15,1960	100	81	66	56	47	38	31	24	16	11
14,1960	100	100	82	53	33	19	13	8	5	3
16,1961	100	100	74	54	42	29	20	13	8	5
20,1963	100	99	79	59	49	40	29	18	10	8
21,1964	100	98	70	50	36	26	19	14	10	7
22,1964	100	97	74	58	48	34	22	14	10	8
23,1965	100	100	74	50	39	29	22	16	11	8
24,1966	100	97	86	75	68	59	49	28	8	4
25,1966	100	99	72	54	39	29	22	16	12	9
26,1967	100	99	76	58	46	35	25	16	9	6
27,1968	100	94	67	48	35	25	18	12	8	5
30,1969	100	97	76	61	54	41	26	16	10	8
$\bar{X}$	100	96	75	57	45	34	25	16	9	6

TABLE A-16

AB

AGGREGATE BASE

	LIQUID LIMIT LL	PLASTIC INDEX PI	SAND EQUIV. SE	PROCTOR MAX. DRY DENSITY	AGGREGATE TYPE FIELD DENSITY	PROCTOR OPTIMUM MOISTURE	FIELD MOISTURE
AASHO	T-89	T-90	T-176	T-99		T-99	
SITE							
3,1941	—	—		130.3*	132.5*	10.2*	6.9*
4,1942	—	—		125.6*	127.8*	10.1*	6.8*
5,1946	—	—		82.9*	85.1	26.6*	23.3*
6,1955	—	—		122.0*	124.2*	12.0*	8.7*
7,1956	—	NP	90	105.1*	107.3*	16.0*	12.7*
1,1956	—	NP	55				
9,1957	20	3	34	126.9*	129.1*	12.0*	8.7*
8,1957	—	NP	90	94	96.2*	10.0	6.7*
2,1960	—	NP	73	126	128.2*	6.0	2.7*
15,1960	—	NP	—	136.3*	138.5*	9.8*	3.8
14,1960	—	NP	93	75	74	21.0	17.6
16,1961	—	NP	60	129	131	9.0	8.0
20,1963	—	NP	30				
21,1964	—	NP	—	134	135	11.0	2.8
22,1964	—	NP	—	138	151	6.8	4.1
23,1965	—	NP	28	117.5*	119.7*	15.0*	11.7*
24,1966	—	NP	37	128.5*	130.7*	7.3*	4.0*
25,1966	—	NP	31	133.5*	135.7*	9.3*	6.0*
26,1967	—	NP	50	135.3*	137.5*	9.2*	5.9*
27,1968	—	NP	—	125.0*	127.2*	10.5*	7.2*
30,1969	—	NP	54	129.8*	132.0*	10.8*	7.5*
37,1975				125.1	127.0	9.9	3.2

TABLE A-17

SM

SELECT MATERIAL SIEVE ANALYSIS

SIEVE SIZE	1½"	3/4"	3/8"	4	8	16	30	50	100	200
INCHES	1.5	.75	.375	.187	.0937	.0469	.0234	.0117	.0059	.0029
MICRONS	38100	19000	9510	4760	2380	1190	595	297	149	74
MILLIMETER	38.1	19.0	9.51	4.76	2.38	1.19	.595	.297	.149	.074
SITE										
3,1941	—									
4,1942	—									
5,1946	—									
6,1955	—									
7,1956	95	78	56	30	14	11	5	5	4	3
8,1957	100	95	83	53	53	42	32	22	12	7
1,1957	66	51	45	42	41	38	30	17	7	4
9,1957	87	80	73	64	55	42	28	14	7	5
10,1958	100	100	97	95	93	86	78	33	11	6
11,1958	100	100	97	95	93	86	78	33	11	6
2,1960	99	98	96	87	69	48	30	17	14	6
12,1960	100	100	100	100	100	100	98	81	37	27
13,1960	100	100	100	100	100	100	97	83	42	15
14,1960	100	98	84	56	37	24	16	10	6	3
15,1960	78	60	48	40	32	26	21	16	13	10
16,1961	76	62	51	44	39	34	27	20	13	9
17,1961	100	100	100	100	100	100	100	98	55	16
18,1961	100	100	100	100	100	100	100	98	55	16
19,1963	98	89	79	71	68	64	59	42	17	9
20,1963	93	91	86	82	74	58	40	20	12	8
21,1964	86	78	70	65	57	43	28	19	14	9
22,1964	79	73	66	59	53	39	24	14	8	5
23,1965	94	83	63	45	30	21	15	9	5	3
24,1966	100	96	87	73	60	46	35	23	13	10
25,1966	78	56	46	40	37	33	24	15	9	6
26,1967	74	67	61	53	46	34	20	9	4	3
27,1968	100	99	92	86	79	67	50	26	14	10
30,1969	95	83	75	70	63	49	29	12	6	1
33,1973	100	100	92	59	39	30	22	18	14	12
37,1975	100	98	93	87	78	64	42	20	9	6
$\bar{X}$	92	85	78	68	62	53	46	30	16	8

SUBGRADE SEAL

SIEVE ANALYSIS

SITE										
15,1960	100	97	88	78	67	55	46	36	27	19
23,1965	100	100	99	73	57	41	31	21	15	11
26,1967	98	95	91	82	69	51	39	29	21	17
28,1968	100	98	75	58	51	44	41	37	31	21
29,1969	100	100	84	64	56	46	39	35	32	25
30,1969	100	100	100	92	83	62	41	23	15	12
35,1974	100	92	70	52	42	34	31	29	28	19
36,1974	100	91	63	50	41	35	31	29	26	18
$\bar{X}$	100	97	83	69	58	46	37	30	24	18

TABLE A-18

SM

SELECT MATERIAL

AASHO SITE	LIQUID LIMIT LL T-89	PLASTIC INDEX PI T-90	SAND EQUIV. SE T-176	PROCTOR MAX. DRY DENSITY T-99	AGGREGATE TYPE FIELD DENSITY	PROCTOR OPTIMUM MOISTURE T-99	FIELD % MOISTURE
3,1941	—	—	—				
4,1942	—	—	—				3.4 (1965)
5,1946	—	—	—				
6,1955	—	—	—				
7,1956	—	NP	69	88	96	17.4	14.2
8,1957	—	NP	61	94	96.2*	10.0	6.7*
1,1957	—	NP	51				
9,1957	—	NP	23				
10,1958	—	NP	—	110.6*	112.8*	11.4*	8.1*
11,1958	—	NP	—	110.6*	112.8*	11.4*	8.1*
2,1960	—	NP	63	127	129.2*	4.6	1.1*
12,1960	—	NP	15	117	110	12.5	12.0
13,1960	—	NP	19	114	108	11.0	9.0
14,1960	—	NP	90	70	78	17.3	17.6
15,1960	23	4	—				
16,1961	—	NP	26	136	137	8.0	6.7
17,1961	—	NP	18	104	106.2*	10.8	7.5*
18,1961	—	NP	18	104	106.2*	10.8	7.5*
19,1963	—	NP	27	114	117	12.1	6.6
20,1963	—	NP	45				
21,1964	—	3	—				
22,1964	—	NP	—	139	145	3.4	2.8
23,1965	—	NP	74				
24,1966	—	NP	23				
25,1966	—	NP	39				
26,1967	—	NP	78				
27,1968	—	NP	29				
30,1969	—	NP	66				
33,1973	32	5	—	104	104	19.5	16.9
37,1975	—	NP	—	119	123	11.0	6.2
SUBGRADE SEAL							
15,1960	26	9	—	129	133	10.8	6.4
23,1965	—	NP	—				
26,1967	26	6	—				
28,1968	—	NP	—	118	122	12.1	8.5
29,1969	19	2	—	130	130	11.0	7.1
30,1969	—	NP	—				
35,1974	—	NP	21	125	128	11.5	7.0
36,1974	17	1	16	122	127	11.5	7.2

TABLE A-19

SUBGRADE

SIEVE ANALYSIS

SIEVE SIZE	1½"	3/4"	3/8"	4	8	16	30	50	100	200
INCHES	1.5	.75	.375	.187	.0937	.0469	.0234	.0117	.0059	.0029
MICRONS	38100	19000	9510	4760	2380	1190	595	297	149	74
MILLIMETER	38.1	19.0	9.51	4.76	2.38	1.19	.595	.297	.149	.074
SITE										
2,1940										
3,1941										
4,1942										
5,1946										
6,1955	100	96	81	70	69	61	52	41	30	19
7,1956	99	90	83	79	75	70	66	59	51	39
8,1957	100	96	91	73	57	41	31	21	12	8
1,1957	100	100	100	100	100	99	97	93	84	74
9,1957	100	97	91	72	65	58	53	47	39	33
10,1958	100	100	100	100	97	89	72	32	11	7
11,1958	100	100	100	100	100	99	94	76	47	34
12,1960	100	100	100	100	98	94	91	81	52	26
13,1960	100	100	100	100	100	100	98	87	42	17
14,1960		ROCK CUT								
15,1960	100	99	97	92	86	81	74	65	53	46
16,1961	100	95	82	68	56	48	40	34	29	23
17,1961	100	100	100	100	100	100	98	81	56	31
18,1961	100	100	100	100	99	97	94	89	78	63
19,1963										
20,1963	100	100	100	100	96	88	80	72	59	49
21,1964	100	98	95	93	88	84	80	77	74	70
22,1964	100	100	100	100	100	95	81	60	40	28
23,1965	94	75	59	42	37	31	26	21	16	13
24,1966	100	98	95	91	83	71	57	33	14	9
25,1966	100	100	100	100	100	87	76	65	56	48
26,1967	96	89	80	68	60	51	44	37	31	27
27,1968	100	100	100	100	100	99	92	85	79	71
28,1968	100	100	100	100	92	84	78	72	65	59
29,1969	—									
30,1969										59
31,1971		DENEY								
32,1971	100	97	95	92	89	83	69	44	19	11
33,1973	100	100	100	99	98	97	96	82	37	22
34,1973	100	99	95	90	86	84	82	79	76	66
35,1974	100	100	100	100	100	100	99	96	88	81
36,1974		ROCK CUT								
37,1975	100	93	81	71	69	65	61	54	46	37
$\bar{X}$	100	97	94	89	85	80	73	62	48	37

TABLE A-20

SUBGRADE

AASHO SITE	LIQUID LIMIT LL	PLASTIC INDEX PI	PROCTOR MAX. DRY DENSITY	AGGREGATE TYPE FIELD DENSITY	PROCTOR OPTIMUM MOISTURE	FIELD % MOISTURE
AASHO	T-89	T-90	T-99		T-99	
2,1940	—	—				
3,1941	—	—	118.6*	115.6*	13.0*	8.2*
4,1942	—	—	130.0*	126.5*	8.4*	5.5*
5,1946	—	—	107.8*	105.2*	16.7*	10.4*
6,1955	—	—	127.2*	123.8*	9.2*	6.0*
7,1956	47	19	96.4*	94.3*	23.3*	14.3*
8,1957	—	NP				
1,1957	33	17				
9,1957	38	23	114.8*	111.9*	14.5*	9.1*
10,1958	—	NP	114.9*	112.0*	13.8*	8.7*
11,1958	21	5	114.9*	112.0*	13.8*	8.7*
12,1960	22	4	117	117	12.5	11.5
13,1960	—	NP	111	110	13.6	12.0
14,1960	—	—	121.2*	121	11.6*	4.8
15,1960	60	46	76.8*	75.4*	35.7*	21.7*
16,1961	—	11	114	113	12.0	10.2
17,1961	19	2	104	101.6*	10.8	6.9*
18,1961	36	19	104	101.6*	10.8	6.9*
19,1963	—	—	108	106	14.7	5.8
20,1963	23	8	122.7*	119.5*	10.3*	6.6*
21,1964	36	22	110	104	19.0	5.6
22,1964	42	10	95.9*	93.8*	25.0*	15.3*
23,1965	39	18	104.8*	102.3*	20.9*	12.9*
24,1966	—	NP	130.6*	127.1*	9.7*	6.3*
25,1966	30	10	120.8*	117.7*	11.6*	7.4*
26,1967	41	24	126.4*	123.1*	10.5*	6.7*
27,1968	36	21	110.6*	107.9	15.4*	9.6*
28,1968	36	17	100	96	22.0	23.7
29,1969			125*	121.7*	10.3*	6.6*
30,1969	—	52	138.1*	134.3*	9.0*	5.9*
31,1971	—	15	110.5*	107.8*	16.3*	10.2*
32,1971	—	NP	129.1*	125.6*	8.4*	5.5*
33,1973	23	5	118	112	20.8	10.4
34,1973	23	6	106.6*	104.0*	17.6*	7.1*
35,1974	49	21	86.1*	84.4*	31.2*	19.0*
36,1974	—	—	123	117	13.3	6.5
37,1975	42	19	112	108	22.0	15.0

Appendix B

Field Sample Materials Tests

TABLE B-1

ASPHALTIC CONCRETE

SITE/YEAR	% ASPHALT BY WEIGHT	PEN AT $77^{o}F$	VISC. @ $77^{o}F$ MEGA-POISE	ABS VISC. @ $140^{o}F$ THOUSANDS	% ASPHALTENES	% $N+A_1$ KIN.[1] VISC. $275^{o}F$	% A_2+P	VANADIUM PPM	DATE SAMPLED
5/1946	11.5	44	4.4		28	39	33	110	1974
6/1955		8	158.		52	--	--	--	1976
1/1956	4.9	10	110.	33	36	--	--	--	1976
9/1957	4.2	7	247.	Too Viscous	46	28	26	160	1974
10/1958	3.8	17	35.	20	39	--	--	--	1976
11/1958	3.8	17	35.	20	39	--	--	--	1976
12/1960									
13/1960									
2/1960		15	47.	27	42	--	--	--	1976
15/1960	4.6	14	54.		37	32	32	135	1974
16/1961	4.2	6	284.	184.	42	35	23	126	1974
17/1961									
18/1961									
19/1963									
20/1963	5.6	8	173.		39	27	34	65	1974
21/1964	5.9	8	200.		40	32	28	150	1974
22/1964	5.6	15	43.		35	34	31	110	1974
7/1964	9.8	72	1.5	1.6	29	43	28	79	1976
4/1965		31	9.6	5.1	24				1976
24/1966	4.6	6	328.		39	36	25	104	1974
14/1966	6.8	59	2.4	2.2	23				1976
25/1966	5.1	5	447.		41	34	25	100	1974
26/1967	5.6	16	38.		32	38	30	130	1974
27/1968	5.8	10	105.	123.	35	34	31	95	1974
8/1969	7.4	19	28.	8.9	28				1976
30/1969	5.6	23	18.		28	39	33		1974
6/1970		18	30.	14.7	29				1976
10/1971	8.4	19	26.		35				1976
11/1971	8.4	19	26.		35				1976
33/1973	9.0	57	2.6		21	34	45	38	1974
12/1973									
13/1973									
1/1974	4.7	34	7.9	3.2	26				1976
37/1975	5.4	25	6.6	1.5	33				1976
4/1975		56	2.7	2.0	22				1976
2/1975		75	1.4	1.3	25				1976
17/1975									
18/1975									
19/1975									
8/1977									

TABLE B-2

ASPHALTIC CONCRETE

SITE/YEAR	% ASPHALT	MAXIMUM DENSITY RICE METHOD	FIELD DENSITY	AIR VOIDS	VMA	VOIDS FILLED
5/1946	11.5	128.9	102.9	20.2	37.1	45.6
6/1955	5.3*	151.4	147.8	2.4	14.5	83.5
1/1956	4.9	150.0*	136.4	9.1*	19.4	53.1
9/1957	4.2	151.9	141.4	6.9	17.3	60.1
10/1958	3.8	151.8*	142.5	6.1*	14.6	58.2
11/1958	3.8	151.8	142.5	6.1*	14.6	58.2
12/1960	4.1*	150.0*	147.8	1.5*	10.9	86.2
13/1960	4.1*	150.0*	147.8	1.5*	10.9	86.2
2/1960	6.0*	153.6*	150.7	1.9*	15.9	88.1
15/1960	4.6	160.1	151.9	5.1	18.0	71.7
16/1961	4.2	154.0	145.4	5.5	15.1	63.6
17/1961	4.8*		149.3			
18/1961	4.6*		149.3			
19/1963	4.6*		139.9			
20/1963	5.6	150.7	137.6	8.7	20.2	56.9
21/1964	5.9	154.6	143.0	7.5	19.7	61.9
22/1964	5.6	157.9	143.1	9.4	21.0	55.2
7/1964	9.8	138.3*	126.2	8.8*	27.6	68.1
4/1965	5.8*	151.7	146.7	3.3	16.5	80.0
24/1966	4.6	150.4	137.9	8.3	18.2	54.4
14/1966	11.1*	129.3*	127.0	1.8*	23.1	92.2
25/1966	5.1	151.4	142.2	6.1	16.9	63.9
26/1967	5.6	158.1	145.1	8.2	20.1	59.2
27/1968	5.8	148.8	138.3	7.1	19.2	63.0
8/1969	7.4	140.0	131.8	5.9	20.3	70.9
30/1969	5.6	158.5	147.6	6.9	19.1	63.9
6/1970	5.5*	149.1*	149.0	.1*	12.8	99.2
10/1971	8.4	136.0	121.2	10.9	26.5	58.9
11/1971	8.4	136.0	121.2	10.9	26.5	58.9
33/1973	9.0	151.8	140.1	7.7	26.2	70.6
12/1973	5.4*	170.0	155.2	8.7	21.7	59.9
13/1973	5.5*	170.0	155.2	8.7	22.0	60.5
1/1974	4.7	152.7*	151.0	1.1*	12.1	90.9
37/1975	5.4	150.00	142.9	4.7	16.7	71.9
4/1975	6.1*	152.0				
2/1975	6.0*	150.0	142.7	4.9	18.3	73.2
17/1975	5.2*	170.0	156.7	7.8	20.5	62.0
18/1975	5.0*	170.0	156.7	7.8	20.0	61.0
19/1975	5.5*	159.0*	147.3	7.4*	19.9	62.8
8/1977	6.4*	151.0				

TABLE B-3

BTB
BITUMINOUS TREATED BASE

SITE/YEAR	% ASPHALT BY WEIGHT	PEN AT 77°F	VISC. @ 77°F MEGA-POISE	ABS VISC. @ 140°F THOUSANDS	% ASPHALTENES	% N+A1 KIN. VISC. 275°F	% A2+P	VANADIUM PPM	DATE SAMPLED
2/1940									
3/1941	5.3	16	37.0		41	30	29	150	1974
4/1942		11	84.0	129.	48	--	--	--	1976
7/1956									
8/1957	7.5	6	353.0	54.	35				1976
10/1958	3.4	5	543.0	23.	44				1976
11/1958	3.4	5	543.0	23.	44				1976
14/1960									
15/1960									
7/1964	3.5	VISC. TOO LOW	VISC. TOO LOW		26	43	31	79	1974
23/1965	8.2	25	14.9	5.	31	37	32	170	1974
26/1967									
30/1969									

TABLE B-4

BITUMINOUS TREATED BASE

SITE/YEAR	% ASPHALT	MAXIMUM DENSITY RICE METHOD	FIELD DENSITY	AIR VOIDS	VMA	VOIDS FILLED
2/1940						
3/1941	5.3	148.7	142.0	4.5	15.6	71.2
4/1942		151.7	146.7	3.3		
7/1956						
8/1957	7.5	151.0*	122.8	18.7		
10/1958	3.4	157.0*	124.5	20.7		
11/1958	3.4	157.0*	124.5	20.7		
14/1960						
15/1960						
7/1964		155.0*				
23/1965	8.2	149.0	123.1	17.4	31.2	44.2
26/1967						
30/1969						

TABLE B-5

CTB
CEMENT TREATED BASE

AASHTO SITE	FIELD DRY DENSITY	FIELD % MOISTURE	DRY DENSITY OF R VALUE T-190	% MOISTURE OF R VALUE T-190	PROCTOR MAXIMUM DRY DENSITY T-99	PROCTOR OPTIMUM MOISTURE T-99
12/1960	121.0	12.9			116	13.7
13/1960	121.0	12.9			115	14.0
17/1961	123.5	13.9			114	13.0
18/1961	123.5	13.9			113	13.2
19/1963		11.3				
20/1963	132.5	8.4				
28/1968	113.9	12.9			120	11.4
29/1968	136.8	10.2			129	7.1
35/1974		14.1				11.5
36/1974	118.2	12.5				11.4

TABLE B-7

AB

AGGREGATE BASE SAMPLED 1977

AASHTO SITE	LIQUID LIMIT LL T-89	PLASTIC LIMIT PL T-90	PLASTIC INDEX PI T-90	SAND EQUIV. SE T-176	+4 ROCK SPEC. GRAV. T-240	+4 ROCK WATER ABS. T-240	-4 FINE SPEC. GRAV. T-100	PH ARIZ.	MIN. REST ARIZ.	PERM. FT/DAY T-215
3/1941			NP	30	2.54	--	2.86	8.2	8,500	1.26
4/1942			NP		2.54	3.10	2.72			.92
5/1946			NP	84			2.73	8.8	17,000	5.81
6/1955			NP	52	2.38	3.80	2.67			.26
7/1956	30	23	7		1.85	8.90	2.77	8.2	3,300	1.68
1/1956					2.61	1.90				
9/1957			NP		2.56		2.72			2.16
8/1957			NP		1.68	9.02	2.90	8.9	20,000	.51
2/1960			NP		2.65	1.56	2.68			3.43
15/1960			NP		2.68	2.12	2.72	8.0	2,500	.65
14/1960			NP		1.59	13.79	2.82	9.2	11,000	5.16
16/1961										
20/1963										
21/1964			NP	41	2.66	.97	2.71	8.1	7,000	.98
22/1964			NP		2.73	1.69	2.75			10.53
23/1965			NP		2.21	5.21	3.06	8.7		24.4
24/1966			NP	50	2.56	1.55	2.77			1.55
25/1966			NP	56	2.66	.81	2.77	8.7	4,900	.39
26/1967			NP		2.65	1.10	2.59	8.2	7,000	.66
27/1968			NP	30			2.74	8.6	1,250	.37
30/1969			NP		2.72	1.74	2.80			4.69

TABLE B-6

AGGREGATE BASE SAMPLED 1977

SIEVE SIZE	1½"	3/4"	3/8"	4	8	16	30	50	100	200	--	--	--	--	--
INCHES	1.5	.75	.375	.187	.0937	.0469	.0234	.0117	.0059	.0029	.0020	.00079	.00039	.000197	.00007
MICRONS	38100	19000	9510	4760	2380	1190	595	297	149	74	50	20	10	5	2
MILLI-METER	38.1	19.0	9.51	4.76	2.38	1.19	.595	2.97	.149	.074	.050	.020	.010	.005	.002
SITE															
3/1941	97	91	83	76	69	58	44	29	16	10	8	7	7	5	5
4/1942	100	99	98	91	70	44	28	16	11	9	8	7	6	5	5
5/1946	100	98	92	62	29	18	13	9	6	4	3	1	0	0	0
6/1955	100	96	87	75	62	51	41	30	22	14	10	9	5	5	5
7/1956	99	91	75	52	41	32	26	24	20	17	13	10	9	7	5
1/1956	100	92	73	65	62	58	50	33	20	14					
9/1957	99	92	83	72	63	48	34	16	9	6	6	4	3	2	0
8/1957	100	99	94	80	63	50	38	27	16	9	6	4	3	2	0
2/1960															
15/1960	97	90	69	58	51	43	37	30	21	14	11	7	7	5	4
14/1960	100	99	89	67	48	35	27	21	14	10	8	3	0	0	0
16/1961	100	100	76	58	43	32	19	10	5	0	0	0	0	0	0
20/1963															
21/1964	91	89	72	59	51	39	26	17	12	9	8	5	4	3	2
22/1964	96	92	68	56	46	35	24	16	12	10	7	5	4	4	3
23/1965	100	100	70	51	43	35	26	18	12	9	8	5	5	3	2
24/1966	100	97	81	70	59	48	38	22	10	7	6	5	4	3	3
25/1966	86	80	64	53	46	39	26	16	10	6	5	5	4	4	4
26/1967	94	87	70	57	52	44	33	21	13	9	7	5	4	3	2
27/1968	98	94	77	66	60	54	41	24	11	8	7	5	5	5	5
30/1969	98	94	79	68	60	44	31	15	11	9	8	7	4	3	2
X̄	98	94	79	65	54	42	32	21	13	9	7	5	4	3	2

TABLE B-8

AB

AGGREGATE BASE SAMPLED 1977

AASHTO SITE X̄	Σ 10 SIEVES HUDSON A 506	R VALUE AT 300 psi T-190	DRY DENSITY OF R VALUE T-190	% MOISTURE OF R VALUE T-190	PROCTOR MAXIMUM DRY DENSITY T-99	PROCTOR OPTIMUM MOISTURE T-99	1976 FIELD DENSITY	1976 FIELD MOISTURE
3/1941	573	85	130.6	8.4	(c) 130.3	10.2	138.7	2.6
4/1942	566	82	126.2	8.5	(c) 125.6	10.1	125.8	3.5
5/1946	431	82	82.9	17.9	(c) 82.9	26.6	78.9	12.3
6/1955	578	84	121.5	9.9	(c) 122.0	12.0	126.0	4.4
7/1956	477	84	105.6	17.1	105.1	16.0	115.6	10.1
1/1956	567						135.8	3.8
9/1957	522	81	126.3	9.4	(c) 126.9	12.0	135.7	6.4
8/1957	576	83	96.2	12.2	(c) 101.6	19.6	108.4	7.0
2/1960		84	126.1	8.8	(c) 125.2	11.7	129.0	2.9
15/1960	510	82	133.0	9.6	(c) 136.3	9.8	135.3	5.2
14/1960	510	84	85.1	15.8	(c) 85.6	22.4	88.2	12.8
16/1961	443						135.8	3.7
20/1963								
21/1964	465	82	131.4	8.9	(A) 125.2	11.4	126.8	4.0
22/1964	455	85	135.0	7.7	137.9	8.0	141.7	2.7
23/1965	464	74	109.5	11.3	(c) 117.5	15.0	121.7	8.9
24/1966	532	83	127.3	8.7	(c) 128.5	7.3	132.6	3.8
25/1966	426	86	129.5	7.8	(c) 133.5	9.3	128.4	3.5
26/1967	480	84	129.2	9.9	(c) 135.3	9.2	132.0	3.4
27/1968	533	85	129.1	8.6	(c) 125.0	10.5	134.1	3.5
30/1969	509	85	131.5	8.8	(c) 129.8	10.8	128.2	4.3
37/1975			124.5	9.9	125.1		125.2	3.3

TABLE B-9

SELECT MATERIAL SAMPLED 1977

	SIEVE ANALYSIS										HYDROMETER				
SIEVE SIZE	1½"	3/4"	3/8"	4	8	16	30	50	100	200	--	--	--	--	--
INCHES	1.5	.75	.375	.187	.0937	.0469	.0234	.0117	.0059	.0029	.0020	.00079	.00039	.000197	.00007
MICRONS	38100	19000	9510	4760	2380	1190	595	297	149	74	50	20	10	5	2
MILLI-METER	38.1	19.0	9.51	4.76	2.38	1.19	.595	2.97	.149	.074	.050	.020	.010	.005	.002
SITE															
3/1941	91	85	80	72	63	45	30	17	9	6					
4/1942															
5/1946	98	88	55	29	23	17	13	11	8	6					
6/1955	100	93	81	65	51	40	30	22	16	11					
7/1956	92	72	57	39	25	16	12	10	8	6					
8/1957															
1/1957	91	73	60	54	51	47	36	21	12	8					
9/1957															
10/1958	100	100	100	100	99	99	91	47	15	8	8	7	7	5	4
11/1958	100	100	100	100	99	99	91	47	15	8	8	7	7	5	4
2/1960															
12/1960	100	100	100	100	98	97	92	66	26	11	9	5	5	3	1
13/1960	100	100	100	100	98	97	92	66	26	11	9	5	5	3	1
14/1960															
15/1960															
16/1961	68	59	48	39	30	22	14	8	3	0					
17/1961															
18/1961															
19/1963	100	100	100	100	96	92	87	71	41	26					
20/1963															
21/1964															
22/1964															
23/1965															
24/1966	99	94	78	66	59	49	39	25	11	7					
25/1966															
26/1967															
27/1968															
30/1969															
33/1973	100	98	74	60	50	45	38	34	27	21	15	9	6	3	1
37/1975															
X̄	95	89	79	71	65	59	51	34	17	10	10	7	6	4	2
SUBGRADE SEAL															
15/1960															
23/1965															
26/1967															
28/1968	100	94	70	58	51	46	42	38	34	23	17	12	8	4	3
29/1969	100	99	84	65	50	40	34	30	27	22	15	8	7	5	4
30/1969															
35/1974	100	96	71	56	46	39	34	31	27	19	14	10	9	4	3
36/1974															
X̄	100	96	75	60	49	42	37	33	29	21	15	10	8	4	3

TABLE B-10

SELECT MATERIAL SAMPLED 1977

AASHTO SITE	LIQUID LIMIT LL T-89	PLASTIC LIMIT PL T-90	PLASTIC INDEX PI T-90	SAND EQUIV. SE T-176	+4 ROCK SPEC. GRAV. T-240	+4 ROCK WATER ABS. T-240	-4 FINE SPEC. GRAV. T-100	PH ARIZ.	MIN. REST ARIZ.	PERM. FT/DAY T-215
3/1941			NP		2.63	1.76	2.71			
4/1942			NP	30	2.58	1.90				
5/1946			NP		2.78	2.44	2.70			
6/1955			NP	40	2.46	.30				
7/1956			NP	62	2.03	11.70				
8/1957										
1/1957			NP	43	2.63	.90				
9/1957										
10/1958			NP	44			2.68	9.2	5,500	3.48
11/1958			NP	44			2.68	9.2	5,500	3.48
2/1960										
12/1960			NP	47			2.68	8.5	6,600	.40
13/1960			NP	47			2.68	8.5	6,600	.40
14/1960										
15/1960										
16/1961										
17/1961										
18/1961										
19/1963			NP	26			2.61	7.6	510	
20/1963										
21/1964										
22/1964										
23/1965										
24/1966			NP	37	2.60	1.60				
25/1966										
26/1967										
27/1968										
30/1969										
33/1973	32	26	6	28	1.88	13.11	2.63			.15
37/1975										
SUBGRADE SEAL										
15/1960										
23/1965										
26/1967										
28/1968			NP		2.24	5.93	2.79			
29/1969			NP	27	2.17	4.07	2.53	7.4		.06
30/1969										
35/1974			NP	41	2.31	5.21	2.78	6.9	4,000	.07
36/1974			NP	41	2.31	5.21	2.78	6.9	4,000	.07

TABLE B-11

SELECT MATERIAL SAMPLE 1977

AASHTO SITE	AGGREGATE TYPE	R VALUE AT 300 psi T-190	DRY DENSITY OF R VALUE T-190	% MOISTURE OF R VALUE T-190	PROCTOR MAXIMUM DRY DENSITY T-99	PROCTOR OPTIMUM MOISTURE T-99	1976 FIELD DENSITY	1976 FIELD MOISTURE
3/1941	498							
4/1942								
5/1946	348							8.1
6/1955	509							5.0
7/1956	337							
8/1957								
1/1957	453						136.1	2.2
9/1957								
10/1958	759	74	111.7	11.5	(A) 110.6	11.4	115.6	3.6
11/1958	759	74	111.7	11.5	(A) 110.6	11.4	115.6	3.6
2/1960								3.9
12/1960	790	75			(A) 113.1	16.1		
13/1960	790							
14/1960								15.0
15/1960								
16/1961	291							4.1
17/1961								
18/1961								
19/1963	813							7.0
20/1963								
21/1964								
22/1964								
23/1965								
24/1966	527							4.1
25/1966								
26/1967								
27/1968								
30/1969								
33/1973	545	88	108.1	17.3	(c) 102.5	17.7	90.3	16.1
37/1975								
X̄	571							
SUBGRADE SEAL								
15/1960								
23/1965								
26/1967								
28/1968	456	81	120.1	10.8	(c) 122.8	11.5	113.9	12.9
29/1969	451	83	125.7	9.9	(c) 125.7	12.4	132.3	8.3
30/1969								
35/1974	419		117.8	11.3	121.6	14.3	109.6	16.3
36/1974							120.4	13.4
X̄	442							

TABLE B-12

SUBGRADE SAMPLED 1977

SIEVE SIZE	1½"	3/4"	3/8"	4	8	16	30	50	100	200	--	--	--	--	--
	SIEVE ANALYSIS										HYDROMETER				
INCHES	1.5	.75	.375	.187	.0937	.0469	.0234	.0117	.0059	.0029	.0020	.00079	.00039	.000197	.00007
MICRONS	38100	19000	9510	4760	2380	1190	595	297	149	74	50	20	10	5	2
MILLI-METER	38.1	19.0	9.51	4.76	2.38	1.19	.595	2.97	.149	.074	.050	.020	.010	.005	.002
SITE															
2/1940															
3/1941	100	100	100	100	95	90	82	69	50	40	30	20	17	14	10
4/1942	100	100	98	95	77	63	52	42	30	23	16	9	5	5	4
5/1946	100	97	95	90	87	86	84	77	62	53	44	35	29	26	19
6/1955	100	93	81	67	57	48	38	29	24	19	15	10	7	6	5
7/1956	100	100	98	96	89	84	80	76	71	63	62	49	40	33	26
8/1957	100	98	95	79	60	43	31	20	11	6	4	3	3	2	0
1/1957															
9/1957	99	98	96	93	86	79	72	65	60	52	48	42	35	31	25
10/1958															
11/1958	100	100	100	100	100	100	99	96	76	50	30	16	10	9	7
12/1960	100	100	100	100	100	100	99	83	46	26	20	13	10	9	7
13/1960															
14/1960	79	65	54	44	39	34	30	28	25	14	12	8	5	4	3
15/1960	100	100	100	100	99	98	96	94	82	68	66	60	45	33	25
16/1961															
17/1961															
18/1961	100	100	100	100	99	98	91	61	22	12	8	7	7	4	3
19/1963	95	91	85	78	73	70	66	54	33	24	14	6	5	2	1
20/1963	100	100	99	97	91	84	75	66	54	50	37	22	15	14	10
21/1964	100	96	94	92	87	81	64	57	48	35	31	20	15	12	10
22/1964	99	97	95	93	90	81	70	54	35	25	16	10	10	5	4
23/1965	94	92	92	92	88	84	81	75	67	62	58	48	41	30	22
24/1966	99	95	89	79	64	49	36	24	14	10	9	8	7	7	6
25/1966	100	99	97	96	92	82	70	61	54	46	30	23	20	14	13
26/1967	91	88	85	80	71	56	45	37	31	27	20	16	13	12	10
27/1968	100	100	100	100	99	96	91	80	66	56	48	43	37	30	25
28/1968	99	95	89	76	64	57	51	44	36	29	23	16	14	13	10
29/1969	91	83	78	75	69	63	59	55	50	34	24	15	15	11	8
30/1969	88	79	69	61	54	40	29	20	14	11	10	8	5	4	3
31/1969	99	98	92	82	75	63	51	40	31	25	17	10	9	7	6
32/1971	100	98	96	93	90	87	79	62	47	26	24	22	20	20	16
33/1973	100	98	96	93	89	84	81	69	40	28	23	15	15	14	12
34/1973	99	94	91	89	87	85	83	81	78	72	54	43	37	30	27
34/1974	100	99	99	99	99	99	98	98	97	96	83	70	61	52	39
36/1974															
37/1975	100	100	100	100	98	93	86	78	64	55	42	32	25	20	17
X	98	95	92	88	82	77	69	60	47	38	31	23	20	15	12

TABLE B-13

SUBGRADE SAMPLED 1977

AASHTO SITE	LIQUID LIMIT LL T-89	PLASTIC LIMIT PL T-90	PLASTIC INDEX PI T-90	SAND EQUIV. SE T-176	+4 ROCK SPEC. GRAV. T-240	+4 ROCK WATER ABS. T-240	-4 FINE SPEC. GRAV. T-100	PH ARIZ.	MIN. REST ARIZ.	PERM. FT/DAY T-215
2/1940										
3/1941	24	20	4	5	--	--	2.91	--	--	.03
4/1942	--	--	NP	--	2.56	1.9	2.71	--	--	.143
5/1946	36	16	20	7	--	--	2.78	--	--	VERY LOW
6/1955	33	25	8	23	2.47	5.80	2.74	--	--	.02
7/1956	47	21	26	--	2.13	7.88	2.21	8.1	1,850	.029
8/1957	--	--	NP	--	1.56	13.12	2.82	7.5	18,000	19.60
1/1957					2.42	6.20				
9/1957	38	16	22	--	2.56	1.08	3.10	--	--	VERY LOW
10/1958										
11/1958	21	18	3	6	--	--	2.70	9.4	2,600	.0029
12/1960	21	19	2	14	--	--	3.74	8.2	--	.220
13/1960										
14/1960	--	--	NP	--	2.23	6.06	2.74	7.9	14,000	.117
15/1960	75	31	44	3	--	--	2.31	8.4	--	.050
16/1961										
17/1961										
18/1961	--	--	NP	25	--	--	2.28	9.0	--	--
19/1963	--	--	NP	23	2.37	4.61	2.64	8.3	6,100	.50
20/1963	22	18	4	12	2.53	1.37	2.77	--	--	.040
21/1964	39	15	24	4	2.63	.77	2.69	8.1	2,250	--
22/1964	37	32	5	32	2.58	3.48	2.62	--	--	.034
23/1965	37	18	19	--	1.17	12.13	2.68	8.3	2.750	VERY LOW
24/1966	--	--	NP	46	2.65	1.26	2.68	--	--	.146
25/1966	27	19	8	11	2.58	1.07	2.69	8.0	1,220	.021
26/1967	33	17	16	15	2.80	.84	2.73	8.4	2,100	.478
27/1968	29	13	16	6	--	--	2.72	--	--	TOO LOW
28/1968	39	27	12	--	1.63	9.50	2.69	8.0	4,000	--
29/1969	21	19	2	12	2.31	4.53	2.72	8.6	5,000	TOO LOW
30/1969	21	19	2	--	2.71	2.01	2.73	--	--	.55
31/1971	31	22	9	23	2.29	10.02	2.74	--	--	.11
32/1971	16	13	3	--	2.55	1.68	2.73	7.4	4,100	.087
33/1973	28	20	8	12	2.14	8.22	2.71	8.1	3,400	.044
34/1973	38	16	22	3	2.71	.59	2.70	--	--	.067
35/1974	70	21	49	2	--	--	2.73	--	--	VERY LOW
36/1974	52	22	30	10	--	--	2.71	--	--	VERY LOW
37/1975										

TABLE B-14

SUBGRADE SAMPLED 1977

AASHTO SITE	AGGRE-GATE TYPE Σ 10 SIEVES HUDSON A	R VALUE AT 300 psi T-190	DRY DENSITY OF R VALUE T-190	% MOISTURE OF R VALUE T-190	PROCTOR MAXIMUM DRY DENSITY T-99	PROCTOR OPTIMUM MOISTURE T-99	1976 FIELD DENSITY	1976 FIELD MOISTURE
2/1940								
3/1941	826	45	123.1	12.7	(A) 118.6	13.0	107.9	10.8
4/1942	680	76	130.0	8.1	(A) 130.0	8.4	129.1	5.8
5/1946	831	13	107.4	19.7	107.8	16.7	104.7	22.6
6/1955	556	79	127.1	9.5	(c) 127.2	9.2	129.2	5.3
7/1956	857	31	95.5	26.1	(c) 96.4	23.3	82.8	20.4
8/1957	573	75	86.6	16.1			89.2	7.9
1/1957								
9/1957	800	15	116.0	16.0	(c) 114.8	14.5	116.7	14.9
10/1958			117.7	13.2	114.9	13.8	105.7	12.8
11/1958	921	36	117.7	13.2	(A) 114.9	13.8	105.7	12.8
12/1960	854	61	118.6	13.3	(A) 116.0	12.7	107.1	12.3
13/1960								
14/1960	412	80	119.5	10.6	(c) 121.2	11.6	134.8	8.7
15/1960	938	15	75.5	43.9	(A) 76.8	35.7	79.5	40.5
16/1961							118.1	9.5
17/1961			115.6	11.7	115.4	9.3	119.5	9.8
18/1961	783	72	115.6	11.7	(A) 115.4	9.3	119.5	9.8
19/1963	669	80	122.9	10.6	(c) 123.0	11.9	133.5	7.1
20/1963	816	62	127.2	10.6	122.7	10.3	128.1	9.6
21/1964	754	9	106.2	20.7	(A) 108.2	17.6	91.6	15.2
22/1964	739	76	95.4	22.6	(c) 95.9	25.0	85.4	21.5
23/1965	827	14	101.6	23.6	(c) 104.8	20.9	108.8	22.8
24/1966	559	84	128.1	8.1	(c) 130.6	9.7	134.8	6.1
25/1966	797	41	123.8	11.3	(A) 120.8	11.6	113.6	9.0
26/1967	611	25	126.0	12.6	(c) 126.4	10.5	111.8	14.0
27/1968	888	6	107.0	20.7	110.6	15.4	114.1	10.3
28/1968	640	74	91.7	25.3	(c) 88.9	22.9	85.2	28.2
29/1969	657	62	123.0	13.4	(c) 125.0	10.3	118.6	11.0
30/1969	465	84	134.2	8.3	(c) 138.1	9.0	122.3	7.1
31/1971	656	51	112.3	17.3	(c) 110.5	16.3	124.5	10.7
32/1971	778	52	131.4	8.8	(c) 129.1	8.4	123.4	5.0
33/1973	774	45	113.8	16.3	(c) 111.2	15.6	105.2	16.1
34/1973	869	11	106.3	20.7	106.6	17.6	114.7	6.2
35/1974	985	2			(A) 86.1	31.2	84.6	35.6
36/1974							129.4	11.8
37/1975	874	24	106.9	20.5	103.2	19.5	107.2	9.6
$\overline{X}$	746							

Appendix C

Average Monthly Temperatures at Various Depths

SITE	ELEVATION*	SITE NAME	SURFACING
24	488	Topock	AC
6	730	Gila Bend	AC
1	994	Avondale	AC
16	1188	Tempe	AC
3	3209	Cutter	AC
4	4186	Benson	AC
10	4897	Winslow	AC
7	5138	Ash Fork	AC
19	6184	Lupton	AC
5	6384	Show Low	AC
29	6496	Cosnino	PCCP
14	6958	Flagstaff SB	PCCP
36	6958	Flagstaff NB	PCCP
33	8063	Alpine	AC

* Elevation in feet above sea level

TABLE 1A

AVERAGE AIR TEMPERATURE

MONTH

SITE	ELEV.	1	2	3	4	5	6	7	8	9	10	11	12
24	488	52	57	63	70	79	87	94	93	86	75	61	53
6	730	53	57	61	69	78	86	93	92	86	75	62	54
1	994	51	55	60	68	76	84	91	89	84	72	60	52
16	1188	51	54	58	66	74	82	89	87	82	71	59	52
3	3209	44	48	52	61	69	77	84	82	76	64	52	45
4	4186	46	49	53	61	69	78	82	79	75	64	53	47
10	4897	32	39	45	54	63	72	79	76	70	57	43	33
7	5138	37	40	44	51	59	67	74	72	67	57	45	38
19	6184	28	36	41	49	58	67	75	72	64	52	41	31
5	6384	31	35	40	48	56	65	71	69	64	52	40	32
29	6496	30	34	38	46	55	64	70	67	64	50	39	31
14	6958	28	31	34	42	50	59	66	64	57	47	37	30
36	6958	28	31	34	42	50	59	66	64	57	47	37	30
33	8063	28	30	34	41	48	56	61	59	54	46	36	30

TABLE 1A

AVERAGE MONTHLY SURFACE TEMPERATURE ^{o}F

MONTH

SITE	ELEV.	1	2	3	4	5	6	7	8	9	10	11	12
24	488	64	71	75	89	104	121	124	130	120	100	70	62
6	730	67	72	80	95	108	122	133	132	122	101	70	66
1	994	61	70	77	86	102	113	124	118	111	91	68	64
16	1188	58	70	79	86	95	106	119	117	106	86	67	63
3	3209	51	64	76	86	91	103	114	107	101	71	64	62
4	4186	49	55	70	72	94	101	100	101	90	62	62	50
10	4897	39	54	55	66	78	98	101	100	89	79	48	38
7	5138	37	40	55	62	74	81	84	83	80	70	48	37
19	6184	29	34	41	51	65	80	85	89	74	62	49	32
5	6384	23	33	39	50	68	82	80	80	65	51	36	23
29	6496	33	37	44	48	63	72	69	76	67	50	40	32
14	6958	27	32	43	45	61	64	74	75	66	43	42	25
36	6958	36	40	47	51	60	65	72	71	67	44	44	35
33	8063	20	26	30	43	53	64	60	63	53	41	26	21

TABLE 1A

3 INCH DEPTH

AVERAGE MONTHLY TEMPERATURE

MONTH

SITE	ELEV.	1	2	3	4	5	6	7	8	9	10	11	12
24	488	63	70	74	89	103	120	123	130	121	101	71	63
6	730	67	73	81	96	109	123	135	134	123	102	70	66
1	994	61	71	75	84	101	111	123	117	110	91	67	63
16	1188	59	71	78	80	96	105	117	115	106	85	65	62
3	3209	56	66	73	84	90	101	112	106	99	70	63	62
4	4186	48	54	70	73	93	101	101	95	88	59	57	50
10	4897	36	47	50	63	76	96	99	98	87	77	46	35
7	5138	38	41	54	64	74	83	87	85	80	71	50	38
19	6184	30	34	42	53	70	83	86	89	76	63	49	33
5	6384	24	34	41	52	70	84	82	82	68	54	40	28
29	6496	33	38	43	48	65	75	72	77	68	50	40	33
14	6958	28	31	43	45	60	65	72	72	65	43	35	26
36	6958	36	39	46	49	56	57	72	72	68	45	42	36
33	8063	20	29	34	47	57	69	64	67	58	45	30	19

TABLE 1A

9 INCH DEPTH

AVERAGE MONTHLY TEMPERATURE

MONTH

SITE	ELEV.	1	2	3	4	5	6	7	8	9	10	11	12
24	488	62	70	73	87	100	118	124	125	110	94	67	65
6	730	69	74	84	89	102	120	128	130	115	98	69	65
1	994	59	69	72	85	102	111	118	110	92	85	66	62
16	1188	60	72	76	82	99	106	113	106	101	83	64	63
3	3209	55	67	73	80	89	101	111	104	99	72	61	60
4	4186	47	50	68	73	90	98	98	87	88	67	47	44
10	4897	43	55	63	65	73	93	97	98	89	70	54	58
7	5138	40	41	47	57	68	79	82	84	80	70	49	38
19	6184	31	35	43	55	71	84	85	89	77	64	52	35
5	6384	30	33	40	45	66	77	82	81	72	58	40	32
29	6496	32	37	44	48	64	74	72	77	67	49	40	33
14	6958	31	32	46	50	62	68	65	67	63	45	39	27
36	6958	35	39	45	48	58	65	73	74	67	46	44	36
33	8063	22	31	37	49	58	69	66	67	61	49	34	22

TABLE 1A

15 INCH DEPTH

AVERAGE MONTHLY TEMPERATURE

MONTH

SITE	ELEV.	1	2	3	4	5	6	7	8	9	10	11	12
24	488	65	72	78	87	101	109	113	116	101	89	76	70
6	730	70	74	82	89	105	111	119	115	93	88	78	72
1	994	58	71	72	84	102	111	116	111	92	86	74	71
16	1188	60	72	76	83	95	98	109	110	95	83	73	68
3	3209	57	68	71	81	88	94	107	101	98	72	68	59
4	4186	48	56	69	74	90	98	98	94	91	67	64	52
10	4897	42	57	63	66	88	94	95	87	80	65	59	52
7	5138	39	40	47	54	63	78	82	81	80	71	59	49
19	6184	33	36	43	62	81	85	85	88	79	67	53	38
5	6384	32	37	42	47	63	78	79	78	74	55	42	34
29	6496	33	38	45	48	64	75	77	78	76	58	45	40
14	6958	32	33	45	49	63	68	65	67	65	55	44	39
36	6958	39	42	45	48	56	66	66	67	64	53	45	39
33	8063	22	30	36	46	59	67	66	67	61	51	37	24

TABLE 1A

24 INCH DEPTH

AVERATE MONTHLY TEMPERATURE

MONTH

SITE	ELEV.	1	2	3	4	5	6	7	8	9	10	11	12
24	488	66	73	79	86	102	107	112	104	96	84	72	68
6	730	71	77	84	93	104	110	108	105	99	82	75	69
1	994	59	72	82	90	96	106	111	105	89	85	77	70
16	1188	61	70	80	90	97	104	110	101	88	80	73	67
3	3209	54	67	67	74	82	89	103	98	95	71	68	63
4	4186	49	54	67	73	88	96	96	93	88	67	66	62
10	4897	39	46	54	63	74	89	93	86	80	58	48	43
7	5138	39	41	48	55	66	77	81	78	72	62	50	42
19	6184	34	35	41	48	76	83	84	86	77	65	52	38
5	6384	35	38	42	47	60	73	77	75	62	56	50	39
29	6496	34	35	40	46	64	68	68	69	68	55	50	35
14	6958	35	35	51	55	68	73	65	67	67	50	44	33
36	6958	39	40	43	43	60	62	64	64	62	51	45	41
33	8063	23	29	35	44	55	64	64	65	60	52	39	27

TABLE 1A

30 INCH DEPTH

AVERAGE MONTHLY TEMPERATURE

MONTH

SITE	ELEV.	1	2	3	4	5	6	7	8	9	10	11	12
24	488	60	61	69	77	94	105	106	101	94	92	86	76
6	730	62	63	70	78	94	106	108	103	95	90	85	72
1	994	61	62	67	76	93	104	105	104	90	86	82	71
16	1188	59	61	68	72	92	104	101	100	89	85	81	70
3	3209	55	58	63	71	76	87	94	92	87	78	76	65
4	4186	50	54	66	72	87	95	95	92	85	67	66	55
10	4897	35	43	50	65	78	88	92	94	86	70	54	40
7	5138	40	41	52	60	70	80	82	81	80	68	61	49
19	6184	41	43	45	48	58	72	74	75	69	64	59	45
5	6384	36	38	42	45	55	68	72	76	71	63	54	41
29	6496	34	38	44	46	60	70	71	72	70	64	51	37
14	6958	37	39	47	50	56	62	63	64	62	59	48	38
36	6958	38	40	45	49	57	60	62	62	61	57	47	39
33	8063	34	35	40	47	54	60	60	61	59	51	38	36

TABLE 2A

AVERAGE MONTHLY AIR HIGH TEMPERATURE

MONTH

SITE	ELEV.	1	2	3	4	5	6	7	8	9	10	11	12
24	488	67	73	79	87	95	103	109	107	103	91	78	68
6	730	68	73	78	88	97	105	109	107	103	92	78	69
1	994	67	72	77	86	95	103	107	105	101	90	77	68
16	1188	66	70	74	83	92	101	104	102	99	89	76	68
3	3209	60	65	70	79	89	97	100	97	93	83	70	60
4	4186	62	66	71	79	88	96	96	93	91	83	71	63
10	4897	46	53	60	71	80	90	94	91	86	74	59	47
7	5138	53	56	61	69	78	87	92	89	85	75	63	55
19	6184	41	51	56	67	78	87	92	89	81	71	57	44
5	6384	44	48	54	64	73	83	86	83	79	69	55	46
29	6496	43	47	52	63	71	82	84	81	77	67	54	45
14	6958	42	45	49	58	67	77	81	78	74	64	51	44
36	6958	42	45	49	58	67	77	81	78	74	64	51	44
33	8063	40	44	51	60	69	77	79	76	73	65	51	42

TABLE 2A

AVERAGE MONTHLY HIGH TEMPERATURE

SURFACE TEMPERATURE

MONTH

SITE	ELEV.	1	2	3	4	5	6	7	8	9	10	11	12
24	488	82	93	105	120	132	160	168	159	150	115	85	80
6	730	89	96	107	126	135	151	167	156	147	112	88	78
1	994	80	90	103	113	124	142	146	136	132	100	85	76
16	1188	80	89	101	106	127	141	145	137	130	101	82	72
3	3209	72	82	98	109	122	136	139	125	121	92	80	65
4	4186	67	73	88	91	118	121	132	117	112	82	74	61
10	4897	58	76	75	81	101	123	120	118	109	95	67	54
7	5138	56	59	77	86	93	114	105	112	101	90	68	51
19	6184	48	50	63	81	90	109	103	107	92	81	63	45
5	6384	45	48	59	73	89	112	107	105	88	72	56	47
29	6496	44	49	62	64	82	98	99	99	85	75	55	46
14	6958	43	53	68	70	80	95	96	95	86	76	54	45
36	6958	44	54	69	70	78	91	92	93	85	70	53	46
33	8063	41	45	60	66	75	86	91	93	88	69	52	43

TABLE 2A

9 INCH DEPTH

AVERAGE MONTHLY HIGH TEMPERATURE

MONTH

SITE	ELEV.	1	2	3	4	5	6	7	8	9	10	11	12
24	488	70	85	91	110	120	135	139	134	130	101	83	72
6	730	71	86	96	111	118	138	141	140	133	105	83	75
1	994	70	80	85	97	111	117	124	125	118	99	80	74
16	1188	71	80	84	101	108	115	121	120	115	96	81	75
3	3209	62	71	85	94	103	105	120	112	105	87	75	68
4	4186	52	58	74	82	97	103	113	108	100	82	71	63
10	4897	49	60	67	69	85	99	101	102	93	85	71	63
7	5138	41	42	50	60	72	83	93	96	90	80	65	53
19	6184	39	41	45	53	70	80	99	92	81	73	52	46
5	6384	36	43	46	54	69	75	80	80	75	70	49	41
29	6496	34	39	46	51	65	79	85	81	78	68	50	36
14	6958	32	37	47	53	64	71	80	79	75	65	49	38
36	6958	37	44	50	52	64	72	79	78	72	63	48	37
33	8063	34	45	48	51	60	64	75	75	69	58	44	35

TABLE 2A

3 INCH DEPTH

AVERAGE MONTHLY HIGH TEMPERATURE

MONTH

SITE	ELEV.	1	2	3	4	5	6	7	8	9	10	11	12
24	488	78	85	97	102	115	129	144	126	116	100	95	81
6	730	79	86	96	103	115	127	145	124	119	95	97	82
1	994	76	82	97	100	116	126	128	118	112	92	82	79
16	1188	75	81	97	95	115	120	128	119	109	86	84	77
3	3209	70	75	91	97	111	116	127	111	101	81	76	73
4	4186	60	66	86	91	106	114	120	107	100	83	67	62
10	4897	43	58	62	77	100	112	112	108	100	78	54	41
7	5138	52	54	71	81	90	100	90	105	98	75	53	49
19	6184	42	50	63	72	82	99	96	101	95	71	51	37
5	6384	29	42	51	65	83	98	95	95	80	67	49	41
29	6496	39	41	49	56	63	81	90	90	82	66	47	42
14	6958	39	40	50	60	65	76	85	86	80	65	46	43
36	6958	37	41	60	64	72	75	81	80	77	63	48	45
33	8063	30	43	58	60	70	73	79	80	79	57	41	39

TABLE 2A

15 INCH DEPTH

AVERAGE MONTHLY HIGH TEMPERATURE

MONTH

SITE	ELEV.	1	2	3	4	5	6	7	8	9	10	11	12
24	488	62	65	72	92	107	107	114	114	101	91	81	66
6	730	60	70	76	90	108	109	115	116	100	90	76	65
1	994	58	64	74	91	105	106	111	112	96	88	72	65
16	1188	57	65	78	90	97	101	110	111	97	89	70	62
3	3209	56	64	75	90	97	100	109	104	96	74	69	60
4	4186	51	56	71	86	93	100	100	100	91	77	66	61
10	4897	53	62	65	80	85	92	95	96	88	80	66	60
7	5138	45	48	57	76	78	82	91	90	81	71	63	51
19	6184	40	42	46	61	70	75	86	89	80	70	62	50
5	6384	36	41	45	60	65	73	80	78	72	62	56	46
29	6496	35	41	46	55	66	71	77	76	75	65	55	44
14	6958	34	43	46	52	64	68	69	68	69	60	51	41
36	6958	39	44	46	50	64	69	72	73	71	62	48	38
33	8063	33	40	45	50	60	66	70	71	72	58	48	35

TABLE 2A

24 INCH DEPTH

AVERAGE MONTHLY HIGH TEMPERATURE

MONTH

SITE	ELEV.	1	2	3	4	5	6	7	8	9	10	11	12
24	488	61	66	72	81	95	104	101	101	98	88	74	70
6	730	60	65	70	80	106	106	107	103	99	87	77	72
1	994	59	63	68	78	96	105	106	105	90	86	74	71
16	1188	57	65	77	72	93	101	102	101	91	83	70	68
3	3209	53	58	69	84	91	100	100	100	86	73	63	60
4	4186	50	55	68	72	89	98	99	95	82	79	66	59
10	4897	46	49	51	61	71	89	93	94	86	70	53	40
7	5138	40	41	46	55	64	79	82	86	87	68	56	44
19	6184	40	42	47	54	62	71	83	86	85	66	54	49
5	6384	37	43	48	52	59	70	80	81	80	65	53	43
29	6496	38	44	50	53	60	65	74	74	73	63	54	45
14	6958	36	41	52	53	59	61	66	67	68	62	52	44
36	6958	39	40	44	46	52	60	68	67	67	61	49	42
33	8063	33	40	43	45	50	64	65	65	61	50	39	37

TABLE 2A

30 INCH DEPTH

AVERAGE MONTHLY HIGH TEMPERATURE

MONTH

SITE	ELEV.	1	2	3	4	5	6	7	8	9	10	11	12
24	488	62	64	66	78	92	100	101	102	93	85	81	72
6	730	61	63	67	80	90	99	101	103	94	84	80	70
1	994	60	63	67	78	88	100	101	101	92	80	75	69
16	1188	59	63	66	74	90	100	100	100	90	80	76	64
3	3209	55	60	64	78	90	90	100	95	86	80	70	60
4	4186	51	55	56	62	80	85	90	88	84	76	62	55
10	4897	48	51	53	60	71	87	83	83	76	70	69	53
7	5138	41	46	49	62	70	82	83	81	77	66	62	52
19	6184	41	45	50	55	60	79	80	78	72	65	59	50
5	6384	38	38	43	45	56	70	73	75	71	63	55	42
29	6496	34	38	44	47	61	72	71	69	68	57	50	39
14	6958	37	41	43	46	53	65	70	67	65	55	52	39
36	6958	39	41	45	47	53	64	66	65	65	51	51	41
33	8063	33	40	47	48	52	62	64	65	65	52	43	38

TABLE 3A

AVERAGE MONTHLY AIR LOW TEMPERATURE

MONTH

SITE	ELEV.	1	2	3	4	5	6	7	8	9	10	11	12
24	488	37	42	47	54	62	70	79	78	70	58	45	38
6	730	38	40	45	51	59	67	77	76	69	57	45	39
1	994	36	39	43	49	57	65	75	74	66	54	42	37
16	1188	35	38	42	48	55	63	73	72	65	53	42	36
3	3209	28	31	34	41	48	56	67	66	58	46	34	28
4	4186	30	32	36	43	50	59	67	65	58	46	35	30
10	4897	19	24	29	37	45	54	63	61	54	41	28	20
7	5138	21	23	27	33	40	48	56	55	48	38	28	22
19	6184	15	22	25	31	37	47	57	55	47	34	26	17
5	6384	18	21	25	32	39	48	56	54	48	36	25	19
29	6496	17	20	23	31	36	46	54	53	46	34	24	18
14	6958	15	17	20	27	33	41	51	49	41	31	22	16
36	6958	15	17	20	27	33	41	51	49	41	31	22	16
33	8063	10	13	17	22	27	35	44	43	35	27	16	12

TABLE 3A

AVERAGE MONTHLY LOW TEMPERATURE

SURFACE

MONTH

SITE	ELEV.	1	2	3	4	5	6	7	8	9	10	11	12
24	488	46	49	51	57	78	91	96	89	81	69	60	49
6	730	48	50	53	62	79	95	98	92	80	70	64	50
1	994	47	50	51	70	81	94	97	89	78	69	60	53
16	1188	46	49	57	65	73	89	94	88	77	66	59	51
3	3209	41	43	54	69	79	88	90	85	76	56	52	46
4	4186	37	43	52	60	75	87	88	82	76	58	51	42
10	4897	27	37	39	51	60	77	85	86	73	59	42	29
7	5138	22	29	38	42	53	63	69	79	65	55	41	27
19	6184	20	30	35	40	49	60	75	75	62	51	40	27
5	6384	15	24	25	31	43	56	62	61	50	47	30	16
29	6496	26	30	34	37	47	54	60	61	51	41	35	27
14	6958	18	22	25	32	47	52	56	55	49	40	39	30
36	6958	21	31	33	36	44	48	57	56	50	42	38	29
33	8063	12	14	25	30	40	51	55	55	46	30	24	12

TABLE 3A

3 INCH DEPTH

AVERAGE MONTHLY LOW TEMPERATURE

SITE	ELEV.	1	2	3	4	5	6	7	8	9	10	11	12
		MONTH											
24	488	48	51	55	62	84	100	107	100	91	81	72	59
6	730	50	53	56	60	85	101	103	93	90	80	70	60
1	994	49	51	57	74	85	103	101	99	85	70	63	54
16	1188	46	50	53	59	82	99	101	91	82	73	65	52
3	3209	42	45	58	74	81	96	101	92	80	59	60	50
4	4186	39	46	55	63	79	91	93	83	79	58	50	45
10	4897	27	36	38	50	75	84	89	87	77	56	48	35
7	5138	29	35	44	49	63	69	72	83	72	55	52	33
19	6184	27	31	41	45	60	70	78	79	70	52	40	30
5	6384	21	31	33	41	56	66	71	71	60	45	33	24
29	6496	26	33	34	36	46	55	62	58	56	43	38	26
14	6958	26	32	36	40	43	50	61	59	56	42	39	28
36	6958	29	36	35	43	42	52	59	60	54	41	36	30
33	8063	21	28	29	38	41	50	60	60	53	37	29	24

TABLE 3A

9 INCH DEPTH

AVERAGE MONTHLY LOW TEMPERATURE

SITE	ELEV.	1	2	3	4	5	6	7	8	9	10	11	12
		MONTH											
24	488	52	56	67	85	94	110	123	125	102	94	75	66
6	730	53	60	65	84	93	112	122	126	100	95	71	68
1	994	51	59	66	84	95	105	111	105	91	85	70	63
16	1188	50	57	63	71	93	101	108	106	96	81	69	60
3	3209	45	53	63	72	82	91	104	99	89	74	58	54
4	4186	41	48	61	71	74	88	93	86	85	72	63	56
10	4897	43	51	59	60	68	87	92	85	83	77	64	57
7	5138	38	40	45	53	65	79	81	84	80	75	56	51
19	6184	34	41	45	46	59	76	83	85	79	72	53	44
5	6384	32	40	44	45	58	72	75	76	71	62	47	41
29	6496	31	35	42	44	57	69	76	77	72	54	44	33
14	6958	30	38	43	45	60	66	68	69	64	56	43	34
36	6958	34	43	41	43	52	59	63	64	63	55	42	35
33	8063	30	37	43	44	50	58	62	63	60	50	41	29

TABLE 3A

15 INCH DEPTH

AVERAGE MONTHLY LOW TEMPERATURE

SITE	ELEV.	1	2	3	4	5	6	7	8	9	10	11	12
		MONTH											
24	488	59	65	74	90	101	103	108	96	90	85	75	62
6	730	57	66	72	86	101	104	110	106	90	83	80	60
1	994	56	63	70	84	98	105	113	101	88	84	78	60
16	1188	57	61	73	78	91	101	108	100	87	80	76	60
3	3209	55	59	68	74	91	100	105	98	81	75	70	58
4	4186	46	52	64	72	86	95	94	90	84	72	61	52
10	4897	52	48	53	63	70	89	93	94	85	79	64	56
7	5138	37	39	46	52	67	81	83	86	80	70	65	45
19	6184	39	41	48	50	64	71	73	76	72	65	60	47
5	6384	41	43	47	51	63	65	70	71	70	65	55	51
29	6496	36	41	46	50	62	63	66	65	64	61	51	46
14	6958	34	40	44	52	61	66	65	64	62	60	50	44
36	6958	39	43	45	49	60	67	66	66	65	60	52	37
33	8063	31	40	45	49	60	66	65	66	60	57	46	34

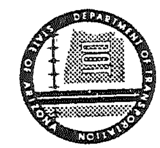


TABLE 3A

24 INCH

AVERAGE MONTHLY LOW TEMPERATURE

SITE	ELEV.	1	2	3	4	5	6	7	8	9	10	11	12
		MONTH											
24	488	58	64	71	88	93	101	100	103	96	85	75	65
6	730	57	63	70	84	101	102	103	104	99	82	76	64
1	994	56	61	67	83	94	103	105	104	96	85	74	63
16	1188	55	60	65	79	90	101	100	101	92	75	72	62
3	3209	52	58	66	80	87	96	102	96	90	70	66	60
4	4186	48	53	55	72	86	94	94	92	85	68	65	58
10	4897	41	44	47	62	79	88	92	94	82	70	53	45
7	5138	42	44	45	52	63	73	80	81	77	67	54	43
19	6184	40	41	45	50	53	60	65	66	65	60	55	46
5	6384	35	40	44	49	54	60	70	67	64	62	57	43
29	6496	36	41	46	50	55	64	66	65	64	61	58	44
14	6958	35	40	45	48	60	62	63	64	63	62	59	42
36	6958	39	40	43	46	54	64	64	65	63	59	53	41
33	8063	32	39	44	45	55	63	64	64	60	49	42	36

TABLE 3A

30 INCH DEPTH

. AVERAGE MONTHLY LOW TEMPERATURE

MONTH

SITE	ELEV.	1	2	3	4	5	6	7	8	9	10	11	12
24	488	60	62	67	74	89	98	99	98	90	80	76	69
6	730	61	61	65	77	87	97	100	97	90	83	75	68
1	994	58	63	64	75	84	99	96	96	91	79	72	67
16	1188	57	60	61	71	86	96	97	95	86	76	72	61
3	3209	53	59	62	75	84	86	88	92	80	77	65	59
4	4186	49	52	59	62	76	80	80	80	76	74	60	53
10	4897	47	50	50	56	70	82	82	81	74	66	63	51
7	5138	40	44	48	61	69	80	80	80	73	64	60	51
19	6184	39	41	45	53	57	75	77	77	71	62	57	48
5	6384	36	38	41	45	54	66	69	71	70	61	54	41
29	6496	34	38	44	46	59	70	68	70	67	53	48	38
14	6958	35	39	44	45	51	64	64	70	64	52	45	37
36	6958	34	40	43	46	51	60	63	65	63	49	46	38
33	8063	33	39	42	46	51	61	61	63	62	49	41	36

Appendix D

Moisture Readings Over Time at
Various Depths

TABLE D-1

Site	Oven Dry % Moisture	Nuclear Volume % Moisture
2	3.5	13.0
2	3.2	12.5
2	3.3	12.5
2	6.1	13.5
2	6.2	17.5
2	5.7	17.5
2	4.9	15.0
2	3.0	7.0
2	2.2	6.0
2	3.8	10.8
2	1.9	5.0
2	2.5	6.8
2	6.2	18.3
2	3.6	8.3
2	3.6	4.8
2	2.3	5.3
2	2.0	5.0
2	1.9	5.0
2	3.5	10.8
9	8.9	22.5
9	6.9	24.3
9	9.3	20.8
9	15.2	30.8
9	14.7	32.3
9	14.8	31.3
9	11.7	22.0
9	13.0	27.8
9	11.8	26.5
9	12.2	22.5
9	10.9	25.3
9	6.1	20.0
9	11.8	26.0
9	14.1	29.8
9	14.0	27.5
9	4.3	13.0
9	4.4	11.0
9	2.7	8.5
9	3.3	10.0
9	2.8	13.8
20	10.9	22.3
20	8.2	23.0
20	7.5	25.5
20	11.4	33.5
20	8.9	12.3
20	5.1	9.0
20	8.0	25.8
20	14.3	30.8
20	7.8	13.5
20	5.5	9.0
20	6.4	11.3
20	3.6	5.8
20	2.2	7.8
20	2.5	3.3
27	3.9	10.3
27	4.2	10.8
27	7.3	17.0
27	6.0	17.3
27	8.0	24.5
27	15.3	30.3
27	7.3	20.3
27	4.1	10.8
27	7.3	19.3
27	3.5	10.0
27	17.9	22.3
27	8.1	19.0
27	7.2	13.8
27	8.7	14.3
27	7.6	15.3
27	6.5	9.5
27	5.2	17.3
25	5.3	17.3
25	7.7	12.5
25	6.2	17.3
25	7.0	16.8
25	8.3	16.3
25	8.1	20.5
25	7.5	16.8

TABLE D-1

Site	Oven Dry % Moisture	Nuclear Volume % Moisture
25	10.6	24.0
25	7.9	15.0
25	6.2	19.5
25	7.6	15.3
25	8.5	21.8
25	7.2	15.0
25	6.7	17.8
25	2.3	7.5
25	3.9	12.3
25	5.9	12.3
25	6.5	16.5
25	7.3	22.5
37	2.0	7.5
37	1.8	11.5
37	2.2	15.5
37	3.0	14.8
37	4.1	11.3
37	2.9	8.3
37	3.0	8.5
37	2.3	14.0
37	3.9	11.0
37	3.0	7.0
37	6.3	11.5
37	6.7	17.5
37	6.3	16.8
37	5.0	8.3
21	4.1	18.3
21	4.8	16.0
21	17.8	35.3
21	13.2	34.0
21	18.3	33.8
21	6.4	18.5
21	17.5	33.8
21	15.2	32.8
21	14.1	25.3
21	17.2	38.3
21	10.0	24.0
21	9.1	22.5
21	7.6	19.8
22	2.5	10.3
22	15.7	33.3
22	16.4	20.5
22	13.3	26.5
22	17.7	34.3
22	18.0	35.3
22	18.4	36.8
22	20.7	31.8
22	19.6	33.8
22	19.2	34.5
22	13.3	26.5
22	15.8	31.5
22	12.3	32.8
22	11.9	32.5
26	14.8	29.0
26	17.1	37.3
26	14.3	31.3
26	8.7	29.0
26	16.1	32.3
26	16.7	33.8
26	12.8	31.3
30	16.4	25.0
30	21.9	39.8
30	31.5	36.8
30	22.6	36.5
30	23.0	36.3
30	23.9	37.8
30	25.0	40.8
30	24.4	37.5
30	24.8	38.3
30	25.9	39.0
30	22.5	40.5

TABLE D-1

Site	Oven Dry % Moisture	Nuclear Volume % Moisture	Site	Oven Dry % Moisture	Nuclear Volume % Moisture
30	28.4	41.0	23	25.8	48.3
30	28.4	41.0	23	25.9	45.5
30	28.3	43.3	23	23.2	46.0
15	12.7	24.3	23	22.7	42.5
15	24.5	39.0	23	41.3	42.3
15	18.2	36.8	23	22.1	49.3
15	17.9	31.0	28	26.8	33.3
15	16.8	36.0	28	29.9	45.5
15	17.2	41.3	28	24.3	36.5
15	16.5	37.5	28	34.5	33.3
15	13.4	38.0	28	29.0	36.0
15	16.5	32.0	28	28.2	33.5
15	18.5	35.3	28	33.3	40.5
15	11.3	28.3	28	32.6	40.3
15	12.9	31.3	28	28.6	28.8
15	16.8	35.8	28	26.3	44.8
15	12.3	20.8	28	25.2	40.0
15	11.1	27.0	8	17.8	27.5
15	13.4	30.5	8	17.2	28.0
15	14.7	43.8	8	16.5	30.0
15	24.2	44.0	8	6.0	18.0
35	29.4	37.5	8	19.5	29.5
35	38.3	39.3	8	20.5	27.0
35	44.9	42.3	8	21.7	31.0
35	23.5	31.0	8	17.3	29.8
35	21.5	40.5	8	18.0	26.5
23	19.3	34.0	8	19.7	26.8
23	16.4	29.8	8	24.6	28.8
23	15.7	30.0	8	28.9	34.5
23	13.3	29.8	8	9.0	18.5
23	14.1	32.8	8	10.8	28.3
23	13.0	42.0	8	6.0	25.5
23	16.7	28.5	8	5.4	26.0
23	24.0	47.5	31	19.3	29.4
23	21.6	44.8	31	5.2	21.2
23	37.3	30.8	31	7.4	32.3

TABLE D-1

Site	Oven Dry % Moisture	Nuclear Volume % Moisture	Site	Oven Dry % Moisture	Nuclear Volume % Moisture
31	6.1	34.3	32	21.0	16.5
31	14.2	37.6	32	21.4	15.5
31	6.9	31.6	32	29.9	20.0
31	7.7	27.4	32	28.8	25.4
31	5.9	33.3	32	29.4	30.5
31	5.2	35.3	32	30.9	28.5
31	9.6	37.2	32	32.8	28.4
34	1.8	16.8	32	33.8	28.5
34	4.5	16.5	32	23.2	33.5
34	3.4	16.3	32	23.5	22.5
34	3.5	17.0	32	29.3	31.3
34	3.0	16.8	32	24.2	14.0
34	3.9	13.8	32	27.8	18.8
34	3.1	16.3	32	25.3	18.8
34	3.0	16.9			
34	2.8	16.4			

TABLE D-2

Site	Date Sampled	Actual Oven Dry % Moisture	% Moisture Calculated From Nuclear
2	3/1974	4.6	4.3
2	3/1974	4.1	5.8
2	3/1974	4.8	5.8
2	7/1977	2.9	1.6
2	11/1977	5.2	3.3
9	10/1976	14.9	14.2
9	3/1974	19.8	11.2
9	3/1974	19.4	13.7
9	3/1974	17.0	13.7
9	7/1977	2.5	3.7
9	11/1977	3.9	5.9
37	10/1976	9.6	12.0
37	3/1975	13.5	12.6
37	3/1975	6.0	4.7
37	6/1977	9.0	9.8
37	11/1977	10.3	9.6
32	4/1977	35.9	37.3
22	3/1974	3.4	19.1
22	3/1974	18.5	22.7
22	3/1974	13.9	19.1
22	3/1974	21.9	22.7
8	5/1976	7.4	9.5
8	3/1974	22.8	16.0
8	3/1974	17.0	13.2
28	5/1976	28.6	26.0
28	3/1974	35.8	25.1
28	3/1974	27.5	30.0
28	3/1974	33.3	25.1
28	3/1974	24.8	30.0
28	3/1974	12.7	25.1
28	3/1974	15.4	25.1
25	10/1976	9.0	7.0
25	3/1974	8.9	8.3
25	3/1974	12.3	8.4
25	3/1974	14.2	8.3
25	3/1974	16.1	8.4
25	3/1977	3.1	2.4

Site	Date Sampled	Actual Oven Dry % Moisture	% Moisture Calculated From Nuclear
34	6/1977	5.6	3.6
34	11/1977	8.8	3.0
30	3/1974	33.5	32.3
30	11/1977	16.6	22.3
30	3/1974	40.8	25.2
30	3/1974	33.9	32.3
30	3/1974	40.4	25.2
30	7/1977	21.1	22.2
27	10/1976	10.3	6.7
27	3/1974	12.3	8.2
27	3/1974	10.5	16.0
27	3/1974	10.4	16.0
21	4/1976	4.3	4.9
21	4/1976	15.5	18.6
21	6/1977	8.4	6.9
21	11/1977	9.9	7.0
21	4/1976	4.3	4.9
21	4/1976	15.5	18.6
21	6/1977	8.4	6.9
21	11/1977	9.9	7.0
20	10/1976	9.6	13.1
20	3/1974	9.2	9.8
20	3/1974	18.0	12.9
20	3/1974	10.0	9.8
20	3/1974	20.4	12.9
20	7/1977	7.1	6.4
20	11/1977	9.8	6.8
17	4/1977	14.9	21.6
18	4/1977	17.6	16.7
12	4/1977	14.5	11.3
13	4/1977	19.1	10.8

TABLE 4D

2-FOOT DEPTH SUBGRADE - WEIGHT PERCENT MOISTURE, UNCOVERED SOIL

SITE NUMBER

Year	Month	37	25	32	11	27	21	12	13	17	18	20	34	9	2	15	30	31	22	8	23	32	34	31
1973	10																			6.0*	13.3*			
	11															12.3*								
	12		2.3*			8.7*	6.4*							4.3*	2.4*	22.6*			13.3*					
1974	1																							
	2											6.4*												
	3		2.3			9.5	6.3					6.8		6.5	2.8	14.7	23.3		17.4	6.9	16.9			
	4	6.3*		29.9*									3.9*					6.9*				21.4*	1.8*	19.3*
	5																							
	6		2.5			9.1	6.5					6.6		3.8	2.2	12.5	22.4		13.7	6.3	14.7			
	7																							
	8	7.5	2.5	35.8		9.3	6.9	7.8*	8.4*	4.8*			3.6	4.7	3.6	12.2	21.9	7.1	16.2			22.8	2.0	18.9
	9																			5.4	15.6			
	10		2.4			9.4	6.6	9.1					3.8			12.1	21.1	7.2	14.1	6.0	15.9		2.1	19.4
	11			36.7					10.4	9.8				6.5	4.2							22.5		
	12		2.8			9.4	6.7						5.1	10.1	3.0	13.7	23.1	8.2	16.5				2.2	19.9
1975	1																							
	2		2.8	35.5		9.4	6.7	8.6	9.3	8.8			4.1	8.8	3.2	13.0	22.8	8.0	15.1	7.4	17.7	20.6	2.1	19.8
	3	7.4		34.5				9.3	9.9	9.9										8.2	17.6	20.7		
	4	7:4	2.7				6.8						3.8	6.0	2.7	13.3	22.7	7.7	17.8				2.0	21.2
	5			35.1																		20.9		
	6	7.2	2.6	34.8		9.3	6.7	8.1	9.1			6.9	3.7	3.6		12.2	21.4	6.6	13.6	8.2	17.6	20.7	2.1	20.1
	7							7.3	8.8	7.3														
	8	7.0	2.4			12.0	6.6					6.8	4.0	3.6	1.9	12.0	20.9	7.2	13.1	6.5	16.5		1.8	20.7
	9			35.9				6.9	9.2	6.8												21.6		
	10			36.4		10.8		6.6	9.0	5.3	15.4	6.5	3.2	3.3	2.4				13.4		14.0	21.2	2.0	
	11	7.6	2.7													12.4		6.0						
	12	8.4	1.9			11.7		7.2	10.7	4.7	16.0	6.4	2.9	2.5		13.3		6.8	17.5				2.1	20.9
1976	1			37.0				8.3	10.1	8.2	16.5									8.7		21.6		
	2	8.8	2.5										6.8			16.7		9.0					2.2	
	3					11.2		8.4	9.8	8.1	17.0	9.7		5.5	2.2									
	4			37.0				8.4	10.0	8.5	16.5		4.0									21.6	2.0	
	5		2.5					8.1	9.8	7.3	16.4					17.2				10.4				
	6			36.3		9.8		7.2	9.0	5.3	16.6			3.7	1.6							21.4		
	7			35.9				7.4	9.7	4.7	16.7											22.0		
	8																							
	9	8.2	2.1			9.0						10.9	3.6	6.4	2.2	12.5	21.9	6.1					2.9	19.7
	10		5.1			9.5		7.0	9.0	3.7	16.5	9.8		5.5	2.1					5.1				
	11																							
	12			36.4				7.3	8.9	3.7	16.6											21.7		
1977																								
	1	9.1	2.6																					
	2					11.2						7.4	5.6	12.2	4.0		23.6	6.9					2.7	20.0
	3			37.6				8.8	10.3	7.8	17.2									6.6		22.7		
	4			37.3				8.9	10.8	7.3	16.4											22.3		
	5																							
	6	9.8	2.4	37.0				6.8	9.0	3.9	15.9		3.6				22.2	7.2				22.1	2.4	
	7											6.4		3.7	1.6									
	8			36.7				7.0	9.3	6.5	15.3											22.0		
	9																							
	10			38.2				7.3	9.3	4.9	15.4											22.5		
	11	9.6	2.5			9.5						6.8	3.0	5.9	3.3		22.3	6.5					1.9	
	12			37.5				7.6	10.0	6.2	15.3											22.7		
1978	1																							
	2																							
	3			38.1																		23.4		
	4	9.8	2.4			11.9		10.2	11.0	9.9	16.4	6.8	8.1	5.4	2.5		23.7	9.2					4.2	
	5																							
	6																			6.7				
Avg.		8.2	2.6	36.2		10.0	6.6	7.9	9.6	6.7	16.2	7.4	4.3	5.6	2.7	13.3	22.4	7.3	15.1	7.1	16.0	21.8	2.3	20.0
Range		2.5	3.2	8.3		3.3	.6	3.6	2.6	6.2	1.9	4.5	5.2	9.7	2.6	5.2	2.8	3.2	4.7	3.6	4.4	2.8	2.4	3.3
Std Dev.		1.2	.6	1.8		1.1	.2	.9	.7	2.0	.6	1.5	1.4	2.4	.8	1.6	.9	.9	1.8	1.5	1.6	.8	.6	.7

TABLE 4D

4-FOOT DEPTH SUBGRADE - WEIGHT PERCENT MOISTURE, UNCOVERED SOIL

SITE NUMBER

Year	Month	37	25	32	11	27	21	12	13	17	18	20	34	9	2	15	30	31	22	8	23	32	34	31
1973	10																			9.0*	14.1*			
	11															11.1*	22.5*							
	12		3.9*			7.6*	9.1*							4.4*	2.0*				15.8*					
1974	1																							
	2											3.6*												
	3		3.9			8.1	9.0					3.8		5.0	2.1	9.1	23.5		18.7	9.0	16.1			
	4	6.7*		30.9									3.1*					7.7*				29.4	4.5	5.2
	5																							
	6		3.8			8.0	9.2					3.8		4.5	1.9	9.5	23.0		16.1	9.0	15.1			
	7																							
	8	8.6	3.9	32.9		8.0	9.0	5.6	8.8	16.2			3.5	4.7	3.2	9.3	23.1	7.9	17.8			29.0	4.7	5.2
	9																			9.2	14.1			
	10		4.0			8.2	9.0						3.0			9.1	22.7	7.9	16.1	8.4	14.6			
	11			33.6				4.9	9.6	16.5				4.7	2.0							28.7	4.8	5.2
	12		3.8			8.1	9.0						3.2	4.7	2.0	9.0	23.1	7.9	17.9				4.8	5.2
1975	1																							
	2		3.9	33.2		8.2	3.9	3.8	10.5	16.5			3.1	4.3	2.1	9.0	23.1	7.9	17.0	8.4	17.1	30.7	4.8	5.2
	3	7.5		33.2				3.9	10.5	14.6										8.5	17.4	30.5		
	4	6.3	3.9			8.1	9.0						3.0	4.8	1.9	8.9	22.8	7.9	19.1				4.7	5.3
	5			33.4																8.6	17.5	30.7		
	6	7.6	3.9	33.4		8.1	8.9	4.6	10.8			3.8	3.0	4.8		9.2	22.8	8.0	15.4			31.1	4.8	5.5
	7							4.3	10.4	16.4														
	8	7.6	3.8			11.1	9.3					3.7	3.0	4.4	1.6	9.1	22.8	7.8	15.2	8.4	16.7		5.2	5.6
	9			33.8				5.2	10.4	16.7												30.7		
	10			35.5		10.2		3.5	10.4	16.5	13.2	3.7	2.8	4.7	1.9						14.8	31.0	4.7	
	11	7.8	3.9				9.1									9.2		8.0	15.1					
	12	8.9	3.7			9.9	9.3	3.7	10.3	15.9	14.2	3.5	2.9	3.6		9.5		8.8	18.6				5.0	5.8
1976	1			34.7				4.0	10.2	17.5	13.7									9.0		30.6	4.9	
	2	9.5	3.8				9.3						3.3		1.6	9.2		9.0						
	3					9.7	9.0	3.9	9.8	16.5	13.4	5.1		4.4										
	4			34.4			9.0	3.8	9.9	16.5	14.0		3.1									30.8	4.9	
	5		3.9					3.8	10.0	16.4	13.2					9.6				9.4				
	6			34.1		8.0		3.9	9.9	16.6	13.7			4.4	1.4							30.8		
	7			33.9				4.0	9.9	17.0	13.9													
	8																							
	9	9.0	3.3			7.4	8.9					3.6	3.0	4.6	1.8	9.6	23.2	8.4					4.9	5.7
	10		3.7			7.9		3.7	9.7	15.2	13.6	3.5		4.4	1.7					7.5				
	11																							
	12			33.5				3.9	9.2	14.5	13.8											30.5		
1977	1	9.8	3.7			7.7																		
	2						8.7					3.5	3.0	4.7	3.4		22.0	6.1					4.8	7.5
	3			34.9				3.6	9.9	16.8	14.5									8.9				
	4			35.0				3.6	9.6	16.1	13.4											30.7		
	5																							
	6	9.8	3.5	34.4			9.2	5.9	9.8	15.4	13.4		3.0				23.3	8.7				30.8	4.9	
	7											3.5		4.6	1.5									
	8			34.4				3.5	7.5	16.4	12.9											31.6		
	9																							
	10			36.2			8.7	3.6	9.3	15.8	12.5											30.5		
	11	9.6	3.5			7.9						3.4	2.8	4.6	4.0		22.9	8.0					4.8	
	12			34.7				3.7	9.6	16.4	12.7											30.2		
1978	1																							
	2																							
	3			35.5																		30.8		
	4	10.9	3.6			8.0	8.7	3.7	10.2	16.4	12.8	3.4	6.7	7.9	3.5		23.8	9.8					4.9	
	5																							
	6																			7.7				
Avg.		8.5	3.8	34.0		8.4	9.0	4.1	9.8	16.2	13.5	3.7	3.3	4.7	2.2	9.4	23.0	8.1	16.9	8.6	15.8	30.5	4.8	5.6
Range		4.6	.7	5.3		3.7	.6	2.4	3.3	2.2	2.0	1.7	3.9	3.5	2.6	2.2	1.8	3.7	4.0	1.9	3.4	2.9	.7	2.5
Std Dev.		1.3	1.8	1.2		1.0	1.9	.7	.7	.7	.5	.4	.9	.8	.8	.5	.4	.8	1.5	.5	1.4	.7	.1	.7

TABLE 4D

6-FOOT DEPTH SUBGRADE - WEIGHT PERCENT MOISTURE, UNCOVERED SOIL

SITE NUMBER

Year	Month	37	25	32	11	27	21	12	13	17	18	20	34	9	2	15	30	31	22	8	23	32	34	31
1973	10																			10.8*	41.3*			
	11															13.4*	28.4*							
	12		5.9			6.5*	7.6*							2.7*	1.9*				12.3*					
1974	1																							
	2											2.2*				14.2								
	3		5.9			6.7	7.6					1.2		3.4	1.8		28.3		13.9	10.5	41.2			
	4	6.3*		23.2*									3.0*					5.9*				33.8*	3.4*	7.4*
	5																							
	6		6.0			6.8	7.7					1.5		4.2	1.5	13.9	28.3		12.5	10.4	41.2			
	7																							
	8	6.7	6.1	23.3		6.8	7.7	9.5*	7.9*	17.5*			3.3	3.3	1.5	13.8	28.1	6.5	13.5			34.2	3.7	7.7
	9																			10.0	41.2			
	10		6.1			6.8	7.6						3.0			13.8	28.1	6.5	12.5	9.8	41.7		3.8	7.8
	11			22.3				11.3	8.1	17.2				3.3	1.5							34.3		
	12		5.9			6.8	7.7						3.2	3.3	1.5	13.8	28.1	6.3	13.5				3.9	7.6
1975	1																							
	2		5.9	22.5		6.7	7.6	10.4	8.7	17.2			3.1	3.3	1.5		28.0	6.2	12.9	10.4	43.0	34.1	3.8	7.5
	3	7.1		22.5				10.2	8.7	17.4						14.1				10.4	42.7	34.0		
	4	7.1	6.0			6.7	7.7						3.1	3.3	1.5	14.0	28.1	6.3					3.7	
	5			22.6																10.4	42.7	34.1		
	6	7.2	6.0	22.6		6.8	7.7	10.3	8.7			1.9	3.0	3.3		13.9	28.1	6.2				34.3	3.8	7.6
	7							10.0	8.4	16.8														
	8	6.3	6.1			6.8	7.8					2.6	3.3	2.3	1.4	14.1	28.3	6.4		10.3	42.4		3.9	7.5
	9			23.8				9.8	8.6	17.4												34.2		
	10			26.2		7.2		10.0	8.7	17.4	13.2*	2.2	2.7	3.2	1.5						40.9	34.0	3.8	
	11	7.2	6.1				7.8									13.7		6.2						
	12	7.2	5.7			7.0	8.0	10.0	8.4	16.9	13.8	1.9	3.0	1.8		14.7		7.5					4.1	9.0
1976	1			24.8				10.3	8.4	17.3	15.3									9.8		33.9		
	2	8.2	5.9				8.0						3.3			14.1		7.1					3.9	
	3					7.0	7.9	10.1	8.1	16.9	15.4	2.9		2.8	1.3									
	4			24.6			7.9	10.3	8.2	17.2	15.8		3.2							9.7		34.0	3.9	
	5		6.0					10.1	8.3	17.0	15.0					14.2								
	6			24.2		6.6		10.3	8.1	18.8	15.9			2.8	1.3							33.8		
	7			24.0				10.5	8.2	17.4	16.3											34.0		
	8																							
	9	8.3	5.3			6.2	7.9					1.9	3.0	2.9	1.3	14.0	28.4	6.7					4.0	8.4
	10	5.5				6.4		10.1	7.8	16.8	16.1	1.9		2.8	1.3					9.0				
	11																							
	12			24.2				8.8	7.6	17.2	17.2											33.5		
1977	1	9.3	5.6			6.4	7.9										28.1							
	2											2.1	3.0	2.7	1.3			6.0					3.8	8.1
	3			24.6				9.3	8.0	17.4	17.6									9.6		33.7		
	4			26.0				9.4	8.1	17.2	18.4											33.7		
	5																							
	6	9.4	5.5	24.9			8.2	8.8	8.3	16.9	18.8		3.0				28.5	7.3				33.9	4.0	
	7											2.2		2.8	1.3									
	8			24.6				9.7	8.1	16.8	17.3											33.7		
	9																							
	10			26.9			7.8	9.4	7.0	16.9	17.6											33.6		
	11	9.6	5.4			6.4						1.8	2.9	2.8	3.3		28.0	6.6						3.9
	12			25.4				9.7	9.1	16.9	17.8											33.5		
1978	1																							
	2																							
	3			26.4																		33.9		
	4	10.4	5.5			6.4	8.2	8.8	8.3	17.4	19.7	3.5	3.2	3.0	3.5		28.9	7.7		8.4				3.8
	5																							
	6																							
Avg		7.9	5.8	24.3		6.7	7.8	9.9	8.3	17.2	16.5	2.1	3.1	3.0	1.7	14.0	28.2	6.6	13.0	10.0	41.8	33.9	3.8	7.9
Range		4.1	.8	4.6		1.0	.6	2.5	1.5	2.0	6.5	2.3	.6	2.4	2.2	.8	.9	1.8	1.6	2.4	1.8	.8	.7	1.6
Std Dev		1.3	.3	1.4		.3	.2	.6	.4	.4	1.7	.6	1.6	.5	.6	.3	.2	.5	.6	.7	.8	.2	.2	.5

TABLE 4D

8-FOOT DEPTH SUBGRADE - WEIGHT PERCENT MOISTURE, UNCOVERED SOIL

SITE NUMBER

Year	Month	37	25	32	11	27	21	12	13	17	18	20	34	9	2	15	30	31	22	8	23	32	34	31
1978	10																			6.0*	22.1*			
	11															24.7*	28.4*							
	12		6.5*			5.2*								3.3*	3.5*				11.9*					
1974	1																							
	2											2.5*												
	3		6.5			5.4						2.4		2.8	4.0	24.0	29.3		13.0	6.1	22.3			
	4	5.0*		23.5*									2.8*					5.2*				27.8*	3.5*	6.1*
	5																							
	6		6.7			7.6						2.4		2.8	3.2	23.7	29.2		11.8	6.2	22.2			
	7																							
	8	5.1	6.7	22.4		5.7		8.6*	4.9*	18.4*			2.8	2.9	3.5	25.2	29.2	5.3	12.9			27.5	3.7	6.7
	9																			5.7	21.8			
	10		6.7			5.7							2.8		3.5	23.9	29.2	5.6	12.1	5.9	19.6		3.9	6.3
	11			21.7				9.1	4.1	18.3				3.2								27.5		
	12		6.5			5.5							3.1	3.0	3.3	23.8	29.2	5.5	12.8					6.5
1975	1																				23.5			
	2		6.7	20.6		5.5		8.8	4.0	19.2			2.8	2.9	3.4	24.0	29.2	5.4	23.2	6.1	22.9	26.5	3.8	6.5
	3	5.2		20.7				8.7	4.0	18.5										6.1		26.5		
	4	5.2	6.5			5.5							2.8	2.9		24.0	29.2	5.6					3.7	6.6
	5			21.3																6.0	23.5	26.6		
	6	5.2	6.7	20.7		8.1		8.6	4.0			2.9	2.8	2.9		24.0	29.3	5.3				26.5	3.8	6.6
	7							8.3	3.9	18.0										6.0	23.4			
	8	5.5	6.7			6.7							3.1	4.7	2.6	23.1	29.3	5.2					4.0	6.6
	9			20.5				8.2	4.0	18.5												26.1		
	10			21.6		5.7		8.2	4.0	18.6	12.4*		2.8	2.9	2.9						22.0	26.2	3.9	
	11	5.7	6.7													23.7		5.0						
	12	5.0	6.7			8.1		8.2	3.8	17.9	13.4		3.0	2.0		25.0		7.8					4.2	8.1
1976	1			22.1				8.4	4.0	18.4	14.1									5.7		26.4		
	2	5.6	6.7										3.1			22.5		5.8					3.9	
	3							8.3	3.7	18.2	15.2			2.9	2.9									
	4			23.1		5.5		8.2	3.9	18.3	15.6		2.8									26.9	4.0	
	5		6.7					8.2	3.8	18.2	15.3					23.9				5.6				
	6			22.5		5.5		8.4	3.9	18.6	17.1			3.0	2.6							26.8		
	7			21.8				8.4	4.0	18.5	16.8											27.0		
	8																							
	9	7.0	5.8			4.9							2.6	3.2	2.9	23.9	29.8	5.4					3.4	7.2
	10		6.2			5.2		8.3	3.9	18.0	14.5			3.0	2.9					4.7				
	11																							
	12			22.0				8.4	5.0	18.0	14.4											27.2		
1977	1	8.2	6.2			5.4									2.8									
	2												2.9	3.3			29.6	5.5					3.3	6.4
	3			22.6				8.0	4.3	18.6	18.7									5.5		27.3		
	4			23.5				8.1	4.0	18.3	17.6											27.3		
	5																							
	6	8.3	6.3	22.7				8.2	4.2	17.9	18.0		3.0				6.1					27.2		
	7													3.3	2.5									
	8			22.1				7.9	4.4	17.9	17.2											27.3		
	9																							
	10			23.6				8.0	4.7	17.7	14.8											27.6		
	11	8.8	6.1			5.5							2.8	3.5	4.6		29.5	5.5						
	12			22.7				8.2	5.7	17.9	14.4											27.5		
1978	1																							
	2																							
	3			23.2																		28.2		
	4		6.3			5.5		8.0	5.2	18.3	17.4		3.0	3.3	5.7		30.4	6.0		4.2				
	5																							
	6																							
Avg.		6.1	6.5	22.1		5.9		8.3	4.2	18.3	15.7	2.6	2.9	3.1	3.3	24.0	29.4	5.6	12.4	5.7	22.3	27.0	3.8	6.7
Range		3.8	.9	3.1		3.2		1.2	2.0	1.5	6.3	.5	.3	1.9	3.2	2.7	2.0	2.8	1.2	2.0	3.9	2.1	.9	2.0
Std Dev		1.4	.3	1.0	1.0			.3	.5	.3	1.8	.2	.1	.5	.8	.7	.4	.6	.5	.6	1.2	.6	.3	.5

TABLE 4D
10-FOOT DEPTH SUBGRADE - WEIGHT PERCENT MOISTURE, UNCOVERED SOIL
SITE NUMBER

Year	Month	37	25	32	11	27	21	12	13	17	18	20	34	9	2	15	30	31	22	8	23	32	34	31
1973	10																			5.4*	21.6*			
	11															24.2*	28.3*							
	12		7.3*			6.7*								2.8*					12.2*					
1974	1																							
	2											3.4*												
	3		7.4											2.7		24.3	28.4			5.5	21.7			
	4	1.6*		24.5*									3.0					9.6*				25.3*		14.2*
	5																							
	6													2.7			28.2			5.6	21.5			
	7																							
	8		7.3	25.0				7.2*	19.9*	17.2*			3.1	2.7		24.3	28.3	9.8				24.9		14.4
	9																			5.4	21.4			
	10		7.5										3.1			24.2	28.3	10.1		5.3	21.8			15.9
	11			25.1				7.4	21.0	17.0				2.8								24.9		
	12		7.3										3.2	2.8		24.1	28.5	10.0						14.5
1975	1																							
	2		7.3	25.8				7.3	21.1	17.1			3.1	2.5		24.2	28.2	10.0		5.3	23.0	25.4		14.4
	3			26.0				7.3	21.0	17.4										5.3	22.3	25.6		
	4		7.3										3.1	2.7		24.2		10.0						
	5			27.2																5.1	22.7	26.7		
	6		7.4	26.7				7.1	21.4				3.1	2.5		24.2	28.3	10.1				25.9		14.3
	7							6.9		17.1														
	8		7.4										3.2	2.9		24.2	28.4	9.9		5.2	22.7			14.6
	9			25.6				6.7	21.3	17.5												25.1		
	10			25.9				6.3	21.4	17.7	12.0*		2.9	2.9								25.1		
	11															24.1		9.9						
	12		7.5					6.6	21.1	17.0	12.9		3.1	2.3		24.0		11.3						15.9
1976	1			26.3				6.7	21.3	17.4	16.1									5.3		25.5		
	2		6.5										3.3			24.0		10.1			22.2			
	3							6.7	20.7	17.5	16.2			2.7										
	4			27.7				6.8	21.2	17.4	17.0		3.2									26.7		
	5		8.3					6.9	21.1	17.2	16.4					24.2				5.0				
	6			27.2				6.9	21.3	17.6	17.1			2.7								26.3		
	7			26.9				6.9	21.3	17.7	17.0											25.7		
	8																							
	9		5.3										3.1	3.6		24.1	28.7	10.8						14.9
	10		6.2					6.7	20.2	17.2	16.4			2.7						4.3				
	11																							
	12							6.8	19.8	17.4	16.4											25.8		
1977	1		5.9																					
	2												3.1	2.8			28.2	9.8						14.3
	3			26.6				6.6	20.7	17.7	17.2									4.9		26.5		
	4			27.5				6.5	20.6	17.4	16.1											26.7		
	5																							
	6		6.1	27.2				6.6	21.0	17.1	16.8						28.5	10.7				26.1		
	7													2.9										
	8			26.2				6.5	21.2	17.1	16.6											25.8		
	9			26.9																				
	10								21.2	16.9	16.6											25.9		
	11												3.0	2.7			28.4	9.9						
	12							6.7	21.4	16.8	16.4											26.2		
1978	1																							
	2																							
	3																							
	4							6.5	21.0	16.9	16.7		3.3	3.2			29.1	10.2						
	5																							
	6																			3.7				
Avg.			7.0	26.4				6.8	21.0	17.3	16.1		3.1	2.8		24.2	28.4	10.1		5.1	22.1	26.0		14.7
Range			3.0	3.2				.9	1.6	.9	5.2		.4	1.3		.3	.9	1.7		1.9	1.3	4.0		1.7
Std Dev.			.8	.9				.3	.5	.3	1.4		.1	.3		.1	.2	.4		.5	.6	.9		.6

TABLE 5D
2-FOOT DEPTH DISTRESS LANE - WEIGHT PERCENT MOISTURE UNDER PAVEMENT
SITE NUMBER

Year	Month	37	25	11	27	21	12	13	17	18	20	9	2	15	26	30	22	8	35	28	23
1973	10																	13.0*		24.3*	18.3*
	11													4.3*	13.6*						
	12		6.2*		7.3*	17.4*					9.8*	9.3*	3.5*				16.4*				
1974	1																				
	2																				
	3		8.3		8.2	18.2					9.8	11.2	4.3	4.1	16.8		19.1	13.2		25.1	20.9
	4																				
	5																				
	6		7.6		6.3	19.1					8.8	12.6	4.0	4.1	15.9		16.6	12.9		25.1	21.8
	7																				
	8		7.7	35.5	8.5	18.2	9.0*	11.3*	7.7*	7.3*	9.4	11.8	4.7	3.8	15.5		18.1				
	9																	13.2		24.8	21.1
	10		7.9		9.1	17.9					9.4			4.2	15.3		20.1	13.2			21.3
	11			36.5			8.2	12.6	8.2	8.8		12.6	5.4								
	12		7.9		8.5	18.3					9.4	12.2	4.9	5.1	14.7		18.6				
1975	1																				
	2		7.7	35.2	8.2	17.9	7.7	12.6	9.9	7.4	9.4	11.5	5.5	5.4	15.7		18.3	12.8		26.0	20.9
	3	12.6*		32.2			7.7	13.4	10.0	8.1								13.3		27.8	24.1
	4	14.0	8.0		8.9	18.2					11.4	12.1	5.4	6.3	18.3		22.4				
	5	14.0		33.8														12.9		26.1	20.6
	6	14.0	7.6	32.5	8.2	18.1	7.7	13.0			9.6	11.4		4.2	15.0		16.8				
	7						7.3	12.7	9.2	8.1											
	8	13.9	7.5		8.4	18.6					9.7	12.5	5.8	3.5	14.3		17.6	12.8		25.2	21.1
	9			33.7			7.2	12.7	9.6	8.1											
	10			33.5	8.7		7.6	12.8	9.4	9.0	9.4	11.9						13.5		24.3	21.1
	11	13.9	7.6			18.1								3.6	15.1		17.4				
	12	14.3	8.3		8.8	18.9	7.5	12.6	9.5	8.1	9.6	13.2		5.1	15.6		18.8				
1976	1			35.3			8.2	13.0	9.1	8.7								13.4		25.2	22.5
	2	14.7	7.9			20.1								5.7	15.7		18.4				
	3					18.9	8.4	12.7	9.1	8.6	10.0	12.2	6.1								
	4			36.2		18.9	8.6	13.2	9.1	9.0										27.4	
	5	14.1	7.7				8.4	13.0	9.0	8.8				6.0	15.7		18.1	14.1		26.0	23.4
	6			35.8			8.5	12.5	9.1	8.7		11.4	5.8								
	7			35.0			8.3	13.0	8.9	9.1											
	8																				
	9	14.1	6.9			18.5					9.9	12.6	6.4	3.5	14.7		20.3				
	10		7.6				7.9	12.4	8.3	9.1	9.8	12.9	6.2					12.1		26.5	21.0
	11																				
	12			33.6			8.4	12.1	8.7	9.7											
1977	1	14.6	7.9												15.9		18.6				
	2					18.7					10.2	13.1	6.5	5.0							
	3			36.7			9.5	12.9	8.4	9.6								14.5		24.5	22.4
	4			36.0			8.9	12.9	8.6	9.0											
	5																				
	6	14.4	7.6	35.3		19.1	8.6	12.5	8.4	9.2					15.9		16.0			26.5	
	7										10.0	12.1	6.3	3.3							
	8			34.6			9.3	12.7	7.9	9.1										27.4	22.1
	9																				
	10			35.5		18.5	9.5	12.4	8.2	9.4										25.9	22.1
	11	14.5	7.5								9.7	12.9	6.2	3.0	12.0		17.5				
	12			36.7			9.7	13.0	8.0	9.4											
1978	1																				
	2																				
	3			36.5																	23.4
	4	15.2	8.0			18.7	9.7	12.9	8.1	9.5	10.2	11.9	6.5	6.3	15.1		17.6				
	5																				
	6																	11.3		25.1	21.9
Avg.		14.2	7.7	35.0	8.4	18.5	8.4	12.7	8.8	8.8	9.8	12.1	5.5	4.6	15.3		18.2	13.1		25.7	21.6
Range		2.6	2.1	4.5	1.8	2.7	3.5	2.1	2.3	2.4	2.6	2.9	3.0	3.3	6.3		6.4	3.1		3.5	5.1
Std Dev.		.6	.5	1.4	.5	.6	.8	.4	.6	.7	.5	.9	.9	1.0	1.3		1.5	.7		1.1	1.3

TABLE 5D

4-FOOT DEPTH DISTRESS LAND - WEIGHT PERCENT MOISTURE UNDER PAVEMENT

SITE NUMBER

Year	Month	37	25	11	27	21	12	13	17	18	20	9	2	15	26	30	22	8	35	28	23
1973	10																	16.5*	28.2*		15.7*
	11													17.9*	16.1*						
	12		8.1*		15.3*	18.3*					12.9*	14.8	5.8*				20.7*				
1974	1																				
	2																				
	3		8.4		16.0	19.6					12.9	13.7	5.8	17.2	18.0		17.7	16.0	30.0		16.7
	4																				
	5																				
	6		8.4		16.4	19.7					12.5	12.6	5.6	16.0	18.1		21.5	16.4	28.7		17.1
	7																				
	8		8.4	31.9*	16.2	19.5	9.6*	11.6*	15.5*	17.9*	12.8	12.8	5.8	16.6	17.9		22.2				
	9																	16.5	27.8		15.0
	10		8.4		16.4	19.4					12.8			16.3	17.3		21.7	16.1			15.6
	11			32.3			9.2	10.2	15.2	18.7		13.3	5.6								
	12		8.4		16.3	19.4					12.8	13.7	5.6	17.2	17.9		22.1				
1975	1																				
	2		8.4	32.0	16.3	19.4	9.6	9.6	13.1	18.8	12.8	13.6	6.7	17.0	17.9		21.8	15.7	30.6		18.4
	3	4.7*		36.4			9.5	10.4	13.9	19.0								16.1	31.7		18.3
	4	4.8	8.6		16.6	19.5					13.4	13.6	6.7	18.4	18.1		24.2				
	5			32.9														15.9	30.0		18.3
	6	5.4	8.5	32.4	16.4	19.5	11.0	10.2			13.1	13.6		18.0	17.5		21.6				
	7						9.0	9.4	13.9	18.7											
	8	5.5	8.3		16.0	19.6					12.8	11.9	6.3	16.9	15.6		21.6	16.1	31.8		18.0
	9			32.8			9.0	9.8	14.5	18.7											
	10			32.7	16.4		9.3	10.3	14.8	18.0	13.2	13.8						16.3	31.3		16.7
	11	6.3	8.4			19.3								16.3	14.6		21.3				
	12	5.9	8.6		16.3	20.6	9.8	10.0	14.8	18.4	12.6	14.1		18.6	15.5		22.9				
1976	1			33.0			9.6	10.9	15.0	18.6								15.6	29.3		17.1
	2	6.7	8.5			19.6								19.8	17.2		22.3				
	3				16.3	19.6	9.8	10.6	14.9	18.7	12.8	13.7	6.8								
	4			33.6		17.7	10.1	11.0	14.9	19.0									29.9		
	5		8.3				9.9	10.8	14.5	19.0				19.9	17.4		22.2	16.5	29.7		17.0
	6			33.2	16.3		10.1	10.6	15.2	18.9		13.1	7.2								
	7			32.7			9.9	10.9	14.9	19.0											
	8																				
	9	8.2	7.8		13.8	19.4					12.7	12.7	7.6	17.6	16.1		23.2				
	10		8.2		14.3		9.6	10.6	14.9	19.0	12.7	12.6	7.2					15.3	31.1		16.5
	11																				
	12			31.8			9.8	10.6	14.9	19.3											
1977	1	8.9	8.3		14.6										17.1		22.1				
	2					19.5					12.7	13.3	7.7	19.5							
	3			33.6			10.4	11.2	14.9	19.3								16.3	28.4		17.0
	4			33.5			9.9	11.2	15.1	18.7											
	5																				
	6	6.7	8.3	33.2		20.0	9.9	10.7	14.9	19.0					14.5		21.2		28.1		
	7				14.4						13.1	13.3	7.8	18.0							
	8			32.4			10.3	11.0	14.9	19.0									29.5		16.9
	9																				
	10			32.4		19.3	10.3	11.1	15.1	19.0									28.7		17.3
	11		7.9		14.0						12.6	13.5	7.5	16.4	14.3		21.6				
	12			32.9			10.5	11.8	15.2	19.0											
1978	1																				
	2																				
	3			33.3																	17.2
	4		8.6			19.5	10.8	12.4	15.9	19.2	12.9	13.7	7.8	20.5	17.7		22.2				
	5																				
	6																	15.2	28.0		16.1
Avg.		6.3	8.3	33.0	15.7	19.4	9.9	10.7	14.8	18.8	12.8	13.4	6.7	17.9	16.8		22.1	16.0	29.7		16.9
Range		4.2	.8	4.6	2.8	2.9	2.0	3.0	2.8	1.4	1.0	2.9	2.2	4.2	3.7		3.5	1.3	3.0		3.4
Std Dev.		1.4	.2	1.0	1.0	.6	.5	.7	.6	.4	.2	.6	.9	1.3	1.3		.8	.4	1.3		.9

TABLE 5D

6-FOOT DEPTH DISTRESS LANE - WEIGHT PERCENT MOISTURE UNDER PAVEMENT

SITE NUMBER

Year	Month	37	25	11	27	21	12	13	17	18	20	9	2	15	26	30	22	8	35	28	23
1973	10																	19.7*		26.3*	16.7*
	11													11.3*	16.7*						
	12		8.5*		17.9*	17.2*						11.8*	6.2*				19.6*				
1974	1																				
	2										12.1*										
	3		9.0		15.7	18.1					12.1	12.5	5.5	12.7	18.7		21.0	20.5		24.1	16.6
	4																				
	5																				
	6		9.0		16.0	17.3					12.3	12.5	4.8	12.5	18.0		20.1	20.1		25.5	17.1
	7																				
	8		9.0	28.9*	15.9	17.5	9.5*	6.2*	23.0*	11.1*	12.2	12.1	5.3	12.7			20.5				
	9																	18.8		20.9	20.2
	10		9.0		15.9	17.8					12.3			12.7	17.3		20.2	20.4			22.2
	11			30.2			10.5	5.5	21.5	13.4		12.4	5.1								
	12		9.0		15.9	17.7					12.3	12.2	5.1	12.9	17.5		19.8				
1975	1																				
	2	4.6*	9.0	29.1	15.9	17.7	10.7	7.5	21.7	14.3	12.3	12.5	5.5	12.9	17.5		19.6	21.1		22.0	18.8
	3			30.5			10.9	6.4	21.0	14.6								20.9		22.4	18.7
	4	4.6	9.0		16.2	17.7					12.4	12.6	5.3	12.8	17.5		21.6				
	5			29.7														21.1			18.4
	6	4.6	9.1	29.5	16.3	18.0	8.8	6.2			12.4	12.8		12.7	17.5		19.6				
	7						10.3	5.8	21.4	14.2											
	8	4.6	9.2		16.5	15.4					12.2	12.0	4.2	13.0	17.2		19.6	21.3		22.1	18.7
	9			29.6			10.0	5.7	22.1	14.2											
	10			29.7	16.2		10.2	5.8	22.2	14.5	12.3	12.5						20.7		21.6	17.0
	11	4.5	9.0			17.3								12.7	17.1		19.5				
	12	3.8	9.4		16.0	18.6	9.6	5.7	22.0	13.5	12.1	13.0		13.6	18.0		20.7				
1976	1			29.6			9.4	5.6	22.0	13.9								19.9		22.3	17.3
	2	4.5	8.9			17.5								13.7	17.1		20.6				
	3				16.3	17.2	9.4	5.5	21.9	13.7	12.2	12.2	5.0								
	4			30.9		17.0	9.4	5.6	22.3	14.3										23.1	17.2
	5		9.0				9.4	5.7	21.9	14.3				14.1	17.3		20.4	20.5		22.0	
	6			30.2			9.5	5.6	22.4	14.1		12.5	5.6								
	7			29.7			9.3	5.9	22.3	14.3											
	8																				
	9		8.3		14.1	16.8					12.1	11.0	4.9	13.7	17.4		20.8				
	10		8.7		14.4		9.3	5.5	22.3	13.5	12.1	11.0	4.9					19.5		22.1	19.2
	11																				
	12			23.7			8.8	5.5	22.3	13.4											
1977	1		8.9		14.4										17.4		20.3				
	2					16.2					12.1	11.9	6.0	13.4							
	3			30.9			9.4	6.1	22.1	14.3								20.2		21.3	17.1
	4			29.9			9.1	6.4	22.4	13.0											
	5																				
	6		8.9	29.9		17.2	8.8	6.4	22.4	12.8					17.4		19.8			26.7	
	7				14.7						12.4	12.5	5.0	13.0							
	8			29.5			9.5	5.8	21.9	13.7										21.9	17.2
	9																				
	10			30.4		16.3	9.4	5.7	22.1	13.3										22.7	17.6
	11		8.5		14.1						12.1	12.2	5.1	12.6	16.8		19.9				
	12			30.0			9.7	6.5	22.2	12.8											
1978	1																				
	2																				
	3			29.8																	17.7
	4		9.2			16.7	9.5	6.7	26.1	14.0	12.5	12.8	6.1	14.4	17.8		20.6				
	5																				
	6																	18.7		20.3	16.6
Avg.		4.5	8.9	29.8	15.7	17.3	9.6	6.0	22.3	13.7	12.2	12.3	5.3	13.0	17.5		20.2	20.2		22.8	18.0
Range		.8	1.1	2.2	3.8	3.2	2.1	2.0	5.1	3.3	.4	1.8	2.0	3.1	2.0		2.1	2.6		6.4	5.6
Std Dev.		.3	.3	.6	1.0	.7	.6	.5	.9	.8	.1	.5	.5	.7	.5		.6	.8		1.8	1.5

TABLE 5D

8-FOOT DEPTH DISTRESS LAND - WEIGHT PERCENT MOISTURE UNDER PAVEMENT

Year	Month	SITE NUMBER 37	25	11	27	21	12	13	17	18	20	9	2	15	26	30	22	8	35	28	23
1973	10																	24.6*		25.2*	23.2*
	11													12.9*	12.8*						
	12		7.2*		8.1*	10.0						14.1*	3.6*				19.2*				
1974	1																				
	2										6.4*										
	3		7.7		7.4	10.3					6.4	14.9	3.6	12.1	13.9		19.9	23.8		26.1	23.1
	4																				
	5																				
	6		8.0		7.6	10.3					6.3	15.3	3.4	12.3	13.6		19.6	24.3		25.7	23.4
	7																				
	8		7.9	33.4*	7.5	10.2	11.6*	10.0*	22.6*	12.0*	6.5	14.8	3.6	12.2			19.6				
	9																	24.2			23.6
	10		7.8		7.6	10.2					6.4			12.0	13.3		19.5	24.1			24.0
	11			31.5			10.9	9.9	22.5	12.2		14.9	3.5								
	12		7.8		7.6	10.2					6.6	14.8	3.5	12.0	13.3		19.7				
1975	1																				
	2		7.8	31.3	7.5	10.1	11.6	8.4	22.5	12.0	6.5	15.1	3.6	12.0	13.3		19.7	23.9			24.5
	3			30.5			11.5	8.8	22.5									24.0			24.4
	4		7.9		7.7	10.2					6.6	15.2	3.6	12.1	13.3		21.3				
	5			30.7														23.8			24.0
	6		7.9	30.5	8.1	10.3	10.9	9.4			6.6	15.3		12.1	13.3		19.8				
	7						10.7	8.8	23.1	12.1											
	8		8.2		7.4	10.0					6.2	15.3	3.2	12.2	13.5		19.8	24.2			24.3
	9			30.3			10.5	9.4	23.8	12.2											
	10			31.8	7.8		10.9	9.9	23.7		6.6	15.1						24.4			23.4
	11		7.9			10.2								12.1	13.1		19.4				
	12		7.8		7.7	10.6	11.2	9.6	23.5	11.6	6.2	15.3		13.0	14.2		20.7				
1976	1			30.6			11.4	10.1	23.4	11.9								24.1			23.9
	2		7.6			11.6								13.1	13.2		20.0				
	3				7.8	10.3	11.3	9.7	23.0	11.9	6.2	14.8	3.4								
	4					10.7	11.5	10.2	23.7	12.3											23.4
	5		7.8				11.4	10.1	23.3	12.2				13.0	13.2		20.1	24.8			
	6				8.1		11.7	10.2	23.6	12.5		14.9	3.3								
	7			31.1			11.5	10.4	23.5	12.8											
	8																				
	9		7.4		6.2	10.4					6.2	14.5	3.4	13.1	13.4		20.2				
	10		7.8		6.3		12.3	10.3	23.4	12.4	6.2	14.2	3.4					23.5			23.6
	11																				
	12			30.9			11.6	9.5	23.5	12.8											
1977	1		7.8		6.2										13.2		19.8				
	2					10.5					6.2	14.4	3.3	13.3							
	3			32.4			11.5	9.9	23.0	11.6								24.3			23.3
	4			32.0			11.3	10.3	23.4	12.2											
	5																				
	6		8.0	32.0		10.8	11.7	10.1	23.4	12.4					14.0		19.6				
	7				6.6						6.4	15.4	3.7	12.9							23.1
	8						11.7	10.4	23.1	12.2											
	9																				
	10					10.2	11.7	10.2	23.4	12.2											23.5
	11		7.6		5.6						6.0	15.1	3.8	12.6	13.5		19.3				
	12						11.8	10.7	23.2	12.2											
1978	1																				
	2																				
	3																				
	4		8.1			10.6	12.1	10.1	26.5	12.3	6.3	15.8	5.1	14.8			20.2				
	5																				
	6																	23.3			22.7
Avg.			7.8	31.4	7.3	10.4	11.4	9.9	23.4	12.2	6.4	15.0	3.6	12.6	13.4		19.9	24.1			23.7
Range			1.0	3.1	2.5	1.6	1.6	2.3	4.0	1.2	.6	2.2	1.9	2.8	1.4		2.1	1.5			1.8
Std Dev.			.2	.9	.7	.4	.4	.6	.8	.3	.2	.5	.4	.6	.3		.5	.4			.4

TABLE 5D

10-FOOT DEPTH DISTRESS LANE - WEIGHT PERCENT MOISTURE UNDER PAVEMENT

SITE NUMBER

Year	Month	37	25	11	27	21	12	13	17	18	20	9	2	15	26	30	22	8	35	28	23
1973	10																	28.9*		25.6*	22.7*
	11													16.8*							
	12		6.7*		7.2*							14.0*	3.6*								
1974	1																				
	2																				
	3		6.9		7.1							14.7	3.8	16.8				28.5		25.6	22.6
	4																				
	5																				
	6		7.0		7.3							14.6	3.8	16.9				28.7		24.9	22.7
	7																				
	8		7.0	32.0*	7.2		14.7*	13.5*	22.0*			14.1	3.8	17.0							
	9																	28.6			22.5
	10		6.9		7.3									16.6				28.7			23.0
	11			32.3			14.7	13.8	22.5			14.4	3.7								
	12		6.9		7.3							14.0	3.8	16.8							
1975	1																				
	2		6.9	31.7	7.2		14.8	13.5	22.5			14.3	3.8	17.0				28.8			23.8
	3			31.8			15.3	12.5	22.6									29.0			24.0
	4		6.9		7.2							14.4	3.8	16.9							
	5			32.2														28.8			23.0
	6		7.1	32.0	7.4		15.2	14.0				14.6		16.8							
	7						15.0	13.8	22.0												
	8		6.9		7.4							14.8	3.6	16.9				29.2			24.1
	9			31.9			15.5	14.6	23.3												
	10			32.2	7.4		15.8	14.5	23.5			14.7						28.6			22.9
	11		7.0											16.9							
	12		6.9		7.3		16.0	13.9	23.1			15.4		17.8							
1976	1						15.9	13.8	22.9									27.7			23.2
	2		6.8											17.1							
	3				7.3		16.1	13.6	22.7			14.4	3.7								
	4						16.2	14.0	23.4												
	5		6.8				16.1	13.9	23.0					17.0				28.9			23.0
	6				7.5		16.3	14.1	23.4			14.6	3.6								
	7			31.8			16.3	14.7	23.2												
	8																				
	9		6.3		6.8							15.1	3.6	16.9							
	10		6.8		6.9		16.4	14.7	23.1			13.8	3.6					28.0			22.8
	11																				
	12			30.9			16.5	13.4	23.2												
1977	1		6.8		6.7																
	2											14.3	3.6	17.0							
	3			32.3			16.3	13.8	22.8									28.6			22.8
	4			32.2			16.0	14.1	23.1												
	5																				
	6		6.9	31.8			16.5	14.2	23.1												
	7				7.0							15.0	3.6	16.4							
	8						16.7	15.3	23.0												22.5
	9																				
	10						16.7	14.5	23.0												23.0
	11		6.9		6.3							14.7	3.7	16.8							
	12						16.9	14.7	22.9												
1978	1																				
	2																				
	3																				23.1
	4		6.9				17.9	13.5	25.6			15.8	4.4	18.4							
	5																				
	6																	27.8			22.2
Avg.			6.8	31.9	7.1		16.0	14.0	23.0			14.6	3.7	17.0				28.6			23.0
Range			.8	1.4	1.2		3.2	2.8	3.6			2.0	.8	2.0				1.3			1.9
Std Dev.			.2	.4	.3		.8	.6	.7			.5	.2	.4				.4			.5

TABLE 6D

0-4" DEPTH SENSOR IN AC OR PCCP - WEIGHT PERCENT MOISTURE UNDER PAVEMENT

SITE NUMBER

Year	Month	24	6	10	1	16	19	4	7	3	5	29	33	36	14
1973	10														
	11														
	12														
1974	1				.1										
	2														
	3														
	4														
	5														
	6														
	7														
	8														
	9														
	10														
	11													.6	
	12													.5	
1975	1								1.2	1.0				.3	
	2									1.2				.2	
	3			.1											
	4		.4						.8	.9				.3	
	5													.2	
	6								.7					.5	
	7		.6	.3								.2		.6	.3
	8											.1			
	9														
	10												.1		
	11			.7								.1		.6	
	12	.1							.8			.2		.5	.3
1976	1									.8			.1		
	2														
	3	.4							1.5			.4		.6	.6
	4		.8							.8		.6	.1		
	5		1.0							.7					
	6	.6							.7			.6	.1	.8	.3
	7		.8							.8					
	8	.4	.7						.9	.7				.7	
	9		.8												
	10									.8			.1		
	11	.1	.7						.8						
	12		.7							.7			.1		
1977	1									.7					
	2												.2		
	3														
	4														
	5	.1	.7						.9					.6	
	6									.7			.1		
	7														
	8	.6	.7						.8					.6	.8
	9														
	10														
	11									.7					
	12								1.3						
1978	1		.7										.1		
	2									.7					
	3												.1		
	4	.6							1.2			.7			.7
	5														
	6														
Avg.		.4	.7	.4	.1				1.0	.8		.3	1.1	.5	.5
Range		.5	.6	.6	--				.7	.5		.5	.1	.5	.5
Std Dev.		.2	.1	.3	--				.3	.1		.2	.0	.2	.2

TABLE 6D
5-10" DEPTH SENSOR IN BASE COURSE - WEIGHT PERCENT MOISTURE UNDER PAVEMENT

SITE NUMBER

Year	Month	24	6	10	1	16	19	4	7	3	5	29	33	36	14
1973	10														
	11														
	12														
1974	1	2.6	4.4		2.2	3.7			11.7*	3.3*	13.8*				
	2							5.7							
	3						14.8					10.2			
	4														
	5														
	6														
	7														
	8												16.9		
	9														
	10														
	11													12.8	
	12											8.7		12.8	
1975	1														
	2							2.7			8.6			13.8	
	3				2.0									13.8	
	4								10.1		15.0			13.8	
	5													13.8	
	6								9.8			8.4		13.8	
	7						11.3					9.4	16.5	13.3	13.3
	8														
	9														
	10										14.8		15.0		
	11											7.8		8.2	12.8
	12								9.6					10.0	12.4
1976	1									2.5	11.5				
	2														
	3	3.3							9.8		13.0	8.0		12.9	13.2
	4									2.4			15.8		
	5									2.5		10.4			
	6	3.1						5.4	10.1		12.1	10.4	17.5	12.6	10.0
	7			3.6						2.3					12.8
	8	2.8							10.6	2.6	12.3		16.0	12.4	
	9							6.2							
	10	3.8						3.5		2.7	13.0				
	11	3.8	4.4						9.8						
	12							4.6		2.3					
1977	1	3.3								2.6					
	2										10.0		15.2		
	3														
	4														
	5	3.4						5.2	10.6					10.7	
	6									2.2	12.2		15.8		
	7							5.2							
	8	3.4							11.6					14.0	15.0
	9														
	10								12.7						
	11							3.5		2.5					
	12								10.6						
1978	1							2.7							
	2									2.5					
	3										12.3	10.0	18.0		
	4	4.7						4.6	10.6						13.4
	5														
	6														
Avg.		3.5	4.4	3.6	2.1	3.7	13.1	4.5	10.6	2.5	12.4	9.2	16.3	12.7	12.9
Range		2.1			.2		3.5	3.5	3.1	1.1	6.4	2.6	3.0	5.8	5.0
Std Dev.		.6			.1		2.5	1.2	.9	.3	1.9	1.1	1.0	1.7	1.4

TABLE 6D

11-17" DEPTH SENSOR IN BASE COURSE - WEIGHT PERCENT MOISTURE UNDER PAVEMENT

Year	Month	24	6	10	1	16	19	4	7	3	5	29	33	36	14
		SITE NUMBER													
1973	10														
	11														
	12														
1974	1	2.6	5.0		11.1	4.0			12.3*	3.4*	8.6*				
	2							6.4							
	3						6.2					10.5			
	4														
	5														
	6														
	7														
	8												11.2		
	9														
	10														
	11													19.2	
	12											11.0		17.0	
1975	1													14.4	
	2							4.5		3.5		9.7		16.9	
	3												16.4		
	4		3.0						9.0	3.6	9.0			16.4	
	5													17.0	
	6								11.6			11.0		16.6	
	7		3.0	11.6			7.0					11.5	10.1	14.5	20.6
	8														
	9														
	10										8.8		9.8		
	11											11.0		14.8	20.6
	12	3.1												13.4	21.2
1976	1									3.8	8.4				
	2														
	3	3.0							9.6		9.0	8.4		13.5	21.7
	4		5.8							4.0			10.0		
	5		6.0							3.6		9.7			
	6	3.1						6.8			9.3	9.7	10.8	13.8	21.4
	7		5.8						10.1	4.2					
	8	3.1	5.5					6.4	10.3	4.2				14.2	
	9		5.5					6.4							
	10							5.0		4.1	8.5		10.0		
	11	2.6	5.3						9.9						
	12		5.1					5.0		4.2	8.0				
1977	1	2.6								4.4					
	2										6.6				
	3														
	4														
	5	2.9	5.4					6.2	9.7						
	6									4.0			10.0		
	7							6.2							
	8	3.1	5.5						10.1						22.8
	9														
	10										8.5				
	11							5.3		4.1					
	12														
1978	1		4.9					4.5							
	2									4.8					
	3										9.3		10.8		
	4	3.3						5.6	9.8			13.5			21.0
	5														
	6														
Avg.		2.9	5.1	11.6	11.1	4.0	6.6	5.9	10.2	4.0	8.5	10.6	10.3	15.6	21.3
Range		.7	3.0				.8	4.2	3.3	1.4	2.7	5.1	1.4	5.8	2.2
Std Dev.		.3	1.0				.4	.8	1.0	.4	.8	1.4	.5	1.7	.8

TABLE 6D

18-36" DEPTH SUBGRADE - WEIGHT PERCENT MOISTURE UNDER PAVEMENT

SITE NUMBER

Year	Month	24	6	37	25	11	10	1	16	27	21	12	13	17	18	20	19
1973	10																
	11																
	12				5.3*					3.9*	4.1*					10.9*	
1974	1	3.0	4.4					12.6									
	2																
	3				7.0					4.5	5.2					12.6	6.9
	4																
	5																
	6				6.8					5.0	4.9					12.9	
	7																
	8				6.9	30.7*				5.7	4.8					13.5	
	9											11.1	10.4	9.0	8.0		
	10				7.6					7.7	4.6					13.3	
	11					31.8						11.7	12.0	11.7	8.0		
	12				7.4					6.7	5.3					13.0	
1975	1																
	2				6.9	30.8				6.2	5.5	12.2	13.0	11.8	5.3	12.9	
	3			11.9*		29.7						12.3	13.5	12.2	6.1		
	4		3.6	12.0	7.5					9.9						13.5	
	5					30.2											
	6			12.0	6.9	30.8				6.4	6.4	11.3	12.8			13.2	
	7		3.0				14.8					11.1	12.7	11.0	5.7		8.6
	8			11.9	7.0					6.5	6.1					13.3	
	9					30.7						11.9	13.6	11.1	6.0		
	10									6.5		11.6	12.5	11.2		13.2	
	11			11.8	6.7						6.0						
	12	6.0		12.0	8.2					7.3	6.7	11.3	12.6	10.9	6.1	12.9	
1976	1											11.7	12.5	11.0	6.2		
	2			11.9	7.1						6.9						
	3	5.6								7.0		11.4	12.4	10.7	6.4	13.1	
	4		4.3								6.9	11.6	12.8	11.0	6.7		
	5		4.9	11.9	7.0							11.8	12.7	10.4	6.4		
	6	6.5								6.7		11.7	12.1	10.9	7.0		
	7		4.8				12.8					12.0	12.8	10.5	7.6		
	8	6.5	4.8														7.1
	9		5.0	12.0	6.3					7.5	6.5					13.3	
	10	6.1			7.0					6.7		11.8	12.6	10.2	7.7	13.1	
	11	6.1	4.5														
	12		4.2									10.9	11.6	10.1	8.0		
1977	1	4.6		12.2	7.3					7.8	6.6						
	2															13.3	
	3											11.7	12.7	10.7	7.6		
	4											10.6	11.9	10.6	8.0		
	5	7.4	4.6														
	6			12.2	7.1						6.8	10.2	12.4	10.2	8.3		
	7									6.7						13.5	
	8	8.6	5.0									10.7	12.6	10.6	8.3		
	9																
	10										6.4	11.0	12.5	10.3	8.4		
	11			12.1	7.6					7.2						13.1	
	12											10.5	12.1	10.3	8.5		
1978	1		4.3														
	2																
	3																
	4	9.4		12.7	7.6					7.1	6.9	10.7	11.9	10.2	8.5	13.9	
	5																
	6																
	7																
	8																
Avg.		6.4	4.4	12.1	7.0	30.7	13.8	12.6	--	6.7	5.9	11.4	12.5	10.7	7.2	13.1	7.5
Range		6.4	2.0	.9	2.9	2.1	2.0	--	--	6.0	5.8	2.1	3.2	3.2	3.2	3.0	1.7
Std. Dev.		1.8	.6	.2	.6	.6	1.4	.0	--	1.3	.9	.6	.6	.7	1.0	.6	.9

SITE NUMBER

Year	Month	9	2	4	15	7	26	30	22	5	8	29	33	35	14	36	28	23
1973	10										7.4*			18.1*			24.3*	18.3*
	11				15.3*		8.2*	4.9*										
	12	8.9*	5.2*						2.5									
1974	1					18.3*				16.1								
	2			4.6*														
	3	12.9	4.9		15.8		11.8	7.5	4.4		7.7	11.0		18.8			25.1	19.0
	4																	
	5																	
	6	12.2	5.0		15.3		12.0	6.7	3.1		7.6			18.9			25.1	19.4
	7																	
	8	13.7	5.7		15.7		11.7	7.4	3.3									
	9										7.3						24.8	20.7
	10				15.4		11.0	7.0	3.3		7.6			19.0				21.0
	11	15.9	6.5													12.4		
	12	14.8	5.7		15.6		12.0	7.3	3.8			8.1				12.2		
1975	1															11.2		
	2	14.7	6.1	7.3	15.6		11.9	7.5	3.9		6.8			20.0		10.6	26.0	20.7
	3										7.8			20.0		10.6	27.8	21.0
	4	16.7	5.9		16.0	17.4	14.7	7.9	6.2	25.0						10.6		
	5										7.3			20.2		10.5	26.1	20.3
	6	14.5			15.3	17.5	11.6	7.0	3.6			7.5				11.8		
	7											7.8	7.4		10.0			
	8	15.3	6.1		15.1		10.1	7.1	3.6		7.5			19.5			25.2	20.4
	9																	
	10	15.3								21.8	8.5		6.2	20.2			24.3	19.7
	11				15.5		10.8		3.5			7.6				6.9		
	12	16.3			16.6	18.4	11.8		3.9						8.7			
1976	1									21.8	8.3			17.9			25.2	20.3
	2				16.1		11.4		4.2									
	3	12.6	5.6			19.2				24.5		9.4			8.7	7.8		
	4												6.7				27.4	
	5				16.3		11.8		4.2		9.5	11.0		19.0			26.0	20.0
	6	14.4	5.6	8.0						23.5		11.2	7.0		8.7	9.4		
	7					20.4												
	8			7.6						22.6						9.5		
	9	14.7	5.5	6.0	15.0		9.5	7.0	5.5									
	10	14.2	5.5	5.8						22.0	7.1		6.8	19.8			26.5	19.3
	11																	
	12			5.0														
1977	1					20.0	9.9		4.3									
	2	14.4	5.6		16.2			8.0		22.1								
	3										8.6			18.1			24.5	20.1
	4					20.0												
	5			6.8												7.0		
	6						9.3	7.5	4.2				6.6				26.5	
	7		5.6	6.8	15.4													
	8													18.9	10.5	9.3	27.4	19.2
	9																	
	10									22.0				19.2			25.9	20.1
	11	14.2	5.6	5.0	15.2		10.1	7.6	4.2									
	12																	
1978	1																	
	2																	
	3									26.5			7.0					20.3
	4	13.7	5.8	6.0	16.0	21.0	11.4	8.2	4.3			10.2			9.2			
	5																	
	6																	
	7													17.6			25.1	19.0
	8										6.7							
Avg.		14.2	5.5	6.4	15.7	19.0	11.1	7.2	4.0	22.5	7.7	9.3	6.8	19.1	9.3	9.9	25.7	19.9
Range		7.8	3.3	3.4	1.5	3.6	6.5	3.3	3.7	10.4	2.7	3.7	1.2	2.6	1.8	5.5	3.5	2.7
Std. Dev.		1.7	.7	1.2	.4	1.3	1.4	.8	.8	2.6	.7	1.6	.4	.8	.8	1.8	1.1	.8

TABLE 6D

4-FOOT DEPTH TRAVEL LANE - WEIGHT PERCENT MOISTURE UNDER PAVEMENT

SITE NUMBER

Year	Month	37	25	11	27	21	12	13	17	18	20	9	2	15	26	30	22	8	35	28	23
1973	10																	17.2*	29.4*	34.5*	16.4*
	11													18.2*	14.8*	31.5*					
	12		7.0*		6.0*	17.8*						15.2*	6.1*				15.7*				
1974	1																				
	2										7.5*										
	3		7.5		6.4	18.3					7.9	14.9	7.2	19.9	17.1	32.3	16.0	16.8	29.5	32.5	16.9
	4																				
	5																				
	6		7.8		6.6	18.4					8.3	13.1	7.8	19.6	15.5	32.5	15.9	17.4	29.5	35.5	16.9
	7																				
	8		7.6	28.9*	6.4	18.3	10.0*	10.2*	11.9*	18.0*	8.1	14.2	8.2	19.6	15.6	32.5	15.9				
	9																	16.8		35.2	16.6
	10		8.2		9.7	18.3					8.0			19.6	14.5	32.5	15.9	17.1	29.5		16.8
	11			29.9			10.7	9.8	11.0	18.7		14.1	8.2								
	12		8.1		8.9	18.3					8.1	14.2	7.7	19.6	15.3	32.3	15.6				
1975	1																				
	2		7.9	28.3	8.6	18.3	11.6	8.9	10.6	16.9	8.0	14.7	7.9	19.8	15.3	32.3	15.8	16.5	31.4	33.9	19.6
	3	4.8*		28.7			11.7	9.3	10.9	17.0								16.7	30.9	34.3	19.7
	4	4.7	8.1		10.4						8.2	15.1	7.8	19.9	16.9	32.6	16.2				
	5			29.3														16.4	31.1	34.1	19.5
	6	4.8	8.1	20.2	9.0	18.6	11.4	9.2			8.0	14.8	19.9	15.0	32.6	16.2					
	7						9.8	8.8	10.9	17.8											
	8	4.7	8.3		9.6	18.6					8.0	13.0	8.3	19.5	12.7	32.7	16.0	16.8	30.3	34.0	19.6
	9			29.4			12.3	10.4	11.3	18.4											
	10				8.9		11.4	9.8	11.5	19.2	8.2	14.2						17.3	31.0	33.9	17.5
	11	4.9	7.8			18.2								19.5	12.3		15.9				
	12	4.1	8.3		9.7	19.6	10.9	9.7	11.2	18.0	8.0	15.1		21.2	13.1		17.1				
1976	1						11.1	9.9	11.3	18.4								17.3	28.7	31.9	17.9
	2	4.7	8.1			18.5								19.5	13.4		16.4				
	3				9.9		10.7	10.1	11.2	18.1	8.0	13.9	7.5								
	4					18.6	10.8	10.1	11.2	18.7										32.5	
	5	4.8	8.3				11.0	10.0		18.5				19.6	13.2		16.6	17.7	29.2	32.3	17.5
	6				9.8		10.8	10.0	11.6	18.7		13.7	7.5								
	7						11.1	10.4	11.2	18.7											
	8																				
	9	5.0	7.5		8.9	18.4					8.2	14.1	9.5	19.6	12.3	32.6	16.8				
	10		8.0		9.5		10.9	10.3	10.9	18.7	8.2	13.7	9.6					16.4	29.9	33.7	17.3
	11																				
	12						10.1	9.5	10.6	18.6											
1977	1	5.9	8.4		10.1										12.3		16.2				
	2					18.3					8.2	14.2	10.4	19.5		32.3					
	3						11.9	10.1	11.1	17.8								17.3	28.8	31.0	17.7
	4						11.6	10.0	11.3	18.6											
	5																				
	6	5.0	8.3			18.8	11.7	10.4	10.9	18.7					12.4	32.8	16.5			30.7	
	7				9.8						8.6		9.2	19.7					29.3		
	8						12.2	10.4	11.2	18.8										32.1	17.3
	9																				
	10	5.1	8.2			18.2	11.9	10.4	10.9	18.7									29.6	31.3	17.7
	11				9.7						8.2	12.8	10.0	19.2	12.3	32.5	16.1				
	12						11.6	10.1	10.9	18.5											
1978	1																				
	2																				
	3																				17.7
	4	6.0	8.3		10.0	18.3	11.9	10.4	11.8	18.5	8.3	14.5	10.4	19.7	15.4	32.7	16.6				
	5																	16.6	27.8	30.6	16.5
	6																				
Avg.		5.0	8.0	29.1	8.9	18.4	11.2	9.9	11.2	18.4	8.1	14.2	8.4	19.6	14.2	32.4	16.2	17.0	29.7	33.0	17.7
Range		1.9	1.4	1.1	4.4	1.8	2.5	1.6	1.3	2.3	1.1	2.4	4.3	3.0	4.6	1.3	1.5	1.3	3.6	4.9	3.3
Std Dev.		.5	.4	.5	1.4	.4	.7	.5	.3	.5	.2	.7	1.2	.5	1.6	.3	.4	.4	1.0	1.5	1.1

TABLE 6D
6-FOOT DEPTH TRAVEL LANE - WEIGHT PERCENT MOISTURE UNDER PAVEMENT
SITE NUMBER

Year	Month	37	25	11	27	21	12	13	17	18	20	9	2	15	26	30	22	8	35	28	23
1973	10																	17.3*	38.3*	33.3*	13.0*
	11													13.4*	17.1*	24.4*					
	12		7.5*		7.3	17.5*						11.7*	4.9*				17.7*				
1974	1																				
	2										11.4*										
	3		7.7		7.0	18.2					11.5	13.1	5.1	13.9	18.8	25.2	17.8	17.2	38.5	34.5	9.9
	4																				
	5																				
	6		7.6		6.5	18.4					11.5	13.9	6.1	13.6	18.6	25.3	17.9	17.5	39.2	32.6	10.5
	7																				
	8		7.7	29.8*	7.1	18.4	13.4*	12.1*	23.4*	11.5*	11.7	13.4	6.5	13.5		25.3	17.5				
	9																	15.9		34.1	13.1
	10		8.0		8.7	18.4					11.6			13.6	17.2	25.3	17.9	17.5	39.0		13.9
	11			30.5			14.8	13.4	23.8	12.6		14.0	6.5								
	12		8.0		8.2	18.4					11.6	13.6	6.0	13.6	17.8	25.1	17.6				
1975	1																			35.4	
	2		8.0	28.4	8.2	18.4	16.4	13.3	24.3	13.3	11.5	13.5	6.2	13.6	17.8	25.0	17.6	17.3	39.0		10.6
	3	4.0		28.4			16.6	13.8	24.5	13.4								17.5	39.2	35.1	11.7
	4	3.9	8.1		9.6						11.7	13.9	6.1	13.9	18.3	25.1	17.8				
	5			28.8														17.2	39.2	35.5	11.2
	6	3.9	8.1	28.5	8.7	13.9	16.5	13.7			11.6	13.5		13.8	17.8	25.3	17.9				
	7						16.4	13.5	24.2	13.2											
	8	3.8	8.5		6.8	18.9					11.1	15.1	6.6	14.0	16.9	25.5	17.8	17.8	38.8	36.0	11.2
	9			29.3			16.9	14.2	24.5	13.2											
	10				9.1		16.4	13.3	24.6		11.6	13.8						17.5	39.8	34.7	10.3
	11	3.8	8.0			18.5								13.5	16.4		17.8				
	12	3.1	8.2		9.0	19.5	15.7	12.9	24.0	12.6	11.4	14.3		15.0	18.0		18.7				
1976	1						15.9	12.9	23.9	12.9								17.5	38.5	35.4	10.9
	2	3.8	8.0			18.9								13.6	16.9		17.9				
	3				9.3		15.7	12.6	23.6	12.7	11.3	13.4	5.8								
	4					19.3	15.9	12.7	24.2	13.2										36.0	
	5	3.8	8.1				15.9	12.9	23.6	13.2				13.8	16.9		18.3	17.8	39.2	35.8	10.5
	6				9.3		15.6	12.9	24.0	13.2		13.5	5.8								
	7						15.4	13.2	23.7	13.2											
	8																				
	9	3.9	7.6		8.5	18.4					11.5	13.4	7.8	13.8	16.2	25.3	18.0				
	10		8.1		9.0		15.0	16.1	23.5	12.5	11.4	13.4	7.9					16.8	39.9	33.5	10.2
	11																				
	12						13.8	15.0	23.4	12.2											
1977	1		8.0		9.4										16.2		17.9				
	2					18.6					11.4	13.6	8.7	13.5		25.1					
	3						14.5	15.6	23.6	11.3								17.4	38.8	32.3	10.5
	4						14.2	15.7	23.9	11.6											
	5																				
	6	3.9	8.2			19.3	14.1	15.8	24.6	11.7					16.5	25.7	18.2			37.7	
	7				9.1						11.8	13.4	7.0	13.5					39.3		
	8						15.1	15.5	23.7	12.3										32.9	10.5
	9																				
	10						15.9	15.9	23.9	11.8									39.6	33.7	10.6
	11		8.1		8.8						11.3	14.3	8.4	13.5	16.3	25.3	17.7				
	12						13.6	15.6	23.6	11.7											
1978	1																				
	2																				
	3																				10.8
	4		8.3		9.4	18.5	14.9	15.9	24.0	11.8	11.4	13.2	9.0	14.0	17.8	25.6	18.4				
	5																				
	6																	16.4	38.1	31.3	9.7
Avg.		3.8	8.0	29.1	8.5	18.6	15.4	14.1	23.9	12.5	11.5	13.6	6.7	13.7	17.3	25.2	17.9	17.3	39.0	34.4	11.1
Range		.9	1.0	2.1	3.1	2.0	3.5	4.0	1.2	1.9	.7	3.4	4.1	1.6	2.6	1.3	1.2	2.1	1.8	4.7	4.2
Std Dev.		[illegible]	.3	.8	1.0	.5	1.0	1.3	.4	.7	.2	.6	1.2	.4	.8	.3	.3	.5	.5	1.6	1.2

TABLE 6D
8-FOOT DEPTH TRAVEL LANE - WEIGHT PERCENT MOISTURE UNDER PAVEMENT
SITE NUMBER

Year	Month	37	25	11	27	21	12	13	17	18	20	9	2	15	26	30	22	8	35	28	23
1973	10																	18.0*	44.9*	32.6*	24.0*
	11													16.5*	14.3*	24.8*					
	12		10.6*		4.1*							13.0*	3.0*				18.0*				
1974	1																				
	2										8.9*										
	3		10.8	4.2							8.9	13.7	3.2	17.3	15.2	25.5	17.9	17.8	45.0		23.6
	4																				
	5																				
	6		10.8	4.4							8.9	13.6	3.2	17.4	14.8	25.6	18.1	18.0	45.6	33.8	23.7
	7																				
	8		11.1	29.7*	4.4		13.2*	9.7*	21.5*	12.0*	9.2	13.4	3.3	17.5	14.2	25.8	17.4				
	9																	18.3		34.5	23.7
	10		11.1	30.5	4.7									17.4	14.5	25.7	18.0	17.9	45.2		24.1
	11						12.7	8.7	21.7	12.2	9.1	13.8	3.2								
	12		10.8		4.6						9.2	13.7	3.2	17.3	14.5	25.5	17.8				
1975	1																				
	2		10.8	28.1	4.6		13.2	4.4	21.7	12.0	9.2	13.8	3.2	17.4	14.5	25.5	17.9	17.7	47.2	35.3	24.8
	3	3.3*		29.2			13.2	5.1	21.7									18.1	46.5	34.4	25.1
	4	3.3	10.9								9.3	14.2	3.2	17.5	14.5	25.4	18.0				
	5			29.8														17.9	47.0		24.7
	6	3.2	11.1	29.7	4.6		12.9	5.2			9.3	14.0		17.4	14.6	25.6	18.1				
	7						14.0	7.0	21.8	12.1											
	8	3.8	10.9		4.6						9.1	15.8	3.1	17.5	15.1	25.7	18.1	18.4	46.5	35.6	25.2
	9			29.7			14.1	6.8	22.3	12.2											
	10				4.3		13.0	8.2	22.3		9.3	14.2		17.3				18.2	47.1		23.7
	11	3.2	10.9												14.2		17.9				
	12	2.9	11.7		4.6		12.8	8.6	21.9	11.6	9.1	14.8		17.5	15.3		18.9				
1976	1						14.0	9.3	21.7	11.9								18.2	44.9		
	2	3.3	10.8											17.5	14.7		17.8				
	3				4.6		12.6	8.9	21.2	11.9	9.2	13.7	3.2								23.7
	4						12.7	9.6	22.0	12.3											
	5	3.4	10.9				12.8	9.8	21.4	12.2				17.5	14.3		18.3	18.5	45.3		
	6				4.8		12.7	10.2	22.1	12.5		12.5	3.2								
	7						13.1	10.4	22.0	12.8											23.6
	8																				
	9	3.5	10.6		5.1						9.1	13.9	5.1	17.5	14.3	25.7	18.0				
	10		11.1		5.9		12.8	10.5	21.7	12.4	9.1	13.4	5.2					17.5	46.1	35.3	23.8
	11																				
	12						12.3	9.3	22.6	12.8											
1977	1		11.2		6.3										14.1		17.9				
	2										8.9		7.3	17.3		25.3					23.7
	3						12.6	10.1	21.7	11.6								18.1	45.1		
	4						12.2	10.4	21.8	12.2											
	5																				
	6	3.5	11.4				12.5	10.5	21.2	12.4					14.4	26.0	18.2				
	7				6.8						9.4		4.8	17.6							
	8						13.0	10.4	21.7	12.2									45.4		23.6
	9																				
	10						13.1	10.7	21.9	12.2									45.7		23.8
	11		11.1		8.8						9.0	14.7	6.2	17.1	14.1	25.5	17.7				
	12						13.4	10.3	21.7	12.2											
1978	1																				
	2																				
	3																				23.7
	4		11.8		9.4		13.7	10.7	21.8	12.3	9.2		6.7	17.8	14.3	25.9	18.4				
	5																				
	6																	17.0			22.3
Avg.		3.3	11.1	29.5	5.3		13.0	9.0	21.8	12.2	9.1	13.9	4.1	17.4	14.5	25.6	18.0	18.0	45.8	34.5	23.9
Range		.9	1.2	2.4	5.3		1.9	6.3	1.4	1.2	.5	2.8	4.3	1.3	1.2	1.2	1.5	1.5	2.3	3.0	2.9
Std Dev.		.2	.3	.7	1.5		.5	1.9	.3	.3	.2	.7	1.4	.3	.4	.3	.3	.4	.8	1.0	.7

TABLE 6D
10-FOOT DEPTH TRAVEL LANE - WEIGHT PERCENT MOISTURE UNDER PAVEMENT
SITE NUMBER

Year	Month	37	25	11	27	21	12	13	17	18	20	9	2	15	26	30	22	8	35	28	23
1973	10																	18.7*	10.9*	32.4*	23.2*
	11													18.5*	8.7*	25.9*					
	12		7.9		7.2*						5.1*	11.8*	2.2*				18.4*				
1974	1																				
	2																				
	3		8.1		7.1						5.4	13.3		19.0		26.7	18.3	18.7	10.6		23.2
	4																				
	5																				
	6		8.1		7.3						5.6	12.8	2.4	19.1	9.1	26.6	18.4		10.8	33.8	23.2
	7																				
	8		8.2		7.2		6.8*	21.3*	21.0*		5.9	12.8	2.4	19.2		26.7	18.3				
	9																	18.6		34.5	22.9
	10		8.0		7.3						5.9			19.0			18.4		10.8		
	11						8.2	22.1	21.1			13.2	2.4								
	12		8.1		7.3						5.9	12.9	2.4	19.2		26.6	18.2				
1975	1																				
	2		8.1		7.2		8.1	21.6	21.0		5.9	13.0	2.4	19.2	8.9	26.5	18.3	18.9	13.2	36.6	24.2
	3	4.4					8.2	20.4	21.2										12.8		24.6
	4	4.3	8.2		7.2						6.0	13.5		19.3	8.9	26.6	18.3				
	5																	18.9	13.0		24.3
	6	4.3	8.3		7.4		8.1	21.8			6.0	12.8		19.3	9.1	26.7	18.3				
	7						7.8	21.6	22.1												
	8	4.4	8.1		7.4							13.2		19.3	9.2	26.0	18.3	19.7	12.6	36.1	24.6
	9						8.5	22.1	21.9												
	10				7.4		8.3	22.2	21.9		6.1	13.3						19.4	13.1	35.0	
	11	4.4	8.1											19.0	8.9		18.3				
	12	4.0	8.2		7.3		7.9	21.5	21.6		5.9	13.9		20.4	10.0			19.3			
1976	1						8.2	22.2	21.5									19.6	11.7		23.7
	2	4.2	8.1											19.2	9.0		18.0				
	3				7.3		8.0	21.9	21.2		5.9	13.0	2.3								
	4						8.1	22.3	20.6												
	5	4.3	8.4				8.1	21.7	21.2					19.3			18.4	19.5	11.5		23.0
	6				7.5		8.2	22.8	21.8			12.9	2.2								
	7						8.3	23.1	20.2												
	8																				
	9	4.4	7.7		6.8						6.0	13.9	3.8	19.2	9.3	26.9	18.3				
	10		8.4		6.9		8.4	23.0	21.3		5.9	12.8	5.0					18.6	12.5	36.0	23.2
	11																				
	12						7.7	21.6	22.4												
1977	1		8.4		6.7												18.1				
	2										5.9	13.3	5.8	19.2		26.6					
	3						9.0	22.4	21.3									19.0	11.4		23.1
	4						8.9	22.6	21.5												
	5																				
	6	4.4	8.6				9.0	22.8	21.2							26.9	18.5				
	7				7.0							14.0		19.6							23.1
	8						9.2	22.7	21.7										11.6		
	9																				
	10						9.5	22.9	21.6										12.0		23.7
	11		11.1		6.3						5.9	13.7	5.0	18.8		26.6	17.9				
	12						9.6	22.6	21.6												
1978	1																				
	2																				
	3																				
	4		9.3				10.0	23.0	21.6		6.1	14.8	5.4			26.8	18.7				
	5																				
	6																	17.8	10.3		22.3
Avg.		4.3	8.4		7.1		8.4	22.2	21.4		5.8	13.2	3.3	19.2	9.1	26.6	18.4	19.0	11.8	34.9	23.6
Range		.4	3.4		1.2		3.2	2.7	2.2		1.0	3.0	3.6	1.9	1.3	1.0	.8	1.9	2.9	4.2	2.3
Std Dev.		.1	.7		.3		.7	.7	.5		.3	.6	1.3	.4	.4	.3	.3	.5	1.0	1.5	.6

TABLE 7D
2-FOOT DEPTH PASSING LANE - WEIGHT PERCENT MOISTURE UNDER PAVEMENT

Year	Month	SITE NUMBER 37	25	11	27	21	12	13	17	18	20	9	2	15	26	30	22	8	35	28	23
1973	10																	5.6*	15.9*		16.0*
	11													12.7*		16.4*					
	12		7.7*		4.2*	4.8*						6.9*	3.3*								
1974	1																				
	2										8.2*										
	3		11.0		4.6	5.9					11.7	9.2	3.9	14.7		19.1		6.4	16.4		16.2
	4																				
	5																				
	6		10.5		4.9	5.3					12.6	10.5	4.2	14.7		17.9		5.7	16.5		17.1
	7																				
	8		10.4	20.0*	5.3	5.5	10.3*	10.8*	10.9*	8.2*	12.1	9.9	5.0	14.4		18.1					
	9																	4.6			17.4
	10		10.9		7.7	5.4					12.0			14.4		18.0		6.5	16.4		19.2
	11			20.5			11.0	11.9	8.2			11.0	5.6								
	12		10.9		6.2	6.6					12.0	10.2	4.9	14.5		18.4					
1975	1																				
	2		10.3	20.4	5.9	5.9	10.8	11.5	11.7	5.9	12.0	9.7	5.1	14.4		18.9		6.4	18.1		20.9
	3	11.2*		20.6			10.7	11.6	12.0	6.6								6.8	17.7		18.8
	4	11.8	11.5		8.2	6.1					12.3	10.2	5.3	15.3		20.2					
	5			21.0														6.3	18.3		18.9
	6	11.8	10.4	20.8	6.1	5.3	10.6	11.3			12.0	9.8		14.5		18.4					
	7						9.9	10.7	10.9	6.2											
	8	11.8	10.7		6.2	5.2					12.0	10.8	5.1	14.1		18.3		6.1	17.4		19.5
	9			20.9			10.7	11.3	11.0	6.9											
	10			20.9	6.1		10.6	11.3	11.1	5.6	11.7	9.7						6.7	17.7		17.8
	11	11.7	10.7			5.5								14.2							
	12					5.8	10.5	11.3	10.8	7.0				15.6							
1976	1			21.1			10.6	11.2	10.8	7.6								6.9	16.8		18.6
	2	12.0	10.9			6.2								14.8							
	3				6.6		10.3	10.8	10.7	7.8	11.9	10.5	4.5								
	4			21.4		6.0	10.5	11.3	11.0	7.9											
	5	11.8	10.8				10.6	10.9	10.6	8.1								7.6	16.4		18.6
	6			21.2	6.2		10.5	10.9	10.8	7.9		10.3	4.4								
	7			20.5			10.1	10.7	10.7	8.2											
	8																				
	9	11.8	9.9		5.9	5.3					12.1	11.2	4.6	14.7		19.5					
	10						10.5	11.0	10.4	8.4								5.2	16.8		18.1
	11																				
	12			19.2			9.9	10.4	10.6	8.2											
1977	1	11.9	11.2		5.8																
	2					6.0					12.1	11.2	4.9	14.8		19.5					
	3			20.4			10.0	10.4	11.1	7.8								6.6	16.4		18.5
	4						10.0	10.6	11.1	8.4											
	5																				
	6	12.8	9.9			7.5	10.2	10.8	10.4	8.4						19.2					
	7				6.4						12.5	10.5	4.7	14.8							
	8						10.6	10.7	10.7	8.6									16.4		18.4
	9																				
	10						10.5	10.9	10.8	8.5									16.6		18.9
	11																				
	12						9.9	11.0	10.2	8.2											
1978	1																				
	2																				
	3																				19.7
	4						9.3	10.9	10.5	8.4											
	5																				
	6																	4.0	14.8		18.6
Avg.		11.9	10.5	20.6	6.0	5.8	10.4	9.9	10.9	7.7	11.8	10.1	4.7	14.5		18.6		6.2	16.0		18.4
Range		1.6	3.8	2.2	4.0	3.7	1.7	1.2	1.7	3.0	4.4	4.3	2.3	2.9		3.8		3.6	3.3		4.9
Std Dev.		.4	.9	.6	1.0	.6	.4	.3	.5	.9	1.0	1.0	.6	.6		1.0		.8	.7		1.2

TABLE 7D

4- FOOT DEPTH PASSING LANE - WEIGHT PERCENT MOISTURE UNDER PAVEMENT

SITE NUMBER

Year	Month	37	25	11	27	21	12	13	17	18	20	9	2	15	26	30	22	8	35	28	23
1973	10																	17.5*	23.5*		19.3*
	11													24.5		21.9*					
	12		8.3*		8.0*	13.2*						14.7*	6.3*								
1974	1																				
	2										8.0*										
	3		8.8		8.0	13.6					8.5	13.3	6.9	24.4		22.4		17.7	23.5		20.2
	4																				
	5																				
	6		8.5		8.3	13.4					8.7	12.8	6.8	24.9		22.1		18.0	24.2		20.5
	7																				
	8		8.6	26.4	8.0	13.2	11.1*	9.6*	12.0*	18.5*	8.6	13.6	7.4	24.8		22.3					
	9																	18.0			20.3
	10		8.8		9.1	13.1					8.6			24.5		22.3		18.0	23.8		21.4
	11			27.1			11.3	8.3	10.6	18.7		13.6	7.4								
	12		8.8		8.8	13.7					8.6	13.9	7.1	24.4		22.1					
1975	1																				22.2
	2		8.9	26.6	8.7	13.6	11.0	8.8	10.4	16.9	8.6	14.0	7.4	24.3		22.5		17.6	25.2		
	3	4.4*		26.9			10.9	8.8	10.6	17.0								17.7	24.9		22.3
	4	4.5	9.1		9.7	13.8					8.7	14.0	7.3	23.6		23.1					
	5			27.5														17.4	25.0		22.1
	6	4.6	8.9	27.2	9.4	13.7	10.8	8.6			8.8	14.0		24.7		22.7					
	7						10.7	8.3	10.9	17.8											
	8	4.5	8.5		9.2	13.6					9.1	12.9	7.5	23.4		22.7		18.2	24.6		22.6
	9			27.1			10.3	8.5	10.9	18.4											
	10			27.1	9.0		10.3	8.5	11.0	19.2	8.7	14.1									21.0
	11	4.7	8.7			13.4								24.0							
	12					14.1	10.1	8.3	11.3	18.0				25.8							
1976	1						10.4	8.3	11.2	18.4								18.6	24.3		21.8
	2	4.6	8.9			13.7								24.4							
	3			27.3	9.8			8.1	11.3	18.1	8.7	13.6	7.2								
	4			27.7		13.7	10.2	8.3	11.6	18.7											
	5	4.6	9.0				10.1	8.2	11.1	18.5								18.8	23.9		22.1
	6			27.1	9.8		10.4	8.2	11.9	18.7		12.9	7.0								
	7			26.5			10.1	8.0	11.8	18.7											
	8																				
	9	4.8	8.1		9.0	13.2					8.8	13.5	7.2	24.7		22.5					
	10						10.5	9.4	11.9	18.7								17.4	24.1		21.4
	11																				
	12			26.2			10.4	7.7	11.8	18.6											
1977	1	4.8	9.0		10.0																
	2					13.3					8.8	13.6	7.0	24.6		22.3					
	3			28.0			10.1	7.8	12.5	17.8								17.4	23.9		21.7
	4						9.9	7.9	12.2	18.6											
	5						10.2														
	6	5.0	9.0			13.6		7.9	12.4	18.7						22.8					
	7				10.0						9.0	13.4	7.3	24.7							
	8						10.4	8.0	12.6	18.8									23.9		21.5
	9																				
	10						10.4	8.1	12.9	18.7									24.1		22.0
	11																				
	12						10.5	8.3	12.2	18.5											
1978	1																				
	2																				
	3																				22.8
	4						10.2	8.1	13.0	18.5											
	5																				
	6																	16.9	22.4		21.9
Avg.		4.7	8.8	27.1	9.0	13.5	10.4	8.3	11.7	18.4	8.7	13.6	7.1	24.5		22.4		17.8	24.1		21.5
Range		.6	1.0	1.8	2.0	1.0	1.4	1.9	2.6	2.3	1.1	1.9	1.2	2.4		1.2		1.4	2.8		3.5
Std Dev.		.2	.3	.5	.7	.3	.4	.5	.8	.5	.2	.5	.3	.5		.3		.5	.7		.9

TABLE 7D

6-FOOT DEPTH PASSING LANE - WEIGHT PERCENT MOISTURE UNDER PAVEMENT

SITE NUMBER

Year	Month	37	25	11	27	21	12	13	17	18	20	9	2	15	26	30	22	8	35	28	23
1973	10																	19.5*	21.5*		37.3*
	11													16.8*		23.0*					
	12		6.2*		7.3*	15.2*						12.2*	3.8*								
1974	1																				
	2										14.3*										
	3		6.3		6.1	15.7					13.7	12.6	4.3	17.3		22.9		18.8	21.4		38.1
	4																				
	5																				
	6		6.4		5.4	15.9					12.7	12.9	4.1	17.3		23.1		19.6	22.0		38.0
	7																				
	8		6.4	29.8*	6.0	15.7	14.0*	12.4*	15.2*	11.4*	13.4	12.7	4.6	17.4		23.2					
	9																	20.0			40.4
	10		6.4		8.3	15.7					13.1			17.2		23.1		19.1	22.1		43.0
	11			30.5			14.9	11.7	15.4	10.1		13.2	4.7								
	12		6.4		7.1	15.7					13.3	13.2	4.6	17.3		22.9					
1975	1																				
	2		6.5	28.4	7.0	15.7	13.6	11.7	16.0	10.7	13.4	13.0	4.8	17.2		22.9		18.8	23.7		39.8
	3	3.5*		28.4			13.5	11.9	16.0	10.3								18.6	22.9		39.9
	4	3.7	6.7		7.9	15.9					13.7	13.0	4.7	17.4		23.2					
	5			28.8														18.0	22.9		
	6	3.7	6.8	28.5	7.2	16.0	13.4	11.6			13.6	13.2		17.3		23.2					
	7						13.3	11.1	15.6	10.5											
	8	3.4	7.0		5.4	16.0					11.5	13.6	4.0	17.4		23.8		19.0	23.1		40.2
	9			29.3			13.7	11.6	16.2	10.8											
	10				7.1		13.8	11.5	16.2	11.6	12.8	12.9						19.1	23.5		38.1
	11	3.7	6.5			16.0								17.2							
	12					16.5	13.8	11.3	15.4	10.3				18.9							
1976	1						14.0	11.4	15.2	10.8								19.8	22.8		39.2
	2	3.5	6.7			15.7	14.0							17.3							
	3				7.2			11.2		10.8	13.5	12.5	4.6								
	4					15.7		11.4	15.5	12.2											
	5	3.5	6.7				14.1	11.4	15.2	12.3								19.8	22.6		39.3
	6				7.1		14.2	11.4	15.6	11.3		12.6	4.3								
	7						14.1	11.4	15.4	11.2											
	8																				
	9	3.5	6.3		6.4	15.6					12.8	13.0	4.3	17.6		23.8					
	10						14.7	11.6	15.0	11.1								18.8	23.4		37.9
	11																				
	12						14.5	11.1	15.2	10.7											
1977	1	3.5	6.8		6.8																
	2					15.5					12.6		4.3	17.3		23.4					
	3						14.5	11.4	15.6	10.1								18.8	22.8		38.8
	4						14.5	11.7	15.8	10.7											
	5																				
	6	3.6	6.8			16.0	14.8	12.2	15.9	10.5						24.0					
	7				7.1						12.8		4.4	17.7							
	8						14.9	11.5	15.7	12.7								18.6	22.6		41.9
	9																				
	10						15.1	11.6	15.5	10.9									23.0		41.0
	11																				
	12						15.7	11.9	15.1	10.6											
1978	1																				
	2																				
	3																				41.9
	4						15.9	11.8	15.6	10.6											
	5																				
	6																		21.5		37.7
Avg.		3.6	6.6	29.1	6.8	15.8	14.3	11.6	15.6	10.9	13.1	12.9	4.4	17.4		23.3		19.1	22.7		39.6
Range		.3	.8	2.1	2.9	1.3	2.6	1.3	1.2	2.6	2.8	1.4	1.0	2.1		1.1		2.0	2.3		5.7
Std Dev.		.1	.2	.8	.8	.3	.7	.3	.3	.6	.7	.4	.3	.4		.4		.6	.7		1.7

TABLE 7D

8-FOOT DEPTH PASSING LANE - WEIGHT PERCENT MOISTURE UNDER PAVEMENT

SITE NUMBER

Year	Month	37	25	11	27	21	12	13	17	18	20	9	2	15	26	30	22	8	35	28	23
1973	10																	20.5*			25.8*
	11													17.2*		23.9*					
	12		7.6*		3.5*	14.1*						10.9*	1.9*								
1974	1																				
	2										7.8*										
	3		8.4		3.7	14.6					7.7	10.4	2.5	17.9		24.0		20.8			25.7
	4																				
	5																				
	6		8.9		3.7	14.6					7.4	9.7	2.3	17.8		24.2		20.6			26.2
	7																				
	8		8.4		3.8	14.6	17.4*	12.5*	17.7*	12.1*	7.7	10.4	2.5	17.8		24.4					
	9																	19.9			25.7
	10		8.8		3.8	14.6					7.6			17.7		24.2		20.8			27.2
	11						17.3	12.1	17.6	10.8		10.5	2.7								
	12		8.6		3.8	15.2					7.6	10.5	2.6	17.9		24.0					
1975	1																				
	2		8.4		3.7	15.0	16.7	8.1	17.5	10.8	7.6	10.6	2.7	17.8		24.2		21.6			26.6
	3	4.2*					16.5	8.0	17.6	10.7								21.3			26.8
	4	4.3	9.0		3.8	15.3					7.7	10.8	2.7	18.0		24.2					
	5																	20.6			26.9
	6	4.2	8.7		3.8	15.3	16.8	8.3			7.6	10.8		17.9		24.1					
	7						16.8	8.2	17.5	11.2											
	8	4.9	10.0		3.7	15.4					7.1	8.6	2.6	17.7		24.5		21.7			27.7
	9						16.9	9.3	19.1	11.0											
	10				3.7		16.9	9.1	19.1	11.9	7.5	10.9						21.0			26.7
	11	4.6	8.6			15.2								17.5							
	12					15.9	16.8	9.7	17.6	11.5				17.9							
1976	1						16.9	10.7	17.6	10.8								21.1			26.5
	2	4.4	9.0			15.5								16.5							
	3				3.7		16.9	10.2	17.4	11.9	7.5	10.2	2.5								
	4						15.5	16.9	11.4	17.9	11.4										
	5	4.5	9.2					16.9	10.6	17.5	12.4							21.0			26.0
	6				3.7			17.0	11.5	17.9	11.5	9.9	2.5								
	7							16.8	11.6	17.9	11.3										
	8																				
	9	4.5	9.0		3.4		15.3				7.5	9.8	2.5	17.9							
	10							17.1	12.5	17.3	11.1							20.1			26.0
	11																				
	12							16.9	11.5	17.5	10.9										
1977	1	4.6	9.3		3.7																
	2					15.2					7.4	10.1	2.3	16.4				20.2			26.2
	3							17.1	11.8	17.6	10.5							20.2			26.2
	4							17.0	12.2	18.7	11.3										
	5																				
	6	4.7	8.9			15.6	17.3	12.7	17.5	11.7						24.6					
	7				3.7						7.5	10.3	2.5	16.4							
	8					17.7	12.7	17.6	12.2												25.8
	9																				
	10					17.3	12.9	17.7	11.3												26.3
	11																				
	12					17.9	13.0	17.1	10.9												
1978	1																				
	2																				
	3																				26.2
	4					18.2	12.7	17.3	11.1												
	5																				
	6																	18.9			25.5
Avg.		4.5	8.8		3.7	15.1	17.1	11.0	17.7	11.3	7.5	10.3	2.5	17.5		24.2		20.8			26.3
Range		.7	2.4		.4	1.8	1.7	5.0	2.0	1.9	.7	2.3	.8	1.5		.7		1.7			2.2
Std Dev.		.2	.5		.1	.5	.4	1.7	.5	.5	.2	.6	.2	.6		.2		.5			.6

TABLE 7D

10-FOOT DEPTH PASSING LANE - WEIGHT PERCENT MOISTURE UNDER PAVEMENT

SITE NUMBER

Year	Month	37	25	11	27	21	12	13	17	18	20	9	2	15	26	30	22	8	35	28	23
1973	10																	21.7*			25.9*
	11													16.5*		25.0*					
	12											6.1*	2.5*								
1974	1																				
	2										5.5*										
	3										5.5			18.2		25.1		21.5			26.6
	4																				
	5																				
	6										5.4	6.7	2.7	17.0		25.2		21.8			26.1
	7																				
	8						14.1*	21.2*	18.8*		5.5	6.7	2.8			25.4					
	9																	21.6			25.3
	10										5.4			16.7		25.2		21.7			26.2
	11						14.6	21.4	19.0			7.1	2.9								
	12										5.4	7.1	2.9	18.5		25.2					
1975	1																				
	2						14.5	21.3	18.9		5.5	6.9	3.0	17.1		25.1		22.1			28.6
	3	4.4					14.2	21.3	19.0									21.8			28.1
	4	4.3										7.1	2.9			25.2					
	5																	21.1			28.4
	6	4.3					14.3	21.4			5.7	7.1		18.4		25.3					
	7						13.7	20.8	18.7												
	8	4.4									5.7	7.2		17.3		25.4		22.5			29.2
	9						14.1	21.6	19.0												
	10						14.2	21.4	19.1		5.7	7.1						21.9			26.8
	11	4.4												17.9							
	12	4.0					14.0	21.1	19.0					20.0							
1976	1						14.2	21.4	18.9									22.2			27.0
	2	4.2												18.4							
	3							21.1	18.9		5.5	6.7	3.0								
	4						14.1	21.5	20.5									22.2			
	5	4.3					14.3	20.0	19.0												25.6
	6						14.2	21.4	18.1			6.7	3.0								
	7							21.5	19.3												
	8																				
	9	4.4									5.5	6.5	3.0	17.8		25.3					
	10						14.3	21.7	18.8									21.3			27.2
	11																				
	12						14.3	20.5	19.0												
1977	1																				
	2										5.4	6.9	2.9	17.8		24.9					
	3							21.2	19.1									21.5			26.4
	4						14.5	21.5	19.3												
	5																				
	6	4.4					14.9	21.6	19.3							25.5					
	7											7.1		17.5							
	8						16.1	21.7	19.5									20.9			26.0
	9																				
	10						15.6	21.8	19.5												26.1
	11																				
	12						15.9	21.8	19.0												
1978	1																				
	2																				
	3																				27.4
	4						16.1	21.7	19.1												
	5																				
	6																				25.6
Avg.		4.3					14.6	21.3	19.1		5.5	6.9	2.9	17.8		25.2		21.7			26.8
Range		.4					2.4	1.8	2.4		.3	1.1	.5	3.5		.6		1.6			3.1
Std Dev.		.1					.7	.4	.4		.1	.3	.2	.9		.2		.4			1.1

APPENDIX E

TABLES 1E THROUGH 37E

DYNAFLECT DEFLECTION

1 Inch = .0254 Meters

$^{o}C = \frac{^{o}F - 32}{1.8}$

TABLE 1E

DYNAFLECT DEFLECTION

Site #1, Avondale
Average of Five Readings

4.3" AC
4.0" AB
8.0" SM
6.0" PCCP

Date Tested	Air	Surface	@2.0"	4"	10"	16"	26"	37"	49"	10" Coefficient of Variation
05/31/74	88	100	89		1.46	.99	.69	.46	.33	16
08/19/74		.5 ACFC		1.5" AC						
10/22/74	68	52	50		.93	.75	.58	.35	.25	46
02/03/75	69	68	85		1.32	.95	.61	.41	.30	23
04/01/75	66	92	112		1.30	.95	.63	.41	.31	20
06/26/75	94	115	124		1.37	.97	.60	.45	.34	16
08/25/75	98	126	118		1.10	.85	.57	.39	.27	24
12/02/75	59	61	59	.85	.82	.70	.47	.32	.24	37
01/16/76	78	86	83		1.46	1.21	.75	.51	.37	13
03/29/76	66	80	75		1.51	1.13	.72	.48	.34	17
06/01/76	85	105	106		1.85	1.36	.86	.54	.37	12
09/13/76	90	108	101		2.03	1.45	.88	.56	.40	9
02/28/77	62	75	70		1.50	1.13	.76	.48	.33	19
N=12										
Average	77	89	89	.85	1.39	1.04	.68	.45	.32	21
Std. Dev.	14	23	23	-	.34	.23	.12	.07	.05	11
Coeff. of Variation	18	26	26	-	24	22	18	16	16	52

TABLE 2E

DYNAFLECT DEFLECTION

Site #2, Sybil Road
Average of Five Tests

5.3" AC
3.0" AB
9.0" SM

Date Tested	Air	Surface	@2.5"	4"	10"	16"	26"	37"	49"	10" Coefficient of Variation
10/05/73	76	95	90		.90	.46	.21	.12	.09	5%
01/24/74	50	48	48		1.10	.61	.25	.14	.09	6
05/28/74	92	108	108		1.28	.62	.25	.15	.11	5
10/15/74	78	80	73		1.38	.64	.22	.12	.09	9
01/14/75	50	33	36		1.19	.63	.23	.13	.08	6
03/07/75	54	50	56		1.09	.57	.23	.13	.09	9
06/09/75	94	106	98		1.15	.54	.18	.12	.09	7
08/19/75	84	98	99	1.98	1.58	.71	.27	.16	.10	4
10/1975	Overlay: .5 ACFC, 1.5" AC									
11/06/75	66	68	62	1.08	1.16	.66	.26	.12	.09	5
01/05/76	56	58	57	1.02	1.05	.64	.27	.14	.09	5
03/10/76	64	66	60		.94	.63	.27	.12	.09	5
05/27/76	90	114	95		1.22	.60	.21	.12	.09	5
09/10/76	71	85	80		1.31	.77	.31	.15	.10	7
10/27/76	50	44	48		1.09	.76	.34	.18	.11	19
01/25/77	58	70	58		1.07	.72	.31	.15	.10	9
N=15										
Average	69	75	71	1.36	1.17	.64	.25	.14	.09	7
Std. Devl	16	26	22	.54	.17	.08	.04	.02	.01	4
Coeff. of Variation	23	35	31	40	15	13	16	14	11	60

TABLE 3E

DYNAFLECT DEFLECTION

Site #3, Cutter
Average of Five Readings

2.9" AC
3.0" AB
6.0" SGS

Date Tested	Air	Surface	@1.5"	4"	10"	16"	26"	37"	49"	10" Coefficient of Variation
05/24/74	72	76	70		2.16	1.35	.82	.63	.44	13
10/28/74	72	76	70		2.36	1.59	.95	.65	.48	9
01/24/75	46	40	38		2.40	1.56	.91	.60	.44	11
03/26/75	46	62	61		2.76	1.79	.87	.58	.42	42
06/16/75	86	104	97		2.47	1.53	.94	.64	.46	10
08/21/75	90	102	96	3.95	3.62	2.31	1.32	.88	.68	11
11/06/75	82	90	84	2.92	2.60	1.64	.97	.64	.48	12
01/08/76	55	56	54	1.95	2.28	1.46	.85	.57	.42	14
03/11/76	57	61	60		2.30	1.58	.89	.60	.42	16
05/26/76	88	111	103		2.87	1.82	1.08	.69	.50	13
08/11/76	82	90	86		2.13	1.50	.93	.64	.47	11
02/15/77	71	75	69		2.96	1.99	1.02	.73	.56	14
N=12										
Average	71	79	74	2.94	2.58	1.68	.96	.65	.48	15
Std. Dev.	16	22	20	1.00	.42	.26	.13	.08	.07	9
Coeff. of Variation	23	28	27	34	16	15	14	12	15	60

TABLE 4E

DYNAFLECT DEFLECTION

Site #4, Benson
Average of Five Readings

6.5" AC
3.0" AB
12.0" SM

Date Tested	Air	Surface	@3.0"	4"	10"	16"	26"	37"	49"	10" Coefficient of Variation
01/24/74	44	34	34		1.02	.71	.41	.23	.16	22
05/28/74	90	112	105		1.19	.65	.38	.25	.19	14
10/15/74	80	84	80		1.15	.70	.37	.19	.13	20
01/14/75	54	44	43		1.12	.69	.38	.22	.13	20
03/17/75	56	58	56		1.03	.66	.38	.22	.15	12
06/09/75	94	102	95		1.12	.67	.30	.18	.13	13
08/19/75	80	85	81	1.36	1.19	.67	.43	.25	.14	19
09/19/75	.5" ACFC, 1.5" AC									
03/10/76	64	65	64		.74	.56	.31	.20	.13	15
05/27/76	90	110	102		1.07	.69	.35	.20	.14	18
09/10/76	70	78	75		.88	.61	.34	.21	.15	25
10/28/76	43	37	36		.77	.63	.39	.25	.17	22
01/25/77	55	60	53		.86	.63	.36	.22	.15	15
04/11/79	66	92	89		.69	.57	.31	.21	.14	17
N=13										
Average	68	74	70	1.36	.99	.65	.36	.22	.15	18
Std. Dev.	17	27	24	-	.18	.05	.04	.02	.02	4
Coeff. of Variation	25	36	34	-	18	8	11	9	13	22

TABLE 5E

DYNAFLECT DEFLECTION

Site #5, Show Low
Average of Five Readings

4.6" AC
4.0" AB
15.5" SM

Date Tested	Air	Surface	@2.0"	4"	10"	16"	26"	37"	49"	10" Coefficient of Variation
05/23/74	74	101	96		2.04	1.14	.36	.19	.13	20
10/30/74	38	37	38		1.97	1.00	.47	.24	.15	9
01/1975	.3" Seal Coat									
01/23/75	44	46	45		1.94	1.09	.51	.26	.15	19
05/01/75	56	58	57		2.26	1.17	.52	.26	.16	7
06/13/75	83	98	93		2.23	1.24	.56	.26	.18	6
08/20/75	66	65	62	3.50	3.02	1.64	.92	.43	.05	14
11/18/75	44	45	43	2.01	1.84	1.06	.46	.24	.15	10
01/08/76	45	44	41	.81	1.06	.80	.47	.30	.12	31
03/16/76	60	64	61		2.62	1.42	.62	.27	.17	5
05/26/76	80	103	98		1.96	1.13	.50	.26	.15	6
08/05/76	76	82	78		2.03	1.23	.55	.29	.16	5
02/24/77	54	52	50		2.37	1.39	.61	.28	.18	5
N=12										
Average	60	66	63	2.11	2.11	1.19	.54	.27	.15	11
Std. Dev.	16	24	22	1.35	.47	.22	.14	.06	.04	8
Coeff. of Variation	27	36	35	64	22	18	26	22	27	73

TABLE 6E

DYNAFLECT DEFLECTION

Site #6, Gila Bend
Average of Five Readings

7.1" AC
4.0" AB
4.0" SM

Date Tested	Air	Surface	@3.5"	4"	10"	16"	26"	37"	49"	10" Coefficient of Variation
05/30/74	96	112	105		.71	.50	.30	.21	.15	14
10/22/74	70	60	58		.41	.32	.20	.15	.10	30
01/15/75	48	33	36		.33	.27	.19	.15	.09	31
03/18/75	62	64	61		.36	.28	.22	.16	.11	29
06/11/75	86	88	84		.43	.29	.20	.13	.11	26
08/18/75	106	130	123	1.35	.64	.42	.30	.22	.15	5
11/21/75	58	58	55	.33	.33	.27	.18	.13	.10	27
12/17/75	58	56	52	.34	.33	.27	.18	.13	.10	25
01/1976	.5" ACFC									
03/09/76	57	54	50		.34	.28	.18	.13	.09	27
05/26/76	90	103	99		.52	.33	.20	.14	.11	37
09/09/76	94	109	103		.53	.36	.20	.13	.10	37
11/03/76	82	85	81		.43	.35	.23	.16	.12	25
01/26/77	62	71	66		.36	.29	.20	.13	.10	26
04/13/79	64	72	69		.35	.26	.17	.13	.10	40
N=14										
Average	74	78	74	.67	.43	.32	.21	.15	.11	27
Std. Dev.	18	27	25	.59	.12	.07	.04	.03	.02	9
Coeff. of Variation	24	35	34	88	28	22	19	20	18	33

TABLE 7E

DYNAFLECT DEFLECTION

Site #7, Ash Fork
Average of Five Readings

6.3" AC
4.0" AB
11.0" SM

Date Tested	Air	Surface	@3.0"	4"	10"	16"	26"	37"	49"	10" Coefficient of Variation
01/16/75	46	42	39		2.50	1.31	.58	.32	.19	20
03/19/75	64	67	63		2.70	1.45	.65	.34	.18	8
06/12/75	80	89	84		2.56	1.39	.68	.34	.25	13
08/28/75	100	116	114	2.96	3.06	1.60	.69	.38	.20	12
11/24/75	61	61	59	2.46	2.54	1.10	.60	.34	.22	18
01/07/76	54	62	58	.87	.89	.68	.39	.25	.17	17
03/25/76	72	74	68		3.34	1.85	.84	.41	.22	23
05/19/76	80	92	87		1.13	.80	.41	.24	.17	20
07/30/76	88	103	101		1.28	.93	.45	.26	.19	17
02/08/77	46	48	46		.83	.71	.43	.27	.19	12
N=10										
Average	69	75	72	2.10	2.08	1.18	.57	.32	.20	16
Std. Dev.	18	24	24	1.09	.95	.40	.15	.06	.03	5
Coeff. of Variation	26	32	33	52	46	34	26	19	15	31

TABLE 8E

DYNAFLECT DEFLECTION

Site #8, Winona
Average of Five Tests

8.6" AC
3.0" AB
9.0" SM

Date Tested	Air	Surface	@4.0"	4"	10"	16"	26"	37"	49"	10" Coefficient of Variation
01/30/74	46	54	52		2.01	1.21	.61	.31	.16	7
05/16/74	76	78	74		2.52	1.65	.81	.39	.23	6
10/23/74	66	63	60		1.61	.95	.50	.22	.13	12
02/06/75	48	52	50		1.97	1.22	.60	.28	.15	10
03/19/75	58	61	58		1.80	1.09	.54	.26	.15	6
06/12/75	80	96	91		1.40	.88	.45	.21	.13	5
08/26/75	89	92	87	1.60	1.57	1.04	.54	.29	.13	9
10/28/75	67	77	73	1.75	1.73	1.19	.68	.36	.20	9
01/14/76	44	44	42		1.71	.98	.47	.25	.14	5
03/18/76	68	68	65		2.53	1.45	.75	.31	.17	5
05/18/76	73	77	73		1.57	1.06	.51	.26	.14	11
07/22/76	85	100	95		1.61	1.08	.49	.24	.12	7
09/14/76	79	91	86		2.31	1.34	.61	.30	.14	10
02/03/77	46	46	44		2.19	1.37	.65	.29	.17	9
N=14										
Average	66	71	68	1.68	1.90	1.18	.59	.28	.15	8
Std. Dev.	15	19	18		.37	.21	.11	.05	.03	2
Coeff. of Variation	23	27	26		19	18	19	18	20	25

TABLE 9E

DYNAFLECT DEFLECTION

Site #9, Wilmot
Average of Five Tests

2.8" AC
4.0" AB
9.0" SM

Date Tested	Air	Surface	@1.5"	4"	10"	16"	26"	37"	49"	10" Coefficient of Variation
10/05/73	78	83	78		1.07	.66	.42	.28	.21	16
01/24/74	58	64	62		1.81	1.03	.58	.37	.27	13
05/28/74	99	110	101		1.56	.89	.57	.35	.27	14
10/16/74	70	72	69		1.46	.75	.40	.27	.22	15
01/14/75	72	60	59		1.59	.88	.47	.31	.23	14
03/17/75	60	70	67		1.41	.73	.43	.29	.22	10
06/10/75	87	98	91		1.33	.74	.44	.29	.22	9
08/19/75	92	110	101	2.60	1.94	.86	.60	.38	.23	9
11/06/75	80	88	82	1.62	1.36	.82	.42	.30	.22	7
12/18/75	64	60	62	1.71	1.27	.73	.42	.29	.22	8
03/09/76	74	78	74		1.37	.84	.44	.30	.22	6
05/27/76	91	107	98		1.49	.85	.46	.31	.23	8
09/10/76	74	78	74		1.75	.98	.51	.35	.26	11
10/26/76	61	60	59		1.45	.92	.50	.35	.25	17
01/25/77	52	54	53		1.45	.81	.45	.29	.22	11
N=15										
Average	74	79	75	1.98	1.49	.83	.47	.32	.23	11
Std. Dev.	14	19	16	.54	.22	.10	.06	.04	.02	3
Coeff. of Variation	19	24	21	27	15	12	13	13	9	27

TABLE 11E

DYNAFLECT DEFLECTION

Site #11, Minnetonka
Average of Five Readings

6.8" AC
15.0" SM

Date Tested	Air	Surface	@4.0"	4"	10"	16"	26"	37"	49"	10" Coefficient of Variation
01/24/74	65	88	84		2.53	2.00	1.40	.95	.69	6
05/28/74	72	82	79		2.31	1.73	1.21	.87	.67	14
10/24/74	68	66	63		2.30	1.62	1.15	.79	.61	21
01/22/75	34	39	36		1.97	1.70	1.13	.87	.57	18
03/24/75	68	75	70		2.23	1.75	1.13	.80	.58	17
06/1975	Asphalt-Rubber Seal Coat									
06/18/75	68	70	68		2.23	1.75	1.15	.81	.59	12
08/26/75	75	74	71	2.60	1.87	1.49	1.10	.84	.56	13
11/20/75	36	44	42	2.50	1.87	1.49	1.00	.74	.56	17
01/14/76	40	45	43	2.60	2.07	1.57	1.05	.78	.58	21
02/19/76	62	64	61	2.28	1.95	1.58	1.06	.79	.55	18
03/17/76	65	67	65		2.69	2.09	1.36	.90	.74	16
05/19/76	68	76	74		2.24	1.73	1.19	.83	.64	20
07/27/76	76	80	80		2.00	1.62	1.10	.83	.61	18
02/08/77	54	63	61		2.92	2.40	1.62	1.09	.82	16
N=14										
Average	61	67	64	2.50	2.23	1.75	1.19	.85	.63	16
Std. Dev.	14	15	15	.15	.31	.25	.17	.09	.08	4
Coeff. of Variation	23	22	23	6	14	14	14	11	13	25

TABLE 12E

DYNAFLECT DEFLECTION

Site #12, Dead River #1
Average of Five Readings

6.8" AC
6.0" CTB
4.0" SM

Date Tested	Air	Surface	@3.5"	4"	10"	16"	26"	37"	49"	10" Coefficient of Variation
05/22/74	78	98	93		1.46	1.21	.88	.69	.52	7
10/23/74	58	60	57		.75	.68	.57	.43	.32	7
01/22/75	40	40	38		.79	.71	.60	.51	.36	8
03/24/75	60	70	67		.90	.79	.67	.53	.39	4
06/17/75	76	75	71		1.03	.84	.72	.56	.40	11
08/26/75	94	114	108	1.29	1.25	1.08	.86	.63	.42	10
11/19/75	34	43	41	.75	.75	.68	.56	.44	.35	3
01/07/76	21	17	17	.76	.77	.70	.56	.45	.35	2
03/17/76	54	46	44		.94	.85	.74	.58	.44	6
05/20/76	63	75	71		.92	.82	.65	.51	.40	9
07/28/76	76	89	84		1.04	.89	.66	.51	.40	10
02/09/77	40	29	28		.77	.76	.61	.48	.37	3
N=12										
Average	58	63	54	.93	.95	.83	.67	.53	.39	7
Std. Dev.	21	29	27	.31	.22	.16	.11	.08	.05	3
Coeff. of Variation	36	46	50	33	23	19	16	15	13	43

TABLE 13E

DYNAFLECT DEFLECTION

Site #13, Dead River #2
Average of Five Readings

8.3" AC
6.0" CTB
4.0" SM

Date Tested	Air	Surface	@4.0"	4"	10"	16"	26"	37"	49"	10" Coefficient of Variation
05/22/74	78	102	97		1.27	.89	.67	.47	.32	28
10/23/74	58	60	57		.62	.52	.44	.33	.25	19
01/23/75	40	40	38		.66	.58	.46	.38	.26	34
03/24/75	60	70	67		.60	.53	.41	.33	.25	18
06/17/75	76	75	71		.79	.65	.54	.41	.28	23
08/26/75	94	114	108	1.05	.88	.74	.57	.41	.25	19
11/19/75	40	45	43	.54	.54	.47	.39	.31	.30	28
01/07/76	25	30	29	.64	.58	.52	.41	.33	.27	25
03/17/76	56	59	56		.71	.64	.51	.40	.30	23
05/20/76	63	75	71		.64	.57	.44	.33	.26	16
07/28/76	84	97	92		.87	.77	.56	.40	.28	15
02/09/77	41	34	33		.57	.52	.41	.32	.26	27
N=12										
Average	60	67	.64	.74	.73	.62	.48	.37	.27	23
Std. Dev.	21	27	26	.27	.21	.13	.09	.05	.02	5
Coeff. of Variation	35	40	41	36	29	21	19	14	7	22

TABLE 14E

DYNAFLECT DEFLECTION

Site #14, Flagstaff Airport
Northbound
Average of Five Readings

5.3" AC
6.0" AB
10.0" SM
12.0" SGS

Date Tested	Air	Surface	@2.5"	4"	10"	16"	26"	37"	49"	10" Coefficient of Variation
10/29/75	62	44	46		1.06	.69	.27	.13	.06	10
01/15/76	52	42	43		.95	.67	.33	.14	.08	7
03/24/76	70	77	72		1.28	.77	.30	.11	.05	12
05/06/76	57	57	53		1.04	.68	.26	.11	.06	10
07/21/76	85	108	101		1.06	.75	.25	.10	.05	6
09/16/76	66	74	71		1.06	.81	.31	.13	.06	6
N=6										
Average	65	67	64		1.08	.73	.29	.12	.06	9
Std. Dev.	12	25	22		.11	.06	.03	.02	.10	3
Coeff. of Variation	18	37	34		10	8	10	17	17	33

TABLE 15E

DYNAFLECT DEFLECTION

Site #15, Sedona, TI
Average of Five Tests

8.1" AC
3.0" AB
15.0" SM
6.0" SGS

Date Tested	Air	Surface	@4.0"	4"	10"	16"	26"	37"	49"	10" Coefficient of Variation
10/04/73	102	102	97		.80	.58	.38	.27	.20	29
01/31/74	62	73	69		1.22	.90	.59	.38	.26	37
05/14/74	88	100	95		1.24	.74	.39	.22	.16	17
10/25/74	68	88	55		.83	.61	.43	.27	.20	28
01/17/75	48	34	33		1.30	.98	.63	.38	.25	40
04/02/75	48	42	40		1.22	.84	.58	.35	.25	44
06/13/75	86	91	86		.95	.68	.43	24	.19	22
08/27/75	84	110	104	1.44	.97	.63	.37	.24	.17	25
11/26/75	48	58	57	1.05	.90	.65	.41	.26	.19	18
01/15/76	70	72	66	1.20	1.01	.76	.45	.30	.21	20
03/23/76	84	85	76		1.35	.95	.56	.34	.26	18
05/06/76	68	76	70		1.13	.89	.51	.33	.22	18
09/16/76	86	106	102		1.39	.99	.50	.31	.22	18
02/22/77	58	65	62		1.34	.92	.57	.34	.24	18
05/03/79	84	106	98		.98	.68	.44	.26	.21	34
N=15										
Average	72	81	74	1.23	1.11	.79	.48	.30	.22	26
Std. Dev.	17	24	23	.20	.20	.14	.09	.05	.03	9
Coeff. of Variation	24	29	31	16	18	18	19	17	14	35

TABLE 16E

DYNAFLECT DEFLECTION

Site #16, Tempe
Average of Five Tests

3.0" AC
6.0" AB
6.0" SM

Date Tested	Air	Surface	@1.5"	4"	10"	16"	26"	37"	49"	10" Coefficient of Variation
02/04/74	78	70	67		1.06	.79	.45	.24	.15	15
05/30/74	90	96	91		.74	.54	.29	.18	.13	14
06/19/74	.5" ACFC, Heater Scarification									
11/06/74	68	64	61		.90	.63	.34	.19	.12	18
01/24/75	64	63	60		.88	.58	.31	.18	.09	21
03/27/75	57	67	64		.80	.56	.28	.17	.11	24
07/03/75	105	133	126		.79	.51	.27	.15	.10	15
08/29/75	101	116	110		.69	.46	.23	.14	.09	24
10/24/75	71	84	80	.76	.76	.51	.27	.14	.11	21
01/16/76	67	69	65	.84	.77	.51	.27	.16	.10	25
03/29/76	60	72	68		.82	.56	.30	.16	.09	18
06/01/76	84	105	101		.84	.50	.28	.17	.10	18
09/08/76	103	128	122		.88	.64	.30	.17	.11	10
02/28/77	62	76	73		.80	.60	.29	.19	.10	18
N=13										
Average	78	88	84	.80	.83	.57	.30	.17	.11	19
Std. Dev.	17	25	24		.09	.09	.05	.03	.02	4
Coeff. of Variation	22	28	29		11	16	17	18	18	21

TABLE 17E

DYNAFLECT DEFLECTION

Site #17, Crazy Creek #1
Average of Five Tests

4.3" AC
6.0" CTB
6.0" SM

Date Tested	Air	Surface	@2.0"	4"	10"	16"	26"	37"	49"	10' Coefficient of Variation
05/22/74	76	92	87		1.18	.92	.64	.46	.33	17
10/24/74	62	50	48		1.19	.91	.67	.51	.35	12
01/22/75	42	42	40		1.52	1.16	.77	.52	.36	8
03/25/75	42	44	42		1.60	1.23	.81	.62	.43	12
08/26/75	93	107	101	1.02	.86	.72	.60	.47	.34	10
10/1975	.5" ACFC, 2.50" AC, Asphalt-Rubber Membrane									
11/19/75	40	44	42	.80	.80	.70	.53	.42	.34	13
01/07/76	30	40	38	1.14	1.10	.88	.66	.48	.36	13
03/17/76	60	60	57		1.07	.94	.73	.57	.42	17
05/20/76	63	78	74		.85	.75	.58	.46	.36	11
07/29/76	82	94	89		.93	.76	.60	.47	.37	10
02/09/77	44	37	36		.92	.81	.66	.49	.37	16
N=11										
Average	58	63	59	.99	1.09	.89	.66	.50	.37	13
Std. Dev.	20	26	24	.17	.27	.17	.08	.06	.03	3
Coeff. of Variation	34	41	41	17	25	19	12	12	8	23

TABLE 18E

DYNAFLECT DEFLECTION

Site #18, Crazy Creek #2
Average of Five Readings

4.3" AC
6.0" CTB
6.0" SM

Date Tested	Air	Surface	@2.0"	4"	10"	16"	26"	37"	49"	10" Coefficient of Variation
05/22/74	76	92	87		1.21	1.00	.74	.52	.36	29
10/24/74	65	50	48		1.00	.85	.56	.40	.27	39
01/22/75	40	40	38		1.15	.93	.64	.44	.28	42
03/25/75	46	46	44		1.25	.93	.61	.46	.30	40
08/26/75	92	104	99	1.02	.83	.73	.57	.41	.29	30
10/1975	.5" ACFC, 3.0" AC, Asphalt-Rubber Membrane									
11/19/75	42	44	42	.59	.59	.51	.41	.32	.26	40
01/07/76	29	34	33	.65	.64	.55	.43	.34	.27	42
03/17/76	60	60	57		.82	.70	.54	.42	..31	41
05/20/76	63	78	74		.76	.65	.50	.39	.29	32
07/29/76	88	102	97		.95	.78	.60	.45	.32	28
02/09/77	45	41	39		.61	.54	.43	.34	.26	42
N=11										
Average	59	63	60	.75	.89	.74	.55	.41	.29	37
Std. Dev.	20	26	25	.23	.24	.17	.10	.06	.03	6
Coeff. of Variation	34	41	42	31	27	23	18	15	10	16

TABLE 19E

DYNAFLECT DEFLECTION

Site #19, Lupton
Average of Five Readings

4.3" AC
6.0" CTB
21.0" SM

Date Tested	Air	Surface	@2.0"	4"	10"	16"	26"	37"	49"	10' Coefficient of Variation
10/24/74	60	68	65		1.06	.92	.63	.47	.34	14
01/22/75	38	38	36		.95	.79	.61	.45	.34	14
03/25/75	36	40	38		1.09	.89	.64	.47	.33	18
06/17/75	74	90	85		1.15	.91	.66	.52	.36	22
08/26/75	82	83	79	1.20	1.07	.89	.62	.44	.31	18
10/1975	.5" ACFC, 2.0" AC, Asphalt-Rubber Membrane									
11/19/75	41	40	38	.64	.64	.53	.46	.37	.30	17
01/07/76	34	34	33	.61	.58	.50	.42	.35	.30	18
03/17/76	69	69	64		.97	.83	.76	.52	.39	18
05/20/76	66	75	70		.86	.73	.55	.42	.33	15
08/03/76	82	87	84		.85	.72	.56	.43	.30	12
02/09/77	44	53	51		.79	.71	.62	.51	.37	12
N=11										
Average	57	62	58	.81	.91	.77	.59	.45	.33	16
Std. Dev.	19	21	20	.34	.19	.15	.09	.06	.03	3
Coeff. of Variation	33	34	34	42	21	19	15	13	9	19

TABLE 20E

DYNAFLECT DEFLECTION

Site #20, Marana
Average of Five Readings

3.3" AC
4.0" AB
6.0" CTB
5.0" SM

Date Tested	Air	Surface	@1.5"	4"	10"	16"	26"	37"	49"	10" Coefficient of Variation
10/05/73	94	112	106		.95	.71	.47	.34	.28	25
01/24/74	60	72	68		1.21	.87	.57	.43	.32	34
05/28/74	99	114	108		1.01	.79	.61	.44	.34	20
10/21/74	84	90	85		.89	.71	.49	.34	.26	33
01/14/75	74	68	65		1.10	.76	.49	.36	.29	32
03/17/75	74	88	83		.96	.71	.48	.33	.26	33
06/10/75	92	130	118		.89	.67	.48	.35	.31	20
08/19/75	92	101	93	1.53	1.06	.75	.62	.45	.29	28
11/05/75	90	100	92	1.32	1.98	.66	.44	.34	.26	24
12/17/75	66	56	55	.99	.86	.65	.43	.31	.25	24
03/09/76	81	83	78		.91	.69	.45	.33	.25	27
05/09/76	80	87	81		.97	.73	.48	.35	.27	20
09/09/76	87	99	92		1.14	.89	.56	.40	.30	26
10/21/76	76	81	76		1.10	.82	.50	.36	.28	19
01/24/77	63	68	65		1.37	1.00	.66	.42	.33	27
N=15										
Average	81	90	84	1.28	1.09	.76	.52	.37	.29	26
Std. Dev.	12	20	18	.27	.28	.10	.07	.05	.03	5
Coeff. of Variation	15	22	21	21	26	13	13	14	10	19

TABLE 20E-M

DYNAFLECT DEFLECTION

Site #20, Marana; Median
Average of Five Readings

Top of
Natural Soil

Date Tested	Air	Surface	4"	10"	16"	26"	37"	49"	10" Coefficient of Variation
01/14/75	74	76		1.81	.77	.45	.34	.25	11
03/17/75	76	90		2.25	.88	.42	.28	.22	42
06/10/75	92	110		1.23	.60	.35	.26	.22	27
08/19/75	92	101	2.70	1.57	.80	.54	.39	.26	7
11/05/75	90	96	3.20	1.42	.72	.42	.31	.23	9
01/05/76	60	56	1.53	1.24	.70	.39	.29	.23	17
03/19/76	81	78		1.08	.51	.37	.28	.21	15
05/25/76	80	97		1.34	.71	.43	.31	.23	7
09/09/76	86	94		1.49	.75	.46	.34	.27	5
10/21/76	75	70		2.86	1.17	.46	.30	.21	42
01/24/77	63	68		1.84	.79	.48	.32	.27	12
N=11									
Average	79	85	2.48	1.65	.76	.43	.31	.24	18
Std. Dev.	11	17	.86	.52	.17	.05	.04	.02	13
Coeff. of Variation	14	20	35	32	22	12	13	8	72

TABLE 21E

DYNAFLECT DEFLECTION

Site #21, Upper Deer Valley
Average of Five Tests

3.5" AC
4.0" AB
22.0" SM

Date Tested	Air	Surface	@1.7"	4"	10"	16"	26"	37"	49"	10' Coefficient of Variation
10/03/74	87	93	88		1.22	.76	.46	.30	.13	17
01/25/74	64	70	66		2.13	1.36	.67	.42	.25	12
05/14/74	84	100	95		2.31	1.42	.78	.51	.35	10
10/22/74	72	52	50		1.84	1.11	.57	.34	.22	10
01/20/75	60	60	57		1.81	1.10	.57	.36	.19	12
03/23/75	81	90	85		2.00	1.30	.73	.46	.29	5
06/26/75	94	104	99		1.62	1.01	.52	.34	.24	13
08/12/75	101	115	109	2.50	1.87	1.06	.70	.43	.26	5
10/27/75	83	94	89	1.83	1.76	1.04	.49	.34	.24	7
12/12/75	59	65	62	1.80	1.66	.94	.50	.32	.22	7
03/13/76	65	65	62		1.74	1.12	.54	.32	.22	5
05/03/76	95	105	100		2.40	1.23	.69	.37	.25	3
09/17/76	86	114	108		1.94	1.27	.65	.41	.29	5
02/11/77	56	45	43		2.18	1.26	.67	.40	.26	7
04/06/79	78	102	97		2.04	1.07	.63	.33	.21	8
N=15										
Average	77	85	81	2.04	1.90	1.14	.61	.38	.24	8
Std. Dev.	14	23	22	.40	.30	.17	.10	.06	.05	4
Coeff. of Variation	18	27	27	20	16	15	16	16	21	50

TABLE 21E-M

DYNAFLECT DEFLECTION

Site #21, Upper Deer Valley
Average of Five Tests

Top of Natural
Soil, median

Date Tested	Air	Surface	4"	10"	16"	26"	37"	49"	10' Coefficient of Variation
01/20/75	60	70		1.55	.50	.18	.10	.06	19
03/23/75	82	86		1.78	.43	.15	.09	.04	16
06/26/75	94	122		1.37	.45	.21	.10	.05	24
08/12/75	101	115	2.28	1.36	.43	.20	.09	.01	10
10/27/75	85	90	2.40	1.58	.46	.14	.08	.04	14
12/11/75	70	58	3.90	1.47	.41	.14	.07	.05	14
03/12/76	60	58		1.76	.62	.16	.08	.05	14
05/05/76	95	90		2.14	.57	.20	.09	.05	14
09/17/76	86	100		1.39	.63	.20	.10	.06	18
02/11/77	56	55		1.83	.59	.20	.10	.05	8
N=10									
Average	79	84	2.86	1.62	.51	.18	.09	.05	15
Std. Dev.	16	24	.90	.25	.09	.03	.01	.01	5
Coeff. of Variation	20	29	31	15	18	17	11	20	33

TABLE 22E

DYNAFLECT DEFLECTION

Site #22, Agua Fria
Average of Five Tests

4.0" AC
4.0" AB
24.0" SM

Date Tested	Air	Surface	@2.0"	4"	10"	16"	26"	37"	49"	10" Coefficient of Variation
10/03/73	88	102	97		.79	.49	.28	.20	.15	3
01/28/74	62	65	62		.80	.41	.16	.10	.07	36
05/14/74	90	110	104		.90	.42	.21	.16	.11	36
10/25/74	76	90	85		.63	.33	.15	.09	.06	28
01/20/75	74	72	68		.64	.32	.12	.09	.05	34
03/23/75	70	81	77		.59	.32	.12	.09	.05	30
06/20/75	76	93	88		.60	.27	.13	.08	.05	32
08/27/75	100	134	127	1.98	1.07	.49	.23	.15	.09	48
12/12/75	60	65	62	.62	.61	.29	.13	.08	.06	33
03/23/76	66	65	64		.78	.36	.15	.08	.05	33
05/24/76	100	127	120		.86	.41	.16	.09	.06	30
09/17/76	80	98	93		.65	.36	.14	.09	.06	34
11/17/76	64	56	53		.59	.37	.16	.10	.06	21
02/11/77	66	59	56		.72	.35	.15	.08	.06	24
04/05/79	86	104	100		.71	.32	.12	.07	.05	18
N=15										
Average	77	88	84	1.30	.71	.37	.16	.10	.07	29
Std. Dev.	13	25	23	--	.16	.07	.05	.04	.03	10
Coeff. of Variation	17	28	27	--	23	19	31	40	43	34

TABLE 23E

DYNAFLECT DEFLECTION

Site #23, Bellemont
Average of Five Tests

2.0" AC
4.0" AB
9.0" SM
6.0" SGS

Date Tested	Air	Surface	@1.0"	4"	10"	16"	26"	37"	49"	10' Coefficient of Variation
10/04/73	64	65	62		2.40	1.00	.47	.24	.13	6
01/30/74	42	42	40		2.22	1.19	.40	.15	.09	7
05/16/74	78	96	91		1.78	1.12	.42	.21	.14	7
10/23/74	48	42	40		2.00	.68	.46	.16	.12	10
01/16/75	56	50	48		.89	.59	.37	.21	.13	3
03/19/75	59	58	55		1.93	.73	.23	.10	.07	8
06/12/75	78	94	81		2.08	.79	.27	.12	.08	9
08/27/75	72	80	76	2.25	1.83	.76	.25	.11	.07	2
11/26/75	32	32	31	2.50	1.81	.73	.27	.11	.07	6
01/07/76	42	40	36	1.47	1.85	.73	.21	.10	.08	8
03/25/76	62	64	61		2.28	.83	.25	.10	.07	9
05/19/76	62	75	71		2.01	.88	.29	.13	.09	12
07/22/76	75	75	73		1.97	.92	.29	.12	.08	8
08/31/76	84	100	95		2.62	1.10	.34	.13	.07	8
02/01/77	42	45	43		2.14	2.51	.27	.11	.08	12
N=15										
Average	60	64	60	2.07	2.05	.97	.32	.14	.09	8
Std. Dev.	16	23	20	.54	.43	.46	.08	.05	.03	3
Coeff. of Variation	27	36	33	26	21	47	25	36	33	38

TABLE 24E

DYNAFLECT DEFLECTION

Site #24, Topock
Average of Five Readings

4.0" AC
4.0" AB
9.0" SM

Date Tested	Air	Surface	@2.0"	4"	10"	16"	26"	37"	49"	10" Coefficient of Variation
10/16/74	92	100	95		.73	.50	.28	.20	.20	2
01/15/75	72	72	68		.82	.60	.30	.20	.16	4
03/18/75	78	90	85		.82	.56	.33	.21	.18	4
06/11/75	106	120	114		.83	.50	.28	.17	.14	3
08/28/75	96	120	116	.65	.67	.43	.26	.19	.16	3
11/25/75	50	54	52	.61	.70	.45	.26	.18	.14	4
01/13/76	57	50	49	.62	.69	.46	.28	.19	.15	4
03/25/76	66	74	68		.91	.62	.32	.23	.17	11
05/25/76	90	115	106		.80	.49	.29	.20	.17	4
08/31/76	96	116	111		.64	.41	.20	.15	.12	6
11/09/76	60	60	59		.84	.60	.31	.23	.18	15
01/28/77	65	67	65		.80	.53	.28	.19	.16	7
N=12										
Average	77	87	82	.63	.77	.51	.28	.20	.16	6
Std. Dev.	18	27	25	.02	.08	.07	.03	.02	.02	4
Coeff. of Variation	23	31	30	3	10	14	11	10	13	66

TABLE 25E

DYNAFLECT DEFLECTION

Site #25, Williams Field
Average of Five Tests

4.0" AC
4.0" AB
15.0" SM

Date Tested	Air	Surface	@2.0"	4"	10"	16"	26"	37"	49"	10' Coefficient of Variation
10/05/73	98	115	109		1.00	.65	.37	.26	.21	7
01/25/74	64	85	80		1.19	.73	.40	.29	.22	5
05/28/74	92	112	103		.99	.63	.38	.27	.22	11
10/16/74	92	102	94		1.10	.68	.37	.26	.21	12
01/14/75	68	70	67		.98	.59	.33	.23	.18	6
03/20/75	84	100	92		.97	.59	.35	.23	.19	8
07/03/75	102	130	123		.92	.54	.32	.22	.18	7
08/22/75	96	106	98	1.23	.98	.64	.43	.30	.22	10
10/23/75	72	84	79	1.17	.94	.59	.33	.25	.19	9
12/12/75	66	72	69	.93	.90	.58	.34	.25	.19	14
03/11/76	74	80	75		1.15	.74	.40	.26	.18	12
05/25/76	85	115	105		1.01	.61	.34	.26	.19	7
09/08/76	94	114	104		1.17	.70	.45	.32	.26	7
10/19/76	77	73	70		1.03	.67	.32	.21	.17	10
01/24/77	55	70	67		1.42	.83	.45	.29	.24	13
3/1979	Overlay 1.5" AC, .5" ACFC									
04/18/79	64	80	75		.82	.67	.33	.24	.19	8
N=16										
Average	80	94	88		1.11	1.04	.65	.37	.26	9
Std. Dev.	15	20	18		.16	.14	.07	.04	.03	3
Coeff. of Variation	19	21	20		14	13	11	11	12	33

TABLE 25E-S

DYNAFLECT DEFLECTION

Site #25, Williams Field
Average of Five Tests

Top of Natural
Soil, Shoulder

Date Tested	Air	Surface	4"	10"	16"	26"	37"	49"	10" Coefficient of Variation
01/14/75	68	74		1.34	.84	.50	.29	.21	10
03/20/75	94	98		1.51	.73	.43	.28	.22	34
07/03/75	102	125		1.16	.67	.36	.22	.17	23
08/22/75	96	106	1.23	1.20	.70	.47	.30	.22	12
10/23/75	74	78	1.17	1.34	.75	.51	.30	.24	20
12/12/75	66	68	2.04	1.48	.72	.40	.25	.19	45
03/11/76	72	78		.89	.61	.33	.23	.17	5
05/25/76	85	115		1.40	.79	.42	.28	.19	17
09/08/76	94	106		1.35	.88	.46	.33	.25	16
01/24/77	55	55		2.48	1.28	.58	.35	.25	19
N=10									
Average	81	90	1.48	1.42	.80	.45	.28	.21	20
Std. Dev.	16	23	.49	.42	.19	.07	.04	.03	12
Coeff. of Variation	20	26	33	30	24	16	14	14	60

TABLE 26E

DYNAFLECT DEFLECTION

Site #26, Sunset Point

8.0" AC
2.0" AB
17.0" SM
6.0" SGS

Date Tested	Air	Surface	@4.0"	4"	10"	16"	26"	37"	49"	10" Coefficient of Variation
10/03/73	96	84	89		.91	.69	.40	.26	.17	3
01/24/74	60	64	61		.83	.60	.39	.22	.15	9
05/14/74	88	98	93		1.63	.95	.57	.33	.23	10
10/25/74	74	84	80		1.24	.84	.52	.30	.20	11
01/20/75	68	63	60		.97	.69	.42	.25	.13	11
04/01/75	67	76	72		.91	.68	.43	.24	.16	10
06/20/75	72	80	76		.95	.63	.39	.24	.15	11
08/27/75	98	127	120	1.31	1.06	.66	.36	.24	.14	18
12/02/75	74	74	71	1.03	.92	.63	.37	.22	.14	15
12/10/75	68	56	54	.82	.81	.58	.38	.21	.17	20
03/23/76	71	74	66		.94	.70	.40	.24	.15	8
05/05/76	61	72	69		.86	.65	.37	.23	.14	17
09/17/76	80	98	93		1.03	.72	.40	.26	.17	8
02/10/77	64	64	64		.95	.76	.45	.25	.17	14
05/04/79	85	92	84		.97	.68	.36	.21	.15	10
N=15										
Average	75	80	77	1.05	1.00	.70	.41	.25	.16	12
Std. Dev.	12	18	17	.25	.20	.09	.06	.03	.03	4
Coeff. of Variation	16	23	22	24	20	13	15	12	19	33

TABLE 27E

DYNAFLECT DEFLECTION

Site #27, Casa Grande
Average of Five Readings

6.0" AC
4.0" AB
18.0" SM

Date Tested	Air	Surface	@5.0"	4"	10"	16"	26"	37"	49"	10" Coefficient of Variation
10/05/73	100	118	112		.77	.59	.38	.27	.20	28
01/25/74	62	67	64		.87	.69	.47	.32	.22	28
05/28/74	94	118	108		1.01	.79	.50	.33	.26	34
10/21/74	84	84	79		.73	.58	.37	.25	.19	32
01/14/75	72	68	65		1.13	.86	.55	.36	.24	26
03/17/75	80	90	84		1.18	.86	.54	.31	.22	24
06/10/75	100	109	100		1.31	.91	.53	.35	.26	21
08/19/75	91	90	84	1.50	1.04	.77	.58	.38	.23	34
11/05/75	93	97	90	1.56	1.37	1.01	.62	.37	.26	22
12/18/75	74	72	69	1.02	1.14	.82	.61	.40	.28	24
03/09/76	66	68	65		1.16	.93	.61	.39	.26	24
05/25/76	82	104	96		1.44	1.06	.61	.39	.26	17
09/09/76	86	102	94		1.57	1.17	.73	.43	.30	13
10/20/76	77	74	70		1.30	1.12	.69	.43	.29	18
01/24/77	64	62	60		1.64	1.23	.81	.50	.33	18
04/12/79	72	98	91		2.05	1.34	.65	.49	.27	9
N=16										
Average	81	89	83	1.36	1.23	.92	.58	.37	.25	23
Std. Dev.	12	19	16	.30	.34	.22	.12	.07	.04	7
Coeff. of Variation	15	21	19	22	28	24	21	19	16	30

TABLE 28E

DYNAFLECT DEFLECTION

Site #28, Woody Mountain
Average of Four Tests

8.0" PCCP
6.0" CTB
6.0" SGS

Date Tested	Air	Surface	@4.0"	4"	10"	16"	26"	37"	49"	10" Coefficient of Variation
05/16/74	72	88	84		1.19	1.11	.84	.68	.53	21
10/23/74	48	48	46		.56	.53	.39	.29	.21	14
01/16/75	56	46	44		.25	.24	.22	.21	.18	15
03/19/75	58	58	55		1.29	1.25	1.09	.89	.67	9
06/12/75	80	85	81		1.09	1.02	.89	.71	.55	12
08/27/75	76	87	83		.45	.37	.29	.20	.14	30
10/28/75	68	70	67	1.20	1.04	.94	.76	.67	.52	21
01/15/76	34	30	29	.30	.31	.28	.24	.23	.18	3
03/25/76	58	64	61		1.48	1.32	1.12	.93	.74	23
05/19/76	59	62	59		.81	.76	.64	.51	.38	14
09/16/76	62	75	71		.86	.83	.72	.57	.48	13
02/01/77	40	41	39		.83	.76	.68	.51	.39	16
06/1977	.5" ACFC, Asphalt-Rubber, .5" ACFC									
05/03/79	69	76	72		.79	.71	.56	.45	.33	9
N=13										
Average	60	64	61	.75	.84	.78	.65	.53	.41	15
Std. Dev.	14	19	18		.38	.35	.30	.25	.19	7
Coeff. of Variation	23	30	30		45	45	46	47	46	47

TABLE 29E

DYNAFLECT DEFLECTION

Site #29, Cosnino
Average of Four Readings

8.0" PCCP
6.0" CTB
5.0" SGS

Date Tested	Air	Surface	@4.0"	4"	10"	16"	26"	37"	49"	10" Coefficient of Variation
05/16/74	72	76	68		.75	.70	.59	.46	.37	8
10/23/74	66	62	60		.43	.40	.34	.29	.24	10
01/28/75	40	43	41		.65	.61	.51	.39	.28	18
03/19/75	59	57	52		.52	.48	.42	.34	.26	20
06/12/75	80	87	79		.64	.60	.56	.43	.32	17
08/26/75	88	90	86		.39	.36	.33	.26	.20	10
10/28/75	68	64	63	.48	.49	.47	.41	.33	.27	9
01/14/76	48	45	43	.52	.57	.54	.44	.37	.29	8
03/18/76	62	60	55		.59	.52	.50	.36	.32	14
05/12/76	71	77	76		.47	.45	.39	.33	.27	16
07/22/76	85	86	78		.41	.39	.35	.30	.24	12
09/01/76	72	68	69		.31	.29	.24	.19	.17	10
02/03/77	46	42	39		.89	.83	.75	.64	.48	11
N=13										
Average	66	66	62	.50	.55	.51	.45	.36	.29	13
Std. Dev.	15	17	16	--	.16	.15	.13	.11	.08	4
Coeff. of Variation	23	26	26	--	29	29	29	31	28	31

TABLE 30E

DYNAFLECT DEFLECTION

Site #30, Cherry Road
Average of Five Tests

10.0" AC
4.0" AB
21.0" SM
6.0" SGS

Date Tested	Air	Surface	@5.0"	4"	10"	16"	26"	37"	49"	10" Coefficient of Variation
10/09/73	78	83	79		.57	.23	.13	.07	.05	11
01/29/74	38	30	29		.45	.34	.21	.14	.08	28
05/14/74	84	92	87		1.03	.58	.30	.18	.13	21
10/25/74	72	67	64		.65	.45	.27	.16	.12	46
01/17/75	58	52	50		.44	.33	.19	.11	.05	25
04/01/75	64	70	67		.50	.33	.21	.12	.07	25
06/13/75	90	97	92		.62	.36	.18	.11	.08	26
08/27/75	90	124	117	1.23	.66	.37	.21	.11	.07	24
03/23/76	70	70	68		.59	.38	.22	.12	.06	23
05/05/76	64	80	74		.52	.35	.18	.10	.07	24
09/16/76	80	96	91		.61	.39	.20	.13	.09	21
11/16/76	59	54	52		.44	.35	.22	.14	.09	20
02/10/77	58	61	59		.50	.37	.21	.12	.08	22
04/27/79	81	106	98		.49	.39	.17	.11	.06	40
N=14										
Average	70	77	73	1.23	.56	.37	.21	.12	.08	25
Std. Dev.	15	25	23		.16	.08	.04	.03	.02	9
Coeff. of Variation	21	32	32		29	22	19	25	25	36

TABLE 31E

DYNAFLECT DEFLECTION

Site #31, Cienega Creek
Average of Five Tests

Top of Grade &
Drain; Subgrade

Date Tested	Air	Surface	4"	10"	16"	26"	37"	49"	10" Coefficient of Variation
05/17/74	72	78		2.42	1.27	.67	.34	.20	25
10/25/74	58	70		1.16	.65	.32	.17	.09	38
01/17/75	58	46		2.39	1.24	.62	.32	.14	27
04/01/75	58	62		1.86	.89	.42	.19	.11	16
06/13/75	90	96		1.85	1.00	.49	.25	.16	31
08/27/75	90	112	2.38	2.13	1.17	.54	.34	.16	22
10/28/75	75	76	1.82	1.50	.86	.33	.23	.20	16
12/11/75	60	52	1.94	1.52	.73	.29	.14	.13	14
01/15/76	57	52		1.41	.74	.36	.19	.10	23
03/23/76	72	69		1.59	.81	.32	.14	.06	7
09/16/76	81	96		1.55	.88	.32	.15	.08	12
11/15/76	54	46		1.53	.82	.32	.17	.09	10
02/28/77	59	57		2.55	1.19	.33	.17	.09	14
N=13									
Average	68	70	2.05	1.80	.94	.41	.22	.12	20
Std. Dev.	13	21	.29	.44	.21	.13	.07	.05	9
Coeff. of Variation	19	30	14	24	22	32	32	42	45

TABLE 32E

DYNAFLECT DEFLECTION

Site #32, Winslow Bypass
Average of Five Tests

Top of
Subgrade

Date Tested	Air	Surface	4"	10"	16"	26"	37"	49"	10' Coefficient of Variation
05/22/74	68	76		2.47	1.80	1.14	.88	.75	15
10/24/74	72	70		1.87	1.15	.91	.68	.59	17
01/22/75	28	24		.76	.74	.65	.58	.50	9
03/24/75	64	70		2.11	1.33	.86	.69	.54	11
06/18/75	68	62		1.76	1.13	.80	.64	.53	20
08/26/75	90	93	2.80	1.63	1.20	.97	.75	.58	21
11/20/75	40	42	1.90	1.86	1.15	.79	.62	.50	26
01/07/76	26	28	1.83	1.98	1.40	.79	.59	.50	8
03/17/76	66	60		2.44	1.43	.95	.73	.67	13
07/22/76	93	108		2.28	1.51	1.10	.88	.68	14
N=10									
Average	62	63	2.18	1.92	1.28	.90	.70	.58	15
Std. Dev.	23	27	.54	.49	.28	.15	.11	.09	6
Coeff. of Variation	37	43	25	26	22	17	16	16	40

TABLE 33E

DYNAFLECT DEFLECTION

Site #33, Alpine
Average of Five Tests

6.8" AC
7.0" SM

Date Tested	Air	Surface	@3.5"	4"	10"	16"	26"	37"	49"	10" Coefficient of Variation
05/23/74	66	92	86		.71	.43	.20	.10	.06	6
01/23/75	40	34	33		.67	.58	.43	.32	.22	12
05/01/75	45	49	47		1.24	.77	.49	.33	.25	8
06/12/75	74	96	91		1.34	.91	.50	.33	.27	7
08/20/75	62	60	61	1.20	1.24	.80	.55	.36	.25	8
11/18/75	35	38	38	.84	.76	.69	.42	.30	.22	3
01/06/76	36	30	32	.73	.66	.53	.38	.29	.24	15
03/16/76	64	73	70		1.59	.94	.63	.38	.29	12
05/26/76	68	82	80		1.37	.81	.45	.31	.25	6
08/04/76	56	65	60		1.05	.80	.51	.34	.25	11
02/24/77	38	43	41		1.07	.84	.59	.38	.28	9
N=11										
Average	53	60	58	.92	1.06	.74	.47	.31	.23	9
Std. Dev.	15	23	22	.25	.32	.16	.12	.08	.06	3
Coeff. of Variation	28	38	38	27	30	22	26	26	26	33

TABLE 34E

DYNAFLECT DEFLECTION

Site #34, Lake Pleasant
Average of Five Tests

Top of Grade &
Drain, Subgrade

Date Tested	Air	Surface	4"	10"	16"	26"	37"	49"	10" Coefficient of Variation
05/20/74	82	100		.82	.43	.23	.17	.11	--
10/25/75	86	88		1.34	.62	.23	.14	.08	26
01/20/75	68	66		.45	.32	.18	.12	.07	25
03/23/75	78	86		.73	.42	.23	.17	.08	40
06/20/75	80	96		.55	.28	.17	.10	.08	48
08/12/75	103	120	.72	.45	.26	.18	.11	.07	32
12/02/75	70	64	.50	.46	.25	.16	.10	.08	28
12/11/75	70	62	1.08	.60	.27	.16	.10	.08	17
03/11/76	70	70		.80	.38	.18	.10	.08	41
05/03/76	95	90		.99	.38	.23	.13	.09	28
09/21/76	94	106		.65	.36	.20	.13	.09	25
02/28/77	72	82		1.30	.60	.37	.20	.12	72
N=12									
Average	81	86	.77	.76	.38	.21	.13	.09	34
Std. Dev.	12	18	.29	.31	.12	.06	.03	.02	15
Coeff. of Variation	15	21	38	41	32	30	23	22	44

TABLE 35E

DYNAFLECT DEFLECTION

Site #35, Kachina Blvd.
Average of Four Tests

8.0" PCCP
6.0" CTB
6.0" SGS

Date Tested	Air	Surface	@4.0"	4"	10"	16"	26"	37"	49"	10" Coefficient of Variation
05/16/74	70	70	67		.35	.30	.26	.21	.16	8
10/25/74	36	36	35		.21	.19	.15	.12	.09	3
01/21/75	36	28	27		.13	.11	.10	.09	.06	7
03/19/75	58	60	57		.34	.32	.27	.21	.16	16
06/13/75	78	80	76		.53	.49	.45	.33	.28	9
08/27/75	77	86	82		.41	.37	.34	.27	.22	4
10/28/75	62	59	56	.29	.34	.31	.26	.21	.15	6
01/15/76	50	50	48	.34	.35	.31	.27	.24	.21	6
03/24/76	66	68	65		.60	.54	.47	.40	.31	9
05/06/76	58	70	67		.40	.37	.32	.27	.23	4
07/21/76	88	103	98		.45	.41	.35	.30	.24	6
09/16/76	68	78	74		.52	.48	.39	.33	.28	5
02/22/76	41	49	49		.48	.44	.37	.30	.24	6
05/02/79	66	78	75		.74	.68	.58	.42	.31	8
N=14										
Average	61	65	63	.32	.42	.38	.33	.26	.21	7
Std. Dev.	16	20	19	--	.16	.14	.13	.09	.08	3
Coeff. of Variation	27	31	30	--	38	37	39	35	38	43

TABLE 36E

DYNAFLECT DEFLECTION

Site #36, Flagstaff Airport
Southbound
Average of Five Readings

8.0" PCCP
6.0" CTB
6.0" SGS

Date Tested	Air	Surface	@4.0"	4"	10"	16"	26"	37"	49"	10" Coefficient of Variation
05/16/74	70	70	67		.39	.36	.30	.25	.23	8
10/25/74	38	36	35		.17	.16	.13	.11	.09	20
01/21/75	36	34	35		.24	.23	.21	.19	.12	4
03/19/75	58	60	56		.33	.29	.25	.21	.17	12
06/13/75	76	77	73		.27	.23	.22	.17	.14	9
08/27/75	78	87	81		.29	.26	.22	.16	.13	5
10/29/75	62	59	59	.29	.28	.26	.21	.18	.13	12
01/15/76	44	40	39	.24	.30	.26	.24	.20	.16	12
03/24/76	67	65	60		.60	.55	.48	.40	.30	8
05/06/76	58	72	70		.33	.30	.26	.22	.17	7
07/22/76	76	74	66		.29	.26	.21	.17	.13	6
09/16/76	63	70	65		.30	.30	.25	.21	.15	17
02/03/77	46	48	48		.33	.29	.23	.18	.13	10
05/02/79	58	60	59		.32	.31	.22	.22	.16	13
N=14										
Average	59	61	58	.72	.32	.29	.25	.21	.16	10
Std. Dev.	14	16	14	--	.10	.09	.08	.07	.05	5
Coeff. of Variation	24	26	24	--	31	31	32	33	31	50

TABLE 37E

DYNAFLECT DEFLECTION

Site #37, Tonopah
Average of Five Tests

13.0" AC
5.0" SM

Date Tested	Air	Surface	96.5"	4"	10"	16"	26"	37"	49"	10" Coefficient of Variation
Grade & Drain, Test on Top of Subgrade										
05/30/74	90	100			1.86	.87	.37	.20	.10	
After AC Construction										
01/15/75	52	48	48		.55	.48	.34	.25	.18	10
03/18/75	72	87	81		.42	.35	.26	.21	.15	1
06/11/75	96	106	95		.59	.42	.28	.19	.14	4
08/18/75	105	125	118	.93	.64	.42	.30	.22	.15	5
11/21/75	72	76	72	.31	.32	.29	.22	.17	.12	2
12/16/75	60	52	32	.26	.29	.25	.19	.16	.13	8
03/08/76	78	86	81		.30	.27	.22	.17	.12	3
05/25/76	90	110	101		.51	.39	.27	.19	.13	3
09/09/76	90	104	96		.42	.38	.25	.16	.13	6
11/04/76	84	85	88		.39	.32	.27	.20	.15	5
01/26/77	63	71	68		.29	.26	.23	.18	.14	8
04/13/79	78	110	101		.42	.37	.22	.21	.16	5
N=12										
Average	78	88	82	.50	.43	.35	.25	.19	.14	5
Std. Dev.	16	24	24	.37	.12	.07	.04	.03	.02	3
Coeff. of Variation	20	27	29	74	28	20	16	16	14	60

Appendix F

Plate Bearing Tests

TABLE 6F-1

PLATE BEARING DEFLECTION

SITE # 6 , GILA BEND — 7.1" AC

AVERAGE OF THREE READINGS — 4.0" AB

SURFACE TEMP. = 56° F. — 4.0" SM

DATE TESTED 12/17/75

DEPTH = 0" 12" PLATE		DEPTH = 0" 18" PLATE		DEPTH = 0" 24" PLATE	
LOAD PSI	DEFLECTION INCHES	LOAD PSI	DEFLECTION INCHES	LOAD PSI	DEFLECTION INCHES
32.4	.007	29.9	.013	17.1	.017
66.9	.018	46.0	.021	26.2	.031
103.1	.028	63.7	.028	36.1	.040
142.9	.036	81.4	.036	46.1	.051
182.7	.044	97.1	.043	54.9	.059
218.1	.052	118.0	.048	68.6	.066
256.1	.060	130.5	.054	73.7	.074
293.2	.067	150.2	.060	84.8	.078
337.4	.075	165.9	.067	94.7	.084
REBOUND	.035	REBOUND	.008	REBOUND	
R^2=.9941	B = 4548	R^2=.9953	B = 2575	R^2 = .9782	B = 1174

DYNAFLECT DEFLECTION AT THE CENTER OF THE SURFACE PLATE LOCATION	GEOPHONE	DEFLECTION IN .001"
	10"	.42
	16"	.36
	26"	.22
	37"	.14
	49"	.10

TABLE 20 F-1

PLATE BEARING DEFLECTION .

SITE # 20 — 3.3" AC

AVERAGE OF THREE READINGS — 4.0" AB

SURFACE TEMP. = 72°F — 6.0" CTB

DATE TESTED 12/17/75 — 5.0" SM

DEPTH = 0" 12" PLATE		DEPTH = 0" 18" PLATE		DEPTH = 0" 24" PLATE	
LOAD PSI	DEFLECTION INCHES	LOAD PSI	DEFLECTION INCHES	LOAD PSI	DEFLECTION INCHES
32.4	.013	29.9	.014	17.1	.009
66.9	.026	46.0	.023	26.2	.019
103.1	.036	63.7	.032	36.1	.027
142.9	.044	81.4	.040	46.1	.035
182.7	.054	97.1	.047	54.9	.042
218.1	.061	118.0	.054	68.6	.046
256.1	.071	130.5	.060	73.7	.052
293.2	.081	150.2	.064	84.8	.056
337.4	.090	165.9	.072	94.7	.060
REBOUND	.025	REBOUND	.009	REBOUND	.002
R^2=.9959	B = 4059	R^2 = .9903	B = 2393	R^2 = .9730	B = 1515

DYNAFLECT DEFLECTION AT THE CENTER OF THE SURFACE PLATE LOCATION	GEOPHONE	DEFLECTION IN .001"
	10"	.62
	16"	.50
	26"	.34
	37"	.26
	49"	.23

TABLE 9F-1

PLATE BEARING DEFLECTION .

SITE # 9 , WILMOT — 2.8" AC

AVERAGE OF THREE READINGS — 4.0" AB

SURFACE TEMP. = 60°F — 9.0" SM

DATE TESTED 12/18/75

DEPTH = 0" 12" PLATE		DEPTH = 0" 18" PLATE		DEPTH = 0" 24" PLATE	
LOAD PSI	DEFLECTION INCHES	LOAD PSI	DEFLECTION INCHES	LOAD PSI	DEFLECTION INCHES
32.4	.013	29.9	.022	17.1	.029
66.9	.029	46.0	.038	26.2	.047
103.1	.043	63.7	.050	36.1	.060
142.9	.057	81.4	.064	46.1	.071
182.7	.072	97.1	.075	54.9	.081
218.1	.086	118.0	.085	68.6	.091
256.1	.100	130.5	.096	73.7	.100
293.2	.118	150.2	.107	84.8	.106
337.4	.135			94.7	.119
REBOUND	.023	REBOUND	.004	REBOUND	.014
R^2=.9990	B=2537	R^2= .9938	B = 1434	R^2 = .9839	B = 904

DYNAFLECT DEFLECTION AT THE CENTER OF THE SURFACE PLATE LOCATION	GEOPHONE	DEFLECTION IN .001"
	10"	1.14
	16"	.69
	26"	.30
	37"	.22
	49"	.18

TABLE 21 F-1

PLATE BEARING DEFLECTION .

SITE # 21 , UPPER DEER VALLEY — 3.5" AC

AVERAGE OF THREE READINGS — 4.0" AB

SURFACE TEMP. = 65°F. — 22.0" SM

DATE TESTED 12/19/75

DEPTH = 0" 12" PLATE		DEPTH = 0" 18" PLATE		DEPTH = 0" 24" PLATE	
LOAD PSI	DEFLECTION INCHES	LOAD PSI	DEFLECTION INCHES	LOAD PSI	DEFLECTION INCHES
32.4	.017	33.9	.030	21.8	.018
66.9	.038	45.7	.051	30.6	.033
102.2	.056	63.7	.069	41.4	.047
142.9	.073	81.4	.082	50.3	.060
182.7	.088	97.1	.098	59.6	.071
218.1	.105	112.9	.108	69.3	.083
257.8	.126	130.5	.122	79.2	.087
				89.2	.100
REBOUND	.029	REBOUND	.012	REBOUND	.000
R^2 = .9961	B = 2143	R^2 = .9832	B = 1079	R^2 = .9849	B = 827

DYNAFLECT DEFLECTION AT THE CENTER OF THE SURFACE PLATE LOCATION	GEOPHONE	DEFLECTION IN .001"
	10"	1.62
	16"	.96
	26"	.54
	37"	.36
	49"	.25

TABLE 22 F-1

PLATE BEARING DEFLECTION .

SITE # 22 , AGUA FRIA — 4.0" AC

AVERAGE OF THREE READINGS — 4.0" AB

SURFACE TEMP. = 65°F — 24.0" SM

DATE TESTED 12/10/75

DEPTH = 0" 12" PLATE		DEPTH = 0" 18" PLATE		DEPTH = 0" 24" PLATE	
LOAD PSI	DEFLECTION INCHES	LOAD PSI	DEFLECTION INCHES	LOAD PSI	DEFLECTION INCHES
32.4	.005	29.9	.011	21.8	.010
76.6	.010	46.0	.020	31.3	.015
100.5	.014	63.7	.025	41.4	.020
142.9	.017	81.4	.029	50.5	.021
182.7	.023	97.1	.032	60.4	.024
218.1	.029	114.8	.035	69.3	.028
257.9	.032	130.5	.042	79.0	.031
293.2	.040	150.2	.045	89.2	.034
337.4	.044				
REBOUND	.015	REBOUND	.007	REBOUND	.007
R^2 = .9925	B = 7635	R^2 = .9744	B = 3670	R^2 = .9861	B = 2883

DYNAFLECT DEFLECTION AT THE CENTER OF THE SURFACE PLATE LOCATION	GEOPHONE	DEFLECTION IN .001"
	10"	.87
	16"	.50
	26"	.22
	37"	.12
	49"	.09

TABLE 21 F-1M

PLATE BEARING DEFLECTION .

SITE # 21M UPPER DEER VALLEY; MEDIAN NATURAL SOIL

AVERAGE OF THREE READINGS

SURFACE TEMP.

DATE TESTED 12/8/75

DEPTH = 0" 12" PLATE		DEPTH = 0" 24" PLATE		DEPTH = 0" 30" PLATE	
LOAD PSI	DEFLECTION INCHES	LOAD PSI	DEFLECTION INCHES	LOAD PSI	DEFLECTION INCHES
17.4	.096	8.3	.041	10.9	.030
32.4	.177	12.9	.076	16.9	.044
50.1	.242	21.8	.118	23.4	.065
76.6	.328	33.9	.179	29.7	.083
85.4	.389	46.1	.242	35.4	.104
				41.8	.128
				47.4	.155
REBOUND	.326	REBOUND	.147	REBOUND	.057
R^2 = .9894	B - 245	R^2 = .9862	B = 178	R^2 = .9912	B = 293

DYNAFLECT DEFLECTION AT THE CENTER OF THE SURFACE PLATE LOCATION	GEOPHONE	DEFLECTION IN .001"
	10"	1.44
	16"	.34
	26"	.11
	37"	.07
	49"	.05

TABLE 25 F-1

PLATE BEARING DEFLECTION .

SITE # 25 , WILLIAMS FIELD — 4.0" AC

AVERAGE OF THREE READINGS — 4.0" AB

SURFACE TEMP. = 72 — 15.0" SM

DATE TESTED 12/12/75

DEPTH = 0" 12" PLATE		DEPTH = 0" 18" PLATE		DEPTH = 0" 24" PLATE	
LOAD PSI	DEFLECTION INCHES	LOAD PSI	DEFLECTION INCHES	LOAD PSI	DEFLECTION INCHES
67.8	.012	30.3	.014	21.8	.012
103.1	.018	46.0	.023	30.6	.020
142.9	.025	63.7	.031	40.5	.028
182.7	.031	81.4	.038	50.5	.036
218.1	.038	97.1	.046	59.3	.043
256.1	.047	118.0	.053	69.3	.050
293.2	.052	130.5	.061	79.2	.055
337.4	.063	150.2	.066	89.2	.060
REBOUND	.003	REBOUND	.006	REBOUND	.010
R^2 = .9958	B = 5329	R^2 = .9948	B = 2285	R^2 = .9904	B = 1375

DYNAFLECT DEFLECTION AT THE CENTER OF THE SURFACE PLATE LOCATION	GEOPHONE	DEFLECTION IN .001"
	10"	.96
	16"	.58
	26"	.34
	37"	.23
	49"	.18

TABLE 25F-1S

PLATE BEARING DEFLECTION.

SITE # 25 , WILLIAMS FIELD: SOIL SHOULDER

AVERAGE OF THREE READINGS

SURFACE TEMP.

DATE TESTED 12/12/75

SOIL FAILED UNDER 12" PLATE ABOVE 100 psi

DEPTH = 0" 18" PLATE		DEPTH = 0" 24" PLATE		DEPTH = 0" 30" PLATE	
LOAD PSI	DEFLECTION INCHES	LOAD PSI	DEFLECTION INCHES	LOAD PSI	DEFLECTION INCHES
30.3	.061	17.3	.047	11.4	.033
46.0	.151	26.2	.097	17.0	.065
63.7	.343	36.1	.200	23.4	.100
		46.1	.363	29.7	.138
		54.9	.550	35.4	.209
				41.5	.332
REBOUND	.205	REBOUND	.460	REBOUND	.186
--	--	R^2 = .9529	B = 71	R^2 = .9145	B = 99

DYNAFLECT DEFLECTION AT THE CENTER OF THE SURFACE PLATE LOCATION	GEOPHONE	DEFLECTION IN .001"
	10"	.90
	16"	.47
	26"	.30
	37"	.22
	49"	.16

TABLE 27F-1

PLATE BEARING DEFLECTION.

SITE # 27 , CASA GRANDE

AVERAGE OF THREE READINGS

SURFACE TEMP. = 72°F

DATE TESTED 12/18/75

6.0" AC
4.0" AB
18.0" SM

DEPTH = 0" 12" PLATE		DEPTH = 0" 18" PLATE		DEPTH = 0" 24" PLATE	
LOAD PSI	DEFLECTION INCHES	LOAD PSI	DEFLECTION INCHES	LOAD PSI	DEFLECTION INCHES
32.4	.010	29.9	.012	17.1	.012
66.9	.022	46.0	.024	26.2	.020
103.1	.037	63.7	.036	36.1	.030
142.9	.047	81.4	.045	46.1	.040
182.7	.061	97.1	.055	54.9	.047
218.1	.077	118.0	.064	68.6	.057
256.1	.096	130.5	.071	73.7	.063
293.2	.112	150.2	.083	84.8	.072
337.4	.128	165.9	.094	94.7	.080
REBOUND	.047	REBOUND	.020	REBOUND	.011
R^2 = .9947	B = 2549	R^2 = .9966	B = 1723	R^2 = .9982	B = 1142

DYNAFLECT DEFLECTION AT THE CENTER OF THE SURFACE PLATE LOCATION	GEOPHONE	DEFLECTION IN .001"
	10"	1.56
	16"	1.20
	26"	.87
	37"	.56
	49"	.40

TABLE 26F-1

PLATE BEARING DEFLECTION.

SITE # 26 , SUNSET POINT

AVERAGE OF THREE READINGS

SURFACE TEMP. = 56°F

DATE TESTED 12/10/75

8.0" AC
2.0" AB
17.0" SM
6.0" SGS

DEPTH = 0" 12" PLATE		DEPTH = 0" 18" PLATE		DEPTH = 0" 24" PLATE	
LOAD PSI	DEFLECTION INCHES	LOAD PSI	DEFLECTION INCHES	LOAD PSI	DEFLECTION INCHES
32.4	.010	29.9	.015	24.0	.014
66.9	.025	45.7	.029	30.6	.023
102.2	.035	63.7	.039	41.4	.031
142.9	.044	81.4	.050	50.3	.037
182.7	.055	97.1	.059	59.6	.043
217.2	.066	114.0	.067	69.3	.048
256.1	.075	130.5	.074	79.2	.052
293.2	.087	150.2	.080	89.2	.058
337.4	.097	167.9	.088	99.1	.064
REBOUND	.046	REBOUND	.026	REBOUND	.013
R^2 = .9963	B = 3578	R^2 = .9819	B = 1908	R^2 = .9823	B = 1572

DYNAFLECT DEFLECTION AT THE CENTER OF THE SURFACE PLATE LOCATION	GEOPHONE	DEFLECTION IN .001"
	10"	.79
	16"	.49
	26"	.28
	37"	.15
	49"	.09

TABLE 31F-1

PLATE BEARING DEFLECTION.

SITE # 31 , CIENAGA CREEK, TOP OF SUBGRADE

AVERAGE OF THREE READINGS

SURFACE TEMP.

DATE TESTED 12/11/75

DEPTH = 0" 12" PLATE		DEPTH = 0" 24" PLATE		DEPTH = 0" 30" PLATE	
LOAD PSI	DEFLECTION INCHES	LOAD PSI	DEFLECTION INCHES	LOAD PSI	DEFLECTION INCHES
66.9	.030	17.1	.020	11.2	.025
103.1	.055	26.0	.033	16.9	.043
142.9	.086	36.1	.051	23.4	.057
182.7	.149	46.1	.070	29.7	.072
218.1	.276	54.9	.085	35.4	.084
		64.4	.107	41.5	.101
		73.7	.128	47.4	.115
		84.8	.152	54.5	.129
REBOUND	.270	REBOUND	.029	REBOUND	.014
R^2 = .8819	B = 577	R^2 = .9954	B = 507	R^2 = .9980	B = 418

DYNAFLECT DEFLECTION AT THE CENTER OF THE SURFACE PLATE LOCATION	GEOPHONE	DEFLECTION IN .001"
	10"	1.32
	16"	.55
	26"	.21
	37"	.10
	49"	.07

TABLE 34F-1

PLATE BEARING DEFLECTION .

SITE # 34 , LAKE PLEASANT, TOP OF SUBGRADE

AVERAGE OF THREE READINGS

SURFACE TEMP.

DATE TESTED 12/9/75

DEPTH = 0" 12" PLATE		DEPTH = 0" 24" PLATE		DEPTH = 0" 30" PLATE	
LOAD PSI	DEFLECTION INCHES	LOAD PSI	DEFLECTION INCHES	LOAD PSI	DEFLECTION INCHES
17.4	.020	8.5	.022	8.5	.019
43.9	.040	17.1	.048	11.2	.031
58.9	.049	26.0	.068	14.2	.041
85.4	.073	36.1	.088	19.7	.059
102.2	.088	46.1	.104	26.8	.076
121.7	.100	54.7	.118	32.4	.093
142.9	.117	64.0	.132	38.4	.103
162.4	.129			44.6	.112
				50.8	.123
REBOUND	.089	REBOUND	.070	REBOUND	.053
R^2 = .9978	B = 1299	R^2 = .9855	B = 510	R^2 = .9784	B = 400

DYNAFLECT DEFLECTION AT THE CENTER OF THE SURFACE PLATE LOCATION	GEOPHONE	DEFLECTION IN .001"
	10"	.53
	16"	.26
	26"	.16
	37"	.11
	49"	.09

TABLE 37F-1

PLATE BEARING DEFLECTION .

SITE # 37 , TONOPAH — 13.0" AC

AVERAGE OF THREE READINGS — 5.0" SM

SURFACE TEMP. 52°F

DATE TESTED 12/16/75

DEPTH = 0" 12" PLATE		DEPTH = 0" 18" PLATE		DEPTH = 0" 24" PLATE	
LOAD PSI	DEFLECTION INCHES	LOAD PSI	DEFLECTION INCHES	LOAD PSI	DEFLECTION INCHES
32.4	.006	30.3	.006	17.3	.007
66.9	.015	46.0	.012	26.2	.013
103.1	.021	63.7	.018	36.1	.020
142.9	.030	81.4	.024	46.1	.025
182.7	.037	97.1	.032	54.9	.031
218.1	.047	192.5	.038	64.0	.037
256.1	.058	130.5	.046	73.7	.042
293.2	.068	150.2	.052	84.8	.050
337.4	.079			94.7	.058
REBOUND	.040	REBOUND	.017	REBOUND	.024
R^2 = .9873	B = 4367	R^2 = .9974	B = 1555	R^2 = .9981	B=1555

DYNAFLECT DEFLECTION AT THE CENTER OF THE SURFACE PLATE LOCATION	GEOPHONE	DEFLECTION IN .001"
	10"	.26
	16"	.23
	26"	.19
	37"	.15
	49"	.12

TABLE 2F-2

PLATE BEARING DEFLECTION

SITE # 2 , SYBIL RD. — 7.1" AC

AVERAGE OF THREE READINGS — 3.0" AB

SURFACE TEMP. = 44°F — 9.0" SM

DATE TESTED 10/27/76

DEPTH = 0" 12" PLATE		DEPTH = 7" 24" PLATE		DEPTH = 20" 30" PLATE	
LOAD PSI	DEFLECTION INCHES	LOAD PSI	DEFLECTION INCHES	LOAD PSI	DEFLECTION INCHES
19.0	.007	3.1	.005	1.8	.002
27.9	.009	5.3	.007	3.9	.018
36.7	.012	7.5	.012	5.3	.029
45.5	.013	9.7	.018	6.7	.044
54.4	.015	11.9	.022	8.1	.048
63.2	.016	14.1	.026	9.5	.058
72.1	.017	16.4	.030	11.0	.065
89.7	.020	18.6	.033	12.4	.070
		23.0	.038	15.2	.080
REBOUND	.003	REBOUND	.019	REBOUND	.060
R^2 = .9877	B = 5451	R^2 = .9919	B = 554	R^2 = .9661	B = 164

DYNAFLECT DEFLECTION AT THE CENTER OF THE SURFACE PLATE LOCATION	GEOPHONE	DEFLECTION IN .001"
	10"	.74
	16"	.50
	26"	.26
	37"	.17
	49"	.13

TABLE 3F-2

PLATE BEARING DEFLECTION

SITE # 3 , CUTTER — 2.9" AC

AVERAGE OF THREE READINGS — 3.0" AB

SURFACE TEMP. = 90°F — 6.0" SGS

DATE TESTED 8/10/76

DEPTH = 0" 12" PLATE		DEPTH = 4" 24" PLATE		DEPTH = 15" 30" PLATE	
LOAD PSI	DEFLECTION INCHES	LOAD PSI	DEFLECTION INCHES	LOAD PSI	DEFLECTION INCHES
10.2	.003	3.1	.002	2.5	.002
19.0	.009	5.3	.005	3.9	.008
27.9	.017	9.7	.019	6.7	.027
36.7	.025	14.2	.028	9.6	.046
54.4	.035	18.6	.037	12.4	.066
72.1	.045	23.0	.041	15.2	.084
89.7	.054				
REBOUND	.005	REBOUND	.001	REBOUND	.030
R^2 = .9946	B = 1537	R^2 = .9882	B = 470	R^2 = .9994	B=151

DYNAFLECT DEFLECTION AT THE CENTER OF THE SURFACE PLATE LOCATION	GEOPHONE	DEFLECTION IN .001"
	10"	2.19
	16"	1.62
	26"	.99
	37"	.70
	49"	.53

TABLE 4F-2

PLATE BEARING DEFLECTION

SITE # 4 , BENSON — 8.5" AC

AVERAGE OF THREE READINGS — 3.0" AB

SURFACE TEMP. = 37°F — 12.0" SM

DATE TESTED 10/28/76

DEPTH = 0" 12" PLATE LOAD PSI	DEFLECTION INCHES	DEPTH = 10" 24" PLATE LOAD PSI	DEFLECTION INCHES	DEPTH = 25" 30" PLATE LOAD PSI	DEFLECTION INCHES
14.6	.006	3.1	.003	1.8	.003
24.4	.010	5.3	.006	3.9	.020
32.3	.012	7.5	.012	5.3	.028
41.1	.015	9.7	.017	6.7	.043
50.0	.018	11.9	.022	8.1	.051
58.8	.020	14.2	.024	9.5	.056
67.6	.023	16.4	.027	11.0	.062
89.7	.026	18.6	.029	12.4	.066
		23.0	.033	15.2	.073
REBOUND	.005	REBOUND	.013	REBOUND	.055
R^2 = .9872	B = 3571	R^2 = .9784	B = 609	R^2 = .9751	B = 174

DYNAFLECT DEFLECTION AT THE CENTER OF THE SURFACE PLATE LOCATION	GEOPHONE	DEFLECTION IN .001"
	10"	.87
	16"	.64
	26"	.36
	37"	.23
	49"	.16

TABLE 6F-2

PLATE BEARING DEFLECTION

SITE # 6 , GILA BEND — 7.6" AC

AVERAGE OF THREE READINGS — 4.0" AB

SURFACE TEMP. = 85°F — 4.0" SM

DATE TESTED 11/3/76

DEPTH = 0" 12" PLATE LOAD PSI	DEFLECTION INCHES	DEPTH = 9" 24" PLATE LOAD PSI	DEFLECTION INCHES	DEPTH = 18" 30" PLATE LOAD PSI	DEFLECTION INCHES
10.2	.001	3.1	.005	2.5	.005
19.0	.004	5.3	.008	3.9	.017
27.9	.005	7.5	.009	5.3	.028
36.7	.007	9.7	.012	6.7	.039
45.5	.011	11.9	.014	8.1	.045
54.4	.013	14.2	.017	9.5	.050
63.2	.015	18.6	.021	12.4	.061
72.1	.017			15.2	.066
89.7	.020				
REBOUND	.010	REBOUND	.001	REBOUND	.055
R^2 = .9933	B = 3986	R^2 = .9971	B = 963	R^2 = .9662	B = 197

DYNAFLECT DEFLECTION AT THE CENTER OF THE SURFACE PLATE LOCATION	GEOPHONE	DEFLECTION IN .001"
	10"	.36
	16"	.27
	26"	.19
	37"	.14
	49"	.11

TABLE 5F-2

PLATE BEARING DEFLECTION

SITE # 5 , SHOW LOW — 4.9" AC

AVERAGE OF THREE READINGS — 4.0" AB

SURFACE TEMP. = 82°F — 15.5" SM

DATE TESTED 8/5/76

DEPTH = 0" 12" PLATE LOAD PSI	DEFLECTION INCHES	DEPTH = 5" 24" PLATE LOAD PSI	DEFLECTION INCHES	DEPTH = 25" 30" PLATE LOAD PSI	DEFLECTION INCHES
10.2	.004	3.1	.005	2.5	.006
19.0	.011	5.3	.015	3.9	.024
27.9	.017	7.5	.028	5.3	.041
45.5	.025	9.7	.039	6.7	.056
54.4	.037	11.9	.048	8.1	.074
72.1	.048	14.2	.056	9.6	.086
89.7	.056	18.6	.071	12.4	.112
		23.0	.080	15.2	.130
REBOUND	.004	REBOUND	.044	REBOUND	.067
R^2 = .9941	B = 1479	R^2 = .9871	B = 254	R^2 = .9934	B = 100

DYNAFLECT DEFLECTION AT THE CENTER OF THE SURFACE PLATE LOCATION	GEOPHONE	DEFLECTION IN .001"
	10"	2.07
	16"	1.26
	26"	.57
	37"	.31
	49"	.19

TABLE 7F-2

PLATE BEARING DEFLECTION

SITE # 7 , ASH FORK — 6.3" AC

AVERAGE OF THREE READINGS — 4.0" AB

SURFACE TEMP. = 103°F — 11.0" SM

DATE TESTED 7/20/76

DEPTH = 0" 12" PLATE LOAD PSI	DEFLECTION INCHES	DEPTH = 7" 24" PLATE LOAD PSI	DEFLECTION INCHES	DEPTH = 24" 30" PLATE LOAD PSI	DEFLECTION INCHES
10.2	.005	4.2	.001	2.5	.004
14.6	.011	5.3	.004	3.9	.015
23.4	.021	6.4	.006	6.7	.045
32.3	.030	9.7	.019	9.6	.074
50.0	.042	14.2	.025	12.4	.105
67.6	.054	18.6	.035	15.2	.131
89.7	.064	23.0	.041		
REBOUND	.022	REBOUND	.000	REBOUND	.031
R^2 = .9879	B = 1331	R^2 = .9883	B = 447	R^2 = .9996	B = 98

DYNAFLECT DEFLECTION AT THE CENTER OF THE SURFACE PLATE LOCATION	GEOPHONE	DEFLECTION IN .001"
	10"	1.56
	16"	1.14
	26"	.64
	37"	.38
	49"	.26

TABLE 8F-2

PLATE BEARING DEFLECTION

SITE # 8 , WINONA — 8.6" AC

AVERAGE OF THREE READINGS — 3.0" AB

SURFACE TEMP. — 9.0" SM

DATE TESTED 5/18/76

DEPTH = 0" 12" PLATE LOAD PSI	DEFLECTION INCHES	DEPTH = 9" 24" PLATE LOAD PSI	DEFLECTION INCHES	DEPTH = 23" 30" PLATE LOAD PSI	DEFLECTION INCHES
5.7	.005	2.1	.009	1.8	.005
14.5	.012	5.4	.018	3.9	.015
23.3	.020	9.8	.025	6.7	.033
32.2	.025	14.3	.029	9.5	.041
49.9	.031	18.7	.035	12.4	.048
67.6	.038	23.1	.045	15.2	.054
89.7	.042	25.3	.048	16.6	.057
REBOUND	.014	REBOUND	.005	REBOUND	.031
R^2 = .9675	B = 2175	R^2 = .9781	B = 774	R^2 = .9768	B = 278

DYNAFLECT DEFLECTION AT THE CENTER OF THE SURFACE PLATE LOCATION	GEOPHONE	DEFLECTION IN .001"
	10"	1.44
	16"	1.02
	26"	.58
	37"	.33
	49"	.19

TABLE 11F-2

PLATE BEARING DEFLECTION

SITE # 11 , MINNETONKA — 9.1" AC

AVERAGE OF THREE READINGS — 15.0" SM

SURFACE TEMP. = 80°F

DATE TESTED 7/27/76

DEPTH = 0" 12" PLATE LOAD PSI	DEFLECTION INCHES	DEPTH = 10" 24" PLATE LOAD PSI	DEFLECTION INCHES	DEPTH = 24" 30" PLATE LOAD PSI	DEFLECTION INCHES
10.2	.004	5.3	.008	2.5	.004
14.6	.007	7.5	.014	3.9	.017
19.0	.010	9.7	.024	5.3	.032
23.4	.014	11.9	.034	6.7	.049
27.9	.018	14.2	.040	8.1	.065
32.3	.021	16.4	.048	9.6	.078
50.0	.031	18.6	.054	11.0	.093
67.6	.043	23.0	.064	12.4	.102
89.7	.050			15.2	.124
REBOUND	.014	REBOUND	.010	REBOUND	.037
R^2 = .9917	B = 1644	R^2 = .9930	B = 300	R^2 = .9964	B = 102

DYNAFLECT DEFLECTION AT THE CENTER OF THE SURFACE PLATE LOCATION	GEOPHONE	DEFLECTION IN .001"
	10"	1.74
	16"	1.38
	26"	.96
	37"	.76
	49"	.56

TABLE 9F-2

PLATE BEARING DEFLECTION

SITE # 9 , WILMOT — 2.8" AC

AVERAGE OF THREE READINGS — 4.0" AB

SURFACE TEMP. = 60°F — 9.0" SM

DATE TESTED 10/26/76

DEPTH = 0" 12" PLATE LOAD PSI	DEFLECTION INCHES	DEPTH = 3" 24" PLATE LOAD PSI	DEFLECTION INCHES	DEPTH = 18" 30" PLATE LOAD PSI	DEFLECTION INCHES
5.8	.011	3.1	.008	2.5	.009
14.6	.018	5.3	.013	3.9	.015
23.4	.026	7.5	.020	5.3	.021
32.3	.033	9.7	.028	6.7	.030
50.0	.045	11.9	.033	8.1	.038
67.6	.057	14.2	.038	9.6	.045
		16.4	.048	11.0	.054
		23.0	.054	12.4	.061
				13.8	.067
REBOUND	.022	REBOUND	.017	REBOUND	.023
R^2 = .9984	B = 1343	R^2 = .9814	B = 390	R^2 = .9990	B = 188

DYNAFLECT DEFLECTION AT THE CENTER OF THE SURFACE PLATE LOCATION	GEOPHONE	DEFLECTION IN .001"
	10"	1.83
	16"	.99
	26"	.53
	37"	.37
	49"	.26

TABLE 12F-2

PLATE BEARING DEFLECTION

SITE # 12 , DEAD RIVER #1 — 6.8" AC

AVERAGE OF THREE READINGS — 6.0" CTB

SURFACE TEMP. = 90°F — 4.0" SM

DATE TESTED 7/28/76

DEPTH = 0" 12" PLATE LOAD PSI	DEFLECTION INCHES	DEPTH = 7" 24" PLATE LOAD PSI	DEFLECTION INCHES	DEPTH = 17" 30" PLATE LOAD PSI	DEFLECTION INCHES
10.2	.003	5.3	.004	3.9	.007
14.6	.005	7.5	.008	5.3	.017
23.4	.011	9.7	.014	6.7	.031
32.3	.016	11.9	.019	8.1	.045
50.0	.027	14.2	.024	9.6	.057
67.6	.035	16.4	.027	11.0	.070
89.7	.045	18.6	.031	12.4	.081
		23.0	.037	15.2	.103
REBOUND	.015	REBOUND	.005	REBOUND	.051
R^2 = .9974	B - 1850	R^2 = .9930	B = 515	R^2 = .9991	B = 115

DYNAFLECT DEFLECTION AT THE CENTER OF THE SURFACE PLATE LOCATION	GEOPHONE	DEFLECTION IN .001"
	10"	1.20
	16"	.96
	26"	.67
	37"	.49
	49"	.36

TABLE 14F-2

PLATE BEARING DEFLECTION

SITE # 14 , FLAGSTAFF AIRPORT NB

AVERAGE OF THREE READINGS

SURFACE TEMP. = 90°F

DATE TESTED 7/21/76

5.3" AC
6.0" AB
10.0" SM
12.0" SGS

DEPTH = 0" 12" PLATE LOAD PSI	DEFLECTION INCHES	DEPTH = 6" 24" PLATE LOAD PSI	DEFLECTION INCHES	DEPTH = 36" 30" PLATE LOAD PSI	DEFLECTION INCHES
10.2	.003	5.3	.002	2.5	.001
14.6	.006	7.5	.004	3.9	.004
23.4	.012	9.7	.008	5.3	.008
32.3	.020	14.2	.011	6.7	.015
50.0	.029	18.6	.015	8.1	.020
67.6	.037	23.0	.018	9.6	.020
89.7	.044			12.4	.024
				13.8	.023
REBOUND	.017	REBOUND	.000	REBOUND	.004
R^2 = .9866	B = 1844	R^2 = .9909	B = 1061	R^2 = .9457	B = 422

DYNAFLECT DEFLECTION AT THE CENTER OF THE SURFACE PLATE LOCATION GEOPHONE	DEFLECTION IN .001"
10"	1.08
16"	.58
26"	.14
37"	.05
49"	.04

TABLE 15F-2

PLATE BEARING DEFLECTION

SITE # 15 , SEDONA TI

AVERAGE OF THREE READINGS

SURFACE TEMP. 70°F

DATE TESTED 5/6/76

8.1" AC
3.0" AB
15.0" SM

DEPTH = 0" 12" PLATE LOAD PSI	DEFLECTION INCHES	DEPTH = 9" 24" PLATE LOAD PSI	DEFLECTION INCHES	DEPTH = 31" 30" PLATE LOAD PSI	DEFLECTION INCHES
5.7	.025	2.1	.020	1.8	.039
14.5	.030	5.4	.030	3.9	.064
23.3	.036	9.8	.045	6.7	.085
32.2	.041	14.3	.055	9.5	.106
49.9	.049	18.7	.067	12.4	.128
67.6	.060	20.9	.071	15.2	.146
REBOUND	.024	REBOUND	.030	REBOUND	.062
R^2 = .9968	B = 1796	R^2 = .9942	B = 365	R^2 = .9929	B = 127

DYNAFLECT DEFLECTION AT THE CENTER OF THE SURFACE PLATE LOCATION GEOPHONE	DEFLECTION IN .001"
10"	1.35
16"	.96
26"	.53
37"	.35
49"	.26

TABLE 17F-2

PLATE BEARING DEFLECTION

SITE # 17 , CRAZY CREEK #1

AVERAGE OF THREE READINGS

SURFACE TEMP. = 94°F

DATE TESTED 7/29/76

7.3" AC
6.0" CTB
6.0" SM

DEPTH = 0" 12" PLATE LOAD PSI	DEFLECTION INCHES	DEPTH = 8" 24" PLATE LOAD PSI	DEFLECTION INCHES	DEPTH = 20" 30" PLATE LOAD PSI	DEFLECTION INCHES
14.6	.002	5.3	.002	3.9	.002
19.0	.006	7.5	.002	5.3	.003
23.4	.009	9.7	.002	6.7	.008
27.9	.012	11.9	.004	8.1	.013
32.3	.016	14.2	.004	9.6	.016
45.5	.023	16.4	.005	12.4	.022
50.0	.025	18.6	.005	15.2	.024
67.6	.032	20.8	.004		
89.7	.040	23.0	.004		
REBOUND	.012	REBOUND	.000	REBOUND	.001
R^2 = .9866	B = 1939	R^2 = .8431	B = 4001	R^2 = .9789	B = 449

DYNAFLECT DEFLECTION AT THE CENTER OF THE SURFACE PLATE LOCATION GEOPHONE	DEFLECTION IN .001"
10"	.87
16"	.70
26"	.55
37"	.43
49"	.34

TABLE 19F-2

PLATE BEARING DEFLECTION

SITE # 19 , LUPTON

AVERAGE OF THREE READINGS

SURFACE TEMP. = 87°F

DATE TESTED 8/3/76

6.8" AC
6.0" CTB
21.0" SM

DEPTH = 0" 12" PLATE LOAD PSI	DEFLECTION INCHES	DEPTH = 7" 24" PLATE LOAD PSI	DEFLECTION INCHES	DEPTH = 34" 30" PLATE LOAD PSI	DEFLECTION INCHES
10.2	.002	3.1	.001	2.5	.003
19.0	.004	5.3	.004	3.9	.015
27.9	.006	7.5	.008	5.3	.026
45.5	.009	11.9	.016	6.7	.037
54.4	.014	14.2	.018	9.6	.050
72.1	.019	18.6	.023	12.4	.061
89.7	.025	20.8	.025	15.2	.066
REBOUND	.003	REBOUND	.007	REBOUND	.042
R^2 = .9916	B = 3391	R^2 = .9925	B = 710	R^2 = .9742	B = 192

DYNAFLECT DEFLECTION AT THE CENTER OF THE SURFACE PLATE LOCATION GEOPHONE	DEFLECTION IN .001"
10"	.75
16"	.70
26"	.55
37"	.42
49"	.30

TABLE 20F-2

PLATE BEARING DEFLECTION

SITE # 20 , MARANA — 3.3" AC

AVERAGE OF THREE READINGS — 4.0" AB

SURFACE TEMP. = 81°F — 6.0" CTB

DATE TESTED 10/21/76 — 5.0" SM

DEPTH = 0" 12" PLATE		DEPTH = 7" 24" PLATE		DEPTH = 19" 30" PLATE	
LOAD PSI	DEFLECTION INCHES	LOAD PSI	DEFLECTION INCHES	LOAD PSI	DEFLECTION INCHES
10.2	.005	10.2	.003	2.5	.011
19.0	.008	19.0	.006	3.9	.018
27.9	.011	27.9	.011	5.3	.025
36.7	.014	36.7	.015	6.7	.035
45.5	.018	45.5	.020	8.1	.042
54.4	.020	54.4	.023	9.5	.049
72.1	.024	72.1	.027	12.4	.059
89.7	.027	89.7	.031	15.2	.067
REBOUND	.006	REBOUND	.012	REBOUND	.025
R^2 = .9881	B = 3436	R^2 = .9822	B = 2646	R^2 = .9893	B = 216

DYNAFLECT DEFLECTION AT THE CENTER OF THE SURFACE PLATE LOCATION	GEOPHONE	DEFLECTION IN .001"
	10"	.99
	16"	.73
	26"	.41
	37"	.29
	49"	.22

TABLE 21F-2M

PLATE BEARING DEFLECTION

SITE # 21 , UPPER DEER VALLEY; — MEDIAN TOP OF SOIL

AVERAGE OF THREE READINGS

SURFACE TEMP.

DATE TESTED 4/28/76

DEPTH = 0" 12" PLATE		DEPTH = 0" 30" PLATE		DEPTH = ___ PLATE	
LOAD PSI	DEFLECTION INCHES	LOAD PSI	DEFLECTION INCHES	LOAD PSI	DEFLECTION INCHES
5.7	.039	1.8	.009		
14.5	.062	3.9	.019		
23.3	.090	6.7	.032		
32.2	.117	9.5	.045		
49.9	.166	12.4	.056		
		15.2	.066		
REBOUND	.071	REBOUND	.039	REBOUND	
R^2 = .9992	B = 344	R^2 = .9966	B = 233		

DYNAFLECT DEFLECTION AT THE CENTER OF THE SURFACE PLATE LOCATION	GEOPHONE	DEFLECTION IN .001"
	10"	2.01
	16"	.50
	26"	.25
	37"	.12
	49"	.06

TABLE 21F-2

PLATE BEARING DEFLECTION

SITE # 21 — 3.5" AC

AVERAGE OF THREE READINGS — 4.0" AB

SURFACE TEMP. 100°F — 22.0" SM

DATE TESTED 4/29/76

DEPTH = 0" 12" PLATE		DEPTH = 4" 24" PLATE		DEPTH = 30" 30" PLATE	
LOAD PSI	DEFLECTION INCHES	LOAD PSI	DEFLECTION INCHES	LOAD PSI	DEFLECTION INCHES
5.7	.012	2.1	.014	1.8	.017
14.5	.015	5.4	.026	3.9	.038
23.3	.020	9.8	.041	6.7	.068
32.2	.025	14.3	.054	9.5	.098
49.9	.032	18.7	.064	12.4	.125
67.6	.041	23.1	.072	13.8	.140
REBOUND	.011	REBOUND	.032	REBOUND	.061
R^2 = .9985	B = 2112	R^2 = .9925	B = 354	R^2 = .9998	B = 97

DYNAFLECT DEFLECTION AT THE CENTER OF THE SURFACE PLATE LOCATION	GEOPHONE	DEFLECTION IN .001"
	10"	2.46
	16"	1.23
	26"	.75
	37"	.41
	49"	.27

TABLE 22F-2

PLATE BEARING DEFLECTION

SITE # 22 , AGUA FRIA — 4.0" AC

AVERAGE OF THREE READINGS — 4.0" AB

SURFACE TEMP. = 56°F — 22.0" SM

DATE TESTED 11/17/76

DEPTH = 0" 12" PLATE		DEPTH = 4" 24" PLATE		DEPTH = 31" 30" PLATE	
LOAD PSI	DEFLECTION INCHES	LOAD PSI	DEFLECTION INCHES	LOAD PSI	DEFLECTION INCHES
10.2	.003	3.1	.004	2.5	.007
19.0	.005	5.3	.007	3.9	.011
27.9	.007	7.5	.012	5.3	.017
36.7	.009	9.7	.017	6.7	.024
45.5	.010	11.9	.020	8.1	.030
54.4	.011	14.2	.023	9.5	.036
72.1	.014	18.6	.027	12.4	.046
REBOUND	.002	REBOUND	.015	REBOUND	.024
R^2 = .9917	B = 5658	R^2 = .9850	B = 624	R^2 = .9980	B = 243

DYNAFLECT DEFLECTION AT THE CENTER OF THE SURFACE PLATE LOCATION	GEOPHONE	DEFLECTION IN .001"
	10"	.64
	16"	.40
	26"	.20
	37"	.09
	49"	.06

TABLE 23F-2

PLATE BEARING DEFLECTION

SITE # 23 , BELLEMONT

AVERAGE OF THREE READINGS

SURFACE TEMP. = 75°F

DATE TESTED 5/20/76

2.0" AC
4.0" AB
9.0" SM
6.0" SGS

DEPTH = 0" 12" PLATE		DEPTH = 3" 24" PLATE		DEPTH = 24" 30" PLATE	
LOAD PSI	DEFLECTION INCHES	LOAD PSI	DEFLECTION INCHES	LOAD PSI	DEFLECTION INCHES
5.7	.012	2.1	.010	1.8	.008
14.5	.020	5.4	.027	3.9	.026
23.3	.027	9.8	.043	6.7	.057
32.2	.032	14.3	.056	9.5	.089
49.9	.041	18.7	.066	12.4	.118
67.6	.048	19.8	.068	15.2	.133
89.7	.056				
REBOUND	.017	REBOUND	.038	REBOUND	.065
R^2 = .9850	B = 1912	R^2 = .9891	B = 308	R^2 = .9955	B = 101

DYNAFLECT DEFLECTION AT THE CENTER OF THE SURFACE PLATE LOCATION	GEOPHONE	DEFLECTION IN .001"
	10"	1.71
	16"	.87
	26"	.31
	37"	.17
	49"	.13

TABLE 25F-2

PLATE BEARING DEFLECTION

SITE # 25 , WILLIAMS FIELD

AVERAGE OF THREE READINGS

SURFACE TEMP. = 73°F

DATE TESTED 10/19/76

4.0" AC
4.0" AB
15.0" SM

DEPTH = 0" 12" PLATE		DEPTH = 4" 24" PLATE		DEPTH = 25" 30" PLATE	
LOAD PSI	DEFLECTION INCHES	LOAD PSI	DEFLECTION INCHES	LOAD PSI	DEFLECTION INCHES
10.2	.008	2.0	.004	3.2	.003
19.0	.011	5.3	.013	4.6	.003
27.9	.015	9.7	.033	6.7	.005
36.7	.019	14.2	.043	9.6	.012
54.4	.025	18.6	.050	12.4	.022
72.1	.030	23.0	.054	13.8	.025
89.7	.035				
REBOUND	.013	REBOUND	.038	REBOUND	.001
R^2 = .9960	B = 2895	R^2 = .9704	B = 381	R^2 = .9725	B = 424

DYNAFLECT DEFLECTION AT THE CENTER OF THE SURFACE PLATE LOCATION	GEOPHONE	DEFLECTION IN .001"
	10"	.96
	16"	.62
	26"	.30
	37"	.21
	49"	.17

TABLE 24F-2

PLATE BEARING DEFLECTION

SITE # 24 , TOPOCK

AVERAGE OF THREE READINGS

SURFACE TEMP. = 60°F

DATE TESTED 11/9/76

4.0" AC
4.0" AB
9.0" SM

DEPTH = 0" 12" PLATE		DEPTH = 4" 24" PLATE		DEPTH = 18" 30" PLATE	
LOAD PSI	DEFLECTION INCHES	LOAD PSI	DEFLECTION INCHES	LOAD PSI	DEFLECTION INCHES
10.2	.006	3.1	.011	3.9	.008
19.0	.009	5.3	.015	5.3	.010
27.9	.011	7.5	.019	6.7	.012
36.7	.015	9.7	.023	8.1	.014
45.5	.016	11.9	.027	9.5	.018
54.4	.018	14.2	.029	12.4	.023
72.1	.023	18.6	.032	14.2	.028
88.4	.026	22.1	.036		
REBOUND	.012	REBOUND	.016	REBOUND	.008
R^2 = .9945	B = 3876	R^2 = .9805	B = 744	R^2 = .9939	B = 510

DYNAFLECT DEFLECTION AT THE CENTER OF THE SURFACE PLATE LOCATION	GEOPHONE	DEFLECTION IN .001"
	10"	.87
	16"	.75
	26"	.38
	37"	.25
	49"	.18

TABLE 26F-2

PLATE BEARING DEFLECTION

SITE # 26 , SUNSET POINT

AVERAGE OF THREE READINGS

SURFACE TEMP. = 72°F

DATE TESTED 5/5/76

8.0" AC
2.0" AB
17.0" SM
6.0" SGS

DEPTH = 0" 12" PLATE		DEPTH = 8" 24" PLATE		DEPTH = 36" 30" PLATE	
LOAD PSI	DEFLECTION INCHES	LOAD PSI	DEFLECTION INCHES	LOAD PSI	DEFLECTION INCHES
5.7	.012	2.1	.025	1.8	.030
14.5	.015	5.4	.032	3.9	.044
23.3	.019	9.8	.040	6.7	.067
32.2	.021	14.3	.045	9.5	.088
49.9	.024	18.7	.050	12.4	.105
67.6	.031	23.1	.053	13.8	.112
76.4	.033				
REBOUND	.014	REBOUND	.031	REBOUND	.039
R^2 = .9934	B = 3425	R^2 = .9835	B = 731	R^2 = .9977	B = 143

DYNAFLECT DEFLECTION AT THE CENTER OF THE SURFACE PLATE LOCATION	GEOPHONE	DEFLECTION IN .001"
	10"	.81
	16"	.63
	26"	.34
	37"	.20
	49"	.11

TABLE 27F-2

PLATE BEARING DEFLECTION

SITE # 27 , CASA GRANDE — 6.0" AC

AVERAGE OF THREE READINGS — 4.0" AB

SURFACE TEMP. = 74°F — 18.0" SM

DATE TESTED 10/20/76

DEPTH = 0" 12" PLATE		DEPTH = 6" 24" PLATE		DEPTH = 28" 30" PLATE	
LOAD PSI	DEFLECTION INCHES	LOAD PSI	DEFLECTION INCHES	LOAD PSI	DEFLECTION INCHES
14.6	.007	3.1	.009	1.8	.011
23.4	.011	5.3	.013	2.5	.018
32.3	.013	7.5	.018	3.9	.032
41.1	.017	9.7	.025	5.3	.045
50.0	.020	11.9	.030	6.7	.057
58.8	.023	14.1	.036	8.1	.067
67.6	.026	16.4	.039	9.5	.075
89.7	.030	18.6	.041	11.0	.085
		20.8	.043	12.4	.093
REBOUND	.008	REBOUND	.013	REBOUND	.045
R^2 = .9907	B = 3109	R^2 = .9856	B = 473	R^2 = .9944	B = 128

DYNAFLECT DEFLECTION AT THE CENTER OF THE SURFACE PLATE LOCATION	GEOPHONE	DEFLECTION IN .001"
	10"	1.14
	16"	.99
	26"	.63
	37"	.42
	49"	.29

TABLE 29F-2

PLATE BEARING DEFLECTION

SITE # 29 , COSNINO — 8.0" PCCP

AVERAGE OF THREE READINGS — 6.0" CTB

SURFACE TEMP. 77°F — 5.0" SGS

DATE TESTED 5/12/76

DEPTH = 0" 12" PLATE		DEPTH = 9" 24" PLATE		DEPTH = 19" 30" PLATE	
LOAD PSI	DEFLECTION INCHES	LOAD PSI	DEFLECTION INCHES	LOAD PSI	DEFLECTION INCHES
5.7	.004	2.1	.021	1.8	.070
14.5	.004	5.4	.028	3.9	.081
23.3	.006	9.8	.034	6.7	.098
32.2	.006	14.3	.040	8.8	.116
49.9	.007	18.7	.044		
67.6	.008				
REBOUND	.004	REBOUND	.018	REBOUND	.076
R^2 = .9808	B = 12,583	R^2 = .9907	B = 717	R^2 = .9945	B = 307

DYNAFLECT DEFLECTION AT THE CENTER OF THE SURFACE PLATE LOCATION	GEOPHONE	DEFLECTION IN .001"
	10"	.41
	16"	.40
	26"	.35
	37"	.31
	49"	.26

TABLE 28F-2

PLATE BEARING DEFLECTION

SITE # 28 , WOODY MTN. — 8.0" PCCP

AVERAGE OF THREE READINGS — 6.0" CTB

SURFACE TEMP. = 62°F — 6.0" SGS

DATE TESTED 5/19/76

DEPTH = 0" 12" PLATE		DEPTH = 10" 24" PLATE		DEPTH = 24" 30" PLATE	
LOAD PSI	DEFLECTION INCHES	LOAD PSI	DEFLECTION INCHES	LOAD PSI	DEFLECTION INCHES
5.7	.001	2.1	.010	1.8	.022
14.5	.002	5.4	.028	3.9	.044
23.3	.003	9.8	.047	6.7	.061
32.2	.003	14.3	.059	9.5	.077
49.9	.005	18.7	.071	12.4	.089
67.6	.007	20.9	.081		
89.7	.008				
REBOUND	.001	REBOUND	.060	REBOUND	.055
R^2 = .9956	B = 11,666	R^2 = .9920	B = 280	R^2 = .9871	B = 158

DYNAFLECT DEFLECTION AT THE CENTER OF THE SURFACE PLATE LOCATION	GEOPHONE	DEFLECTION IN .001"
	10"	.87
	16"	.81
	26"	.73
	37"	.56
	49"	.42

TABLE 30F-2

PLATE BEARING DEFLECTION

SITE # 30 , CHERRY ROAD — 10.5" AC

AVERAGE OF THREE READINGS — 4.0" AB

SURFACE TEMP. = 54°F — 21.0" SM

DATE TESTED 11/16/76 — 6.0" SGS

DEPTH = 0" 12" PLATE		DEPTH = 11" 24" PLATE		DEPTH = 42" 30" PLATE	
LOAD PSI	DEFLECTION INCHES	LOAD PSI	DEFLECTION INCHES	LOAD PSI	DEFLECTION INCHES
10.2	.004	3.1	.003	2.5	.012
19.0	.008	5.3	.004	3.9	.019
27.9	.010	7.5	.008	5.3	.033
36.7	.014	9.7	.013	6.7	.051
45.5	.017	11.9	.017	8.1	.063
54.4	.019	14.2	.020	9.5	.075
72.1	.024	18.6	.026	12.4	.096
80.9	.026	20.8	.029	13.8	.101
REBOUND	.016	REBOUND	.016	REBOUND	.067
R^2 = .9952	B = 3208	R^2 = .9949	B = 637	R^2 = .9929	B = 118

DYNAFLECT DEFLECTION AT THE CENTER OF THE SURFACE PLATE LOCATION	GEOPHONE	DEFLECTION IN .001"
	10"	.36
	16"	.33
	26"	.22
	37"	.14
	49"	.10

TABLE 31F-2

PLATE BEARING DEFLECTION

SITE # 31 , CIENAGA CREEK, TOP OF SUBGRADE

AVERAGE OF THREE READINGS

SURFACE TEMP:

DATE TESTED 11/16/76

DEPTH = 0" 30" PLATE		DEPTH = ___ PLATE		DEPTH = ___ PLATE	
LOAD PSI	DEFLECTION INCHES	LOAD PSI	DEFLECTION INCHES	LOAD PSI	DEFLECTION INCHES
2.5	.005				
3.9	.009				
5.3	.013				
6.7	.017				
8.1	.021				
9.5	.024				
12.4	.031				
13.8	.034				
REBOUND	.011	REBOUND		REBOUND	
R^2 = .9984	B = 388				

DYNAFLECT DEFLECTION AT THE CENTER OF THE SURFACE PLATE LOCATION	GEOPHONE	DEFLECTION IN .001"
	10"	1.38
	16"	.75
	26"	.31
	37"	.16
	49"	.08

TABLE 33F-2

PLATE BEARING DEFLECTION

SITE # 33 , ALPINE — 6.8" AC

AVERAGE OF THREE READINGS — 7.0" SM

SURFACE TEMP.

DATE TESTED 8/4/76

DEPTH = 0" 12" PLATE		DEPTH = 7" 24" PLATE		DEPTH = 16" 30" PLATE	
LOAD PSI	DEFLECTION INCHES	LOAD PSI	DEFLECTION INCHES	LOAD PSI	DEFLECTION INCHES
10.2	.001	3.1	.002	2.5	.002
19.0	.004	5.3	.010	3.9	.006
27.9	.006	7.5	.020	6.7	.020
36.7	.010	9.7	.024	9.6	.031
54.4	.016	11.9	.028	12.4	.043
72.1	.024	14.2	.030	15.2	.050
89.7	.029	18.6	.038		
		23.0	.042		
REBOUND	.000	REBOUND	.006	REBOUND	.006
R^2 = .9980	B = 2747	R^2 = .9629	B = 482	R^2 = .9965	B = 252

DYNAFLECT DEFLECTION AT THE CENTER OF THE SURFACE PLATE LOCATION	GEOPHONE	DEFLECTION IN .001"
	10"	.90
	16"	.75
	26"	.71
	37"	.43
	49"	.30

TABLE 32F-2

PLATE BEARING DEFLECTION

SITE # 32 , WINSLOW BYPASS; TOP OF SUBGRADE

AVERAGE OF THREE READINGS

SURFACE TEMP.

DATE TESTED 7/22/76

DEPTH = 0" 30" PLATE		DEPTH = ___ PLATE		DEPTH = ___ PLATE	
LOAD PSI	DEFLECTION INCHES	LOAD PSI	DEFLECTION INCHES	LOAD PSI	DEFLECTION INCHES
3.9	.001				
5.3	.002				
6.7	.005				
8.1	.009				
9.6	.012				
12.4	.016				
13.8	.018				
REBOUND	.000	REBOUND		REBOUND	
R^2 = .9926	B = 540				

DYNAFLECT DEFLECTION AT THE CENTER OF THE SURFACE PLATE LOCATION	GEOPHONE	DEFLECTION IN .001"
	10"	2.34
	16"	1.50
	26"	1.08
	37"	.84
	49"	.62

TABLE 35F-2

PLATE BEARING DEFLECTION

SITE # 35 , KACHINA BLVD. — 8.0" PCCP

AVERAGE OF THREE READINGS — 6.0" CTB

SURFACE TEMP. = 73°F — 6.0" SGS

DATE TESTED 5/11/76

DEPTH = 0" 12" PLATE		DEPTH = 8" 24" PLATE		DEPTH = 20" 30" PLATE	
LOAD PSI	DEFLECTION INCHES	LOAD PSI	DEFLECTION INCHES	LOAD PSI	DEFLECTION INCHES
5.7	.001	2.1	.021	1.8	.096
14.5	.003	5.4	.028	2.5	.110
23.3	.003	9.8	.036	3.9	.131
32.2	.003	14.3	.043	6.7	.161
49.9	.004	18.7	.049	9.5	.187
67.6	.004			11.7	.204
REBOUND	.003	REBOUND	.012	REBOUND	.140
R^2 = .8910	B = 21,524	R^2 = .9967	B = 591	R^2 = .9925	B = 92

DYNAFLECT DEFLECTION AT THE CENTER OF THE SURFACE PLATE LOCATION

GEOPHONE	DEFLECTION IN .001"
10"	.40
16"	.38
26"	.32
37"	.27
49"	.22

TABLE 34F-2

PLATE BEARING DEFLECTION

SITE # 34 , LAKE PLEASANT, — TOP OF SUBGRADE

AVERAGE OF THREE READINGS

SURFACE TEMP.

DATE TESTED 4/30/76

DEPTH = 0" 30" PLATE		DEPTH = ____ PLATE		DEPTH = ____ PLATE	
LOAD PSI	DEFLECTION INCHES	LOAD PSI	DEFLECTION INCHES	LOAD PSI	DEFLECTION INCHES
1.8	.043				
3.9	.051				
6.7	.070				
9.5	.087				
12.4	.106				
14.5	.112				
REBOUND	.088	REBOUND		REBOUND	
R^2 = .9964	B - 172				

DYNAFLECT DEFLECTION AT THE CENTER OF THE SURFACE PLATE LOCATION

GEOPHONE	DEFLECTION IN .001"
10"	1.44
16"	.45
26"	.24
37"	.13
49"	.08

Appendix G

Performance Measurements

TABLE 1G

PERCENT CRACKING

Site	1973	1974	1975	1976	1977	1978	1979
1	39	Olay	0	0	2	3	5
2	2	2	3	Olay	0	0	0
3	32	Seal	20	25	30	30	35
4	10	12	Olay	0	0	0	0
5	40	55	Seal	75	80	80	85
6	0	0	0	Olay	0	0	0
7	15	20	24	29	35	40	45
8	12	18	30	40	Olay	0	4
9	80	80	80	80	80	80	80
10	0	0	Seal	0	0	0	0
11	0	6	Seal	1	2	2	2
12	28	Olay	0	0	0	1	2
13	33	Olay	0	0	1	2	3
14	8	Olay	8	10	12	15	21
15	1	1	2	3	3	3	4
16	10	Olay	0	0	0	1	2
17	30	39	Olay	0	0	0	0
18	25	30	Olay	0	0	0	0
19	10	15	Olay	0	0	0	0
20	3	5	7	9	12	15	18
21	2	4	6	8	10	10	12
22	1	1	1	1	2	4	8
23	70	70	70	70	70	70	70
24	0	0	1	1	1	2	4
25	1	1	2	3	5	12	22
26	1	1	1	1	2	2	2
27	0	0	0	1	1	4	4
28	3	5	7	Olay	0	1	2
29	0	0	0	0	0	0	0
30	1	1	1	Olay	0	0	1
31	Grade & Drain						
32	Grade & Drain						
33	Const.	0	0	0	1	1	2
34	Grade & Drain						
35	PCCP	0	0	0	0	0	0
36	PCCP	0	0	0	0	0	0
37	--	--	Const.	0	0	0	0

Olay is Overlay
Seal is Seal Coat

TABLE 2G

ROUGHNESS IN INCHES/MILE

Site	1972	1973	1974	1975	1976	1977	1978	1979
1	150	175	114	137	157	147	180	185
2	35	50	45	63	36	41	30	30
3	160	146	194	133	170	202	246	229
4	37	43	37	53	49	45	40	38
5	135	187	153	159	138	209	204	210
6	20	29	32	38	35	24	62	55
7	191	199	224	225	283	237	213	225
8	21	62	60	104	132	86	62	65
9	130	173	166	173	147	202	195	200
10	31	64	72	104	144	176	168	175
11	18	68	66	115	116	132	158	180
12	198	266	55	52	65	114	89	114
13	175	214	35	39	51	110	84	89
14	59	93	54	92	100	126	142	160
15	70	94	128	105	115	116	123	132
16	169	203	156	181	156	168	237	192
17	163	185	248	42	41	101	62	64
18	221	272	328	50	55	106	82	55
19	250	267	281	99	56	73	68	61
20	72	174	188	219	215	262	257	260
21	112	130	132	142	145	155	150	163
22	43	76	81	33	90	90	93	100
23	196	189	194	214	218	228	244	250
24	66	15	74	35	75	68	134	129
25	31	42	49	60	50	59	105	108
26	26	47	76	73	94	100	106	115
27	13	29	39	35	52	53	65	84
28	77	118	144	202	92	156	212	215
29	63	109	107	160	134	170	187	219
30	30	54	51	60	55	50	48	53
31	--	--	--	--	--	--	--	--
32	--	--	--	--	--	--	--	--
33	--	--	74	64	80	116	102	103
34	--	--	--	--	--	--	--	--
35	--	--	50	55	71	114	106	120
36	--	--	76	72	72	112	105	117
37	--	--	--	20	22	83	55	46

TABLE 3G

RUT DEPTH IN INCHES

Site	1973	1974	1975	1976	1977	1978	1979
1	.09	Olay	.00	.00	.10	.10	.10
2	.20	.20	.25	Olay	.00	.00	.10
3	.10	Seal	.15	.15	.20	.20	.20
4	.20	.20	Olay	.10	.10	.20	.20
5	.20	.20	Seal	.35	.40	.40	.40
6	.10	.10	.15	Olay	.00	.00	.10
7	.10	.10	.15	.20	.25	.30	.35
8	.15	.20	.20	.25	Olay	.00	.10
9	.40	.45	.50	.50	.60	.60	.60
10	.00	.10	.10	.15	.15	.20	.20
11	.10	.20	.20	.25	.25	.30	.30
12	.10	Olay	.05	.10	.15	.15	.20
13	.15	Olay	.10	.15	.20	.25	.30
14	.10	Olay	.00	.10	.15	.25	.25
15	.20	.20	.20	.20	.25	.25	.25
16	.10	Olay	.00	.10	.10	.15	.15
17	.20	.20	Olay	.10	.10	.10	.15
18	.15	.15	Olay	.00	.00	.10	.10
19	.15	.15	Olay	.00	.00	.10	.15
20	.20	.20	.20	.20	.25	.25	.25
21	.15	.20	.25	.30	.30	.30	.30
22	.15	.20	.20	.20	.25	.25	.25
23	.35	.35	.40	.40	.45	.50	.50
24	.20	.20	.20	.25	.25	.25	.25
25	.20	.20	.20	.20	.25	.25	.25
26	.15	.15	.20	.20	.20	.25	.25
27	.20	.20	.25	.25	.30	.30	.30
28	.00	.00	.00	Olay	.15	.20	.20
29	.00	.00	.00	.00	.00	.00	.00
30	.15	.20	.20	Olay	.00	.00	.10
31	Grade & Drain						
32	Grade & Drain						
33	Const.	.00	.00	.00	.10	.10	.10
34	Grade & Drain						
35	PCCP	.00	.00	.00	.00	.00	.00
36	PCCP	.00	.00	.00	.00	.00	.00
37	--	--	Const.	.10	.20	.25	.25

TABLE 4G

PRESENT SERVICEABILITY INDEX

Site	1973	1974	1975	1976	1977	1978	1979
1	2.83	Olay	3.19	.303	3.08	2.83	2.80
2	4.13	4.22	3.90	Olay	4.36	4.56	4.54
3	3.04	Seal	3.17	2.87	2.63	2.38	2.46
4	4.23	4.34	Olay	4.21	4.27	4.32	4.35
5	2.70	2.93	Seal	2.92	2.37	2.40	2.37
6	4.56	4.51	4.38	Olay	4.67	4.02	4.11
7	2.69	2.54	2.51	2.74	2.39	2.47	2.36
8	3.95	3.95	3.39	3.08	Olay	4.02	3.94
9	2.60	2.59	2.48	2.67	2.14	2.18	2.15
10	3.99	3.86	3.48	3.10	2.86	2.89	2.84
11	3.92	3.88	Seal	3.28	3.13	2.88	2.73
12	2.32	Olay	4.17	3.96	3.36	3.62	3.33
13	2.57	Olay	4.38	4.16	3.37	3.62	3.52
14	3.57	Olay	3.60	3.49	3.22	3.02	2.87
15	3.54	3.20	3.42	3.31	3.27	3.21	3.12
16	2.67	Olay	2.86	3.02	2.93	2.50	2.76
17	2.72	2.36	Olay	4.34	3.51	4.00	3.96
18	2.28	2.04	Olay	4.12	3.48	3.73	4.11
19	2.32	2.25	Olay	4.11	3.86	3.92	4.00
20	2.83	2.74	2.55	2.57	2.29	2.31	2.29
21	3.20	3.15	3.03	2.97	2.89	2.93	2.82
22	3.78	3.69	4.44	3.59	3.55	3.51	3.42
23	2.55	2.52	2.35	2.33	2.22	2.07	2.04
24	4.78	3.79	4.40	3.74	3.84	3.11	3.15
25	4.27	4.16	3.98	4.13	3.95	3.37	3.32
26	4.21	3.78	3.80	3.54	3.47	3.38	3.29
27	4.52	4.34	4.38	4.08	4.02	3.83	3.58
28	3.34	3.11	2.70	Olay	3.00	2.60	2.58
29	3.44	3.47	3.01	3.21	2.93	2.82	2.63
30	4.10	4.12	3.98	Olay	4.20	4.24	4.13
31	Grade & Drain						
32	Grade & Drain						
33	Const.	3.85	3.99	3.77	3.35	3.49	3.48
34	Grade & Drain						
35	PCCP	4.20	4.12	3.89	3.40	3.48	3.34
36	PCCP	3.82	3.88	3.88	3.41	3.49	3.37
37	--	--	Const.	4.69	3.68	4.04	4.18

TABLE 5G

SLOPE OF THE DISTRESS VERSUS CUMULATIVE SINGLE AXLE 18 KIP LOAD LINE AS A MEASURE OF PERFORMANCE

Site	Service Time	% Cracking	Roughness	Rut Depth	PSI
1	1956-74	1.16×10^{-5}	5.29×10^{-5}	4.07×10^{-8}	-6.20×10^{-7}
2	1960-75	$.13 \times 10^{-5}$	$.73 \times 10^{-5}$	12.00×10^{-8}	$-.75 \times 10^{-7}$
3	1941-79	9.5×10^{-5}	52.52×10^{-5}	137.45×10^{-8}	-49.66×10^{-7}
4	1965-75	1.05×10^{-5}	$.32 \times 10^{-5}$	12.26×10^{-8}	-1.26×10^{-7}
5	1940-79	35.64×10^{-5}	57.60×10^{-5}	140.76×10^{-8}	-64.93×10^{-7}
6	1970-79	----	3.06×10^{-5}	27.47×10^{-8}	-3.85×10^{-7}
7	1964-79	1.96×10^{-5}	7.99×10^{-5}	14.83×10^{-8}	-8.14×10^{-7}
8	1969-77	3.01×10^{-5}	7.44×10^{-5}	19.60×10^{-8}	-8.10×10^{-7}
9	1957-79	2.75×10^{-5}	7.31×10^{-5}	28.12×10^{-8}	-9.43×10^{-7}
10	1971-79	----	12.22×10^{-5}	16.66×10^{-8}	-11.79×10^{-7}
11	1971-79	----	11.35×10^{-5}	21.82×10^{-8}	-11.49×10^{-7}
12	1960-73	1.66×10^{-5}	12.01×10^{-5}	5.92×10^{-8}	-11.12×10^{-7}
13	1960-73	1.95×10^{-5}	9.61×10^{-5}	8.88×10^{-8}	-9.64×10^{-7}
14	1966-79	1.63×10^{-5}	10.93×10^{-5}	21.68×10^{-8}	-11.22×10^{-7}
15	1960-79	$.26 \times 10^{-5}$	6.59×10^{-5}	18.23×10^{-8}	-7.53×10^{-7}
16	1961-74	$.73 \times 10^{-5}$	10.48×10^{-5}	7.94×10^{-8}	-12.14×10^{-7}
17	1961-75	1.81×10^{-5}	8.93×10^{-5}	10.34×10^{-8}	-8.69×10^{-7}
18	1961-75	1.44×10^{-5}	13.25×10^{-5}	7.75×10^{-8}	-10.62×10^{-7}
19	1963-75	$.77 \times 10^{-5}$	14.19×10^{-5}	8.98×10^{-8}	-11.50×10^{-7}
20	1963-79	$.48 \times 10^{-5}$	7.24×10^{-5}	7.45×10^{-8}	-5.80×10^{-7}
21	1964-79	$.77 \times 10^{-5}$	7.75×10^{-5}	21.03×10^{-8}	-8.87×10^{-7}
22	1964-79	$.40 \times 10^{-5}$	4.58×10^{-5}	17.42×10^{-8}	-5.47×10^{-7}
23	1965-79	3.36×10^{-5}	9.66×10^{-5}	24.18×10^{-8}	-10.40×10^{-7}
24	1966-79	$.17 \times 10^{-5}$	4.79×10^{-5}	14.22×10^{-8}	-7.30×10^{-7}
25	1966-79	$.52 \times 10^{-5}$	2.15×10^{-5}	8.07×10^{-8}	-3.24×10^{-7}
26	1967-79	$.17 \times 10^{-5}$	7.58×10^{-5}	18.33×10^{-8}	-10.00×10^{-7}
27	1968-79	$.20 \times 10^{-5}$	2.37×10^{-5}	15.12×10^{-8}	-4.82×10^{-7}
28	1968-76	$.40 \times 10^{-5}$	9.14×10^{-5}	----	-8.72×10^{-7}
29	1969-79	----	8.93×10^{-5}	----	-7.56×10^{-7}
30	1969-79	----	2.11×10^{-5}	25.39×10^{-8}	-1.10×10^{-7}
31	---				
32	---				
33	1973-79	$.95 \times 10^{-5}$	31.20×10^{-5}	75.63×10^{-8}	-36.97×10^{-7}
34	---				
35	1974-79	----	12.76×10^{-5}	----	-14.72×10^{-7}
36	1974-79	----	10.22×10^{-5}	----	-11.24×10^{-7}
37	1975-79	----	5.49×10^{-5}	40.63×10^{-8}	-6.81×10^{-7}

$Y = A + BX$

Y = Distress

X = Cumulative 18 kip Loads in Year of Record

Typical A Values are:

% Cracking	A = 0
Roughness	A = 40 inches/mile
Rut Depth	A = 0 inches
PSI	A = 4.2 PSI

TABLE 6G

NUMBER OF YEARS TO UNACCEPTABLE DISTRESS LEVEL

Site	20% Cracking	256 Inches/Mile Roughness	.50 Inch Rut Depth	2.5 PSI
1	9	20	40(94)	21
2	40(65)	40(174)	32	40(174)
3	25	40(42)	40(400)	37
4	16	40(339)	21	40(71)
5	8	40(44)	40(51)	37
6	--	40(59)	14	34
7	7	18	22	13
8	4	16	14	12
9	7	30	18	18
10	--	10	18	9
11	--	11	13	9
12	9	13	40(65)	12
13	8	17	40(43)	14
14	13	24	27	18
15	40(50)	40(44)	37	30
16	26	20	40(60)	13
17	7	16	31	13
18	9	12	40(42)	10
19	16	10	35	9
20	19	14	31	12
21	25	27	23	18
22	31	38	32	35
23	4	15	13	10
24	40(52)	32	25	17
25	13	40(42)	26	22
26	40(72)	29	27	17
27	40(42)	40(49)	18	19
28	18	10	--	9
29	--	12	--	11
30	--	40(62)	14	40(110)
31	--	--	--	--
32	--	--	--	--
33	40(49)	20	19	14
34	--	--	--	--
35	--	15	--	10
36	--	18	--	13
37	--	25	8	16
Average	20	25	27	19