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SD97-03

Optimization of Recycled Asphalt Concrete and Base Materials for Bases of New Asphalt Concrete Pavements

Study SD97-03
Final Report

Prepared by
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DISCLAIMER

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16. Abstract

Asphalt pavement rehabilitation techniques used in South Dakota include the process of reclaiming the existing asphalt, and a part of the underlying aggregate base, for use as a new aggregate base material. The reclamation process is often called Process in Place (PIP). The use of millings as an unbound base, termed salvage for this report, was also evaluated.

The South Dakota DOT has experienced some problems with PIP, either during construction or poor performance once the project is in service. This research was to evaluate the performance of PIP, both during and after construction.

The research included a literature search, interviews, the evaluation of 10 sections selected from existing projects that used reclaimed asphalt in the base, and the construction of test sections using three reclaimed asphalt to aggregate blend ratio, three construction processes, and two compaction efforts. In addition, laboratory tests were conducted to identify properties that may be unique to reclaimed asphalt. Reclaimed asphalt does relax, or consolidate with time, which can reduce its structural capacity and/or contribute to rutting.

PIP was found to be a valuable alternative to use for the rehabilitation of asphalt pavements. The reclaimed material, as used in PIP, provides less structural support than aggregate base. Limiting the asphalt content and densification during construction are keys to satisfactory performance. PIP was found to be able to bridge very soft subgrade conditions that other forms of construction such as the salvage process would have problems with.

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

Executive Summary

Introduction

The South Dakota Department of Transportation (DOT) has used reclaimed asphalt as an unbound aggregate base material for pavement rehabilitation. One common process, called Process-In-Place (PIP) involves the use of a reclaimer to pulverize existing asphalt surface and leaves the pulverized material behind so it can be used as is for base. The PIP process may pulverize only the asphalt, or it may also include part or all of the underlying aggregate material. A reclaimer is a machine with a rotating drum with carbide teeth or bits. The drum rotates at a speed sufficient to cut the asphalt into small chunks. The reclaimer moves forward, grinding up the asphalt and leaves the pulverized material behind the machine where it is compacted as an unbound aggregate base. Typically, once the reclaimed material is compacted, it is surfaced with a new layer of hot-mix asphalt. The DOT constructed at least 59 projects through 1997. This is fairly new technology for the DOT as for as rehabilitation goes. The first project listed to use this technique was constructed in 1987.

In this time, the DOT has had a few problems with projects that utilized PIP. The nature of the problems, as described in the research problem statement, has been reports of premature transverse and longitudinal cracks on some DOT projects, and reports of structural failure on some county projects. Because of these problems and related concerns, this research project was created to investigate the use of reclaimed asphalt materials in pavement rehabilitation.

The research concentrated on the structural performance of reclaimed asphalt base materials, material properties, and construction issues. The project included:

- a literature search;
- interviews with DOT staff, contractors, and other people with experience with reclaimed asphalt base;
- a survey of ten existing sections, five on each side of the Missouri River;
- laboratory evaluation of reclaimed asphalt materials; and
- the construction and evaluation of test sections to investigate equipment type, blend ratios, and compaction efforts.

Very little literature is available regarding the use of reclaimed asphalt material as unbound aggregate base; the vast majority dealt with the use of reclaimed asphalt and some sort of stabilizing agent added to it, such as asphalt emulsion, or cement, lime, and/or flyash.

The survey of the 10 sections found very little distress, with only some cracking on one. The depth of rutting is the significant indicator of performance. However, the support provided from the reclaimed material was less than typical of virgin aggregate base material on over half of the sections. The structural evaluation was done with a Dynatest Model 8000 Falling Weight Deflectometer (FWD) which applies an impulse load to the pavement and measures the resulting deflection. The FWD deflection data allows us to evaluate the structural capacity of the sections and estimate the amount of support that resulted from the reclaimed base material.

The laboratory evaluation indicated one probable cause for poor performance of the reclaimed materials. This material behaves just like an unbound aggregate material except for one unique characteristic; the laboratory tests confirmed, as expected, that the material had a tendency to consolidate over time if held under a constant load. This is thought to be due to small deformations in the small chunks of asphalt that occur under sustained load. This behavior may result in a slow strength reduction if further consolidation does not occur. Further consolidation could result in rutting of the paved surface.

The test sections that were constructed were intended to provide an evaluation of three methods of reclaiming asphalt into base, three blend ratios, and two compaction efforts. The construction of the sections allowed an evaluation of single stage reclaimers, two stage reclaimers, and the use of salvage RAP from millings. Compaction of the reclaimed asphalt blends for each construction method was monitored. Densities were measured with a sand cone and a direct transmission nuclear gauge. It was found that the blend with 75 percent reclaimed asphalt did not compact as well as the 50 percent or 25 percent blends. The density data also allowed a relationship between the sand cone density test and the direct transmission nuclear density gauge to be developed. Following construction, the test sections were evaluated in June of 1999 and again in April of 2000. The monitoring consisted of a condition survey and deflection testing. All the sections were performing very well. The rutting that has occurred is relatively low, generally less than 4 mm (0.16 in.). The sections with highest asphalt content generally show the most rutting. The sections with the weakest subgrade moduli are also showing the most rutting at this time. The test sections did show that the salvage method had limitations with regards to the capability of the subgrade to support construction equipment; the salvage sections had problems supporting the equipment. This becomes a significant factor if the road is to be open to local traffic, as is commonly the case.

Implementation recommendations include:

1. Conduct a structural evaluation (deflection testing) of the existing roadway prior to selecting a project for PIP or Salvage. Limit sections with subgrade moduli less than 70 MPa (10,000 psi) to the PIP method of reconstruction (no Salvage approach).

The experience attempting to construct the test sections and the experience of the interviewees strongly suggests that pre-construction investigation is necessary to select the proper design and construction process. Subgrades with moduli less than 70 PMa should be considered vulnerable to significant loss of strength due to traffic by heavy construction equipment or local traffic if all the asphalt material is removed.

2. In design limit the recycled materials to a maximum of 50 percent of the new base mixture.

Higher asphalt contents make compaction of the material difficult in the field, resulting in lower strengths and more rutting. There was not much difference between the 50 percent and 25 percent material but the 75 percent material was significantly less dense.

3. Use a structural layer coefficient of 0.10 to 0.15 for base materials that use reclaimed or milled asphalt material. The value may be selected based on how critical it is if there is a performance failure, or on the amount of design information available (how well are traffic, subgrade types, existing pavement structure, etc. identified).

The statistical analyses of the test data using AASHTO design methods suggest a layer coefficient closer to 0.05. However, it is the authors' experience that this value would be low. Further, we understand that SDDOT's experience with the AASHTO design methods show those methods to be quite conservative for South Dakota environmental, traffic and materials conditions. Past designs used 0.15 and many are performing adequately. Revised specifications recommended in this report should result in better performance due to better field compaction during construction. Thus, we can recommend values higher than the specific test data suggest.

Roads with low volumes of truck traffic may have a higher than average number of very heavy loads such that a more conservative layer coefficient may be appropriate.

4. Modify the existing construction specification for PIP to require:

    - Conduct moisture-density tests on the reclaimed material before compaction begins and require that the field compaction be a minimum of 97 percent of the maximum density. Use control strips to determine the need for addition of moisture, lift thickness, roller size, or number of passes to achieve the required compaction. Repeat the moisture-density test and control strip procedure for changes in material gradations or percent bituminous. Be careful not to exceed the compaction effort needed as that may damage the subgrade.

    - Require each lift of reclaimed material to be recompacted after the reclaimed material has rested for at least one day.

Compaction should be controlled by some reference measure, such as a Proctor density. Doing so is difficult for the PIP process since the material to be compacted is not available until construction starts. This would require a field lab equipped to produce a standard laboratory compacted maximum density value that can be used in the field for control and regular density testing. As a less difficult (and less accurate) alternative a control strip can be constructed to a minimum of 97 percent of a representative Proctor density. Then the established compaction procedure can be the measure of compaction. When the material changes significantly a new Proctor and control strip will be necessary.

The performance of the test sections suggest that overcompaction of the reclaimed material can be damaging to the subgrade, resulting in higher rutting. The control strip method should identify the minimum compactive effort that is required to achieve 97 percent of maximum density and avoid using more compactive effort than necessary.

Problem Description

The South Dakota Department of Transportation (SDDOT) has been recycling asphalt concrete pavement to make base course materials for many years. This saves money on reconstruction and minimizes the negative impacts on the environment that might occur with landfilling the materials if they were to be removed and wasted. There are many State and County roadways that have recycled asphalt concrete in the base course.

Problem Description: Recycled asphalt concrete pavement and base materials have been used as a source of new base materials in asphalt concrete pavement construction for more than a decade in South Dakota. Typically, a blend of the recycled material (70%) with virgin aggregate (30%) is used for the new base. Construction of the new recycled base section is usually accomplished by placing virgin granular base material either above or below the recycled blend on state projects, whereas, counties frequently use only the recycled blend. Although the structural capacity of these new bases on the state system appears to be good there are numerous reports of anomalous transverse and longitudinal cracking within months after construction. Also, there are numerous reports of structural failure at the county level. The use of these recycled materials provides a significant cost savings with minimal environmental impact, but no investigation of factors which provide the best quality of recycled base has been conducted. Some of the factors include but are not limited to: type of recycling machine, horsepower, rate of travel, existing pavement thickness, quality of the material, gradation of the material before and after recycling, moisture content, laydown thickness, density, and recycled/virgin blend ratio.

It is important to determine the best procedures for constructing recycling bases and whether the current methods are contributing to random cracking or structural failure. Also, there are questions concerning the tendency of the recycled blend to compact into a section which performs more like asphalt concrete rather than granular material. When the recycled blend is placed immediately below the new asphalt concrete both layers may be acting more as a single full depth asphalt pavement rather than separate layers. On the other hand, when virgin layer is placed between the recycled blend and the new asphalt concrete the impermeability of the underlying recycled blend may adversely affect pavement performance.

The purpose of this research is to optimize the use of recycled concrete and base materials and develop recommendations for changes to our current construction practices which will achieve an improvement in the quality and performance of these bases.

Figure 1 Problem Statement in Request for Proposal (RFP)

Because the cost of new materials and construction continues to escalate, as does the cost of old materials disposal, it is increasingly important to recycle the old materials. However, if the reuse could be better engineered and more controlled, it would reduce the risks of premature failure of the reconstructed pavements, and improve the performance of the roadways.

This research report will discuss the past practices in South Dakota and in other states, and conduct new research on a controlled test project to evaluate the best methods to produce a pavement with optimal performance. Factors to be considered include:

- blending ratio of recycled asphalt materials with virgin aggregate,
- construction equipment and processes,
- bound or unbound behavior of reconstructed base,
- material qualities such as gradation and percent asphalt,
- construction controls,
- thickness of the constructed base,
- permeability,
- position in the structure of the pavement, and
- other factors out of the literature search or research.

The Problem Description (Figure 1) in the request for proposal (RFP) indicated that some existing roadways have suffered distresses such as transverse and longitudinal cracking, rutting, and structural failure shortly after construction. The research will focus on preventing such failure types.

In our experience, the potential causes of these failures include:

- inadequate compaction of the base course,
- poor gradation of materials,
- inadequate thickness,
- damage due to excess moisture in the base, and
- changes in the shape of the asphalt concrete particles from flow (black rock phenomenon).

The *"black rock"* phenomenon (in this case) is loss of strength in the base caused by realignment of aggregate particles as the asphalt undergoes viscous (plastic) deformation over time. The realignment reduces inter-granular pressure and the frictional resistance of the aggregate resulting in loss of strength of the base course.

Other possible failure causes were looked for in the literature search. The test sections that were constructed were designed to evaluate some of these potential causes that seemed to be the most important.

The evaluation of existing information and new information to be gathered from existing roads and new test sections is expected to lead to a better understanding of the material properties. This new understanding would enable recommendations for material qualities and operational procedures that will result in optimum performance and pavement life when Process-in-Place (PIP) is used.

Objectives

The Request for Research identifies three objectives for this project. Our understanding of these objectives is described in the following paragraphs.

1. *To examine the relationships between construction practices and performance of existing pavements with recycled bases.*

Thickness and layer design, density requirements, testing during construction to evaluate conformance to plans, and weather events are examples of construction practices and events that will affect the ultimate performance in a number of ways. These factors establish the design strength of the pavement section and control the conformance of the actual construction to the intended design. The research will look at the strengths that can be achieved with varying amounts of recycled materials from typical production practices including millings and pulverization. In addition to the percentage of blended recycled asphalt in the base material, additional qualities that will be examined include such items as gradation, moisture-density controls, and response to compactive efforts. The objective is to evaluate such factors and recommend construction controls to facilitate obtaining the strengths in the field that are necessary to achieve the expected performance.

2. *To determine the effects of the milling/recycling operation on the quality of recycled asphalt concrete base materials.*

The particular types of equipment used and the operations of the equipment impact the quality of the materials in the final constructed condition. Particle gradation, asphalt content, and moisture content are particularly critical factors that determine final quality. These factors can change during the construction depending on the effect of the equipment and operations on the particular material being recycled. The research will evaluate these factors.

3. *To determine the effects of different ratios and sizes of virgin aggregate blend material on the base quality.*

The blend of recycled material and virgin aggregate impacts the gradation and the percent of asphalt in the final mixture. These factors are important to the ultimate strength and behavior of the base course as they influence internal friction and tensile strength. This research will evaluate if there is a maximum percent of recycled material, maximum particle size and maximum percent fines for satisfactory performance and how those factors can be adjusted by the proper blend.

Task Descriptions

The Request for Research defined 11 tasks that were considered necessary to successfully complete this study. The Task description (in italics), as written in the RFP, and the description in our proposal are contained in the text boxes below. Following each of the Task text boxes is a description of the activities.

Task 1. Meet with Technical Panel

Task 1. Meet with Technical Panel

Meet with the technical panel to review project scope and work plan.

In preparation for the meeting, we will begin a review of the available literature to find other information that will be valuable to the research direction.

At the meeting we will explain our proposed work plan and get input from the technical panel. We will make agreed-upon changes to the work plan at that time. We invite the technical panel to provide comments and suggestions regarding the factors that should be evaluated for effect on performance of the base course. They should also recommend people to be interviewed in Task 3. The Principal Investigator (PI) and a Senior Engineer will travel to Pierre, at an agreed-upon time, to attend this meeting. A meeting of approximately one-half day is anticipated.

Effective meeting techniques will be used to make the best use of technical panel and Department staff time. We will provide a draft agenda with issues, responsibilities, actions needed or anticipated, and estimated timing. We will provide meeting minutes to the attendees with a summary of discussions, decisions and responsibilities for future action.

The meeting was held on May 21, 1997. The proposed task activities were reviewed and the panel made comments or suggestions on some of the tasks. Other items covered included the development of a list of people to interview for Task 3, selection of projects, and a discussion of factors to be evaluated as part of the study. The meeting minutes are contained in the appendix.

Task 2. Literature Search

Task 2. Literature Search

Review and summarize literature relevant to recycling asphalt concrete and base materials for use as new base materials.

We will search for studies of similar uses of recycled asphalt concrete to limit the research that has to be done and to help focus the research on relevant issues. Available literature that we will search includes the TRIS database of TRB, publications of the various technical associations such as ASTM and ASCE, and the Internet. An important source of information will be our contacts with other experienced people who may have knowledge of information, either published or unpublished. These contacts will include Dr. David Newcomb of the University of Minnesota, the Minnesota Department of Transportation, Purdue University, The Asphalt Recycling and Reclaiming Association, and large contractors such as Brown and Brown.

This work will be directed and reviewed by the PI. The literature search will be by experienced senior engineers. The search of our network of experts in pavements will be by the PI, senior engineers and technical advisor.

Literature searches were conducted using a commercial search NERAC, a search of TRB reports, the Internet, and trade magazines and similar publications. The information available on reclaiming existing asphalt pavements for use as an unbound (aggregate) base material is very limited.

Task 3. Conduct Interviews

Task 3. Conduct Interviews

Conduct interviews with necessary department personnel and recycling contractors concerning South Dakota's recycling practices and past recycling projects.

The people identified at the meeting with the technical panel will be interviewed to ascertain their opinions as to what is working and what needs to be improved. These interviews will help identify:

- how equipment has been used,
- what processes seemed most suitable in the field,
- relative costs of parts of the processes,
- relative costs of virgin aggregate versus recycled material within regions or areas,
- what future equipment could be available,
- what issues people think are worthy of study, and
- other issues suggested by the technical panel and literature search.

The interviews will be conducted by the PI traveling to South Dakota. We assume this will require two trips and a total of three days. We will try to arrange several initial interviews to take place after meeting with the technical panel. The interviews will be summarized for inclusion in the Interim and Final Report.

A list of candidates for interviews was developed while conducting Task 1. The candidates are listed in Figure 2. The list included a cross section of DOT construction, materials, and Area Engineers, contractors, and other people that are known to be experienced in the use of pulverized asphalt as an unbound aggregate base material.

A list of questions was developed, shown in Figure 3, to aid in the interview process. These questions were expected to provide input relative to the bulleted items in the Proposal. The topics of future equipment and items people think are worthy of study were more hypothetical in nature and were not specifically emphasized in the interviews.

Interviews

A list of people to be interviewed was developed. The list includes the following.

SDDOT		
Jim Hyde 773-3464	Engineer	Pierre
Gary Elsworth 626-2244	Region Materials Engineer	Aberdeen
Ron Gillen 995-4737		Mitchell
Lyle Haak 892-2872	Area Engineer	Belle Fourche
Todd Goldsmith 845-3844	Area Engineer	Mobridge
Jeff Gustafson 842-0810	Area Engineer	Winner
Late Addition:		
Merle Jenner 353-7140	Meet at Miller	Huron
Contractors		
Neil Reede 225-7082	Upper Plains Contracting, Inc.	Aberdeen
Charles Valentine	Valentine Construction (360) 574-2313	Vancouver, WA
Lyle Bowes 693-3557	Bowes Construction	Brookings
SDSU		
Ken Skorseth (800) 422-0129	Field Operations Manager	Brookings
FHWA		
Jim Sorrenson	OTA	Washington, D.C
Asphalt Recyclers and Reclaiming Association (ARRA)		
Mike Christhoff	Representative	(410) 267-0023

Figure 2 List of Interview Candidates developed during meeting with Technical Panel

SD 97-03 Interview Items:

1. What processes are you familiar with:
a) Using PIP with:
i) Single Stage Reclaimers
ii) Two stage machines.
b) Using Salvage?

(Get information about Equipment type, use, project, etc.)

2. Describe the Construction Process. How was the equipment used?

3. What are your experiences regarding the following:
a) Depth (blend) control?
b) Gradation (large chunks and fines)?
c) Compaction?

4. What would have been the alternative to recycling?

5. Would the alternative been more or less expensive?
a) For construction costs?
b) Over the life of the rehabilitation?

Figure 3 Interview Items

In addition to the general topics in Figure 3, other questions that were discussed include:

- What happens if the initial gradations were not met?
- What factors, such as temperature, water, and gradations, seemed to influence the compaction efforts?
- What kinds of rollers were used and typically, how many passes were required before densities would peak out?

Task 4. Establish Historical Database

Task 4. Establish Historical Database

> *Establish a historical database on recycled base projects on the state highway system throughout South Dakota.*

We will design and create a database to store information about recycled base projects on the state highway system. The database will be compatible with current Department programming. We have expertise in database programming including Access, Paradox, Oracle, and others, plus spreadsheet programming including Excel, Quattro Pro, and Lotus.

The items to be included in the database will be agreed upon by the Department or the technical panel. We recommend that items in the database match the pavement management system of the Department and also use items from the FHWA LTPP research, where they are compatible.

We propose to input the data for the ten existing sites selected for field testing. The Department will be able to input data for the remaining sites.

The first activity of Task 4 was to develop a list of all of the projects in the state highway system that are known to have recycled base in the state highway system. At the end of the 1997 construction year, 59 projects were identified by DOT staff and a review of the *1997 Highway Needs and Project Analysis Report* (Needs Book). The list is contained in the Appendix. Most of the information came from Gill Hedman, Materials and Surfacing. It was not practical to search the Needs Book for recycled base, however, it is noted that PIP is a very common entry in the Improvement Type field of the Needs Book.

The amount of data available is easily placed into an EXCEL spreadsheet. Tables are set up on individual worksheets within the workbook to contain similar data items. For example, one worksheet contains the list of all known PIP projects. A set of tables were set up for the data collected during the sampling of the existing projects that took place in Task 5, including condition, PIP properties, and deflection data. Another set of tables were set up to contain the data from the test sections that were constructed and monitored as Tasks 7 and 8.

Task 5. Conduct Material Testing on Existing Projects

Task 5. Conduct Material Testing on Existing Projects

> *Conduct material testing on a minimum of ten reconstructed pavements across South Dakota. The pavements will be selected in conjunction with the panel and will contain the recycled blend material.*

We will conduct a series of tests on the materials in place on ten existing roadways that contain the blend of recycled materials as base course. This test program will be finalized after the literature review and the technical panel meeting. However, we currently propose a program of three 12-inch test cores in a selected 500-foot long test section in each roadway. The test cores will be used to:

- evaluate layer thicknesses,
- determine in-place densities and moisture contents (sand cone method because of core limitations) of the base layer (SD105), and
- sample materials for laboratory tests (SD201).

We will evaluate the test site surface conditions using SDDOT methodology, to document current distresses as used in the Department pavement management system such as:

- transverse cracking,
- fatigue cracking,
- patching/patch deterioration,
- block cracking, and
- rutting.

In the laboratory we will test for maximum density and optimum moisture content of the base materials, (SD104, Method 4 or SD308) and the asphalt content and gradation of the aggregates (SD202 and SD206).

The testing will be performed by our engineer and a technician visiting each of the ten sites. We will provide equipment for coring. We have assumed that the Department will provide staff and equipment for traffic control, and materials for patching three 12-inch diameter core holes.

As an addition to this task, we propose a limited laboratory testing program to evaluate the loss of strength due to the "*black rock*" phenomenon. We will obtain samples of asphalt concrete being recycled and virgin aggregate. These materials will be blended as 0, 25, 50 and 70 percent asphalt concrete. The materials source will be selected to provide information on the behavior of materials typically used for cold in-place recycling within the state. Three tests are proposed to evaluate the compaction and stiffness behavior of the blends.

Confinement Pressure: The blended samples will be tested in a device to measure possible loss of confining stress with time at temperatures of 60 degrees Celsius.

Creep Consolidation: The same materials will be subjected to a form of consolidation test. Compacted samples will be heated to 60 degrees Celsius and subjected to a steady load for a period of time to determine the effect the percent pulverized asphalt or millings has on long term densification.

Gyratory Compaction: Samples will be compacted at room temperature and at 60 degrees Celsius. The results will be compared. The density versus the accumulation of gyrations will provide an insight as to the time dependant behavior of the various blended materials.

Critical strength parameters for unbound base materials, including cold in-place recycled materials, consist of shear strength and stiffness. Both of these parameters can be measured in a tri-axial test device. However, since a tri-axial test includes a constant confining force, the material behavior from the above tests will help determine if tri-axial testing is reasonable.

A list of projects that have unbound recycled base in a flexible pavement to be sampled was developed from the list that was developed during Task 4. Ten sites were selected from that list for evaluation, half west river and half east river (west or east of the Missouri River). The projects selected are listed in Table 1.

Table 1 Existing Projects Selected for Evaluation

County	Proj.No.	Route	Ref. Location	Proj. MRM	Length Km	Year Const.	Process
Union	P0011(37)34	11	Alcester	35.510	6.022	1993	PIP
Haakon	NH0014(111)151	14	Midland	151.123	22.175	1995	Salv.
Clark		28	Jct 25 N	316.920	4.812	1994	Recycle
Bon Homme /Yankton	P0046(00)318	46	Jct. 25 West	318.500	6.359	1996	PIP
Potter	P0047(32)189	47	Jct 212 – Lebanon	189.910	16.111	1994	PIP
Meade	P0073(11)160	73	22.775 Km. N. of 34	160.387	22.489	1987	Salv.*
Dewey	NH 0212(120)187	212	LaPlant	189.100	30.578	1996	PIP
Spink	NH212(100)313	212	Frankfort	313.937	4.691	1992	Recycle
Jones	90-4(47)198	90E	E. of Murdo	198.143	19.327	1996	PIP
Jones	90-4(52)198	90W	E.of Murdo	198.126	19.359	1995	Recycle

*Assumed to be a PIP of a blotter section – sample had only 0.4% asphalt

The identified sections were sampled, surveyed, and tested for deflection. The sampling was done through a test pit. The DOT maintenance staff provided traffic control plus equipment such as a backhoe and operator to assist in the operation. A saw was used to cut about a 600 mm square block of asphalt from the pavement in the outer wheel path. The backhoe was used to lift out the asphalt, exposing the underlying base. A sand cone density test was conducted on the exposed base material. Following the sand cone test, a bulk sample and moisture sample of material was removed from the test pit area and returned to the Braun Intertec laboratory for testing.

During the analysis of the research data, it was learned that the fourth project (Proj. No. P0046(00)318, SD46) was not constructed as initially thought. Thus, this project has been eliminated from some of the analyses.

Task 6. Submit Plan Notes for Test Section Construction

Task 6. Submit Plan Notes for Test Section Construction

Develop and submit plan notes by September 1, 1997, for inclusion into an existing construction project. The plan notes should define a series of test sections designed to evaluate significant recycling construction factors and their effect on performance. The significant factors should be determined from the previous tasks.

Plan notes will be prepared for the construction of test sections in a project to be selected by SDDOT. The plan notes will specify the layer thickness, material preparation and blends, placement considerations, compaction requirements, and other factors that are found to be necessary to control for the purposes of the research. The plan notes will be provided to the SDDOT Project Manager by September 1, 1997, which will allow for review by the SDDOT Project Manager and the technical panel before they are incorporated into the project documents. The plan notes will be submitted in the style of SDDOT plans and specifications. The notes will use the U.S. Customary units with International System of Units (SI) equivalents.

The layout of the test sections will take advantage of our experience in laying out over 1,300 test sections for SHRP and LTPP studies and other studies. Testing and test section design will consider statistical analysis of the various factors to be evaluated. Test sections must include a virgin aggregate base control section plus sections to measure critical factors such as blends, compaction and process.

The analysis of the data will be directed and completed by the PI. The analysis will include the expert opinions of the senior engineers and the technical advisor. The Interim Report will be written by the PI. It will be edited by an experienced technical writer for clarity and conciseness.

Available projects for the construction season of 1998 were searched to find a suitable project for the construction of test sections. The DOT staff thought the PIP project on US 18 east of Tripp was best suited for the construction of test sections of the projects that were available. This section of US 18 between Tripp and Olivet is a straight 23 km (14 mile) section of east-west highway with relatively flat terrain. The project was in the program as a PIP and had room to construct test sections. There was FWD data available for the section. Core data that was taken at approximate 1.6 km (1-mile) intervals was also available.

Based on the PIP issues that had been identified, and what we felt could be accomplished in the construction of test sections, the following experimental factors were selected.

- PIP Processing/Equipment
- Blend Ratios of reclaimed asphalt to aggregate
- Compaction Effort

Other items that were identified as concerns on the PIP process include process control issues, such as machine speed and drum rotation speed and how that relates to the gradation of the PIP material. These were not included because of budget limitations and applicability.

The three factors would result in too many sections to construct and monitor effectively. There are three PIP processes that are routinely used in South Dakota; single stage reclaimers, two stage reclaimers, and milling/salvage processing. Coupling this with three blend ratios and three compaction efforts results in 27 test sections without any repetition. In addition, a control section of 100 percent virgin aggregate base is desired (this could be considered to be a fourth blend ratio of 0 percent).

Table 2 shows how the experimental factors were arranged to define individual test sections.

Table 2 Number of Test Section Cells

		Percent Reclaimed AC					
		25		50		75	
Compactive Effort >>		L	H	L	H	L	H
Process Equip.	Single Stage	1	4	7	10	13	16
	Two Stage	2	5	8	11	14	17
	Salvage	3	6	9	12	15	18

The above table contains 18 cells which represent the combinations of the three variables at three levels of blending, two compactive levels, and three process levels (3 x 2 x 3 = 18). The Processing Method variables are actually discrete which means that the table contains three separate experiments. The processing equipment can be compared, but they cannot be defined by continuous variables in any form of regression equation whereas the compactive effort and blend percentage are considered to be continuous variables. An important co-variable that exists in this experiment is the gradation of the resulting materials as a function of equipment and blend ratios.

Task 7. Monitor and Evaluate Construction

Task 7. Monitor and Evaluate Construction

Monitor and evaluate the construction of the test sections and conduct necessary testing (including FWD testing) of materials before, during, and after recycling.

The PI and an engineer or technician would be present for the test section construction. The PI may only be there for the start-up of the project, depending on scheduling and performance of the contractor. SDDOT would provide the necessary test equipment and field laboratory for the materials testing. Tests would be conducted using SDDOT procedures where available or AASHTO or ASTM procedures. A number of these tests may be a routine part of the normal SDDOT project control.

Tests we anticipate include:

- gradations of the recovered asphalt concrete materials being recycled,
- asphalt content of the recovered asphalt concrete materials being recycled,
- gradations of the virgin aggregate before blending,
- gradations of the blended materials,
- maximum density and optimum moisture content of the blended materials,
- moisture content of the blended materials just before placement,
- gradations of the blended materials after compaction,
- densities achieved during compaction, as a function of compaction equipment and procedures,
- equipment performance monitoring and conformance of the procedures to the plan notes, and
- surface measurement for rutting immediately after construction.

The SDDOT will provide a calibrated FWD and a trained, experienced operator for FWD testing after construction of the test section. Braun Intertec will provide the FWD testing plan, including the FWD setup, for the testing. The resulting FWD data will be provided to Braun Intertec and analyzed to evaluate the back-calculated layer strength of the constructed test sections. One characteristic of recycled base materials that the FWD measures is the change in deflection for successive drops. This change is a result of load-related compaction during the test itself. The relative effects of this change will be compared among the test sections. We will test in the outer wheelpath and between the wheelpaths.

Construction of the project and the test sections began in 1998. A pre-construction meeting was held in Yankton on August 11, 1998. The contractor began the project on the east end and worked from east to west until they got near the test sections. Figure 4 shows the layout of the test sections.

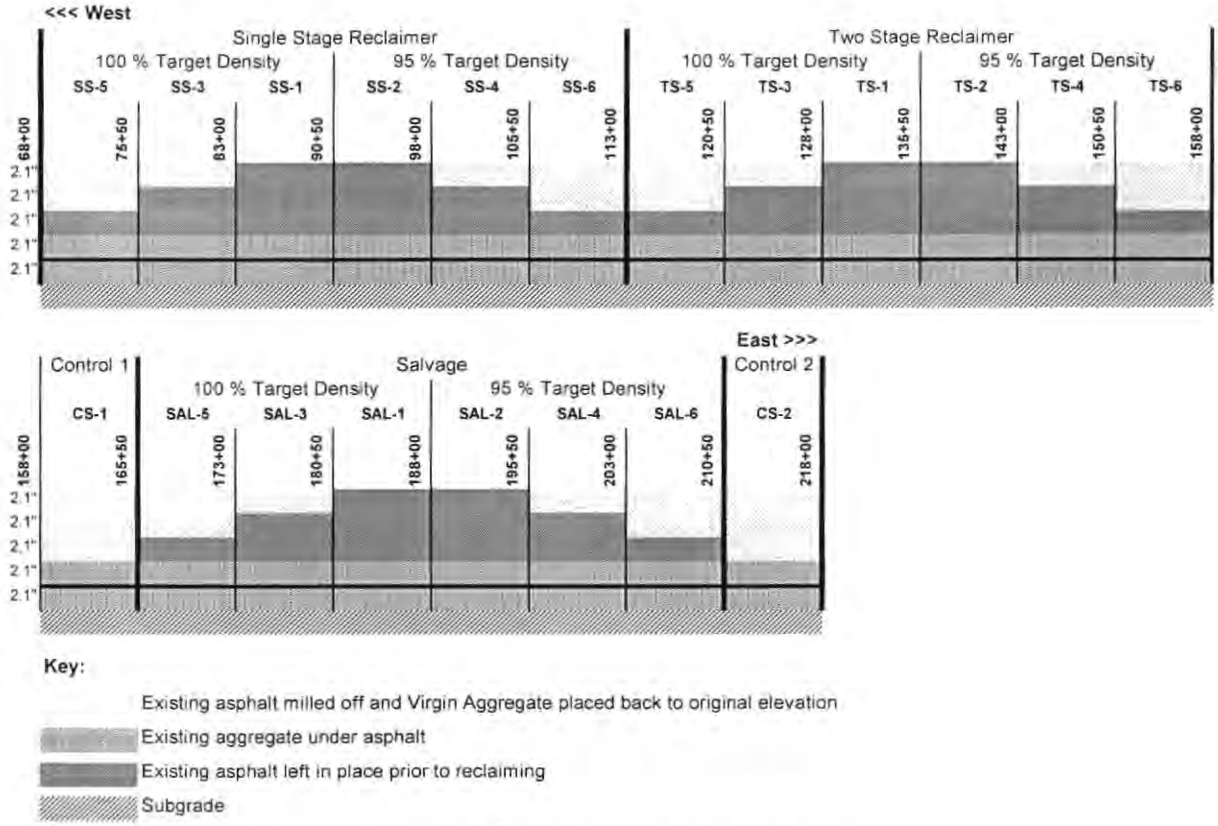


Figure 4 Layout of the Test Sections

Work began on the test sections began on September 21, 1998 and continued on to October 5, 1998. Reclaiming in the sections started at the Single Stage sections at west end and progressed from west to east. The two-stage equipment was not available at the beginning of the work in the sections because of delays the sub-contractor was having on another project. The milling of the 25 and 50 percent sections was done and the millings were hauled to a storage area at the west end of the project where the material was processed for use in the salvage sections. Erland Lukanen, the Principal Investigator for the project was on site for the first two days. Mr. Lukanen was only able to observe the single stage operation and some of the milling processing for the salvage sections. Braun Intertec provided a technician for the first week for the testing. He was not able to stay on site to provide testing for all of the sections because of budget limitations and scheduling conflicts. The construction of the test sections took much longer than anticipated. The DOT staff was able to help out with the testing with a reduced testing schedule after our technician had to leave. The main testing emphasis during construction was to conduct sand cone density tests of each lift for each section. The technicians were also collecting representative samples from each of the sections for material properties testing at a later date. The DOT provided the testing for gradations, moisture-density tests, and asphalt content.

Task 8. Monitor and Evaluate Test Section Performance

Task 8. Monitor and Evaluate Test Section Performance

Monitor and evaluate the initial performance (including FWD testing) of the test sections through the following winter and note any significant differences.

We recommend testing the sections one year after construction with FWD to measure the bearing capacity of the sections and conducting a pavement condition survey to document any pavement distresses that may be present. FWD testing will compare strengths to the time immediately after construction to see if there have been changes. The surface condition rating would be performed by our staff. The FWD testing and traffic control will be provided by SDDOT.

At this time we will recommend an ongoing evaluation of the test sections by SDDOT for long-term evaluation of the various factors.

Construction of the test sections was completed late in the fall of 1998. It was too late in the fall to place the asphalt wear on the project, but it was decided that it would be better overall for the test sections to extend the cut-off date for the placement of asphalt wear so that the wear could be placed on the test sections. The asphalt wear was placed on the rest of the project the following construction season.

The initial monitoring of the test sections took place on June 8, 1999. The intent was to monitor the section during the spring thaw but was delayed due to internal scheduling conflicts. The monitoring consisted of deflection testing with the DOT FWD, rut depth measurements, and a distress survey.

Task 9. Develop Proposed Specifications for Recycled Materials

Task 9. Develop Proposed Specifications for Recycled Materials

Recommend practical guidelines and specification changes which will optimize the use of recycled materials.

Our recommendations will address:

- pre-construction site investigations,
- equipment for recycling and reconstruction,
- processes that are beneficial or detrimental,
- gradation controls through the addition of virgin aggregate,
- anticipation of gradation changes during the construction process,
- percent recycled materials in the blend for long-term stability and strength,
- moisture control during compaction,
- compaction methods and target densities,
- construction testing and controls, and
- other factors that arise in the course of the study.

The intent of these recommendations is to accomplish the purpose of this research -- to optimize the use of recycled asphalt concrete and base materials and improve the quality and performance of these bases.

The recommendations will be described in appropriate engineering and specification language to serve as a basis for implementing the recommended methods. Measurements for evaluating and improving the new processes and designs will also be recommended. The report will also include the details of the study, ways to implement the findings and benefits to be expected from changes. The draft of the Final Report and Executive Summary will be prepared in accordance with the *Guidelines for Performing Research for the South Dakota Department of Transportation,* November, 1996. Ten copies of the draft will be submitted to the project manager and technical panel for review.

This task will be performed by the PI, senior engineers and technical advisor. The draft report will be edited for clarity and conciseness by an experienced technical writer.

The results of this study provides answers to some of the questions posed in the original Problem Description and Objectives, but not all of them. One of the main objectives was to optimize the use of reclaimed asphalt as part on an unbound base that is part of the PIP method of construction. The specific items identified in the proposal are addressed in the Implementation Recommendations chapter.

Task 10. Final Report

Task 10. Final Report

"Prepare a Final Report and Executive Summary of the literature review, research methodology, findings, conclusions, and recommendations."

After review of the revised draft of the Final Report in Task 9, we will incorporate any final changes and submit a red-lined re-draft to the project manager for his review to verify that we have correctly interpreted the comments of the technical panel. After his review, we will submit 60 copies and one camera-ready or electronic copy of the Final Report and Executive Summary, in accordance with the "Guidelines."

This task will be performed by the PI and the project assistants.

This is the final report that was submitted for reflect and modified to reflect the panel's comments, corrections, and discussions.

Task 11. Make Executive Presentation

Task 11. Make Executive Presentation

Make an executive presentation to the SDDOT Research Review Board at conclusion of the project.

The PI will attend a meeting of the Research Review Board to present the study results. We propose to give a formal presentation lasting about 30 minutes and then open the meeting for questions from the Board. Slides or overhead projections will be prepared in accordance with the requirements for presentations at Transportation Research Board sessions.

We propose that this be a meeting not only for presenting the results but for convincing the Board members of the need to implement the recommendations. Implementation will require their proactive support. Prior to starting our presentation, we will ask questions designed to learn about concerns and opposition. We will address those issues while making our presentation. Again in the Question and Answer period, we will be an advocate for implementation by soliciting and addressing barriers the Board foresees.

An executive presentation was made to the Research Review Board in December, 2000. The significant findings and recommendations were presented to the Research Review Board. A copy of the PowerPoint™ Presentation is included in the Appendix.

Findings and Conclusions

Task 2. Literature Search

Findings
The following is a discussion of the reviews of the information that was found.

RECLAIMED ASPHALT PAVEMENT Material Description, htpp://www/tfhrc.gov/recycle/waste/rap131.htm
This site contains the following description for Granular Base Aggregate:

> *To produce a granular base or subbase aggregate, RAP must be crushed, screened, and blended with conventional granular aggregate, or sometimes reclaimed concrete material. Blending granular RAP with suitable materials is necessary to attain the bearing strengths needed for most load-bearing unbound granular applications. RAP by itself may exhibit a somewhat lower bearing capacity than conventional granular aggregate bases.*

The article also describes some of the characteristics of RAP, including typical densities, which are listed as running five to ten percent less than virgin aggregates. It also indicates that the California Bearing Ratios of pure RAP of about 20 to 25 percent and of a 40% RAP – 60% natural aggregate blend of 150 percent or higher.

A conclusion of Jeffrey Davis, Milton T. Huston, and K. Wayne Lee in *Structural Analysis of New England Subbase Materials and Structures* stated that "The pure RAP may be a better candidate for a base due to its higher strength and location on the pavement structure." This contradicts the recommendation in the FHWA article given above. A possible reason for the difference is the conclusion of Davis et.al. is based on resilient modulus tests run with short loading pulse times of 0.03 to 0.05 seconds, compared to slower loading times of 0.1 seconds that are typical of most resilient modulus tests. Also, resilient modulus test methods maintain a continual confining pressure and load platen pressure on the sample as opposed to a space confinement environment in the field. Similar laboratory results were obtained with resilient modulus tests conducted in this study as part of Task 5.

Sayed M. Sayed and John M. Pulsifer published at least two reports, each with a different third author, on the use of UNRAP Base in Florida. They coined the term UNRAP as untreated reclaimed asphalt pavement. They concluded that information to characterize the performance of UNRAP is almost nonexistent based on literature searches they conducted. They concluded that the standard and modified Proctor densities of UNRAP are comparable with the local limerock. The Limerock Bearing Ratio (LBR), a modified CBR, of UNRAP is typically in the order of 20 to 30 percent of limerock, whereas, Dynaflect test data indicate that UNRAP is about 70 to 85 percent as strong as corresponding limerock base materials. Another report indicates that LBR values of UNRAP to be 13 and 25 which raised questions as to whether the LBR test is appropriate for UNRAP. The two samples tested had modified Proctor densities of 1,586 to 1,666 kg/m^3 (99 and 104 pcf) respectively.

A CD-ROM produced as a joint effort by the National Center for Asphalt Technology and the Federal Highway Administration, contains the complete copy of *Pavement Recycling Guidelines for State and Local Governments - Participant's Reference Book,* U.S. Dept. of Transportation, Federal Highway Administration, March 1998. That document mentions the use of pulverized asphalt pavements as a unbound aggregate base only in passing. It concentrates mostly on various forms of recycling that include additional processing or the addition of a stabilizing agent of some sort. It includes a definition, stated below, of reclaiming, but includes the words "treated" and "stabilized" as part of the definition.

> **Full Depth Reclamation** - A recycling method in which all of the asphalt pavement section and a predetermined amount of underlying material is treated to produce a stabilized base course.

The Province of Quebec has incorporated the moduli of base and subbase material into the pavement thickness design methodology for the province. The design utilized the modulus values to characterize the structural characteristics of the materials used. Figure 5 was provided by Quebec for reference for this study. It was taken from "CHAUSSÉE - Logiciel de dimensionnement des chaussées souples. Manuel de l'utilisateur" (in French) Québec Ministry of Transportation, Québec, Canada, p. 20, St-Laurent, D. (1999). The internal workings of the Quebec design are not documented in any English published reports. The curves in Figure 5 show "Unbound Reclaimed Material" resilient moduli to be about two-thirds that of "Unbound Base Material."

Conclusions

The use of reclaimed asphalt as an unbound aggregate base is a common process, but one that has not received much research attention. There is very little information available in the literature dealing directly with the use of reclaimed asphalt as an unbound base. There are many references available dealing with cold-in-place (CIR) recycling, which incorporates some form of binder with the reclaimed asphalt, resulting in a stabilized base. The only research work found that deals specifically with the use of unbound reclaimed asphalt as a base, called UNRAP for unbound recycled asphalt pavement, is from the State of Florida. The Province of Quebec utilizes a stiffness versus bulk stress relationship for base materials, including unbound base consisting of 50 percent reclaimed asphalt.

The available information strongly suggests that reclaimed material has a lower density and strength than natural aggregate base. However, the reclaimed material can be used successfully when blended with natural aggregates.

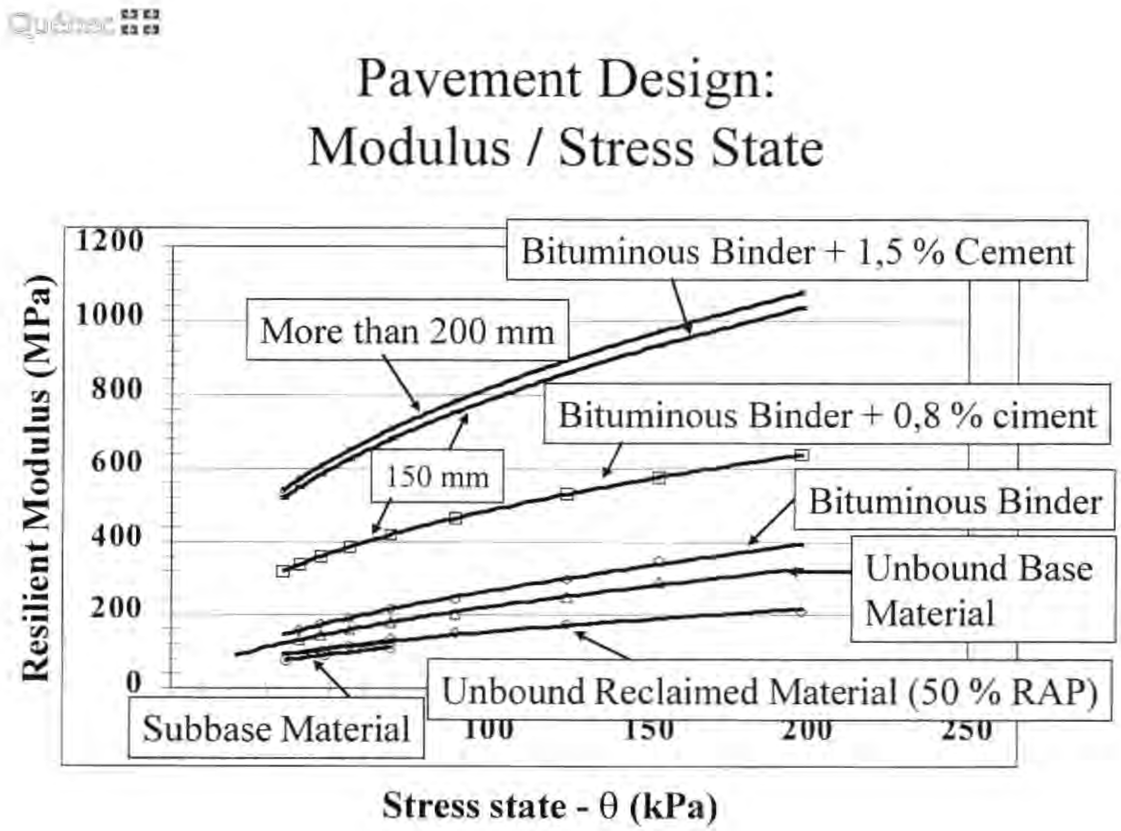


Figure 5 Base and Subbase Moduli Used by Quebec Design

Task 3. Conduct Interviews

Findings

A summary of the interview results follows:

1. What processes are you familiar with?

   Single and two stage reclaiming equipment was the most common. The interviewees had less experience with milling machines. Ken Skorseth indicated familiarity with ripping and the use of tracked dozers to break up existing surfaces for use as subbase on local roads.

2. Describe the Construction Process. How was the equipment used, and, what are your experiences regarding the following?

   The typical construction process includes the reclaiming operation, blading, and compaction. The reclaiming equipment was used to pulverize the asphalt and blend the pulverized asphalt with some of the underlying material. Several people indicated problems with the overall bearing capacity of the roadbed during the reclaiming process. During the blading and compaction process, problems with bearing capacity were also reported. One of the contractors expressed concern about problems with pumping the subgrade during compaction of the first lift. He attributed those problems to the use of water. A DOT person indicated problems with using multiple lifts in the compaction process because of the problems with bearing capacity. Another DOT staff person indicated a concern with getting sufficient compaction of the PIP material indicating that there were almost no compaction failures. He indicated that if there was difficulty obtaining compaction, another test strip was used.

Gradation control issues brought comments about the use of reclaiming equipment. Some of the DOT staff would like the specifications to allow them to direct the contractors operation of the equipment regarding gradation. Another comment that could be a concern regarding gradation is that some single stage equipment tended to leave the larger chunks at the bottom.

3. What would have been the alternative to recycling, and would the alternative have been more or less expensive?

   There were no real alternative construction methods offered that would be suitable as an alternative for how PIP is used. Reconstruction may be the only viable alternative for many of the PIP projects. The first cost for reconstruction would be much more expensive. However, there may be cases where traffic loadings and the overall structural capacity of the roadbed may favor life cycle costs of reconstruction.

Conclusions

During the interviews with DOT staff and contractors, their primary interest was with construction issues, such as gradations, equipment operations, and compaction control.

There was a common consensus between everyone that we talked to regarding the need to utilize PIP as an alternative to hot-mix asphalt overlays or to reconstruction and that using PIP can be cost effective. The interviewees also tended to indicate that the selection of the equipment should be dependant on the pavement section available and the ability of the subgrade to support the construction process; the heavier two stage equipment cannot be used on weak sections and the ability to use them may be limited on two lane roads (This was born out during the construction of test sections as discussed in Task 8). The smaller single stage equipment is generally considered to be unsuitable for thicker pavement or wherever deep cuts are needed that would slow forward speed. Also, there was a general consensus that gradation and compaction are subjects of concern. Generally everyone felt that both gradation and density can be controlled, but it requires the proper selection of equipment for the job.

The Problem Description contains a sentence "Some of the factors include but are not limited to: type of recycling machine, horsepower, rate of travel, existing pavement thickness, quality of material, gradation of material before and after recycling, moisture content, laydown thickness, density, and recycled/virgin blend ratio." The first three items in the list of factors, ". . . type of recycling machine, horsepower, rate of travel . . .," are very important factors relative to reclaiming operations. When problems occur, the tendency of project staff is to try to control the operation of the contractor and the development of equipment or process specific method specifications. If specifications are developed that address these specific items, a method specification (one that specifies equipment and its operation) would result. Method specifications that can accommodate all situations are very difficult to develop, and could very likely limit the quality of the final product. Agencies, however, have been moving away from using method specifications. The use of method specifications does not transfer responsibility of obtaining a good product to the contractor, but instead puts more of the responsibility on the agency in enforcing the "method". It is essential that the final product be the emphasis of the specifications, ultimately one that provides the best chance of getting the best performance. This form of specification is typically called performance related specifications.

In this light, the Problem Description brought up more controversial items with regards to methods than the interviewees did. From the discussions, we conclude that, when things are not going right for the contractor, the typical project engineer is anxious to tell the contractor how to solve the problem by creating and applying a site specific method specification. Such impulses should be avoided. The question then, is how to minimize situations where the contractor is ill equipped, equipment-wise or experience-wise, to do the work. The same mechanism used in selecting paving contractors or grading contractors could be used. There must be some way to judge whether a contractor is qualified to do the work.

Task 5. Conduct Material Testing on Existing Projects

Findings

Condition Surveys

A detailed condition survey, consisting of the identification of the type and amount of cracking was done for each existing pavement selected for sampling. Rut depths were measured at 6.1 m (20-foot) intervals for each wheel path. The survey length was 76.2 m (250 feet). The length was selected to provide information that would be representative of the section in the vicinity of the test pit. The survey results for the rut measurements, longitudinal cracking, and transverse cracking are summarized in Table 3, Table 4, and Table 5, respectively.

Table 3 Average Rut Depths of Survey Sections

Route	Ref. Location	Rut Depth, mm	
		Inside	Outside
11	Alcester	3.62	2.89
14	Midland	2.15	2.15
28	Jct 25 N	2.77	3.50
46	Jct. 25 West	4.92	4.50
47	Jct 212 – Lebanon	0.19	0.13
73	22.775 Km. N. of 34	0.00	0.00
212	LaPlant	3.69	4.77
212	Frankfort	0.08	0.08
90E	E. of Murdo	1.31	0.96
90W	E.of Murdo	1.92	1.15

Table 4 Longitudinal Cracking of Survey Sections

Route	Ref. Location	Longitudinal Cracking, m											
		Wheel Path			W.Path Sealed			Non-W.Path			Non-W.Path, Sealed		
		Low	Mod.	High	Low	Mod.	High	Low	Mod.	High	Low	Mod.	High
11	Alcester	14.25	-	-	-	-	-	-	1.25	-	-	-	-
14	Midland	-	-	-	-	-	-	-	-	-	-	-	-
28	Jct 25 N	-	-	-	-	-	-	-	-	-	-	-	-
46	Jct. 25 West	-	-	-	-	-	-	-	-	-	-	-	-
47	Jct 212 – Lebanon	-	-	-	-	-	-	-	-	-	-	-	-
73	22.775 Km. N. of 34	-	-	-	-	-	-	-	-	-	-	-	-
212	LaPlant	-	-	-	-	-	-	-	-	-	-	-	-
212	Frankfort	-	-	-	-	-	-	-	-	-	-	-	-
90E	E. of Murdo	-	-	-	-	-	-	-	-	-	-	-	-
90W	E.of Murdo	-	-	-	-	-	-	-	-	-	-	-	-

Table 5 Transverse Cracking of Survey Sections

Route	Ref. Location	Transverse Cracks								
			Length Unsealed, m			Length Sealed, m			Rating	
		No.	Low	Mod.	High	Low	Mod.	High	Pred.	Extent
11	Alcester	4	0.07	-	-	10.98	-	-	Low	1
14	Midland	-	-	-	-	-	-	-		-
28	Jct 25 N	-	-	-	-	-	-	-		-
46	Jct. 25 West	-	-	-	-	-	-	-		-
47	Jct 212 - Lebanon	13	-	-	-	44.88	-	-	Low	2
73	22.775 Km. N. of 34	8	29.86	-	-	-	-	-	Low	2
212	LaPlant	-	-	-	-	-	-	-		-
212	Frankfort	2 & 2	-	-	-	7.32	5.16	-	Low	1
90E	E. of Murdo	-	-	-	-	-	-	-		-
90W	E.of Murdo	-	-	-	-	-	-	-		-

Base Density Testing and Material Sampling
At each of the sections, a test pit was made to provide access to the base material. Maintenance staff from the respective DOT area provided traffic control and a backhoe to remove the asphalt surface. Our subcontractor, Broz Engineering, provided a saw that was used to cut a 600 mm by 600 mm (2-foot by 2-foot) test pit in the outer wheel path of the pavement. The asphalt was removed with the backhoe, exposing the base. Density of the exposed base material was measured by the sand-cone method. After the density test, a bulk sample of the base was removed for laboratory testing and a small sample was placed in a sealed container for moisture tests. At the laboratory, the material was tested for moisture content, gradation, moisture-density (Proctors) and asphalt content.

Deflection Tests
Deflection testing, using Model 8000 Dynatest Falling-Weight-Deflectometer (FWD) equipment, was conducted at each of the sections. Deflection tests were taken at the test pit location prior to sawing and at 26 locations at about 3-meter (ten-foot) intervals in the survey section. The South Dakota FWD was used for the sections on SD 11 and SD 46 and the Braun Intertec FWD was used on the remainder of the sections because of a breakdown of the tow vehicle for the SD unit. The results of the testing, and analysis results, are contained in the Appendix.

The deflection data were analyzed with a program called MODULUS 5.1. MODULUS is a program that estimates the modulus value of each layer of a linear elastic layered system. The program estimates the moduli of the layers that provide the best match between the calculated deflections and the measured deflections. It does this by creating an array of deflections based on the typical range of moduli for each of the layers and matches the measured deflections to the deflections calculated for the array. The deflection database for the version of MODULUS used is WESLEA, an elastic layered program available from the U.S. Army Corps of Engineers. Utilizing the database process allows a number of deflection tests taken on the same pavement system to be quickly evaluated from the same database array.

The stiffness range and Poisson's ratio used for each material category are as follows.

	Moduli Range (Mpa*)		Poisson
Material	Minimum	Maximum	Ratio
Asphalt	689	17,237	0.35
Agg. Base	34	3,447	0.35
Reclaimed Base	28	1,379	0.35
Subgrade	103		0.40

*1 MPa = 145 psi

MODULUS 5.1 estimates the depth to an apparent stiff layer from the deflection data, or a depth to the apparent stiff layer can be input. The stiff layer may be a result of any number of conditions; the most often thought of is bedrock. Other conditions, such as a stiffer soil strata, water table, or stress sensitive soils may produce deflection results similar to a bedrock condition. For the analysis of all of the sections, the depth to the apparent stiff layer was set to 6.1 meters below the pavement surface.

MODULUS calculates a statistic that describes the agreement between the calculated deflection basin and the measured basin called the Absolute Error per sensor or commonly called Fit. The statistic is calculated as the absolute difference between the calculated deflection and measured deflection divided by the measured deflection. It does this for each of the sensors and calculates the average of the differences. This value is reported in the tabulations in the appendix and is under the heading of Absolute ERR/Sens. This statistic is an indication of how well the measured deflections compare with the deflections calculated by the model. Generally, values of less than 2 percent are considered to be reasonable. Very good fits are not evidence that the model used is correct and conversely, very poor fits (over 5 percent error) are not evidence that the model is incorrect. Other factors such as pavement condition and machine calibration can result in poor fits, even when the correct layer thickness and Poisson's ratios are used.

Table 6 contains the layer type and thickness values used for the MODULUS analysis and a summary of the results.

Table 6 Backcalculation Layer Parameters and Average Results

		Thickness for Backcalculation, mm			Average Moduli, MPa				
Route	Ref. Location	Asphalt	PIP	Agg	Asphalt	PIP	Agg	Subgrade	Fit %
11	Alcester	64	102	305	7,074	86	---	209	14.5
14	Midland	89	356	---	5,026	378	---	100	2.1
28	Jct 25 N	114	145	178	4,799	321	335	69	0.4
46	Jct. 25 West	76	221	102	8,115	181	---	256	11.0
47	Jct 212 – Lebanon	64	102	305	7,467	222	201	123	1.1
73	Joins Above	76	152	203	10,811	663	212	81	1.6
212	LaPlant	89	203	203	3,337	110	329	68	0.9
212	Frankfort	114	114	114	1,710	164	1655	80	1.4
90E	E. of Murdo	165	457	---	7,812	128	---	90	1.5
90W	E.of Murdo	152	457	---	6,874	74	---	63	1.2

1 mm = 0.03937 in.; 1 MPa = 145 psi

Two of the sections, SD 11 and SD 46 had much higher basin fit results. Both of these sections were tested with the South Dakota FWD. On further analysis of the deflection data with SLIC method, it was concluded that there may have been a problem with either the spacing of the sensors or sensor gains but we could not identify which sensors were suspect. The SLIC method is a deflection basin transform process developed by Stubstad, Lukanen, Irwin, and Clevenson to screen for potential sensor positioning errors in the Long Term Pavement Performance deflection data. The backcalculation results from SD 11 and SD 46 both show very strong subgrade soils and low PIP moduli. The backcalculation process calculates what the layer moduli for the model to obtain the best match between the measured basin and the basin calculated for the model, resulting in moduli values for the subgrade that are higher than expected. The moduli for the PIP layer in all of the other sections ranged between 74.5 MPa (10.8 ksi) for the section in the westbound lane of I-90 west bound, to 663 MPa (96.1 ksi) for the section on SD 73. The results for both I-90 sections and the section on US 212 by LaPlant are lower than expected for an unbound base material. The average modulus value of 663 MPa (96.1 ksi) on SD 73 is higher than expected for a PIP material. All of the moduli on SD 73, except the subgrade soil, are higher than expected. The presence of an additional layer in the pavement section that was not included in the layers listed, such as a stabilized subgrade layer, would affect the backcalculation process by calculating higher stiffness values for each of the modeled layers to account for the low deflections. This is mentioned here as a possibility since the LTPP section on SD 73 near Faith is reported to have a stabilized subgrade layer. The remainder of the sections had typical values for the PIP layer and the other layers.

Base Layer Coefficients

Layer coefficients can be calculated from the base moduli determined from backcalculation of FWD testing. The 1993 *AASHTO Guide for Design of Pavement Structures* provides an equation to convert the material moduli to a layer coefficient in section 2.3.5. The equation is:

$$a_2 = 0.249(\log_{10}E_{BS}) - 0.977 \text{ for US Customary Units in psi.}$$

This equation is based on US Customary units and to convert the equation to use base moduli in SI units of MPa, the equation converts to:

$$a_2 = 0.249\{(\log_{10}E_{BS})+2.162\} - 0.977 \text{ for SI units in MPa.}$$

All of the backcalculated base moduli were for the sections tested were converted to layer coefficients. The average and 85th percentile layer coefficient values for each of the sections are included in Table 7. The data from the survey part of each of the sections is more representative than the test pit since it includes 26 test points. The 85th percentile coefficients ranged from a high of 0.16 for the section on US 14 near Midland to a low of zero (calculated to be –0.02) for the westbound section on I-90 east of Murdo. The coefficients, in fact, tended to be either high (four sections at 0.10 or higher) or low (six sections at 0.05 or lower). Part of this variation may be due to the layer thickness used in the backcalculation process. The presence of an additional layer that the model did not account for usually increase or decrease the moduli of the intermediate (base and subbase) layers.

Table 7 Base Layer Coefficients from Backcalculated Moduli

Route	Ref. Location	Year Const.	Process	Layer Coefficients			
				Test Pit		Survey	
				Avg	85th %	Avg	85th %
11	Alcester	1993	PIP	0.04	0.03	0.04	0.03
14	Midland	1995	Salv.	0.22	0.21	0.19	0.16
28	Jct 25 N	1994	Recycle	0.29	0.24	0.18	0.12
46	Jct. 25 West	1996	PIP	0.11	0.11	0.12	0.10
47	Jct 212 – Lebanon	1994	PIP	0.00	-0.02	0.11	0.00
73	22.775 Km. N. of 34	1987	Salv.*	0.18	0.14	0.21	0.12
212	LaPlant	1996	PIP	0.12	0.11	0.06	0.01
212	Frankfort	1992	Recycle	0.14	0.13	0.10	0.04
90E	E. of Murdo	1996	PIP	0.13	0.10	0.08	0.05
90W	E.of Murdo	1995	Recycle	0.04	0.03	0.02	-0.02

Performance of Sampled Sections

The performance of the sampled sections provides little information to relate any distress to the presence of PIP or salvage materials. Table 8 shows a correlation matrix that relates the average rut depth to number of trucks (HCADT multiplied by the years between the survey and when it was constructed, divided by two) and the thickness of the various layers. What may seem to be a surprise at first is that the rut depth decreases with the number of trucks, also shown on the following graph, Figure 6. This may be more a function of the overall structure of the road. It may be possible that the actual number of trucks, or truck weights may be higher than expected on the lower volume routes. If that would be the case, these roads are more sensitive to increases in traffic because they have less overall structural capacity and are more prone to rutting. Another possible factor may be that higher traffic roads have thicker structures and perhaps more attention to quality control during construction. It is interesting to note that there is nearly no correlation to the thickness of PIP and the amount of rutting, which tends to support the hypothesis that the truck weights and volumes are higher than anticipated on the lower volume routes.

Table 8 Correlation Matrix for Rutting, Trucks, and Structure

	Avg.Rut	*Total Trucks*	*Asphalt*	*PIP*	*Agg*
Avg.Rut	1				
Total Trucks	-0.5659	1			
Asphalt	-0.2043	0.7402	1		
PIP	-0.0055	0.4194	0.7540	1	
Agg	0.0386	-0.4721	-0.7429	-0.8694	1

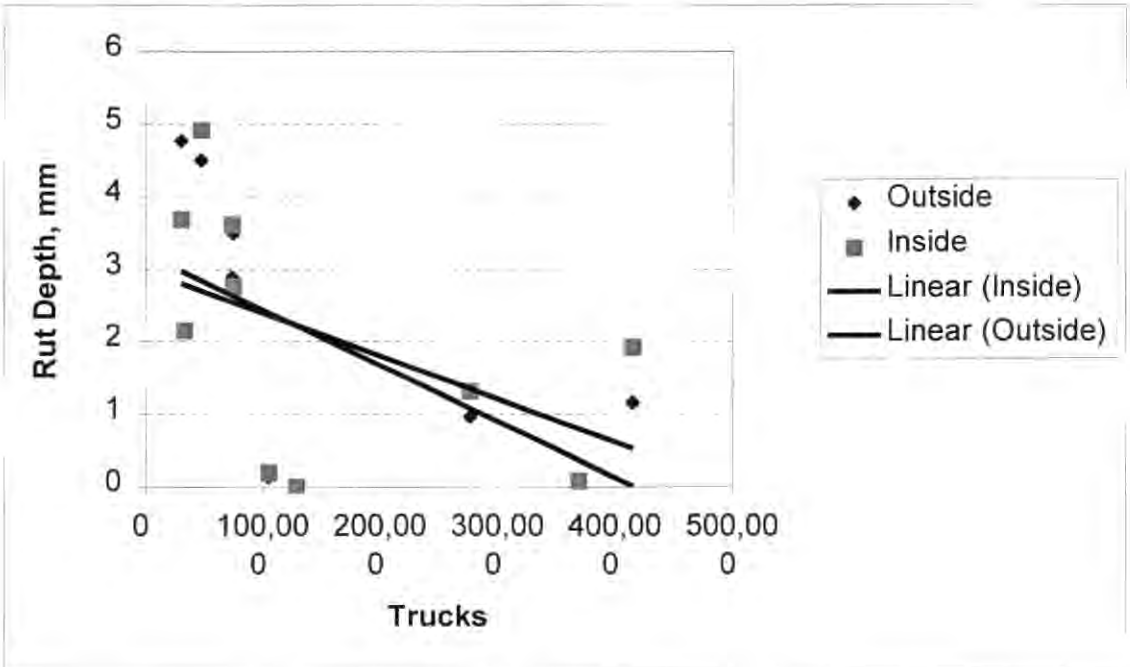


Figure 6 Rutting as a Function of Truck Passes

Laboratory Test of Samples
The bulk base samples that were brought back to the laboratory were tested for moisture content, gradations, moisture-density, and asphalt content. The results are listed in Table 9.

Table 9 Sample Section PIP Properties

		Field Moisture-Densities and AC Contents					Proctor	
Route	Loc.	Wet Density kg/m^3	Moisture Content	Dry Density kg/m^3	Asphalt Content	Percent Max. Density	Max. Dry Density kg/m^3	Optimum moisture
SD 11	SD11	2249	3.5%	2172	3.1%		No Sample returned	
US 14	US14WB	2111	3.4%	2042	2.0%	98.9%	2066	7.0%
SD 28	SD28 c3(9.91)	1898	2.6%	1850	4.0%	100.0%	1850	6.5%
SD 46	SD46	2122	3.1%	2058	0.7%	103.6%	1986	7.0%
SD 47	US47/US212	1836	6.5%	1724	1.2%	90.8%	1898	11.5%
SD 73	SD73/US212	2079	6.5%	1954	0.4%	92.7%	2106	8.0%
US 212 a	US212/SD37	2239	6.2%	2110	0.0%	99.0%	2130	8.0%
US 212 b	US212/SD37	2203	8.3%	2034	0.0%	95.5%	2130	8.0%
US 212	US212LaPLANT	2116	6.2%	1993	2.9%	97.2%	2050	8.5%
I-90 WB	I-90WB	2047	5.8%	1935	2.5%	97.4%	1986	7.0%
I-90 EB	I-90EB	2203	6.0%	2078	3.1%	104.6%	1986	8.0%

1 kg/m^3 = 0.0624 pcf/

Figure 7 shows a general trend between the maximum dry density and the percent asphalt in the reclaimed base, indicating that the asphalt in the reclaimed base makes compaction more difficult (more discussion on compaction of PIP will be in the "Black Rock Phenomena" section and in the discussion of Task 7).

The field densities found range from 1724 kg/m3 (107.6 pcf) at the SD 47 site to 2172 kg/m3 (135.6 pcf) at the SD 11 site. The SD 47 site also had the second lowest maximum dry density value of 1898 kg/m3 (118.5 pcf). The field densities, as a percent of the maximum densities, ranged from 90.8 percent, again on the SD 47 site, to 104.6 percent on the I-90 EB site. The maximum dry densities ranged from 1850 kg/m3 (115.5 pcf) for the sample from SD 28 to a high of 2130 kg/m3 (133.0 pcf) for the samples taken from US 212/SD 37, sites a and b. (The reason for two samples on this section of US 212/SD 37 is that virgin gravel was found in the first test pit. Another test pit was dug about 0.8 km (0.5 mile) west of the first pit and gravel was found in that one also. Under the gravel was a layer of millings. The Proctor is on the gravel.)

It should be noted, as discussed in the next section, that the densities measured in the field at the test pits are likely several percent higher than the densities achieved when the PIP materials were placed.

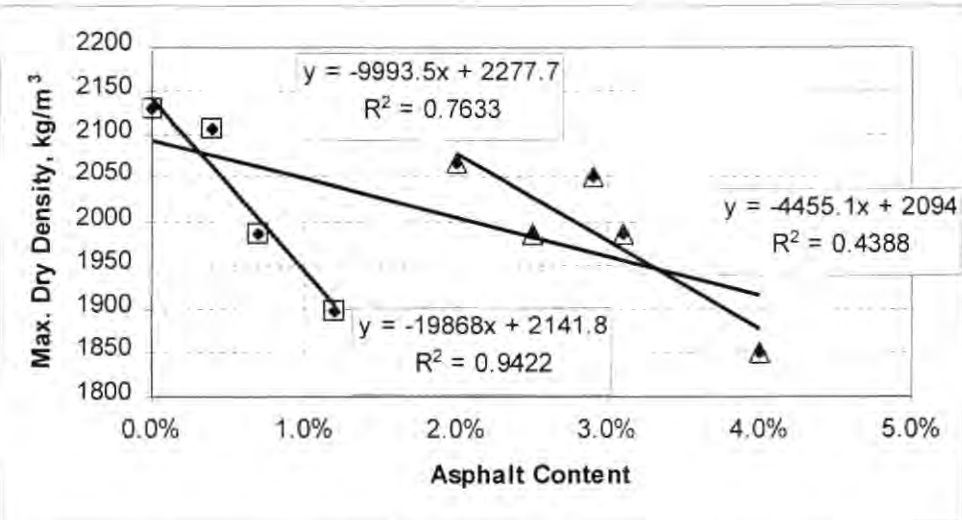
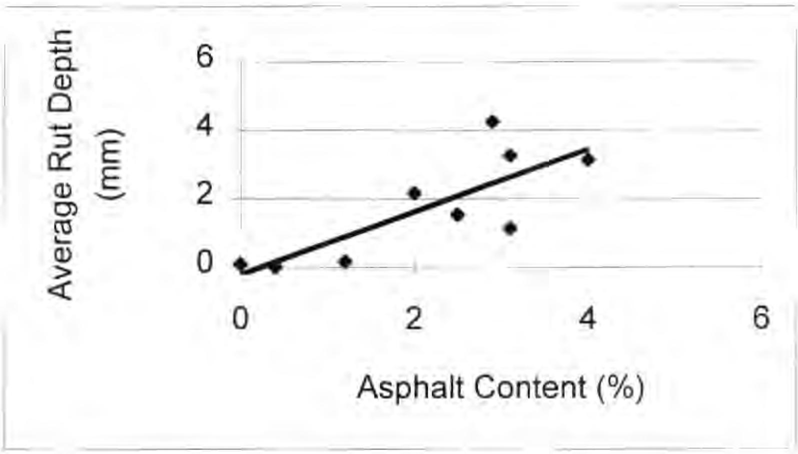


Figure 7 Relationship Between Asphalt Content and Proctor Densities

1 kg/m^3 = 0.0624 pcf

During an interim review of the data, Dan Johnston, project manager noted that the Proctor densities in Figure 7 shows two distinct groups relative to the density versus asphalt content behavior, less than two percent asphalt and two percent or higher asphalt content. Figure 7 contains three trend lines and respective regression equations. The shallow trend line is for all the data points and the regression equation at the top of the graph applies to it. The other two trend lines are relative to the subsets, less than two percent asphalt content and two percent and over. The respective regression results for those trend lines are adjacent to their respective line. The physical reason for these differences is not clear at this time. However, the data supports a conclusion that having an increased asphalt content makes compaction in the field more difficult.



Average Rut Depth (mm) = -0.2111 + 0.915622 Asphalt Content (%)
$R^2 = 0.630824$

Figure 8 Correlation of Average Rut Depth with Asphalt Content

There is also a strong relationship between the average rut depth of the highway sections and the asphalt content of the recycled base materials, as shown in Figure 8.

Examination of the data comparing rut depth with dry density showed a weak relationship between the average rut depth and the measured dry density. This may be because the dry density has been increased as a result of consolidation under rutting pressures.

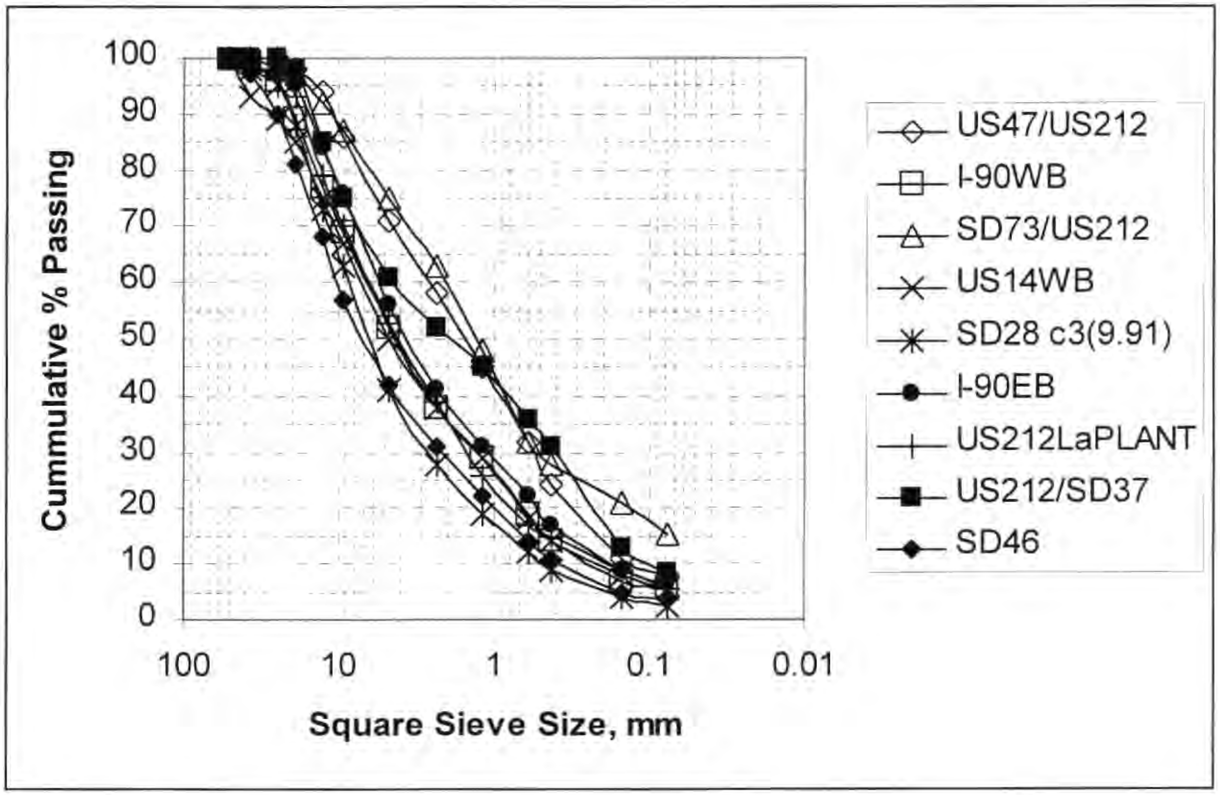


Figure 9 Gradation of Sampled Base Material

The results of the gradations of the materials collected are displayed in Figure 9. Three of the materials, SD 73, SD 47, and US 212/SD 37 are finer than the rest, particularly below the 4.75 mm (#4) sieve. The material from SD 73 is high on fines with 15 percent passing the 0.075 mm (#200) sieve. The material from the rest of the sections appeared to be reasonably well graded. Two of the sections, SD 28 and SD 46 had very low amount of material passing the 0.075 mm sieve. The results from SD 28 are particularly interesting since this material also had the lowest maximum dry density of all of the materials sampled.

The Technical Review panel, during a review of the draft final report, asked if information on the type of equipment used at each of the sites was available. After checking, it was decided that information on the type of equipment was not readily available. The reason for the question relates to one of the questions in the original Problem Statement about equipment type and operation. Part of this question was addressed in the construction of the test sections described in Tasks 6 and 7, but not all of the issues were able to be addressed in this project.

Laboratory Testing for "Black Rock" Phenomena

The "black rock" phenomena, as used in this report is the concern that the individual pieces of asphalt pavement that make up some of the particles of the reclaimed base are not dimensionally stable as individual pieces of virgin aggregates. The reason for this concern is that the overall strength or support that an unbound base material is available to provide is highly dependant on how well it is confined. One of the traditional models used to relate the stiffness or resilient modulus of an unbound aggregate base material is called the bulk stress model as shown in the equation below.

$$M_R = k_1\theta^{k_2}$$

where:

M_R	=	Resilient Modulus
k_1 and k_2	=	Model Coefficients
θ	=	Bulk Stress (sum of normal stresses)

Confinement (θ) here is thought of as the internal horizontal and vertical pressures on the unbound base within the pavement system. Confinement initially comes from compaction during construction and then from traffic over the life of the pavement. If the particles of asphalt deform over time, as asphalt does when it is subjected to constant pressure, the result is a loss of confinement, and according to the bulk stress model, stiffness or strength. This deformation of the asphalt particles could also be thought of as a lack of volumetric stability.

In the proposal, we identified three possible test procedures to measure possible volumetric instability of the reclaimed material. The procedures envisioned included measurement of confinement pressure, creep consolidation, and compaction as a function of temperature. All of the material collected from the test sections constructed on Highway 18 near Tripp, (see Task 7) were used in the laboratory test to characterize the materials and none was left over for these tests. However, to characterize the "Black Rock" phenomena, we suggested that we try to obtain additional material from the shoulder of the test section along Highway 18. On a return visit to the test sections after construction, it was found that there was not any material available outside the edge of the asphalt surface. Additional test section material could not be obtained without digging test pits. To avoid test pits, we suggested that local materials be sampled to characterize the behavior. The intent of these tests is to demonstrate that the granular particles (small asphalt chunks) of the PIP are not dimensionally stable when subjected to the loading forces of compaction. The project technical advisor agreed that local pulverized asphalt material could be used for this purpose.

We selected a local PIP project that used a single stage reclaimer that was the same as the single stage reclaimers used on Highway 18. The general local practice is to reclaim at least equal depth of aggregate as asphalt, resulting in a 50 percent blend or less. The material we were able to get at the time had a residual asphalt content of 1.8 percent, so it likely was already a lean blend; probably in the range of 25 to 33 percent pulverized asphalt.

For the purpose of the test, oversize material (over 25 mm) was removed. The gradation of the remaining material used for the laboratory test is shown in the plot below.

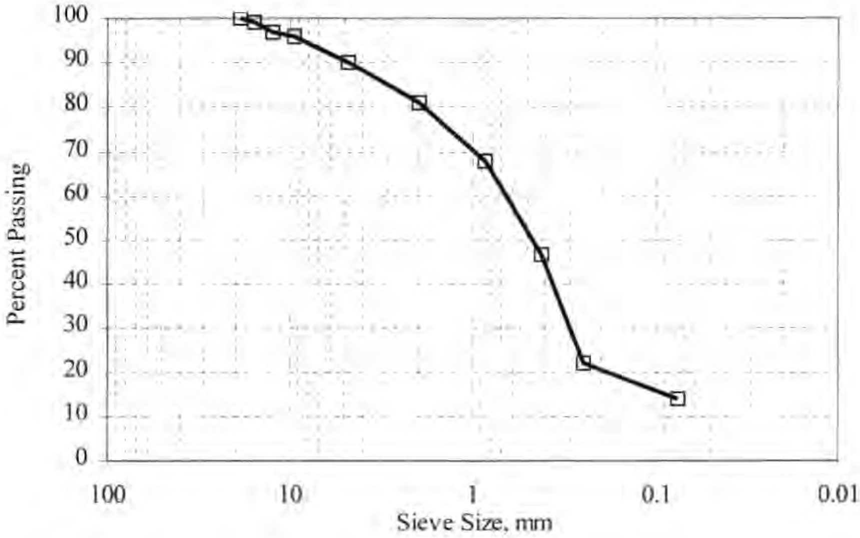


Figure 10 Gradation of Material Used to Evaluate "Black Rock" Phenomena

Equal amounts of the PIP material and the pit run gravel obtained for these tests were combined to provide another blend of the material. The virgin pit run material was used as a control material. The optimum moisture and maximum density (Proctor) results for the three materials are shown in the following table:

Table 10 Properties of Material Used to Evaluate "Black Rock" Phenomena

	Pit Run Gravel	Blend	Reclaimed Material
Maximum Density (kg/m^3)	2018	2034	2018
Optimum Moisture	9.5 %	8.5 %	6.5 %
Asphalt Content	0 %	0.9 %	1.8 %

1 kg/m^3 = 0.0624 pcf

Two of the proposed tests, creep consolidation and gyratory compaction, were used to evaluate the behavior of the two blends of the material, and a virgin pit run sand and gravel. The third, confinement pressure, was not done. We did not have the resources necessary to devise a fixture to measure the confinement force or how it may change with time.

Creep Consolidation

A consolidation apparatus was set up in a environmentally controlled chamber. The consolidation test was designed to measure the creep consolidations of prepared samples when subjected to a constant 103.4 kPa (15 psi) load. The materials were intended to be prepared to about 95 percent of the maximum dry density, however, the initial densities of the blended samples were near the maximum density and the pit run gravel sample was below the target value. The initial densities and moisture contents of the samples are shown in the following table:

Table 11 Initial Moisture and Densities for Creep Consolidation Tests

	Molded Moisture Content, %	Molded Density, kg/m^3			Average Percent Proctor, %
		Sample 1	Sample 2	Sample 3	
Virgin	11.0	1898	1895	1885	93.4
Blend	7.5	2028	2042	2020	99.8
Reclaimed	6.0	2025	1985	1996	99.2

1 kg/m^3 = 0.0624 pcf

The consolidation test consisted of preparing three 100 mm diameter by 67 mm high (4 in. by 2.5 in.) molded samples and mounting them in the confinement frame. The load was applied to each sample by suspending dead weights from the top platen of each one. Linear variable differential transformers (LVDTs) connected to a data logger were used to measure the vertical dimension of each sample. A fourth LVDT was set up on a dummy frame without any load to measure the stability of the LVDTs and data recording set-up.

The intent was to measure the creep consolidation at room temperature, and then increase the ambient temperature to 40°C (104 °F). It was found that once the room temperature consolidation had occurred with the blend material, no additional consolidation occurred when the temperature was increased. Subsequently the other samples were only consolidated at room temperature. Figure 11 shows the consolidation that occurred in the samples over the first 24 hours. The tests clearly showed that there was a consolidation of the materials with reclaimed asphalt and that the amount of consolidation was in the same order as the asphalt content of the materials. The pit run material had very little consolidation, comparatively, even though it was not compacted to the same degree of maximum density.

The creep consolidation that expected to occur in the typical South Dakota PIP material could be more than double that of the highest blend shown in the above plot, if tested in the same manner. The typical South Dakota PIP material is made up of about 75 percent reclaimed asphalt and 25 percent underlying aggregate materials and tends to be coarser graded. The coarse gradation may allow for more consolidation.

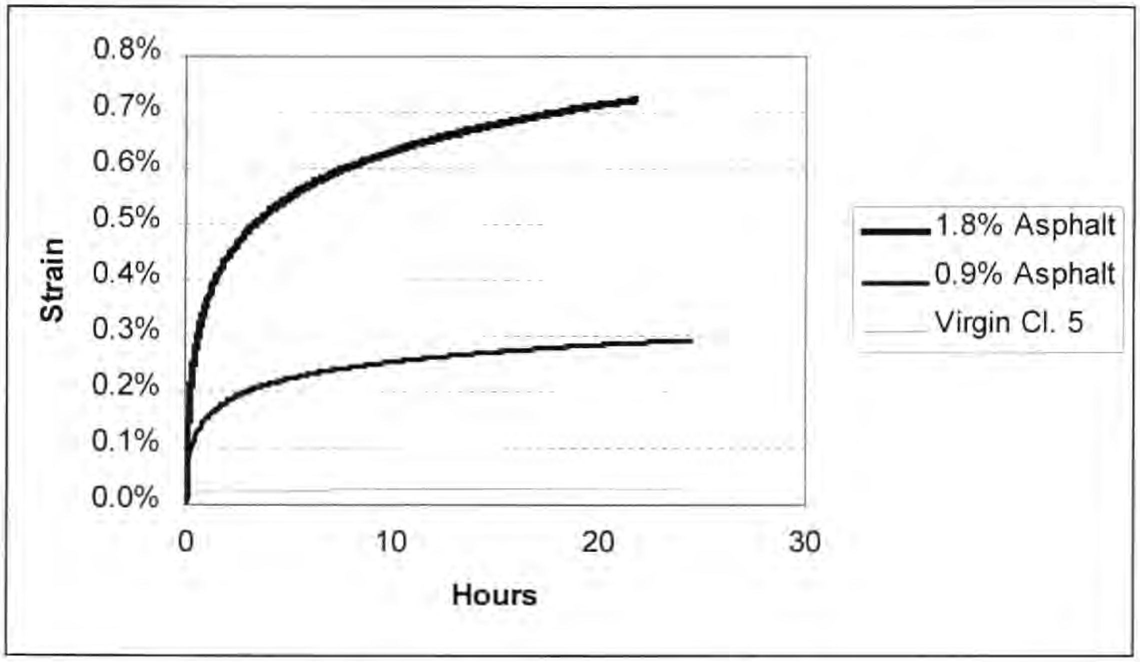


Figure 11 Creep Consolidation Curves

Gyratory Compaction
The three samples were prepared to the optimum moisture contents, warmed to 40°C (104 °F) in an oven and then compacted in a Superpave Gyratory compactor. The Gyratory applied a 600 kPa load and was set at a 1.25 degree angle of gyration. Figure 12 shows the density as a percent of maximum Proctor versus number of gyrations. All of the materials compacted to well over their maximum Proctor density. Both the samples with RAP compacted to a higher percent of maximum Proctor density than the pit run gravel. It was noted that the compaction was forcing water out of the virgin pit run material, but no water was forced out the sample with the most RAP.

Figure 13 is the from the same data set as the above plot, but scaled to distinguish more of the compactive differences in the first few gyrations.

Resilient Modulus Test
The material collected from I-90 in the westbound lane was tested at 40 degrees Celsius (104 °F) using the repeated load triaxial method. The repeated load tri-axial test method was the same as used for NCHRP 4-23 "Performance Related Tests of Aggregates for use in Unbound Pavement Layers," with the exception that it was ran at 40 °C (104 °F). After reviewing the results of this test, it was apparent that it identified one of the characteristics, plastic deformation under the continual confinement and repeated load. Consolidation, as discussed above, is expected for reclaimed material and becomes a special limitation for triaxial resilient modulus testing. During the conditioning phase, even though it wasn't instrumented at the time, there was significant continuing consolidation of the sample.

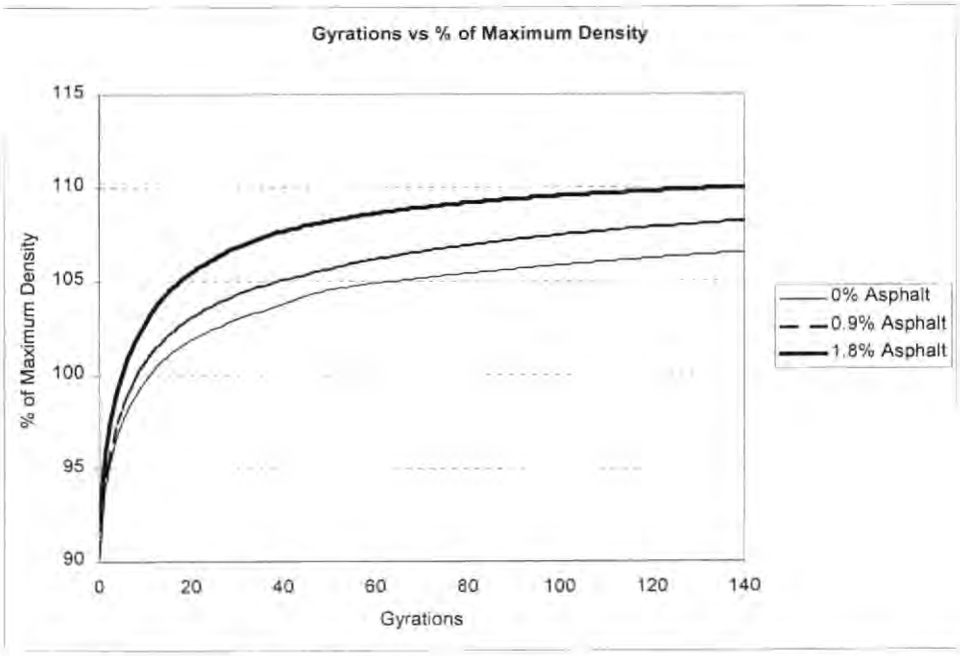


Figure 12 Gyratory Compaction Curves

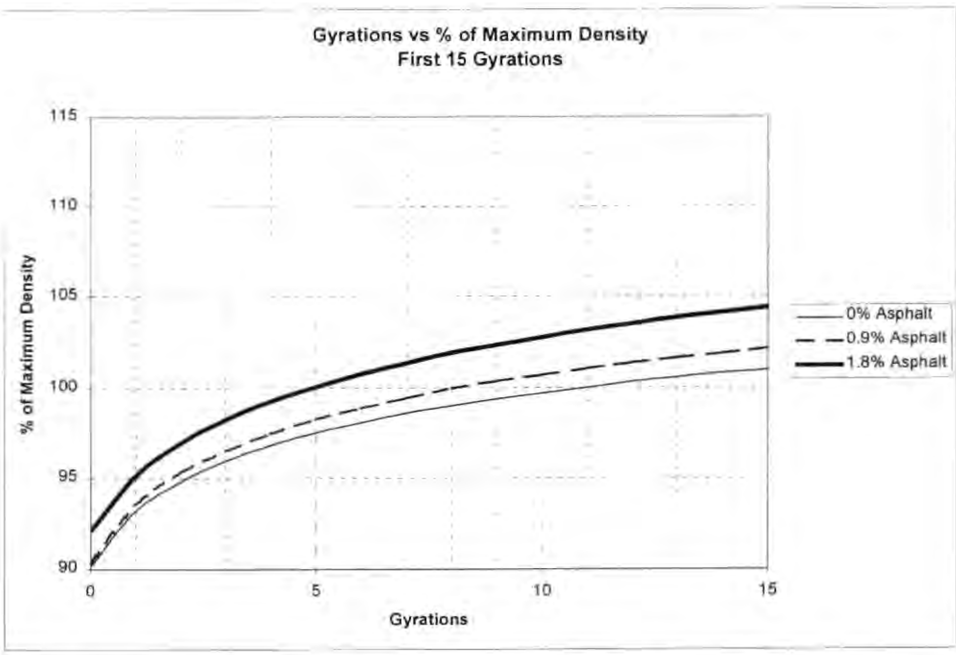


Figure 13 Gyratory Compaction Curves for First 15 Gyrations

There was sufficient material from some of the sampling sections to conduct a repeated load triaxial test. The interest in doing this test was to compare the behavior of the reclaimed material with a test results from aggregate materials from around the country and tested as part of the NCHRP 4-23 "Performance Related Tests of Aggregates for use in Unbound Pavement Layers," project. The material collected from

I-90 in the westbound lane was molded into a 152 by 305 mm (6 by 12 inch) sample at a moisture and density approximately as found in the test pit. The sample was placed in the test chamber and warmed to 40 degrees Celsius in an environmental chamber. The 40 °C temperature was selected to be representative of near maximum temperatures the material is expected to reach in the summer. The repeated load tri-axial test method was the same as used for the NCHRP 4-23 project, with the exception that it was ran at 40 °C. The sample was kept at a constant 103 kPa (15 psi) confining pressure during the temperature conditioning time. Unfortunately, we did not instrument the sample during this time, since, as an afterthought, we found that some consolidation of the material took place. The creep consolidation tests discussed above indicate that significant consolidation takes place under a continuous confining load. In addition, the result of the confining pressure during the temperature conditioning likely modified the sample, resulting in a higher resilient modulus than we would have measured on the sample if ran without any confinement consolidation and at room temperature.

Even after the conditioning, the results of this test identified one of the expected "Black Rock" characteristics, plastic deformation under the confinement and repeated load. During the conditioning phase, even though it wasn't instrumented at the time, there was significant continuing consolidation of the sample. The permanent strain that developed in the sample during the measurement phase of the test was similar to that of the poorest performing aggregates tested as part of NCHRP 4-23. The test ended when the axial LVDTs were fully extended. Shear failure or bulging was still not evident when the test ended. Another comparative criteria used to rank the material, as an aggregate base, is the amount of axial stress applied when the permanent strain reaches two percent. Eleven out of twelve materials submitted by state agencies of the NCHRP 4-23 sample materials tested at optimum moisture ranked better than this sample, and 10 out of 12 when saturated.

The resilient modulus of the material, however, was good, at the 310 MPa (45,000 psi) range. This compares favorably with the resilient moduli of the aggregate materials tested in the NCHRP 4-23 study. It was more in the middle of the range with six of the 12 materials tested having lower resilient modulus values.

It is concluded that the traditional resilient modulus test methods currently available are not suitable tests for characterizing what the material stiffness will be in the field. The tendency is to provide higher modulus values than can be delivered in the field, because the confining, vertical contact, and axial pressures are the control. If a test method could be developed that maintained constant horizontal dimensions and monitored the horizontal pressures without restricting the vertical compressibility of the sample, it may provide more realistic results. Such a device has been developed at Arizona State University but is not commercially available.

Conclusions
The survey of ten existing sections that utilized PIP, or salvage, found that the pavements were performing well. There was very little cracking on the sections and moderate rutting. The rutting was more pronounced on lower volume roads. Deflection tests found that the typical moduli of the reclaimed base was less than expected from virgin aggregate base. The conclusion from the deflection results is that the structural capacity of the sections may be less than the design capacity.

Laboratory tests on reclaimed asphalt as an unbound aggregate found the material had definite creep consolidation characteristics. The amount of creep consolidation under a constant load increased with the percent asphalt. Most of the creep took place in the first 24 hours when loaded at room temperature. After 24 hours of consolidation, elevating the temperature of the material to 40 °C did not result in significant additional consolidation. The sample with 1.8 percent residual asphalt, the highest percent material available for the test, had a vertical consolidation of about 0.75 percent. The typical PIP materials had about twice the asphalt content. For those, the consolidation may be in the 1 to 2 percent range. From this, we conclude that better compaction of PIP could be obtained if a second round of compaction was provided after some period of time, such as the following day, for the particles to relax. Another expectation that can be offered from this behavior, but not measured during this research, is that the PIP density would increase when the first lift of hot-mix asphalt is placed. The PIP has had time for the small asphalt chunks to relax, the hot-mix asphalt transfers heat to the PIP, and the compaction of the first lift provides significant compactive effort to the upper part of the underlying PIP.

The same material used for the creep consolidation curve was conditioned to have the optimum moisture determined in the Proctor tests. The material was warmed to 40 °C and compacted in a Superpave Gyratory compactor. All of the blends tested, virgin aggregate, 0.9 percent asphalt, and 1.8 percent asphalt, compacted to more than standard Proctor densities after a few gyrations. The rate of compaction, expressed as a percent of Proctor, was more for the highest asphalt content and lowest for the virgin aggregate. From this, we would conclude that we do not have the ability to compact the PIP to the density that it is capable of achieving.

We would also expect that the densities of the PIP in the existing sections would be greater than measured on the test sections, but that was not the case. This may be due to lower compaction efforts during the construction of the existing.

Task 6. Submit Plan Notes for Test Section Construction

Findings
If specifications were developed giving DOT staff control over machine operation, contractors could argue that they are no longer responsible for meeting gradation requirements, and are only responsible to proceed as directed. While these items can be very important, specifications for gradation and compaction requirement transfer responsibility to the contractor and, if met, are more in line with the material qualities that are thought to relate to performance. There may be cases where a combination of

material conditions and equipment will not produce the desired results. Selecting a two-stage machine instead of a single stage machine may, for example, be the solution, and it gets to be a problem if the DOT retains the authority to have such control without mechanisms for adjustments in cost. Allowing adjustments in cost, once a project has been let, could bring up bidding issues. It may be in the contractor's best interest to bid the lowest cost equipment and negotiate upgrading the equipment one the project is underway. It would take a larger research project to resolve such issues.

The project location for the test section construction is a part of SD 97-03 on US 18 east of Tripp. The MRM at junction SD 37 is 393.94. Between SD 37 and SD 25 the Needs Book indicates two construction sections. The west end has a section 1.442 km (0.896 mi.) in length that was built in 1957, surfaced in 1958, overlaid in 1979 and the last seal coat was placed in 1986. The remaining 20.691 km (12.857 mi.) between MRM 374+0.836 and SD 25 was constructed in 1941, and, as listed in the Needs Book, consists of the following section.

- 12 mm (0.5 in.) chip seal with 9.5 mm (3/8 in.) aggregate placed in 1986,
- 37 mm (1.5 in.) Class D overlay placed in 1979,
- 50 mm (2.0 in.) Class F Surface placed in 1948, and
- 100 mm (4.0 in.) 19 mm (3/4 in.) cut-back bound aggregate placed in 1941.

This section is classified as "thin on weak" (TONW). It is this second 20.691 km (12.857-mile) section that was of interest for construction of the test sections. The roadway typical section has a 7.3 m (24 feet) wide pavement, approximately 0.3 m (1-foot) shoulders on each side, and approximate 3:1 ditch slope.

The most recent condition ratings for this section, as published in the 1997 Needs Book, are listed below.

- Condition Index 3.35
- Roughness Index 4.04
- Average Strength 2.80

- Transverse Cracking 3.74
- Fatigue Cracking 3.20
- Patching 4.84
- Block Cracking 4.50
- Rut Depth 4.12

The general verbal description of the condition is: closely spaced transverse cracks with some longitudinal cracks progressing to block cracking, medium- to high-severity, in some areas. There were random areas of alligator cracking and rutting in the outside wheelpath over the length of this section. The majority of alligator cracking was medium severity with some low- and high-severity areas. The alligator cracking areas varied from 15 to 30 m (50 to 100 feet) in length and occur about once every 150 m (500 feet). There are a number of patched areas. The nature of the patching is in the form of full-width overlays that generally range from 60 m to 150 m (200 to 500 feet) long. There are also some short areas of full-width chip seals. The patched areas generally would show only some transverse cracking.

A general observation is that the cross-section geometry of the road contributes to some of the localized rutting and alligator cracking in the outer wheel paths. The grade width is not sufficiently wide to develop full lateral support within the underlying embankment for the wheel loads.

The traffic listed for the section is 815 vehicles per day that includes 97 trucks per day. A contract has been let for patching and spot sealcoating in 1997 and includes a number of locations on US 18 between SD 37 and SD 25. The patching and seal coat work was during the 1997 construction season.

Borings were made to measure asphalt and gravel thickness and identify the type of subgrade. It is assumed that the borings were made to provide information for the planned PIP project. The results of the borings are shown in **Table 12**.

Table 12 Layer Thickness and Identification on US 18

Station Km From 37	Offset From C/L	Width, m	*Thickness, mm*		Soil	Comment
			Asphalt	Gravel		
0.805	2.4 m S.	8.1	152	178	Clay	
4.023	1.7 m S.	7.8	152	152	Clay	
7.242	1.7 m S.	7.9	152	127	Clay	
10.461	1.7 m S.	8.1	152	152	Clay	
13.679	2.7 m S.	7.4	241	114	Clay	Maint. Patch
16.898	3.0 m S.	8.0	127	152	Clay	
20.117	2.9 m S.	7.8	127	178	Clay	
21.726	2.4 m N.	7.8	203	102	Clay	Maint. Patch
18.507	0.9 m N.	7.7	140	203	Clay	
15.289	0.8 m N.	7.5	152	127	Clay	
12.070	1.5 m N.	7.7	127	178	Clay	
8.851	1.5 m N.	7.3	165	203	Clay	
5.633	1.8 m N.	7.5	140	165	Clay	
2.414	2.4 m N.	7.9	152	178	Clay	
Averages		7.7	156	157		

The thickness results in the table are much different from the 90 mm (3.5 inches) of asphalt and 100 mm (4 inches) of cutback bound base as listed in the Needs Book. It appears that at least one full-length overlay was added that was not accounted for, and the cutback bound base either had very little binder or what was there has leached away. The aggregate thickness as determined from the borings is greater than listed in the Needs Book.

Design of Research Sections
The use of reclaimed asphalt in an unbound aggregate base presents unique problems regarding characterization of the materials in terms of gradations, standard densities, and strength. Gradation and density control are potentially problem factors during construction. The processes used by the Department include:

- Process In Place (PIP), and
- Use of millings (Salvage).

The PIP may be further divided into two general categories that are dependant on the thickness of the existing surfacing. Thin surfaces (about 4 inches or less) may be pulverized in-place with reclaimer-type equipment that are termed here as single stage reclaimers. Thicker surfaces are pulverized by larger pieces of equipment, termed here as two stage reclaimers, that pulverize and blend the asphalt and underlying aggregate with a horizontal rotating drum and then pick up material and pass it through a knuckle crusher to control the maximum sizing before it is placed back on the road.

Asphalt millings are typically carried off the project to a storage site where the millings can be processed and blended with aggregate, or brought out to the project to be blended with aggregate, to produce an unbound aggregate base.

There are a number of variables that can have an effect on performance. As an example, critical variables that can be investigated in this project could include:

- Method of Processing
- Gradation Control
- Percent Asphalt blended
- Compaction achieved

The gradation control was considered to be a co-variable in the experimental matrix described above. The remaining factors, as described above, resulted in 18 test sections. Two additional control sections were included, resulting in a total of 20 test sections. At 228.6 meters per section (750 feet), the total length of pavement required for the test sections is 4.6 km (2.79 mi.).

Each of the sections should have the same thickness for all layers. Using the new AASHTO design guide and the following parameters:

- Average Truck Factor = 1.5
- Aggregate Structural Coefficient = 0.11

- Recycled Layer Structural Coefficient = 0.14
- Hot Mixed Asphalt Structural Coefficient = 0.40
- Subgrade Modulus for Clay = 41.4 MPa (6,000 psi)
- Design Period = 12 years
- Traffic Growth Factor = 1.0

therefore:
The required structure number = 3.3.

Assuming a section that consists of 37 mm (1.5 inches) of asphalt wear, 76 mm (3.0 inches) of asphalt non-wear, and 76 mm (3 inches) of undisturbed aggregate underneath, the resulting thickness of recycled material must be 213 mm (8.4 inches) thick.

The only way that the same thickness section can be constructed for all of the test cells is to include additional material handling. The Salvage method does not present a problem (for controlling the blend) since materials handling will be the same for all blends. The two PIP methods, however, present a challenge. The additional handling of the materials will not represent normal construction procedures. This particular project has, on average, only 150 mm (6 inches) of aggregate available and to lower the risks of contamination, we suggest 76 mm (3 inches) of aggregate be left in-place. That only leaves 76 mm (3 inches) of aggregate available for either of the two PIP methods. To reach the 25-, 50- and 75-percent blends, part of the existing asphalt must be milled off and replaced by virgin aggregate before the PIP is done. The three blends could be accomplished as follows.

75 Percent Blend

This requires that 150 mm (6 inches) of asphalt be blended with 50 mm (2 inches) of the underlying aggregate for a total depth of 200 mm (8 inches). This work is generally only done with the larger two-stage equipment and is not often done by reclaimers. This would leave 100 mm (4 inches) of aggregate under the PIP, although this may not be a serious departure from the design thickness.

50 Percent Blend

Three inches of asphalt must first be milled off. The remaining 75 mm (3 inches) of asphalt could then be blended with 75 mm (3 inches) of the underlying aggregate. To achieve the 200 mm (8-inch) total target thickness, some of this material would have to be hauled to result in 200 mm (8 inches) of total thickness. To accomplish the 50-percent blend, it was decided to mill 50 mm (2 inches) of asphalt and replace it with two inches of virgin aggregate and PIP 200 mm (eight inches) total depth.

25 Percent Blend

A 225 mm (five-inch) layer of asphalt would have to be milled off. The remaining 25 mm (1inch) of asphalt could be blended with 75 mm (3 inches) of underlying aggregate. To achieve the 200 mm (8-inch) total target thickness, this material from half of the treatment area would have to be picked up and placed over the other half to result in a 200 mm (8-inch) PIP layer. The area where the PIP material was removed could become a control section by using virgin aggregate base material as a replacement. As with the 50 percent blend, it was decided to mill 100 mm (four inches) of asphalt and replace it with a equal thickness of virgin aggregate prior to 200 mm (eight inches) of PIP.

Compaction Issues

A 200 mm (8-inch) lift is too thick to be compacted at one time. For the 75-percent blend, the material should be compacted in at least two lifts, resulting in an extra materials handling step. The handling of the material to control the lift thickness during compaction is typical of all PIP projects and is not considered to be a departure from standard practices. Therefore, for the comparisons of the various test sections on this project, the way the materials are handled will be similar for all three blends.

The control strip (or test strip) method of compaction will be used for the research test sections. Specified density methods have not been effective because of the combined difficulties of establishing a "standard" maximum density for the material, and the problem of making satisfactory density measurements in the field.

The use of the maximum roller size possible is recommended when the control strip method is used. The roller size should be sufficient to produce the maximum density possible without having excessive problems with pumping the subgrade. The Department currently calls for a minimum of 890 N per 25 mm of tire width (250 pounds per inch) for pneumatic rollers.

The initial test section matrix considered three levels of compaction effort. In view of the difficulties in controlling compaction, the levels of compaction were reduced to two. It was our opinion that underlying subgrade support and materials variation would also affect the densities obtained during construction.

Gradation Issues

Gradation of the material was not considered to be an experiment variable. The nature of the particle size distribution is a function of the equipment used to process the material. The one stage is expected to have the poorest gradation control and will have a particular problem when working in alligator-cracked areas, particularly when the asphalt is thin. The equipment would need to incorporate some sort of containment system to keep the chunks in the drum chamber until the size is reduced to the required size. The two-stage equipment is expected to be able to do a much better job with gradation control. Milling is also expected to give good results with regard to control on the maximum size particles because post processing can be incorporated into the process. There are no controls established for the fine particles that were demonstrated to be a problem on three of the ten sections sampled in Task 5.

Plan notes were developed and submitted to the DOT for review. Following the review, they were revised to reflect the comments and suggestions provided. The plan notes are included for reference in the Appendix of this report.

Task 7. Monitor and Evaluate Construction

Findings
The construction of the test sections on US 18 east of Tripp, showed minimal significant differences between the single stage reclamation process and the two stage process. It did show that removing the pavement for a salvage operation was not feasible on US 18 because of low subgrade strength. The subgrade could not support the construction equipment without pumping. Lower field densities were achieved on the 75 percent blends than on the 25 and 50 percent blends. Density tests made with the sand cone method and a nuclear gauge (direct method) were compared. The comparison showed that the nuclear densities could be related to the sand cone densities, but the asphalt content had to be accounted for. The nuclear results tended to be higher than the sand cone at lower densities (110 to 115 pcf) and about equal to the sand cone at higher densities (125 pcf).

There were no significant problems encountered with the construction until work began on the salvage sections. The two stage machines were used to mill off the asphalt and aggregate to the proper depth. The subgrade, however, did not have sufficient capacity to support the two stage equipment or the trucks. Pumping occurred and the salvage sections had to be abandoned. The area that was to be the salvage sections were processed using the routine PIP method used on the rest of the project. This problem prevented the evaluation of the salvage materials, but did provide direct evidence of the limitations that exist for this process. This section of US 18 was categorized as having a weak subgrade in the Needs Book. It also had little or no shoulder width available, making the roadbed particularly vulnerable near the edges. On very soft subgrades, the salvage method of construction may not be possible without limiting the size of the equipment, or doing a significant amount of subgrade correction that may interfere with carrying local traffic.

Compaction
Compaction was provided with pneumatic rollers towed by a tractor. The tractor towed two two-axle carts with six tires on the front axle and seven tires on the rear axle. The carts were loaded to provide 1432 N per 25 mm (322 pounds of load per inch) of tire width on one roller and 1472 N (331 pounds) on the other. The tires were 8.5/90-15K and applying the load per inch to the tire dimension results in one cart weighing 158.4 kN (35,600 pounds) and the other 162.4 kN (36,500 pounds). The actual measured total load for the rollers was not provided. A nuclear density gauge was used to monitor the density of each of the two lifts of PIP. A single pass of the tractor could be considered two roller passes. The sequence was that the tractor would travel from one end of the section to the other and then return, followed by density measurements. It was typical that the maximum density obtained during this process was obtained on the next repetition. The density for the third repetition was typically within tolerance (less than 16 kg/m^3 (one pcf) increase) and that would complete the rolling for the section. This resulted in difficulty for the 95 percent compaction sections. The densities were well above the 95 percent value after the first repetition of the rollers, resulting in very little difference in density between the high compaction effort and low compaction effort sections. Another factor that is relevant to densities on this project is the roadway is open to local and construction traffic. This traffic, although not high volume,

resulted in additional compaction, particularly in the wheel paths, in all the sections. We expect the final density of the PIP materials, prior to placement of the hot-mix asphalt, was very similar for both the low and high compactive effort sections. Densities obtained on the high compactive effort sections, as a function of roller passes, are shown in Figure 14 and Figure 15 for the single stage processing and in Figure 16 and Figure 17 for the two stage processing.

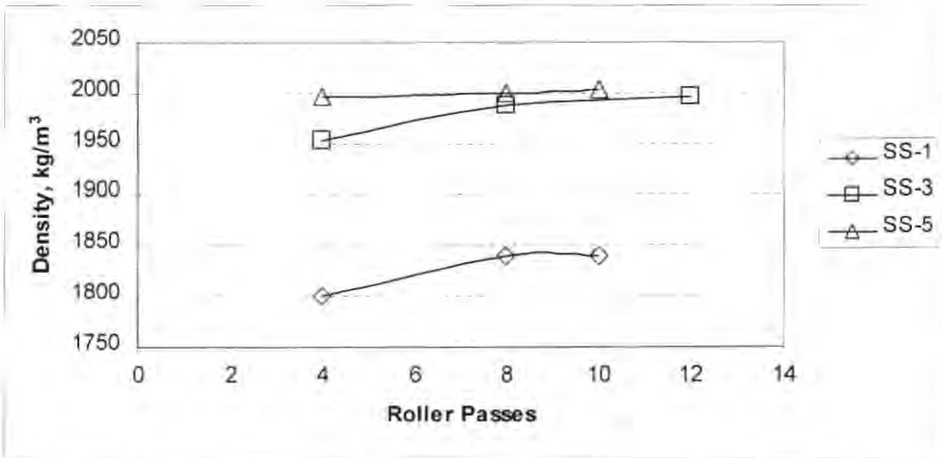


Figure 14 Densities Obtained on First Lift

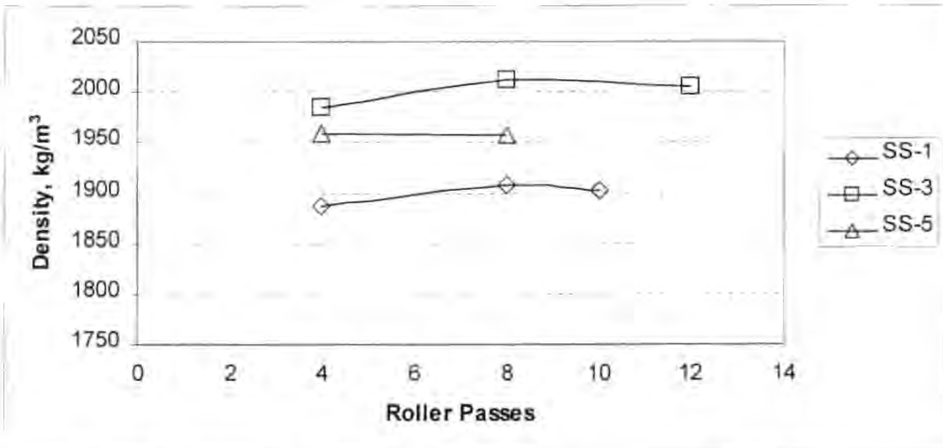


Figure 15 Densities Obtained on Top Lift

The densities obtained increased as the amount of blend percentage decreased. Also, the 75 percent blend showed higher densities on the top lift than the bottom lift, whereas the other two blends provided about the same density on the bottom and top lifts. The two stage material showed similar behavior.

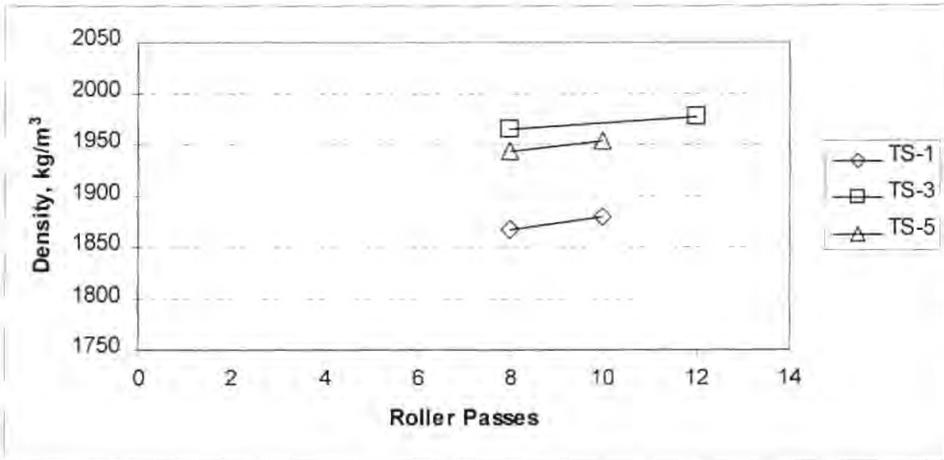


Figure 16 Densities Obtained on First Lift in the Two Stage Sections

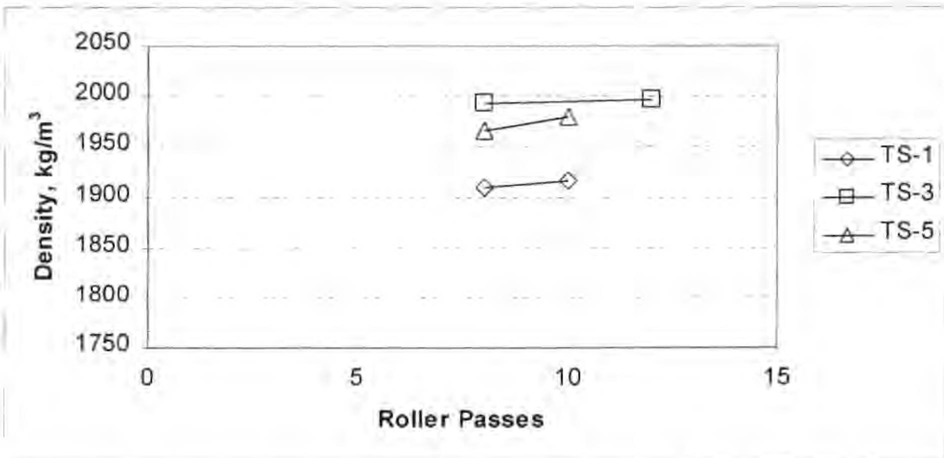


Figure 17 Densities Obtained on the Top Lift in the Two Stage Sections

Figure 14 through Figure 17 show that essentially the same densities were obtained on both lifts. The densities of the 75 percent blend are a little higher on the first lift for the two stage than the single stage process. This difference could be due to the material, but also could be due to the underlying subgrade support.

The final dry densities of the materials, as a function of the type of processing, single stage, two stage, or salvage (salvage included here as a reference since the sections were said to be constructed as a single stage) are shown in Figure 18, Figure 19, and Figure 20.

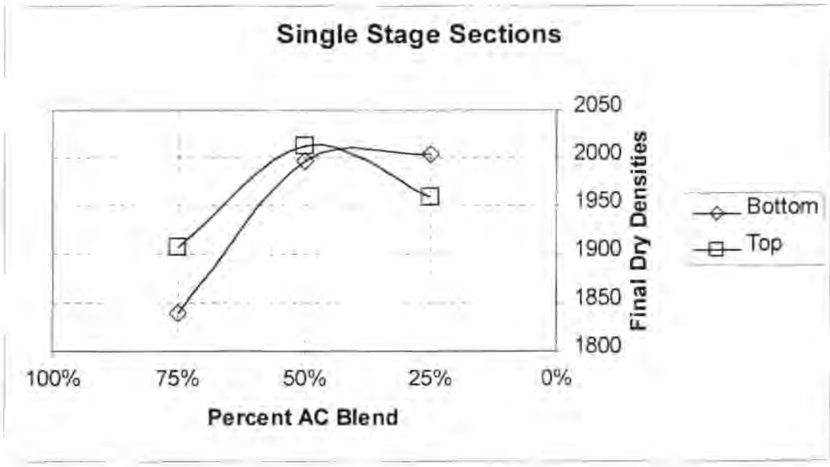


Figure 18 Final Rolling Densities for Single Stage Sections

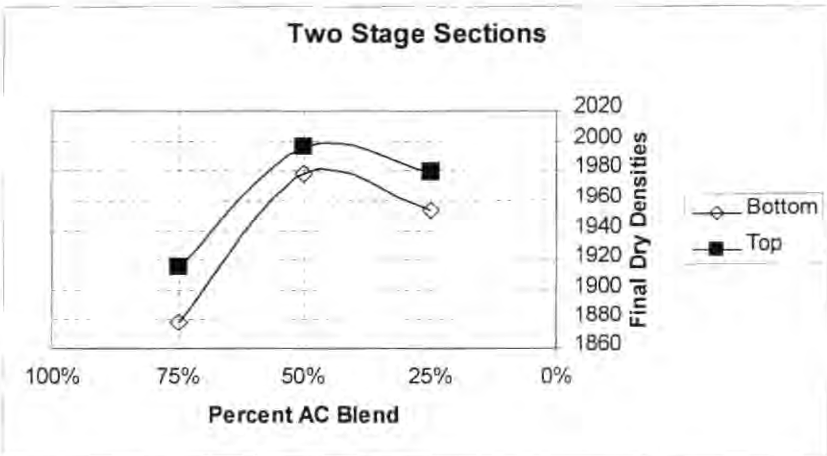


Figure 19 Final Rolling Densities for Two Stage Sections

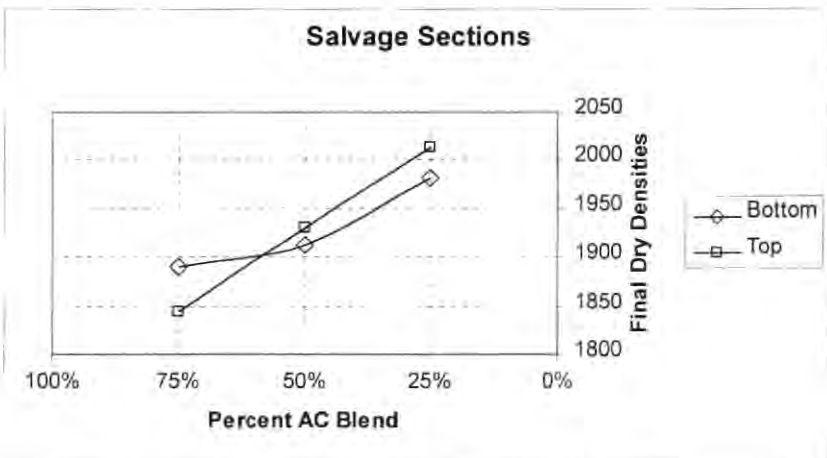


Figure 20 Final Rolling Densities for Salvage Sections

In all cases, the plots show that the 75 percent blend did not compact as much as the 50 percent or 25 percent blend materials, which is consistent with the past experience we have had with this material. The tendency of the 25 percent materials to be slightly lower than the 50 percent materials is more a function of the number of roller passes than a material property as indicated by the laboratory Proctor densities discussed later. The densities shown in Figure 18, Figure 19, and Figure 20 are all from Sand Cone tests.

Gradations

The gradations of the materials from the three processes and the three blends are shown in Figure 21, Figure 22, and Figure 23. The gradations are quite similar for all three types of processing with the single stage materials being slightly finer. Also, for all three types of processing, the blends ranked from coarse to fine in reverse order of the percent reclaimed material.

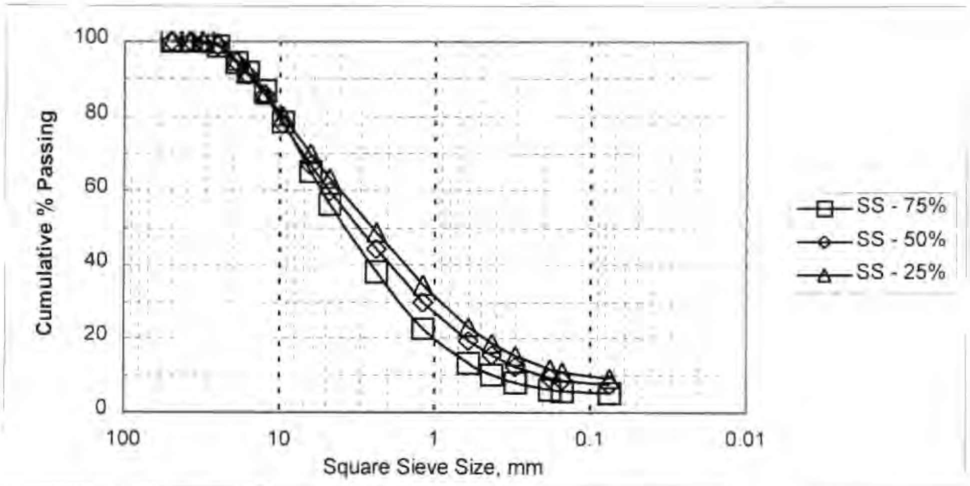


Figure 21 Gradations of the Single Stage Materials.

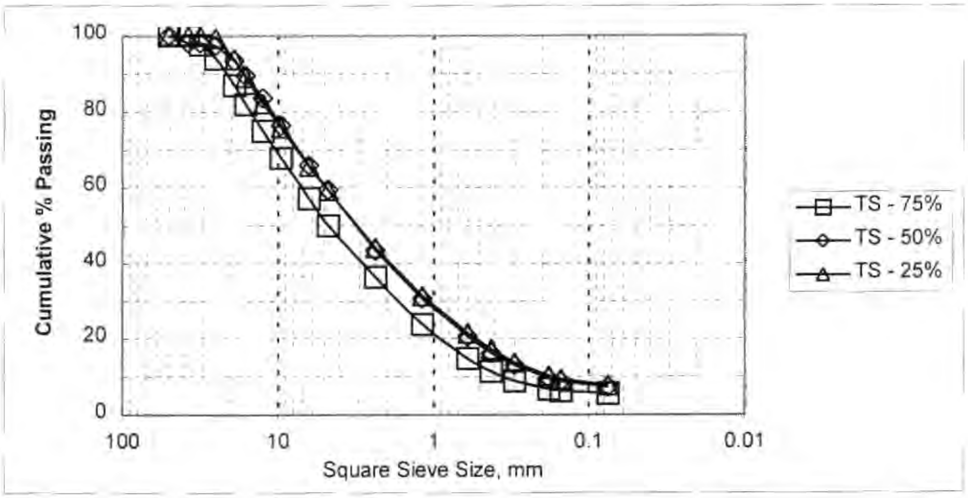


Figure 22 Gradations of the Two Stage Materials

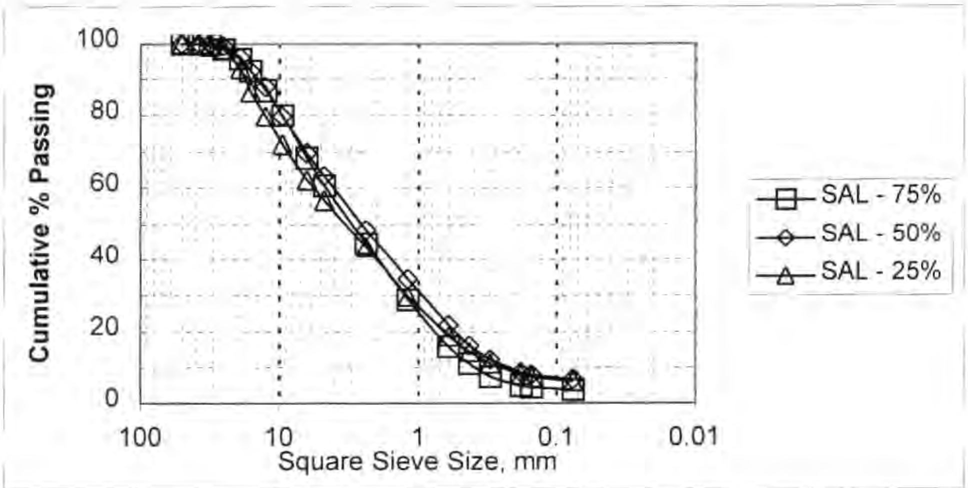


Figure 23 Gradations of the Salvage Materials.

Comparison of Nuclear and Sand Cone Densities

There were 42 pairs of density tests taken with sand cone and nuclear gauge that allows a comparison of the two methods. The dry densities from the two methods are shown Figure 24. The plot shows a definite relationship, but some scatter. From a regression standpoint, the standard error between the two is 48 kg/m^3 (3 pcf). Figure 25 shows little correlation between the moisture contents measured by the two methods. The nuclear gauge reads the asphalt content as moisture, so the amount of asphalt has to be compensated for. Comparing the nuclear dry density, moisture content, and asphalt content measured in the laboratory to sand cone densities, some improvement in the correlation is seen. The regression results in Table 13 show that if the asphalt content is accounted for, the correlation between the two methods improves slightly to a standard error of estimate for the dry density of 43 kg/m^3 (2.7 pcf). This indicates, that within the capabilities of the sand cone, that the nuclear device can successfully measure the density of the PIP material.

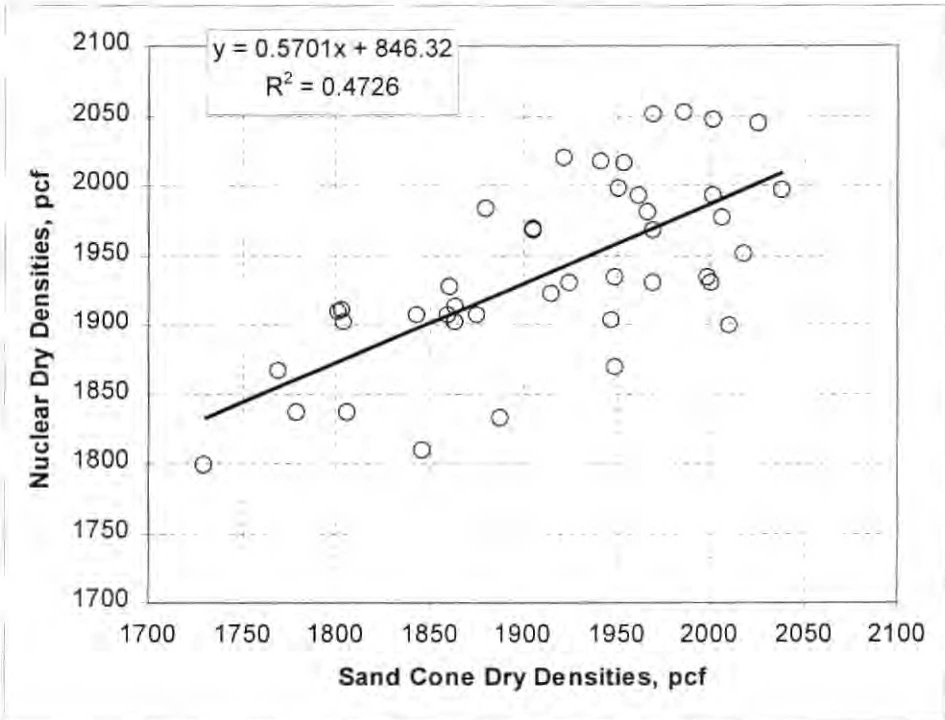


Figure 24 Comparison of Density Test Methods

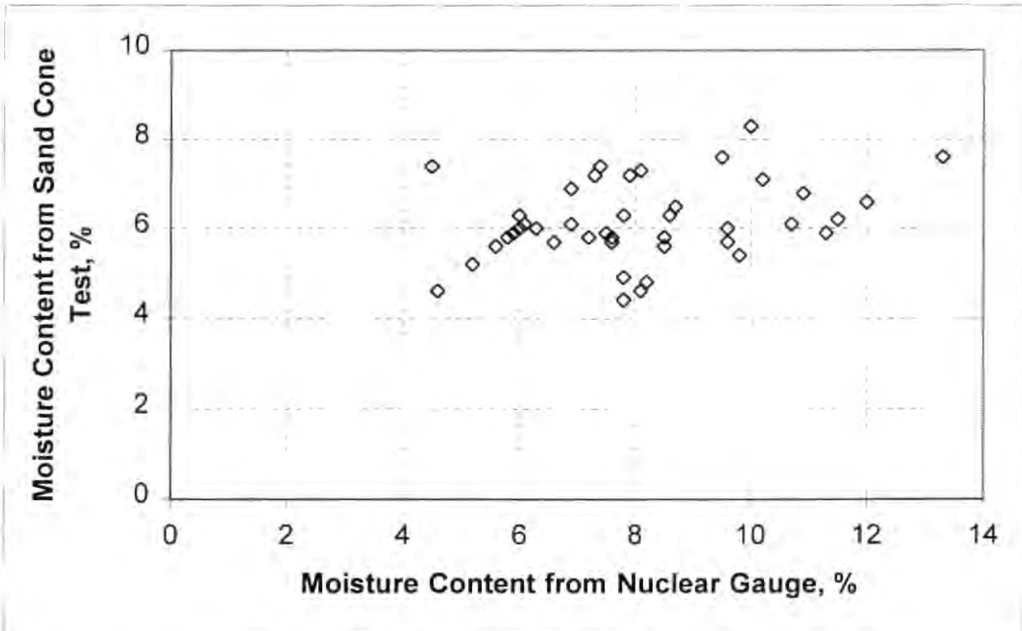


Figure 25 Comparison of Moisture Contents

Table 13 Regression results of Sand Cone and Nuclear Density Measurements

Regression Statistics	
Multiple R	0.77436
R Square	0.59964
Adjusted R Square	0.56803
Standard Error	43.29559
Observations	42

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3	106686.34	35562.1	19.0	1.104E-07
Residual	38	71231.31	1874.5		
Total	41	177917.64			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	1003.9	285.6986	3.5139	0.0012	425.542	1582.275
Nuc.	0.5	0.1329	3.6318	0.0008	0.214	0.752
M.C	9.2	4.0150	2.2906	0.0276	1.069	17.325
AC Content	-16.9	6.4189	-2.6299	0.0123	-29.875	-3.886

Task 8. Monitor and Evaluate Test Section Performance

Findings

There was minimal rutting on all of the test sections when measured in 1999 and 2000. The rutting between 1999 and 2000 increased about 40 percent and the sections with higher rut depths in 1999 still had the higher rut depths in 2000. The amount of rutting related most strongly with the backcalculated moduli of the subgrade, showing more rutting for the weaker subgrades. The backcalculated moduli of the reclaimed material tended to be greater for the higher asphalt blend materials than the lower. This is contrary to our experiences, but it is not due to the higher percent blends having higher moduli than usual, but the lower asphalt blends had much lower moduli than usual.

Deflection Testing and Analysis

Deflection measurements were made in the outer wheelpath of the westbound lane, traveling from east to west. Eleven tests were taken at nominal 15.24 m (50-foot) intervals. Each location was tested with three drops, one at a nominal 26,689 N (6000-lb) peak load and two at 40,034 N (9000-lb) peak load. The deflection sensors were placed at 0, 203, 305, 457, 610, 914, and 1524 mm (0, 8, 12, 18, 24, 36, and 60 inches) from the center of the load plate

The deflection data was evaluated with MODULUS 5.1 to calculate layer moduli for each of the deflection basins. The MODULUS program is described in Task 5. The analysis outputs are contained in the Appendix.

Distress Surveys

Pavement distress surveys, rut measurements, and deflection tests were conducted on June 8, 1999 and again on April 18, 2000. The distress surveys and rut measurements were made by Braun Intertec staff and the deflection tests were conducted with the South Dakota FWD. (It was interesting to observe that the survey conducted in 2000, after two winters, found no transverse cracks (or cracking of any type) in any of the test sections. There was a small area that had open texture that appeared to have occurred when the wear was placed.) The FWD analysis was conducted by Braun Intertec.

Table 14 Measured Rut Depth, in millimeters, on June 8, 1999

Sect	CS2	SA6	SA4	SA2	SA1	SA3	SA5	CS1	TS6	TS4	TS2	TS1	TS3	TS5	SS6	SS4	SS2	SS1	SS3	SS5
	0	2	3	1	3	1	1	4	1	1	1	3	2	2	1	2	2	3	2	3
	0	2	3	2	2	3	1	2	1	1	1	3	2	1	3	3	1	3	2	7
	0	3	0	1	1	2	1	2	2	1	2	3	1	2	3	2	3	3	2	6
	0	2	0	2	3	1	0	3	1	2	3	2	2	1	1	2	2	3	2	3
	0	3	2	1	3	1	0	3	1	1	1	3	3	1	2	2	2	2	2	2
	0	3	3	2	3	1	1	1	1	1	2	3	3	2	2	1	2	3	1	3
	0	1	2	3	1	2	1	1	1	3	3	2	3	2	2	2	2	3	2	3
	0	1	3	2	1	2	0	1	2	2	2	2	2	1	2	2	2	3	2	2
	0	2	3	3	1	1	1	1	1	2	2	2	2	3	2	2	2	3	3	2
	0	3	3	2	2	1	0	1	2	2	3	2	3	1	2	2	2	3	3	2
	0	3	3	1	3	1	1	1	1	2	2	2	3	1	1	2	3	2	3	3
Avg	0.0	2.2	2.1	1.8	2.0	1.4	0.5	1.7	1.2	1.5	1.9	2.3	2.3	1.4	1.8	1.8	2.1	2.6	2.0	3.1
Std Dev	0.0	0.6	1.1	0.6	1.1	0.8	0.3	1.0	0.6	0.6	0.8	0.4	0.6	0.7	0.6	0.5	0.4	0.4	0.6	1.8

Table 15 Measured Rut Depths, in millimeters, on April 18, 2000

Sect	CS2	SA6	SA4	SA2	SA1	SA3	SA5	CS1	TS6	TS4	TS2	TS1	TS3	TS5	SS6	SS4	SS2	SS1	SS3	SS5
	5	3	3	3	5	3	3	0	0	3	3	3	3	3	3	3	3	3	3	5
	3	3	3	3	3	3	3	0	3	3	3	3	3	3	3	3	5	5	3	8
	3	3	3	3	3	3	0	0	3	3	3	3	3	0	3	3	3	3	3	5
	3	3	3	3	3	3	0	5	3	3	3	3	0	3	3	3	3	3	3	5
	3	3	5	3	3	0	0	0	3	3	3	3	3	3	3	0	3	3	3	3
	3	3	5	3	3	5	0	3	0	0	3	5	3	0	3	3	3	5	3	5
	3	3	5	3	3	3	0	3	0	0	3	5	3	3	0	3	3	5	3	5
	0	3	5	3	3	0	0	0	3	3	3	5	3	3	3	3	3	5	3	3
	0	3	3	3	3	0	0	0	3	0	3	3	3	3	0	3	3	5	3	3
	3	3	3	3	3	3	0	5	3	3	3	3	3	3	3	3	3	5	3	3
	3	3	3	3	3	3	0	0	3	3	3	3	5	3	3	3	3	3	3	3
Avg	2.3	2.5	3.5	2.5	2.8	2.1	0.5	1.4	1.8	1.8	2.5	3.2	2.5	2.1	2.1	2.3	2.8	3.9	2.5	4.2
Std Dev	1.4	0.0	1.3	0.0	0.8	1.5	1.0	2.1	1.2	1.2	0.0	1.2	1.1	1.0	1.0	0.8	0.8	1.3	0.0	1.7

The rut depths are shown in Table 14 and Table 15. The rut depths measured in 2000 generally were about 40 percent higher than the depths measured in 1999. Figure 26 is a plot of the average rut depth for the sections. The plot shows that the rutting increased by about the same percentage for all sections, and that the rutting in 2000 relates well to the rutting measured in 1999. The rate of rutting on flexible pavements is generally higher in the first few years and slows down as the traffic compacts the layers and the asphalt hardens. The behavior of reclaimed material is felt to be similar, but we feel that it may be possible that the early rutting period will be longer for pavements constructed with reclaimed asphalt in the base, whether it is unbound, as for this project, or bound as with Cold Inplace Recycling (CIR).

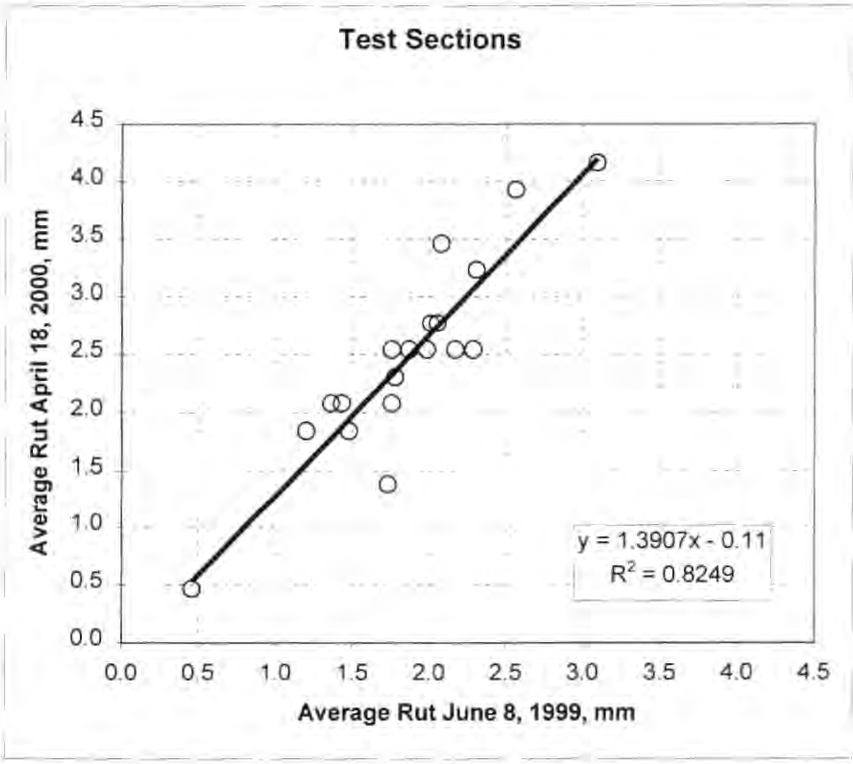


Figure 26 Comparison of Average Rut Depths Measured in 1999 and 2000

Conclusions

Analysis of Monitoring Data

The monitoring results were combined with relevant data from Task 7 for analysis. Specific data from Task 7 that was included in the evaluation was the percent blend or asphalt content data, density data, and equipment used.

Table 16 is a summary of the results of the backcalculation analysis and rut depths for all of the test sections. The asphalt moduli in 2000 were much higher than in 1999 because of the temperature at the time of testing. The base moduli values are also much higher in 2000. Two possible reasons for this are that the base was compacted by traffic and that temperature may also contribute to the higher moduli.

Table 16 Summary of Backcalculated Moduli and Rut Depth for Test Sections

Sect.	%RAP	Comp. Effort	Field Density, kg/m^3	Rel. Density	Year 2000 Average Layer Moduli, MPa				Year 1999 Average Layer Moduli, MPa				Avg. Rut Depth, mm	
					E_{ac}	E_{base}	E_{sg}	Fit	E_{ac}	E_{base}	E_{sg}	Fit	1999	2000
Cs1	0	Std.			15,810	224	102	4.1	1,910	157	82	2.5	1.7	1.4
Cs2	0	Std.			11,193	167	75	2.0	2,348	85	58	2.6	0.0	2.3
Sa1	75	High	1833		12,310	235	90	1.9	1,755	126	69	2.3	0.5	0.5
Sa2	75	Low			10,470	195	86	1.7	1,986	98	67	2.5	1.4	2.1
Sa3	50	High	1948	---	16,204	231	85	1.7	1,949	127	64	2.6	2.0	2.8
Sa4	50	Low			11,963	193	79	1.7	2,313	101	60	2.4	1.8	2.5
Sa5	25	High	1999	---	16,816	199	85	2.4	2,492	100	66	2.3	2.1	3.5
Sa6	25	Low			7,786	155	79	1.7	2,300	93	61	2.7	2.2	2.5
Ss1	75	High	1898	89.8%	8,407	151	72	1.6	1,567	90	57	2.5	2.6	3.9
Ss2	75	Low	---	---	8,420	141	71	1.6	1,335	95	54	2.5	2.1	2.8
Ss3	50	High	2018	95.6%	4,863	84	73	2.8	1,402	69	58	2.4	2.0	2.5
Ss4	50	Low	---	---	4,975	104	67	2.3	1,432	80	51	2.2	1.8	2.3
Ss5	25	High	1977	92.3%	3,575	71	73	3.0	1,165	65	59	2.2	3.1	4.2
Ss6	25	Low	1998	---	7,105	90	73	2.3	1,765	77	57	2.2	1.8	2.1
Ts1	75	High	1908	90.4%	8,562	133	76	1.9	1,737	80	58	2.4	2.3	3.2
Ts2	75	Low	---	---	9,718	146	81	1.9	1,770	88	59	2.8	1.9	2.5
Ts3	50	High	2016	91.9%	8,233	102	78	2.2	1,665	81	60	2.1	2.3	2.5
Ts4	50	Low	1903	---	10,849	120	88	2.2	1,657	94	69	2.4	1.5	1.8
Ts5	25	High	2009	93.5%	8,764	104	80	2.2	1,717	82	62	2.3	1.4	2.1
Ts6	25	Low	2052	---	8,804	108	102	2.2	1,936	86	88	2.7	1.2	1.8

The correlation matrix in Table 17 was calculated for the Table 16 values, except relative density. The correlation matrix provides one to one correlation values. One of the relationships that are of interest is how the rutting compares to the other values.

Table 17 Moduli, Rut Depth, and Field Density Correlation Matrix

	FieldDen	*2000 E_{ac}*	*2000 E_{base}*	*2000 E_{sg}*	*2000 Fit*	*1999 E_{ac}*	*1999 E_{base}*	*1999 E_{sg}*	*1999 Fit*	*Rut1999*	*Rut2000*	*AC %*
FieldDen	1											
2000 E_{ac}	-0.2607	1										
2000 E_{base}	-0.5704	0.8687	1									
2000 E_{sg}	0.0262	0.5021	0.3843	1								
2000 Fit	0.5127	-0.4873	-0.5716	-0.2167	1							
1999 E_{ac}	0.1092	0.8446	0.5915	0.5228	-0.3328	1						
1999 E_{base}	-0.5480	0.8478	0.9507	0.5101	-0.6002	0.5251	1					
1999 E_{sg}	0.1860	0.3057	0.1784	0.9614	-0.0988	0.4105	0.3070	1				
Fit	0.0856	0.2425	0.2146	0.5468	-0.3828	0.2414	0.2359	0.5925	1			
Rut1999	0.2133	-0.3464	-0.3721	-0.6911	0.2789	-0.3376	-0.5220	-0.5814	-0.1647	1		
Rut2000	0.1875	-0.1841	-0.2279	-0.5642	0.1965	-0.1476	-0.4217	-0.4631	0.0067	0.9489	1	
AC %	-0.8457	0.2623	0.5907	-0.0448	-0.6344	-0.0708	0.5457	-0.2056	0.0487	-0.1534	-0.1722	1

Examination of Table 17 for high correlation values shows good correlation between the measured rut depths in 1999 and 2000 and between various backcalculated moduli values, indicating reasonable agreement between those measurements. The matrix also shows there is a correlation between the resulting field densities and the asphalt content of the base material, as described under Task 7. Correlation values in Table 17 show that the amount of rutting measured in 2000 related most highly (excepting the 1999 rutting) with the average subgrade moduli from the 2000 deflection test results. In 1999, the rutting also correlated the most with the subgrade moduli from either 1999 or 2000, followed by the base moduli in 1999. The rutting correlation to base moduli dropped from 1999 to 2000 which may not be significant, but could indicate that the effect the base moduli has on rutting is diminishing.

There are six sections with relative density data available for the test sections so that data was not included in the correlation matrix in Table 17. Each of these data points, however, represent a different blend or equipment, limiting the conclusions that can be drawn. The data is, however, consistent with the expectations regarding the relationship between the compaction and the development of rutting and subgrade stiffness and compaction, but not consistent with our expectations relative to compaction and base moduli. The comparison between relative density and rutting show a very strong relationship between the relative density and the average rut depth measured in 2000 for the two stage process as plotted in Figure 27. The single stage sections also show a relationship, but not quite as strong. Both data sets, however, support the expectation that consolidation under traffic, which leads to rutting, is reduced if greater compaction is obtained during construction.

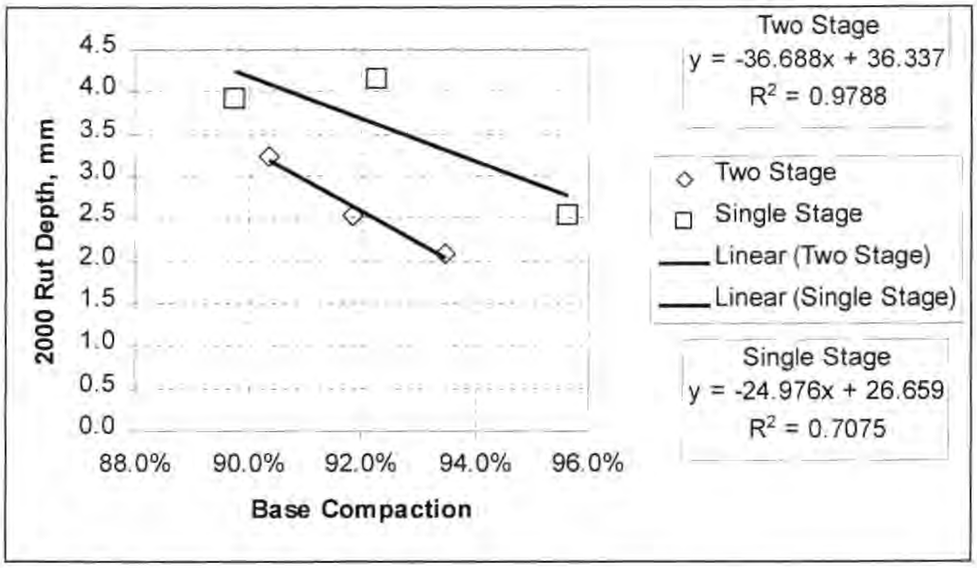


Figure 27 Rutting compared to Relative Density of Base.

The plots in Figure 28 are also consistent with the expectation that higher compaction is achievable on stiffer subgrades. Although both the single stage and two stage show very high relationships between relative density and subgrade stiffness, there is such a small range in subgrade moduli that the results may be more a product of random chance.

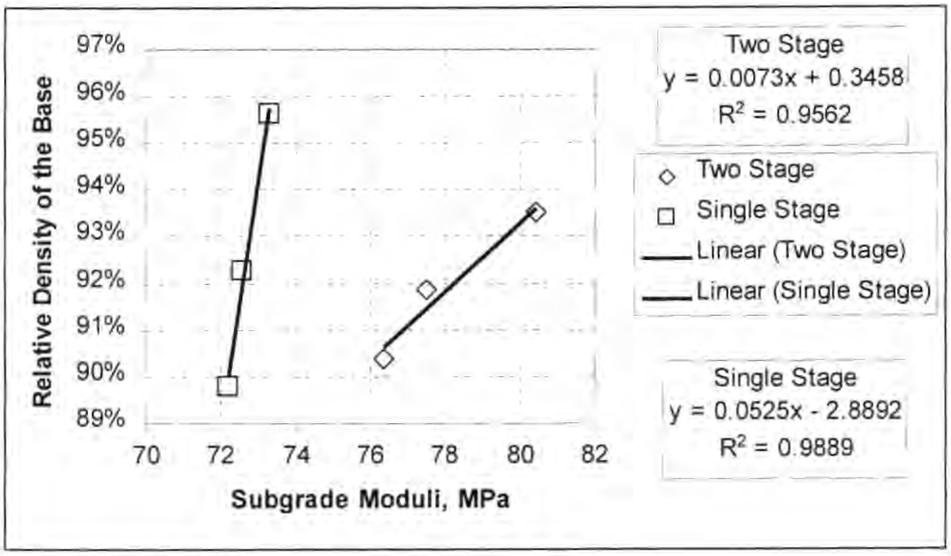


Figure 28 Relative Density compared to Subgrade Stiffness

The trends shown in Figure 29 are contrary to our expectations for normal unbound base material. In this case, however, the lower relative densities are for the higher percentage blends and the high percentage blends sometimes show greater stiffness under the short duration of the impulse load of an FWD.

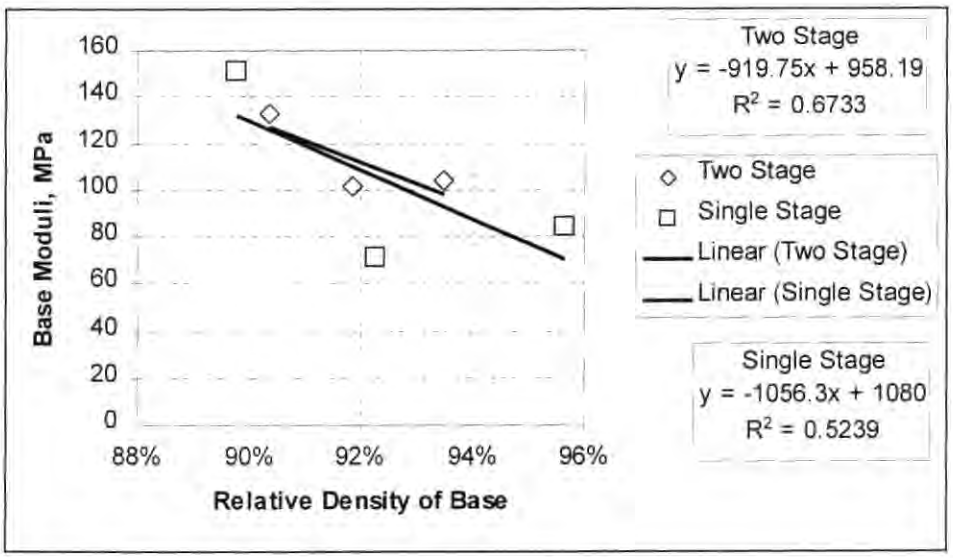


Figure 29 Base Modulus compared to Relative Density

The subgrade moduli are plotted in Figure 30. The regression constants in Figure 30 show a nearly one to one ratio between the 1999 and 2000 subgrade results after accounting for a 17 MPa offset. There is no ready explanation for the change from 1999 to 2000, a list of possible explanations could include the non-linear behavior of the subgrade resulted in higher moduli because of lower strain levels and differences in the FWD calibration.

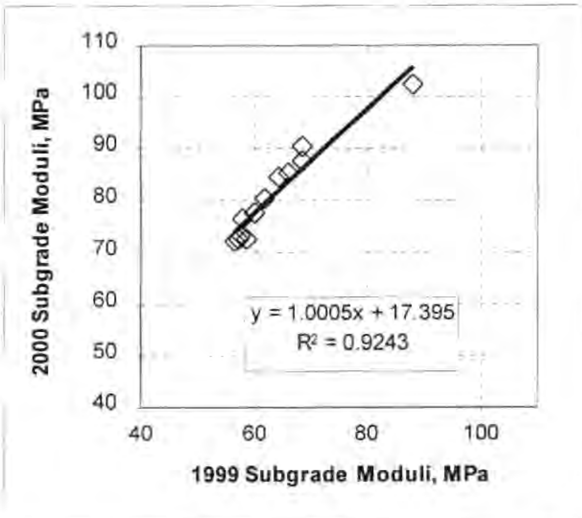


Figure 30 Comparison of Subgrade Moduli

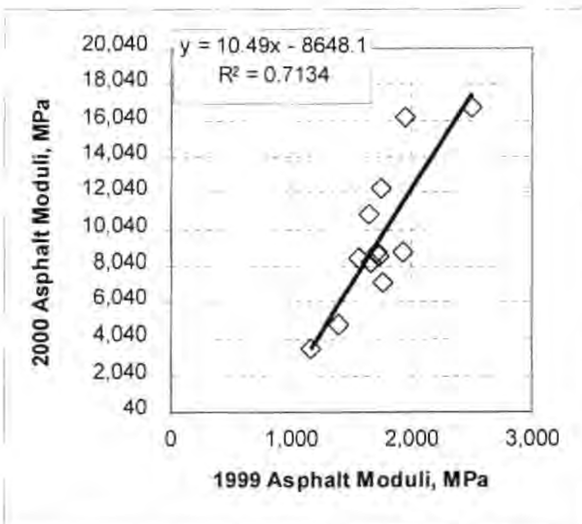


Figure 31 Comparison of Asphalt Moduli

Figure 31 shows the relationship between the 1999 and 2000 asphalt moduli. The 2000 values are about a magnitude larger than the 1999 moduli values. This is a much larger increase than expected for temperatures alone; temperature adjustment factors for typical asphalt and the temperature difference would predict about a three or four to one increase in moduli. The 1999 testing was in the afternoon when air temperatures were in the mid to high 30 °C range and the 2000 testing was in the morning with the air temperatures in the 10 to 20 °C range. The infrared sensor on the FWD was not operating correctly so the pavement temperatures could not be estimated. Traffic compaction may have also contributed to some of the increase in the backcalculated asphalt moduli.

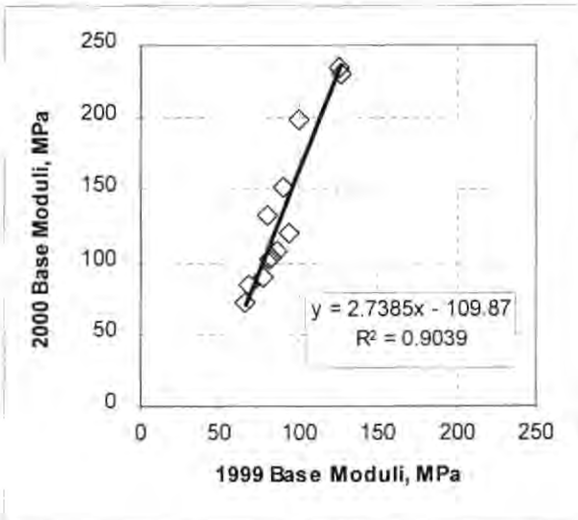


Figure 32 Comparison of Base Moduli

The backcalculated base moduli for all of the sections are plotted in Figure 32. The plot shows a strong relationship between the 1999 and 2000 values and that the 2000 values were about 1.5 times higher. As discussed earlier, the increase in moduli may be from consolidation of the base after one full summer of traffic, and may be partially due to the lower temperatures during the testing in 2000. To determine how much of a role temperature had in the increase in the base moduli, the deflections could be measured in one or two more years at a time when the temperatures are higher. The backcalculated base moduli could be compared the values from these first two rounds of deflection tests to see if the trend continues and if there is a temperature relationship.

The backcalculated base moduli in 1999 ranged from 65 to 130 MPa (10,000 to 18,000 psi), much lower than the typical moduli from virgin aggregate materials that range from 200 to 350 MPa (30,000 to 50,000 psi). The moduli from the 2000 tests are higher, but still not in the range of virgin aggregates. Control Section 1, constructed with virgin base material, had the highest backcalculated moduli in 1999 of 160 MPa (23,000 psi) and second highest in 2000 at 220 MPa (32,000 psi) (SAL-1 had the highest base moduli in 2000, and was very close to the highest in 1999).

An interesting pair of relationships is shown in Figure 33 and Figure 34. The base moduli increases with asphalt content but decreases with density. The decrease in moduli as density decreases is typical of unbound materials and is expected and the increase in moduli as the asphalt content increases seems reasonable, but there is a corresponding decrease in density as the asphalt content increases. This somewhat contradictory behavior may be due to the nature of the load impulse that is part of the FWD test. The high rate of loading tends to mobilize more of the asphalt binder strength whereas slow loading rates are expected to be more responsive to the aggregate structure.

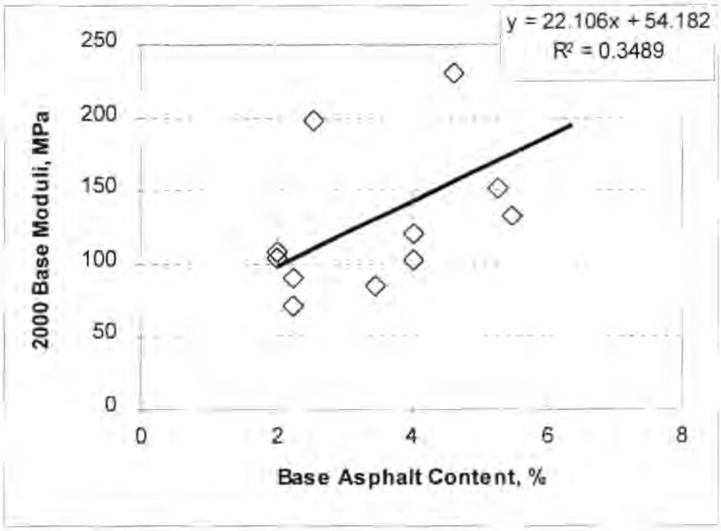


Figure 33 Relationship between Base Moduli and Asphalt Content

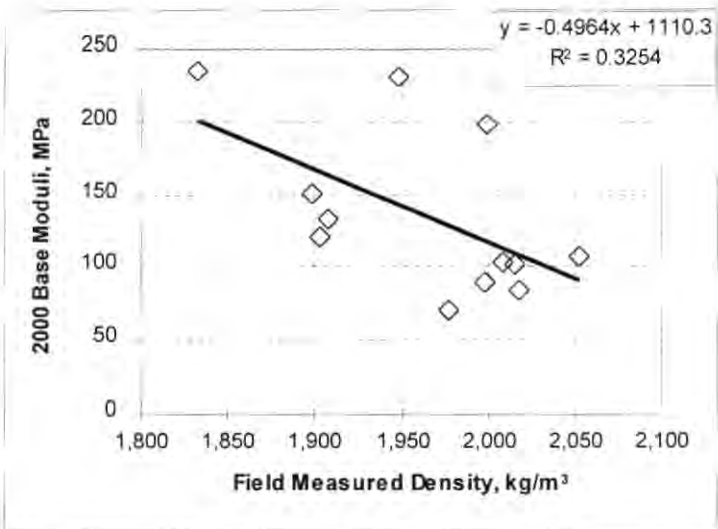


Figure 34 Relationship between Base Moduli and Field Density

Base Layer Coefficients

Layer coefficients can be calculated from the base moduli determined from backcalculation of FWD tests or from the laboratory. As discussed in Task 5, the laboratory moduli for reclaimed base material may be higher than it would be in the field because of the laboratory test methods maintain a constant confining pressure which is what granular material relies on to provide strength. Thus, we have used the field testing for analysis.

The 1993 *AASHTO Guide for Design of Pavement Structures* provides an equation to convert the material moduli to a layer coefficient in section 2.3.5. The equation is:

$$a_2 = 0.249(\log_{10}E_{BS}) - 0.977 \quad \text{for US Customary Units in psi.}$$

This equation is based on US Customary units and to convert the equation to use base moduli in SI units of MPa, the equation converts to:

$$a_2 = 0.249\{(\log_{10}E_{BS})+2.162\} - 0.977 \text{ for SI units in MPa.}$$

The backcalculated base moduli for the test sections from both 1999 and 2000 were used to calculate layer coefficients. Table 18 and Table 19 summarize the resulting layer coefficients for all of the test sections. The average, standard deviation, and mean minus one standard deviation values are included for each section. The section designation and blend were also included in the tables for reference.

Table 18 Base Layer Coefficients from 1999 Backcalculated Moduli

	Base Layer Coefficients			
Section	Average	Std.Dev.	-1sd	Blend
All	0.048	0.029	0.018	
Cs1	0.107	0.018	0.089	Virgin
Cs2	0.039	0.024	0.015	PIP
Sa1	0.083	0.019	0.064	PIP
Sa2	0.055	0.019	0.037	PIP
Sa3	0.084	0.014	0.069	PIP
Sa4	0.058	0.019	0.040	PIP
Sa5	0.059	0.012	0.046	???
Sa6	0.049	0.020	0.029	PIP
Ss1	0.046	0.018	0.028	75
Ss2	0.051	0.021	0.031	75
Ss3	0.018	0.016	0.002	50
Ss4	0.034	0.021	0.012	50
Ss5	0.008	0.035	-0.027	25
Ss6	0.030	0.015	0.014	25
Ts1	0.034	0.015	0.019	75
Ts2	0.043	0.020	0.024	75
Ts3	0.035	0.021	0.014	50
Ts4	0.050	0.020	0.030	50
Ts5	0.036	0.016	0.021	25
Ts6	0.042	0.013	0.028	25

Table 19 Base Layer Coefficients from 2000 Backcalculated Moduli

	Base Layer Coefficients			
Section	Average	Std.Dev.	-1sd	Blend
All	0.092	0.046	0.046	
Cs1	0.135	0.051	0.084	Virgin
Cs2	0.099	0.053	0.046	PIP
Sa1	0.149	0.023	0.126	PIP
Sa2	0.130	0.018	0.111	PIP
Sa3	0.147	0.027	0.120	PIP
Sa4	0.128	0.022	0.106	PIP
Sa5	0.127	0.038	0.089	???
Sa6	0.103	0.028	0.075	PIP
Ss1	0.099	0.032	0.067	75
Ss2	0.095	0.018	0.077	75
Ss3	0.040	0.016	0.023	50
Ss4	0.060	0.030	0.030	50
Ss5	0.019	0.027	-0.008	25
Ss6	0.047	0.016	0.031	25
Ts1	0.088	0.020	0.068	75
Ts2	0.098	0.024	0.074	75
Ts3	0.059	0.020	0.040	50
Ts4	0.078	0.019	0.059	50
Ts5	0.061	0.019	0.043	25
Ts6	0.066	0.016	0.050	25

The results for all of the sections are listed in the top row of Table 18 and Table 19. The average layer coefficient for all of the data in 1999 is 0.048 and in 2000 is 0.092. The mean minus one standard deviation values are 0.018 and 0.046 for 1999 and 2000 respectively. The higher layer coefficients for the salvage (Sa#) sections were not included in the analysis. The salvage sections could not be constructed as test sections because the subgrade was not able to support the construction equipment, so they were processed with the single stage equipment and were not evaluated or monitored during construction.

The two stage sections had slightly higher layer coefficients than the single stage sections in both 1999 and 2000.

The higher percent reclaimed asphalt blends showed tendencies for higher layer coefficients in both 1999 and 2000; this may be due to the higher speed impulse load provided by the FWD which is more responsive to the asphalt binder content. It is possible that slower loadings typical of farm equipment may show the opposite trend.

The layer coefficients calculated from the backcalculated moduli from Task 5 and Task 8 are generally low. Four of the sections from Task 5 had high layer coefficients ranging from 0.10 to 0.16 (85th percentile) and six sections had low layer coefficients ranging from -0.02 to 0.05. The backcalculated moduli data, by itself, would support an 85^{th} percentile layer coefficient for reclaimed asphalt base lower than 0.05. (Six of the 10 Task 5 sections had layer coefficients of 0.05 or less and the 85^{th} percentile of the 2000 testing of the test sections resulted in 0.037 average for all the single stage sections and 0.056 for all the two stage sections.) From our experience, we feel that the overall layer capacity could be higher.

It is our opinion that a design layer coefficient for future reclaimed material can be 0.10 to 0.15 for pavements constructed in accordance with SDDOT specifications that adopt our proposed recommendations. This is higher than a coefficient based strictly on the data which was collected but seems reasonable when combined with our recommendations for changes in the design and construction specifications to improve the performance of the reclaimed material and based on the experience of SDDOT in application of the AASHTO *Guide for Design of Pavement Structures* to South Dakota environmental, material and traffic conditions. It should be noted that pulverization methods that utilize smaller equipment that may be used on local roads may have lower layer coefficients, but that was not part of this study.

Summary of Conclusions

The best indicator of performance seems to be the measurement of rut depth. There was very little cracking or other deficiencies to indicate performance failures. Rut depth generally correlated directly with asphalt content (higher asphalt contents resulted in higher rut depths) and inversely with dry density and percent of maximum density (lower densities resulted in higher rut depths).

Rutting is an indication of inadequate material strength at the time of construction, generally brought on by lack of density. As the material ruts it densifies and strength is improved. Thus, density of the material at time of construction is the most important criteria for successful performance and density should be closely monitored during construction.

Field densification of the recycled material is also inversely related to the percent of asphalt content (higher asphalt content materials had lower field densities although they can be compacted to higher densities in the laboratory).

However, too much effort in compaction can be detrimental to the underlying subgrade if the subgrade is weak or soft. This is suggested by the results of the test sections because the rut depths of the "High" compactive effort sections are generally greater than of the "Low" compactive effort sections. In actuality, the densities of the recycled materials were not significantly different between the High and Low test sections. It appears that the extra compactive effort in the High sections may have disturbed the subgrade. The subgrade at the test site was found to be unable to support construction equipment when all the bituminous was removed in the initial attempts at the Salvage process of reconstruction.

Design of the reconstruction must take into consideration the strength, or weakness, of the subgrade to recommend a constructible pavement section. Removing too much bituminous and aggregate base will expose a weak subgrade. This can interfere with compaction of new materials and disturb the strength of the subgrade.

The laboratory study shows the "black rock" phenomenon is real. The reclaimed material does undergo consolidation over a period of time. This consolidation would also lead to rutting, with poorer strength initially and greater strength over time. The consolidation occurs in a period of hours versus days or weeks so there is an opportunity to recompact the material during construction and reduce subsequent consolidation after construction.

The construction of the test sections showed that both the single-stage equipment used and the two-stage equipment used tended to provide an acceptable product. The equipment used to produce salvage material, milling machines, and post processing crushing and blending is not expected to provide any limitations based on the product developed for this project. However, smaller reclaimers that have been used on county roads and other equipment such as rippers and tracked dozers were reported by the interviewees to have problems producing acceptable material.

Implementation Recommendations

Based on the findings and conclusions of the tasks of this research we recommend SDDOT implement the following recommendations.

1. Conduct a structural evaluation (deflection testing) of the existing roadway prior to selecting a project for PIP or Salvage. Limit sections with subgrade moduli less than 70 MPa (10,000 psi) to the PIP method of reconstruction (no Salvage approach).

The experience attempting to construct the test sections and the experience of the interviewees strongly suggests that pre-construction investigation is necessary to select the proper design and construction process. Subgrades with moduli less than 70 PMa should be considered vulnerable to significant loss of strength due to traffic by heavy construction equipment or local traffic if all the asphalt material is removed.

2. In design limit the recycled materials to a maximum of 50 percent of the new base mixture.

Higher asphalt contents make compaction of the material difficult in the field, resulting in lower strengths and more rutting. There was not much difference between the 50 percent and 25 percent material but the 75 percent material was significantly less dense.

3. Use a structural layer coefficient of 0.10 to 0.15 for base materials that use reclaimed or milled asphalt material. The value may be selected based on how critical it is if there is a performance failure, or on the amount of design information available (how well are traffic, subgrade types, existing pavement structure, etc. identified).

The statistical analyses of the test data using AASHTO design methods suggest a layer coefficient closer to 0.05. However, it is the authors' experience that this value would be low. Further, we understand that SDDOT's experience with the AASHTO design methods show those methods to be quite conservative for South Dakota environmental, traffic and materials conditions. Past designs used 0.15 and many are performing adequately. Revised specifications recommended in this report should result in better performance due to better field compaction during construction. Thus, we can recommend values higher than the specific test data suggest.

Roads with low volumes of truck traffic may have a higher than average number of very heavy loads such that a more conservative layer coefficient may be appropriate.

4. Modify the existing construction specification for PIP to require:

- Conduct moisture-density tests on the reclaimed material before compaction begins and require that the field compaction be a minimum of 97 percent of the maximum density. Use control strips to determine the need for addition of moisture, lift thickness, roller size, or number of passes to achieve the required compaction. Repeat the moisture-density test and control strip procedure for changes in material gradations or percent bituminous. Be careful not to exceed the compaction effort needed as that may damage the subgrade.

- Require each lift of reclaimed material to be recompacted after the reclaimed material has rested for at least one day.

Compaction should be controlled by some reference measure, such as a Proctor density. Doing so is difficult for the PIP process since the material to be compacted is not available until construction starts. This would require a field lab equipped to produce a standard laboratory compacted maximum density value that can be used in the field for control and regular density testing. As a less difficult (and less accurate) alternative a control strip can be constructed to a minimum of 97 percent of a representative Proctor density. Then the established compaction procedure can be the measure of compaction. When the material changes significantly a new Proctor and control strip will be necessary.

The performance of the test sections suggest that overcompaction of the reclaimed material can be damaging to the subgrade, resulting in higher rutting. The control strip method should identify the minimum compactive effort that is required to achieve 97 percent of maximum density and avoid using more compactive effort than necessary.

APPENDIX

Task 11 – Presentation to Research Review Board

Optimization of Recycled Asphalt Concrete and Base Materials For Bases of New Asphalt Concrete Pavements

SD97-03

Executive Presentation

By

Braun Intertec Corporation

Background

The DOT has been using reclaimed asphalt as unbound aggregate base for over 10 years. Over this time, concerns and questions regarding construction and performance resulted in the development of this research project.

Reclaimed asphalt is generated by machines called reclaimers which use large rotating drums with carbide teeth to grind up asphalt pavements in place. Typically, the reclaiming includes all of the asphalt, and some underlying aggregate. A 70-30 ratio of asphalt to aggregate is common on South Dakota projects. This process is termed Process-In-Place or PIP. Millings can also be use in base courses neat or blended with aggregate.

Problem Description

- Numerous reports of anomalous transverse and longitudinal cracking within months after construction
- Numerous reports of structural failure at the county level
- No investigation of factors which provide the best quality of recycled base has been conducted

Factors and Questions Listed in Problem Statement:

- Factors Listed
  - type of recycling machine,
  - horsepower,
  - rate of travel,
  - existing pavement thickness,
  - quality of the material,
  - gradation of the material before and after recycling,
  - moisture content,
  - laydown thickness,
  - density, and
  - recycled/virgin blend ratio
- Questions Listed
  - Does PIP act like HMA?
  - If virgin aggregate is used, should it go above or below the PIP

Objectives Listed

1. *To examine the relationships between construction practices and performance of existing pavements with recycled bases.*
2. *To determine the effects of the milling/recycling operation on the quality of recycled asphalt concrete base materials.*
3. *To determine the effects of different ratios and sizes of virgin aggregate blend material on the base quality.*

Research Activities

- Literature Search
- Interview DOT Staff and Contractors
- Identify all DOT Asphalt Pavement Rehabilitation Projects that have used reclaimed asphalt as base
- Survey 10 Existing Projects Used Reclaimed Material in the base
- Conduct a Laboratory Evaluation of the Properties of Reclaimed Material
- Construct a Test Section to Examine Specific Factors
- Monitor the Test Section Performance

Literature Search

- Very little literature is available regarding the use of reclaimed asphalt as an unbound aggregate base.
- Most of the literature deals with Cold Inplace Recycling (CIR) that includes a binder added to the reclaimed material
- The Florida DOT was the only agency that had research reports on the use of Unbound Reclaimed Asphalt Pavement (UNRAP). They reported a generally positive experience.

Interviews

- DOT field staff and Central Office staff, Contractors, and Ken Skorseth from South Dakota State University Additional contacts were made with FHWA and other out of state contractors that were knowledgeable with the use of reclaimed material.
- The staff and contractors interviewed reiterated the same concerns identified in the problem description.

Historic Data

- The DOT records were searched and a list of projects (asphalt only) was developed that used reclaimed asphalt in the base.
- An Excel file of the projects was produced.

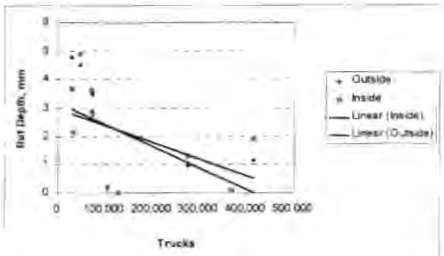
Survey of Ten Existing Sections

County	Proj.No	Route	Ref. Location
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	34	[illegible]
Clark		28	Jct 25 N
Bon Homme /Yankton	[illegible]	46	Jct 25 West
Potter	[illegible]	47	Jct 212 - Lebanon
Meade	[illegible]	73	14 1/2 Mi. N. of 34
Dewey	[illegible]	212	LaPlant
Spink	[illegible]	212	Frankfort
Jones	[illegible]	90E	E. of Murdo
Jones	[illegible]	90W	E. of Murdo

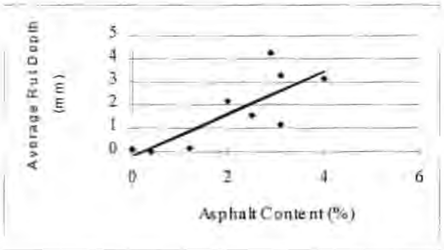
Survey Activities

- Condition Survey
- Rut Depth Measurement
- Deflection Testing
- Test Pit
  - Sand Cone Density Test of Base
  - Inplace Moisture Sample
  - Bulk Sampling for Laboratory
    - Gradation
    - Proctor Moisture/Density
    - Asphalt Content

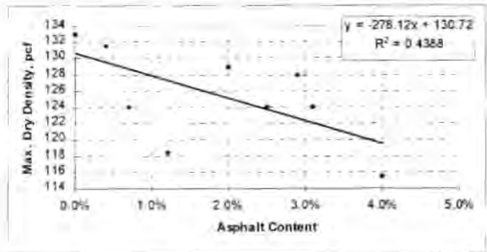
Rut Depths of Sampled Sections



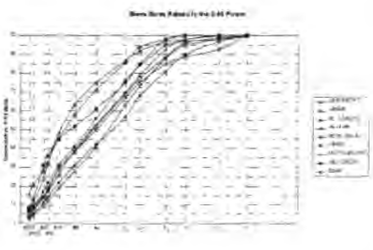
Rut Depths and Asphalt Content



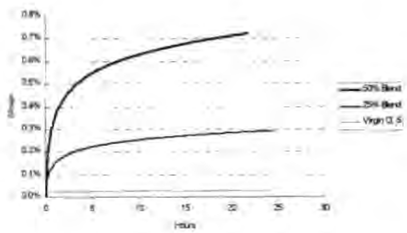
Density and AC Content



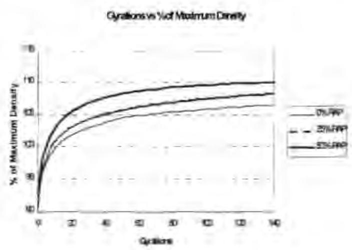
Gradations of Sampled Sections



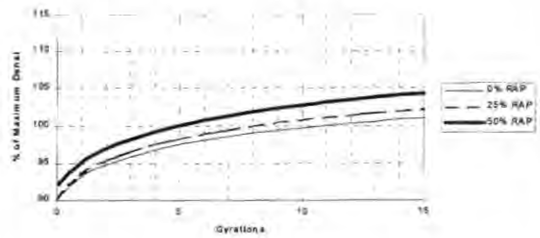
Laboratory Creep Consolidation



Gyratory Compaction



Gyrations vs % Maximum Density First 15 Gyrations

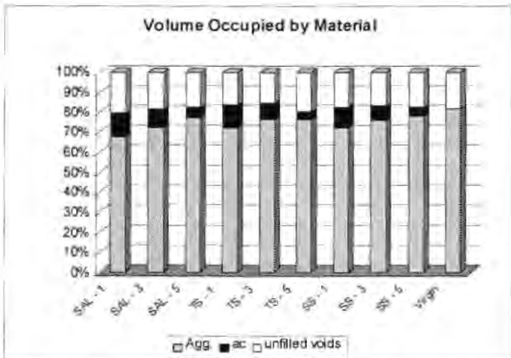


Test Sections

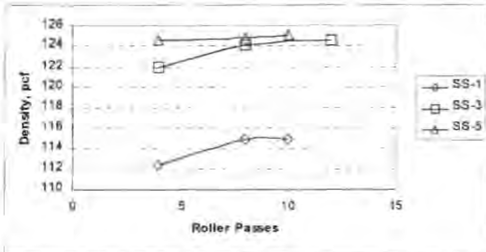
- US 18 East of Tripp
  - Narrow Grade (1-ft Shoulders)
  - Soft Subgrade
  - ~ 6 inches AC
  - ~ 4 to 6 inches Agg. Base
- Relatively Flat Terrain
- Sufficient Room to Construct Test Sections

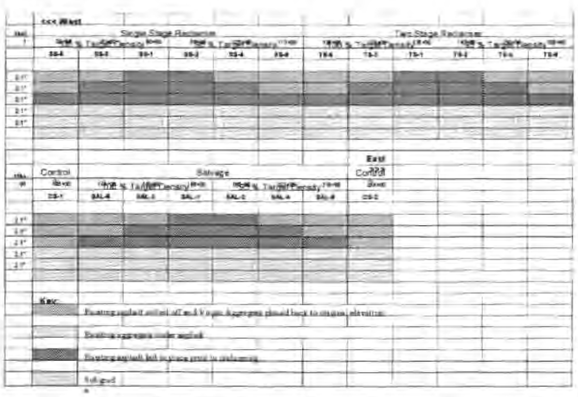
Experiment Factors

		Percent Reclaimed AC					
		25		50		75	
Compactive Effort >>		L	H	L	H	L	H
Process Equip	Single Stage	1	4	7	10	13	16
	Two Stage	2	5	8	11	14	17
	Salvage	3	6	9	12	15	18

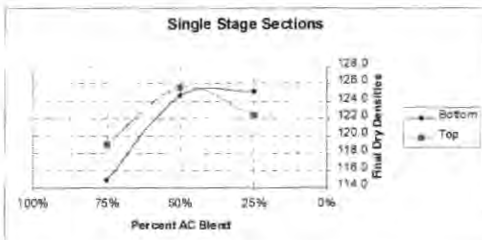


Densities on Single Stage – First Lift





Final Single Stage Densities



Implementation Recommendations

1. Evaluate Subgrade Strength Prior to Using Milling and Salvage – Use PIP on Poor Subgrades
2. Limit recycled materials to 50% of new base
3. Use 0.10 – 0.15 Layer Coefficient for Base Utilizing Reclaimed Asphalt – Select Based on Consequences of Risk

Additional Recommendations

4. Incorporate a Specific Target Density of 97 percent Proctor during Control Strip Operations
5. Recompact each lift after one day

Task 1 - Meeting Minutes

MINUTES OF MEETING WITH TECHNICAL PANEL

OPTIMIZATION OF RECYCLED ASPHALT CONCRETE AND BASE MATERIALS FOR BASES OF NEW ASPHALT CONCRETE PAVEMENTS

SD97-03

May 21, 1997

Introductions

The meeting began shortly after 1:00 p.m. with introductions. Those in attendance included:

Dan Strand, Research Office
for Dan Johnston
Tom Grannes, Material and Surfacing
Terje Preber, SDSM&T
Erland Lukanen, Braun Intertec
Gill Hedman, Materials and Surfacing
Jim Hyde, Pierre Area
Brett Hestdalen, FHWA
Ken Skorseth, SDSU/ SD LTAP Cntr.
Cameron Kruse, Braun Intertec

Review Work Plan

We went through the work plan, by task. Specific discussions regarding tasks are as follows:

Task 2 Literature Search: There was little available on the topic when South Dakota did a literature search in preparation for the project. Tom Johnson of Mid-State Recycling was suggested as a possible resource.

Task 3 Interviews: Discussion was deferred to the agenda item dealing with interviews.

Task 4 Historical Database: We discussed the database, and what information may be available from the SDDOT that should be in the database. SD is a Microsoft Office agency so the database will be in Access . It was suggested that the database contain "control" sections as well as sections with recycled materials.

Task 5 Materials Testing on Existing Projects: A partial list of projects was provided and we stated that more projects are to be identified. There was some discussion of candidate projects; however, additional projects needed to be added to the list and a matrix needs to be established before projects are selected.

Task 6 Submit Plan Notes: A sample of Plan Notes on P 0046(00) 356, Clay County, was provided by Gill. There was discussion about the test sections to be built. The key to success here will be related to controlling the number of experimental variables. We will get estimates of cost from the "Estimating" group.

Task 7 Monitor and Evaluate Construction: We briefly discussed the observations and testing required. SDOT will provide the necessary equipment during construction of the test sections and may have to do some of the testing, depending on contractor scheduling.

Task 8 Monitor and Evaluate Test Section Performance: The task was described and there was no further discussion.

Task 9 Develop Proposed Specifications for Recycled Materials: The task was briefly described with no further discussion.

Tasks 10 and 11 Final Report and Presentation: The presentation would be best suited for the late summer meeting for 1999.

Interviews

A list of people to be interviewed was developed. The list includes the following.

SDDOT			
	Jim Hyde	Engineer	Pierre
	Gary Elsworth	Region Materials Engineer	Aberdeen
	Ron Gillen		Mitchell
	Lyle Haak	Area Engineer	Belle Fourche
	Todd Goldsmith	Area Engineer	Mobridge
	Jeff Gustafson	Area Engineer	Winner
Late Addition:			
	Merle Jenner		at Miller
Contractors			
	Neil Reede	Upper Plains Contracting, Inc.	Aberdeen
	Charles Valentine	Valentine Construction (360) 574-2313	Vancouver, WA
	Lyle Bowes	Bowes Construction	Brookings
SDSU			
	Ken Skorseth	Field Operations Manager	Brookings
FHWA			
	Jim Sorrenson	OTA	Washington, D.C
ARRA			
	Mike Christhoff	Representative	(410) 267-0023

Selection of Projects

Discussion of the selection of projects continued. We suggested that a matrix be formed and the list of recycled or salvage projects be completed, then projects be chosen from that list to fill the matrix.

Variables which might be included in the study were listed as:

- pulverized in-place vs. salvage construction;
- source of failures (could fail for reasons other than recycled material);
- percent of recycled material;
- type of equipment used;
- recycled material above virgin, or vice versa;
- stripping of asphalt from recycled material; and
- construction controls.

One project offered by Gill is SD 168 in the Belle Fourche Area. It has truck traffic and has shown bad performance (Note: During my discussion with Ken Marks on Thursday, I found that FWD test data is available for this project, and for others. Some of the projects have before and after FWD data).

Final Remarks

Cam Kruse asked "What will be necessary to make the study successfully?" The comments that followed included:

- Focus - Keep variables to a minimum.
- Care in construction of test sections.
- Compaction specification and control needs to be a factor.
- Success does not always mean positive findings.
- Need to know how the percent RAP and its compaction affect performance.
- Need parameters that are relevant and are quick and easy to measure in the field.
- Where to put the recycled vs. virgin. Top lift or bottom lift?
- May need specification for gradation of recycled materials.

Other Comments

Comment regarding yield of recycled asphalt and virgin and need to change percentages as the project goes.

Gradation results (Sizing): May want to collect samples from projects under construction in 1997.

Adjournment

The meeting critique indicated satisfaction with the processes and progress, but advance copies of the agenda would have been helpful. The meeting was adjourned at about 4:00 p.m.

Task 4 - List of Projects with Reclaimed Base

Table A-1. List of Projects with Reclaimed Asphalt as part of the Unbound Base.

County	Proj.No.	Route	Ref. Location	MRM	Length	Year	Process
Union	P0011(37)34	11	Alcester	35.510	3.742	1993	PIP
Edmunds	NH 0012(00)247	12	Roscoe	248.040	15.000	1996	PIP
Haakon	NH0014(111)151	14	Midland	151.123	13.779	1995	Salv.
Stanley	P0014(130)202	14	Ft. Pierre	206.000	20.000	1996	PIP
Dewey	P0020(65)140	20	Isabel	141.019	11.934	1994	Salv
Spink	P0020(57)317	20	Northville	317.629	14.013	1995	PIP
Hanson	P0025(00)61	25	Farmer	61.720	10.163	1995	PIP
Marshall	P0025(00)219	25	No. of SD 10	219.000	11.376	1996	PIP
Spink	RS3026(6)267	26	W. of Jct. 281	267.770	11.910	1989	PIP
Clark	P0028(13)307	28	Willow Lk	307.938	9.013	1994	PIP
				316.920	2.990	1994	Recycle
Clark	P0028(16)319	28	Jct. 25 East	319.910	0.830	1996	PIP
				320.791	3.316	1996	PIP
				324.350	5.473	1996	PIP
				329.885	11.209	1996	PIP
Moody	P0032(2)97	32	I 29 East	414.000	8.472	1997	PIP
Buffalo	P0034(116)283	34	W.of Jct.45	283.727	7.166	1995	PIP
Jackson/Mellette	P0044(112)148	44	Jct. 73 to 63	155.350	3.603	1994	PIP
Jackson/Mellette	P0044(112)148	44	Jct. 73 to 63	158.948	4.645	1994	PIP
Jackson/Mellette	P0044(112)148	44	Jct. 73 to 63	163.598	8.062	1994	PIP
Mellette	RS3044(5)201	44	Jct. 83	200.740	12.384	1987	PIP
Hand	P0045(00)88	45	No. of Jct. 34	88.000	13.150	1997	PIP
Hand	P0045(27)101	45	S.of Miller	101.289	8.480	1994	PIP
Edmunds	F0045(11)182	45	Jct. 12 North	182.680	10.023	1992	Recycle
Bon Homme/Yankton	P0046(00)318	46	Jct. 25 West	318.500	3.951	1996	PIP
				322.440	2.797	1996	PIP
Clay	P0046(00)356	46	Jct. 19 West	356.000	7.987	1997	Mill/PIP
Porter	P0047(32)189	47	Jct 212 - Lebanon	189.910	10.011	1994	PIP
McPherson	P3047(00)248	47	Eureka	248.280	10.113	1996	PIP
Buffalo	P0050(61)211	50	Jct. 34 Lee's Corner	211.770	7.584	1995	PIP
Brule		50	So. of SD 34	219.371	2.891	1995	PIP
Jackson/Mellette	P3063(7)69	63	I-90 South	68.346	7.248	1994	PIP
Stanley	P0063(10)119	63	Jct. 34 North	119.120	13.017	1994	Salv
Dewey		63	US 212 North	173.807	11.233		Salv
Ziebach	P3065(3)164	65	Jct. 212 North	164.000	10.960	1995	Salv
Carson	P0065(5)216	65	McIntosh	216.440	15.263	1996	PIP
Bennett	P0073(39)0	73	S. State Line	0.000	12.623	1995	PIP
Jackson	P0073(00)53	73	N. of SD 44, S. of I-90	53.000	17.875	1996	PIP
Jackson		73	Kadoka	65.333	5.000	1997	PIP
Haakon	P0073(15)102	73	So. of Jct.34	102.608	15.056	1992	Recycle
Meade	P0073(13)146	73	No. of Jct.34	146.140	14.152	1988	
Meade	P0073(11)160	73	Joins Above	160.387	13.974	1987	
Perkins	P0075(4)213	75	Jct. 20 North	213.650	7.867	1995	Salv
Butte	F0079(33)144	79	Near Jct. 168	144.000	6.468	1991	PIP
Harding/Butte	NH 0085(53)99	85	Redig	99.666	12.573	1996	PIP
Harding	NH 0085(00)124	85	Jct 20 North	124.000	9.480	1997	Mill/PIP
Roberts	RS3109(2)157	109	No. of Jct. 12	157.000	8.471	1991	
Butte	F168(2)25	168	U.S.85 TO 79	25.000	6.991	1991	PIP
Dewey	NH0212(42)154	212	Eagle Butte	154.996	0.720	1994	Salv

County	Proj.No.	Route	Ref. Location	MRM	Length	Year	Process
Dewey	F0212(43)116	212	E. of Jct.63	166.000	20.818	1990	PIP
Dewey	NH 0212(120)187	212	LaPlant	189.100	19.000	1996	PIP
Spink	NH212(100)313	212	Frankfort	313.937	2.915	1992	Recycle
Spink	NH212(100)313	212	Frankfort	316.890	2.087	1992	Recycle
Walworth	P3804(00)339	1804	So. of Jct 12	339.000	8.000	1997	PIP
Walworth		1804	So. of Jct 12	343.600	8.000	1997	PIP
Campbell/Walworth	P3804(36)360	1804	Mobridge	360.160	13.291	1993	Recycle
Campbell		1804	Mobridge	373.473	18.226	1993	Recycle
Campbell		1804	Mobridge	391.755	0.697	1993	Recycle
Campbell		1804	Mobridge	393.075	8.425	1993	Recycle
Lyman	P-PLH3806(21)138	1806	Jct.273	138.450	5.867	1995	Salv
Lyman\Stanley		1806	N. of Jct 273	145.872	12.325	1995	Salv
Lyman\Stanley		1806	N. of Jct 273	159.265	5.189	1995	Salv
Jones	90-4(47)198	90E	E. of Murdo	198.143	12.009	1996	PIP
Jones	90-4(52)198	90W	E.of Murdo	198.126	12.029	1995	Recycle

Task 5 - Deflection Data and Backcalculation Results

The following is the output of MODULUS 5.1, the software used to backcalculate the layer moduli from the deflection data. MODULUS is only work with and provides U.S. Customary units for output. The input and output quantities are described, along with the appropriate conversion to SI units.

Program Input Values

Variable	Unit	SI Unit	Conversion	Factor
Layer Thickness	inches	mm	Multiply by	25.4 mm/in.
Moduli Range	psi	MPa	Multiply by	0.00689 MPa/psi

Deflection Data Input Units

Variable	Unit	SI Unit	Conversion	Factor
Station	Feet	m	Multiply by	0.305 m/ft.
Load	lbs	N	Multiply by	4.45 N/lb.
Deflection	Mils	μm	Multiply by	0.254 mils/μm
Calculated Moduli	ksi	MPa	Multiply by	6.89 MPa/ksi
Depth to Bedrock	in.	m	Multiply by	0.0254 m/in.

The moduli output is listed for four layers. If less than four layers were used in the analysis, the values for the subbase is 0.0 if only three layers were used. The Absolute ERR/Sens describes the fit between the measured deflection basin and the basin calculated for the moduli values listed. The Absolute ERR/Sens is the average percentage error for all seven sensors.

TTI MODULUS ANALYSIS SYSTEM (SUMMARY REPORT) (Version 5.1)

			MODULI RANGE(psi)		
County: Union		Thickness(in)	Minimum	Maximum	Poisson Ratio Values
Highway/Road:SD 11 Test Pit	Pavement:	2.50	100,000	2,500,000	H1: = 0.35
	Base:	16.00	5,000	500,000	H2: = 0.35
	Subbase:	0.00	0	0	H3: = 0.35
	Subgrade:	221.50	15,000		H4: = 0.40

Station	Load (lbs)	Measured Deflection (mils): R1	R2	R3	R4	R5	R6	R7	Calculated Moduli values (ksi): SURF(E1)	BASE(E2)	SUBB(E3)	SUBG(E4)	Absolute ERR/Sens	Dpth to Bedrock
0.000	6,013	15.72	12.26	9.47	3.51	1.85	1.42	0.95	1057.	11.7	0.0	35.2	17.32	46.93
0.000	9,044	23.98	18.78	14.65	5.74	2.82	2.41	2.18	1077.	11.6	0.0	32.7	18.23	47.10
0.000	9,136	23.74	18.57	14.63	5.55	2.82	2.43	1.85	1072.	12.1	0.0	32.8	18.63	47.09
0.000	5,851	14.93	11.68	9.08	3.48	1.76	1.49	1.15	1092.	12.2	0.0	34.1	18.23	47.04
0.000	9,037	23.52	18.32	14.47	5.52	2.85	2.30	1.83	1091.	12.0	0.0	32.9	17.72	46.84
0.000	8,878	23.42	18.29	14.36	5.55	2.81	2.24	2.11	1092.	11.6	0.0	33.0	17.53	46.91
0.000	5,799	14.81	11.72	9.11	3.37	1.75	1.40	1.06	1108.	11.7	0.0	35.7	18.32	47.14
0.000	8,838	21.65	18.34	14.41	5.39	2.84	2.21	1.81	1303.	11.4	0.0	34.1	19.81	46.81
0.000	8,766	23.02	18.35	14.47	5.35	2.81	2.18	1.82	1114.	11.3	0.0	33.9	18.34	46.98
0.000	5,819	14.69	11.75	9.14	3.34	1.68	1.34	1.00	1130.	11.5	0.0	37.7	18.83	47.73
0.000	8,953	23.33	18.55	14.65	5.36	2.83	2.19	2.03	1114.	11.4	0.0	34.6	18.36	47.05
0.000	8,949	23.18	18.54	14.60	5.32	2.81	2.20	1.93	1123.	11.4	0.0	34.9	18.68	47.09
Mean:		20.50	16.26	12.75	4.79	2.47	1.98	1.64	1114.	11.7	0.0	34.3	18.33	47.00
Std. Dev:		4.08	3.26	2.63	1.02	0.53	0.43	0.46	63.	0.3	0.0	1.5	0.65	0.22
Var Coeff(%):		19.90	20.06	20.60	21.20	21.27	21.72	28.14	6.	2.6	0.0	4.3	3.56	0.47

TTI MODULUS ANALYSIS SYSTEM (SUMMARY REPORT) (Version 5.1)

			MODULI RANGE(psi)		
County: Union		Thickness(in)	Minimum	Maximum	Poisson Ratio Values
Highway/Road:SD 11 Survey Section	Pavement:	2.50	100,000	2,500,000	H1: = 0.35
	Base:	16.00	5,000	500,000	H2: = 0.35
	Subbase:	0.00	0	0	H3: = 0.35
	Subgrade:	221.50	29,900		H4: = 0.40

Station	Load (lbs)	Measured Deflection (mils): R1	R2	R3	R4	R5	R6	R7	Calculated Moduli values (ksi): SURF(E1)	BASE(E2)	SUBB(E3)	SUBG(E4)	Absolute ERR/Sens	Dpth to Bedrock
0.000	5,862	16.52	12.28	9.67	3.55	1.68	1.32	0.97	979.	10.8	0.0	36.1	17.61	48.58
0.000	8,778	25.02	18.96	15.05	5.53	2.72	2.13	1.74	1033.	10.4	0.0	34.6	17.93	47.92
0.000	8,719	24.58	18.87	15.05	5.61	2.73	2.14	1.83	1078.	10.3	0.0	34.3	18.06	47.86
10.000	5,465	15.32	10.76	8.01	3.30	1.58	1.27	1.05	883.	12.5	0.0	33.6	14.25	46.88
10.000	8,604	23.72	17.14	13.10	5.29	2.46	2.26	1.61	940.	12.3	0.0	33.1	16.95	47.46
10.000	8,453	23.30	16.69	12.61	5.39	2.49	2.33	1.76	934.	12.7	0.0	31.3	15.98	46.86

20.000	6,148	14.28	10.96	8.34	3.18	1.91	1.44	0.98	1167.	14.8	0.0	33.6	15.73	45.93
20.000	8,810	21.90	16.97	13.02	5.04	3.02	2.28	1.44	1133.	13.7	0.0	30.6	15.67	45.87
20.000	8,818	21.61	16.93	13.41	5.02	3.09	2.31	1.51	1196.	13.6	0.0	30.4	16.32	45.85
30.000	5,902	15.05	10.51	7.70	3.11	1.63	1.25	1.04	905.	14.5	0.0	35.6	13.40	46.30
30.000	8,945	23.10	16.48	12.44	4.96	2.67	2.20	1.70	931.	14.3	0.0	32.4	14.86	46.17
30.000	8,854	22.70	16.32	12.34	5.02	2.69	2.20	1.52	969.	14.2	0.0	32.0	14.60	46.08
40.000	5,906	14.09	10.07	7.69	3.32	1.94	1.33	0.91	1124.	15.5	0.0	31.7	10.79	46.24
40.000	8,913	21.68	15.77	12.16	5.61	3.16	2.18	1.55	1231.	14.6	0.0	29.4	10.20	46.49
40.000	8,949	21.34	15.48	11.82	5.81	3.17	2.21	1.56	1283.	15.1	0.0	28.9	9.19	46.95
50.000	5,938	14.74	10.40	7.64	3.11	1.69	1.50	0.89	879.	15.9	0.0	32.5	15.04	46.06
50.000	9,072	22.69	16.44	12.24	5.04	2.93	2.53	1.46	922.	15.9	0.0	29.2	14.77	45.96
50.000	8,838	22.34	16.38	12.11	5.21	3.48	1.76	1.45	1168.	13.6	0.0	31.2	7.67	48.57
60.000	5,712	14.40	10.63	7.48	3.24	1.73	1.36	1.00	971.	14.5	0.0	32.3	13.43	45.94
60.000	8,647	22.29	16.54	11.98	5.19	2.83	2.18	1.62	1008.	14.0	0.0	30.4	13.24	45.92
60.000	8,659	22.01	16.27	12.19	5.16	2.87	2.09	1.59	1079.	13.8	0.0	31.1	12.91	45.90
70.000	5,636	14.67	11.12	8.18	3.15	1.88	1.20	0.87	1041.	12.8	0.0	33.5	13.41	45.89
70.000	8,770	22.96	17.63	13.27	5.02	3.06	2.02	1.43	1065.	12.6	0.0	31.9	14.34	45.86
70.000	8,778	22.74	17.58	13.13	4.90	3.19	2.05	1.40	1054.	13.1	0.0	31.1	14.07	45.95
80.000	5,433	14.96	11.62	8.21	3.24	1.98	1.16	0.87	1007.	11.8	0.0	32.0	12.33	45.92
80.000	8,707	24.22	19.01	13.81	5.43	3.16	1.98	1.55	1053.	11.2	0.0	31.7	13.79	45.83
80.000	8,711	23.84	18.67	13.38	5.59	3.29	1.97	1.38	1097.	11.5	0.0	30.7	11.89	45.99
90.000	5,847	16.15	11.84	8.94	3.53	1.88	1.14	0.95	1039.	11.3	0.0	35.5	12.44	46.25
90.000	9,096	25.06	18.80	14.40	5.93	3.15	1.71	1.67	1171.	10.5	0.0	35.0	11.02	45.98
90.000	8,770	24.72	18.55	14.41	6.03	3.24	1.86	1.67	1188.	10.3	0.0	32.7	11.40	45.85
100.000	5,676	15.85	11.77	9.14	3.25	1.57	1.21	1.19	945.	11.1	0.0	37.1	17.82	48.78
100.000	8,659	24.61	18.68	14.68	5.31	2.58	2.02	1.88	993.	10.6	0.0	35.2	18.21	48.36
100.000	8,707	24.21	18.61	14.34	5.35	2.60	2.04	1.81	1040.	10.7	0.0	35.5	17.96	47.89
110.000	5,755	15.62	11.73	9.05	3.34	1.85	1.32	0.90	1016.	11.8	0.0	33.6	15.79	46.47
110.000	8,806	24.44	18.78	14.60	5.44	3.13	2.27	1.56	1035.	11.5	0.0	30.5	16.09	46.06
110.000	8,715	24.06	18.80	14.69	5.50	3.22	2.26	1.52	1086.	11.3	0.0	29.9	15.92	45.93
120.000	5,533	16.11	11.82	8.89	3.49	1.83	1.24	0.98	942.	11.1	0.0	32.7	13.81	46.38
120.000	8,691	26.00	19.50	15.01	5.74	3.01	2.15	1.80	953.	10.4	0.0	31.1	15.45	46.58
120.000	8,639	25.64	19.42	14.81	5.80	3.15	2.15	1.85	985.	10.6	0.0	30.2	14.49	46.08
130.000	5,731	17.10	13.12	9.78	3.68	1.73	1.39	0.93	910.	10.2	0.0	34.0	18.03	48.22
130.000	8,651	26.40	20.40	15.65	5.87	2.88	2.31	1.61	955.	9.7	0.0	31.9	18.18	47.59
130.000	8,611	25.91	20.17	15.48	5.97	2.87	2.22	1.59	1002.	9.6	0.0	32.2	17.58	47.49
140.000	5,902	16.76	12.06	9.74	3.45	1.97	1.56	0.94	892.	12.3	0.0	30.5	16.59	46.54
140.000	9,068	26.02	19.23	15.05	5.70	3.51	1.87	1.69	1055.	10.8	0.0	31.9	11.19	45.79
140.000	9,040	25.85	19.19	15.01	5.75	3.43	1.99	1.77	1048.	11.0	0.0	31.2	12.17	45.80
150.000	5,874	18.04	12.67	10.17	3.72	1.85	1.59	1.11	819.	11.1	0.0	31.0	17.08	47.83
150.000	8,897	27.52	20.04	16.06	6.02	3.06	2.55	1.81	880.	10.6	0.0	29.2	17.03	47.15
150.000	8,997	27.34	20.04	16.23	6.07	3.24	2.56	1.73	918.	10.8	0.0	28.5	16.37	46.61
160.000	5,632	15.50	12.20	9.35	3.46	2.13	1.32	0.92	1102.	11.1	0.0	31.2	14.69	45.81
160.000	8,627	24.05	18.92	14.88	5.49	3.32	2.26	1.69	1091.	11.2	0.0	29.3	15.84	45.83
160.000	8,552	23.67	18.83	14.84	5.58	3.42	2.42	1.90	1113.	11.4	0.0	27.6	16.02	45.76
170.000	5,549	14.87	11.07	8.37	3.42	1.98	1.51	0.90	992.	13.4	0.0	28.4	14.05	45.86
170.000	8,615	23.20	17.50	13.39	5.54	3.17	2.45	1.54	1039.	13.0	0.0	27.6	14.32	45.84
170.000	8,592	22.85	17.41	13.19	5.67	3.26	2.49	1.65	1081.	13.2	0.0	26.8	13.62	46.00
180.000	5,612	14.93	10.71	8.83	3.42	2.14	1.59	0.99	1004.	14.1	0.0	26.8	13.60	45.88

180.000	8,687	23.13	16.91	14.06	5.48	3.38	2.57	1.74	1066.	13.6	0.0	26.3	14.26	45.84
180.000	8,699	22.75	16.81	14.06	5.53	3.45	2.58	1.90	1122.	13.7	0.0	26.1	14.04	45.91
190.000	5,628	13.96	10.27	8.22	3.42	2.04	1.35	1.05	1230.	13.7	0.0	30.1	11.72	46.04
190.000	8,715	21.67	16.26	13.23	5.40	3.19	2.28	1.61	1250.	13.5	0.0	29.0	13.48	45.89
190.000	8,643	21.24	16.04	13.10	5.41	3.20	2.26	1.56	1308.	13.5	0.0	29.0	13.26	45.94
200.000	5,640	14.10	10.45	8.06	3.20	2.15	1.43	0.86	1063.	14.9	0.0	28.4	12.14	46.84
200.000	8,750	21.98	16.66	13.20	5.30	3.35	2.43	1.72	1153.	14.2	0.0	27.4	13.75	46.19
200.000	8,667	21.42	16.33	12.89	5.27	3.40	2.46	1.89	1174.	14.7	0.0	26.7	13.35	46.63
210.000	5,612	15.46	10.94	9.09	3.67	2.06	1.67	0.92	995.	13.3	0.0	26.7	14.13	45.84
210.000	8,631	23.86	17.39	14.69	5.80	3.30	2.65	1.78	1065.	12.6	0.0	26.2	15.03	45.83
210.000	8,627	23.48	17.13	14.48	5.88	3.33	2.71	1.82	1099.	12.9	0.0	25.7	14.69	45.79
220.000	5,676	15.89	11.65	9.39	3.75	2.15	1.57	1.03	1038.	12.2	0.0	27.6	13.81	45.80
220.000	8,663	24.05	18.00	14.65	5.95	3.43	2.71	1.87	1074.	12.5	0.0	25.6	14.79	45.77
220.000	8,683	23.65	17.92	14.47	5.92	3.45	2.65	2.04	1121.	12.5	0.0	26.0	14.53	45.80
230.000	6,017	18.32	13.25	9.68	3.54	2.12	1.49	1.09	752.	11.9	0.0	29.7	14.38	45.95
230.000	9,259	27.97	20.43	15.06	5.68	3.33	2.39	1.80	795.	11.9	0.0	28.9	14.37	45.91
230.000	8,607	27.20	20.21	15.15	5.72	3.37	2.38	1.83	812.	11.0	0.0	27.1	14.56	45.82
240.000	5,731	16.17	10.70	8.44	3.58	1.98	1.71	1.11	764.	15.0	0.0	26.4	12.72	45.87
240.000	8,866	24.56	17.03	13.32	5.71	3.12	2.95	1.86	825.	14.9	0.0	25.4	14.55	45.85
240.000	8,858	24.17	16.84	13.38	5.80	3.21	2.97	1.94	875.	15.1	0.0	24.8	14.13	45.88
250.000	5,688	16.21	12.75	9.45	3.79	2.18	1.54	1.20	1025.	11.3	0.0	28.2	14.79	45.79
250.000	8,639	24.94	19.75	15.18	5.96	3.41	2.86	1.94	1001.	11.6	0.0	25.6	17.30	45.80
250.000	8,468	24.33	19.45	14.84	6.13	3.43	3.16	2.12	1004.	12.1	0.0	23.6	17.68	45.75
Mean:		21.14	15.79	12.22	4.84	2.72	2.01	1.46	1026.	12.5	0.0	30.3	14.52	46.21
Std. Dev:		4.24	3.34	2.68	1.05	0.63	0.51	0.37	118.	1.6	0.0	3.1	2.18	0.77
Var Coeff(%):		20.07	21.15	21.90	21.72	23.14	25.27	25.25	11.	13.1	0.0	10.1	15.01	1.67

TTI MODULUS ANALYSIS SYSTEM (SUMMARY REPORT) (Version 5.1)

County: Bon Homme/Yankton
Highway/Road: SD 46 Test Pit

	Thickness(in)	MODULI RANGE(psi) Minimum	Maximum	Poisson Ratio Values
Pavement:	3.00	100,000	2,500,000	H1: = 0.35
Base:	12.70	5,000	500,000	H2: = 0.35
Subbase:	0.00	0	0	H3: = 0.35
Subgrade:	224.30	15,000		H4: = 0.40

Station	Load (lbs)	Measured Deflection (mils): R1	R2	R3	R4	R5	R6	R7	Calculated Moduli values (ksi): SURF(E1)	BASE(E2)	SUBB(E3)	SUBG(E4)	Absolute ERR/Sens	Dpth to Bedrock
0.000	6,061	8.74	6.89	5.50	2.66	1.71	1.36	0.72	1289.	27.0	0.0	33.3	12.10	51.82
0.000	9,060	13.70	10.81	8.84	4.13	2.62	1.93	1.10	1352.	22.8	0.0	34.2	11.96	49.62
0.000	9,076	13.62	10.66	8.81	4.17	2.64	2.02	1.26	1338.	24.1	0.0	33.1	12.01	50.03
0.000	6,125	8.81	6.82	5.61	2.76	1.75	1.40	0.89	1333.	27.4	0.0	32.6	11.58	51.92
0.000	9,064	13.59	10.60	8.80	4.19	2.67	2.00	1.20	1362.	24.1	0.0	33.0	11.54	50.54
0.000	9,056	13.61	10.64	8.81	4.18	2.66	1.98	1.25	1368.	23.7	0.0	33.3	11.59	50.33
0.000	6,109	8.85	6.89	5.64	2.72	1.77	1.26	0.70	1416.	24.9	0.0	34.3	10.52	52.27
0.000	9,048	13.62	10.66	8.85	4.18	2.66	1.94	1.22	1395.	23.0	0.0	33.7	11.47	50.14

0.000	9,040	13.64	10.69	8.89	4.17	2.64	1.94	1.28	1382.	22.9	0.0	33.8	11.74	49.67
0.000	6,053	8.82	6.84	5.65	2.72	1.72	1.26	0.74	1406.	24.6	0.0	34.5	10.97	50.71
0.000	9,029	13.61	10.66	8.85	4.16	2.63	1.89	1.19	1412.	22.4	0.0	34.4	11.46	49.70
0.000	9,025	13.61	10.68	8.89	4.17	2.62	1.91	1.17	1407.	22.5	0.0	34.2	11.73	49.39
Mean:		12.02	9.40	7.76	3.68	2.34	1.74	1.06	1372.	24.1	0.0	33.7	11.55	50.49
Std. Dev:		2.37	1.88	1.60	0.72	0.45	0.32	0.23	39.	1.7	0.0	0.6	0.44	0.93
Var Coeff(%):		19.75	19.98	20.58	19.44	19.06	18.10	21.60	3.	6.9	0.0	1.9	3.83	1.84

TTI MODULUS ANALYSIS SYSTEM (SUMMARY REPORT) (Version 5.1)

County: Bon Homme/Yankton
Highway/Road: SD 46 Survey Section

	Thickness(in)	MODULI RANGE(psi) Minimum	Maximum	Poisson Ratio Values
Pavement:	3.00	100,000	2,500,000	H1: = 0.35
Base:	12.70	5,000	500,000	H2: = 0.35
Subbase:	0.00	0	0	H3: = 0.35
Subgrade:	224.30	15,000		H4: = 0.40

Station	Load (lbs)	Measured Deflection (mils): R1	R2	R3	R4	R5	R6	R7	Calculated Moduli values (ksi): SURF(E1)	BASE(E2)	SUBB(E3)	SUBG(E4)	Absolute ERR/Sens	Dpth to Bedrock
0.000	6,462	9.47	7.07	6.00	2.89	2.04	1.22	0.63	1494.	24.3	0.0	34.4	7.20	58.27
0.000	6,458	9.42	7.08	6.00	2.87	1.94	1.24	0.76	1474.	24.2	0.0	35.0	8.50	54.05
0.000	9,648	14.74	11.14	9.52	4.43	2.91	1.88	1.19	1429.	21.9	0.0	35.0	9.45	50.82
10.000	6,375	9.86	7.34	5.89	2.92	1.72	1.46	0.73	1094.	26.0	0.0	33.3	11.63	49.12
10.000	6,383	9.82	7.34	5.91	2.94	1.74	1.44	0.90	1139.	25.6	0.0	33.4	11.34	49.40
10.000	9,644	15.42	11.51	9.35	4.47	2.69	2.05	1.25	1148.	22.9	0.0	34.3	10.94	48.63
20.000	6,327	10.18	7.41	6.10	2.67	1.85	1.24	0.74	1051.	23.7	0.0	35.0	9.72	50.57
20.000	6,299	10.07	7.37	6.06	2.66	1.85	1.26	0.72	1051.	24.2	0.0	34.6	9.97	50.87
20.000	9,577	15.99	11.82	9.79	4.24	2.78	1.93	1.13	1070.	21.3	0.0	35.1	10.94	48.25
30.000	6,407	10.80	7.84	6.36	2.67	1.62	1.35	1.31	967.	21.6	0.0	37.0	13.92	46.44
30.000	6,327	10.60	7.77	6.42	2.66	1.61	1.35	0.52	1006.	21.3	0.0	36.8	14.43	46.30
30.000	9,589	16.83	12.47	10.34	4.35	2.61	1.98	1.07	1067.	18.6	0.0	36.3	13.23	46.32
40.000	6,446	10.97	7.86	6.55	2.91	1.98	1.20	0.62	1092.	20.7	0.0	35.1	8.02	50.37
40.000	6,395	10.76	7.79	6.48	2.89	1.96	1.19	0.62	1122.	20.7	0.0	35.2	8.23	50.40
40.000	9,589	16.95	12.39	10.41	4.49	2.88	1.85	1.09	1083.	18.6	0.0	35.4	10.02	47.58
50.000	6,351	10.65	7.48	6.35	2.71	1.59	1.32	0.90	1004.	21.8	0.0	37.1	13.04	46.29
50.000	6,315	10.43	7.32	6.27	2.68	1.57	1.30	0.79	1034.	22.1	0.0	37.4	13.06	46.29
50.000	9,620	16.55	11.94	10.10	4.33	2.53	2.01	1.22	1061.	19.9	0.0	36.3	12.99	46.27
60.000	6,347	10.05	7.49	5.83	2.80	1.81	1.35	0.94	1036.	25.2	0.0	33.8	10.11	51.79
60.000	6,383	10.01	7.47	5.88	2.79	1.81	1.29	0.71	1098.	24.4	0.0	34.8	9.80	51.34
60.000	9,632	15.60	11.84	9.33	4.31	2.77	1.93	1.08	1116.	22.0	0.0	35.1	10.43	49.75
70.000	6,403	9.50	7.28	5.69	2.81	1.69	1.47	0.82	1118.	27.4	0.0	33.9	12.49	49.79
70.000	6,383	9.37	7.22	5.59	2.81	1.70	1.46	0.82	1138.	27.9	0.0	33.7	12.09	50.79
70.000	9,660	14.67	11.37	8.98	4.35	2.66	2.13	1.21	1201.	24.7	0.0	34.1	12.02	49.66
80.000	6,431	9.19	6.99	5.39	2.80	1.87	1.28	0.88	1269.	28.4	0.0	34.1	7.90	60.92
80.000	6,462	9.13	6.95	5.31	2.73	1.86	1.33	0.80	1189.	30.4	0.0	33.7	8.59	62.21
80.000	9,696	14.17	10.91	8.54	4.23	2.79	1.98	1.15	1263.	26.4	0.0	34.3	9.60	55.05

90.000	6,367	9.19	6.72	5.37	2.73	1.55	1.22	0.47	1237.	26.2	0.0	38.1	10.02	48.79
90.000	6,339	9.07	6.61	5.28	2.64	1.55	1.19	0.72	1224.	26.7	0.0	38.5	9.76	49.35
90.000	9,613	14.24	10.53	8.57	4.09	2.47	1.83	1.03	1240.	24.6	0.0	37.7	10.40	48.72
100.000	6,299	9.54	7.01	5.64	2.56	1.58	1.23	0.90	1139.	24.6	0.0	38.0	11.70	47.98
100.000	6,276	9.40	6.99	5.62	2.57	1.57	1.22	0.90	1145.	24.6	0.0	38.1	11.72	47.92
100.000	9,481	14.69	11.05	9.00	4.02	2.43	1.87	1.31	1154.	22.6	0.0	37.7	12.35	47.20
110.000	6,272	9.98	7.53	5.98	2.69	1.81	1.22	0.87	1115.	22.8	0.0	35.6	10.18	50.54
110.000	6,315	9.97	7.55	5.99	2.65	1.74	1.20	0.82	1117.	22.4	0.0	37.0	10.91	49.00
110.000	9,569	15.63	11.89	9.53	4.17	2.65	1.86	1.30	1121.	20.7	0.0	36.8	11.63	47.78
120.000	6,307	9.97	7.57	6.04	2.72	1.70	1.27	0.04	1119.	22.5	0.0	36.4	11.86	48.08
120.000	6,291	9.92	7.53	5.98	2.66	1.70	1.22	0.48	1118.	22.4	0.0	37.0	11.46	48.35
120.000	9,561	15.54	11.85	9.53	4.15	2.59	1.88	0.83	1119.	20.7	0.0	37.1	12.24	47.31
130.000	6,280	9.34	7.16	5.70	2.50	1.47	1.35	0.62	1157.	24.3	0.0	38.6	15.47	46.60
130.000	6,248	9.21	7.11	5.61	2.50	1.45	1.31	0.48	1167.	24.4	0.0	38.9	15.12	46.63
130.000	9,589	14.66	11.29	9.00	3.96	2.35	1.99	0.97	1146.	22.8	0.0	38.2	14.37	46.73
140.000	6,268	9.03	6.72	5.15	2.56	1.41	1.23	0.65	1198.	25.8	0.0	39.9	12.22	47.54
140.000	6,252	8.96	6.70	5.20	2.58	1.43	1.25	0.66	1172.	26.4	0.0	39.1	12.25	47.61
140.000	9,517	14.17	10.70	6.56	4.01	2.28	1.85	1.05	854.	30.6	0.0	37.2	8.73	62.38
150.000	6,232	8.99	6.95	5.36	2.41	1.69	0.91	0.64	1416.	21.4	0.0	43.4	8.25	52.77
150.000	6,303	9.07	6.93	5.40	2.45	1.65	1.02	0.68	1309.	23.5	0.0	41.2	9.25	51.06
150.000	9,497	14.22	10.99	4.95	3.81	2.47	1.54	1.01	473.	37.9	0.0	38.5	9.06	300.00
160.000	6,240	9.37	7.05	5.36	2.45	1.39	1.02	0.59	1212.	21.5	0.0	44.3	11.80	46.70
160.000	6,256	9.23	7.05	5.38	2.46	1.41	1.04	0.78	1282.	21.5	0.0	44.1	12.14	46.83
160.000	9,557	14.67	11.21	8.79	3.83	2.28	1.67	1.16	1235.	20.6	0.0	42.2	12.81	46.67
170.000	6,311	8.86	6.80	5.22	2.47	1.76	1.10	0.68	1285.	26.7	0.0	38.1	8.42	57.94
170.000	6,327	8.81	6.74	5.18	2.45	1.69	1.09	0.51	1288.	26.6	0.0	39.1	8.88	55.08
170.000	9,593	13.88	10.70	2.07	3.83	2.56	1.66	1.37	159.	53.1	0.0	53.1	39.38	*** *
180.000	6,260	8.25	6.53	5.28	2.56	1.64	1.41	0.56	1376.	31.2	0.0	34.5	13.14	51.78
180.000	6,284	8.17	6.41	5.29	2.57	1.64	1.33	0.65	1499.	30.1	0.0	35.6	12.23	51.63
180.000	9,549	13.02	10.23	8.47	4.03	2.52	2.05	0.98	1441.	27.5	0.0	35.3	12.79	49.78
190.000	6,288	8.37	6.40	4.98	2.46	1.50	1.04	0.50	1453.	26.1	0.0	42.1	9.60	50.41
190.000	6,288	8.31	6.35	4.99	2.45	1.52	1.08	0.61	1443.	27.1	0.0	41.0	9.93	50.89
190.000	9,593	13.13	10.10	8.01	3.86	2.38	1.65	1.06	1450.	24.8	0.0	40.7	10.19	49.82
200.000	6,359	8.38	6.32	4.96	2.67	1.62	1.18	0.69	1462.	29.5	0.0	37.5	8.34	54.99
200.000	6,347	8.38	6.28	4.67	2.66	1.63	1.18	0.68	1314.	32.0	0.0	36.9	6.93	61.78
200.000	9,561	13.08	9.95	7.97	3.96	2.50	1.78	1.06	1423.	27.0	0.0	37.7	9.59	52.32
210.000	6,272	7.89	5.93	5.00	2.32	1.81	1.24	0.57	1404.	35.2	0.0	35.2	9.33	66.72
210.000	6,224	7.80	5.86	5.05	2.32	1.81	1.22	0.53	1467.	34.9	0.0	35.0	9.26	64.97
210.000	9,533	12.29	9.37	8.06	3.66	2.72	1.84	0.94	1521.	30.9	0.0	35.8	10.00	57.61
220.000	6,240	7.99	5.84	4.20	2.46	1.60	1.17	0.69	1150.	37.4	0.0	37.0	5.83	78.88
220.000	6,252	7.93	5.83	3.52	2.47	1.61	1.18	0.71	774.	47.5	0.0	36.4	6.18	300.00
230.000	6,319	8.36	6.20	4.80	2.48	1.60	1.14	0.73	1297.	31.0	0.0	38.3	8.14	56.77
230.000	6,311	8.23	6.16	4.75	2.49	1.58	1.14	0.69	1336.	31.4	0.0	38.4	8.28	56.59
230.000	9,549	12.96	9.81	7.67	3.88	2.46	1.71	1.09	1381.	27.7	0.0	38.4	8.76	53.75
240.000	6,244	9.16	6.99	5.35	2.50	1.72	1.23	0.73	1104.	27.3	0.0	36.0	10.30	54.01
240.000	6,204	9.02	6.89	5.23	2.50	1.70	1.24	0.73	1105.	28.0	0.0	35.7	10.20	54.81
250.000	9,466	14.59	11.52	6.49	4.08	2.44	2.11	1.26	716.	32.1	0.0	34.1	10.96	78.58
Mean:		11.03	8.30	6.44	3.10	1.97	1.44	0.83	1177.	26.3	0.0	37.2	10.97	51.43

Std. Dev:		2.71	2.06	1.77	0.72	0.45	0.33	0.26	223.	5.9	0.0	3.2	3.93	9.48
Var Coeff(%):		24.58	24.80	27.54	23.30	23.01	22.91	30.87	19.	22.3	0.0	8.5	35.78	18.43

TTI MODULUS ANALYSIS SYSTEM (SUMMARY REPORT) (Version 5.1)

County: Haakon
Highway/Road: US 14 Test Pit

	Thickness(in)	MODULI RANGE(psi) Minimum	Maximum	Poisson Ratio Values	
Pavement:	3.50	100,000	2,500,000	H1:	= 0.35
Base:	14.00	5,000	500,000	H2:	= 0.35
Subbase:	0.00	0	0	H3:	= 0.35
Subgrade:	282.50	15,000		H4:	= 0.40

Station	Load (lbs)	Measured Deflection (mils): R1	R2	R3	R4	R5	R6	R7	Calculated Moduli values (ksi): SURF(E1)	BASE(E2)	SUBB(E3)	SUBG(E4)	Absolute ERR/Sens	Dpth to Bedrock
0.000	6,855	8.45	6.57	5.10	4.15	3.21	2.05	1.35	1192.	58.4	0.0	20.7	2.14	300.00
0.000	8,999	11.82	9.04	7.14	5.81	4.42	2.83	1.79	1121.	54.5	0.0	19.7	1.97	300.00
0.000	9,047	11.78	9.00	7.18	5.76	4.46	2.92	1.74	1021.	59.5	0.0	19.3	1.43	300.00
0.000	6,615	8.28	6.26	5.05	4.03	3.21	2.09	1.22	953.	66.6	0.0	19.6	1.54	300.00
0.000	8,999	11.61	8.91	7.09	5.81	4.55	2.96	1.79	1026.	62.7	0.0	18.8	1.93	300.00
0.000	9,047	11.70	9.00	7.18	5.85	4.55	2.96	1.83	1082.	60.3	0.0	18.9	1.79	300.00
0.000	6,631	8.24	6.34	5.05	4.07	3.17	2.09	1.26	1082.	63.3	0.0	19.8	1.43	300.00
0.000	8,991	11.57	8.91	7.09	5.72	4.42	2.83	1.79	1167.	56.3	0.0	19.6	1.80	300.00
0.000	9,023	11.57	8.91	7.14	5.76	4.51	2.96	1.79	1077.	61.4	0.0	19.0	1.47	300.00
0.000	6,623	8.24	6.26	5.05	4.11	3.26	2.18	1.31	912.	71.5	0.0	19.0	1.39	300.00
0.000	9,015	11.49	8.78	7.09	5.72	4.51	2.96	1.74	1035.	63.9	0.0	18.9	1.55	300.00
0.000	9,047	11.57	8.74	7.14	5.72	4.55	3.01	1.74	913.	67.8	0.0	18.7	1.40	300.00
Mean:		10.53	8.06	6.44	5.21	4.07	2.65	1.61	1048.	62.2	0.0	19.3	1.65	300.00
Std. Dev:		1.65	1.26	1.02	0.83	0.63	0.41	0.25	91.	4.9	0.0	0.6	0.26	169.21
Var Coeff(%):		15.64	15.66	15.82	15.89	15.58	15.50	15.20	9.	7.9	0.0	3.0	15.66	56.40

TTI MODULUS ANALYSIS SYSTEM (SUMMARY REPORT) (Version 5.1)

County: Haakon
Highway/Road: US 14 Survey Section

	Thickness(in)	MODULI RANGE(psi) Minimum	Maximum	Poisson Ratio Values	
Pavement:	3.50	100,000	2,500,000	H1:	= 0.35
Base:	14.00	5,000	500,000	H2:	= 0.35
Subbase:	0.00	0	0	H3:	= 0.35
Subgrade:	282.50	15,000		H4:	= 0.40

Station	Load (lbs)	Measured Deflection (mils): R1	R2	R3	R4	R5	R6	R7	Calculated Moduli values (ksi): SURF(E1)	BASE(E2)	SUBB(E3)	SUBG(E4)	Absolute ERR/Sens	Dpth to Bedrock
0.000	6,919	10.18	7.65	6.18	4.49	3.44	2.05	1.09	1138.	37.0	0.0	21.1	0.99	212.38
0.000	8,999	13.71	10.65	8.65	6.49	5.04	2.83	1.35	1550.	29.5	0.0	19.9	2.00	138.34
0.000	8,951	13.75	10.61	8.65	6.45	5.04	2.79	1.31	1534.	29.0	0.0	20.0	2.19	128.31

10.000	6,687	7.86	5.60	4.88	4.11	3.26	2.61	1.22	264.	144.8	0.0	17.4	2.13	300.00
10.000	8,967	10.98	8.04	7.09	5.59	4.37	3.14	1.65	851.	81.6	0.0	18.2	1.99	300.00
10.000	8,943	10.89	7.96	6.88	5.55	4.37	3.14	1.61	704.	89.0	0.0	18.2	1.71	300.00
30.000	6,735	7.55	5.78	4.97	3.86	3.35	2.70	1.39	584.	125.5	0.0	16.8	2.68	300.00
30.000	8,991	10.60	7.52	7.18	5.55	5.22	3.75	1.96	205.	185.7	0.0	15.4	3.06	300.00
30.000	9,055	10.60	7.39	7.22	5.72	5.27	3.62	1.92	176.	197.7	0.0	15.6	3.72	300.00
40.000	6,807	8.49	6.22	5.49	4.53	3.53	2.66	1.39	595.	99.4	0.0	16.4	2.16	300.00
40.000	8,991	11.61	8.74	7.70	6.36	4.91	3.75	1.92	773.	89.2	0.0	15.3	2.30	300.00
40.000	9,031	11.57	8.78	7.74	6.36	4.91	3.75	1.92	897.	85.5	0.0	15.4	2.32	300.00
40.000	6,855	8.32	6.39	5.53	4.24	3.44	2.57	1.39	988.	81.1	0.0	17.5	1.68	300.00
40.000	8,999	11.65	9.00	7.74	5.93	4.91	3.57	1.96	942.	75.5	0.0	16.3	1.18	300.00
40.000	8,991	11.61	8.96	7.53	5.93	4.86	3.44	2.00	933.	74.4	0.0	16.7	0.23	300.00
50.000	6,719	8.83	6.86	5.62	4.32	3.53	2.57	1.61	847.	70.9	0.0	17.2	1.25	300.00
50.000	8,975	12.33	9.65	8.00	6.11	5.13	3.62	2.31	904.	66.9	0.0	16.0	0.96	300.00
50.000	8,999	12.29	9.61	8.00	6.03	5.18	3.57	2.26	895.	67.4	0.0	16.1	1.27	300.00
60.000	6,703	9.80	7.26	5.87	4.87	3.21	2.48	1.35	823.	53.0	0.0	18.0	4.20	81.69
60.000	8,919	13.71	10.09	8.48	6.74	4.69	3.36	2.26	917.	47.1	0.0	17.2	2.97	140.15
60.000	8,967	13.71	10.13	8.48	6.78	4.78	3.40	2.35	912.	48.4	0.0	17.0	2.62	173.33
70.000	7,111	10.26	7.26	6.87	4.32	3.97	2.48	1.52	819.	55.7	0.0	17.9	5.49	172.69
70.000	9,055	14.18	10.04	9.34	6.11	5.58	3.49	2.18	701.	54.4	0.0	16.2	5.05	300.00
70.000	8,983	14.10	9.78	9.17	6.20	5.80	3.62	2.18	517.	64.9	0.0	15.4	5.43	300.00
80.000	7,055	9.80	7.35	6.35	4.37	3.57	2.66	1.26	820.	59.5	0.0	18.0	3.40	300.00
80.000	9,047	13.46	10.30	8.87	6.28	5.00	3.57	1.83	987.	49.8	0.0	16.7	2.38	300.00
80.000	9,023	13.42	10.30	8.87	6.24	5.00	3.66	1.87	932.	51.9	0.0	16.5	2.82	300.00
90.000	7,047	9.97	7.61	6.44	4.87	3.84	2.70	1.74	990.	56.6	0.0	16.9	1.03	300.00
90.000	9,047	13.71	10.56	8.91	6.82	5.40	3.70	2.31	1028.	50.8	0.0	15.6	0.54	300.00
90.000	9,047	13.58	10.52	8.99	6.74	5.18	3.62	2.35	1178.	46.2	0.0	16.2	1.33	300.00
100.000	7,111	11.23	8.61	7.05	5.47	3.88	2.92	1.48	897.	45.9	0.0	16.3	2.63	194.41
100.000	9,111	15.23	12.30	9.47	7.72	5.62	4.45	2.18	774.	49.4	0.0	14.0	4.04	300.00
100.000	9,071	15.15	11.91	9.77	7.68	5.49	4.23	2.05	942.	44.1	0.0	14.5	2.85	229.76
110.000	6,959	11.65	8.83	7.26	5.30	4.37	2.75	1.61	835.	42.4	0.0	15.8	1.43	300.00
110.000	9,031	16.12	12.03	10.46	7.80	5.94	4.27	2.26	785.	43.7	0.0	13.8	2.15	300.00
110.000	8,975	16.03	11.90	10.42	7.76	5.89	4.27	2.18	771.	44.2	0.0	13.7	2.41	300.00
120.000	6,991	12.16	9.00	7.18	5.47	4.42	2.92	1.74	560.	48.3	0.0	15.1	0.60	300.00
120.000	9,031	17.04	12.42	10.03	7.77	6.16	4.05	2.35	503.	45.3	0.0	14.0	1.09	300.00
120.000	8,959	16.92	12.42	10.07	7.77	6.11	4.10	2.40	530.	44.7	0.0	13.8	0.64	300.00
130.000	7,023	12.33	9.09	8.13	5.85	4.73	3.44	1.57	659.	50.9	0.0	13.4	2.68	300.00
130.000	9,007	16.83	12.46	11.20	8.23	6.69	4.75	2.26	674.	47.9	0.0	12.2	2.07	241.56
130.000	8,999	16.79	12.46	11.15	8.19	6.69	4.79	2.31	647.	49.1	0.0	12.2	2.13	254.81
140.000	6,831	12.37	9.13	7.57	5.30	4.15	2.92	1.70	615.	40.9	0.0	15.5	2.12	300.00
140.000	8,967	16.92	12.60	10.42	7.51	5.80	4.05	2.26	642.	38.8	0.0	14.5	1.57	300.00
140.000	8,943	16.75	12.43	9.90	7.51	5.89	3.97	2.18	546.	42.9	0.0	14.3	0.26	300.00
150.000	6,919	12.50	9.56	7.99	5.72	4.33	3.01	1.70	854.	35.7	0.0	15.2	1.88	300.00
150.000	8,975	17.17	12.81	10.85	8.02	6.20	4.36	2.18	673.	40.4	0.0	13.3	1.48	299.07
150.000	8,927	17.04	12.94	10.51	7.85	6.20	4.10	2.26	689.	38.3	0.0	13.8	0.24	300.00
160.000	6,719	13.55	9.83	8.87	6.02	4.55	2.96	1.83	866.	28.2	0.0	14.7	2.79	300.00
160.000	8,919	18.73	13.68	12.06	8.49	6.60	4.27	2.48	758.	30.4	0.0	13.3	1.78	300.00
160.000	8,919	18.65	13.72	12.02	8.53	6.56	4.31	2.53	758.	30.8	0.0	13.2	1.71	300.00
170.000	6,703	12.54	9.96	8.26	5.93	4.51	3.49	1.70	799.	38.7	0.0	13.2	3.77	300.00

170.000	8,975	17.51	13.85	11.46	8.36	6.47	4.40	2.31	940.	31.6	0.0	13.4	1.39	300.00
170.000	8,935	17.51	13.85	11.37	8.40	6.52	4.49	2.35	867.	33.6	0.0	13.0	1.33	300.00
180.000	6,815	14.27	9.91	8.56	6.11	5.09	3.23	1.79	429.	40.7	0.0	13.1	2.82	300.00
180.000	8,855	19.79	13.81	11.93	8.78	6.78	4.58	2.53	438.	37.0	0.0	12.2	2.03	300.00
180.000	8,847	19.58	13.59	11.80	8.70	6.60	4.49	2.44	454.	36.6	0.0	12.5	2.33	300.00
190.000	6,575	13.38	9.87	8.39	6.06	4.55	3.27	1.70	612.	36.3	0.0	13.2	2.26	300.00
190.000	8,943	18.56	13.98	11.76	8.70	6.60	4.53	2.40	714.	33.4	0.0	12.8	1.34	300.00
190.000	8,943	18.65	13.90	11.67	8.61	6.60	4.53	2.48	636.	35.0	0.0	12.7	1.21	300.00
200.000	6,911	13.58	10.35	8.26	6.06	4.95	3.27	1.65	599.	38.7	0.0	13.5	0.95	300.00
200.000	8,999	18.94	14.59	11.54	8.66	7.10	4.62	2.57	587.	36.2	0.0	12.3	1.25	300.00
200.000	8,935	18.82	14.46	11.41	8.66	7.10	4.62	2.53	576.	36.9	0.0	12.2	1.27	300.00
210.000	6,695	13.26	10.00	8.09	6.31	4.60	3.27	1.83	649.	37.6	0.0	13.3	1.71	300.00
210.000	8,895	18.44	13.90	11.37	8.87	6.69	4.75	2.53	588.	38.8	0.0	12.1	1.26	300.00
210.000	8,911	18.31	13.90	11.37	8.83	6.65	4.71	2.53	632.	37.9	0.0	12.2	1.21	300.00
220.000	6,799	12.67	9.56	8.04	6.10	4.73	3.53	1.96	599.	47.5	0.0	12.8	1.75	300.00
220.000	8,871	17.55	13.20	11.03	8.49	6.78	4.84	2.66	526.	46.8	0.0	11.9	0.75	300.00
220.000	8,919	17.47	13.20	11.03	8.49	6.69	4.71	2.53	598.	44.2	0.0	12.2	0.77	300.00
230.000	6,743	11.82	8.83	7.74	6.07	5.49	3.62	2.13	453.	70.7	0.0	11.4	2.64	300.00
230.000	8,975	16.58	12.25	10.94	8.49	8.03	5.01	2.87	368.	71.4	0.0	10.6	3.99	300.00
230.000	8,951	16.54	12.29	10.94	8.49	7.95	5.06	2.92	384.	70.7	0.0	10.6	3.61	300.00
240.000	7,103	13.63	10.78	9.12	6.82	5.04	4.36	2.00	690.	45.2	0.0	11.6	4.69	300.00
240.000	9,263	19.03	15.11	12.75	9.88	7.45	5.97	2.79	714.	42.0	0.0	10.6	2.79	300.00
240.000	9,255	18.82	15.03	12.71	9.63	7.18	5.97	2.70	729.	41.3	0.0	10.8	3.85	300.00
250.000	7,071	16.12	12.38	10.03	7.76	5.98	4.14	2.13	590.	33.7	0.0	11.0	0.75	300.00
250.000	9,271	22.61	17.46	14.13	11.07	8.48	5.67	2.79	630.	29.3	0.0	10.4	0.75	275.33
250.000	9,191	22.23	17.24	14.00	11.03	8.44	5.58	2.79	682.	28.7	0.0	10.4	0.89	296.88
Mean:		14.38	10.82	9.15	6.89	5.45	3.80	2.06	729.	54.8	0.0	14.5	2.09	300.00
Std. Dev:		3.45	2.66	2.14	1.62	1.26	0.86	0.44	239.	30.8	0.0	2.5	1.20	164.59
Var Coeff(%):		24.01	24.57	23.39	23.53	23.16	22.75	21.51	33.	56.3	0.0	16.9	57.29	54.86

TTI MODULUS ANALYSIS SYSTEM (SUMMARY REPORT) (Version 5.1)

County: Clark
Highway/Road: SD 28 Test Pit

	Thickness (in)	MODULI RANGE (psi) Minimum	Maximum	Poisson Ratio Values
Pavement:	4.50	100,000	2,500,000	H1: = 0.35
Base:	5.70	5,000	500,000	H2: = 0.35
Subbase:	7.00	4,000	200,000	H3: = 0.35
Subgrade:	282.80	15,000		H4: = 0.40

Station	Load (lbs)	Measured Deflection (mils): R1	R2	R3	R4	R5	R6	R7	Calculated Moduli values (ksi): SURF(E1)	BASE(E2)	SUBB(E3)	SUBG(E4)	Absolute ERR/Sens	Dpth to Bedrock
0.000	6,775	10.77	9.35	8.39	7.05	5.94	4.31	2.61	1195.	87.3	30.8	10.2	0.20	300.00
0.000	9,255	15.53	13.20	11.80	9.88	8.22	5.88	3.48	684.	148.8	16.9	10.7	0.34	300.00
0.000	9,215	15.48	13.12	11.80	9.93	8.27	5.84	3.48	513.	219.9	10.0	11.2	0.28	300.00
0.000	6,775	10.81	9.39	8.48	7.20	5.98	4.27	2.57	1523.	68.1	26.1	10.4	0.41	300.00
0.000	9,239	15.44	13.16	11.80	9.97	8.22	5.88	3.44	677.	165.9	13.9	10.9	0.47	279.54

0.000	9,207	15.40	13.12	11.80	9.97	8.22	5.84	3.44	644.	186.9	10.6	11.1	0.47	300.00
0.000	6,727	10.81	9.39	8.48	7.20	5.98	4.27	2.57	1512.	67.7	25.9	10.3	0.41	300.00
0.000	9,199	15.44	13.16	11.88	10.05	8.27	5.88	3.48	672.	187.2	9.7	11.1	0.57	300.00
0.000	9,239	15.48	13.20	11.84	10.01	8.27	5.88	3.48	701.	160.8	13.8	10.8	0.39	300.00
0.000	6,751	10.81	9.35	8.48	7.16	5.89	4.23	2.57	1311.	89.8	21.4	10.6	0.61	300.00
0.000	9,199	15.44	13.16	11.85	9.97	8.27	5.93	3.53	979.	92.5	26.4	10.1	0.44	300.00
0.000	9,159	15.36	13.12	11.76	9.88	8.22	5.80	3.44	640.	186.8	10.2	11.2	0.25	300.00
Mean:		13.90	11.89	10.70	9.02	7.48	5.33	3.17	921.	138.5	18.0	10.7	0.40	300.00
Std. Dev:		2.29	1.86	1.65	1.38	1.13	0.79	0.44	368.	54.0	7.7	0.4	0.12	21.69
Var Coeff(%):		16.46	15.67	15.46	15.32	15.13	14.75	13.85	40.	39.0	43.1	3.7	30.52	7.23

TTI MODULUS ANALYSIS SYSTEM (SUMMARY REPORT) (Version 5.1)

			MODULI RANGE(psi)			
County: Clark		Thickness(in)	Minimum	Maximum	Poisson Ratio Values	
Highway/Road: SD 28 Survey Section	Pavement:	4.50	100,000	2,500,000	H1:	= 0.35
	Base:	5.70	5,000	500,000	H2:	= 0.35
	Subbase:	7.00	4,000	200,000	H3:	= 0.35
	Subgrade:	186.30	15,000		H4:	= 0.40

	Load	Measured Deflection (mils):							Calculated Moduli values (ksi):				Absolute	Dpth to
Station	(lbs)	R1	R2	R3	R4	R5	R6	R7	SURF(E1)	BASE(E2)	SUBB(E3)	SUBG(E4)	ERR/Sens	Bedrock
0.000	6,727	10.89	9.43	8.22	6.66	5.58	3.97	2.40	1319.	19.4	174.7	9.2	0.51	300.00
0.000	9,183	16.16	13.33	11.72	9.59	7.91	5.49	3.22	935.	27.7	92.1	9.2	0.65	292.65
0.000	9,191	16.12	13.42	11.76	9.55	7.91	5.49	3.22	972.	26.5	91.3	9.2	0.39	290.14
10.000	6,711	11.57	9.70	8.48	6.91	5.76	4.10	2.31	957.	30.0	95.3	9.0	0.15	200.65
10.000	9,135	16.45	13.85	12.02	9.84	8.13	5.67	3.27	956.	26.1	87.5	8.9	0.27	248.51
10.000	9,159	16.58	13.64	11.93	9.84	8.03	5.67	3.27	811.	32.6	79.7	9.0	0.50	242.28
20.000	6,775	12.11	10.09	8.82	7.13	5.98	4.14	2.44	917.	27.2	90.6	9.0	0.50	300.00
20.000	9,143	17.09	14.20	12.36	9.97	8.27	5.67	3.18	880.	24.6	81.1	9.0	0.40	204.75
20.000	9,199	17.17	14.25	12.44	10.01	8.35	5.67	3.18	894.	24.4	80.1	9.0	0.62	208.08
30.000	6,783	12.28	10.30	8.95	7.13	5.85	4.05	2.35	946.	23.4	78.7	9.5	0.30	250.79
30.000	9,231	17.51	14.64	12.61	10.14	8.27	5.62	3.18	791.	36.7	38.7	9.6	0.18	214.43
30.000	9,159	17.25	14.51	12.48	10.01	8.18	5.58	3.14	820.	35.8	39.1	9.6	0.32	204.84
40.000	6,743	13.25	10.74	9.25	7.30	5.94	4.10	2.40	480.	56.6	33.6	9.8	0.68	273.96
40.000	9,175	18.77	15.29	13.13	10.39	8.35	5.75	3.31	685.	21.7	71.9	9.1	0.26	233.94
40.000	9,207	18.86	15.37	13.18	10.44	8.40	5.75	3.22	686.	21.9	69.3	9.1	0.17	194.36
50.000	6,719	13.12	10.74	9.08	7.13	5.80	3.92	2.35	657.	27.8	54.0	9.9	0.37	300.00
50.000	9,135	19.03	15.51	13.05	10.22	8.31	5.49	3.22	525.	41.4	28.8	9.9	0.57	300.00
50.000	9,183	19.15	15.64	13.13	10.35	8.35	5.53	3.27	516.	43.5	27.7	9.9	0.46	300.00
60.000	6,679	13.16	10.78	8.82	7.47	5.76	4.01	2.26	458.	58.6	32.0	9.9	1.78	204.62
60.000	9,143	18.90	15.51	12.70	10.65	8.22	5.62	3.14	565.	33.2	41.6	9.5	1.42	197.66
60.000	9,143	18.90	15.51	12.79	10.61	8.27	5.62	3.14	420.	69.0	20.9	9.9	1.42	198.61
70.000	6,647	13.33	10.95	9.47	7.38	5.94	4.05	2.35	754.	20.8	64.6	9.5	0.50	246.38
70.000	9,087	19.41	15.59	13.56	10.56	8.44	5.58	3.14	422.	67.5	16.9	10.0	0.69	203.24
70.000	9,079	19.53	15.72	13.69	10.65	8.52	5.71	3.27	449.	59.3	19.6	9.7	0.81	226.84

80.000	6,703	13.12	10.82	9.21	7.26	5.89	4.05	2.26	705.	25.1	63.4	9.5	0.44	188.35
80.000	9,087	19.15	15.46	13.18	10.39	8.35	5.67	3.09	498.	41.0	33.4	9.5	0.38	168.75
80.000	9,135	19.20	15.46	13.30	10.61	8.44	5.71	3.14	432.	60.7	24.1	9.6	0.43	177.46
90.000	6,727	12.32	10.09	8.74	7.05	5.71	3.92	2.22	689.	44.0	43.7	10.0	0.22	210.31
90.000	9,167	17.72	14.38	12.40	10.01	8.09	5.40	3.05	449.	85.9	20.7	10.3	0.08	216.62
90.000	9,199	17.80	14.29	12.44	10.27	8.18	5.58	3.14	379.	103.5	21.8	10.0	0.55	207.99
100.000	6,703	12.08	10.00	8.56	6.91	5.62	3.84	2.18	754.	39.2	46.5	10.1	0.14	215.97
100.000	9,151	17.51	14.29	12.23	9.84	7.91	5.36	2.96	690.	34.1	44.9	9.9	0.21	182.28
100.000	9,111	17.42	14.29	12.23	9.76	7.91	5.32	2.96	695.	33.8	44.3	9.9	0.13	191.73
110.000	6,743	11.49	9.43	8.09	6.49	5.31	3.66	2.09	617.	63.5	39.2	10.9	0.40	219.39
110.000	9,167	16.62	13.59	11.59	9.33	7.59	5.14	2.87	521.	72.7	29.3	10.7	0.34	195.32
110.000	9,199	16.58	13.59	11.59	9.46	7.72	5.14	2.92	548.	72.6	29.8	10.6	0.52	229.70
130.000	6,823	11.27	9.35	8.09	6.49	5.36	3.66	2.00	987.	25.8	97.0	10.4	0.34	170.09
130.000	9,239	16.28	13.25	11.41	9.25	7.55	5.10	2.74	474.	94.3	26.8	10.9	0.10	160.92
130.000	9,215	16.24	13.25	11.46	9.21	7.41	5.06	2.87	578.	71.5	30.0	10.9	0.34	209.00
120.000	6,815	11.06	9.26	8.00	6.32	5.18	3.57	2.05	901.	43.4	45.4	11.3	0.71	221.16
120.000	9,215	15.99	13.20	11.33	9.12	7.36	4.92	2.79	815.	43.4	36.4	11.0	0.15	214.74
120.000	9,215	15.99	13.25	11.37	9.08	7.41	5.01	2.83	777.	45.6	38.7	10.8	0.26	206.98
130.000	6,767	11.27	9.26	8.04	6.45	5.27	3.62	1.96	744.	54.5	42.6	11.0	0.24	160.28
130.000	9,191	16.07	13.07	11.41	9.04	7.41	5.01	2.74	609.	67.1	32.5	10.9	0.39	170.95
130.000	9,223	16.07	13.16	11.46	9.21	7.51	5.10	2.70	710.	54.1	38.1	10.6	0.18	148.65
140.000	6,807	11.86	9.70	8.39	6.78	5.62	3.84	2.18	833.	27.1	101.8	9.7	0.60	220.32
140.000	9,247	16.62	13.64	11.80	9.55	7.82	5.27	2.83	704.	51.0	37.6	10.2	0.29	161.78
140.000	9,239	16.62	13.68	11.85	9.55	7.82	5.27	2.87	724.	50.1	36.3	10.3	0.20	172.01
150.000	6,727	11.19	9.48	8.22	6.61	5.44	3.75	2.09	1106.	24.6	84.1	10.1	0.23	187.21
150.000	9,183	15.82	13.42	11.67	9.38	7.68	5.23	2.92	1037.	37.1	38.5	10.3	0.28	192.05
150.000	9,199	15.82	13.38	11.67	9.38	7.72	5.19	2.83	1061.	35.9	38.2	10.4	0.25	171.99
160.000	6,775	11.74	9.61	8.26	6.61	5.44	3.70	2.13	555.	76.3	32.3	10.9	0.37	240.93
160.000	9,207	16.41	13.55	11.80	9.46	7.78	5.19	2.87	799.	45.2	36.9	10.4	0.43	187.93
160.000	9,199	16.50	13.59	11.89	9.55	7.82	5.27	2.87	753.	53.6	32.6	10.3	0.30	171.11
170.000	6,727	11.57	9.74	8.52	6.88	5.53	3.79	2.00	1050.	34.5	39.7	10.5	0.35	143.70
170.000	9,183	16.62	13.90	12.11	9.67	7.86	5.23	2.79	969.	33.2	33.9	10.4	0.22	155.40
170.000	9,143	16.62	13.90	12.11	9.67	7.86	5.23	2.79	965.	33.1	33.8	10.3	0.22	155.51
180.000	6,743	11.44	9.52	8.26	6.61	5.44	3.75	2.05	978.	24.2	98.6	10.1	0.22	168.61
180.000	9,151	16.20	13.46	11.72	9.42	7.68	5.19	2.79	888.	38.5	40.1	10.3	0.17	159.48
180.000	9,151	16.28	13.51	11.72	9.42	7.68	5.19	2.74	828.	42.3	38.3	10.3	0.12	148.16
190.000	6,871	12.16	9.96	8.56	6.82	5.62	3.79	2.09	556.	70.8	32.0	10.8	0.38	181.90
190.000	9,287	17.17	14.20	12.19	9.76	7.95	5.27	2.96	765.	40.6	34.2	10.3	0.26	207.40
190.000	9,263	17.13	14.16	12.15	9.76	7.95	5.27	2.92	766.	40.9	34.3	10.3	0.29	191.33
200.000	6,807	12.37	10.00	8.65	6.95	5.62	3.84	2.13	479.	80.6	28.5	10.7	0.31	184.13
200.000	9,255	17.85	14.33	12.36	9.88	8.03	5.36	2.92	377.	94.9	20.8	10.6	0.22	173.68
200.000	9,223	17.68	14.33	12.41	9.88	7.99	5.36	2.92	685.	33.9	44.8	9.9	0.40	170.54
210.000	6,799	12.11	10.04	8.65	6.99	5.62	3.92	2.26	757.	41.9	45.8	10.2	0.45	231.69
210.000	9,239	17.51	14.33	12.35	10.01	7.91	5.58	3.09	640.	42.3	43.2	9.7	0.74	174.22
210.000	9,271	17.51	14.33	12.41	9.93	8.09	5.40	3.00	679.	47.4	32.1	10.1	0.25	192.90
220.000	6,815	12.61	10.26	8.95	7.13	5.89	4.05	2.35	497.	77.7	30.6	10.1	0.49	259.13
220.000	9,231	18.01	14.68	12.66	10.05	8.27	5.62	3.27	543.	54.7	32.7	9.7	0.36	272.38
220.000	9,191	17.89	14.68	12.61	10.05	8.27	5.62	3.22	536.	60.2	30.0	9.7	0.41	238.23
230.000	6,759	12.49	10.13	8.78	7.09	5.89	4.18	2.40	663.	31.7	98.5	8.9	0.21	232.21

230.000	9,239	17.89	14.51	12.48	10.10	8.31	5.80	3.27	459.	63.0	39.6	9.4	0.28	208.34
230.000	9,215	17.85	14.51	12.53	10.10	8.27	5.75	3.35	424.	82.6	28.5	9.7	0.54	270.27
240.000	6,751	12.53	10.22	8.82	6.99	5.71	4.05	2.31	691.	29.1	82.0	9.4	0.51	209.63
240.000	9,231	17.97	14.59	12.45	9.88	8.03	5.53	3.18	541.	44.5	41.1	9.8	0.43	234.93
240.000	9,215	17.93	14.59	12.41	9.88	8.09	5.58	3.31	526.	45.6	43.4	9.7	0.39	300.00
250.000	6,743	13.37	10.48	8.95	7.16	5.80	4.10	2.09	401.	45.2	56.9	9.6	0.44	128.06
250.000	9,231	19.11	15.03	12.74	10.18	8.18	5.62	3.00	357.	56.2	34.7	9.8	0.30	154.47
250.000	9,223	19.15	15.07	12.79	10.18	8.18	5.62	3.18	396.	46.1	40.2	9.7	0.28	210.38
Mean:		15.65	12.84	11.06	8.87	7.22	4.92	2.76	696.	46.5	48.6	10.0	0.40	203.51
Std. Dev:		2.69	2.14	1.81	1.45	1.15	0.75	0.43	208.	19.5	26.9	0.6	0.28	41.38
Var Coeff(%):		17.19	16.63	16.38	16.32	15.91	15.33	15.54	30.	42.0	55.3	5.8	68.69	20.33

TTI MODULUS ANALYSIS SYSTEM (SUMMARY REPORT) (Version 5.1)

		Thickness(in)	MODULI RANGE(psi) Minimum	Maximum	Poisson Ratio Values
County: Porter					
Highway/Road: SD 47 Test Pit	Pavement:	2.50	100,000	2,500,000	H1: = 0.35
	Base:	4.50	5,000	500,000	H2: = 0.35
	Subbase:	12.00	4,000	200,000	H3: = 0.35
	Subgrade:	221.00	15,000		H4: = 0.40

Station	Load (lbs)	Measured Deflection (mils): R1	R2	R3	R4	R5	R6	R7	Calculated Moduli values (ksi): SURF(E1)	BASE(E2)	SUBB(E3)	SUBG(E4)	Absolute ERR/Sens	Dpth to Bedrock
0.000	6,751	18.35	12.26	8.90	5.30	3.48	2.22	1.39	1097.	6.8	54.7	18.0	1.33	78.91
0.000	8,927	23.96	16.24	11.98	7.37	4.95	3.09	1.96	1072.	10.4	31.4	17.2	1.17	93.35
0.000	8,967	23.71	16.11	11.89	7.37	4.95	3.05	1.92	1240.	7.0	55.9	17.2	0.81	93.38
0.000	6,543	17.72	11.87	8.73	5.30	3.48	2.18	1.35	1158.	6.8	53.3	17.7	1.32	78.91
0.000	8,951	23.33	15.81	11.80	7.46	4.95	3.18	1.96	1202.	8.5	44.9	16.8	1.63	84.86
0.000	8,967	23.33	15.98	11.89	7.38	5.04	3.09	1.96	1229.	8.9	39.3	17.1	0.76	109.60
0.000	6,487	17.34	11.56	8.60	5.30	3.48	2.18	1.31	989.	13.2	25.5	17.8	1.77	78.94
0.000	8,959	23.16	15.77	11.85	7.43	5.00	3.09	1.92	1273.	8.3	44.0	17.1	1.13	94.99
0.000	8,943	23.08	15.85	11.85	7.38	5.00	3.09	1.96	1276.	8.4	42.8	17.1	0.92	101.06
0.000	6,503	17.25	11.69	8.65	5.26	3.48	2.14	1.35	1299.	5.0	155.2	16.7	2.33	83.04 *
0.000	8,975	22.99	15.59	11.80	7.51	5.00	3.18	1.92	1285.	8.4	46.9	16.7	1.66	87.04
0.000	8,959	22.91	15.72	11.76	7.38	5.00	3.05	1.87	1318.	8.2	44.4	17.2	0.81	101.09
Mean:		21.43	14.54	10.81	6.70	4.48	2.80	1.74	1203.	8.3	53.2	17.2	1.30	89.43
Std. Dev:		2.81	2.00	1.54	1.04	0.74	0.46	0.29	103.	2.1	33.3	0.4	0.48	9.31
Var Coeff(%):		13.10	13.77	14.29	15.58	16.55	16.33	16.62	9.	24.7	62.7	2.4	36.45	10.41

TTI MODULUS ANALYSIS SYSTEM (SUMMARY REPORT) (Version 5.1)

		Thickness(in)	MODULI RANGE(psi) Minimum	Maximum	Poisson Ratio Values
County: Porter					
Highway/Road: SD 47 Survey Section	Pavement:	2.50	100,000	2,500,000	H1: = 0.35

Base:	4.50	5,000	500,000	H2: = 0.35
Subbase:	12.00	4,000	200,000	H3: = 0.35
Subgrade:	221.00	15,000		H4: = 0.40

Station	Load (lbs)	Measured Deflection (mils): R1	R2	R3	R4	R5	R6	R7	Calculated Moduli values (ksi): SURF(E1)	BASE(E2)	SUBB(E3)	SUBG(E4)	Absolute ERR/Sens	Dpth to Bedrock
10.000	6,799	18.90	12.87	9.16	5.30	3.53	2.27	1.44	1116.	5.4	89.0	17.9	1.18	66.48 *
10.000	8,991	24.64	16.85	12.23	7.33	4.91	3.18	1.96	1209.	5.3	102.3	16.9	0.92	86.90
10.000	9,031	24.26	16.72	12.19	7.37	4.95	3.14	1.92	1192.	6.9	52.5	17.2	1.16	93.31
20.000	6,767	18.06	13.26	9.38	5.59	3.75	2.18	1.35	1410.	5.4	53.9	18.1	1.23	82.45 *
20.000	8,967	24.17	17.94	12.80	7.84	5.36	3.05	1.87	1508.	5.1	56.4	17.1	1.21	110.67 *
20.000	8,967	24.00	17.81	12.75	7.89	5.36	3.09	1.87	1541.	5.1	57.8	17.0	1.10	103.60
20.000	6,703	16.50	11.74	8.56	5.51	3.75	2.14	1.31	1510.	8.4	38.0	18.1	0.72	105.86
20.000	8,935	22.11	15.51	11.63	7.93	5.49	3.05	1.87	590.	61.4	13.9	17.9	0.35	129.30
20.000	8,935	21.85	15.46	11.50	7.76	5.40	3.05	1.87	711.	53.0	14.8	17.8	0.30	138.81
30.000	6,831	17.97	12.04	8.60	5.34	3.53	2.14	1.39	870.	17.5	21.5	18.8	0.85	82.66
30.000	8,951	23.33	16.07	11.67	7.34	5.04	3.01	1.92	1196.	9.1	37.9	17.3	0.28	116.56
30.000	8,935	23.25	15.98	11.63	7.38	5.04	3.05	1.96	1196.	9.0	39.6	17.1	0.38	109.69
40.000	6,871	18.31	11.48	8.26	5.59	3.57	2.05	1.31	127.	75.9	14.8	21.2	1.43	68.00
40.000	8,991	24.38	15.77	11.33	7.59	4.95	2.75	1.79	244.	61.4	13.6	20.2	0.94	75.85
40.000	8,919	23.92	15.59	11.24	7.46	4.95	2.75	1.74	250.	62.5	13.8	20.1	0.66	84.99
50.000	6,863	18.06	11.91	8.52	5.09	3.48	2.14	1.31	948.	10.9	33.7	18.9	0.85	84.49
50.000	9,087	23.88	15.90	11.46	7.29	4.91	3.05	1.87	732.	23.2	20.9	17.8	1.03	95.83
50.000	9,015	23.58	15.68	11.33	7.20	4.91	2.92	1.79	685.	28.0	18.8	18.2	0.53	108.10
60.000	6,983	17.04	12.30	8.55	4.96	3.88	2.18	1.26	1284.	7.7	56.5	18.4	3.26	67.75
60.000	9,135	22.99	16.59	11.76	7.13	5.27	3.05	1.74	1372.	6.7	65.0	17.4	2.03	98.18
60.000	9,111	22.82	16.46	11.67	7.05	5.27	3.05	1.74	1315.	8.1	47.3	17.4	2.05	94.40
70.000	6,703	19.36	12.95	9.11	5.47	3.61	2.27	1.35	985.	6.5	52.5	17.3	0.66	81.58
70.000	8,855	26.41	17.63	12.49	7.72	5.18	3.09	1.87	739.	15.9	18.8	16.8	0.42	92.49
70.000	8,855	26.24	17.55	12.23	7.76	5.27	3.09	1.83	667.	19.0	18.2	16.6	0.46	103.38
80.000	6,711	20.12	13.13	9.20	5.51	3.57	2.09	1.22	716.	15.0	18.2	18.6	0.67	72.88
80.000	8,855	27.00	17.72	12.62	7.76	5.00	2.92	1.79	672.	18.7	15.8	17.7	0.99	70.75
80.000	8,807	26.83	17.68	12.58	7.76	5.04	2.96	1.87	708.	16.7	16.9	17.3	0.84	73.84
90.000	6,511	18.77	11.69	8.56	5.17	3.75	2.40	1.09	559.	17.8	25.6	16.4	1.69	94.08
90.000	8,895	25.19	16.07	11.59	7.30	5.27	3.27	1.70	459.	27.5	20.5	16.5	0.90	175.94
90.000	8,919	24.98	15.98	11.63	7.38	5.31	3.36	1.79	547.	22.7	23.4	16.1	0.97	207.47
100.000	6,631	18.14	11.78	8.48	5.68	3.75	2.27	1.35	269.	53.3	15.4	18.2	1.42	82.00
100.000	8,887	24.47	16.29	11.85	7.84	5.22	3.18	1.83	479.	39.9	15.8	17.1	1.23	87.10
100.000	8,903	24.17	16.07	11.72	7.80	5.22	3.14	1.79	417.	46.3	15.4	17.4	1.07	90.73
110.000	6,583	17.68	12.13	8.56	5.55	3.53	2.18	1.26	1278.	5.0	142.1	16.7	2.61	66.65 *
110.000	8,943	24.05	16.59	11.72	7.84	5.13	3.09	1.74	981.	15.3	22.6	16.9	1.29	77.33
110.000	8,959	23.84	16.50	11.67	7.93	5.22	3.18	1.79	1230.	7.6	50.5	16.2	1.73	80.37
120.000	6,567	16.79	11.09	8.52	5.42	3.39	2.00	1.18	1271.	11.3	26.6	19.1	2.36	62.28
120.000	8,919	22.74	15.29	11.67	7.63	4.95	2.88	1.79	611.	49.6	14.0	19.1	1.91	73.53
120.000	8,927	22.53	15.20	11.63	7.59	5.00	2.88	1.79	663.	47.3	14.6	18.9	1.58	80.73
130.000	6,551	14.93	10.43	7.82	5.09	3.66	2.14	1.22	929.	37.1	20.2	18.2	0.46	178.46
130.000	9,031	20.21	14.38	10.72	7.20	5.18	3.05	1.79	971.	39.5	20.5	17.6	0.36	188.87
130.000	9,023	20.12	14.33	10.64	7.20	5.22	3.14	1.83	1001.	36.1	22.4	17.2	0.36	229.51

140.000	6,487	17.34	11.56	8.56	5.34	3.57	2.35	1.26	1074.	8.5	48.0	16.5	1.76	89.88
140.000	8,943	23.16	15.59	11.76	7.55	5.13	3.27	1.79	1197.	8.9	47.1	16.1	1.39	104.05
140.000	8,959	22.99	15.46	11.67	7.64	5.18	3.27	1.74	747.	30.0	20.1	16.6	1.65	101.91
150.000	6,719	16.20	11.13	8.30	6.10	3.61	2.18	1.44	284.	93.9	13.0	20.3	3.47	53.53
150.000	9,031	21.60	15.46	11.63	7.84	5.22	3.01	1.83	1344.	23.9	18.3	17.7	0.83	87.18
150.000	9,071	21.47	15.29	11.54	7.89	5.22	3.01	1.83	927.	48.9	14.8	18.4	1.14	83.24
160.000	6,535	15.74	11.30	7.91	5.81	3.75	1.96	1.13	527.	74.9	12.0	20.7	2.38	300.00
160.000	9,031	21.22	15.33	11.15	7.93	5.27	2.96	1.83	730.	62.1	14.0	18.8	1.55	86.08
160.000	9,055	21.01	15.24	11.07	7.84	5.27	2.92	1.79	801.	60.0	14.2	18.9	1.35	94.38
170.000	6,639	15.57	10.95	7.82	5.30	3.70	2.14	1.13	702.	45.5	18.0	18.4	0.80	145.90
170.000	8,975	21.18	15.07	10.94	7.68	5.49	3.31	1.87	732.	44.8	19.9	16.3	0.88	227.74
170.000	8,951	20.97	14.94	10.94	7.64	5.49	3.31	1.83	743.	46.7	19.6	16.3	0.70	234.80
180.000	6,359	15.61	10.61	7.86	5.17	3.97	2.57	1.31	950.	15.0	43.2	14.5	0.73	300.00
180.000	8,903	21.47	14.72	11.03	7.30	5.44	3.31	1.83	699.	36.9	22.4	16.2	0.55	300.00
180.000	8,935	21.39	14.68	11.03	7.34	5.49	3.36	1.87	725.	36.0	23.2	16.0	0.54	277.10
190.000	6,583	14.51	10.52	8.03	5.30	3.57	2.14	1.31	1578.	22.4	21.0	18.6	0.96	96.01
190.000	9,007	19.62	14.20	10.94	7.64	5.04	3.05	1.83	1746.	21.4	22.4	17.8	1.54	81.66
190.000	8,991	19.45	14.12	10.98	7.80	5.04	3.09	1.92	1888.	20.5	22.3	17.7	2.10	72.09
200.000	6,623	13.58	10.13	7.47	4.96	3.57	2.09	1.26	1768.	18.7	27.3	18.8	0.95	180.63
200.000	9,071	18.14	13.59	10.16	6.91	5.04	2.92	1.87	1947.	19.3	28.3	18.4	1.08	167.33
200.000	9,055	17.93	13.42	10.07	6.78	4.95	2.88	1.79	1813.	25.8	24.9	18.8	0.91	172.54
210.000	6,887	13.59	9.83	7.66	5.30	4.11	2.35	1.31	616.	94.8	19.9	18.0	1.18	153.42
210.000	8,943	18.06	13.07	10.12	7.16	5.36	3.05	1.92	383.	123.0	17.6	18.3	0.80	148.75
210.000	8,975	18.06	13.12	10.20	7.20	5.40	3.14	1.87	475.	111.6	18.2	17.9	0.56	172.06
220.000	6,911	14.22	10.65	8.16	5.38	3.61	2.09	1.26	2086.	19.4	20.3	20.1	0.81	92.92
220.000	8,943	19.24	14.33	11.03	7.47	5.00	2.92	1.79	2014.	19.3	20.0	18.6	0.83	90.98
220.000	9,055	19.36	14.38	11.07	7.43	5.09	2.96	1.79	1976.	19.1	21.2	18.5	0.42	113.80
230.000	6,439	13.67	10.22	7.86	5.38	3.44	2.18	1.22	2165.	12.5	28.3	18.4	2.08	68.37
230.000	8,919	18.27	13.94	10.81	7.68	5.00	3.09	1.79	2045.	33.1	17.9	18.0	2.03	75.18
230.000	8,903	18.10	13.59	10.64	7.16	5.13	3.09	1.79	1909.	28.5	22.1	17.6	0.70	232.37
240.000	6,639	14.26	10.17	7.78	5.55	3.75	2.35	1.39	1772.	14.7	35.2	16.7	1.79	98.95
240.000	8,991	18.82	13.42	10.33	7.38	5.13	3.05	1.79	234.	136.9	16.8	19.1	1.13	137.24
240.000	8,975	18.52	13.33	10.29	7.16	5.09	3.01	1.74	983.	62.8	19.0	18.1	0.36	196.19
250.000	6,831	14.68	10.65	7.99	5.34	3.70	2.18	1.22	1572.	21.6	23.8	18.6	0.27	131.03
250.000	9,031	19.49	14.29	10.98	7.59	5.44	3.14	1.79	1146.	54.8	17.2	17.4	0.17	162.64
250.000	9,031	19.28	14.16	10.77	7.30	5.22	3.09	1.79	1674.	22.0	24.9	17.4	0.28	197.51
250.000	6,495	13.50	10.04	7.74	5.00	3.57	2.18	1.26	1970.	14.4	31.0	18.1	1.08	221.17
250.000	8,967	18.39	14.07	10.72	7.59	5.00	3.23	1.87	2352.	12.2	33.9	17.3	2.16	80.93
250.000	8,983	18.31	13.98	10.77	7.51	5.04	3.23	1.92	2267.	15.8	28.1	17.3	1.73	93.09
Mean:		20.08	14.01	10.33	6.80	4.66	2.78	1.64	1083.	32.2	29.2	17.8	1.14	102.64
Std. Dev:		3.55	2.25	1.57	1.05	0.74	0.44	0.27	558.	28.0	21.1	1.2	0.68	38.76
Var Coeff(%):		17.68	16.03	15.19	15.43	15.83	15.84	16.33	52.	87.0	72.3	6.6	59.64	37.76

TTI MODULUS ANALYSIS SYSTEM (SUMMARY REPORT) (Version 5.1)

County: Meade	Thickness(in)	MODULI RANGE(psi) Minimum	Maximum	Poisson Ratio Values

Highway/Road: SD 73 Test Pit

	Thickness (in)	Minimum	Maximum	Poisson Ratio Values
Pavement:	3.00	100,000	2,500,000	H1: = 0.35
Base:	6.00	5,000	500,000	H2: = 0.35
Subbase:	8.00	4,000	200,000	H3: = 0.35
Subgrade:	265.90	15,000		H4: = 0.40

Station	Load (lbs)	Measured Deflection (mils): R1	R2	R3	R4	R5	R6	R7	Calculated Moduli values (ksi): SURF(E1)	BASE(E2)	SUBB(E3)	SUBG(E4)	Absolute ERR/Sens	Dpth to Bedrock
0.000	7,287	13.63	11.86	10.38	8.27	6.60	4.31	2.13	2500.	38.2	31.0	10.4	1.98	282.84 *
0.000	9,343	18.82	16.37	14.30	11.54	9.34	6.06	2.96	2500.	31.7	32.7	9.4	1.99	268.14 *
0.000	9,239	18.77	16.33	14.26	11.50	9.29	6.06	2.96	2500.	30.7	32.8	9.3	1.80	267.99 *
0.000	6,855	13.20	11.47	10.03	8.06	6.47	4.23	2.13	2500.	40.9	29.4	9.9	1.83	300.00 *
0.000	9,127	18.65	16.20	14.21	11.45	9.25	6.01	2.96	2500.	30.6	32.1	9.2	1.88	277.90 *
0.000	9,119	18.69	16.24	14.26	11.50	9.25	6.01	3.00	2500.	72.6	9.9	10.4	0.56	295.85 *
0.000	6,775	13.20	11.51	10.03	8.06	6.47	4.23	2.13	2500.	40.4	27.9	9.9	1.78	300.00 *
0.000	9,015	18.56	16.11	14.17	11.41	9.25	6.06	2.96	2500.	31.4	32.9	9.1	1.81	267.83 *
0.000	9,015	18.56	16.16	14.21	11.45	9.25	6.01	3.00	2500.	77.5	9.5	10.3	0.62	295.83 *
0.000	6,751	13.25	11.47	10.07	8.06	6.43	4.23	2.18	2500.	30.3	35.2	9.8	1.81	300.00 *
0.000	8,983	18.56	16.20	14.21	11.45	9.25	6.06	2.92	2500.	88.7	7.3	10.7	0.40	252.90 *
0.000	8,983	18.60	16.16	14.21	11.45	9.25	6.01	3.00	2500.	79.4	8.7	10.4	0.46	295.78 *
Mean:		16.87	14.67	12.86	10.35	8.34	5.44	2.69	2500.	49.4	24.1	9.9	1.41	282.92
Std. Dev:		2.63	2.29	2.02	1.65	1.37	0.88	0.41	0.	22.9	11.4	0.5	0.67	23.37
Var Coeff(%):		15.58	15.60	15.72	15.98	16.38	16.17	15.15	0.	46.3	47.4	5.6	47.58	8.26

TTI MODULUS ANALYSIS SYSTEM (SUMMARY REPORT) (Version 5.1)

County: Meade
Highway/Road: SD 73 Survey Section

	Thickness(in)	MODULI RANGE(psi) Minimum	Maximum	Poisson Ratio Values
Pavement:	3.00	100,000	2,500,000	H1: = 0.35
Base:	6.00	5,000	500,000	H2: = 0.35
Subbase:	8.00	4,000	200,000	H3: = 0.35
Subgrade:	239.90	15,000		H4: = 0.40

Station	Load (lbs)	Measured Deflection (mils): R1	R2	R3	R4	R5	R6	R7	Calculated Moduli values (ksi): SURF(E1)	BASE(E2)	SUBB(E3)	SUBG(E4)	Absolute ERR/Sens	Dpth to Bedrock
0.000	7,439	13.63	11.94	10.46	8.44	6.87	4.40	2.13	2500.	81.2	13.8	11.0	1.36	259.06 *
0.000	9,399	18.65	16.50	14.51	11.66	9.69	6.10	3.00	2500.	73.0	13.5	9.8	1.80	276.76 *
0.000	9,327	18.73	16.55	14.64	11.71	9.74	6.19	3.00	2500.	107.8	6.0	10.9	1.17	259.50 *
10.000	7,255	14.09	11.55	10.20	8.87	7.27	4.75	2.18	149.	500.0	10.8	10.4	1.07	214.34 *
10.000	9,303	19.15	16.16	14.21	11.88	9.74	6.49	3.44	319.	284.4	8.4	10.1	0.28	300.00
10.000	9,239	19.28	16.42	14.47	11.71	9.56	6.45	3.57	2500.	34.4	32.9	8.7	0.85	300.00 *
20.000	7,487	12.83	11.26	9.25	8.10	6.52	4.75	2.18	2410.	65.8	44.2	9.6	1.82	300.00
20.000	9,559	18.06	15.72	13.26	11.28	9.20	6.45	3.18	2500.	25.6	85.4	8.5	1.70	281.87 *
20.000	9,503	18.01	15.64	13.26	11.24	9.20	6.41	3.18	2500.	25.5	85.1	8.5	1.70	290.13 *
30.000	7,351	12.78	10.81	10.03	7.77	6.56	4.23	2.09	425.	362.3	4.9	13.9	1.40	283.61
30.000	9,583	17.55	15.11	13.82	11.03	9.25	6.19	3.00	799.	280.0	4.0	12.6	0.98	260.43

30.000	9,559	17.63	15.37	13.48	11.28	9.20	6.14	3.05	811.	260.7	4.6	12.2	0.54	291.43	
40.000	7,495	12.49	11.17	9.47	7.60	6.60	4.53	2.26	2500.	39.8	81.0	9.4	2.32	299.25	*
40.000	9,503	17.42	15.33	13.22	10.56	9.16	6.45	3.18	2500.	39.3	60.6	8.7	1.47	281.81	*
40.000	9,471	17.42	15.29	13.22	10.56	9.20	6.45	3.22	2500.	61.6	35.6	9.0	1.28	299.16	*
50.000	7,471	12.28	10.69	9.69	7.98	6.25	4.71	2.26	2500.	155.8	12.5	11.0	2.00	300.00	*
50.000	9,463	16.96	14.72	13.22	10.86	8.71	6.10	3.05	2365.	158.7	6.2	11.7	0.94	300.00	
50.000	9,375	17.04	14.68	13.30	10.82	8.76	6.14	3.05	775.	264.0	6.2	11.5	1.25	290.56	
60.000	7,735	12.49	10.91	9.64	7.81	6.34	4.23	2.13	2500.	173.0	5.6	14.4	0.76	300.00	*
60.000	9,911	17.55	15.07	13.26	10.82	8.85	5.93	3.09	1324.	192.6	6.8	12.4	0.45	300.00	
60.000	9,823	17.47	14.98	13.18	10.73	8.80	5.84	3.00	813.	248.3	5.5	13.1	0.61	300.00	
70.000	7,599	12.74	10.95	9.60	7.77	6.38	4.18	2.13	2500.	47.3	45.7	10.6	2.14	300.00	*
70.000	9,623	17.97	15.37	13.52	10.90	9.43	5.88	3.09	508.	302.4	4.4	13.0	1.34	300.00	
70.000	9,551	17.89	15.24	13.35	10.94	9.24	5.84	3.05	340.	366.5	4.6	13.0	0.95	300.00	
80.000	7,335	14.01	12.25	10.59	9.04	7.10	3.79	1.96	2500.	24.9	38.4	10.3	6.44	109.05	*
80.000	9,423	19.41	17.03	14.69	12.39	9.77	5.32	2.87	2500.	33.0	13.8	10.9	4.75	118.24	*
80.000	9,343	19.45	17.03	14.73	12.43	9.77	5.32	2.87	2500.	32.7	13.8	10.7	4.80	118.21	*
90.000	7,679	13.33	11.30	9.95	7.89	6.38	4.10	2.05	2500.	50.8	28.4	11.4	1.69	300.00	*
90.000	9,831	18.73	15.85	14.00	11.20	9.06	5.84	2.96	2500.	41.0	29.5	10.1	1.69	300.00	*
90.000	9,719	18.52	15.64	13.82	11.16	9.15	5.93	2.92	2500.	42.8	32.4	9.8	1.67	279.03	*
100.000	7,271	13.63	11.74	9.99	8.32	7.01	4.27	1.92	2500.	102.2	9.2	11.4	1.78	201.24	*
100.000	9,471	19.07	16.20	14.00	11.11	8.80	5.62	2.74	2500.	54.1	12.8	11.1	0.25	265.64	*
100.000	9,447	19.07	16.20	14.04	11.20	8.80	5.62	2.74	2500.	50.8	13.6	11.0	0.50	265.52	*
110.000	7,583	18.77	13.38	10.94	8.49	6.43	4.01	2.05	102.	120.4	15.1	12.7	0.45	300.00	
110.000	9,703	24.89	18.68	15.33	11.92	9.06	5.62	2.87	199.	105.1	10.8	11.6	0.43	300.00	
110.000	9,639	24.68	18.55	15.38	11.71	9.06	5.67	2.79	275.	86.6	12.3	11.2	0.17	274.33	
120.000	7,463	14.43	11.61	9.77	8.15	6.56	4.05	2.13	190.	299.8	9.9	12.9	1.16	300.00	
120.000	9,599	20.38	16.55	14.08	11.45	9.06	5.67	2.61	368.	190.1	6.8	12.4	0.40	214.84	
120.000	9,487	20.38	16.50	14.04	11.45	9.10	5.67	2.57	214.	246.6	7.1	12.3	0.48	204.76	
130.000	7,423	15.48	12.38	11.03	8.15	6.07	3.75	1.79	1135.	105.8	4.8	15.9	2.09	241.76	
130.000	9,383	21.39	17.42	15.38	11.45	8.61	5.36	2.40	2130.	35.9	9.7	12.0	1.23	195.37	
130.000	9,295	21.43	17.37	15.42	11.50	8.66	5.45	2.48	2056.	35.6	10.6	11.5	1.31	204.73	
140.000	7,319	15.44	12.55	11.03	8.19	6.02	3.79	1.83	2329.	30.3	12.5	12.9	1.51	252.62	
140.000	9,335	21.56	17.59	15.33	11.45	8.66	5.45	2.53	1951.	34.5	11.5	11.4	0.95	218.27	
140.000	9,239	21.43	17.42	15.38	11.45	8.66	5.53	2.53	1946.	36.5	11.3	11.2	1.35	208.14	
150.000	7,327	16.71	13.46	11.63	8.74	6.74	4.58	2.13	1670.	28.1	25.0	10.2	1.15	220.25	
150.000	9,287	23.46	18.72	16.20	12.22	9.47	6.36	2.92	1261.	37.1	17.8	9.4	1.11	210.48	
150.000	9,223	23.54	18.59	16.16	12.22	9.47	6.54	2.83	1104.	38.0	21.1	9.0	1.35	178.59	
160.000	7,407	15.27	12.64	10.46	8.53	6.11	3.79	1.92	1361.	93.4	5.9	14.7	1.76	239.28	
160.000	9,303	21.30	17.68	14.64	11.92	8.70	5.36	2.70	588.	134.8	4.0	14.1	1.75	300.00	*
160.000	9,239	21.35	17.76	14.69	11.88	8.66	5.40	2.70	1284.	77.6	6.0	12.5	1.55	295.68	
170.000	6,719	20.04	12.04	9.86	7.72	5.98	3.79	2.09	100.	42.5	34.8	11.2	2.61	300.00	*
170.000	8,895	27.46	17.33	13.87	10.82	8.40	5.23	2.83	100.	47.4	25.5	10.9	1.90	300.00	*
170.000	8,935	27.55	17.29	13.87	11.03	8.52	5.36	2.87	100.	45.9	28.5	10.6	2.15	300.00	*
180.000	7,415	16.50	13.64	10.98	8.36	6.25	4.01	1.61	2008.	11.3	55.5	11.5	0.92	153.05	
180.000	9,575	23.50	19.02	15.51	11.79	8.89	5.53	2.70	1282.	38.0	12.6	11.2	0.51	264.43	
180.000	9,471	23.41	18.94	15.46	11.75	8.89	5.58	2.61	1288.	36.3	13.3	11.0	0.53	224.22	
190.000	7,383	14.51	11.94	10.03	7.55	5.76	3.53	1.87	2176.	41.3	13.0	13.9	0.27	282.59	
190.000	9,567	20.42	16.72	14.04	10.69	8.18	5.01	2.57	1324.	71.4	8.9	13.1	0.38	279.72	
190.000	9,455	20.29	16.68	14.00	10.61	8.13	5.01	2.57	1799.	43.9	12.2	12.4	0.19	300.00	

200.000	7,391	17.04	13.12	10.64	7.80	5.94	3.75	1.74	858.	43.7	17.6	12.5	0.35	219.00	
200.000	9,679	23.67	18.24	14.73	11.07	8.66	5.40	2.44	641.	53.2	16.2	11.4	0.49	201.63	
200.000	9,583	23.50	18.24	14.73	10.99	8.61	5.49	2.40	1042.	25.8	28.4	10.7	0.46	184.02	
210.000	7,367	13.29	11.22	8.82	7.34	5.62	3.57	1.61	1348.	95.8	13.6	13.6	1.81	300.00	
210.000	9,575	18.73	15.68	12.74	10.35	7.99	5.01	2.44	2500.	15.7	57.7	11.5	1.87	265.49	*
210.000	9,495	18.69	15.72	12.74	10.44	7.99	5.01	2.44	2500.	15.8	55.2	11.4	2.05	265.40	*
220.000	7,431	11.85	10.30	8.82	6.88	5.53	3.66	1.83	2500.	17.4	108.2	12.8	3.76	300.00	*
220.000	9,471	16.71	14.38	12.36	9.76	7.81	4.92	2.40	2500.	64.7	16.1	12.4	1.06	267.64	*
220.000	9,359	16.62	14.29	12.23	9.67	7.85	4.97	2.44	2500.	62.2	18.2	12.0	1.04	275.57	*
230.000	7,167	16.45	10.39	8.65	6.53	5.18	3.31	1.74	100.	78.2	34.3	14.3	1.22	300.00	*
230.000	9,295	22.74	14.98	12.49	9.33	7.41	4.79	2.40	100.	81.8	27.5	12.9	0.77	300.00	*
230.000	9,207	22.61	14.98	12.49	9.33	7.54	4.97	2.40	100.	77.9	31.2	12.4	0.87	255.41	*
240.000	7,207	13.50	11.90	10.45	5.76	4.78	3.31	1.74	2177.	8.2	200.0	14.8	8.09	53.65	*
240.000	9,167	19.62	16.81	14.78	8.27	6.78	4.66	2.48	1844.	7.2	200.0	13.2	7.20	56.48	*
240.000	9,127	19.79	16.81	14.83	8.23	6.74	4.58	2.44	1740.	9.7	60.1	13.5	7.35	54.79	
250.000	7,615	13.29	10.74	9.04	7.09	5.49	3.62	1.57	981.	113.3	16.4	13.9	0.67	181.99	
250.000	9,799	18.27	15.11	12.83	10.10	7.95	5.19	2.70	2500.	11.4	181.4	11.4	1.73	300.00	*
250.000	9,687	18.18	14.98	12.74	10.01	7.95	5.14	2.79	2500.	13.5	135.0	11.2	1.33	300.00	*
Mean:		18.28	14.88	12.73	9.96	7.90	5.09	2.51	1568.	96.1	30.8	11.7	1.61	256.93	
Std. Dev:		3.67	2.52	2.13	1.71	1.37	0.91	0.48	924.	100.2	41.2	1.6	1.59	175.83	
Var Coeff(%):		20.08	16.94	16.72	17.16	17.33	17.87	18.91	59.	100.0	100.0	13.7	98.50	68.43	

TTI MODULUS ANALYSIS SYSTEM (SUMMARY REPORT) (Version 5.1)

County: Spink
Highway/Road: US 212 Test Pit
Near Frankfort

	Thickness(in)	MODULI RANGE(psi) Minimum	Maximum	Poisson Ratio Values
Pavement:	4.50	100,000	2,500,000	H1: = 0.35
Base:	4.50	5,000	500,000	H2: = 0.35
Subbase:	4.50	4,000	1,000,000	H3: = 0.35
Subgrade:	226.50	15,000		H4: = 0.40

Station	Load (lbs)	Measured Deflection (mils): R1	R2	R3	R4	R5	R6	R7	Calculated Moduli values (ksi): SURF(E1)	BASE(E2)	SUBB(E3)	SUBG(E4)	Absolute ERR/Sens	Dpth to Bedrock
0.000	6,591	14.10	10.00	7.48	6.20	5.13	3.49	1.65	177.	26.9	638.4	11.8	1.77	300.00
0.000	8,975	18.27	13.38	10.25	8.57	7.14	4.88	2.44	201.	33.7	449.3	11.4	1.71	300.00
0.000	8,991	18.18	13.25	10.25	8.49	7.05	4.79	2.44	223.	28.7	624.4	11.5	1.66	300.00
0.000	6,575	13.55	9.74	7.43	5.98	4.95	3.36	1.74	200.	30.1	400.7	12.3	1.28	300.00
0.000	8,999	18.01	13.20	10.20	8.44	7.01	4.79	2.44	211.	34.7	399.6	11.6	1.48	300.00
0.000	8,999	17.97	13.12	10.20	8.36	6.92	4.75	2.44	224.	30.4	541.6	11.7	1.29	300.00
0.000	6,543	13.51	9.78	7.53	6.02	4.95	3.40	1.74	219.	27.3	476.3	12.0	1.05	136.71
0.000	8,951	17.89	13.12	10.29	8.32	6.87	4.75	2.44	232.	30.8	458.2	11.7	0.89	138.36
0.000	8,967	17.85	13.07	10.25	8.27	6.87	4.71	2.44	249.	27.8	581.3	11.7	1.00	143.85
0.000	6,599	13.55	9.74	7.57	5.98	4.86	3.36	1.79	245.	22.2	760.5	12.2	0.68	153.83
0.000	8,999	17.89	13.12	10.29	8.36	6.92	4.75	2.48	234.	32.3	409.0	11.7	1.01	148.24
0.000	8,991	17.85	13.07	10.29	8.23	6.74	4.62	2.44	235.	34.5	281.3	12.2	0.80	151.23

	Load	R1	R2	R3	R4	R5	R6	R7	SURF(E1)	BASE(E2)	SUBB(E3)	SUBG(E4)	ERR/Sens	Dpth to Bedrock
Mean:		16.55	12.05	9.34	7.60	6.28	4.30	2.21	221.	29.9	501.7	11.8	1.22	195.59
Std. Dev:		2.13	1.65	1.35	1.15	0.98	0.67	0.35	21.	3.7	132.0	0.3	0.37	68.56
Var Coeff(%):		12.88	13.72	14.51	15.19	15.52	15.55	16.02	9.	12.2	26.3	2.5	30.48	35.05

TTI MODULUS ANALYSIS SYSTEM (SUMMARY REPORT) (Version 5.1)

County: Spink
Highway/Road: US 212 Survey Section
Near Frankfort

	Thickness(in)	MODULI RANGE(psi) Minimum	Maximum	Poisson Ratio Values
Pavement:	4.50	100,000	2,500,000	H1: = 0.35
Base:	4.50	5,000	500,000	H2: = 0.35
Subbase:	4.50	4,000	1,000,000	H3: = 0.35
Subgrade:	226.50	15,000		H4: = 0.40

Station	Load (lbs)	Measured Deflection (mils): R1	R2	R3	R4	R5	R6	R7	Calculated Moduli values (ksi): SURF(E1)	BASE(E2)	SUBB(E3)	SUBG(E4)	Absolute ERR/Sens	Dpth to Bedrock	
10.000	6,535	13.92	10.04	7.61	6.10	4.69	3.44	1.74	246.	18.3	1000.0	12.1	2.23	300.00	*
10.000	8,975	18.18	13.51	10.51	8.61	6.60	4.84	2.44	283.	24.0	555.1	11.7	2.17	300.00	
10.000	8,999	17.97	13.38	10.46	8.40	6.60	4.75	2.48	317.	19.4	1000.0	11.8	1.48	134.05	*
20.000	6,567	14.61	10.00	8.22	6.27	4.78	3.44	2.05	194.	26.9	267.4	12.3	1.83	300.00	
20.000	8,999	19.03	13.59	11.28	8.87	6.74	4.84	2.74	232.	34.1	175.4	11.9	1.68	300.00	
20.000	9,015	18.86	13.46	11.03	8.44	6.83	4.79	2.61	222.	31.8	255.5	12.0	0.79	161.90	
30.000	6,527	15.19	10.13	7.95	5.76	4.73	3.44	1.96	176.	17.3	1000.0	12.5	1.80	300.00	*
30.000	8,951	19.79	13.64	11.54	8.53	6.52	4.79	2.61	223.	24.5	299.9	12.1	2.43	300.00	
30.000	8,943	19.45	13.51	11.24	8.40	6.60	4.75	2.61	217.	26.0	317.0	12.1	1.75	156.59	
40.000	6,471	13.92	10.13	8.13	5.98	4.82	3.40	2.05	305.	15.3	1000.0	12.0	1.13	300.00	*
40.000	8,943	18.31	13.59	10.98	8.40	6.87	4.66	2.53	272.	33.9	154.1	12.2	0.71	165.36	
40.000	8,983	18.01	13.46	10.90	8.27	6.87	4.66	2.53	290.	32.4	187.5	12.2	0.92	165.72	
50.000	6,535	14.09	10.09	8.09	5.85	4.55	3.36	1.83	290.	14.8	1000.0	12.7	2.07	300.00	*
50.000	8,951	18.44	13.46	11.03	8.23	6.60	4.71	2.57	294.	23.1	397.3	12.1	1.29	153.74	
50.000	8,967	18.18	13.33	10.94	8.23	6.65	4.71	2.61	273.	31.2	207.5	12.2	1.26	169.08	
50.000	6,543	14.81	10.78	8.65	6.88	5.98	4.10	1.70	193.	28.9	499.4	9.8	1.27	94.70	
50.000	8,999	19.49	14.59	11.89	9.50	8.09	5.40	2.57	257.	30.7	308.3	10.1	1.19	119.06	
50.000	9,007	19.28	14.38	11.67	9.04	7.36	5.06	2.74	270.	31.6	172.2	11.2	0.55	164.05	
60.000	6,559	13.96	10.13	8.65	6.57	4.86	3.70	1.87	335.	20.1	425.4	11.4	3.04	159.03	
60.000	9,015	18.27	13.77	11.80	9.16	6.93	5.14	2.57	345.	37.1	114.3	11.5	2.29	300.00	
60.000	8,991	17.97	13.64	11.67	9.04	6.93	5.14	2.61	404.	26.0	273.1	11.1	1.99	300.00	
70.000	6,535	14.39	10.39	8.52	6.45	5.18	3.40	1.79	262.	25.8	184.1	11.9	0.61	147.45	
70.000	8,967	19.11	14.42	11.85	8.95	7.14	4.53	2.48	298.	46.2	45.5	12.5	0.40	163.80	
70.000	8,959	19.11	14.29	11.80	9.08	7.32	4.75	2.48	256.	49.0	62.9	12.0	0.30	145.52	
80.000	6,279	17.47	12.94	10.12	6.70	4.78	2.92	1.70	300.	12.0	26.7	13.5	1.78	93.92	
80.000	8,735	22.36	16.98	13.06	8.91	6.47	4.10	2.44	335.	11.9	51.6	13.5	1.97	120.40	
80.000	8,735	22.06	16.72	12.80	8.83	6.43	4.05	2.40	326.	13.4	45.9	13.6	1.68	128.21	
90.000	6,287	18.35	12.94	10.38	7.13	5.04	2.88	1.65	197.	33.7	9.8	13.3	0.71	81.36	
90.000	8,663	23.63	16.94	13.53	9.50	6.83	3.97	2.31	260.	22.4	18.3	13.2	0.64	87.85	
90.000	8,751	23.33	16.94	13.40	9.42	6.83	4.05	2.35	298.	15.1	32.7	13.1	0.34	95.54	
100.000	6,287	18.48	13.38	10.68	7.30	5.13	3.14	1.65	279.	12.1	28.7	12.4	1.12	81.44	
100.000	8,663	23.92	17.55	14.21	10.05	7.14	4.40	2.40	317.	13.6	33.5	12.2	1.10	92.23	

100.000	8,719	23.58	17.29	13.79	9.76	7.10	4.45	2.53	290.	15.6	40.1	12.2	0.71	129.01	
110.000	6,295	19.36	13.64	10.64	7.47	5.22	3.44	1.87	212.	12.2	59.2	11.5	1.65	77.09	
110.000	8,663	25.02	17.94	14.13	10.10	7.18	4.66	2.53	229.	16.7	38.4	11.7	1.30	92.45	
110.000	8,703	24.60	17.81	14.08	10.01	7.18	4.53	2.48	261.	14.7	42.4	11.9	0.90	104.07	
120.000	6,167	18.73	13.08	9.64	6.82	4.51	3.23	1.83	191.	10.4	118.0	12.5	3.43	53.49	
120.000	8,647	24.85	17.63	13.23	9.38	6.43	4.36	2.35	215.	12.4	74.7	12.6	2.34	66.39	
120.000	8,679	24.43	17.33	13.06	9.21	6.43	4.31	2.31	225.	11.5	114.0	12.7	1.89	76.37	
130.000	6,319	19.74	13.68	10.55	7.04	4.91	3.14	1.61	200.	11.5	41.7	12.5	1.56	75.26	
130.000	8,623	25.61	17.68	14.22	9.93	6.96	4.66	2.40	201.	15.3	51.1	11.8	2.28	78.24	
130.000	8,687	24.98	17.72	13.62	9.29	6.69	4.14	2.44	229.	13.7	38.7	12.9	0.81	109.30	
140.000	6,271	19.79	13.85	10.29	6.95	4.86	3.09	1.70	186.	12.6	32.0	12.7	1.49	78.08	
140.000	8,639	25.27	18.07	13.62	9.46	6.65	4.31	2.44	224.	11.5	66.7	12.6	1.50	81.77	
140.000	8,679	24.89	17.72	13.44	9.33	6.65	4.27	2.40	226.	12.3	65.4	12.7	1.13	95.03	
150.000	6,287	19.53	13.85	10.64	7.47	5.13	3.23	1.83	205.	15.8	23.5	12.1	1.34	68.54	
150.000	8,623	25.44	18.24	14.13	10.39	7.14	4.66	2.74	212.	18.8	29.7	11.7	1.85	69.20	
150.000	8,679	24.89	18.02	13.91	10.27	7.14	4.66	2.61	231.	16.9	39.1	11.7	1.78	75.72	
160.000	6,311	20.12	14.20	10.98	7.16	5.22	3.14	1.79	208.	12.3	26.2	12.3	1.15	98.91	
160.000	8,679	25.78	18.46	14.57	9.80	7.18	4.40	2.57	235.	14.6	29.0	12.2	1.11	110.66	
160.000	8,695	25.23	18.20	14.31	9.67	7.23	4.40	2.61	237.	16.1	29.1	12.2	0.95	108.28	
170.000	6,359	20.21	14.59	11.20	7.55	5.53	3.49	1.96	216.	11.6	40.0	11.4	1.51	136.21	
170.000	8,695	25.82	18.89	14.60	10.14	7.50	4.92	3.27	241.	11.2	95.8	11.2	1.52	180.85	
170.000	8,719	25.23	18.55	14.35	9.93	7.45	4.79	2.57	253.	11.3	97.8	11.4	1.30	143.79	
180.000	6,439	18.10	12.81	10.64	7.94	6.02	4.23	2.22	244.	11.5	655.9	9.5	1.74	300.00	
180.000	8,815	24.22	17.59	14.73	11.20	8.61	5.97	2.92	219.	23.4	99.9	9.4	1.33	112.16	
180.000	8,807	23.79	17.42	14.51	11.11	8.57	5.93	2.92	213.	28.3	76.4	9.5	1.15	114.93	
190.000	6,415	14.68	10.52	8.91	6.57	5.49	3.75	1.79	216.	32.1	160.7	10.9	1.43	300.00	
190.000	8,935	20.33	15.11	12.80	9.72	8.09	5.45	2.53	244.	38.6	107.3	10.4	0.92	106.55	
190.000	8,943	20.21	15.07	12.75	9.72	8.09	5.49	2.61	235.	42.3	101.6	10.5	0.89	111.47	
200.000	6,479	14.64	10.35	8.17	6.16	5.04	3.70	1.87	218.	18.2	1000.0	11.3	1.51	120.08	*
200.000	8,903	19.41	14.20	11.46	8.87	7.28	5.23	2.66	231.	28.0	339.2	10.9	1.12	126.39	
200.000	8,927	19.20	14.12	11.33	8.87	7.32	5.10	2.79	241.	27.9	348.9	10.9	0.66	175.31	
210.000	6,423	14.35	9.91	8.00	6.41	5.18	3.70	1.96	157.	31.9	399.1	11.1	0.67	149.89	
210.000	8,911	19.15	13.77	11.33	9.08	7.36	5.27	2.74	210.	32.2	377.4	10.6	0.50	138.27	
210.000	8,911	18.86	13.64	11.24	9.04	7.32	5.27	2.74	215.	33.4	375.9	10.6	0.55	137.35	
220.000	6,503	14.51	10.26	8.82	6.41	5.40	4.23	1.92	227.	21.8	1000.0	10.1	3.37	300.00	*
220.000	8,927	19.11	14.16	12.19	9.16	7.72	5.93	2.66	271.	28.1	527.2	9.6	2.50	300.00	
220.000	8,911	18.86	14.16	12.06	9.12	7.64	5.80	2.74	310.	22.0	957.7	9.6	2.02	99.98	*
230.000	6,471	15.69	10.95	8.78	6.99	5.36	3.84	1.92	174.	25.2	301.6	10.7	1.25	300.00	
230.000	8,871	20.88	15.11	12.40	10.05	7.78	5.49	2.74	180.	39.3	133.5	10.4	1.06	121.95	
230.000	8,871	20.55	14.98	12.32	9.93	7.72	5.49	2.79	194.	39.3	133.3	10.5	1.09	126.87	
240.000	6,423	16.66	11.78	9.95	7.81	6.25	4.05	2.05	100.	88.0	44.8	10.3	0.28	137.63	*
240.000	8,847	22.57	17.11	13.95	10.56	8.31	5.49	2.92	292.	24.7	66.5	10.2	0.35	151.65	
240.000	8,807	22.36	17.07	13.82	10.44	8.18	5.36	2.83	308.	23.1	65.5	10.4	0.40	147.20	
250.000	6,383	16.41	12.25	10.42	7.64	5.71	3.88	2.00	306.	27.0	40.0	10.7	1.82	252.86	
250.000	8,823	21.90	16.76	14.34	10.77	8.13	5.49	2.79	336.	34.2	35.2	10.4	1.50	120.11	
250.000	8,847	21.52	16.59	14.26	10.69	8.13	5.49	2.79	347.	37.4	33.7	10.4	1.49	120.27	
Mean:		19.94	14.46	11.63	8.57	6.54	4.43	2.36	248.	23.8	240.0	11.6	1.38	128.48	
Std. Dev:		3.53	2.62	2.02	1.43	1.12	0.81	0.39	52.	12.2	295.3	1.1	0.68	55.19	

Var Coeff(%):		17.70	18.13	17.36	16.69	17.09	18.25	16.74	21.	51.0	100.0	9.1	49.18	42.96

TTI MODULUS ANALYSIS SYSTEM (SUMMARY REPORT) (Version 5.1)

		Thickness(in)	MODULI RANGE(psi) Minimum	Maximum	Poisson Ratio Values
County: Dewey					
Highway/Road: US 212 Test Pit	Pavement:	3.50	100,000	2,500,000	H1: = 0.35
Near LaPlant	Base:	8.00	5,000	500,000	H2: = 0.35
	Subbase:	8.00	4,000	200,000	H3: = 0.35
	Subgrade:	280.50	15,000		H4: = 0.40

Station	Load (lbs)	Measured Deflection (mils): R1	R2	R3	R4	R5	R6	R7	Calculated Moduli values (ksi): SURF(E1)	BASE(E2)	SUBB(E3)	SUBG(E4)	Absolute ERR/Sens	Dpth to Bedrock
0.000	6,383	23.63	15.98	12.36	8.87	6.83	4.49	2.61	160.	23.3	16.2	9.2	0.24	300.00
0.000	8,751	31.60	22.32	17.32	12.60	9.65	6.28	3.66	208.	24.3	13.4	9.1	0.16	300.00
0.000	8,751	31.22	22.19	17.24	12.55	9.69	6.32	3.66	232.	22.5	15.6	8.9	0.12	300.00
0.000	6,359	22.91	15.81	12.32	8.91	6.83	4.49	2.57	182.	24.9	14.5	9.2	0.30	300.00
0.000	8,735	31.05	22.11	17.19	12.51	9.65	6.28	3.66	219.	24.7	13.4	9.0	0.21	300.00
0.000	8,711	30.88	21.98	17.15	12.47	9.60	6.23	3.57	229.	23.8	14.1	9.0	0.08	300.00
0.000	6,335	22.82	15.81	12.28	8.87	6.83	4.49	2.61	190.	23.9	15.2	9.2	0.22	300.00
0.000	8,719	30.75	21.93	17.06	12.47	9.60	6.23	3.57	216.	25.9	12.7	9.1	0.23	300.00
0.000	8,743	30.92	21.98	17.15	12.55	9.65	6.32	3.61	219.	25.3	13.4	9.0	0.21	300.00
0.000	6,295	22.70	15.64	12.23	8.91	6.83	4.49	2.53	164.	27.2	13.2	9.2	0.33	300.00
0.000	8,767	30.88	21.93	17.19	12.60	9.65	6.28	3.57	207.	27.3	12.1	9.2	0.18	300.00
0.000	8,743	30.97	21.98	17.24	12.68	9.74	6.36	3.66	196.	27.9	12.1	9.0	0.21	300.00
Mean:		28.36	19.97	15.56	11.33	8.71	5.69	3.27	202.	25.1	13.8	9.1	0.21	300.00
Std. Dev:		3.96	3.08	2.41	1.80	1.39	0.89	0.51	24.	1.7	1.3	0.1	0.07	27.24
Var Coeff(%):		13.96	15.40	15.49	15.93	15.96	15.57	15.69	12.	6.8	9.6	1.1	33.32	9.08

TTI MODULUS ANALYSIS SYSTEM (SUMMARY REPORT) (Version 5.1)

		Thickness(in)	MODULI RANGE(psi) Minimum	Maximum	Poisson Ratio Values
County: Dewey					
Highway/Road: US 212 Survey Section	Pavement:	3.50	100,000	2,500,000	H1: = 0.35
Near LaPlant	Base:	8.00	5,000	500,000	H2: = 0.35
	Subbase:	8.00	4,000	200,000	H3: = 0.35
	Subgrade:	280.50	15,000		H4: = 0.40

Station	Load (lbs)	Measured Deflection (mils): R1	R2	R3	R4	R5	R6	R7	Calculated Moduli values (ksi): SURF(E1)	BASE(E2)	SUBB(E3)	SUBG(E4)	Absolute ERR/Sens	Dpth to Bedrock
0.000	6,359	19.32	13.51	10.33	7.51	5.89	4.05	2.53	270.	21.6	33.4	9.9	0.26	300.00
0.000	8,807	25.57	18.59	14.38	10.65	8.27	5.62	3.40	331.	24.1	26.4	9.9	0.45	300.00
0.000	8,807	25.23	18.50	14.34	10.61	8.27	5.67	3.40	350.	23.8	28.2	9.8	0.58	300.00
10.000	6,391	20.84	14.85	11.41	8.19	6.38	4.23	2.57	282.	20.6	22.4	9.6	0.35	300.00

10.000	8,823	28.27	20.59	16.03	11.66	8.98	5.93	3.53	339.	20.0	22.4	9.4	0.15	300.00
10.000	8,807	27.89	20.46	15.98	11.66	9.02	5.97	3.61	336.	21.9	20.1	9.4	0.30	300.00
20.000	6,351	21.22	15.51	12.11	8.74	6.78	4.53	2.74	321.	19.6	21.2	8.9	0.42	300.00
20.000	8,695	28.69	21.59	16.93	12.30	9.47	6.28	3.70	466.	12.8	41.2	8.5	0.27	300.00
20.000	8,719	28.39	21.32	16.76	12.26	9.47	6.23	3.66	429.	16.4	26.1	8.7	0.28	300.00
30.000	6,271	20.93	15.24	11.80	8.44	6.47	4.31	2.57	364.	15.0	32.4	9.1	0.17	300.00
30.000	8,735	28.35	21.41	16.67	12.00	9.16	6.01	3.53	491.	12.0	44.3	8.9	0.36	300.00
30.000	8,719	28.18	21.11	16.54	11.92	9.20	6.01	3.48	382.	19.9	18.2	9.3	0.53	300.00
40.000	6,343	22.78	16.20	12.15	8.61	6.56	4.36	2.53	278.	15.1	26.4	9.2	0.38	300.00
40.000	8,711	30.33	22.24	16.93	12.17	9.29	6.06	3.57	353.	14.2	28.2	8.9	0.49	300.00
40.000	8,727	30.08	22.02	16.85	12.17	9.34	6.10	3.57	344.	15.6	25.5	8.9	0.45	300.00
50.000	6,263	20.80	15.42	11.89	8.44	6.52	4.40	2.61	398.	13.3	42.3	8.8	0.60	300.00
50.000	8,751	28.18	21.76	16.93	12.17	9.34	6.19	3.66	569.	9.5	86.0	8.6	0.62	300.00
50.000	8,751	28.18	21.63	16.85	12.13	9.34	6.19	3.66	509.	12.4	40.6	8.8	0.68	300.00
60.000	6,327	19.15	15.94	12.45	8.78	6.74	4.45	2.61	795.	7.9	89.8	8.9	1.93	300.00
60.000	8,759	25.06	22.02	17.45	12.43	9.47	6.19	3.66	1058.	8.6	32.0	9.4	2.92	300.00
60.000	8,735	24.98	21.72	17.32	12.39	9.47	6.19	3.57	1038.	9.1	30.1	9.3	2.61	300.00
70.000	6,319	21.94	15.29	11.41	8.02	6.25	4.10	2.44	254.	16.5	28.1	9.7	0.66	300.00
70.000	8,703	29.19	21.24	16.07	11.41	8.80	5.75	3.44	363.	13.5	38.4	9.3	0.67	300.00
70.000	8,735	28.81	20.98	15.98	11.41	8.80	5.71	3.35	328.	17.9	22.3	9.6	0.57	300.00
80.000	6,151	20.04	13.77	10.55	7.51	5.85	3.97	2.44	245.	19.5	30.3	9.8	0.21	300.00
80.000	8,583	27.51	19.33	14.99	10.82	8.40	5.58	3.44	258.	23.0	21.2	9.8	0.14	300.00
80.000	8,655	27.30	19.24	14.95	10.82	8.44	5.62	3.40	264.	23.5	22.0	9.8	0.13	300.00
90.000	6,359	15.69	13.25	10.25	7.30	5.71	3.92	2.44	975.	9.4	198.3	10.0	2.27	300.00
90.000	8,791	20.17	18.20	14.26	10.27	7.99	5.45	3.35	1388.	8.1	189.1	10.4	3.20	300.00
90.000	8,799	20.46	18.15	14.26	10.31	8.03	5.49	3.35	1281.	9.6	108.2	10.2	2.91	300.00
100.000	6,327	17.17	13.00	9.99	7.20	5.71	3.97	2.44	526.	14.4	96.9	9.7	0.92	300.00
100.000	8,791	22.19	18.02	14.08	10.31	8.09	5.49	3.35	828.	13.3	71.9	9.9	1.40	300.00
100.000	8,791	22.23	17.94	14.04	10.31	8.13	5.53	3.35	830.	12.3	103.3	9.7	1.23	300.00
110.000	6,343	18.90	12.91	9.77	6.99	5.44	3.75	2.26	269.	19.7	42.9	10.7	0.12	300.00
110.000	8,759	25.44	18.02	13.83	9.97	7.72	5.14	3.14	318.	22.3	27.5	10.8	0.14	300.00
110.000	8,775	25.19	17.85	13.78	10.05	7.78	5.19	3.14	299.	25.3	24.4	10.8	0.14	300.00
120.000	6,423	18.73	13.56	9.86	6.74	5.18	3.40	2.05	430.	11.2	116.8	11.4	1.23	300.00
120.000	8,759	24.38	18.28	13.62	9.46	7.18	4.66	2.70	482.	14.9	39.1	11.7	1.20	300.00
120.000	8,775	24.22	18.20	13.66	9.55	7.27	4.75	2.79	558.	11.2	106.2	11.2	0.91	300.00
130.000	6,231	19.11	13.47	9.90	6.78	5.13	3.40	2.00	387.	11.0	109.6	11.1	0.65	300.00
130.000	8,663	25.35	18.63	13.92	9.67	7.27	4.79	2.79	467.	12.0	68.9	11.1	0.68	300.00
130.000	8,679	25.23	18.55	13.92	9.72	7.32	4.84	2.83	487.	11.2	98.6	10.9	0.53	300.00
140.000	6,255	20.67	13.81	10.12	7.05	5.36	3.57	2.13	246.	14.9	47.8	10.8	0.55	300.00
140.000	8,639	27.89	19.07	14.27	9.97	7.54	4.97	2.96	250.	18.9	25.4	11.0	0.15	300.00
140.000	8,655	27.55	19.02	14.26	10.01	7.55	5.01	3.00	284.	17.2	30.7	10.9	0.16	300.00
150.000	6,327	20.17	13.56	9.86	6.91	5.31	3.66	2.35	246.	15.8	53.3	10.9	0.40	300.00
150.000	8,711	26.41	18.55	13.75	9.72	7.36	4.92	3.00	312.	17.5	33.8	11.1	0.48	300.00
150.000	8,703	26.16	18.55	13.83	9.76	7.45	4.97	3.14	334.	17.1	36.1	11.0	0.42	300.00
160.000	6,247	18.23	12.26	9.30	6.57	5.13	3.57	2.09	269.	19.0	53.3	11.0	0.33	300.00
160.000	8,615	24.51	16.98	13.01	9.29	7.32	5.01	3.00	279.	23.0	34.9	10.9	0.35	300.00
160.000	8,663	24.13	16.89	12.93	9.25	7.27	4.84	3.00	311.	23.0	32.2	11.3	0.31	300.00
170.000	6,159	17.25	12.08	9.30	6.66	5.13	3.53	2.22	320.	22.0	34.7	11.1	0.38	300.00
170.000	8,631	23.71	16.85	13.10	9.55	7.32	5.06	3.18	338.	24.1	30.8	10.9	0.50	300.00

170.000	8,623	23.54	16.81	13.10	9.59	7.41	5.14	3.27	359.	22.6	38.1	10.6	0.36	300.00
180.000	6,263	18.98	14.03	10.90	7.77	6.02	4.10	2.53	409.	16.7	36.5	9.6	0.73	300.00
180.000	8,639	26.03	19.41	15.25	10.90	8.44	5.71	3.44	479.	14.1	51.7	9.3	0.41	300.00
180.000	8,663	25.73	19.37	15.25	10.99	8.48	5.75	3.44	502.	14.7	46.6	9.3	0.48	300.00
190.000	6,063	20.67	14.38	11.24	8.10	6.29	4.31	2.61	248.	19.4	27.6	8.9	0.40	300.00
190.000	8,471	27.51	20.02	15.81	11.50	8.94	6.01	3.66	324.	20.9	22.2	8.9	0.28	300.00
190.000	8,663	27.72	20.15	15.90	11.62	8.98	6.06	3.66	321.	21.8	21.9	9.1	0.29	300.00
200.000	6,183	21.56	15.03	11.46	8.15	6.29	4.23	2.57	235.	19.1	22.8	9.3	0.35	300.00
200.000	8,663	29.28	21.32	16.46	11.75	9.11	6.01	3.61	356.	14.9	32.0	8.9	0.37	300.00
200.000	8,663	29.03	21.19	16.41	11.83	9.20	6.10	3.75	322.	18.5	22.9	9.0	0.42	300.00
210.000	6,295	21.52	15.94	12.06	8.53	6.47	4.27	2.57	400.	11.7	43.1	9.1	0.64	300.00
210.000	8,631	28.98	22.24	17.11	12.22	9.20	6.06	3.66	516.	9.5	62.0	8.7	0.69	300.00
210.000	8,703	28.77	22.06	17.02	12.17	9.24	5.97	3.61	537.	9.5	64.6	8.9	0.68	300.00
220.000	6,271	16.12	15.98	12.02	8.49	6.52	4.31	2.66	1431.	6.6	42.4	10.2	5.44	300.00
220.000	8,631	21.85	22.11	16.85	12.09	9.15	5.97	3.61	1652.	5.0	77.8	10.4	5.42	*** *
220.000	8,623	22.61	21.80	16.76	12.00	9.15	5.97	3.61	1431.	6.5	40.8	10.1	4.55	300.00
230.000	6,231	18.52	16.24	12.36	8.70	6.60	4.36	2.61	919.	6.1	172.5	9.2	3.04	300.00
230.000	8,655	25.23	22.54	17.41	12.47	9.56	6.19	3.70	1025.	8.3	32.5	9.2	3.08	300.00
230.000	8,655	25.69	22.28	17.24	12.47	9.52	6.23	3.70	926.	8.1	53.9	8.9	2.45	300.00
240.000	6,263	23.33	16.20	12.23	8.83	6.78	4.58	2.70	217.	17.3	24.6	8.6	0.32	300.00
240.000	8,663	31.47	22.45	17.15	12.51	9.65	6.32	3.70	247.	19.6	17.9	8.7	0.37	300.00
240.000	8,679	30.92	22.24	16.98	12.47	9.65	6.36	3.75	233.	21.9	16.7	8.8	0.41	300.00
250.000	6,215	24.68	16.81	12.71	9.04	6.83	4.40	2.57	167.	20.0	13.9	9.1	0.14	300.00
250.000	8,607	33.45	23.58	18.10	13.06	9.83	6.32	3.70	199.	21.4	11.9	8.8	0.31	300.00
250.000	8,599	32.86	23.32	17.97	13.06	9.87	6.36	3.75	193.	24.0	10.8	8.9	0.41	300.00
Mean:		24.42	18.26	14.03	10.06	7.74	5.15	3.09	484.	15.9	47.7	9.8	0.91	300.00
Std. Dev:		4.15	3.16	2.53	1.88	1.43	0.90	0.52	329.	5.4	37.9	0.9	1.15	181.56
Var Coeff(%):		17.01	17.29	18.04	18.71	18.47	17.51	16.97	68.	33.6	79.5	9.0	127.24	60.52

TTI MODULUS ANALYSIS SYSTEM (SUMMARY REPORT) (Version 5.1)

County: Jones
Highway/Road: I 90 E.B. Test Pit

	Thickness(in)	MODULI RANGE(psi) Minimum	Maximum	Poisson Ratio Values
Pavement:	6.50	100,000	2,500,000	H1: = 0.35
Base:	18.00	5,000	500,000	H2: = 0.35
Subbase:	0.00	0	0	H3: = 0.35
Subgrade:	226.50	15,000		H4: = 0.40

Station	Load (lbs)	Measured Deflection (mils): R1	R2	R3	R4	R5	R6	R7	Calculated Moduli values (ksi): SURF(E1)	BASE(E2)	SUBB(E3)	SUBG(E4)	Absolute ERR/Sens	Dpth to Bedrock
0.000	6,583	8.03	6.83	6.88	5.21	4.95	3.62	1.79	1059.	41.5	0.0	10.0	3.32	***
0.000	9,087	11.19	9.70	9.38	7.55	6.74	4.66	2.70	1410.	19.7	0.0	12.5	2.03	300.00
0.000	9,087	11.15	9.65	9.38	7.47	6.74	4.75	2.61	1268.	26.7	0.0	11.5	2.17	300.00
0.000	6,543	7.94	6.79	6.88	5.21	4.95	3.66	1.83	1116.	41.8	0.0	9.8	3.29	***
0.000	9,007	11.19	9.56	9.38	7.47	6.78	4.75	2.66	1252.	27.1	0.0	11.3	2.52	300.00
0.000	9,015	11.15	9.52	9.38	7.38	6.74	4.84	2.48	1196.	31.2	0.0	10.8	2.51	300.00

0.000	6,447	7.77	6.66	6.78	5.09	4.86	3.62	1.74	1112.	43.5	0.0	9.6	3.42	***
0.000	8,975	11.11	9.56	9.30	7.43	6.65	4.84	2.53	1181.	31.4	0.0	10.8	1.95	300.00
0.000	9,023	11.15	9.61	9.30	7.43	6.65	4.84	2.48	1143.	32.6	0.0	10.8	1.86	300.00
0.000	6,455	7.86	6.74	6.70	5.17	4.82	3.62	1.79	1037.	44.3	0.0	9.7	2.74	300.00
0.000	8,983	11.11	9.65	9.25	7.47	6.65	4.84	2.53	1184.	30.9	0.0	10.9	1.59	300.00
0.000	9,015	11.15	9.65	9.25	7.55	6.65	4.84	2.57	1182.	30.9	0.0	10.9	1.39	142.92
0.000	6,559	8.28	6.92	7.05	5.81	4.60	3.53	1.92	1257.	23.9	0.0	11.6	3.49	***
0.000	9,071	11.44	9.87	9.60	8.02	6.56	4.88	2.61	1292.	22.6	0.0	11.7	1.91	137.81
0.000	9,039	11.36	9.70	9.64	7.98	6.47	4.84	2.57	1330.	21.3	0.0	11.9	2.47	131.39
0.000	6,447	8.03	6.70	6.91	5.64	4.46	3.44	1.87	1305.	23.3	0.0	11.9	3.73	***
0.000	9,007	11.36	9.65	9.60	7.98	6.47	4.88	2.66	1281.	23.9	0.0	11.5	2.56	144.46
0.000	9,047	11.36	9.70	9.64	7.98	6.43	4.88	2.61	1260.	24.3	0.0	11.5	2.62	300.00
0.000	6,471	8.07	6.79	6.95	5.64	4.55	3.44	1.87	1367.	20.7	0.0	12.2	3.17	***
0.000	8,999	11.32	9.70	9.56	7.89	6.47	4.84	2.61	1278.	23.4	0.0	11.6	2.15	140.11
0.000	9,007	11.23	9.56	9.43	7.85	6.43	4.79	2.57	1269.	24.9	0.0	11.6	2.16	138.68
0.000	6,455	8.07	6.74	6.91	5.59	4.51	3.44	1.87	1237.	25.4	0.0	11.6	3.24	***
0.000	9,007	11.36	9.78	9.64	8.06	6.56	4.92	2.70	1361.	21.6	0.0	11.5	2.24	151.18
0.000	8,999	11.27	9.65	9.60	7.94	6.43	4.84	2.61	1334.	22.0	0.0	11.8	2.51	137.78
Mean:		10.16	8.69	8.60	6.95	5.96	4.40	2.34	1238.	28.3	0.0	11.2	2.54	195.39
Std. Dev:		1.56	1.39	1.25	1.14	0.92	0.62	0.37	97.	7.6	0.0	0.8	0.64	72.62
Var Coeff(%):		15.38	16.01	14.51	16.34	15.36	14.11	15.84	8.	26.8	0.0	7.0	25.19	37.17

TTI MODULUS ANALYSIS SYSTEM (SUMMARY REPORT) (Version 5.1)

		Thickness(in)	MODULI RANGE(psi) Minimum	Maximum	Poisson Ratio Values
County: Jones					
Highway/Road: I-90 E.B. Survey Section	Pavement:	6.50	100,000	2,500,000	H1: = 0.35
	Base:	18.00	5,000	500,000	H2: = 0.35
	Subbase:	0.00	0	0	H3: = 0.35
	Subgrade:	226.50	15,000		H4: = 0.40

Station	Load (lbs)	Measured Deflection (mils): R1	R2	R3	R4	R5	R6	R7	Calculated Moduli values (ksi): SURF(E1)	BASE(E2)	SUBB(E3)	SUBG(E4)	Absolute ERR/Sens	Dpth to Bedrock
0.000	6,487	9.21	7.91	7.44	6.28	5.40	3.40	1.70	1466.	5.7	0.0	19.0	1.63	136.76
0.000	9,159	12.95	11.12	10.38	8.78	7.45	4.79	2.40	1332.	8.5	0.0	15.7	1.31	134.18
0.000	9,103	12.87	10.99	10.16	8.74	7.41	4.84	2.53	1195.	13.1	0.0	13.0	1.64	155.55
10.000	6,567	9.25	7.87	7.44	6.24	5.13	3.49	1.74	1127.	14.4	0.0	13.0	1.20	122.83
10.000	9,095	12.87	10.99	10.16	8.61	7.01	4.75	2.44	1059.	15.0	0.0	13.2	0.94	134.66
10.000	9,031	12.83	11.03	10.03	8.49	6.96	4.71	2.40	1012.	15.8	0.0	13.0	0.53	132.13
30.000	6,503	8.87	7.91	7.61	5.76	5.22	3.40	1.87	1348.	9.0	0.0	15.7	2.52	300.00
30.000	9,039	12.57	11.03	10.38	8.10	7.23	4.79	2.53	1104.	15.0	0.0	12.9	1.97	300.00
30.000	9,023	12.53	10.99	10.33	8.02	7.32	4.79	2.48	1133.	14.7	0.0	12.9	2.27	300.00
30.000	6,431	8.91	7.70	7.18	5.99	5.22	3.62	1.79	1102.	21.1	0.0	11.0	1.19	123.22
30.000	8,983	12.53	10.81	10.03	8.40	7.32	5.06	2.53	1086.	21.0	0.0	11.0	1.15	127.88
30.000	9,007	12.53	10.82	9.95	8.36	7.32	5.01	2.61	1056.	21.7	0.0	11.1	1.16	148.20
40.000	6,455	8.32	7.44	6.88	5.76	4.91	3.66	1.70	1122.	29.2	0.0	10.4	0.89	99.13

40.000	8,991	12.28	10.52	9.73	8.19	6.83	4.92	2.44	939.	26.6	0.0	11.0	0.72	116.72
40.000	8,991	12.23	10.52	9.64	8.19	6.83	4.92	2.40	933.	27.5	0.0	10.9	0.56	112.81
50.000	6,471	8.53	7.87	7.34	5.64	5.00	3.57	1.79	1212.	17.2	0.0	12.2	2.70	300.00
50.000	8,991	12.32	11.03	10.12	8.06	7.01	4.88	2.48	1071.	18.0	0.0	12.2	1.48	127.23
50.000	8,975	12.15	10.94	10.12	8.06	6.92	4.79	2.53	1179.	14.4	0.0	13.1	1.48	143.44
60.000	6,391	8.36	7.57	6.74	5.64	4.95	3.49	1.74	1112.	24.3	0.0	11.2	1.05	123.82
60.000	9,055	12.11	10.87	9.69	8.06	7.05	4.88	2.48	1096.	20.9	0.0	11.8	0.99	132.42
60.000	9,031	12.02	10.82	9.64	7.94	7.01	4.75	2.44	1125.	18.9	0.0	12.3	1.29	139.31
70.000	6,511	8.62	7.13	6.95	5.47	4.95	3.53	1.61	811.	38.2	0.0	10.3	2.59	300.00
70.000	9,103	11.94	10.22	9.73	7.89	6.92	4.75	2.53	1166.	20.5	0.0	12.2	1.73	153.93
70.000	9,047	11.85	10.35	9.64	8.02	6.96	4.75	2.48	1384.	13.7	0.0	13.3	1.04	145.18
80.000	6,487	8.79	7.52	7.39	5.68	5.18	3.40	1.83	1253.	13.9	0.0	13.2	3.03	300.00
80.000	9,047	12.40	10.51	10.25	8.02	7.14	4.75	2.53	1201.	14.4	0.0	13.2	2.54	300.00
80.000	9,071	12.36	10.51	10.25	7.98	7.18	4.75	2.53	1217.	14.4	0.0	13.2	2.71	300.00
90.000	6,519	8.83	7.35	7.09	6.19	4.69	3.40	1.70	1216.	14.5	0.0	13.5	3.14	300.00
90.000	9,087	12.40	10.43	9.82	8.44	6.60	4.75	2.40	1028.	19.9	0.0	12.5	2.10	118.71
90.000	9,111	12.36	10.43	9.82	8.44	6.65	4.79	2.48	1078.	19.2	0.0	12.5	2.01	127.98
100.000	6,463	8.62	7.26	6.91	5.59	5.04	3.70	1.83	789.	42.5	0.0	9.5	1.81	300.00
100.000	9,007	12.19	10.30	9.73	7.98	7.01	5.19	2.57	790.	39.8	0.0	9.6	1.24	115.55
100.000	9,015	12.19	10.30	9.73	7.94	7.05	5.23	2.57	774.	41.5	0.0	9.5	1.38	300.00
110.000	6,455	8.45	7.05	6.61	5.76	4.86	3.62	1.70	845.	42.3	0.0	9.7	1.29	103.15
110.000	9,031	11.98	10.04	9.43	8.15	6.74	4.92	2.40	972.	31.0	0.0	10.7	1.34	111.74
110.000	8,999	11.95	10.00	9.38	8.10	6.74	4.92	2.40	948.	32.4	0.0	10.6	1.27	112.17
120.000	6,495	8.45	7.35	6.91	5.47	4.73	3.18	1.65	1139.	16.7	0.0	13.9	1.42	136.98
120.000	9,071	11.94	10.35	9.60	7.77	6.65	4.62	2.35	1043.	21.2	0.0	12.7	0.96	126.74
120.000	9,015	11.90	10.26	9.56	7.72	6.60	4.53	2.31	1046.	20.2	0.0	13.0	1.05	128.66
130.000	6,399	8.53	7.83	6.91	5.93	4.95	3.40	1.74	1279.	13.4	0.0	13.2	0.74	134.41
130.000	9,015	12.32	10.91	9.86	8.32	6.96	4.84	2.40	1196.	14.6	0.0	13.0	0.37	120.63
130.000	8,975	12.28	11.00	9.77	8.40	6.96	4.79	2.44	1190.	14.2	0.0	13.0	0.52	132.24
140.000	6,447	8.74	7.61	6.88	6.20	5.22	3.44	1.83	1407.	12.0	0.0	13.1	2.17	171.42
140.000	9,015	12.57	10.82	9.73	8.61	7.23	4.88	2.57	1180.	16.0	0.0	12.2	1.66	157.97
140.000	9,015	12.40	10.74	9.69	8.53	7.14	4.79	2.48	1266.	13.4	0.0	13.1	1.44	147.07
150.000	6,487	8.83	7.87	7.34	5.59	4.86	3.40	1.65	976.	19.0	0.0	12.7	2.28	300.00
150.000	9,047	12.40	10.94	10.12	7.98	6.74	4.66	2.26	1004.	17.1	0.0	13.2	1.45	110.14
150.000	9,015	12.32	10.86	10.07	7.94	6.74	4.62	2.22	1032.	16.4	0.0	13.4	1.32	108.91
160.000	6,463	8.83	7.48	6.91	5.81	4.51	3.14	1.57	972.	16.8	0.0	14.3	1.72	116.10
160.000	9,015	12.11	10.56	9.69	8.23	6.38	4.40	2.22	1164.	12.0	0.0	15.7	1.49	120.24
160.000	9,023	12.15	10.56	9.69	8.23	6.38	4.45	2.18	1133.	13.0	0.0	15.1	1.57	110.79
170.000	6,463	8.74	7.48	7.05	5.72	4.95	3.23	1.61	1147.	14.8	0.0	13.8	1.75	127.32
170.000	9,031	12.32	10.52	9.86	8.10	6.83	4.49	2.13	1144.	13.5	0.0	14.3	1.22	111.40
170.000	8,999	12.19	10.48	9.77	8.06	6.83	4.49	2.13	1167.	13.7	0.0	14.2	1.17	112.00
180.000	6,431	8.87	7.52	6.91	5.68	4.78	3.09	1.39	1001.	15.6	0.0	14.3	1.17	101.80
180.000	8,991	12.28	10.65	9.64	8.02	6.60	4.40	2.22	1048.	14.8	0.0	14.4	0.22	127.34
180.000	9,023	12.28	10.69	9.64	8.02	6.60	4.40	2.18	1028.	15.4	0.0	14.3	0.18	121.07
190.000	6,463	8.57	7.48	6.88	5.55	4.42	3.31	1.48	877.	24.6	0.0	12.6	2.03	300.00
190.000	8,991	12.19	10.65	9.64	7.94	6.38	4.71	2.18	847.	25.3	0.0	12.1	1.47	95.40
190.000	8,991	12.15	10.65	9.51	7.94	6.43	4.58	2.13	914.	21.7	0.0	12.8	0.90	99.94
200.000	6,471	8.28	7.26	6.84	5.42	4.64	3.09	1.52	1203.	14.7	0.0	14.8	1.42	117.09
200.000	9,023	11.64	10.17	9.47	7.68	6.56	4.36	2.09	1204.	15.1	0.0	14.4	1.13	112.17

Station	Load (lbs)	R1	R2	R3	R4	R5	R6	R7	SURF(E1)	BASE(E2)	SUBB(E3)	SUBG(E4)	ERR/Sens	Dpth to Bedrock
200.000	9,023	11.60	10.22	9.43	7.72	6.65	4.36	2.09	1266.	13.7	0.0	14.7	1.15	114.49
210.000	6,471	8.11	7.31	6.74	5.34	4.42	3.09	1.48	1156.	16.3	0.0	14.7	1.97	104.08
210.000	9,047	11.69	10.35	9.51	7.55	6.34	4.53	2.22	1023.	21.1	0.0	13.2	1.76	109.19
210.000	9,015	11.60	10.30	9.47	7.51	6.34	4.49	2.13	1029.	21.0	0.0	13.2	1.67	102.87
220.000	6,431	8.28	7.09	6.84	5.59	4.91	3.23	1.52	1455.	12.1	0.0	14.4	2.13	111.33
220.000	9,007	11.64	10.04	9.47	7.85	6.65	4.49	2.18	1296.	14.7	0.0	13.9	1.10	115.43
220.000	9,015	11.74	10.00	9.60	7.89	6.69	4.53	2.22	1296.	14.7	0.0	13.8	1.44	117.32
230.000	6,471	7.94	7.18	6.95	5.76	4.69	3.36	1.61	1885.	5.8	0.0	19.5	1.84	104.06 *
230.000	9,015	11.77	10.04	9.77	8.10	6.60	4.75	2.35	1336.	15.0	0.0	13.2	2.01	112.23
230.000	9,039	11.52	10.04	9.69	8.06	6.60	4.66	2.31	1434.	13.1	0.0	13.9	1.47	114.77
240.000	6,463	8.36	6.96	7.09	5.64	4.60	3.36	1.61	1225.	18.8	0.0	12.8	2.85	***
240.000	9,007	11.86	9.96	9.95	8.02	6.56	4.79	2.35	1180.	19.6	0.0	12.3	2.43	107.13
240.000	8,991	11.78	9.91	9.90	7.98	6.56	4.75	2.31	1237.	18.0	0.0	12.6	2.36	106.08
250.000	6,431	8.57	7.57	7.34	5.68	4.86	3.44	1.57	1240.	14.4	0.0	13.2	2.31	300.00
250.000	8,975	12.11	10.64	10.20	8.06	6.87	4.84	2.26	1202.	15.2	0.0	12.8	1.79	101.28
250.000	8,951	12.11	10.64	10.12	8.06	6.87	4.75	2.44	1202.	14.3	0.0	13.2	1.41	129.73
Mean:		10.99	9.53	8.89	7.32	6.19	4.28	2.13	1133.	18.5	0.0	13.0	1.54	134.92
Std. Dev:		1.72	1.49	1.34	1.15	0.96	0.66	0.36	178.	7.7	0.0	1.7	0.64	38.86
Var Coeff(%):		15.70	15.64	15.09	15.71	15.60	15.49	16.97	16.	41.5	0.0	13.4	41.63	28.80

TTI MODULUS ANALYSIS SYSTEM (SUMMARY REPORT) (Version 5.1)

County: Jones
Highway/Road: I 90 W.B. Test Pit

	Thickness(in)	MODULI RANGE(psi) Minimum	Maximum	Poisson Ratio Values
Pavement:	6.00	100,000	2,500,000	H1: = 0.35
Base:	18.00	5,000	500,000	H2: = 0.35
Subbase:	0.00	0	0	H3: = 0.35
Subgrade:	216.00	15,000		H4: = 0.40

Station	Load (lbs)	Measured Deflection (mils): R1	R2	R3	R4	R5	R6	R7	Calculated Moduli values (ksi): SURF(E1)	BASE(E2)	SUBB(E3)	SUBG(E4)	Absolute ERR/Sens	Dpth to Bedrock
0.000	6,567	11.90	10.17	9.34	7.98	6.74	4.49	2.35	1089.	12.2	0.0	9.7	1.28	161.08
0.000	8,783	16.50	14.16	13.00	11.07	9.25	6.28	3.31	976.	13.8	0.0	9.0	0.94	161.23
0.000	8,855	16.54	14.25	12.96	11.16	9.47	6.32	3.31	1031.	13.1	0.0	9.0	1.38	164.92
0.000	6,407	11.81	10.09	9.17	8.02	6.87	4.45	2.35	1131.	11.2	0.0	9.6	2.18	181.53
0.000	8,719	16.45	14.07	12.79	11.16	9.56	6.28	3.27	1016.	13.8	0.0	8.7	2.08	168.71
0.000	8,711	16.41	14.07	12.74	11.16	9.56	6.19	3.22	1063.	12.1	0.0	9.1	2.23	171.06
0.000	6,375	11.81	10.09	9.12	8.06	7.01	4.49	2.40	1135.	11.9	0.0	9.2	2.67	203.37
0.000	8,727	16.45	14.07	12.87	11.20	9.60	6.28	3.31	1135.	10.7	0.0	9.3	1.97	178.11
0.000	8,735	16.41	14.07	12.83	11.16	9.52	6.23	3.22	1065.	12.2	0.0	9.1	1.95	162.44
0.000	6,351	11.78	9.96	9.04	8.02	6.96	4.40	2.31	1156.	10.9	0.0	9.5	3.03	188.25
0.000	8,711	16.41	14.07	12.79	11.20	9.60	6.28	3.27	1171.	10.0	0.0	9.4	2.01	170.23
0.000	8,727	16.41	14.12	12.87	11.16	9.47	6.32	3.31	1067.	12.4	0.0	8.9	1.55	166.67
Mean:		14.91	12.77	11.63	10.11	8.63	5.67	2.97	1086.	12.0	0.0	9.2	1.94	169.98
Std. Dev:		2.28	1.99	1.82	1.55	1.29	0.89	0.46	61.	1.2	0.0	0.3	0.59	11.11

Var Coeff(%):		15.27	15.56	15.64	15.29	14.93	15.78	15.39	6.	9.9	0.0	3.3	30.25	6.54	

TTI MODULUS ANALYSIS SYSTEM (SUMMARY REPORT) (Version 5.1)

County: Jones
Highway/Road: I 90 W.B. Survey Section

	Thickness(in)	MODULI RANGE(psi) Minimum	Maximum	Poisson Ratio Values	
Pavement:	6.00	100,000	2,500,000	H1:	= 0.35
Base:	18.00	5,000	500,000	H2:	= 0.35
Subbase:	0.00	0	0	H3:	= 0.35
Subgrade:	227.00	15,000		H4:	= 0.40

	Load	Measured Deflection (mils):							Calculated Moduli values (ksi):				Absolute	Dpth to	
Station	(lbs)	R1	R2	R3	R4	R5	R6	R7	SURF(E1)	BASE(E2)	SUBB(E3)	SUBG(E4)	ERR/Sens	Bedrock	
0.000	6,471	12.02	10.95	9.60	8.49	7.01	4.62	2.26	1246.	7.1	0.0	10.9	1.27	131.91	
0.000	8,671	16.83	15.16	13.43	11.62	9.56	6.45	3.18	1085.	8.6	0.0	9.8	0.61	129.87	
0.000	8,687	16.75	14.90	13.39	11.16	9.29	6.32	3.27	980.	10.6	0.0	9.6	0.34	145.76	
0.000	6,599	12.19	10.16	10.85	8.44	7.05	4.31	1.96	1282.	5.0	0.0	14.0	3.89	***	*
0.000	8,687	16.92	14.64	14.56	11.58	9.74	6.28	3.09	1237.	5.0	0.0	12.5	1.96	123.98	*
0.000	8,727	16.96	14.51	14.47	11.45	9.65	6.32	3.05	1255.	5.0	0.0	12.7	1.99	116.84	*
10.000	6,631	12.61	11.38	10.33	8.10	6.74	4.53	2.26	887.	10.5	0.0	10.5	1.77	122.82	
10.000	8,791	17.76	15.72	14.08	11.28	9.52	6.28	3.14	805.	11.1	0.0	9.7	0.97	130.97	
10.000	8,687	17.51	15.59	14.04	11.24	9.43	6.36	3.22	831.	11.0	0.0	9.5	1.09	132.52	
20.000	6,559	13.16	11.47	10.85	8.87	7.05	4.58	2.26	1070.	5.1	0.0	13.5	1.27	121.88	
20.000	8,687	18.44	15.81	14.56	12.00	9.83	6.36	3.31	866.	8.2	0.0	10.2	0.74	152.36	
20.000	8,703	18.35	15.81	14.47	11.96	9.78	6.41	3.31	815.	9.8	0.0	9.5	0.63	146.66	
30.000	6,391	13.50	11.64	10.33	8.53	6.92	4.58	2.35	691.	12.1	0.0	9.4	0.12	141.65	
30.000	8,727	19.03	16.07	14.43	12.00	9.74	6.58	3.35	616.	14.7	0.0	8.5	0.53	137.66	
30.000	8,679	18.98	16.07	14.43	12.05	9.83	6.58	3.44	648.	13.6	0.0	8.5	0.64	154.00	
40.000	6,383	13.25	11.55	10.68	8.66	7.10	4.79	2.44	843.	10.1	0.0	9.3	0.82	133.75	
40.000	8,695	18.44	15.85	14.90	11.91	10.18	6.76	3.31	841.	10.6	0.0	8.7	1.44	124.64	
40.000	8,767	18.44	15.90	14.86	11.91	10.18	6.76	3.35	892.	9.5	0.0	9.1	1.37	129.04	
50.000	6,415	14.09	12.33	11.11	8.99	7.32	4.79	2.40	730.	9.4	0.0	9.5	0.47	129.96	
50.000	8,687	19.66	17.24	15.81	12.76	10.63	6.89	3.27	810.	7.6	0.0	9.4	0.76	116.20	
50.000	8,671	19.62	17.24	15.85	12.76	10.68	6.89	3.40	850.	6.8	0.0	9.8	0.81	128.40	
60.000	6,495	13.71	12.25	10.77	9.25	7.32	4.92	2.53	840.	9.2	0.0	9.4	1.04	142.67	
60.000	8,703	18.86	17.33	14.73	12.80	10.72	6.97	3.53	896.	8.2	0.0	8.9	1.65	151.90	
60.000	8,671	18.77	17.16	14.73	12.67	10.50	6.89	3.48	856.	8.8	0.0	8.8	1.33	145.41	
70.000	6,455	12.49	11.29	10.33	8.83	7.28	5.32	2.48	1071.	13.3	0.0	7.8	0.85	105.94	
70.000	8,759	17.59	15.68	14.43	12.08	10.01	7.15	3.48	950.	12.9	0.0	7.9	0.65	117.18	
70.000	8,767	17.68	15.81	14.17	12.38	10.23	7.50	3.31	887.	17.3	0.0	7.0	0.75	98.83	
80.000	6,511	12.02	11.03	10.25	8.27	6.70	5.06	2.40	993.	14.6	0.0	8.4	2.61	99.56	
80.000	8,767	17.00	15.16	13.87	11.54	9.60	6.62	3.27	1083.	9.0	0.0	9.6	0.57	124.47	
80.000	8,703	16.88	14.90	13.65	11.45	9.60	6.49	3.22	1055.	9.8	0.0	9.4	0.38	130.15	
90.000	6,527	11.98	10.77	10.33	8.10	7.18	4.53	2.48	1335.	5.0	0.0	13.2	2.36	300.00	*
90.000	8,703	16.62	14.90	14.38	11.54	9.87	6.23	3.61	1259.	5.0	0.0	12.5	2.11	169.93	*
90.000	8,807	16.75	15.03	14.17	11.58	9.87	6.45	3.57	1310.	5.0	0.0	12.3	1.15	207.64	
100.000	6,359	11.94	10.91	9.47	7.98	7.10	4.53	2.22	1077.	10.0	0.0	9.7	2.18	139.92	

100.000	8,695	17.09	15.46	13.43	11.40	10.01	6.45	3.09	1053.	8.9	0.0	9.6	1.81	130.98	
100.000	8,695	17.04	15.46	13.39	11.44	10.01	6.49	3.14	1034.	9.8	0.0	9.2	1.79	134.21	
110.000	6,431	12.28	10.82	9.99	8.32	6.83	4.66	2.13	1053.	9.4	0.0	9.9	0.58	104.64	
110.000	8,687	17.59	15.29	14.30	11.70	10.14	6.84	3.18	950.	11.8	0.0	8.4	1.33	113.04	
110.000	8,687	17.59	15.29	14.30	11.74	10.10	6.89	3.14	912.	13.2	0.0	8.1	1.19	107.60	
120.000	6,343	11.73	10.48	9.95	8.32	7.27	4.71	2.44	1485.	5.0	0.0	11.6	1.54	160.59	*
120.000	8,687	16.71	14.85	13.87	11.74	10.05	6.80	3.53	1341.	6.6	0.0	9.9	0.77	155.56	
120.000	8,711	16.71	14.81	13.87	11.65	10.05	6.71	3.48	1334.	6.4	0.0	10.2	1.03	156.80	
130.000	6,527	12.53	11.25	10.07	8.61	7.28	5.14	2.61	968.	15.3	0.0	7.9	0.34	138.40	
130.000	8,671	17.72	15.90	14.13	12.21	10.27	7.32	3.79	856.	16.4	0.0	7.2	0.52	149.10	
130.000	8,695	17.63	15.85	14.04	12.16	10.27	7.32	3.61	879.	16.3	0.0	7.2	0.56	128.68	
140.000	6,623	12.36	11.12	10.16	9.12	7.59	5.10	2.66	1529.	5.1	0.0	10.9	1.26	165.30	
140.000	8,711	17.42	15.46	14.13	12.54	10.50	7.15	3.70	1311.	6.7	0.0	9.1	1.16	159.38	
140.000	8,711	17.34	15.46	14.08	12.50	10.45	7.15	3.66	1283.	7.4	0.0	8.8	1.06	151.93	
150.000	6,391	12.40	11.34	10.07	8.66	7.36	5.14	2.66	1092.	11.6	0.0	8.2	0.66	151.38	
150.000	8,703	17.42	15.85	14.13	12.12	10.36	7.28	3.75	983.	14.0	0.0	7.5	0.69	149.31	
150.000	8,743	17.47	15.85	14.17	12.16	10.41	7.37	3.83	967.	15.1	0.0	7.3	0.61	153.45	
160.000	6,519	12.78	11.51	10.59	8.61	7.68	5.36	2.57	994.	14.8	0.0	7.6	1.34	300.00	
160.000	8,695	18.06	15.94	14.64	12.16	10.54	7.28	3.70	885.	14.1	0.0	7.5	0.83	142.48	
160.000	8,679	18.06	15.98	14.60	12.12	10.54	7.28	3.61	889.	13.8	0.0	7.5	0.77	132.60	
170.000	6,543	13.16	11.90	10.98	8.74	7.41	5.14	2.31	937.	10.6	0.0	8.7	1.56	99.63	
170.000	8,815	17.93	16.24	14.73	12.08	10.27	7.06	3.61	1032.	8.6	0.0	9.0	0.97	139.90	
170.000	8,807	17.89	16.33	14.69	12.04	10.27	7.02	3.57	1029.	8.4	0.0	9.1	1.08	138.52	
180.000	6,511	12.49	10.94	10.20	8.49	7.27	4.97	2.48	1038.	12.6	0.0	8.5	0.95	132.67	
180.000	8,855	17.21	14.85	13.78	11.66	9.92	6.80	3.44	974.	14.1	0.0	8.2	0.97	140.07	
180.000	8,783	17.04	14.68	13.52	11.58	9.83	6.71	3.40	974.	14.3	0.0	8.3	1.12	143.01	
190.000	6,567	12.11	10.73	10.20	8.32	7.27	4.88	2.53	1235.	9.5	0.0	9.3	1.51	151.48	
190.000	8,791	16.45	14.64	13.87	11.32	10.01	6.76	3.27	1323.	8.0	0.0	9.4	1.49	124.04	
190.000	8,759	16.66	14.85	14.00	11.57	10.27	7.15	3.70	1166.	13.5	0.0	7.7	1.35	151.51	
200.000	6,679	12.07	10.91	9.99	7.77	6.69	4.66	2.57	913.	14.6	0.0	9.5	1.99	300.00	
200.000	8,791	16.75	14.98	13.48	11.11	9.47	6.58	3.40	896.	15.1	0.0	8.5	0.71	144.03	
200.000	8,799	16.66	14.90	13.39	11.07	9.43	6.54	3.31	905.	15.1	0.0	8.6	0.65	135.01	
210.000	6,487	11.90	10.52	9.51	7.94	6.65	4.66	2.35	905.	16.6	0.0	8.8	0.28	130.86	
210.000	8,759	16.54	14.59	13.18	11.07	9.52	6.84	3.40	816.	21.8	0.0	7.5	0.38	127.45	
210.000	8,775	16.50	14.55	13.18	11.07	9.52	6.84	3.40	839.	21.3	0.0	7.6	0.34	127.34	
220.000	6,439	12.57	10.86	10.42	8.19	7.05	4.84	2.48	933.	12.6	0.0	8.8	1.66	135.61	
220.000	8,807	17.59	15.20	14.43	11.45	9.87	6.76	3.40	904.	12.6	0.0	8.6	1.53	130.30	
220.000	8,807	17.51	15.16	14.26	11.33	9.87	6.67	3.40	879.	13.3	0.0	8.6	1.56	300.00	
230.000	6,415	12.66	11.38	10.33	8.27	7.36	4.66	2.53	994.	8.9	0.0	9.8	1.93	300.00	
230.000	8,807	17.93	16.11	14.17	11.70	10.41	6.45	3.35	939.	8.9	0.0	9.6	2.09	160.27	
230.000	8,767	17.85	16.11	14.04	11.65	10.41	6.54	3.44	945.	9.3	0.0	9.3	2.17	184.82	
240.000	6,479	12.83	11.38	10.25	8.44	7.32	4.66	2.40	973.	9.2	0.0	9.8	1.13	157.38	
240.000	8,767	18.27	16.11	14.38	11.99	10.27	6.71	3.48	914.	9.3	0.0	9.2	0.91	159.97	
240.000	8,743	18.23	16.07	14.30	11.91	10.23	6.67	3.44	868.	10.4	0.0	8.9	1.01	157.25	
250.000	6,519	13.16	11.17	9.95	8.74	7.32	4.92	2.48	773.	16.9	0.0	8.1	1.92	146.00	
250.000	8,687	17.72	15.51	13.91	12.25	10.10	6.84	3.44	1004.	10.2	0.0	8.6	1.19	141.64	
250.000	8,663	17.68	15.42	13.78	12.08	10.14	6.80	3.40	945.	11.8	0.0	8.3	1.41	142.51	
Mean:		15.93	14.10	12.88	10.71	9.07	6.12	3.08	997.	10.8	0.0	9.2	1.17	137.87	

		R1	R2	R3	R4	R5	R6	R7	SURF(E1)	BASE(E2)	SUBB(E3)	SUBG(E4)	ERR/Sens	Dpth to Bedrock
Std. Dev:		2.48	2.17	1.92	1.64	1.41	0.98	0.50	185.	3.8	0.0	1.5	0.63	26.86
Var Coeff(%):		15.59	15.39	14.88	15.31	15.51	15.94	16.40	19.	34.6	0.0	15.9	54.17	19.48

TTI MODULUS ANALYSIS SYSTEM (SUMMARY REPORT) (Version 5.1)

County: Spink
Highway/Road: US 212 Test Pit
Original Location
No PIP Found

	Thickness(in)	MODULI RANGE(psi) Minimum	Maximum	Poisson Ratio Values	
Pavement:	4.50	100,000	2,500,000	H1:	= 0.35
Base:	4.50	5,000	500,000	H2:	= 0.35
Subbase:	4.50	4,000	1,000,000	H3:	= 0.35
Subgrade:	226.50	15,000		H4:	= 0.40

Station	Load (lbs)	Measured Deflection (mils): R1	R2	R3	R4	R5	R6	R7	Calculated Moduli values (ksi): SURF(E1)	BASE(E2)	SUBB(E3)	SUBG(E4)	Absolute ERR/Sens	Dpth to Bedrock
0.000	6,415	16.79	11.90	9.16	6.19	4.42	2.83	1.79	249.	14.4	48.3	14.2	1.49	95.20
0.000	8,959	21.64	15.85	12.35	8.52	6.20	3.92	2.44	322.	12.5	100.3	14.2	1.09	126.49
0.000	8,943	21.43	15.68	12.27	8.52	6.16	3.92	2.48	322.	14.5	63.4	14.3	1.12	113.57
0.000	6,519	16.54	11.86	9.20	6.23	4.51	2.83	1.79	274.	14.3	51.5	14.3	1.21	115.77
0.000	8,927	21.26	15.64	12.22	8.52	6.20	3.97	2.44	317.	16.0	55.8	14.2	1.27	126.21
0.000	8,927	21.26	15.64	12.22	8.48	6.20	3.97	2.48	321.	14.7	70.2	14.1	1.28	137.43
0.000	6,511	16.41	11.81	9.11	6.19	4.51	2.83	1.79	276.	14.4	54.3	14.3	1.19	129.58
0.000	8,967	21.22	15.59	12.18	8.48	6.20	3.92	2.44	339.	12.3	121.2	14.2	0.89	138.97
0.000	8,951	21.18	15.59	12.22	8.52	6.20	3.97	2.48	329.	14.9	66.9	14.2	1.20	126.06
0.000	6,479	16.37	11.77	9.16	6.27	4.55	2.88	1.83	276.	14.9	53.7	14.1	1.17	120.60
0.000	8,959	21.18	15.59	12.18	8.52	6.20	3.97	2.48	330.	14.2	80.6	14.1	1.10	126.45
0.000	8,959	21.14	15.55	12.18	8.48	6.16	3.92	2.44	337.	13.0	98.8	14.2	1.04	122.57
Mean:		19.70	14.37	11.20	7.74	5.63	3.58	2.24	308.	14.2	72.1	14.2	1.17	125.35
Std. Dev:		2.35	1.88	1.51	1.13	0.83	0.54	0.33	30.	1.1	23.4	0.1	0.15	12.72
Var Coeff(%):		11.93	13.05	13.50	14.53	14.82	15.19	14.53	10.	7.6	32.4	0.6	12.55	10.15

TTI MODULUS ANALYSIS SYSTEM (SUMMARY REPORT) (Version 5.1)

County: Spink
Highway/Road: US 212 Survey Section
Orig. Sample Location
No PIP Found

	Thickness(in)	MODULI RANGE(psi) Minimum	Maximum	Poisson Ratio Values	
Pavement:	4.50	100,000	2,500,000	H1:	= 0.35
Base:	4.50	5,000	500,000	H2:	= 0.35
Subbase:	4.50	4,000	1,000,000	H3:	= 035
Subgrade:	202.60	15,000		H4:	= 0.40

Station	Load (lbs)	Measured Deflection (mils): R1	R2	R3	R4	R5	R6	R7	Calculated Moduli values (ksi): SURF(E1)	BASE(E2)	SUBB(E3)	SUBG(E4)	Absolute ERR/Sens	Dpth to Bedrock
0.000	6,415	17.72	12.65	9.30	6.02	4.24	2.75	1.74	228.	10.7	71.5	14.5	2.81	80.66
0.000	8,855	23.08	16.68	12.45	8.27	5.98	3.88	2.48	252.	11.2	121.8	14.1	2.35	111.05
0.000	8,887	23.03	16.63	12.45	8.27	5.98	3.88	2.48	245.	14.2	52.2	14.2	2.46	110.96
10.000	6,399	17.89	12.56	9.60	6.44	4.78	3.01	1.83	224.	11.2	132.9	12.8	1.20	135.85

10.000	8,847	22.65	16.33	12.45	8.53	6.29	4.05	2.53	259.	12.7	127.6	13.3	1.49	166.94	
10.000	8,855	22.44	16.11	12.32	8.53	6.34	4.10	2.48	255.	13.5	133.1	13.2	1.30	178.71	
20.000	6,391	18.73	13.04	9.77	6.44	4.60	2.96	1.92	207.	9.9	119.8	13.2	1.88	95.21	
20.000	8,815	23.63	17.07	13.06	8.87	6.47	4.05	2.66	264.	11.1	109.4	13.1	1.23	127.95	
20.000	8,831	23.08	16.72	12.80	8.70	6.34	3.97	2.53	260.	15.0	46.1	13.6	1.45	127.97	
30.000	6,375	18.65	12.65	9.12	6.02	4.37	3.05	1.87	161.	11.7	134.5	13.4	3.10	115.27	
30.000	8,775	24.05	16.50	12.15	8.32	6.16	4.27	2.66	204.	8.7	1000.0	13.1	1.91	178.80	*
30.000	8,807	23.54	16.29	12.06	8.27	6.07	4.18	2.57	220.	8.6	1000.0	13.4	1.84	144.54	*
40.000	6,663	11.86	8.00	6.22	4.58	3.79	3.14	1.83	192.	30.1	1000.0	14.9	4.33	300.00	*
40.000	9,079	15.48	10.65	8.48	6.32	5.36	4.27	2.44	210.	34.3	1000.0	14.3	3.52	300.00	*
40.000	9,111	15.40	10.82	8.61	6.41	5.36	4.10	2.44	250.	30.4	1000.0	14.5	2.73	300.00	*
50.000	6,591	12.37	8.13	6.70	4.70	3.93	3.09	1.87	193.	26.7	1000.0	14.4	4.12	300.00	*
50.000	9,047	15.95	10.95	8.87	6.53	5.40	4.18	2.53	230.	29.1	1000.0	14.2	2.94	300.00	*
50.000	9,063	15.78	11.09	8.74	6.53	5.40	4.10	2.48	248.	28.0	1000.0	14.4	2.54	300.00	*
60.000	6,575	12.84	8.83	6.84	5.09	4.11	3.27	1.87	205.	23.9	1000.0	13.6	3.38	300.00	*
60.000	9,055	16.37	11.61	9.12	6.88	5.67	4.31	2.53	247.	26.6	1000.0	13.6	2.48	221.11	*
60.000	9,023	16.16	11.43	8.99	6.74	5.62	4.23	2.53	246.	27.1	1000.0	13.8	2.38	300.00	*
70.000	6,583	14.73	9.91	8.16	5.64	4.60	3.05	2.05	184.	27.8	138.0	13.6	1.98	300.00	
70.000	9,007	18.10	13.33	10.94	7.94	6.29	4.53	2.57	361.	15.8	1000.0	12.3	1.81	177.42	*
70.000	8,991	17.93	13.26	9.82	7.81	6.29	4.36	2.57	274.	19.4	1000.0	12.6	1.60	300.00	*
80.000	6,551	13.26	9.48	7.57	5.72	4.64	3.27	1.87	238.	27.5	367.6	12.5	1.15	209.04	
80.000	9,039	17.17	12.73	10.38	8.02	6.52	4.53	2.61	299.	33.7	253.7	12.2	0.62	227.80	
80.000	9,039	17.00	12.64	10.29	8.02	6.52	4.58	2.48	319.	28.6	453.3	11.9	0.54	156.47	
90.000	6,567	13.21	9.43	7.70	5.72	4.64	3.23	1.96	270.	23.8	480.2	12.5	1.05	300.00	
90.000	9,055	17.38	12.68	10.51	8.15	6.56	4.53	2.44	256.	42.1	173.4	12.4	0.59	154.03	
90.000	9,055	17.17	12.55	10.42	8.10	6.52	4.49	2.48	251.	46.4	153.8	12.6	0.58	174.03	
100.000	6,583	12.54	9.35	7.57	5.68	4.55	3.18	1.74	334.	27.3	275.4	12.8	1.21	157.23	
100.000	8,991	16.50	12.55	10.33	7.89	6.29	4.40	2.48	382.	31.4	215.7	12.6	1.00	184.13	
100.000	9,031	16.37	12.46	10.29	7.89	6.29	4.36	2.44	443.	21.7	631.1	12.3	0.56	178.70	
110.000	6,591	11.86	8.83	7.05	5.30	4.28	3.05	1.79	376.	20.1	1000.0	13.3	1.26	239.95	*
110.000	9,087	15.99	12.13	9.77	7.55	6.11	4.31	2.53	409.	21.7	1000.0	12.6	0.84	253.13	*
110.000	9,135	15.86	12.00	9.77	7.60	6.16	4.31	2.53	389.	29.6	434.7	12.8	0.63	258.48	
120.000	6,599	11.32	8.31	6.74	5.09	4.19	3.05	1.79	342.	25.7	957.6	13.3	1.50	234.82	
120.000	9,047	14.81	11.13	9.12	7.05	5.71	4.14	2.44	402.	27.0	936.7	13.2	1.11	243.98	
120.000	9,079	14.68	11.04	9.12	6.99	5.71	4.14	2.40	420.	26.8	987.5	13.2	1.20	211.19	
130.000	6,543	10.98	7.91	6.22	4.79	3.93	2.83	1.74	295.	28.0	963.3	14.3	1.40	300.00	
130.000	9,039	14.39	10.56	8.61	6.70	5.53	4.05	2.40	347.	31.6	1000.0	13.6	1.10	258.35	*
130.000	9,071	14.26	10.48	8.61	6.70	5.58	4.05	2.40	340.	36.2	766.8	13.6	1.00	265.21	
140.000	6,551	10.43	7.52	6.09	4.70	3.93	2.96	1.83	288.	35.4	1000.0	13.9	1.86	300.00	*
140.000	9,103	13.84	10.13	8.39	6.57	5.49	4.05	2.44	334.	39.6	867.2	13.7	1.16	300.00	
140.000	9,079	13.71	10.13	8.35	6.57	5.49	4.10	2.44	345.	38.5	1000.0	13.5	1.32	262.14	*
150.000	6,767	11.23	8.13	6.57	5.26	4.37	3.23	1.83	275.	35.5	1000.0	12.8	1.16	188.73	*
150.000	9,047	14.43	10.78	8.78	7.05	5.85	4.23	2.40	365.	33.2	1000.0	12.7	0.66	194.88	*
150.000	9,111	14.34	10.74	8.78	7.05	5.80	4.23	2.44	341.	42.5	540.0	13.2	0.97	212.87	
160.000	6,583	10.30	7.61	6.13	4.66	3.88	2.92	1.70	347.	31.8	1000.0	14.1	2.13	204.85	*
160.000	9,095	13.67	10.13	8.30	6.41	5.36	3.97	2.31	370.	35.1	1000.0	14.0	1.50	211.76	*
160.000	9,063	13.54	10.13	8.30	6.49	5.36	4.01	2.40	392.	35.2	1000.0	13.8	1.46	268.99	*
170.000	6,599	10.18	7.65	6.26	4.83	3.97	2.88	1.70	410.	32.5	741.8	13.9	1.19	245.70	
170.000	9,039	13.67	10.35	8.56	6.74	5.58	4.05	2.35	409.	38.0	685.9	13.4	0.88	217.91	

170.000	9,063	13.63	10.30	8.52	6.70	5.58	4.05	2.35	422.	34.1	1000.0	13.3	0.83	218.67	*
180.000	6,591	10.85	7.65	6.22	4.83	3.97	2.96	1.65	265.	33.8	1000.0	13.9	1.48	162.48	*
180.000	9,015	14.34	10.30	8.52	6.70	5.53	4.05	2.31	297.	37.4	878.4	13.6	0.96	191.73	
180.000	9,039	14.22	10.22	8.48	6.70	5.49	4.05	2.31	298.	38.6	873.6	13.6	1.02	188.47	
190.000	6,543	11.40	8.04	6.65	4.83	4.19	3.05	1.57	266.	29.0	1000.0	13.5	2.09	300.00	*
190.000	9,007	14.68	10.74	8.95	6.66	5.67	4.10	2.26	351.	29.5	1000.0	13.4	1.54	300.00	*
190.000	9,007	14.64	10.61	8.56	6.57	5.44	3.97	2.31	315.	30.4	1000.0	14.0	1.34	218.87	*
200.000	6,519	12.75	8.87	7.01	5.13	4.15	2.92	1.65	256.	19.6	1000.0	13.9	1.24	184.31	*
200.000	8,943	16.79	11.91	9.51	7.13	5.76	4.05	2.35	287.	21.1	1000.0	13.6	0.86	225.22	*
200.000	8,999	16.71	11.91	9.51	7.20	5.80	4.14	2.44	294.	21.9	1000.0	13.4	0.98	254.01	*
210.000	6,567	12.62	8.78	7.01	5.21	4.24	2.96	1.74	257.	21.1	1000.0	13.7	0.85	257.92	*
210.000	8,943	16.58	11.69	9.47	7.16	5.76	4.01	2.35	226.	39.7	206.0	14.1	1.09	249.76	
210.000	8,975	16.50	11.74	9.51	7.20	5.80	4.10	2.40	298.	22.6	979.8	13.4	0.81	241.18	
220.000	6,567	12.03	8.26	6.66	5.21	4.46	3.01	1.70	183.	38.8	544.8	13.3	0.79	218.85	
220.000	9,023	15.90	11.48	9.25	7.21	6.07	4.14	2.40	300.	26.8	1000.0	12.9	0.63	255.51	*
220.000	8,983	15.74	11.43	9.17	7.17	6.07	4.14	2.26	281.	32.4	631.2	13.0	0.82	171.63	
230.000	6,503	11.61	7.91	6.57	4.96	4.11	2.96	1.61	199.	39.0	488.5	13.9	1.71	151.59	
230.000	8,983	15.27	10.78	9.04	6.91	5.76	4.14	2.31	270.	34.0	802.7	13.2	1.25	172.87	
230.000	9,015	15.15	10.82	8.99	6.82	5.62	4.01	2.26	297.	32.9	659.7	13.8	1.18	180.47	
240.000	6,551	11.44	8.09	6.44	4.87	3.97	2.88	1.79	278.	25.8	1000.0	14.2	1.39	300.00	*
240.000	9,007	15.19	10.87	8.78	6.70	5.49	4.01	2.40	299.	28.2	1000.0	13.9	1.34	284.77	*
240.000	9,007	14.98	10.74	8.69	6.61	5.49	4.01	2.40	297.	29.7	1000.0	13.9	1.44	287.62	*
250.000	6,527	11.82	8.57	6.74	5.04	4.15	3.05	1.87	291.	23.5	1000.0	13.5	2.01	300.00	*
250.000	9,007	15.31	11.43	9.17	6.99	5.71	4.23	2.35	361.	25.3	1000.0	13.2	1.79	159.17	*
250.000	9,023	15.23	11.39	9.12	6.99	5.71	4.18	2.44	371.	25.2	1000.0	13.3	1.55	222.78	*
Mean:		15.40	11.09	8.85	6.60	5.31	3.78	2.22	293.	27.2	732.5	13.4	1.53	216.15	
Std. Dev:		3.38	2.42	1.74	1.16	0.84	0.56	0.32	67.	9.0	352.8	0.6	0.81	77.24	
Var Coeff(%):		21.97	21.84	19.68	17.53	15.81	14.82	14.60	23.	33.0	48.2	4.6	52.73	35.73	

Task 6 - Plan Notes

PLAN NOTES
P-0018( )373
HUTCHINSON COUNTY

SPECIFICATIONS

Standard specifications for Roads and Bridges, 1990 Edition, and Required Provisions, Supplemental Specifications and/or Special Provisions as included in the proposal.

SURFACING THICKNESS DIMENSIONS

Except as hereinafter set forth, planned tonnages will be applied even though the thickness may vary from that shown on the plans.

The thickness of the layers above the remaining aggregate base will have a tolerance of 0.5 inch on thickness, not on interface elevation, for the recycled base materials.

TEST SECTIONS

This project contains 18 test sections that are to be constructed for the purpose of investigating the properties and performance of recycled asphalt used in an unbound aggregate base. The test sections include three methods of utilizing asphalt in unbound aggregate bases, three blend levels, and two levels of compactive effort.

Each test section shall be a minimum of 750 feet long. A 500-foot monitoring section shall be included within the section starting 150 feet from one end.

The test sections to be constructed are identified and numbered according to the following table.

		Percent Asphalt					
		25		50		75	
Compaction Effort		L	H	L	H	L	H
Processing Methods	Single Stage	1	2	3	4	5	6
	Two Stage	7	8	9	10	11	12
	Salvage	13	14	15	16	17	18

Definitions

Single Stage includes any equipment that are included in the general category of reclaimers. A reclaimer is a horizontal shaft-mounted rotor equipped with replaceable carbide-topped cutting tools.

The reclaimer should be capable of a maximum cutting/mixing depth of 10 inches. The rotor must turn such that the tools are cutting in an upward direction.

Two Stage includes milling equipment that has a secondary process of controlling the maximum gradation of the millings.

Salvage is a blend of aggregate and millings. The aggregate may be a virgin aggregate, or may be existing base taken from the project if the Engineer approves.

Compaction Effort is divided into two levels. The high (H) compaction effort is the rolling pattern based on the control strip method. The low (L) compaction effort is the rolling pattern that results in 95 percent of the final density obtained in the control strip. The compaction process is described as follows:

Compaction and density requirements shall be established by monitoring the density of the high (H) compactive section. The density shall be achieved by a rolling pattern approved by the Engineer. The Engineer will use a nuclear meter to establish a density growth curve. The rolling shall cease whenever four consecutive passes of the roller do not increase the density one pound per cubic foot. In the event of pumping or the development of soft spots during rolling, the subgrade soil in the problem areas must be corrected by drying the soils to less than 4 percent above optimum and recompacting the soil to a density that is similar to the adjoining subgrade soils.

The low (L) compactive section will be rolled using the pattern and number of passes that resulted in 95 percent of the density achieved on the high compactive section.

At the time of compaction, the material shall have approximately 4 percent moisture uniformly blended throughout the depth of the material. The percent moisture may be adjusted by the Engineer, provided the moisture content is approximately the same for both the low (L) and high (H) density sections.

Rollers shall be pneumatic tired, with an effective roller weight of at least 250 pounds per inch of tire width. A vibratory drum roller may be used subject to approval by the Engineer.

Compaction should be in two 4-inch lifts.

Percent Asphalt is the amount of pulverized, milled, or salvage asphalt, by weight, contained in the material.

The three blends shall be achieved by milling off sufficient asphalt to provide the target blend. For the one- and two-stage equipment, the 75 percent blend will consist of a single pass at about an 8-inch depth. The 50 percent blend will require that 3 inches of asphalt be milled off and a single pass at a 6-inch depth will be made. Sufficient volume of material must be processed to construct an 8-inch layer. The 25 percent blend will require that 5 inches of asphalt be milled off, leaving 1.5 inches of asphalt. The depth of cut for pulverizing should be set for 6 inches. Sufficient volume of material must be processed to construct an 8-inch layer in the test section.

All milled asphalt concrete material shall be stockpiled at a Contractor-furnished site for use in the salvage sections. Salvage blends will be processed by blending asphalt millings with virgin aggregate to the three percentages. The tolerance for all three blends is ± 5 percent of the asphalt component; for instance, the 25 percent blend may vary between 20 and 30 percent.

The asphalt mix and granular material shall be processed to provide a nominal 1-inch maximum size. A tolerance of 5 percent in material retained on a 1-inch sieve will be permitted, provided all material passes a 1½-inch sieve.

The placement of the recycled layer on any individual test section shall be completed in one working day.

TYPE II FIELD LABORATORY

The contractor will be required to furnish, activate and pay monthly billings on a telephone located in the Field Laboratory. The telephone is intended for project business only and will remain on the property of the Contractor at the completion of the project. Cost for the telephone service shall be included in the contract lump sum for Type II Field Laboratory. The Laboratory shall also include additional laboratory test equipment, as listed below.

- Proctor Equipment
- Gradation Equipment
- Ovens
- Electronic balances, (0.001 g readable)
- Extraction Equipment and ventilated hood and muffle furnace or ignition oven.
- Sand Cone Test Equipment
- Six-foot straightedge

RESEARCH - TEST SECTIONS

Test sections will be constructed as part of this project to evaluate the performance of Process In Place (PIP) or salvage process methods, blends, and compaction efforts. Section 2 is the typical section used for the construction of the test sections. The blended materials will be produced by three methods:

1. Process in Place with a single stage reclaimer (PIP SS).

2. Process in Place with a two stage machine that grinds up the existing asphalt with a rotating drum and sizes the material with a crushing device (PIP TS).

3. Collecting the millings from a milling machine, hauling the millings to a storage facility where it is blended to the appropriate proportions of millings and virgin aggregate and placed as an aggregate base (SALVAGE).

Three blends will be constructed for evaluation: 25 percent RAP; 50 percent RAP; and 75 percent RAP. Each of these three blends will be compacted at two levels, 100 percent test strip density and 95 percent test strip density.

LOCATION OF TEST SECTIONS

The test sections will be constructed in the West Bound Lane between MRM 375.9 and 379. Test section designations are SS for single stage PIP, TS for two stage PIP, SAL for salvage, and CS for control sections.

Each Test Section will be constructed 750 feet in length. The following table identifies the location of the sections.

Test Section	Beg. MRM	Process	Percent RAP	Compaction
SS1	375.900	PIP SS	75%	100%
SS2	376.042	PIP SS	75%	95%
SS3	376.184	PIP SS	50%	100%
SS4	376.326	PIP SS	50%	95%
SS5	376.468	PIP SS	25%	100%
SS6	376.610	PIP SS	25%	95%
TS1	376.752	PIP TS	75%	100%
TS2	376.894	PIP TS	75%	95%
TS3	377.036	PIP TS	50%	100%
TS4	377.178	PIP TS	50%	95%
TS5	377.320	PIP TS	25%	100%
TS6	377.462	PIP TS	25%	95%
CS1	377.605	Base Course	—	97%
SAL1	377.747	SALVAGE	75%	100%
SAL2	377.889	SALVAGE	75%	95%
SAL3	378.031	SALVAGE	50%	100%
SAL4	378.173	SALVAGE	50%	95%
SAL5	378.315	SALVAGE	25%	100%
SAL6	378.457	SALVAGE	25%	95%
CS2	378.599	Base Course	—	97%

RESEARCH PROCESSING TEST SECTIONS

Research Processing Test Sections (PIP SS and PIP TS) shall consist of processing and blending the inplace asphalt mix, inplace granular material and virgin material necessary to get the appropriate blend for each test section. The processed material shall be placed in two equal lifts.

The typical sections shall be finished to the crossslope shown on the typical section +/- 0.2%. The quarter crown within any 12 foot lane (or the actual lane width paved with a single paver pass) shall not exceed 0.5 inch (0.04 feet) when measured with a straightedge, stringline, or other suitable equipment.

The asphalt mix and granular material shall be processed to provide a nominal 1 inch maximum size. A tolerance of five percent in material retained on a 1 inch sieve will be permitted, provided all material passes a 1 1/2 inch sieve.

At the time of compaction the processed material may require an additional 4% of moisture be uniformly blended throughout the depth of material. The percent moisture may be adjusted by the Engineer. Included in the Estimate of Quantities are ____ M.Gal./per mile for Water for Granular Material for watering, shaping and compacting the material to the typical section.

Compaction and density for the PIP SS and PIP TS test sections shall be a minimum of 100 percent or 95 percent of the target density according to the requirement in the Table of Test Locations. The target density shall be established in accordance with Test No SD219 and compacted under the following conditions:

1. A minimum of one test strip for each lift placed shall be completed to determine the target density and optimum rolling sequence. The test strips will remain in place as part of the completed work.

2. The depth of the test strip lift shall be representative of the project.

3. Rollers shall be either pneumatic tired, with an effective roller weight of at least 250 pounds per inch of roller width, or satisfactory vibratory compaction equipment.

4. When there is a significant change in the mix proportions, weather conditions, or other controlling factors, the Engineer may require construction of another test strip(s) to check target density.

Smoothness of the surface shall be to the satisfaction of the Engineer.

Payment for Research Processing of the Test Sections will be paid for at the contract unit price per square yard, inclusive of all costs for processing, shaping, compacting, equipment, labor and incidentals necessary to satisfactorily complete the work.

RESEARCH SALVAGING TEST SECTIONS

Research Salvage Test Sections (SAL) shall consist of removing the asphalt by milling and salvaging the inplace granular according to the typical section , stockpiling, and blending with virgin base course resulting in three blended Salvage stockpiles: 25 percent millings, 50 percent millings, and 75 percent millings on the basis of dry weight. The contractor shall employ stockpiling and blending procedures to assure uniformity of material and blending percentages, subject to the approval of the engineer. The salvage materials shall be placed in two equal lifts.

Compaction and density for the salvage test sections shall be a minimum of 100 percent or 95 percent of the target density according to the requirement in the Table of Test Locations. The target density shall be established in accordance with Test No SD219 and compacted under the following conditions:

1. A minimum of one test strip for each lift placed shall be completed to determine the target density and optimum rolling sequence. The test strips will remain in place as part of the completed work.

2. The depth of the test strip lift shall be representative of the project.

3. Rollers shall be either pneumatic tired, with an effective roller weight of at least 250 pounds per inch of roller width, or satisfactory vibrator compaction equipment.

4. When there is a significant change in the mix proportions, weather conditions, or other controlling factors, the Engineer may require construction of another test strip(s) to check target density.

Smoothness of the surface shall be to the satisfaction of the Engineer.

Payment for Research Salvaging of the Test Sections will be paid for at the contract price per square yard, inclusive of all costs for salvaging, processing, shaping, compacting, equipment, labor and incidentals necessary to satisfactorily complete the work.

CONTROL TEST SECTIONS

Two control sections (CS) are included and will be constructed with 8.5 inches of Base Course and compacted according to the Standard Specifications.

Payment for constructing, compacting, equipment, labor and incidentals necessary to satisfactorily complete the work in the control section shall be included in the price bid for Base Course.

Task 8 – FWD Deflections and Backcalculation Results

Table A - 2. 1999 Deflection Data and Backcalculated Moduli for Test Sections.

Section	Proj. Sta.	Sect. Sta., m	Time	Temperature, C Pvm't	Temperature, C Air	Load, N	Deflections, um D_1	D_2	D_3	D_4	D_5	D_6	D_7	Moduli, MPa E_{ac}	E_{base}	$E_{subgrade}$	Fit,%
Cs2	218+00	0.00	12:12	68.9	34.4	26,471	634	419	334	201	139	83	57	2,287	93	73	3.454
Cs2	218+00	0.00	12:12	68.9	34.4	37,143	958	654	521	321	215	127	85	2,572	79	67	3.099
Cs2	218+00	0.00	12:12	68.9	34.4	37,232	958	662	529	321	219	129	87	2,673	77	66	3.167
Cs2	217+50	15.24	12:14	70.0	34.4	25,426	556	367	295	189	136	89	66	1,793	135	69	2.397
Cs2	217+50	15.24	12:14	70.0	34.4	37,623	854	585	473	303	213	135	95	2,453	112	66	2.497
Cs2	217+50	15.24	12:14	70.0	34.4	37,832	855	583	473	305	216	137	96	2,363	116	66	2.548
Cs2	217+00	30.48	12:15	70.6	34.4	26,133	789	530	406	253	168	96	70	2,026	67	61	3.119
Cs2	217+00	30.48	12:15	70.6	34.4	36,987	1175	824	638	386	260	147	106	2,298	57	56	3.046
Cs2	217+00	30.48	12:15	70.6	34.4	37,018	1173	830	650	384	261	151	105	2,334	57	56	3.075
Cs2	216+50	45.72	12:15	70.6	34.4	25,711	604	415	333	223	157	98	68	2,343	113	62	2.398
Cs2	216+50	45.72	12:15	70.6	34.4	37,089	932	655	532	347	246	151	104	2,637	96	57	2.700
Cs2	216+50	45.72	12:15	70.6	34.4	37,654	938	664	542	353	251	154	107	2,788	96	57	2.702
Cs2	216+00	60.96	12:16	71.1	33.9	25,800	710	489	391	251	175	107	71	2,177	87	56	2.625
Cs2	216+00	60.96	12:16	71.1	33.9	36,827	1053	750	601	383	268	163	111	2,495	77	53	2.554
Cs2	216+00	60.96	12:16	71.1	33.9	36,791	1065	766	616	388	275	166	116	2,592	74	52	2.683
Cs2	215+50	76.20	12:17	71.1	34.4	25,551	726	498	392	247	167	101	68	2,197	76	58	2.394
Cs2	215+50	76.20	12:17	71.1	34.4	36,226	1098	776	617	384	260	155	104	2,450	65	54	2.526
Cs2	215+50	76.20	12:17	71.1	34.4	36,791	1109	782	625	393	268	161	107	2,423	68	53	2.558
Cs2	215+00	91.44	12:18	71.1	35.0	25,164	754	525	413	264	182	112	74	2,057	76	52	2.195
Cs2	215+00	91.44	12:18	71.1	35.0	36,418	1166	842	668	417	289	170	121	2,459	61	49	2.649
Cs2	215+00	91.44	12:18	71.1	35.0	36,649	1170	850	676	424	294	175	121	2,538	61	49	2.492
Cs2	214+50	106.68	12:19	71.7	33.9	26,329	720	485	388	253	179	112	75	1,840	97	55	2.573
Cs2	214+50	106.68	12:19	71.7	33.9	36,613	1047	726	584	380	270	166	114	2,065	88	51	2.664
Cs2	214+50	106.68	12:19	71.7	33.9	36,809	1066	739	596	394	279	171	117	2,036	89	50	2.637
Cs2	214+00	121.92	12:19	72.2	33.9	25,995	683	473	374	234	162	98	68	2,376	84	61	2.652
Cs2	214+00	121.92	12:19	72.2	33.9	36,845	1033	736	588	369	256	154	106	2,560	75	55	2.578
Cs2	214+00	121.92	12:19	72.2	33.9	36,542	1021	729	582	370	260	156	109	2,606	77	55	2.683
Cs2	213+50	137.16	12:20	72.2	34.4	25,003	657	449	361	236	164	102	71	2,154	96	57	2.543
Cs2	213+50	137.16	12:20	72.2	34.4	37,125	1049	744	600	384	268	164	112	2,508	79	53	2.619
Cs2	213+50	137.16	12:20	72.2	34.4	37,267	1051	752	609	387	273	166	113	2,578	78	52	2.626
Cs2	213+00	152.40	12:21	72.2	34.4	26,240	612	406	329	221	157	100	70	1,781	129	62	2.539
Cs2	213+00	152.40	12:21	72.2	34.4	37,054	904	625	506	327	236	149	104	2,230	109	59	2.738
Cs2	213+00	152.40	12:21	72.2	34.4	37,232	900	631	510	328	237	149	107	2,451	106	59	2.610
Cs2	212+50	167.64	12:22	72.2	33.9	26,347	585	420	333	204	153	97	70	2,636	112	66	2.904
Cs2	212+50	167.64	12:22	72.2	33.9	37,690	885	646	514	315	234	148	102	2,775	100	62	2.913
Cs2	212+50	167.64	12:22	72.2	33.9	37,107	867	631	505	316	234	148	103	2,827	103	60	2.567
Cs2	212+00	182.88	12:24	71.7	33.3	26,062	651	434	344	216	150	93	64	2,035	98	66	2.569
Cs2	212+00	182.88	12:24	71.7	33.3	37,125	963	665	528	327	228	140	99	2,337	87	62	2.668
Cs2	212+00	182.88	12:24	71.7	33.3	37,690	976	677	539	335	234	143	103	2,392	87	62	2.774
Cs2	211+50	198.12	12:25	72.2	33.9	26,133	725	495	377	231	156	96	70	2,028	77	64	2.183
Cs2	211+50	198.12	12:25	72.2	33.9	37,214	1092	767	593	360	244	148	104	2,238	68	59	2.257
Cs2	211+50	198.12	12:25	72.2	33.9	36,471	1055	735	570	354	241	146	100	2,199	72	58	2.267
Cs2	211+00	213.36	12:26	72.2	33.9	24,688	772	532	418	266	181	109	74	2,009	70	52	2.415
Cs2	211+00	213.36	12:26	72.2	33.9	36,773	1205	861	682	423	288	170	112	2,342	58	50	2.621
Cs2	211+00	213.36	12:26	72.2	33.9	36,364	1197	862	684	425	290	171	112	2,425	57	49	2.568

Section	Proj. Sta.	Sect. Sta., m	Time	Temperature, C		Load, N	Deflections, um							Moduli, MPa			Fit,%
				Pvm't	Air		D_1	D_2	D_3	D_4	D_5	D_6	D_7	E_{ac}	E_{base}	$E_{subgrade}$	
Cs2	210+50	228.60	12:26	72.8	34.4	26,062	693	477	375	229	157	96	68	2,289	81	63	2.595
Cs2	210+50	228.60	12:26	72.8	34.4	36,738	1015	717	569	344	236	143	98	2,531	72	60	2.644
Cs2	210+50	228.60	12:26	72.8	34.4	36,507	1009	711	566	346	240	144	100	2,525	74	59	2.774
Sa6	209+25	38.10	12:28	72.2	34.4	25,426	646	448	351	217	153	94	290	2,281	90	63	2.581
Sa6	209+25	38.10	12:28	72.2	34.4	37,054	1003	710	562	349	245	149	88	2,460	80	58	2.595
Sa6	209+25	38.10	12:28	72.2	34.4	37,000	1002	708	562	356	250	151	104	2,468	82	57	2.626
Sa6	208+75	53.34	12:29	72.2	34.4	24,790	657	452	351	215	148	90	62	2,208	82	64	2.453
Sa6	208+75	53.34	12:29	72.2	34.4	36,471	1015	712	558	342	236	141	98	2,388	74	60	2.698
Sa6	208+75	53.34	12:29	72.2	34.4	36,400	1009	708	555	346	240	143	99	2,405	76	59	2.655
Sa6	208+25	68.58	12:30	72.2	33.9	26,169	716	484	375	232	157	93	63	2,137	78	64	2.800
Sa6	208+25	68.58	12:30	72.2	33.9	36,738	1023	709	552	349	240	137	104	2,384	75	60	3.060
Sa6	208+25	68.58	12:30	72.2	33.9	36,507	1017	705	557	351	240	143	95	2,329	77	59	2.736
Sa6	207+75	83.82	12:30	72.2	33.9	25,693	690	465	364	214	146	86	59	2,245	75	68	3.480
Sa6	207+75	83.82	12:30	72.2	33.9	37,143	1040	724	570	340	231	135	90	2,490	68	63	3.126
Sa6	207+75	83.82	12:30	72.2	33.9	36,809	1035	727	575	343	233	136	92	2,591	66	62	2.999
Sa6	207+25	99.06	12:31	72.2	33.9	26,418	652	437	344	211	147	92	63	2,070	97	68	2.606
Sa6	207+25	99.06	12:31	72.2	33.9	37,552	951	654	518	320	224	138	97	2,293	90	64	2.703
Sa6	207+25	99.06	12:31	72.2	33.9	36,578	924	632	502	315	221	136	97	2,257	94	63	2.751
Sa6	206+75	114.30	12:32	72.2	34.4	25,906	655	447	355	220	153	95	65	2,235	92	64	2.618
Sa6	206+75	114.30	12:32	72.2	34.4	37,054	976	687	548	338	236	146	100	2,492	83	60	2.528
Sa6	206+75	114.30	12:32	72.2	34.4	36,969	970	683	548	340	240	147	100	2,518	85	59	2.692
Sa6	206+25	129.54	12:33	72.2	34.4	26,400	647	440	350	221	153	96	63	2,261	98	65	2.476
Sa6	206+25	129.54	12:33	72.2	34.4	36,845	944	665	530	335	235	140	105	2,675	85	61	2.873
Sa6	206+25	129.54	12:33	72.2	34.4	36,578	935	653	526	335	235	145	99	2,519	91	59	2.594
Sa6	205+75	144.78	12:34	72.2	34.4	25,199	602	390	310	206	150	97	69	1,295	136	63	2.364
Sa6	205+75	144.78	12:34	72.2	34.4	36,315	898	609	479	317	232	145	116	1,782	117	59	2.625
Sa6	205+75	144.78	12:34	72.2	34.4	37,018	919	628	498	325	238	151	110	1,866	115	58	2.498
Sa6	205+25	160.02	12:35	73.3	33.9	25,960	607	419	334	206	151	97	64	2,178	110	65	2.558
Sa6	205+25	160.02	12:35	73.3	33.9	36,951	885	627	501	311	228	145	101	2,448	103	61	2.657
Sa6	205+25	160.02	12:35	73.3	33.9	36,809	883	628	502	312	232	145	109	2,471	104	61	2.892
Sa6	204+75	175.26	12:35	72.8	34.4	26,049	613	430	344	225	160	147	231	1,423	156	53	6.450
Sa6	204+75	175.26	12:35	72.8	34.4	37,018	923	664	532	346	247	155	104	2,731	97	57	2.174
Sa6	204+75	175.26	12:35	72.8	34.4	36,880	910	651	518	346	247	151	114	2,709	99	57	2.382
Sa6	204+25	190.50	12:37	72.8	33.9	25,675	612	428	336	214	151	96	66	2,347	103	64	1.876
Sa6	204+25	190.50	12:37	72.8	33.9	37,285	943	673	529	333	237	149	104	2,479	92	60	2.193
Sa6	204+25	190.50	12:37	72.8	33.9	36,987	930	663	523	333	239	150	103	2,460	95	59	2.165
Sa4	201+75	38.10	12:38	72.8	34.4	25,657	615	430	340	215	153	97	70	2,387	102	63	2.221
Sa4	201+75	38.10	12:38	72.8	34.4	36,791	949	675	541	336	245	154	105	2,403	93	57	2.639
Sa4	201+75	38.10	12:38	72.8	34.4	36,684	949	687	541	341	244	152	111	2,583	88	57	2.261
Sa4	201+25	53.34	12:39	73.9	35.0	26,133	651	463	370	236	171	108	76	2,478	99	58	2.346
Sa4	201+25	53.34	12:39	73.9	35.0	37,000	981	709	570	361	263	165	114	2,549	90	54	2.496
Sa4	201+25	53.34	12:39	73.9	35.0	36,280	957	689	555	359	259	163	111	2,567	92	53	2.313
Sa4	200+75	68.58	12:40	73.9	34.4	25,110	604	412	333	216	155	99	70	2,095	114	60	2.542
Sa4	200+75	68.58	12:40	73.9	34.4	36,613	940	663	538	343	247	155	108	2,389	98	56	2.621
Sa4	200+75	68.58	12:40	73.9	34.4	36,649	930	657	534	343	248	157	108	2,418	100	56	2.595
Sa4	200+25	83.82	12:41	73.3	35.0	25,551	607	391	301	201	143	92	68	1,254	133	66	1.878
Sa4	200+25	83.82	12:41	73.3	35.0	36,916	911	617	486	315	225	144	101	1,868	111	61	2.108
Sa4	200+25	83.82	12:41	73.3	35.0	37,232	915	628	488	316	226	145	106	1,919	110	62	1.870
Sa4	199+75	99.06	12:42	72.8	34.4	25,462	570	395	316	205	153	100	70	2,040	132	62	2.245

Section	Proj. Sta.	Sect. Sta., m	Time	Temperature, C		Load, N	Deflections, um							Moduli, MPa			Fit,%
				Pvm't	Air		D_1	D_2	D_3	D_4	D_5	D_6	D_7	E_{ac}	E_{base}	$E_{subgrade}$	
Sa4	199+75	99.06	12:42	72.8	34.4	37,036	889	632	513	329	244	158	109	2,359	114	57	2.407
Sa4	199+75	99.06	12:42	72.8	34.4	36,631	875	625	507	329	243	158	108	2,440	115	56	2.262
Sa4	199+25	114.30	12:43	73.3	35.0	26,116	597	412	330	212	153	98	66	2,261	118	64	2.361
Sa4	199+25	114.30	12:43	73.3	35.0	37,214	894	631	511	323	234	151	96	2,441	107	59	2.397
Sa4	199+25	114.30	12:43	73.3	35.0	36,987	891	632	507	328	240	148	117	2,540	105	59	2.649
Sa4	198+75	129.54	12:44	73.9	35.0	25,746	584	403	322	209	151	98	65	2,176	122	64	2.181
Sa4	198+75	129.54	12:44	73.9	35.0	36,809	882	619	502	323	234	151	102	2,361	111	59	2.393
Sa4	198+75	129.54	12:44	73.9	35.0	36,631	867	612	490	323	237	150	107	2,345	116	58	2.340
Sa4	198+25	144.78	12:45	73.9	34.4	26,240	618	419	334	211	151	93	69	2,168	109	66	2.944
Sa4	198+25	144.78	12:45	73.9	34.4	37,445	877	616	496	315	228	143	101	2,542	107	62	2.619
Sa4	198+25	144.78	12:45	73.9	34.4	36,845	859	601	485	311	228	137	105	2,629	107	62	3.231
Sa4	197+75	160.02	12:45	74.4	34.4	25,604	634	443	347	215	152	96	67	2,305	95	64	2.167
Sa4	197+75	160.02	12:45	74.4	34.4	36,507	930	658	521	326	231	146	102	2,437	91	60	2.242
Sa4	197+75	160.02	12:45	74.4	34.4	36,418	930	661	523	326	233	147	108	2,428	92	59	2.331
Sa4	197+25	175.26	12:46	73.9	35.0	25,551	702	475	372	228	158	98	69	1,940	84	61	2.526
Sa4	197+25	175.26	12:46	73.9	35.0	36,773	1050	731	578	351	245	152	106	2,153	77	57	2.542
Sa4	197+25	175.26	12:46	73.9	35.0	37,178	1061	732	582	361	251	156	108	2,089	80	56	2.561
Sa4	196+75	190.50	12:47	73.3	34.4	26,031	704	489	388	233	160	97	67	2,453	75	63	2.804
Sa4	196+75	190.50	12:47	73.3	34.4	36,773	1046	745	594	356	245	147	101	2,635	67	59	2.801
Sa4	196+75	190.50	12:47	73.3	34.4	36,542	1033	738	589	355	246	147	100	2,677	68	58	2.851
Sa2	194+25	38.10	12:49	73.9	35.0	25,995	665	434	334	207	147	90	67	1,582	101	67	2.932
Sa2	194+25	38.10	12:49	73.9	35.0	36,631	964	650	504	311	222	130	103	2,016	88	64	3.427
Sa2	194+25	38.10	12:49	73.9	35.0	36,898	980	661	516	319	227	139	104	1,896	91	62	2.872
Sa2	193+75	53.34	12:49	74.4	35.0	26,062	686	441	334	200	141	91	67	1,348	99	69	2.239
Sa2	193+75	53.34	12:49	74.4	35.0	36,489	1001	665	499	304	213	138	102	1,502	91	64	1.971
Sa2	193+75	53.34	12:49	74.4	35.0	36,351	974	646	497	300	211	136	93	1,638	92	65	2.240
Sa2	193+25	68.58	12:50	74.4	34.4	25,377	705	465	354	208	140	86	61	1,830	76	69	2.599
Sa2	193+25	68.58	12:50	74.4	34.4	37,036	1078	733	560	328	218	133	94	2,036	67	65	2.476
Sa2	193+25	68.58	12:50	74.4	34.4	36,297	1042	709	543	322	215	131	90	2,048	70	64	2.383
Sa2	192+75	83.82	12:51	74.4	35.0	25,675	724	469	344	201	145	87	72	1,321	86	69	3.081
Sa2	192+75	83.82	12:51	74.4	35.0	36,507	1055	704	525	305	216	130	103	1,620	77	65	3.043
Sa2	192+75	83.82	12:51	74.4	35.0	36,280	1037	690	527	307	212	131	94	1,759	76	65	2.773
Sa2	192+25	99.06	12:52	73.9	35.0	25,640	694	467	352	213	149	95	68	1,685	88	65	1.956
Sa2	192+25	99.06	12:52	73.9	35.0	37,054	1037	719	549	330	232	146	107	1,924	80	61	2.282
Sa2	192+25	99.06	12:52	73.9	35.0	36,613	1023	714	549	330	233	146	107	2,001	80	60	2.322
Sa2	191+75	114.30	12:53	73.9	35.0	25,479	619	412	319	201	144	91	69	1,720	111	67	2.367
Sa2	191+75	114.30	12:53	73.9	35.0	37,071	936	639	496	315	227	149	90	1,784	107	61	1.933
Sa2	191+75	114.30	12:53	73.9	35.0	37,196	925	635	494	313	229	139	107	2,005	103	63	2.832
Sa2	191+25	129.54	12:53	75.0	35.0	25,128	591	389	304	187	128	80	56	2,042	102	74	2.670
Sa2	191+25	129.54	12:53	75.0	35.0	36,631	887	601	472	288	200	123	84	2,271	94	70	2.724
Sa2	191+25	129.54	12:53	75.0	35.0	36,987	893	618	472	294	203	122	96	2,426	90	70	2.348
Sa2	190+75	144.78	12:54	75.0	35.0	25,906	606	406	319	199	140	86	63	2,164	104	71	2.854
Sa2	190+75	144.78	12:54	75.0	35.0	36,916	887	606	474	299	210	129	89	2,248	100	67	2.493
Sa2	190+75	144.78	12:54	75.0	35.0	37,107	890	615	478	304	214	128	97	2,407	97	67	2.708
Sa2	190+25	160.02	12:55	74.4	35.6	26,311	574	389	301	198	137	84	66	2,346	115	73	2.140
Sa2	190+25	160.02	12:55	74.4	35.6	37,071	840	581	455	295	206	128	90	2,456	108	68	2.083
Sa2	190+25	160.02	12:55	74.4	35.6	36,773	826	575	449	295	203	123	99	2,722	104	69	2.242
Sa2	189+75	175.26	12:56	74.4	35.0	25,377	549	365	285	183	130	83	56	1,931	127	73	2.198
Sa2	189+75	175.26	12:56	74.4	35.0	37,338	850	584	458	290	208	131	91	2,247	112	68	2.418

Section	Proj. Sta.	Sect. Sta., m	Time	Temperature, C		Load, N	Deflections, um							Moduli, MPa			Fit,%
				Pvm't	Air		D_1	D_2	D_3	D_4	D_5	D_6	D_7	E_{ac}	E_{base}	$E_{subgrade}$	
Sa2	189+75	175.26	12:56	74.4	35.0	36,809	830	569	446	289	206	129	91	2,258	116	67	2.239
Sa2	189+25	190.50	12:56	73.9	35.0	25,270	548	366	290	189	136	88	61	1,855	136	69	2.193
Sa2	189+25	190.50	12:56	73.9	35.0	37,036	837	576	459	298	214	137	96	2,225	120	65	2.279
Sa2	189+25	190.50	12:56	73.9	35.0	37,036	850	588	471	306	222	142	97	2,234	120	62	2.341
Sa1	186+75	38.10	12:58	75.6	34.4	26,240	615	405	315	199	139	89	64	1,783	113	70	2.205
Sa1	186+75	38.10	12:58	75.6	34.4	37,036	913	622	479	305	214	135	96	2,004	101	65	2.097
Sa1	186+75	38.10	12:58	75.6	34.4	36,773	900	619	474	301	213	133	97	2,062	101	66	2.037
Sa1	186+25	53.34	12:59	75.6	34.4	26,365	605	401	305	196	142	92	71	1,552	126	70	1.823
Sa1	186+25	53.34	12:59	75.6	34.4	37,570	900	611	473	299	216	141	100	1,843	113	65	1.966
Sa1	186+25	53.34	12:59	75.6	34.4	37,249	875	599	461	293	213	137	103	1,941	114	66	2.043
Sa1	185+75	68.58	12:59	75.6	35.6	26,204	579	389	307	195	143	95	68	1,771	133	68	2.215
Sa1	185+75	68.58	12:59	75.6	35.6	37,516	865	594	469	302	220	145	104	1,945	123	63	1.905
Sa1	185+75	68.58	12:59	75.6	35.6	37,321	859	592	468	303	221	145	104	2,004	124	63	1.924
Sa1	185+25	83.82	13:00	75.6	35.6	26,062	585	397	314	201	147	97	68	1,876	129	66	2.081
Sa1	185+25	83.82	13:00	75.6	35.6	37,623	880	606	483	309	226	148	104	2,022	120	62	2.223
Sa1	185+25	83.82	13:00	75.6	35.6	36,773	844	581	464	300	221	144	102	2,018	126	62	2.250
Sa1	184+75	99.06	13:01	75.6	35.0	26,311	591	392	309	198	145	97	70	1,541	138	67	2.101
Sa1	184+75	99.06	13:01	75.6	35.0	37,071	868	588	465	299	218	145	103	1,782	125	63	2.044
Sa1	184+75	99.06	13:01	75.6	35.0	37,392	872	592	469	303	223	147	107	1,788	127	62	2.119
Sa1	184+25	114.30	13:01	75.6	35.6	26,169	543	359	275	175	137	92	68	1,307	163	72	2.886
Sa1	184+25	114.30	13:01	75.6	35.6	37,672	812	546	420	268	209	141	101	1,394	154	67	2.819
Sa1	184+25	114.30	13:01	75.6	35.6	37,499	802	539	417	275	208	141	100	1,391	159	67	1.889
Sa1	183+75	129.54	13:02	75.6	34.4	26,169	530	339	261	169	126	87	64	1,154	171	77	2.200
Sa1	183+75	129.54	13:02	75.6	34.4	36,987	782	513	396	258	192	131	96	1,328	157	71	2.013
Sa1	183+75	129.54	13:02	75.6	34.4	37,018	779	513	393	257	192	131	99	1,333	159	71	1.950
Sa1	183+25	144.78	13:03	76.1	35.6	26,489	535	348	270	173	124	84	59	1,547	153	78	1.873
Sa1	183+25	144.78	13:03	76.1	35.6	37,654	788	525	408	261	189	125	89	1,776	140	74	1.863
Sa1	183+25	144.78	13:03	76.1	35.6	37,636	786	522	409	264	191	127	90	1,720	145	73	1.798
Sa1	182+75	160.02	13:04	75.6	35.0	25,604	551	367	284	182	133	84	130	1,819	132	73	2.562
Sa1	182+75	160.02	13:04	75.6	35.0	36,280	817	555	434	277	202	127	464	2,039	120	68	2.567
Sa1	182+75	160.02	13:04	75.6	35.0	36,934	844	574	447	286	208	131	821	1,974	119	67	2.392
Sa1	182+75	160.02	13:06	72.8	35.0	26,276	590	393	304	193	138	89	64	1,802	123	71	2.119
Sa1	182+75	160.02	13:06	72.8	35.0	37,178	848	577	453	288	208	134	96	2,033	118	67	2.194
Sa1	182+75	160.02	13:06	72.8	35.0	36,382	828	563	437	281	202	124	93	2,133	114	69	2.589
Sa1	182+25	175.26	13:07	77.2	35.0	26,489	663	433	331	187	133	84	58	1,737	92	76	3.198
Sa1	182+25	175.26	13:07	77.2	35.0	37,374	975	658	508	287	202	127	89	2,036	81	71	3.252
Sa1	182+25	175.26	13:07	77.2	35.0	37,214	956	646	501	288	204	127	88	2,065	85	70	2.985
Sa1	181+75	190.50	13:08	77.2	35.6	26,365	625	398	304	186	132	85	60	1,384	116	75	2.362
Sa1	181+75	190.50	13:08	77.2	35.6	36,667	887	581	448	277	197	126	89	1,611	111	70	2.301
Sa1	181+75	190.50	13:08	77.2	35.6	36,631	882	581	450	280	200	128	90	1,649	112	69	2.354
Sa3	179+25	38.10	13:09	77.2	36.1	25,533	545	352	280	178	131	89	65	1,340	153	72	2.422
Sa3	179+25	38.10	13:09	77.2	36.1	36,951	812	547	438	278	205	138	99	1,845	136	66	2.432
Sa3	179+25	38.10	13:09	77.2	36.1	36,631	800	542	436	279	207	137	99	1,911	137	66	2.394
Sa3	178+75	53.34	13:10	77.2	35.6	26,382	542	361	281	176	139	96	69	1,391	165	71	3.453
Sa3	178+75	53.34	13:10	77.2	35.6	36,987	790	544	435	276	212	144	103	1,844	148	65	2.810
Sa3	178+75	53.34	13:10	77.2	35.6	36,934	787	546	437	276	213	145	104	1,937	146	64	2.957
Sa3	178+25	68.58	13:11	77.2	35.6	25,800	530	352	279	174	132	89	65	1,646	152	73	2.903
Sa3	178+25	68.58	13:11	77.2	35.6	36,773	781	532	426	268	203	135	101	1,971	141	68	2.726
Sa3	178+25	68.58	13:11	77.2	35.6	37,054	784	536	430	272	207	137	98	1,988	143	67	2.713

		Sect.		Temperature, C			Deflections, um							Moduli, MPa			
Section	Proj. Sta.	Sta., m	Time	Pvm't	Air	Load, N	D_1	D_2	D_3	D_4	D_5	D_6	D_7	E_{ac}	E_{base}	$E_{subgrade}$	Fit,%
Sa3	177+75	83.82	13:11	77.2	35.0	26,329	563	383	299	186	140	94	68	1,836	137	70	2.802
Sa3	177+75	83.82	13:11	77.2	35.0	36,738	820	573	454	281	210	139	102	2,146	123	65	2.797
Sa3	177+75	83.82	13:11	77.2	35.0	36,280	806	566	450	280	210	140	102	2,201	125	64	2.828
Sa3	177+25	99.06	13:12	77.8	35.0	25,711	530	361	285	182	137	91	65	1,903	148	70	2.331
Sa3	177+25	99.06	13:12	77.8	35.0	36,631	786	548	433	281	211	140	98	2,050	140	64	2.083
Sa3	177+25	99.06	13:12	77.8	35.0	36,880	788	550	438	284	214	141	99	2,100	141	64	2.191
Sa3	176+75	114.30	13:13	78.3	35.6	25,978	608	411	324	195	143	93	65	1,988	110	69	2.890
Sa3	176+75	114.30	13:13	78.3	35.6	37,160	908	628	499	303	223	143	100	2,106	103	63	2.806
Sa3	176+75	114.30	13:13	78.3	35.6	36,435	888	616	490	298	218	140	97	2,170	103	63	2.722
Sa3	176+25	129.54	13:14	77.8	35.0	26,347	610	414	329	207	152	102	74	1,840	124	64	2.518
Sa3	176+25	129.54	13:14	77.8	35.0	36,987	893	622	499	313	232	154	110	2,040	115	59	2.626
Sa3	176+25	129.54	13:14	77.8	35.0	36,880	885	617	497	317	233	154	111	2,090	117	59	2.246
Sa3	175+75	144.78	13:15	77.8	35.0	25,960	601	413	328	203	153	101	71	1,907	122	64	2.785
Sa3	175+75	144.78	13:15	77.8	35.0	36,916	885	625	500	311	231	152	107	2,191	112	60	2.762
Sa3	175+75	144.78	13:15	77.8	35.0	36,827	881	623	500	312	232	152	107	2,223	112	59	2.682
Sa3	175+25	160.02	13:15	77.8	35.0	26,080	616	421	331	202	151	99	69	1,903	115	65	2.918
Sa3	175+25	160.02	13:15	77.8	35.0	37,232	922	645	513	316	234	151	106	2,114	105	60	2.722
Sa3	175+25	160.02	13:15	77.8	35.0	36,333	883	617	488	305	229	145	101	2,087	110	60	2.816
Sa3	174+75	175.26	13:16	77.8	35.0	25,906	611	411	318	205	145	94	65	1,846	115	67	1.778
Sa3	174+75	175.26	13:16	77.8	35.0	37,374	920	639	497	321	227	145	101	2,121	104	62	1.827
Sa3	174+75	175.26	13:16	77.8	35.0	36,827	901	624	487	320	227	145	100	2,071	109	61	1.825
Sa3	174+25	190.50	13:17	77.8	35.0	25,853	593	395	311	202	148	97	69	1,569	134	65	2.030
Sa3	174+25	190.50	13:17	77.8	35.0	37,071	884	607	482	315	228	148	103	1,968	119	60	2.149
Sa3	174+25	190.50	13:17	77.8	35.0	36,542	872	602	476	312	236	145	102	1,964	121	59	2.979
Sa5	171+75	38.10	13:19	74.4	35.0	25,342	632	417	317	191	131	85	58	1,725	97	72	1.999
Sa5	171+75	38.10	13:19	74.4	35.0	36,791	957	653	503	301	208	131	91	2,082	85	67	2.226
Sa5	171+75	38.10	13:19	74.4	35.0	36,578	955	654	495	304	214	132	90	1,959	89	65	2.353
Sa5	171+25	53.34	13:21	76.7	35.6	25,181	625	431	332	203	141	92	65	2,119	94	67	2.067
Sa5	171+25	53.34	13:21	76.7	35.6	37,054	939	663	521	316	224	144	101	2,324	90	62	2.566
Sa5	171+25	53.34	13:21	76.7	35.6	37,018	939	665	524	325	227	146	103	2,417	90	61	2.108
Sa5	170+75	68.58	13:21	77.8	35.0	25,800	630	437	340	212	154	90	70	2,356	95	66	3.383
Sa5	170+75	68.58	13:21	77.8	35.0	36,880	914	647	516	321	233	157	109	2,182	106	58	2.608
Sa5	170+75	68.58	13:21	77.8	35.0	36,244	888	625	495	314	233	145	105	2,254	106	59	2.688
Sa5	170+25	83.82	13:22	77.8	35.6	25,817	619	438	348	210	152	100	70	2,398	100	64	2.929
Sa5	170+25	83.82	13:22	77.8	35.6	37,178	901	657	528	319	229	149	104	2,860	91	61	3.016
Sa5	170+25	83.82	13:22	77.8	35.6	36,756	901	652	526	327	234	151	106	2,772	95	59	2.463
Sa5	169+75	99.06	13:23	77.8	35.0	25,395	599	421	329	210	148	96	67	2,322	106	64	1.652
Sa5	169+75	99.06	13:23	77.8	35.0	36,382	897	646	516	327	232	151	105	2,610	97	58	2.083
Sa5	169+75	99.06	13:23	77.8	35.0	37,232	913	658	529	327	242	152	106	2,632	98	59	2.799
Sa5	169+25	114.30	13:24	78.3	36.1	25,604	638	438	339	212	146	94	67	2,103	96	65	1.666
Sa5	169+25	114.30	13:24	78.3	36.1	36,596	924	653	517	324	223	142	100	2,538	89	62	1.830
Sa5	169+25	114.30	13:24	78.3	36.1	36,578	919	652	514	328	228	146	100	2,489	93	60	1.725
Sa5	168+75	129.54	13:25	77.8	36.1	25,800	617	428	342	212	149	97	68	2,376	101	64	2.277
Sa5	168+75	129.54	13:25	77.8	36.1	37,303	912	648	522	329	230	148	102	2,688	95	61	2.011
Sa5	168+75	129.54	13:25	77.8	36.1	37,427	919	655	521	335	234	148	101	2,689	95	60	1.904
Sa5	168+25	144.78	13:26	78.9	36.1	26,365	580	410	323	204	144	93	67	2,649	110	68	1.921
Sa5	168+25	144.78	13:26	78.9	36.1	37,654	854	615	496	312	221	144	100	2,939	104	64	2.205
Sa5	168+25	144.78	13:26	78.9	36.1	36,756	836	605	488	309	219	142	99	3,038	103	63	2.169
Sa5	167+75	160.02	13:27	78.9	36.1	26,560	523	351	270	163	113	73	52	2,439	120	88	2.110

Section	Proj. Sta.	Sect. Sta., m	Time	Temperature, C		Load, N	Deflections, um							Moduli, MPa			Fit,%
				Pvm't	Air		D_1	D_2	D_3	D_4	D_5	D_6	D_7	E_{ac}	E_{base}	$E_{subgrade}$	
Sa5	167+75	160.02	13:27	78.9	36.1	37,392	752	519	405	248	172	109	78	2,792	113	82	2.015
Sa5	167+75	160.02	13:27	78.9	36.1	37,516	744	516	403	249	173	110	79	2,881	116	82	2.018
Sa5	167+25	175.26	13:27	78.9	35.6	25,924	530	360	281	173	124	84	60	2,226	129	77	2.430
Sa5	167+25	175.26	13:27	78.9	35.6	37,178	766	533	422	263	186	124	90	2,556	123	74	2.206
Sa5	167+25	175.26	13:27	78.9	35.6	36,862	755	525	412	260	185	117	96	2,665	121	75	2.219
Sa5	166+75	190.50	13:28	78.3	35.6	25,377	613	435	340	201	141	92	64	2,489	90	67	2.902
Sa5	166+75	190.50	13:28	78.3	35.6	36,773	916	661	524	312	218	139	98	2,766	83	64	2.825
Sa5	166+75	190.50	13:28	78.3	35.6	36,048	889	645	513	306	213	137	96	2,897	83	64	2.929
Cs1	164+25	38.10	13:30	78.3	36.1	26,049	542	371	291	184	135	90	64	2,132	135	72	2.310
Cs1	164+25	38.10	13:30	78.3	36.1	36,951	789	554	440	281	207	137	96	2,365	130	66	2.178
Cs1	164+25	38.10	13:30	78.3	36.1	37,071	800	567	451	288	213	141	99	2,349	130	64	2.214
Cs1	163+75	53.34	13:30	80.0	36.1	26,365	473	322	249	173	125	83	59	1,975	183	77	1.318
Cs1	163+75	53.34	13:30	80.0	36.1	37,427	694	484	382	264	193	126	90	2,380	170	71	1.541
Cs1	163+75	53.34	13:30	80.0	36.1	37,285	686	478	379	266	195	128	90	2,277	179	70	1.547
Cs1	163+25	68.58	13:31	80.0	37.2	26,382	529	349	265	167	122	85	62	1,551	152	79	2.390
Cs1	163+25	68.58	13:31	80.0	37.2	37,921	767	521	404	254	188	129	94	1,865	146	74	2.458
Cs1	163+25	68.58	13:31	80.0	37.2	37,338	756	517	401	250	190	130	95	1,851	149	73	2.901
Cs1	162+75	83.82	13:32	80.0	37.2	26,614	506	338	265	168	123	83	59	1,906	158	80	2.263
Cs1	162+75	83.82	13:32	80.0	37.2	37,623	738	504	400	260	189	126	89	2,186	150	73	1.843
Cs1	162+75	83.82	13:32	80.0	37.2	37,338	723	495	394	261	190	126	89	2,183	157	72	1.771
Cs1	162+25	99.06	13:32	80.6	36.1	26,240	509	344	267	167	128	81	59	2,019	149	78	2.989
Cs1	162+25	99.06	13:32	80.6	36.1	37,410	744	515	411	259	193	128	88	2,300	144	72	2.521
Cs1	162+25	99.06	13:32	80.6	36.1	36,738	723	503	402	254	192	117	89	2,660	136	74	3.460
Cs1	161+75	114.30	13:33	79.4	36.1	26,062	463	304	240	155	121	79	58	1,516	197	81	2.778
Cs1	161+75	114.30	13:33	79.4	36.1	37,957	680	460	369	237	183	124	88	1,913	187	77	2.619
Cs1	161+75	114.30	13:33	79.4	36.1	37,410	667	450	361	235	187	121	87	1,772	197	75	3.031
Cs1	161+25	129.54	13:34	78.3	36.1	26,489	501	331	256	167	122	84	59	1,615	171	80	1.882
Cs1	161+25	129.54	13:34	78.3	36.1	36,969	724	494	386	254	187	125	88	2,009	157	73	1.693
Cs1	161+25	129.54	13:34	78.3	36.1	37,089	716	491	383	254	188	124	87	2,043	160	73	1.740
Cs1	160+75	144.78	13:35	78.9	36.7	26,507	513	343	264	167	123	83	58	1,790	155	80	2.188
Cs1	160+75	144.78	13:35	78.9	36.7	37,481	745	511	401	255	189	128	89	2,102	148	73	2.310
Cs1	160+75	144.78	13:35	78.9	36.7	36,916	733	505	398	255	189	128	89	2,132	149	72	2.242
Cs1	160+25	160.02	13:36	80.0	36.7	25,764	497	323	247	147	109	72	51	1,734	145	89	2.981
Cs1	160+25	160.02	13:36	80.0	36.7	37,089	729	486	376	227	166	108	77	2,071	136	84	2.767
Cs1	160+25	160.02	13:36	80.0	36.7	37,000	721	477	367	229	168	110	77	1,829	148	82	2.239
Cs1	159+75	175.26	13:36	80.6	36.1	25,995	392	231	160	96	72	47	42	1,182	198	142	2.947
Cs1	159+75	175.26	13:36	80.6	36.1	36,845	539	326	237	137	104	76	59	1,340	209	135	4.356
Cs1	159+75	175.26	13:36	80.6	36.1	36,684	535	327	230	138	106	72	60	1,315	211	135	3.685
Cs1	159+25	190.50	13:37	79.4	36.7	25,479	555	350	258	147	105	72	53	1,382	120	90	3.382
Cs1	159+25	190.50	13:37	79.4	36.7	36,226	807	526	387	227	162	105	79	1,609	113	84	2.608
Cs1	159+25	190.50	13:37	79.4	36.7	35,942	788	514	386	224	160	108	80	1,668	116	83	3.156
Ts6	156+75	38.10	13:38	80.0	36.1	25,675	634	414	309	176	119	76	49	1,794	88	80	2.619
Ts6	156+75	38.10	13:38	80.0	36.1	36,507	924	620	470	273	185	113	81	2,122	81	75	2.648
Ts6	156+75	38.10	13:38	80.0	36.1	36,507	915	618	464	276	188	111	85	2,198	82	75	2.824
Ts6	156+25	53.34	13:39	79.4	37.2	25,906	666	433	322	189	126	77	53	1,744	85	77	2.333
Ts6	156+25	53.34	13:39	79.4	37.2	36,507	974	653	491	290	195	119	80	1,993	77	71	2.436
Ts6	156+25	53.34	13:39	79.4	37.2	36,435	971	650	492	296	199	120	81	2,008	79	70	2.414
Ts6	155+75	68.58	13:40	79.4	36.7	26,080	682	434	317	170	113	69	46	1,624	77	87	2.880
Ts6	155+75	68.58	13:40	79.4	36.7	36,827	1006	662	492	267	177	107	72	1,830	70	79	2.929

Section	Proj. Sta.	Sect. Sta., m	Time	Temperature, C Pvm't	Air	Load, N	Deflections, um D_1	D_2	D_3	D_4	D_5	D_6	D_7	Moduli, MPa E_{ac}	E_{base}	$E_{subgrade}$	Fit,%
Ts6	155+75	68.58	13:40	79.4	36.7	36,578	985	648	484	269	177	107	72	1,889	72	78	2.752
Ts6	155+25	83.82	13:40	80.0	36.7	26,151	584	354	251	141	91	55	38	1,526	98	107	2.459
Ts6	155+25	83.82	13:40	80.0	36.7	36,613	831	522	378	214	138	83	57	1,807	92	99	2.456
Ts6	155+25	83.82	13:40	80.0	36.7	36,400	824	519	376	216	139	84	57	1,817	93	98	2.314
Ts6	154+75	99.06	13:41	79.4	36.1	25,995	566	337	235	123	80	49	34	1,451	97	121	2.770
Ts6	154+75	99.06	13:41	79.4	36.1	36,560	806	497	358	191	123	76	52	1,710	93	110	2.660
Ts6	154+75	99.06	13:41	79.4	36.1	36,542	804	503	365	192	124	76	53	1,832	91	110	2.862
Ts6	154+25	114.30	13:42	79.4	36.7	25,764	612	385	273	134	86	53	38	1,725	78	112	3.787
Ts6	154+25	114.30	13:42	79.4	36.7	36,578	871	563	406	205	129	79	57	1,985	75	106	3.414
Ts6	154+25	114.30	13:42	79.4	36.7	36,137	864	567	412	206	131	80	58	2,078	73	104	3.766
Ts6	153+75	129.54	13:42	79.4	36.7	25,533	576	370	269	144	93	57	38	1,980	86	102	2.714
Ts6	153+75	129.54	13:42	79.4	36.7	36,596	847	559	412	224	143	86	62	2,273	79	97	2.558
Ts6	153+75	129.54	13:42	79.4	36.7	36,489	842	560	416	224	145	87	64	2,380	78	96	2.768
Ts6	153+25	144.78	13:43	80.6	36.1	26,098	639	405	300	173	115	69	46	1,728	88	86	2.949
Ts6	153+25	144.78	13:43	80.6	36.1	36,702	931	610	458	265	175	104	70	2,002	79	80	2.871
Ts6	153+25	144.78	13:43	80.6	36.1	36,649	926	607	456	266	179	104	71	2,007	81	79	3.288
Ts6	152+75	160.02	13:44	80.6	37.2	25,871	548	361	270	157	110	73	54	1,923	113	88	2.789
Ts6	152+75	160.02	13:44	80.6	37.2	36,631	792	534	404	238	166	107	79	2,190	106	83	2.555
Ts6	152+75	160.02	13:44	80.6	37.2	36,684	784	531	403	238	166	109	81	2,249	108	83	2.623
Ts6	152+25	175.26	13:44	79.4	37.2	25,551	636	412	313	175	114	70	49	2,006	80	84	2.605
Ts6	152+25	175.26	13:44	79.4	37.2	36,560	929	624	480	271	176	108	75	2,338	73	79	2.580
Ts6	152+25	175.26	13:44	79.4	37.2	36,507	920	618	479	274	179	109	76	2,369	75	77	2.665
Ts6	151+75	190.50	13:45	79.4	36.1	26,258	648	418	312	187	126	82	60	1,558	99	77	1.865
Ts6	151+75	190.50	13:45	79.4	36.1	37,427	951	632	482	285	195	127	92	1,823	91	71	2.270
Ts6	151+75	190.50	13:45	79.4	36.1	37,321	939	627	481	285	194	127	92	1,923	91	71	2.328
Ts4	149+25	38.10	13:47	77.2	35.6	25,146	639	423	314	186	136	86	58	1,502	100	71	2.702
Ts4	149+25	38.10	13:47	77.2	35.6	36,951	968	660	506	296	213	137	97	1,880	89	66	3.044
Ts4	149+25	38.10	13:47	77.2	35.6	36,951	950	652	503	295	213	138	98	1,966	91	66	3.043
Ts4	148+75	53.34	13:48	78.9	36.1	25,960	651	409	304	183	124	77	53	1,401	99	78	2.301
Ts4	148+75	53.34	13:48	78.9	36.1	37,054	961	628	465	281	192	121	85	1,572	92	72	1.891
Ts4	148+75	53.34	13:48	78.9	36.1	37,018	945	626	478	281	193	125	89	1,798	91	71	2.420
Ts4	148+25	68.58	13:49	79.4	36.1	26,062	714	443	333	184	124	78	51	1,366	82	78	2.798
Ts4	148+25	68.58	13:49	79.4	36.1	36,845	974	636	491	288	191	114	77	2,013	78	73	3.204
Ts4	148+25	68.58	13:49	79.4	36.1	37,089	964	635	494	292	195	117	79	2,103	80	73	3.130
Ts4	147+75	83.82	13:50	80.6	36.7	26,204	586	364	281	167	124	82	58	1,152	134	80	3.116
Ts4	147+75	83.82	13:50	80.6	36.7	37,516	872	560	438	264	196	129	90	1,362	126	72	3.013
Ts4	147+75	83.82	13:50	80.6	36.7	37,552	863	563	439	274	199	128	90	1,581	124	71	2.538
Ts4	147+25	99.06	13:50	80.0	36.1	25,693	594	389	298	197	140	87	352	1,568	125	69	2.241
Ts4	147+25	99.06	13:50	80.0	36.1	37,285	912	620	481	314	223	140	583	1,915	109	63	2.135
Ts4	147+25	99.06	13:50	80.0	36.1	37,338	903	624	487	318	227	144	816	2,096	109	62	2.088
Ts4	146+75	114.30	13:51	80.6	37.2	25,906	692	416	309	203	140	89	63	790	117	70	1.786
Ts4	146+75	114.30	13:51	80.6	37.2	36,809	1017	645	484	314	217	136	95	1,114	103	64	1.897
Ts4	146+75	114.30	13:51	80.6	37.2	37,018	1012	653	493	321	221	139	97	1,261	102	63	1.812
Ts4	146+25	129.54	13:52	80.0	36.7	25,942	660	400	297	187	124	77	52	1,083	107	78	2.225
Ts4	146+25	129.54	13:52	80.0	36.7	36,382	958	611	459	287	191	118	83	1,463	94	71	2.172
Ts4	146+25	129.54	13:52	80.0	36.7	36,809	966	628	475	293	195	122	82	1,655	90	70	2.105
Ts4	145+75	144.78	13:52	80.0	36.1	26,116	712	466	354	209	145	92	63	1,593	86	68	2.370
Ts4	145+75	144.78	13:52	80.0	36.1	36,542	1047	708	545	323	223	140	97	1,860	76	62	2.414
Ts4	145+75	144.78	13:52	80.0	36.1	36,969	1029	699	540	326	229	139	95	1,952	80	62	2.823

Section	Proj. Sta.	Sect. Sta., m	Time	Temperature, C		Load, N	Deflections, um							Moduli, MPa			Fit,%
				Pvm't	Air		D_1	D_2	D_3	D_4	D_5	D_6	D_7	E_{ac}	E_{base}	$E_{subgrade}$	
Ts4	145+25	160.02	13:53	80.0	36.1	25,622	735	480	361	208	144	91	64	1,492	80	67	2.494
Ts4	145+25	160.02	13:53	80.0	36.1	36,596	1092	735	557	325	222	139	97	1,739	71	62	2.298
Ts4	145+25	160.02	13:53	80.0	36.1	36,631	1081	729	556	324	225	140	97	1,768	73	62	2.495
Ts4	144+75	175.26	13:54	80.0	35.6	25,622	649	408	307	199	134	84	196	1,257	109	71	1.827
Ts4	144+75	175.26	13:54	80.0	35.6	37,071	992	649	495	315	212	132	573	1,628	93	65	2.098
Ts4	144+75	175.26	13:54	80.0	35.6	36,827	985	657	503	318	214	134	736	1,833	89	64	1.947
Ts4	144+75	175.26	13:55	78.9	36.1	25,995	672	436	332	207	144	87	64	1,585	97	69	2.750
Ts4	144+75	175.26	13:55	78.9	36.1	36,542	976	654	503	309	215	131	96	1,875	87	65	2.720
Ts4	144+75	175.26	13:55	78.9	36.1	36,880	982	659	511	313	217	133	96	1,961	86	65	2.700
Ts4	144+25	190.50	13:55	79.4	36.1	25,978	708	476	350	209	132	84	50	1,974	73	73	1.148
Ts4	144+25	190.50	13:55	79.4	36.1	36,560	1049	725	545	324	208	129	81	2,172	65	66	1.528
Ts4	144+25	190.50	13:55	79.4	36.1	36,453	1037	726	551	323	210	128	85	2,333	64	66	1.955
Ts2	141+75	38.10	13:57	80.0	35.6	25,871	647	432	338	216	151	98	68	1,776	106	64	1.977
Ts2	141+75	38.10	13:57	80.0	35.6	36,684	986	677	532	334	235	151	105	1,942	92	58	2.101
Ts2	141+75	38.10	13:57	80.0	35.6	37,303	994	689	542	335	240	153	107	2,002	92	59	2.234
Ts2	141+25	53.34	13:57	81.1	36.1	25,342	618	409	317	198	147	93	64	1,545	116	66	2.838
Ts2	141+25	53.34	13:57	81.1	36.1	36,756	936	633	494	315	234	144	100	1,712	109	60	2.936
Ts2	141+25	53.34	13:57	81.1	36.1	36,418	932	637	496	318	236	145	99	1,810	106	59	2.918
Ts2	140+75	68.58	13:58	81.1	36.7	25,444	650	429	334	209	147	94	66	1,655	103	65	2.230
Ts2	140+75	68.58	13:58	81.1	36.7	36,333	980	665	520	315	228	145	100	1,807	92	60	2.690
Ts2	140+75	68.58	13:58	81.1	36.7	36,880	984	666	523	324	233	146	102	1,828	95	60	2.694
Ts2	140+25	83.82	13:59	80.6	37.2	25,253	696	476	366	219	150	187	271	944	129	52	12.315
Ts2	140+25	83.82	13:59	80.6	37.2	36,631	1066	747	582	351	237	145	101	2,266	68	59	2.306
Ts2	140+25	83.82	13:59	80.6	37.2	36,667	1065	740	578	358	249	146	96	2,192	73	57	2.996
Ts2	139+75	99.06	14:02	77.2	36.1	25,395	665	440	340	207	143	90	64	1,761	92	67	2.322
Ts2	139+75	99.06	14:02	77.2	36.1	36,280	1020	691	535	316	223	138	97	1,867	80	62	2.748
Ts2	139+75	99.06	14:02	77.2	36.1	36,720	1032	697	539	322	227	140	99	1,837	81	62	2.747
Ts2	139+25	114.30	14:02	80.6	37.2	25,128	742	480	366	211	146	89	61	1,503	76	66	3.115
Ts2	139+25	114.30	14:02	80.6	37.2	36,400	1135	766	589	334	230	138	93	1,834	63	61	3.235
Ts2	139+25	114.30	14:02	80.6	37.2	36,791	1133	768	591	342	236	141	96	1,847	66	60	3.091
Ts2	138+75	129.54	14:03	81.1	36.7	25,622	762	495	373	230	154	93	65	1,508	78	63	2.473
Ts2	138+75	129.54	14:03	81.1	36.7	36,773	1153	768	586	363	241	143	99	1,783	67	58	2.624
Ts2	138+75	129.54	14:03	81.1	36.7	36,596	1139	763	578	364	244	143	101	1,764	70	58	2.616
Ts2	138+25	144.78	14:04	81.1	37.2	25,426	740	509	398	244	169	108	75	1,887	79	57	2.063
Ts2	138+25	144.78	14:04	81.1	37.2	36,489	1136	800	629	384	268	169	118	1,983	71	52	2.300
Ts2	138+25	144.78	14:04	81.1	37.2	36,596	1133	798	635	388	273	171	120	2,058	71	51	2.394
Ts2	137+75	160.02	14:05	80.6	36.7	25,462	671	435	336	209	150	96	67	1,348	106	64	2.455
Ts2	137+75	160.02	14:05	80.6	36.7	36,684	1014	681	528	328	233	149	105	1,640	93	59	2.232
Ts2	137+75	160.02	14:05	80.6	36.7	36,827	1012	687	533	334	236	150	106	1,760	92	59	2.177
Ts2	137+25	175.26	14:05	80.0	36.1	25,817	660	439	340	214	152	98	70	1,618	106	63	2.097
Ts2	137+25	175.26	14:05	80.0	36.1	36,880	1007	683	533	334	237	152	106	1,755	94	58	2.185
Ts2	137+25	175.26	14:05	80.0	36.1	37,089	1004	681	533	338	242	154	108	1,762	97	58	2.219
Ts2	136+75	190.50	14:06	80.0	36.7	25,479	733	493	381	234	165	103	71	1,690	84	58	2.479
Ts2	136+75	190.50	14:06	80.0	36.7	36,333	1107	763	594	368	258	160	108	1,826	76	54	2.364
Ts2	136+75	190.50	14:06	80.0	36.7	36,453	1098	763	595	371	262	162	110	1,895	77	53	2.385
Ts1	134+25	38.10	14:07	80.0	36.7	25,075	727	487	369	219	156	100	69	1,532	83	61	2.527
Ts1	134+25	38.10	14:07	80.0	36.7	36,578	1117	764	582	351	248	156	107	1,655	76	56	2.299
Ts1	134+25	38.10	14:07	80.0	36.7	36,453	1103	757	580	353	251	157	108	1,696	78	55	2.348
Ts1	133+75	53.34	14:08	79.4	37.2	24,950	723	486	378	232	163	106	74	1,620	86	57	2.102

Section	Proj. Sta.	Sect. Sta., m	Time	Temperature, C		Load, N	Deflections, um							Moduli, MPa			Fit,%
				Pvm't	Air		D_1	D_2	D_3	D_4	D_5	D_6	D_7	E_{ac}	E_{base}	$E_{subgrade}$	
Ts1	133+75	53.34	14:08	79.4	37.2	36,453	1111	767	600	363	253	160	110	1,856	74	54	2.232
Ts1	133+75	53.34	14:08	79.4	37.2	36,262	1094	763	596	367	255	161	111	1,947	75	54	2.093
Ts1	133+25	68.58	14:09	80.0	36.7	25,413	747	490	380	231	162	106	74	1,393	88	58	2.246
Ts1	133+25	68.58	14:09	80.0	36.7	36,435	1123	765	597	360	252	162	114	1,677	76	54	2.374
Ts1	133+25	68.58	14:09	80.0	36.7	36,191	1109	763	595	363	255	164	115	1,729	77	53	2.280
Ts1	132+75	83.82	14:10	80.0	37.2	25,359	728	474	360	221	155	99	67	1,307	91	61	2.130
Ts1	132+75	83.82	14:10	80.0	37.2	36,297	1094	735	563	343	242	153	105	1,549	81	57	2.339
Ts1	132+75	83.82	14:10	80.0	37.2	36,351	1094	742	571	350	246	156	106	1,647	80	56	2.219
Ts1	132+25	99.06	14:10	80.6	36.7	25,622	666	425	332	195	147	96	67	1,195	111	66	3.563
Ts1	132+25	99.06	14:10	80.6	36.7	36,471	994	657	514	303	228	147	102	1,419	99	61	3.393
Ts1	132+25	99.06	14:10	80.6	36.7	36,560	994	661	518	308	232	150	104	1,457	100	60	3.253
Ts1	131+75	114.30	14:11	80.6	37.2	25,657	687	458	346	197	139	84	57	1,833	80	71	3.220
Ts1	131+75	114.30	14:11	80.6	37.2	36,934	1044	711	541	312	220	131	88	1,969	73	66	3.259
Ts1	131+75	114.30	14:11	80.6	37.2	36,315	1026	703	536	312	219	131	89	1,994	73	64	3.081
Ts1	131+25	129.54	14:12	81.1	37.8	25,640	653	434	342	212	148	92	62	1,908	96	66	2.751
Ts1	131+25	129.54	14:12	81.1	37.8	36,489	986	674	531	328	228	141	97	2,086	85	61	2.583
Ts1	131+25	129.54	14:12	81.1	37.8	36,613	979	670	530	331	231	143	98	2,119	88	60	2.597
Ts1	130+75	144.78	14:13	81.1	37.2	25,426	667	452	347	211	148	93	63	1,896	90	65	2.289
Ts1	130+75	144.78	14:13	81.1	37.2	36,524	1017	703	542	332	231	144	98	2,010	81	60	2.247
Ts1	130+75	144.78	14:13	81.1	37.2	36,351	1004	694	538	335	233	145	99	2,036	83	59	2.177
Ts1	130+25	160.02	14:13	80.6	37.2	25,444	751	512	393	238	161	100	69	1,911	73	60	2.079
Ts1	130+25	160.02	14:13	80.6	37.2	36,226	1127	789	608	363	246	151	105	2,040	64	56	2.184
Ts1	130+25	160.02	14:13	80.6	37.2	36,524	1131	792	612	373	251	155	108	2,072	65	55	1.977
Ts1	129+75	175.26	14:14	80.0	37.2	25,075	816	545	414	255	174	110	76	1,440	73	54	1.922
Ts1	129+75	175.26	14:14	80.0	37.2	36,297	1258	867	660	402	274	171	117	1,626	62	50	1.968
Ts1	129+75	175.26	14:14	80.0	37.2	35,835	1240	868	663	396	274	171	118	1,696	61	50	2.321
Ts1	129+25	190.50	14:15	79.4	37.2	25,128	781	528	401	248	174	110	75	1,521	78	55	1.962
Ts1	129+25	190.50	14:15	79.4	37.2	35,977	1188	832	636	392	276	172	116	1,710	69	50	2.144
Ts1	129+25	190.50	14:15	79.4	37.2	35,959	1187	842	647	395	281	175	118	1,772	68	49	2.471
Ts3	126+75	38.10	14:16	81.1	36.7	24,897	834	558	419	244	167	104	71	1,479	64	56	2.289
Ts3	126+75	38.10	14:16	81.1	36.7	35,924	1266	879	668	377	265	163	110	1,621	57	52	3.272
Ts3	126+75	38.10	14:16	81.1	36.7	36,333	1266	886	678	384	271	166	112	1,694	57	52	3.258
Ts3	126+25	53.34	14:17	81.1	37.2	25,075	728	475	361	226	160	104	76	1,218	95	59	1.896
Ts3	126+25	53.34	14:17	81.1	37.2	36,542	1112	753	585	361	252	162	115	1,625	80	54	2.056
Ts3	126+25	53.34	14:17	81.1	37.2	36,542	1100	756	590	362	254	164	116	1,749	79	54	2.187
Ts3	125+75	68.58	14:18	81.1	36.7	25,253	706	454	341	199	134	86	61	1,445	83	70	2.133
Ts3	125+75	68.58	14:18	81.1	36.7	36,471	1069	716	543	319	216	136	96	1,749	73	64	2.173
Ts3	125+75	68.58	14:18	81.1	36.7	36,613	1052	712	527	327	218	132	96	1,842	75	64	1.849
Ts3	125+25	83.82	14:18	81.1	36.7	25,413	766	505	378	228	154	98	68	1,484	77	62	1.764
Ts3	125+25	83.82	14:18	81.1	36.7	36,333	1146	788	597	357	241	150	103	1,818	65	57	2.001
Ts3	125+25	83.82	14:18	81.1	36.7	36,880	1138	789	600	363	245	152	105	1,905	67	57	1.923
Ts3	124+75	99.06	14:19	80.6	37.2	25,181	789	523	396	245	166	105	71	1,468	75	57	1.851
Ts3	124+75	99.06	14:19	80.6	37.2	36,364	1203	824	631	386	261	161	109	1,724	65	53	2.089
Ts3	124+75	99.06	14:19	80.6	37.2	36,507	1196	832	639	386	264	164	111	1,820	64	53	2.171
Ts3	124+25	114.30	14:20	79.4	36.7	25,253	794	521	395	235	159	100	70	1,439	73	59	2.196
Ts3	124+25	114.30	14:20	79.4	36.7	36,297	1198	816	628	372	251	155	107	1,750	62	55	2.356
Ts3	124+25	114.30	14:20	79.4	36.7	36,524	1194	816	632	379	257	159	109	1,785	64	54	2.310
Ts3	123+75	129.54	14:20	79.4	36.7	25,426	699	462	352	219	151	95	67	1,598	90	63	2.123
Ts3	123+75	129.54	14:20	79.4	36.7	36,507	1064	741	576	340	233	147	103	2,071	71	59	2.504

Section	Proj. Sta.	Sect. Sta., m	Time	Temperature, C		Load, N	Deflections, um							Moduli, MPa			Fit,%
				Pvm't	Air		D_1	D_2	D_3	D_4	D_5	D_6	D_7	E_{ac}	E_{base}	$E_{subgrade}$	
Ts3	123+75	129.54	14:20	79.4	36.7	36,773	1056	730	561	343	244	150	104	1,896	80	58	2.546
Ts3	123+25	144.78	14:21	78.3	35.6	25,462	680	438	330	204	143	93	66	1,254	102	66	1.829
Ts3	123+25	144.78	14:21	78.3	35.6	36,773	1007	672	515	318	222	142	101	1,639	91	62	1.974
Ts3	123+25	144.78	14:21	78.3	35.6	36,649	1000	672	515	322	226	145	100	1,661	93	61	1.988
Ts3	122+75	160.02	14:22	78.3	36.1	25,479	686	446	340	213	142	90	62	1,584	91	66	1.778
Ts3	122+75	160.02	14:22	78.3	36.1	36,791	1030	693	534	334	224	139	94	1,920	81	62	2.001
Ts3	122+75	160.02	14:22	78.3	36.1	36,333	1018	695	535	333	225	138	91	2,025	78	61	2.098
Ts3	122+25	175.26	14:23	78.9	35.0	25,426	623	406	314	200	139	90	63	1,537	113	68	1.832
Ts3	122+25	175.26	14:23	78.9	35.0	36,702	933	641	492	312	215	134	93	2,124	92	64	1.913
Ts3	122+25	175.26	14:23	78.9	35.0	36,756	923	642	498	316	218	137	96	2,274	93	63	1.820
Ts3	121+75	190.50	14:23	78.9	36.1	25,324	648	404	308	192	139	92	67	981	121	68	2.218
Ts3	121+75	190.50	14:23	78.9	36.1	36,507	967	630	482	297	215	140	101	1,304	106	64	2.219
Ts3	121+75	190.50	14:23	78.9	36.1	36,400	957	633	487	302	217	142	102	1,470	104	63	2.114
Ts5	119+25	38.10	14:24	79.4	36.1	25,324	685	446	341	216	151	96	68	1,374	101	63	1.984
Ts5	119+25	38.10	14:24	79.4	36.1	36,649	1035	696	536	336	235	149	104	1,675	88	59	2.180
Ts5	119+25	38.10	14:24	79.4	36.1	36,507	1023	697	539	338	236	150	105	1,796	87	58	2.018
Ts5	118+75	53.34	14:25	79.4	36.1	25,413	717	469	358	220	149	93	62	1,559	85	64	2.209
Ts5	118+75	53.34	14:25	79.4	36.1	36,507	1060	720	553	339	232	145	98	1,843	78	59	2.187
Ts5	118+75	53.34	14:25	79.4	36.1	36,173	1046	717	553	343	233	145	97	1,944	77	59	2.009
Ts5	118+25	68.58	14:26	79.4	36.1	25,199	721	486	364	217	149	96	67	1,650	80	63	2.188
Ts5	118+25	68.58	14:26	79.4	36.1	36,471	1074	747	568	339	234	149	103	1,891	73	59	2.312
Ts5	118+25	68.58	14:26	79.4	36.1	36,827	1067	754	575	339	235	150	104	2,029	72	59	2.812
Ts5	117+75	83.82	14:27	79.4	35.6	25,342	759	498	380	226	152	97	66	1,529	76	62	2.107
Ts5	117+75	83.82	14:27	79.4	35.6	36,351	1121	769	590	346	236	147	101	1,834	67	58	2.365
Ts5	117+75	83.82	14:27	79.4	35.6	36,209	1114	775	591	350	242	149	103	1,894	67	57	2.383
Ts5	117+25	99.06	14:27	78.3	35.6	25,110	738	488	367	212	148	95	66	1,492	78	64	2.656
Ts5	117+25	99.06	14:27	78.3	35.6	36,382	1098	752	573	335	231	147	103	1,785	71	60	2.526
Ts5	117+25	99.06	14:27	78.3	35.6	36,351	1083	752	570	339	240	149	101	1,824	73	58	2.546
Ts5	116+75	114.30	14:28	78.9	35.6	24,741	730	485	369	221	154	97	68	1,548	80	61	2.382
Ts5	116+75	114.30	14:28	78.9	35.6	36,226	1109	760	585	354	245	151	105	1,811	72	56	2.412
Ts5	116+75	114.30	14:28	78.9	35.6	36,244	1100	759	588	358	249	153	106	1,890	73	56	2.436
Ts5	116+25	129.54	14:38	78.9	35.6	25,377	635	406	309	194	138	91	64	1,209	117	68	1.837
Ts5	116+25	129.54	14:38	78.9	35.6	37,125	954	631	484	303	214	139	96	1,548	104	65	1.971
Ts5	116+25	129.54	14:38	78.9	35.6	36,845	945	634	488	302	215	141	99	1,659	103	64	2.153
Ts5	115+75	144.78	14:39	79.4	35.6	25,413	651	424	309	167	109	68	47	1,777	77	87	2.766
Ts5	115+75	144.78	14:39	79.4	35.6	36,667	956	646	478	259	168	103	72	2,117	69	83	2.749
Ts5	115+75	144.78	14:39	79.4	35.6	36,987	947	639	476	264	172	105	74	2,198	72	82	2.467
Ts5	115+25	160.02	14:39	80.0	35.6	25,288	704	466	358	220	155	99	68	1,531	91	61	2.222
Ts5	115+25	160.02	14:39	80.0	35.6	36,400	1061	723	558	343	241	153	106	1,716	82	57	2.102
Ts5	115+25	160.02	14:39	80.0	35.6	36,578	1051	715	555	346	244	154	106	1,748	85	57	2.174
Ts5	114+75	175.26	14:40	80.0	35.6	25,342	678	443	347	219	154	99	69	1,472	103	61	2.296
Ts5	114+75	175.26	14:40	80.0	35.6	36,351	1020	687	542	341	239	153	106	1,725	91	57	2.315
Ts5	114+75	175.26	14:40	80.0	35.6	36,507	1014	689	541	344	244	154	105	1,776	93	56	2.300
Ts5	114+25	190.50	14:41	78.9	36.1	25,021	773	507	385	232	161	99	72	1,444	76	59	2.689
Ts5	114+25	190.50	14:41	78.9	36.1	36,333	1168	792	611	365	253	156	108	1,681	68	55	2.620
Ts5	114+25	190.50	14:41	78.9	36.1	36,031	1156	792	604	372	260	158	108	1,682	70	53	2.494
Ss6	111+75	38.10	14:43	78.3	36.1	25,444	684	448	352	220	151	99	67	1,586	97	62	2.022
Ss6	111+75	38.10	14:43	78.3	36.1	36,471	1020	692	547	344	237	153	103	1,864	88	57	1.958
Ss6	111+75	38.10	14:43	78.3	36.1	36,596	1024	701	555	351	242	155	106	1,960	87	56	1.969

Section	Proj. Sta.	Sect. Sta., m	Time	Temperature, C		Load, N	Deflections, um							Moduli, MPa			Fit,%
				Pvm't	Air		D_1	D_2	D_3	D_4	D_5	D_6	D_7	E_{ac}	E_{base}	$E_{subgrade}$	
Ss6	111+25	53.34	14:45	80.0	36.1	25,306	683	442	348	218	154	99	69	1,412	102	61	2.419
Ss6	111+25	53.34	14:45	80.0	36.1	36,315	1016	679	535	336	236	150	104	1.661	92	58	2.393
Ss6	111+25	53.34	14:45	80.0	36.1	36,297	1009	675	534	339	238	151	105	1,720	93	57	2.355
Ss6	110+75	68.58	14:46	80.0	37.2	25,426	752	498	379	230	155	93	61	1,754	73	63	2.698
Ss6	110+75	68.58	14:46	80.0	37.2	36,418	1113	765	589	356	239	141	94	2,072	65	59	2.631
Ss6	110+75	68.58	14:46	80.0	37.2	36,916	1113	770	594	363	244	145	97	2,122	66	58	2.458
Ss6	110+25	83.82	14:47	80.0	36.7	25,764	767	517	386	228	150	89	59	1,912	65	66	2.409
Ss6	110+25	83.82	14:47	80.0	36.7	36,560	1122	776	586	351	230	137	91	2,096	61	61	2.191
Ss6	110+25	83.82	14:47	80.0	36.7	36,489	1126	781	593	358	238	139	91	2,124	61	60	2.515
Ss6	109+75	99.06	14:47	79.4	36.1	25,253	738	478	368	229	156	98	66	1,400	87	60	2.273
Ss6	109+75	99.06	14:47	79.4	36.1	36,631	1108	743	577	355	243	150	101	1,740	75	57	2.441
Ss6	109+75	99.06	14:47	79.4	36.1	36,667	1103	746	584	360	245	152	103	1,855	75	57	2.374
Ss6	109+25	114.30	14:48	79.4	37.2	25,515	778	499	379	233	158	100	68	1,281	82	60	2.212
Ss6	109+25	114.30	14:48	79.4	37.2	36,400	1148	766	587	357	243	152	103	1,580	72	56	2.221
Ss6	109+25	114.30	14:48	79.4	37.2	36,226	1144	775	595	362	247	153	104	1,726	69	56	2.230
Ss6	108+75	129.54	14:49	79.4	36.7	25,164	783	520	386	230	150	92	62	1,650	66	63	1.904
Ss6	108+75	129.54	14:49	79.4	36.7	36,382	1180	809	609	362	237	144	97	1,862	59	58	2.021
Ss6	108+75	129.54	14:49	79.4	36.7	36,155	1162	801	604	366	239	146	98	1,913	61	57	1.718
Ss6	108+25	144.78	14:49	79.4	37.2	25,426	781	513	382	240	168	105	70	1,257	84	57	1.962
Ss6	108+25	144.78	14:49	79.4	37.2	36,297	1148	775	588	363	257	160	107	1,459	77	54	2.232
Ss6	108+25	144.78	14:49	79.4	37.2	36,013	1135	776	584	363	257	161	108	1,542	76	53	2.051
Ss6	107+75	160.02	14:50	80.0	37.2	25,377	761	513	389	244	167	107	75	1,571	81	57	1.582
Ss6	107+75	160.02	14:50	80.0	37.2	36,453	1138	791	609	379	260	164	113	1,833	72	53	1.810
Ss6	107+75	160.02	14:50	80.0	37.2	36,578	1127	792	603	381	263	164	114	1,890	73	53	1.703
Ss6	107+25	175.26	14:51	80.0	37.2	25,395	729	494	378	232	162	105	72	1,674	85	59	1.921
Ss6	107+25	175.26	14:51	80.0	37.2	36,578	1090	765	595	366	256	163	112	1,947	77	54	2.055
Ss6	107+25	175.26	14:51	80.0	37.2	36,542	1080	765	597	368	258	164	112	2,056	76	53	2.104
Ss6	106+75	190.50	14:52	79.4	37.2	25,640	751	519	400	243	172	112	77	1,738	82	56	2.311
Ss6	106+75	190.50	14:52	79.4	37.2	36,613	1096	781	607	374	265	171	118	1,957	78	52	2.371
Ss6	106+75	190.50	14:52	79.4	37.2	36,191	1084	776	606	380	269	173	120	2,041	78	51	2.054
Ss4	104+25	38.10	14:54	78.3	37.2	25,342	887	571	434	258	172	106	72	1,265	65	55	2.593
Ss4	104+25	38.10	14:54	78.3	37.2	36,084	1323	889	681	402	269	163	109	1,557	55	51	2.705
Ss4	104+25	38.10	14:54	78.3	37.2	36,400	1320	896	689	410	275	165	111	1,634	55	51	2.621
Ss4	103+75	53.34	14:55	77.8	37.2	24,932	824	552	424	247	176	112	75	1,425	71	54	2.933
Ss4	103+75	53.34	14:55	77.8	37.2	35,942	1262	873	666	391	276	174	115	1,535	62	50	2.714
Ss4	103+75	53.34	14:55	77.8	37.2	36,262	1266	886	677	397	280	177	120	1,606	62	49	2.879
Ss4	103+25	68.58	14:56	78.3	36.7	25,462	848	560	433	263	184	117	79	1,325	74	52	2,391
Ss4	103+25	68.58	14:56	78.3	36.7	36,226	1266	864	671	403	284	179	121	1,502	66	48	2.480
Ss4	103+25	68.58	14:56	78.3	36.7	36,262	1266	876	682	410	289	182	123	1,588	65	48	2.438
Ss4	102+75	83.82	14:56	77.8	36.7	24,968	848	554	421	263	183	115	79	1,169	76	51	2.193
Ss4	102+75	83.82	14:56	77.8	36.7	35,977	1287	874	668	412	286	177	119	1,445	65	48	2.283
Ss4	102+75	83.82	14:56	77.8	36.7	35,977	1281	885	680	417	290	179	120	1,571	63	47	2.289
Ss4	102+25	99.06	14:58	76.7	36.7	24,510	724	499	382	242	169	108	293	1,707	84	54	1.690
Ss4	102+25	99.06	14:58	76.7	36.7	36,471	1122	780	605	399	277	176	117	1,746	83	49	1.565
Ss4	102+25	99.06	14:58	76.7	36.7	36,066	1116	784	612	399	277	175	118	1,909	78	49	1.710
Ss4	102+25	99.06	14:58	76.1	36.7	25,306	745	508	387	263	182	116	81	1,498	94	52	1.271
Ss4	102+25	99.06	14:58	76.1	36.7	36,631	1115	783	606	401	283	179	121	1,770	85	49	1.681
Ss4	102+25	99.06	14:58	76.1	36.7	36,756	1122	791	614	401	286	181	121	1,793	84	48	1.844
Ss4	101+75	114.30	15:00	78.3	36.7	25,146	820	531	400	237	168	105	73	1,189	76	57	2.668

		Sect.		Temperature, C			Deflections, um							Moduli, MPa			
Section	Proj. Sta.	Sta., m	Time	Pvm't	Air	Load, N	D_1	D_2	D_3	D_4	D_5	D_6	D_7	E_{ac}	E_{base}	$E_{subgrade}$	Fit,%
Ss4	101+75	114.30	15:00	78.3	36.7	35,959	1214	815	620	380	263	168	116	1,377	71	51	1.892
Ss4	101+75	114.30	15:00	78.3	36.7	36,351	1197	803	617	382	268	169	118	1,430	75	51	2.191
Ss4	101+25	129.54	15:02	78.3	37.2	25,377	861	566	434	274	195	126	86	1,092	82	49	2.003
Ss4	101+25	129.54	15:02	78.3	37.2	36,084	1251	861	667	414	298	191	130	1,409	73	46	2.213
Ss4	101+25	129.54	15:02	78.3	37.2	36,191	1240	868	673	418	301	193	132	1,548	72	45	2.209
Ss4	100+75	144.78	15:03	77.8	37.2	25,110	825	522	396	251	172	115	79	924	87	53	1.394
Ss4	100+75	144.78	15:03	77.8	37.2	36,542	1221	809	622	393	272	176	120	1,266	78	50	1.726
Ss4	100+75	144.78	15:03	77.8	37.2	36,418	1209	814	635	395	275	177	121	1,461	75	49	2.067
Ss4	100+25	160.02	15:04	77.8	37.2	25,253	781	500	388	262	179	117	80	1,001	100	52	1.663
Ss4	100+25	160.02	15:04	77.8	37.2	36,596	1164	776	606	403	282	179	120	1,310	89	48	1.971
Ss4	100+25	160.02	15:04	77.8	37.2	36,453	1145	770	608	403	283	181	123	1,448	89	48	2.059
Ss4	99+75	175.26	15:04	78.3	37.2	25,395	732	453	356	232	165	105	73	876	112	58	2.617
Ss4	99+75	175.26	15:04	78.3	37.2	36,435	1092	699	546	354	252	155	109	1,116	98	55	2.922
Ss4	99+75	175.26	15:04	78.3	37.2	36,155	1078	696	556	357	256	161	111	1,232	98	53	2.927
Ss4	99+25	190.50	15:05	79.4	37.2	25,359	659	435	346	221	161	107	75	1,403	116	58	2.273
Ss4	99+25	190.50	15:05	79.4	37.2	36,262	975	661	531	340	249	162	115	1,652	107	54	2.464
Ss4	99+25	190.50	15:05	79.4	37.2	36,435	966	658	530	346	251	164	115	1,755	109	54	2.280
Ss2	96+75	38.10	15:07	79.4	37.2	25,324	702	438	347	244	170	110	78	798	130	55	2.448
Ss2	96+75	38.10	15:07	79.4	37.2	36,489	1048	679	533	374	262	168	116	1,046	116	51	2.265
Ss2	96+75	38.10	15:07	79.4	37.2	36,435	1040	681	532	375	263	168	118	1,094	116	51	2.163
Ss2	96+25	53.34	15:07	78.9	36.7	25,324	727	446	348	236	161	101	69	865	112	59	2.935
Ss2	96+25	53.34	15:07	78.9	36.7	36,809	1091	694	543	364	251	155	106	1,115	101	55	2.792
Ss2	96+25	53.34	15:07	78.9	36.7	36,578	1074	688	536	363	252	156	106	1,117	103	54	2.730
Ss2	95+75	68.58	15:08	80.0	37.2	25,395	695	434	343	236	163	106	75	874	126	57	2.224
Ss2	95+75	68.58	15:08	80.0	37.2	36,524	1053	682	543	366	255	162	112	1,213	107	53	2.322
Ss2	95+75	68.58	15:08	80.0	37.2	36,756	1046	688	545	355	256	162	112	1,296	105	54	2.554
Ss2	95+25	83.82	15:09	79.4	37.2	25,199	729	455	353	245	174	108	77	765	121	55	2.651
Ss2	95+25	83.82	15:09	79.4	37.2	36,560	1107	718	564	382	273	169	117	1,068	104	50	2.629
Ss2	95+25	83.82	15:09	79.4	37.2	36,333	1087	713	560	381	273	167	117	1,196	103	50	2.683
Ss2	94+75	99.06	15:10	78.9	37.2	24,723	652	440	339	222	158	102	71	1,581	107	58	1.770
Ss2	94+75	99.06	15:10	78.9	37.2	36,702	1017	702	549	345	254	161	109	1,752	96	55	2.469
Ss2	94+75	99.06	15:10	78.9	37.2	36,596	1007	709	546	344	256	161	111	1,810	95	55	2.517
Ss2	94+25	114.30	15:10	79.4	37.2	25,306	770	501	392	249	181	115	78	1,165	96	53	2.743
Ss2	94+25	114.30	15:10	79.4	37.2	36,435	1156	784	617	384	282	177	119	1,485	83	49	2.864
Ss2	94+25	114.30	15:10	79.4	37.2	36,400	1146	787	613	385	286	176	120	1,522	84	49	2.885
Ss2	93+75	129.54	15:11	79.4	37.2	25,199	766	505	376	253	172	105	73	1,288	89	55	1.983
Ss2	93+75	129.54	15:11	79.4	37.2	36,418	1155	784	589	388	267	160	110	1,595	76	52	2.119
Ss2	93+75	129.54	15:11	79.4	37.2	36,297	1144	786	592	388	271	163	113	1,642	77	51	2.039
Ss2	93+25	144.78	15:12	79.4	37.2	25,217	697	443	339	220	156	97	69	1,111	107	61	2.462
Ss2	93+25	144.78	15:12	79.4	37.2	36,418	1049	686	532	340	243	150	104	1,341	96	57	2.669
Ss2	93+25	144.78	15:12	79.4	37.2	36,738	1038	683	532	341	244	152	106	1,405	98	57	2.565
Ss2	92+75	160.02	15:13	80.0	37.8	25,199	744	493	378	228	158	99	70	1,573	80	60	2.430
Ss2	92+75	160.02	15:13	80.0	37.8	36,400	1128	770	591	357	249	151	108	1,777	71	56	2.645
Ss2	92+75	160.02	15:13	80.0	37.8	36,702	1120	771	591	359	254	152	109	1,818	73	56	2.828
Ss2	92+25	175.26	15:13	79.4	37.2	25,711	772	515	399	260	182	116	78	1,434	90	53	1.968
Ss2	92+25	175.26	15:13	79.4	37.2	36,173	1140	783	613	388	279	174	118	1,627	80	49	2.490
Ss2	92+25	175.26	15:13	79.4	37.2	36,453	1147	790	615	396	285	176	120	1,632	82	49	2.452
Ss2	91+75	190.50	15:14	78.9	37.2	25,235	852	550	413	256	174	108	73	1,173	74	54	2.156
Ss2	91+75	190.50	15:14	78.9	37.2	36,244	1288	860	649	399	273	167	113	1,375	64	51	2.288

Section	Proj. Sta.	Sect. Sta., m	Time	Temperature, C		Load, N	Deflections, um							Moduli, MPa			Fit,%
				Pvm't	Air		D_1	D_2	D_3	D_4	D_5	D_6	D_7	E_{ac}	E_{base}	$E_{subgrade}$	
Ss2	91+75	190.50	15:14	78.9	37.2	36,102	1278	863	660	400	276	169	115	1,492	63	50	2.518
Ss1	89+25	38.10	15:17	79.4	37.8	25,324	703	456	344	205	148	86	59	1,488	87	67	3.647
Ss1	89+25	38.10	15:17	79.4	37.8	36,578	1063	703	540	325	230	138	93	1,594	81	61	3.167
Ss1	89+25	38.10	15:17	79.4	37.8	36,542	1061	705	546	330	234	142	96	1,663	81	60	3.170
Ss1	88+75	53.34	15:17	78.9	37.2	25,515	683	429	312	196	139	86	64	1,051	104	70	2.244
Ss1	88+75	53.34	15:17	78.9	37.2	36,934	1028	664	485	307	215	134	97	1,196	97	65	1.862
Ss1	88+75	53.34	15:17	78.9	37.2	36,898	1019	666	490	311	218	135	99	1,315	95	64	1.928
Ss1	88+25	68.58	15:18	78.9	37.2	25,622	767	515	400	246	167	107	73	1,717	78	57	1.970
Ss1	88+25	68.58	15:18	78.9	37.2	36,720	1152	799	623	383	263	164	111	1,884	70	53	2.140
Ss1	88+25	68.58	15:18	78.9	37.2	36,453	1139	796	623	381	265	166	111	1,932	71	52	2.253
Ss1	87+75	83.82	15:19	79.4	37.2	26,560	801	527	409	256	178	109	74	1,491	83	57	2.697
Ss1	87+75	83.82	15:19	79.4	37.2	36,560	1141	775	608	374	264	160	108	1,736	75	53	2.927
Ss1	87+75	83.82	15:19	79.4	37.2	36,209	1125	777	610	376	263	161	108	1,885	73	53	2.645
Ss1	87+25	99.06	15:19	79.4	37.2	25,693	745	483	370	225	156	98	63	1,387	86	62	2.537
Ss1	87+25	99.06	15:19	79.4	37.2	36,631	1129	751	581	359	244	150	99	1,634	75	57	2.466
Ss1	87+25	99.06	15:19	79.4	37.2	36,827	1130	756	582	367	251	155	99	1,622	78	55	2.278
Ss1	86+75	114.30	15:20	80.0	37.2	25,462	678	460	359	228	163	104	70	1,754	99	59	2.131
Ss1	86+75	114.30	15:20	80.0	37.2	37,036	1054	731	574	355	259	163	110	1,823	88	54	2.609
Ss1	86+75	114.30	15:20	80.0	37.2	36,791	1042	721	571	362	261	164	111	1,850	91	53	2.490
Ss1	86+25	129.54	15:21	80.0	37.2	26,293	736	473	375	239	173	112	78	1,144	110	56	2.607
Ss1	86+25	129.54	15:21	80.0	37.2	36,827	1076	717	570	364	264	170	118	1,386	99	52	2.479
Ss1	86+25	129.54	15:21	80.0	37.2	36,845	1067	718	559	364	262	172	119	1,366	101	52	1.781
Ss1	85+75	144.78	15:22	80.0	37.2	26,080	696	452	365	246	177	117	81	1,157	127	54	2.138
Ss1	85+75	144.78	15:22	80.0	37.2	36,756	1032	694	562	370	269	177	123	1,473	109	50	2.334
Ss1	85+75	144.78	15:22	80.0	37.2	36,827	1028	701	568	366	272	179	124	1,567	108	50	2.496
Ss1	85+25	160.02	15:22	80.0	37.2	26,400	645	432	334	212	153	98	67	1,690	112	65	2.238
Ss1	85+25	160.02	15:22	80.0	37.2	37,036	970	659	512	327	235	150	102	1,770	102	59	2.198
Ss1	85+25	160.02	15:22	80.0	37.2	37,534	978	667	520	341	241	154	106	1,792	104	58	1.836
Ss1	84+75	175.26	15:23	79.4	37.2	25,995	724	478	371	240	168	104	72	1,540	96	58	2.425
Ss1	84+75	175.26	15:23	79.4	37.2	36,351	1068	725	568	360	254	157	107	1,744	85	54	2.549
Ss1	84+75	175.26	15:23	79.4	37.2	37,054	1092	743	586	372	264	163	112	1,773	85	53	2.622
Ss1	84+25	190.50	15:24	79.4	37.2	25,039	801	522	402	247	174	109	73	1,266	80	54	2.666
Ss1	84+25	190.50	15:24	79.4	37.2	36,364	1244	840	651	392	276	169	115	1,514	67	50	2.807
Ss1	84+25	190.50	15:24	79.4	37.2	36,613	1253	850	659	400	283	174	117	1,519	68	50	2.772
Ss3	81+75	38.10	15:25	78.9	37.2	25,995	805	542	403	240	164	107	75	1,478	74	59	2.036
Ss3	81+75	38.10	15:25	78.9	37.2	36,951	1169	809	610	363	250	162	115	1,665	70	55	2.359
Ss3	81+75	38.10	15:25	78.9	37.2	36,845	1149	800	596	368	254	163	114	1,658	73	55	1.940
Ss3	81+25	53.34	15:26	79.4	37.8	25,853	825	529	400	243	166	104	73	1,199	78	58	2.257
Ss3	81+25	53.34	15:26	79.4	37.8	37,036	1214	809	616	374	257	162	114	1,438	71	54	2.140
Ss3	81+25	53.34	15:26	79.4	37.8	36,756	1188	802	614	374	257	164	114	1,553	71	54	1.980
Ss3	80+75	68.58	15:27	78.9	37.2	25,622	822	528	392	240	163	105	71	1,124	79	58	1.615
Ss3	80+75	68.58	15:27	78.9	37.2	36,507	1203	809	608	369	251	159	113	1,479	69	55	1.809
Ss3	80+75	68.58	15:27	78.9	37.2	36,262	1171	798	601	363	251	158	109	1,594	69	55	1.956
Ss3	80+25	83.82	15:28	78.9	37.2	24,741	799	521	389	228	159	103	74	1,210	75	58	2.461
Ss3	80+25	83.82	15:28	78.9	37.2	36,756	1236	833	627	367	258	163	117	1,426	67	54	2.547
Ss3	80+25	83.82	15:28	78.9	37.2	36,613	1207	818	618	364	258	162	115	1,471	69	54	2.490
Ss3	79+75	99.06	15:28	78.9	37.2	25,515	915	599	441	253	168	102	70	1,324	57	57	2.470
Ss3	79+75	99.06	15:28	78.9	37.2	36,507	1356	928	694	397	264	159	108	1,584	51	53	2.500
Ss3	79+75	99.06	15:28	78.9	37.2	36,489	1334	917	689	401	266	160	109	1,633	52	53	2.403

Section	Proj. Sta.	Sect. Sta., m	Time	Temperature, C		Load, N	Deflections, um							Moduli, MPa			Fit, %
				Pvm't	Air		D_1	D_2	D_3	D_4	D_5	D_6	D_7	E_{ac}	E_{base}	$E_{subgrade}$	
Ss3	79+25	114.30	15:29	78.9	37.2	24,932	820	535	400	230	153	94	62	1,443	64	61	2.530
Ss3	79+25	114.30	15:29	78.9	37.2	36,191	1226	835	633	361	243	147	97	1,712	57	57	2.752
Ss3	79+25	114.30	15:29	78.9	37.2	36,315	1227	849	646	365	249	151	100	1,783	56	56	2.891
Ss3	79+25	114.30	15:30	77.2	38.3	25,871	846	558	420	252	165	100	66	1,586	64	59	2.335
Ss3	79+25	114.30	15:30	77.2	38.3	36,364	1204	823	627	375	247	149	99	1,859	59	56	2.228
Ss3	79+25	114.30	15:30	77.2	38.3	36,226	1206	840	641	372	247	149	99	1,937	56	56	2.441
Ss3	78+75	129.54	15:31	77.8	37.2	25,497	848	554	402	246	163	101	70	1,260	69	59	1.604
Ss3	78+75	129.54	15:31	77.8	37.2	36,102	1234	839	628	359	246	152	105	1,575	59	56	2.547
Ss3	78+75	129.54	15:31	77.8	37.2	36,364	1226	845	634	363	249	156	106	1,672	59	56	2.755
Ss3	78+25	144.78	15:33	78.3	37.2	25,586	815	511	375	220	153	97	72	1,013	79	63	2.284
Ss3	78+25	144.78	15:33	78.3	37.2	36,578	1196	781	583	335	240	152	106	1,199	73	58	2.844
Ss3	78+25	144.78	15:33	78.3	37.2	36,649	1180	777	581	336	240	153	108	1,261	74	58	2.808
Ss3	77+75	160.02	15:34	78.3	37.2	25,729	777	489	364	227	159	103	72	952	94	61	1.706
Ss3	77+75	160.02	15:34	78.3	37.2	36,596	1121	722	539	339	242	151	105	1,090	90	58	2.264
Ss3	77+75	160.02	15:34	78.3	37.2	36,880	1122	734	545	340	251	154	100	1,120	91	57	2.634
Ss3	77+25	175.26	15:35	78.9	37.2	26,031	845	519	382	230	153	91	66	1,034	75	64	2.901
Ss3	77+25	175.26	15:35	78.9	37.2	36,471	1216	772	577	344	231	135	97	1,252	68	60	3.246
Ss3	77+25	175.26	15:35	78.9	37.2	36,613	1210	773	581	349	236	140	101	1,264	70	59	3.113
Ss3	76+75	190.50	15:35	78.9	37.2	26,293	869	535	388	230	150	90	61	1,058	70	65	2.648
Ss3	76+75	190.50	15:35	78.9	37.2	36,400	1250	802	583	346	226	134	90	1,256	62	61	2.482
Ss3	76+75	190.50	15:35	78.9	37.2	37,018	1250	807	597	352	233	139	94	1,316	64	60	2.721
Ss5	74+25	38.10	15:37	79.4	37.2	26,258	696	446	327	212	147	97	69	1,102	109	66	0.989
Ss5	74+25	38.10	15:37	79.4	37.2	36,880	1028	672	496	314	223	146	104	1,165	101	62	1.478
Ss5	74+25	38.10	15:37	79.4	37.2	36,702	997	654	483	309	223	147	104	1,137	108	62	1.551
Ss5	73+75	53.34	15:38	80.0	37.2	25,533	639	394	289	171	121	78	54	1,111	107	80	2.243
Ss5	73+75	53.34	15:38	80.0	37.2	36,702	936	591	434	259	184	118	79	1,198	104	75	2.189
Ss5	73+75	53.34	15:38	80.0	37.2	36,244	907	572	424	253	184	116	75	1,176	109	75	2.590
Ss5	73+25	68.58	15:39	80.0	37.2	25,657	778	465	338	208	142	91	65	789	92	68	1.933
Ss5	73+25	68.58	15:39	80.0	37.2	35,995	1118	691	508	314	216	137	98	905	88	62	1.935
Ss5	73+25	68.58	15:39	80.0	37.2	36,084	1108	688	506	311	219	135	102	922	89	63	2.570
Ss5	72+75	83.82	15:40	79.4	37.2	25,253	979	623	446	255	169	106	71	979	57	55	1.980
Ss5	72+75	83.82	15:40	79.4	37.2	35,661	1412	932	679	391	262	163	110	1,143	53	51	2.106
Ss5	72+75	83.82	15:40	79.4	37.2	35,781	1406	942	688	395	265	164	112	1,272	51	51	2.098
Ss5	72+25	99.06	15:40	78.9	37.2	25,324	941	584	423	235	157	97	65	973	59	60	2.586
Ss5	72+25	99.06	15:40	78.9	37.2	35,835	1365	881	646	362	242	150	100	1,131	55	55	2.450
Ss5	72+25	99.06	15:40	78.9	37.2	35,959	1368	892	658	372	248	154	105	1,205	55	54	2.329
Ss5	71+75	114.30	15:41	78.9	37.2	24,510	991	596	419	235	151	94	67	788	55	60	2.057
Ss5	71+75	114.30	15:41	78.9	37.2	35,608	1484	929	663	371	239	148	103	928	50	55	2.126
Ss5	71+75	114.30	15:41	78.9	37.2	35,817	1491	946	672	380	246	152	107	954	50	54	1.922
Ss5	71+25	129.54	15:42	78.9	37.2	24,932	1126	714	499	265	167	100	69	930	42	56	2.432
Ss5	71+25	129.54	15:42	78.9	37.2	35,608	1662	1090	776	420	265	157	106	1,059	39	51	2.428
Ss5	71+25	129.54	15:42	78.9	37.2	35,519	1645	1089	775	426	273	160	108	1,091	39	50	2.599
Ss5	70+75	144.78	15:43	79.4	37.2	25,342	946	607	445	243	159	96	65	1,205	53	60	2.792
Ss5	70+75	144.78	15:43	79.4	37.2	36,031	1385	923	684	375	247	146	97	1,416	48	56	3.017
Ss5	70+75	144.78	15:43	79.4	37.2	36,667	1388	940	703	393	255	151	102	1,576	47	55	2.599
Ss5	70+25	160.02	15:43	80.6	37.2	24,599	854	544	396	245	157	96	67	1,159	66	58	1.721
Ss5	70+25	160.02	15:43	80.6	37.2	36,400	1302	874	644	384	248	150	103	1,533	55	55	1.964
Ss5	70+25	160.02	15:43	80.6	37.2	36,280	1293	875	650	389	254	155	107	1,582	55	54	1.925
Ss5	69+75	175.26	15:44	79.4	37.2	25,413	983	628	456	251	164	102	71	1,096	53	58	2.307

Section	Proj. Sta.	Sect. Sta., m	Time	Temperature, C		Load, N	Deflections, um							Moduli, MPa			Fit,%
				Pvm't	Air		D_1	D_2	D_3	D_4	D_5	D_6	D_7	E_{ac}	E_{base}	$E_{subgrade}$	
Ss5	69+75	175.26	15:44	79.4	37.2	36,333	1452	964	705	389	253	155	108	1,262	48	54	2.356
Ss5	69+75	175.26	15:44	79.4	37.2	35,959	1413	943	698	391	258	158	111	1,326	49	53	2.455
Ss5	69+25	190.50	15:45	78.9	36.7	25,426	891	575	421	246	160	99	69	1,262	60	59	2.018
Ss5	69+25	190.50	15:45	78.9	36.7	35,835	1284	858	640	373	245	150	104	1,490	56	55	2.198
Ss5	69+25	190.50	15:45	78.9	36.7	36,315	1288	868	653	375	255	152	106	1,566	55	55	2.865

Table A - 3. 2000 Deflection Data and Backcalculated Moduli for Test Sections..

Section	Proj. Sta.	Sect. Sta., m	Time	Temperature, C		Load, N	Deflections, um							Moduli, MPa			Fit,%
				Pvm't	Air		D_1	D_2	D_3	D_4	D_5	D_6	D_7	E_{ac}	E_{base}	$E_{subgrade}$	
Cs2	218+00	0.00	9:03	-3.6	39.6	27,886	278	249	222	175	132	91	62	17,237	288	75	3.184
Cs2	218+00	0.00	9:03	-3.6	39.6	41,649	423	378	339	268	201	138	94	17,237	284	73	3.407
Cs2	218+00	0.00	9:03	-3.6	39.6	41,173	420	377	337	266	200	137	93	17,237	282	72	3.388
Cs2	217+50	15.24	9:04	12.6	39.6	28,629	214	189	169	141	110	80	58	17,237	605	84	2.939
Cs2	217+50	15.24	9:04	12.6	39.6	41,666	321	283	255	215	166	119	87	17,237	597	81	3.248
Cs2	217+50	15.24	9:04	12.6	39.6	41,898	321	282	256	214	166	120	86	17,237	612	81	3.209
Cs2	217+00	30.48	9:05	12.6	39.6	27,779	293	244	211	168	122	83	57	17,237	222	85	1.494
Cs2	217+00	30.48	9:05	12.6	39.6	40,412	438	368	320	254	184	124	86	17,237	204	82	1.634
Cs2	217+00	30.48	9:05	12.6	39.6	40,216	439	368	320	254	185	125	88	17,237	203	82	1.589
Cs2	216+50	45.72	9:06	14.4	39.6	27,423	348	289	246	189	134	90	62	15,071	142	80	1.528
Cs2	216+50	45.72	9:06	14.4	39.6	40,959	532	445	380	292	207	137	93	16,168	122	79	1.526
Cs2	216+50	45.72	9:06	14.4	39.6	40,448	530	443	380	291	208	138	94	16,192	123	77	1.540
Cs2	216+00	60.96	9:06	14.4	39.6	27,250	419	322	271	200	139	94	64	7,417	152	74	2.040
Cs2	216+00	60.96	9:06	14.4	39.6	40,007	637	495	418	313	217	142	97	8,311	132	71	1.830
Cs2	216+00	60.96	9:06	14.4	39.6	39,883	629	490	415	312	217	142	97	8,792	131	71	1.895
Cs2	215+50	76.20	9:09	14.4	41.4	27,196	467	355	295	218	148	97	66	6,654	124	71	1.989
Cs2	215+50	76.20	9:09	14.4	41.4	39,901	711	549	457	339	230	148	101	7,363	108	68	1.867
Cs2	215+50	76.20	9:09	14.4	41.4	40,061	711	549	456	341	232	149	101	7,424	108	68	1.753
Cs2	215+00	91.44	9:09	16.2	41.4	27,214	490	383	316	230	157	101	69	7,218	103	68	1.756
Cs2	215+00	91.44	9:09	16.2	41.4	39,758	743	589	490	358	245	156	105	7,999	89	65	1.558
Cs2	215+00	91.44	9:09	16.2	41.4	39,478	740	588	491	360	247	155	106	8,428	85	65	1.430
Cs2	214+50	106.68	9:10	16.2	41.4	27,072	404	327	278	205	145	98	68	10,469	130	72	1.862
Cs2	214+50	106.68	9:10	16.2	41.4	39,829	621	507	432	320	225	149	103	11,175	109	70	1.806
Cs2	214+50	106.68	9:10	16.2	41.4	40,007	621	506	432	323	226	150	104	11,180	114	69	1.821
Cs2	214+00	121.92	9:11	18.0	41.4	27,179	431	340	280	207	143	94	64	8,336	124	74	1.520
Cs2	214+00	121.92	9:11	18.0	41.4	40,061	655	527	437	321	222	141	98	9,607	100	73	1.385
Cs2	214+00	121.92	9:11	18.0	41.4	39,687	652	521	435	323	224	142	97	9,710	102	72	1.297
Cs2	213+50	137.16	9:12	18.0	41.4	27,214	406	319	270	203	142	95	67	9,199	144	73	1.921
Cs2	213+50	137.16	9:12	18.0	41.4	39,954	614	489	417	313	218	144	99	10,396	122	72	1.832
Cs2	213+50	137.16	9:12	18.0	41.4	39,936	610	490	419	312	219	144	100	10,843	119	72	1.794
Cs2	213+00	152.40	9:13	19.8	41.4	26,965	361	283	236	177	124	84	59	9,361	168	82	1.781
Cs2	213+00	152.40	9:13	19.8	41.4	40,132	556	444	373	280	196	129	90	10,604	144	79	1.585
Cs2	213+00	152.40	9:13	19.8	41.4	39,865	551	439	370	278	195	130	91	10,508	148	79	1.645
Cs2	212+50	167.64	9:13	19.8	41.4	27,179	380	287	241	180	127	87	61	6,652	197	79	2.082
Cs2	212+50	167.64	9:13	19.8	41.4	39,829	570	437	369	277	194	131	92	7,908	171	77	2.006
Cs2	212+50	167.64	9:13	19.8	41.4	39,829	564	435	367	277	195	131	92	8,156	174	77	1.951
Cs2	212+00	182.88	9:14	21.6	41.4	27,107	384	303	252	184	125	82	58	9,758	129	85	1.853
Cs2	212+00	182.88	9:14	21.6	41.4	39,740	591	470	394	290	198	127	88	10,500	111	81	1.737
Cs2	212+00	182.88	9:14	21.6	41.4	39,567	588	467	392	291	199	127	88	10,724	112	80	1.691
Cs2	211+50	198.12	9:15	21.6	41.4	26,752	424	332	280	206	139	90	62	9,428	108	76	2.260
Cs2	211+50	198.12	9:15	21.6	41.4	39,425	649	515	435	324	216	138	96	10,368	90	75	2.157
Cs2	211+50	198.12	9:15	21.6	41.4	39,478	646	512	433	324	218	140	96	10,231	96	73	2.104
Cs2	211+00	213.36	9:16	21.6	43.2	26,560	453	362	300	223	151	98	67	9,095	97	70	1.830
Cs2	211+00	213.36	9:16	21.6	43.2	39,514	697	565	472	348	235	150	101	9,788	82	69	1.844
Cs2	211+00	213.36	9:16	21.6	43.2	39,353	697	565	471	353	238	152	103	10,030	82	68	1.736
Cs2	210+50	228.60	9:17	21.6	43.2	26,578	399	314	265	202	139	90	62	9,937	129	75	1.842
Cs2	210+50	228.60	9:17	21.6	43.2	39,211	621	493	416	317	217	139	95	10,434	108	72	1.753

Section	Proj. Sta.	Sect. Sta., m	Time	Temperature, C Pvm't	Temperature, C Air	Load, N	Deflections, um D_1	D_2	D_3	D_4	D_5	D_6	D_7	Moduli, MPa E_{ac}	E_{base}	$E_{subgrade}$	Fit,%
Cs2	210+50	228.60	9:17	21.6	43.2	40,096	629	502	423	321	220	142	97	10,686	108	73	1.787
Sa6	209+25	38.10	9:18	23.4	43.2	26,489	398	317	263	194	134	88	60	9,379	125	78	1.700
Sa6	209+25	38.10	9:18	23.4	43.2	39,425	614	499	418	305	209	137	95	10,454	104	75	1.963
Sa6	209+25	38.10	9:18	23.4	43.2	39,442	612	499	418	305	209	137	96	10,667	103	75	1.985
Sa6	208+75	53.34	9:19	23.4	43.2	26,614	421	315	260	187	130	86	59	5,938	149	78	1.797
Sa6	208+75	53.34	9:19	23.4	43.2	39,580	648	499	415	297	205	134	92	7,260	122	75	1.832
Sa6	208+75	53.34	9:19	23.4	43.2	40,025	649	502	418	298	205	134	93	7,508	121	76	1.792
Sa6	208+25	68.58	9:20	23.4	43.2	27,054	414	321	261	182	123	81	56	7,337	122	86	2.031
Sa6	208+25	68.58	9:20	23.4	43.2	38,944	637	501	411	292	198	125	88	8,201	102	79	1.576
Sa6	208+25	68.58	9:20	23.4	43.2	39,069	637	498	410	297	201	128	89	8,226	107	78	1.659
Sa6	207+75	83.82	9:20	23.4	43.2	26,418	418	326	261	182	123	80	54	7,036	117	84	1.919
Sa6	207+75	83.82	9:20	23.4	43.2	39,336	645	508	411	289	194	124	83	7,745	101	81	1.840
Sa6	207+75	83.82	9:20	23.4	43.2	39,514	641	505	411	289	195	125	84	7,936	103	81	1.840
Sa6	207+25	99.06	9:21	25.2	45.0	26,823	396	296	241	174	122	80	54	5,908	167	83	1.511
Sa6	207+25	99.06	9:21	25.2	45.0	39,567	602	457	378	270	187	122	83	6,927	142	82	1.766
Sa6	207+25	99.06	9:21	25.2	45.0	39,580	595	454	374	271	188	122	82	7,166	145	81	1.576
Sa6	206+75	114.30	9:22	28.8	45.0	27,072	377	294	243	176	124	83	58	7,902	164	83	1.557
Sa6	206+75	114.30	9:22	28.8	45.0	40,007	575	456	379	275	193	127	88	9,333	136	81	1.582
Sa6	206+75	114.30	9:22	28.8	45.0	40,025	570	454	378	275	194	128	89	9,503	140	80	1.475
Sa6	206+25	129.54	9:23	25.2	45.0	26,841	395	293	238	174	122	83	58	5,075	187	82	1.711
Sa6	206+25	129.54	9:23	25.2	45.0	39,651	605	459	375	272	190	127	88	6,059	160	78	1.615
Sa6	206+25	129.54	9:23	25.2	45.0	39,812	596	452	371	272	191	128	89	6,262	166	78	1.626
Sa6	205+75	144.78	9:24	23.4	45.0	26,805	350	279	233	170	122	84	60	9,368	179	82	1.789
Sa6	205+75	144.78	9:24	23.4	45.0	39,669	544	437	367	268	191	129	90	10,027	154	79	1.605
Sa6	205+75	144.78	9:24	23.4	45.0	39,580	543	438	368	269	193	130	92	10,194	154	78	1.575
Sa6	205+25	160.02	9:25	25.2	45.0	26,329	348	261	216	162	117	82	58	5,457	243	81	1.755
Sa6	205+25	160.02	9:25	25.2	45.0	39,687	538	416	345	255	183	126	88	7,161	198	80	1.582
Sa6	205+25	160.02	9:25	25.2	45.0	39,442	530	410	343	254	181	125	87	7,497	199	80	1.795
Sa6	204+75	175.26	9:26	25.2	43.2	26,560	349	269	228	174	126	87	61	7,777	223	77	1.583
Sa6	204+75	175.26	9:26	25.2	43.2	39,371	532	418	355	269	194	132	92	9,371	186	76	1.545
Sa6	204+75	175.26	9:26	25.2	43.2	39,634	530	417	354	270	196	133	94	9,477	191	76	1.535
Sa6	204+25	190.50	9:27	27.0	45.0	26,258	374	276	231	177	126	86	61	5,271	224	76	1.978
Sa6	204+25	190.50	9:27	27.0	45.0	39,901	579	438	368	279	198	133	91	6,682	189	75	1.790
Sa6	204+25	190.50	9:27	27.0	45.0	39,496	575	436	367	278	197	133	92	6,826	188	74	1.816
Sa4	201+75	38.10	9:28	32.4	45.0	26,667	299	246	211	165	122	86	61	14,171	235	80	1.379
Sa4	201+75	38.10	9:28	32.4	45.0	39,883	465	385	331	259	191	131	91	15,439	198	78	1.290
Sa4	201+75	38.10	9:28	32.4	45.0	40,288	464	383	330	259	191	131	91	15,728	203	79	1.258
Sa4	201+25	53.34	9:30	32.4	46.8	26,698	337	275	235	183	133	90	63	13,391	178	76	1.336
Sa4	201+25	53.34	9:30	32.4	46.8	39,442	517	426	365	285	205	138	96	14,506	151	74	1.454
Sa4	201+25	53.34	9:30	32.4	46.8	39,407	514	426	366	285	206	138	97	15,035	149	74	1.380
Sa4	200+75	68.58	9:31	36.0	46.8	26,698	324	264	223	170	123	85	60	12,088	194	81	1.486
Sa4	200+75	68.58	9:31	36.0	46.8	39,531	500	408	345	265	191	130	91	12,739	172	78	1.377
Sa4	200+75	68.58	9:31	36.0	46.8	39,634	503	410	348	267	193	131	92	12,720	173	78	1.453
Sa4	200+25	83.82	9:31	37.8	46.8	26,787	328	256	215	161	115	79	55	9,081	211	86	1.742
Sa4	200+25	83.82	9:31	37.8	46.8	40,341	502	400	337	253	180	121	84	11,210	176	85	1.618
Sa4	200+25	83.82	9:31	37.8	46.8	40,043	500	400	338	252	179	121	84	11,141	176	85	1.737
Sa4	199+75	99.06	9:32	37.8	48.6	26,805	307	248	212	169	126	90	66	11,121	281	75	1.389
Sa4	199+75	99.06	9:32	37.8	48.6	39,567	468	383	328	259	193	137	98	12,852	239	74	1.337
Sa4	199+75	99.06	9:32	37.8	48.6	39,776	470	386	331	260	194	137	100	13,304	232	74	1.349
Sa4	199+25	114.30	9:33	39.6	48.6	26,894	300	247	211	170	127	89	64	13,958	258	76	1.163

Section	Proj. Sta.	Sect. Sta., m	Time	Temperature, C		Load, N	Deflections, um							Moduli, MPa			Fit,%
				Pvm't	Air		D_1	D_2	D_3	D_4	D_5	D_6	D_7	E_{ac}	E_{base}	$E_{subgrade}$	
Sa4	199+25	114.30	9:33	39.6	48.6	39,567	454	379	326	259	192	133	94	16,543	206	76	1.127
Sa4	199+25	114.30	9:33	39.6	48.6	39,847	459	384	331	263	195	135	98	16,885	202	76	1.170
Sa4	198+75	129.54	9:34	39.6	48.6	26,614	309	244	211	164	120	84	59	11,424	241	81	1.883
Sa4	198+75	129.54	9:34	39.6	48.6	39,425	470	378	328	253	184	127	89	12,840	210	79	1.724
Sa4	198+75	129.54	9:34	39.6	48.6	39,954	471	379	330	253	185	129	90	13,183	210	80	1.806
Sa4	198+25	144.78	9:35	43.2	48.6	26,400	289	233	202	161	119	84	59	13,547	263	80	1.534
Sa4	198+25	144.78	9:35	43.2	48.6	39,669	443	360	314	250	184	128	89	17,237	149	91	4.175
Sa4	198+25	144.78	9:35	43.2	48.6	39,687	440	360	313	249	183	128	90	17,237	149	91	4.332
Sa4	197+75	160.02	9:36	45.0	48.6	26,049	343	260	218	166	118	82	57	6,853	224	80	1.839
Sa4	197+75	160.02	9:36	45.0	48.6	39,336	526	407	342	261	185	126	89	8,287	198	79	1.714
Sa4	197+75	160.02	9:36	45.0	48.6	39,669	521	406	342	261	186	127	90	8,620	202	79	1.667
Sa4	197+25	175.26	9:37	45.0	50.4	26,436	396	303	250	184	126	84	57	7,415	146	80	1.960
Sa4	197+25	175.26	9:37	45.0	50.4	39,549	609	476	395	292	200	131	88	8,445	128	77	1.775
Sa4	197+25	175.26	9:37	45.0	50.4	39,531	603	472	392	292	199	131	89	8,682	129	77	1.861
Sa4	196+75	190.50	9:38	43.2	50.4	26,667	399	297	246	182	127	86	61	5,552	184	77	1.996
Sa4	196+75	190.50	9:38	43.2	50.4	39,634	608	462	386	281	196	131	91	6,888	152	77	1.992
Sa4	196+75	190.50	9:38	43.2	50.4	39,705	607	460	384	284	197	132	92	6,668	160	76	2.051
Sa2	194+25	38.10	9:50	39.6	50.4	26,418	329	251	208	156	109	75	54	7,754	211	90	1.970
Sa2	194+25	38.10	9:50	39.6	50.4	39,514	506	395	328	243	168	114	82	9,136	176	89	1.990
Sa2	194+25	38.10	9:50	39.6	50.4	39,634	502	393	327	241	167	114	82	9,322	178	89	1.939
Sa2	193+75	53.34	9:51	39.6	50.4	26,649	353	269	217	160	112	78	57	6,125	207	87	1.806
Sa2	193+75	53.34	9:51	39.6	50.4	39,616	531	414	336	244	170	117	85	7,630	175	87	1.850
Sa2	193+75	53.34	9:51	39.6	50.4	39,407	531	411	338	247	175	116	87	7,791	176	86	1.345
Sa2	193+25	68.58	9:52	39.6	48.6	26,560	312	254	216	170	121	81	57	15,386	172	84	1.623
Sa2	193+25	68.58	9:52	39.6	48.6	39,247	472	389	335	259	183	122	87	16,578	145	84	1.657
Sa2	193+25	68.58	9:52	39.6	48.6	39,069	470	389	336	258	183	121	89	17,237	136	85	1.618
Sa2	192+75	83.82	9:52	37.8	48.6	26,596	337	269	231	176	124	84	60	12,440	167	82	1.968
Sa2	192+75	83.82	9:52	37.8	48.6	39,580	510	415	355	270	190	128	89	13,446	148	81	1.915
Sa2	192+75	83.82	9:52	37.8	48.6	39,247	506	412	353	267	188	127	92	13,480	147	81	1.855
Sa2	192+25	99.06	9:53	37.8	48.6	26,311	397	300	238	175	123	85	61	4,817	186	78	1.632
Sa2	192+25	99.06	9:53	37.8	48.6	39,175	599	463	368	269	187	128	91	5,949	159	78	1.782
Sa2	192+25	99.06	9:53	37.8	48.6	39,087	596	461	367	269	187	129	92	5,722	166	77	1.827
Sa2	191+75	114.30	9:54	37.8	48.6	26,649	334	252	210	156	111	77	56	6,648	233	87	1.917
Sa2	191+75	114.30	9:54	37.8	48.6	39,865	505	389	327	241	171	117	84	8,333	200	87	1.842
Sa2	191+75	114.30	9:54	37.8	48.6	39,687	496	385	324	237	169	116	84	8,745	199	87	1.787
Sa2	191+25	129.54	9:55	39.6	48.6	26,930	314	248	208	158	112	77	55	10,509	214	89	1.645
Sa2	191+25	129.54	9:55	39.6	48.6	39,531	478	386	325	243	172	116	83	12,473	169	88	1.669
Sa2	191+25	129.54	9:55	39.6	48.6	39,990	478	387	326	243	172	117	84	12,314	176	88	1.687
Sa2	190+75	144.78	9:56	41.4	50.4	26,787	323	247	205	156	110	75	52	8,212	225	90	1.667
Sa2	190+75	144.78	9:56	41.4	50.4	40,132	499	384	321	245	173	115	78	9,049	202	87	1.624
Sa2	190+75	144.78	9:56	41.4	50.4	39,883	497	383	321	244	173	116	80	8,938	206	86	1.626
Sa2	190+25	160.02	9:57	43.2	50.4	26,632	302	238	200	152	108	75	53	10,509	228	91	1.736
Sa2	190+25	160.02	9:57	43.2	50.4	39,865	473	378	319	240	171	117	82	11,484	194	88	1.686
Sa2	190+25	160.02	9:57	43.2	50.4	39,954	468	374	316	239	171	117	82	11,520	203	87	1.631
Sa2	189+75	175.26	9:58	45.0	50.4	26,632	297	229	197	151	110	76	53	9,505	270	88	1.706
Sa2	189+75	175.26	9:58	45.0	50.4	39,407	456	357	307	234	170	116	81	10,890	229	86	1.795
Sa2	189+75	175.26	9:58	45.0	50.4	39,514	456	359	309	234	171	117	82	11,014	229	85	1.656
Sa2	189+25	190.50	9:59	46.8	50.4	27,072	281	228	193	149	110	76	55	13,048	260	90	1.317
Sa2	189+25	190.50	9:59	46.8	50.4	39,549	426	350	298	226	166	115	81	14,544	215	89	1.482
Sa2	189+25	190.50	9:59	46.8	50.4	39,353	421	346	296	225	165	114	81	14,976	217	89	1.477

Section	Proj. Sta.	Sect. Sta., m	Time	Temperature, C Pvm't	Air	Load, N	Deflections, um D_1	D_2	D_3	D_4	D_5	D_6	D_7	Moduli, MPa E_{ac}	E_{base}	$E_{subgrade}$	Fit,%
Sa1	186+75	38.10	10:05	55.8	54.0	26,489	317	248	207	162	115	79	56	9,392	232	84	1.624
Sa1	186+75	38.10	10:05	55.8	54.0	39,069	476	377	318	246	174	118	83	11,192	197	84	1.646
Sa1	186+75	38.10	10:05	55.8	54.0	39,531	474	377	318	247	176	119	84	11,553	200	84	1.569
Sa1	186+25	53.34	10:05	57.6	54.0	26,347	318	251	209	157	112	78	56	9,297	218	86	1.702
Sa1	186+25	53.34	10:05	57.6	54.0	39,122	483	385	323	243	172	118	85	10,610	189	85	1.723
Sa1	186+25	53.34	10:05	57.6	54.0	39,300	478	383	321	242	172	119	86	10,884	193	85	1.705
Sa1	185+75	68.58	10:06	57.6	55.8	27,797	301	241	203	155	113	78	57	11,762	243	91	1.525
Sa1	185+75	68.58	10:06	57.6	55.8	39,389	445	358	303	233	168	115	83	12,836	210	88	1.554
Sa1	185+75	68.58	10:06	57.6	55.8	39,651	442	358	304	233	168	115	83	13,552	209	88	1.533
Sa1	185+25	83.82	10:07	61.2	55.8	26,841	293	230	196	151	111	80	57	9,775	287	86	1.791
Sa1	185+25	83.82	10:07	61.2	55.8	39,371	447	355	303	233	170	120	86	10,701	251	84	1.779
Sa1	185+25	83.82	10:07	61.2	55.8	39,847	444	355	304	232	169	120	86	11,416	250	85	1.712
Sa1	184+75	99.06	10:08	61.2	55.8	26,876	297	235	199	155	112	79	57	10,677	261	87	1.767
Sa1	184+75	99.06	10:08	61.2	55.8	40,185	453	364	309	238	170	119	86	12,181	225	86	1.777
Sa1	184+75	99.06	10:08	61.2	55.8	40,078	451	366	311	238	171	120	87	12,489	221	86	1.811
Sa1	184+25	114.30	10:09	64.8	55.8	26,698	291	233	197	154	113	81	60	10,717	280	85	1.714
Sa1	184+25	114.30	10:09	64.8	55.8	39,616	440	354	300	234	170	121	89	11,724	254	84	1.682
Sa1	184+25	114.30	10:09	64.8	55.8	39,140	433	352	298	230	168	120	88	12,071	248	84	1.728
Sa1	183+75	129.54	10:09	63.0	55.8	27,405	249	202	174	139	103	75	56	14,688	351	93	1.618
Sa1	183+75	129.54	10:09	63.0	55.8	39,723	372	301	261	206	153	110	81	14,997	322	92	1.586
Sa1	183+75	129.54	10:09	63.0	55.8	39,229	365	299	259	203	152	109	81	16,198	312	92	1.542
Sa1	183+25	144.78	10:10	64.8	55.8	26,752	240	197	170	135	100	71	53	17,237	316	96	1.561
Sa1	183+25	144.78	10:10	64.8	55.8	39,336	366	302	261	207	152	108	80	17,237	130	128	10.272
Sa1	183+25	144.78	10:10	64.8	55.8	39,669	364	304	262	207	153	109	81	17,237	303	93	1.511
Sa1	182+75	160.02	10:11	66.6	55.8	26,400	281	223	187	145	104	72	52	11,546	252	93	1.595
Sa1	182+75	160.02	10:11	66.6	55.8	39,758	430	341	291	225	160	109	78	13,237	220	93	1.793
Sa1	182+75	160.02	10:11	66.6	55.8	39,478	427	341	291	224	160	109	79	13,484	218	92	1.840
Sa1	182+25	175.26	10:12	68.4	55.8	26,596	302	238	201	154	107	71	50	12,933	183	95	1.914
Sa1	182+25	175.26	10:12	68.4	55.8	39,616	460	367	311	240	166	109	76	13,991	166	93	1.825
Sa1	182+25	175.26	10:12	68.4	55.8	39,175	456	364	310	238	166	109	75	14,243	164	92	1.851
Sa1	181+75	190.50	10:13	70.2	55.8	26,632	308	235	193	144	102	71	51	7,567	244	95	1.749
Sa1	181+75	190.50	10:13	70.2	55.8	39,651	467	364	303	224	158	108	78	9,283	209	93	1.668
Sa1	181+75	190.50	10:13	70.2	55.8	40,554	474	371	308	229	162	111	81	9,533	211	93	1.652
Sa3	179+25	38.10	10:23	72.0	57.6	26,365	240	201	177	140	105	72	51	17,237	314	91	1.761
Sa3	179+25	38.10	10:23	72.0	57.6	39,407	371	316	277	218	163	112	78	17,237	295	87	2.012
Sa3	179+25	38.10	10:23	72.0	57.6	39,353	371	313	275	218	162	112	78	17,237	296	88	1.854
Sa3	178+75	53.34	10:24	73.8	57.6	26,400	279	224	192	148	108	75	55	12,732	255	89	1.673
Sa3	178+75	53.34	10:24	73.8	57.6	39,229	421	341	294	229	166	115	83	14,874	225	88	1.742
Sa3	178+75	53.34	10:24	73.8	57.6	39,794	426	345	298	234	169	117	85	15,566	223	87	1.798
Sa3	178+25	68.58	10:25	73.8	57.6	26,436	247	203	177	142	105	74	55	17,237	308	90	1.575
Sa3	178+25	68.58	10:25	73.8	57.6	39,104	374	311	272	216	160	112	82	17,237	291	88	1.628
Sa3	178+25	68.58	10:25	73.8	57.6	39,033	373	310	272	216	160	113	83	17,237	296	87	1.649
Sa3	177+75	83.82	10:25	72.0	57.6	26,400	268	219	190	152	111	77	56	17,230	251	87	1.512
Sa3	177+75	83.82	10:25	72.0	57.6	39,033	403	335	292	229	168	116	83	17,237	233	86	1.565
Sa3	177+75	83.82	10:25	72.0	57.6	39,175	399	331	289	228	168	116	83	17,237	246	86	1.444
Sa3	177+25	99.06	10:26	72.0	57.6	26,454	278	229	200	158	116	80	58	17,237	229	85	1.613
Sa3	177+25	99.06	10:26	72.0	57.6	39,069	414	346	305	237	174	120	86	17,237	222	83	1.699
Sa3	177+25	99.06	10:26	72.0	57.6	39,033	414	344	304	238	175	121	86	17,237	226	82	1.739
Sa3	176+75	114.30	10:27	72.0	57.6	27,441	295	244	211	165	120	83	59	17,135	210	85	1.561
Sa3	176+75	114.30	10:27	72.0	57.6	38,646	427	356	309	241	175	120	85	17,237	190	84	1.732

Section	Proj. Sta.	Sect. Sta., m	Time	Temperature, C		Load, N	Deflections, um							Moduli, MPa			Fit,%
				Pvm't	Air		D_1	D_2	D_3	D_4	D_5	D_6	D_7	E_{ac}	E_{base}	$E_{subgrade}$	
Sa3	176+75	114.30	10:27	72.0	57.6	39,371	427	358	311	243	177	122	87	17,237	151	92	3.546
Sa3	176+25	129.54	10:28	72.0	57.6	26,098	323	262	224	173	123	85	61	12,767	184	79	1.824
Sa3	176+25	129.54	10:28	72.0	57.6	38,895	492	404	346	264	189	129	93	13,809	161	78	1.663
Sa3	176+25	129.54	10:28	72.0	57.6	39,211	493	405	348	267	192	131	94	14,264	162	78	1.648
Sa3	175+75	144.78	10:29	72.0	59.4	26,276	302	246	212	164	118	81	57	15,111	189	84	1.814
Sa3	175+75	144.78	10:29	72.0	59.4	39,069	457	380	328	252	180	122	86	17,237	152	85	1.847
Sa3	175+75	144.78	10:29	72.0	59.4	39,104	457	380	329	253	181	123	88	17,237	149	85	2.019
Sa3	175+25	160.02	10:29	72.0	59.4	26,667	304	251	215	168	121	84	60	15,573	193	82	1.586
Sa3	175+25	160.02	10:29	72.0	59.4	39,865	462	384	331	256	184	126	90	16,422	174	82	1.674
Sa3	175+25	160.02	10:29	72.0	59.4	38,806	452	378	326	253	183	126	89	17,038	171	81	1.636
Sa3	174+75	175.26	10:30	72.0	59.4	26,560	297	237	203	161	117	81	58	12,589	243	83	1.693
Sa3	174+75	175.26	10:30	72.0	59.4	38,926	445	362	311	242	174	120	85	14,363	202	83	1.617
Sa3	174+75	175.26	10:30	72.0	59.4	39,069	443	359	310	242	175	120	86	15,006	202	84	1.771
Sa3	174+25	190.50	10:31	73.8	59.4	26,787	250	209	184	150	114	81	57	17,237	350	82	1.312
Sa3	174+25	190.50	10:31	73.8	59.4	39,300	373	316	279	224	170	120	85	17,237	318	82	1.643
Sa3	174+25	190.50	10:31	73.8	59.4	39,211	370	314	277	223	169	120	86	17,237	321	82	1.700
Sa5	171+75	38.10	10:35	72.0	61.2	26,734	362	293	246	186	127	82	56	12,946	117	85	1.722
Sa5	171+75	38.10	10:35	72.0	61.2	39,616	539	445	377	282	194	125	85	14,849	99	85	1.707
Sa5	171+75	38.10	10:35	72.0	61.2	39,175	534	441	373	281	193	125	85	14,471	103	83	1.776
Sa5	171+25	53.34	10:36	72.0	61.2	26,543	322	266	226	173	120	81	57	15,449	142	86	1.866
Sa5	171+25	53.34	10:36	72.0	61.2	38,980	486	407	348	263	184	122	86	16,728	120	85	1.942
Sa5	171+25	53.34	10:36	72.0	61.2	39,389	485	407	347	265	186	124	87	16,942	125	85	1.872
Sa5	170+75	68.58	10:36	72.0	59.4	26,649	293	244	214	168	122	84	60	17,237	128	94	5.114
Sa5	170+75	68.58	10:36	72.0	59.4	39,264	440	371	325	254	184	127	90	17,237	124	92	4.746
Sa5	170+75	68.58	10:36	72.0	59.4	39,389	438	370	325	255	185	128	91	17,237	125	92	5.102
Sa5	170+25	83.82	10:37	72.0	59.4	26,578	288	244	215	172	127	88	62	17,237	239	76	1.641
Sa5	170+25	83.82	10:37	72.0	59.4	39,104	430	368	325	257	190	132	93	17,237	227	75	1.690
Sa5	170+25	83.82	10:37	72.0	59.4	38,913	425	365	322	255	190	132	93	17,237	236	74	1.732
Sa5	169+75	99.06	10:38	75.6	59.4	26,734	280	238	208	167	121	81	56	17,237	229	82	2.160
Sa5	169+75	99.06	10:38	75.6	59.4	38,980	417	358	314	249	182	121	84	17,237	217	80	2.289
Sa5	169+75	99.06	10:38	75.6	59.4	38,877	412	354	311	247	180	120	83	17,237	224	80	2.365
Sa5	169+25	114.30	10:39	75.6	61.2	26,204	311	259	223	176	127	88	64	16,171	181	77	1.557
Sa5	169+25	114.30	10:39	75.6	61.2	39,389	468	392	339	266	194	133	96	17,233	171	77	1.498
Sa5	169+25	114.30	10:39	75.6	61.2	39,425	467	392	339	266	194	134	96	17,237	174	77	1.487
Sa5	168+75	129.54	10:40	75.6	61.2	26,858	264	233	208	166	125	88	61	17,237	315	75	2.734
Sa5	168+75	129.54	10:40	75.6	61.2	39,318	392	344	309	249	188	131	92	17,237	270	77	2.767
Sa5	168+75	129.54	10:40	75.6	61.2	39,598	394	345	310	251	190	133	93	17,237	270	77	3.009
Sa5	168+25	144.78	10:41	77.4	61.2	26,734	239	202	180	145	108	75	53	17,237	328	89	2.173
Sa5	168+25	144.78	10:41	77.4	61.2	39,158	358	305	272	221	165	114	80	17,237	318	86	2.241
Sa5	168+25	144.78	10:41	77.4	61.2	39,549	357	304	272	221	165	114	81	17,237	358	84	2.620
Sa5	167+75	160.02	10:42	79.2	61.2	26,649	261	224	193	151	108	72	51	17,237	233	92	2.614
Sa5	167+75	160.02	10:42	79.2	61.2	39,705	401	345	298	234	167	111	77	17,237	222	88	2.743
Sa5	167+75	160.02	10:42	79.2	61.2	39,883	397	341	295	233	167	111	77	17,237	228	89	2.633
Sa5	167+25	175.26	10:42	79.2	61.2	26,222	266	217	183	139	97	65	48	16,439	185	105	1.762
Sa5	167+25	175.26	10:42	79.2	61.2	39,033	400	328	280	213	150	100	73	17,237	177	102	1.870
Sa5	167+25	175.26	10:42	79.2	61.2	38,962	398	326	279	212	150	100	73	17,237	184	101	1.734
Sa5	166+75	190.50	10:43	75.6	61.2	26,454	283	234	202	160	115	79	57	17,237	206	86	1.589
Sa5	166+75	190.50	10:43	75.6	61.2	39,069	426	358	311	243	175	119	85	17,237	129	95	4.312
Sa5	166+75	190.50	10:43	75.6	61.2	39,300	424	356	309	243	175	119	85	17,237	152	93	3.400
Cs1	164+25	38.10	10:47	86.4	63.0	26,080	282	234	203	157	112	76	55	17,237	185	88	1.874

Section	Proj. Sta.	Sect. Sta., m	Time	Temperature, C		Load, N	Deflections, um							Moduli, MPa			Fit,%
				Pvm't	Air		D_1	D_2	D_3	D_4	D_5	D_6	D_7	E_{ac}	E_{base}	$E_{subgrade}$	
Cs1	164+25	38.10	10:47	86.4	63.0	38,842	432	364	318	245	176	119	84	17,237	181	84	1.797
Cs1	164+25	38.10	10:47	86.4	63.0	38,788	433	366	319	245	176	119	85	17,237	179	83	1.821
Cs1	163+75	53.34	10:48	86.4	63.0	26,614	231	202	180	144	109	76	53	17,237	391	84	2.933
Cs1	163+75	53.34	10:48	86.4	63.0	39,353	350	307	274	221	168	117	82	17,237	379	81	2.903
Cs1	163+75	53.34	10:48	86.4	63.0	39,705	348	304	272	221	168	118	83	17,237	399	81	2.843
Cs1	163+25	68.58	10:49	86.4	63.0	26,525	258	210	182	145	106	73	52	17,237	126	122	9.431
Cs1	163+25	68.58	10:49	86.4	63.0	39,087	386	318	278	222	163	112	80	17,237	265	88	1.585
Cs1	163+25	68.58	10:49	86.4	63.0	39,211	384	316	278	221	163	112	81	17,237	167	105	6.270
Cs1	162+75	83.82	10:49	86.4	63.0	26,365	246	206	179	145	107	73	53	17,237	306	89	1.811
Cs1	162+75	83.82	10:49	86.4	63.0	39,069	369	311	273	218	163	112	79	17,237	304	86	1.930
Cs1	162+75	83.82	10:49	86.4	63.0	38,980	366	309	272	218	163	112	80	17,237	312	86	1.933
Cs1	162+25	99.06	10:50	84.6	63.0	26,716	237	200	175	141	104	71	50	17,237	324	93	2.210
Cs1	162+25	99.06	10:50	84.6	63.0	39,247	352	301	266	213	157	107	75	17,237	322	89	2.534
Cs1	162+25	99.06	10:50	84.6	63.0	39,282	351	300	265	212	157	108	75	17,237	323	89	2.535
Cs1	161+75	114.30	10:51	84.6	63.0	26,471	249	208	183	145	106	73	52	17,237	127	123	10.026
Cs1	161+75	114.30	10:51	84.6	63.0	38,926	372	314	279	220	162	111	78	17,237	123	119	10.394
Cs1	161+75	114.30	10:51	84.6	63.0	39,140	370	313	278	220	162	111	78	17,237	297	87	2.461
Cs1	161+25	129.54	10:52	86.4	63.0	26,769	211	179	157	128	96	67	48	17,237	436	97	2.450
Cs1	161+25	129.54	10:52	86.4	63.0	39,336	320	277	243	196	147	103	74	17,237	413	93	2.767
Cs1	161+25	129.54	10:52	86.4	63.0	39,407	319	276	242	196	147	103	74	17,237	406	94	2.354
Cs1	160+75	144.78	10:53	86.4	63.0	27,072	257	215	188	150	108	74	52	17,237	126	122	9.762
Cs1	160+75	144.78	10:53	86.4	63.0	39,425	377	318	279	223	162	110	78	17,237	124	120	9.944
Cs1	160+75	144.78	10:53	86.4	63.0	39,175	371	316	276	220	162	110	78	17,237	125	120	10.223
Cs1	160+25	160.02	10:54	86.4	63.0	26,454	233	192	164	128	93	63	45	17,237	276	106	1.565
Cs1	160+25	160.02	10:54	86.4	63.0	39,087	354	293	253	196	142	97	69	17,237	135	134	9.046
Cs1	160+25	160.02	10:54	86.4	63.0	39,211	352	292	252	196	142	97	68	17,237	136	135	9.426
Cs1	159+75	175.26	10:55	88.2	63.0	26,436	227	190	166	127	92	64	46	17,237	224	115	4.127
Cs1	159+75	175.26	10:55	88.2	63.0	39,264	340	287	251	192	139	96	68	17,237	221	114	4.073
Cs1	159+75	175.26	10:55	88.2	63.0	38,926	338	284	250	191	139	96	69	17,237	220	113	4.262
Cs1	159+25	190.50	10:56	88.2	63.0	26,347	253	207	175	133	90	59	42	17,237	177	116	2.366
Cs1	159+25	190.50	10:56	88.2	63.0	39,514	394	325	277	210	143	93	67	17,237	158	111	2.553
Cs1	159+25	190.50	10:56	88.2	63.0	39,496	390	322	275	210	144	94	68	17,237	173	108	2.293
Cs1	158+75	205.74	10:57	90.0	63.0	26,258	361	269	215	145	92	61	45	6,950	129	110	3.014
Cs1	158+75	205.74	10:57	90.0	63.0	38,824	540	410	331	227	144	93	69	7,988	117	107	2.810
Cs1	158+75	205.74	10:57	90.0	63.0	38,753	534	408	330	227	144	94	69	8,204	118	106	2.879
Cs1	158+25	220.98	10:58	88.2	64.8	26,204	389	294	236	167	107	68	48	7,328	117	97	2.342
Cs1	158+25	220.98	10:58	88.2	64.8	38,735	587	455	368	259	165	104	73	8,500	98	95	2.398
Cs1	158+25	220.98	10:58	88.2	64.8	38,539	581	453	367	258	165	105	73	8,795	97	95	2.349
Ts6	156+75	38.10	11:02	91.8	64.8	25,978	402	304	242	165	105	67	46	6,773	106	98	2.361
Ts6	156+75	38.10	11:02	91.8	64.8	38,575	613	474	382	259	165	103	72	7,543	93	95	2.327
Ts6	156+75	38.10	11:02	91.8	64.8	38,611	606	469	378	259	166	104	72	7,779	95	95	2.278
Ts6	156+25	53.34	11:02	90.0	66.6	25,942	423	323	263	188	119	75	52	7,692	97	87	2.397
Ts6	156+25	53.34	11:02	90.0	66.6	38,397	638	495	406	294	188	116	79	8,714	85	85	2.226
Ts6	156+25	53.34	11:02	90.0	66.6	38,700	634	497	408	294	188	116	79	8,962	85	85	2.160
Ts6	155+75	68.58	11:03	88.2	66.6	25,960	453	337	265	181	111	69	47	5,738	91	93	2.460
Ts6	155+75	68.58	11:03	88.2	66.6	38,259	684	521	415	286	178	109	74	6,542	82	88	2.294
Ts6	155+75	68.58	11:03	88.2	66.6	38,290	678	516	411	288	180	112	76	6,566	86	86	2.287
Ts6	155+25	83.82	11:04	88.2	66.6	26,258	369	280	221	151	97	61	41	7,403	118	108	2.083
Ts6	155+25	83.82	11:04	88.2	66.6	38,593	554	427	341	233	149	93	62	8,205	105	105	2.119
Ts6	155+25	83.82	11:04	88.2	66.6	38,259	550	424	339	234	150	94	63	8,243	107	103	2.138

Section	Proj. Sta.	Sect. Sta., m	Time	Temperature, C		Load, N	Deflections, um							Moduli, MPa			Fit %
				Pvm't	Air		D_1	D_2	D_3	D_4	D_5	D_6	D_7	E_{ac}	E_{base}	$E_{subgrade}$	
Ts6	154+75	99.06	11:05	90.0	66.6	26,031	318	245	200	143	94	60	40	10,340	137	111	2.026
Ts6	154+75	99.06	11:05	90.0	66.6	38,753	483	378	312	225	147	93	62	11,565	121	107	2.044
Ts6	154+75	99.06	11:05	90.0	66.6	38,944	480	377	311	225	149	94	63	11,852	123	107	1.972
Ts6	154+25	114.30	11:06	93.6	66.6	26,258	336	241	185	121	74	46	32	6,249	134	139	2.564
Ts6	154+25	114.30	11:06	93.6	66.6	38,486	514	370	289	192	116	71	50	6,699	120	132	2.585
Ts6	154+25	114.30	11:06	93.6	66.6	38,860	512	368	287	194	117	72	50	6,778	125	132	2.737
Ts6	153+75	129.54	11:07	93.6	66.6	25,835	380	280	224	156	102	66	46	6,084	136	98	2.143
Ts6	153+75	129.54	11:07	93.6	66.6	38,717	581	439	355	246	160	100	70	7,457	111	97	2.068
Ts6	153+75	129.54	11:07	93.6	66.6	38,522	573	434	351	245	159	100	70	7,616	113	97	2.016
Ts6	153+25	144.78	11:07	95.4	66.6	26,596	320	251	205	148	96	60	41	11,959	121	114	2.013
Ts6	153+25	144.78	11:07	95.4	66.6	38,593	480	384	316	226	147	91	63	12,806	105	110	1.986
Ts6	153+25	144.78	11:07	95.4	66.6	38,735	480	383	315	229	149	93	64	12,887	109	108	1.923
Ts6	152+75	160.02	11:08	97.2	68.4	26,151	343	269	218	155	100	61	42	10,562	108	109	1.903
Ts6	152+75	160.02	11:08	97.2	68.4	38,379	520	415	339	241	155	94	64	11,593	92	106	1.891
Ts6	152+75	160.02	11:08	97.2	68.4	38,926	522	413	338	246	158	97	66	11,744	98	104	1.861
Ts6	152+25	175.26	11:09	100.8	68.4	26,151	369	276	221	158	103	66	45	7,054	137	99	2.066
Ts6	152+25	175.26	11:09	100.8	68.4	38,224	553	424	343	245	160	101	70	8,281	117	95	1.960
Ts6	152+25	175.26	11:09	100.8	68.4	38,717	554	422	344	250	163	103	71	8,367	124	94	2.008
Ts6	151+75	190.50	11:10	100.8	68.4	26,436	375	299	242	168	110	69	45	9,837	99	99	2.197
Ts6	151+75	190.50	11:10	100.8	68.4	38,895	568	456	373	261	172	107	72	10,266	93	94	2.114
Ts6	151+75	190.50	11:10	100.8	68.4	39,229	572	458	375	264	174	109	73	10,365	94	94	2.099
Ts4	149+25	38.10	11:13	93.6	68.4	26,169	377	308	258	191	132	90	65	11,039	126	77	2.264
Ts4	149+25	38.10	11:13	93.6	68.4	38,980	575	473	398	298	207	139	100	11,657	117	74	2.022
Ts4	149+25	38.10	11:13	93.6	68.4	38,806	569	469	395	297	206	139	99	11,759	120	73	2.045
Ts4	148+75	53.34	11:14	91.8	66.6	26,454	417	331	273	197	131	84	58	9,331	99	82	2.126
Ts4	148+75	53.34	11:14	91.8	66.6	38,824	634	511	423	305	204	132	90	9,560	92	77	2.148
Ts4	148+75	53.34	11:14	91.8	66.6	38,664	629	507	421	305	204	132	91	9,881	91	77	2.087
Ts4	148+25	68.58	11:15	91.8	66.6	26,632	357	281	234	168	113	73	51	10,413	125	94	2.095
Ts4	148+25	68.58	11:15	91.8	66.6	39,353	545	435	363	264	177	115	80	11,308	112	90	2.137
Ts4	148+25	68.58	11:15	91.8	66.6	38,998	537	430	359	261	176	114	80	11,538	113	89	2.003
Ts4	147+75	83.82	11:15	91.8	66.6	26,471	324	249	202	149	99	65	45	9,379	162	103	1.916
Ts4	147+75	83.82	11:15	91.8	66.6	39,460	501	394	322	232	155	101	70	10,086	140	100	1.972
Ts4	147+75	83.82	11:15	91.8	66.6	39,918	498	393	322	231	156	102	71	10,547	142	101	1.918
Ts4	147+25	99.06	11:16	93.6	66.6	26,489	297	246	209	152	107	73	52	14,851	159	96	2.443
Ts4	147+25	99.06	11:16	93.6	66.6	40,519	457	382	326	239	168	114	82	16,375	146	95	2.311
Ts4	147+25	99.06	11:16	93.6	66.6	40,132	455	382	325	239	168	115	82	16,166	148	93	2.412
Ts4	146+75	114.30	11:17	91.8	66.6	26,667	330	262	221	160	111	75	54	11,071	161	92	2.076
Ts4	146+75	114.30	11:17	91.8	66.6	39,865	517	418	354	257	179	120	84	12,045	137	87	1.990
Ts4	146+75	114.30	11:17	91.8	66.6	40,132	515	419	355	255	179	120	85	12,358	136	88	2.199
Ts4	146+25	129.54	11:18	90.0	66.6	26,716	360	285	238	175	117	77	54	10,466	133	89	2.271
Ts4	146+25	129.54	11:18	90.0	66.6	39,087	551	443	374	271	182	119	83	11,630	107	87	2.305
Ts4	146+25	129.54	11:18	90.0	66.6	39,087	546	439	371	272	183	120	84	11,960	111	86	2.258
Ts4	145+75	144.78	11:19	93.6	66.6	26,685	389	306	251	176	118	77	54	8,802	116	90	2.212
Ts4	145+75	144.78	11:19	93.6	66.6	39,247	592	474	392	275	185	120	84	9,630	102	86	2.253
Ts4	145+75	144.78	11:19	93.6	66.6	39,229	588	472	392	276	186	121	85	9,907	103	85	2.211
Ts4	145+25	160.02	11:19	99.0	66.6	26,133	396	312	260	192	127	82	57	9,948	106	82	2.194
Ts4	145+25	160.02	11:19	99.0	66.6	38,824	605	486	408	297	198	126	87	11,127	87	82	2.154
Ts4	145+25	160.02	11:19	99.0	66.6	38,913	602	485	409	298	199	126	87	11,543	86	81	2.100
Ts4	144+75	175.26	11:20	100.8	68.4	26,382	370	289	235	164	108	70	50	8,904	117	97	2.370
Ts4	144+75	175.26	11:20	100.8	68.4	38,611	560	442	363	253	166	107	75	9,520	103	94	2.246

Section	Proj. Sta.	Sect. Sta., m	Time	Temperature, C		Load, N	Deflections, um							Moduli, MPa			Fit, %
				Pvm't	Air		D_1	D_2	D_3	D_4	D_5	D_6	D_7	E_{ac}	E_{base}	$E_{subgrade}$	
Ts4	144+75	175.26	11:20	100.8	68.4	38,664	552	436	360	252	167	107	75	9,791	107	94	2.275
Ts4	144+25	190.50	11:21	104.4	68.4	26,276	384	294	242	176	118	77	54	7,912	135	86	2.082
Ts4	144+25	190.50	11:21	104.4	68.4	38,326	581	453	374	270	182	118	83	8,712	116	84	1.968
Ts4	144+25	190.50	11:21	104.4	68.4	38,860	581	453	375	273	183	119	84	8,793	121	83	2.029
Ts2	141+75	38.10	11:23	108.0	72.0	26,329	396	312	262	192	131	87	60	9,256	125	78	1.946
Ts2	141+75	38.10	11:23	108.0	72.0	38,504	602	484	406	297	204	133	92	10,249	104	76	1.851
Ts2	141+75	38.10	11:23	108.0	72.0	38,664	603	482	406	298	205	134	93	10,062	109	75	1.867
Ts2	141+25	53.34	11:25	108.0	72.0	26,560	340	273	228	172	122	84	61	10,489	181	81	1.721
Ts2	141+25	53.34	11:25	108.0	72.0	38,842	517	424	357	265	187	128	91	11,674	148	80	1.977
Ts2	141+25	53.34	11:25	108.0	72.0	39,015	515	422	355	266	189	129	92	12,041	152	79	1.821
Ts2	140+75	68.58	11:25	106.2	72.0	25,746	326	251	210	161	116	81	58	7,484	240	80	1.794
Ts2	140+75	68.58	11:25	106.2	72.0	38,664	506	395	332	254	182	126	90	8,264	212	78	1.722
Ts2	140+75	68.58	11:25	106.2	72.0	38,824	506	396	333	255	183	127	91	8,544	212	78	1.639
Ts2	140+25	83.82	11:26	104.4	72.0	26,098	341	262	218	164	116	79	56	7,779	201	84	1.793
Ts2	140+25	83.82	11:26	104.4	72.0	38,433	523	411	343	256	180	121	86	9,017	168	81	1.606
Ts2	140+25	83.82	11:26	104.4	72.0	38,646	524	410	343	258	182	122	87	9,006	173	80	1.690
Ts2	139+75	99.06	11:27	102.6	70.2	26,116	352	280	235	173	119	80	56	10,578	142	85	1.994
Ts2	139+75	99.06	11:27	102.6	70.2	38,504	541	442	371	271	186	123	87	11,741	115	82	2.086
Ts2	139+75	99.06	11:27	102.6	70.2	38,557	540	441	370	271	187	124	88	11,594	121	81	2.030
Ts2	139+25	114.30	11:28	100.8	70.2	26,169	380	291	240	169	116	77	55	7,490	141	87	1.997
Ts2	139+25	114.30	11:28	100.8	70.2	38,575	581	450	374	268	183	119	84	8,243	126	83	1.935
Ts2	139+25	114.30	11:28	100.8	70.2	38,486	576	448	373	269	183	120	85	8,547	126	82	1.936
Ts2	138+75	129.54	11:29	99.0	68.4	26,062	363	288	239	176	122	82	58	9,254	148	82	1.857
Ts2	138+75	129.54	11:29	99.0	68.4	38,188	557	449	375	273	189	125	88	10,382	120	80	1.890
Ts2	138+75	129.54	11:29	99.0	68.4	38,486	556	449	375	273	189	126	89	10,286	126	79	1.886
Ts2	138+25	144.78	11:30	99.0	68.4	26,311	405	310	253	182	121	78	52	7,608	120	86	2.012
Ts2	138+25	144.78	11:30	99.0	68.4	38,344	613	482	395	282	186	119	79	8,508	100	83	2.121
Ts2	138+25	144.78	11:30	99.0	68.4	38,468	613	481	395	286	188	121	80	8,658	102	82	2.041
Ts2	137+75	160.02	11:31	99.0	68.4	26,222	350	278	233	174	121	81	57	10,371	155	83	1.898
Ts2	137+75	160.02	11:31	99.0	68.4	39,104	544	441	370	275	190	126	89	11,587	126	81	1.849
Ts2	137+75	160.02	11:31	99.0	68.4	38,842	540	438	368	275	191	127	89	11,347	133	79	1.791
Ts2	137+25	175.26	11:32	99.0	66.6	26,013	343	270	226	164	114	77	54	9,378	162	86	2.029
Ts2	137+25	175.26	11:32	99.0	66.6	39,158	529	424	357	256	178	118	83	10,699	135	86	1.894
Ts2	137+25	175.26	11:32	99.0	66.6	38,771	525	421	355	255	178	118	84	10,882	134	85	1.901
Ts2	136+75	190.50	11:33	99.0	66.6	26,013	350	281	236	170	120	85	61	9,310	168	80	2.378
Ts2	136+75	190.50	11:33	99.0	66.6	38,646	542	440	370	269	190	131	93	10,130	145	77	2.110
Ts2	136+75	190.50	11:33	99.0	66.6	38,700	539	437	368	271	192	132	95	10,229	152	76	1.889
Ts1	134+25	38.10	11:35	99.0	68.4	25,871	419	319	263	187	129	85	59	6,463	133	77	1.844
Ts1	134+25	38.10	11:35	99.0	68.4	38,522	642	499	413	291	200	130	90	7,404	111	76	1.820
Ts1	134+25	38.10	11:35	99.0	68.4	38,259	638	497	411	291	200	130	90	7,437	112	75	1.784
Ts1	133+75	53.34	11:36	100.8	68.4	26,204	401	307	254	184	128	87	62	6,638	155	77	1.975
Ts1	133+75	53.34	11:36	100.8	68.4	38,486	605	474	394	284	198	133	95	7,677	133	75	1.857
Ts1	133+75	53.34	11:36	100.8	68.4	38,486	602	474	395	284	198	133	96	7,879	133	74	1.868
Ts1	133+25	68.58	11:37	104.4	68.4	26,222	419	328	271	195	135	92	65	7,344	133	74	1.935
Ts1	133+25	68.58	11:37	104.4	68.4	38,308	633	506	421	302	211	141	99	8,182	116	70	1.845
Ts1	133+25	68.58	11:37	104.4	68.4	38,397	629	506	421	303	213	142	99	8,498	116	70	1.832
Ts1	132+75	83.82	11:38	102.6	70.2	26,031	401	318	263	190	131	88	62	8,009	132	76	1.984
Ts1	132+75	83.82	11:38	102.6	70.2	38,188	613	497	413	295	203	135	96	9,238	106	74	2.178
Ts1	132+75	83.82	11:38	102.6	70.2	38,188	610	494	411	297	204	136	96	9,345	109	73	2.094
Ts1	132+25	99.06	11:39	100.8	68.4	26,098	347	281	235	174	125	87	62	9,852	175	78	1.868

Section	Proj. Sta.	Sect. Sta., m	Time	Temperature, C Pvm't	Temperature, C Air	Load, N	Deflections, um D_1	D_2	D_3	D_4	D_5	D_6	D_7	Moduli, MPa E_{ac}	E_{base}	$E_{subgrade}$	Fit,%
Ts1	132+25	99.06	11:39	100.8	68.4	38,468	538	438	368	272	195	134	95	10,503	151	75	1.800
Ts1	132+25	99.06	11:39	100.8	68.4	38,628	537	437	368	273	195	135	97	10,344	156	75	1.858
Ts1	131+75	114.30	11:40	100.8	68.4	26,222	364	284	236	173	121	81	57	8,437	161	82	1.703
Ts1	131+75	114.30	11:40	100.8	68.4	38,415	556	439	368	270	190	126	87	9,055	145	78	1.563
Ts1	131+75	114.30	11:40	100.8	68.4	38,486	555	439	368	272	192	127	88	9,245	145	77	1.503
Ts1	131+25	129.54	11:41	100.8	68.4	26,276	367	291	241	175	120	78	54	10,077	127	87	1.666
Ts1	131+25	129.54	11:41	100.8	68.4	38,575	567	456	380	273	188	120	83	10,618	107	84	1.593
Ts1	131+25	129.54	11:41	100.8	68.4	38,344	562	452	377	273	189	121	83	10,768	109	83	1.512
Ts1	130+75	144.78	11:41	102.6	68.4	25,906	335	264	220	166	116	78	55	10,280	168	85	1.615
Ts1	130+75	144.78	11:41	102.6	68.4	38,611	523	421	354	260	183	121	85	11,083	140	82	1.596
Ts1	130+75	144.78	11:41	102.6	68.4	38,664	521	419	353	262	185	122	86	11,259	143	82	1.533
Ts1	130+25	160.02	11:42	104.4	68.4	26,049	351	281	236	176	127	89	66	8,754	193	75	1.781
Ts1	130+25	160.02	11:42	104.4	68.4	38,753	552	442	372	278	199	137	98	9,296	165	73	1.686
Ts1	130+25	160.02	11:42	104.4	68.4	38,379	547	439	370	277	199	137	98	9,279	168	72	1.633
Ts1	129+75	175.26	11:43	104.4	70.2	25,835	426	336	271	189	127	85	60	6,954	112	79	2.467
Ts1	129+75	175.26	11:43	104.4	70.2	38,028	652	520	421	293	196	129	91	7,451	97	77	2.575
Ts1	129+75	175.26	11:43	104.4	70.2	38,063	646	519	422	293	197	130	91	7,800	96	77	2.688
Ts1	129+25	190.50	11:44	108.0	70.2	26,049	459	351	283	199	136	92	67	5,418	124	73	2.014
Ts1	129+25	190.50	11:44	108.0	70.2	38,397	706	549	446	314	214	143	103	5,889	110	69	2.003
Ts1	129+25	190.50	11:44	108.0	70.2	38,206	697	545	442	314	215	144	103	6,077	111	68	1.961
Ts3	126+75	38.10	11:46	111.6	70.2	25,497	485	375	304	206	135	87	61	6,059	86	75	2.438
Ts3	126+75	38.10	11:46	111.6	70.2	38,344	753	590	482	329	215	136	94	6,692	74	73	2.242
Ts3	126+75	38.10	11:46	111.6	70.2	38,081	748	590	482	331	217	138	96	6,831	75	71	2.259
Ts3	126+25	53.34	11:47	109.8	72.0	25,906	476	369	299	203	134	88	62	6,285	91	76	2.486
Ts3	126+25	53.34	11:47	109.8	72.0	38,188	732	575	470	323	213	136	95	6,873	79	73	2.232
Ts3	126+25	53.34	11:47	109.8	72.0	38,170	723	569	467	325	214	138	97	7,137	81	72	2.258
Ts3	125+75	68.58	11:47	109.8	72.0	26,013	438	345	283	201	135	91	65	7,243	112	74	2.354
Ts3	125+75	68.58	11:47	109.8	72.0	38,664	663	526	435	313	210	138	98	8,178	99	73	2.137
Ts3	125+75	68.58	11:47	109.8	72.0	38,788	665	528	437	318	215	141	100	8,205	103	71	1.986
Ts3	125+25	83.82	11:48	108.0	72.0	25,978	452	348	280	191	125	81	56	6,317	98	82	2.414
Ts3	125+25	83.82	11:48	108.0	72.0	38,753	691	542	437	302	198	127	88	7,021	87	79	2.311
Ts3	125+25	83.82	11:48	108.0	72.0	38,188	683	536	433	301	198	127	88	7,105	88	78	2.184
Ts3	124+75	99.06	11:49	106.2	72.0	26,276	405	327	274	198	134	88	61	10,483	100	79	2.052
Ts3	124+75	99.06	11:49	106.2	72.0	38,522	620	509	427	308	209	135	94	11,109	84	76	2.171
Ts3	124+75	99.06	11:49	106.2	72.0	38,575	615	506	425	309	210	136	95	11,233	87	76	2.074
Ts3	124+25	114.30	11:50	104.4	70.2	26,098	446	346	284	206	137	87	61	7,676	100	76	1.929
Ts3	124+25	114.30	11:50	104.4	70.2	38,170	671	533	442	316	211	133	94	8,660	83	74	1.883
Ts3	124+25	114.30	11:50	104.4	70.2	38,117	669	535	444	316	211	134	95	8,875	81	74	1.961
Ts3	123+75	129.54	11:51	104.4	70.2	25,782	471	348	284	200	133	87	62	5,056	116	74	2.360
Ts3	123+75	129.54	11:51	104.4	70.2	38,224	717	547	448	314	210	137	97	5,916	100	71	2.130
Ts3	123+75	129.54	11:51	104.4	70.2	38,290	710	544	447	314	211	137	97	6,171	101	71	2.063
Ts3	123+25	144.78	11:51	102.6	70.2	25,800	411	325	262	185	124	82	58	7,614	112	81	2.383
Ts3	123+25	144.78	11:51	102.6	70.2	38,522	632	508	412	290	193	126	89	8,452	95	80	2.448
Ts3	123+25	144.78	11:51	102.6	70.2	38,344	627	502	408	289	193	126	89	8,318	99	79	2.344
Ts3	122+75	160.02	11:52	102.6	70.2	26,276	398	307	251	181	123	83	59	7,160	139	81	2.027
Ts3	122+75	160.02	11:52	102.6	70.2	38,379	603	473	390	282	192	127	89	8,063	122	78	1.884
Ts3	122+75	160.02	11:52	102.6	70.2	38,611	604	475	392	285	195	129	91	8,034	126	77	1.939
Ts3	122+25	175.26	11:53	100.8	70.2	26,222	405	311	253	179	118	78	55	7,258	120	86	2.242
Ts3	122+25	175.26	11:53	100.8	70.2	38,628	615	480	393	278	183	118	83	8,089	103	84	2.184
Ts3	122+25	175.26	11:53	100.8	70.2	38,241	608	477	392	277	184	119	83	8,222	104	83	2.150

Section	Proj. Sta.	Sect. Sta., m	Time	Temperature, C		Load, N	Deflections, um							Moduli, MPa			Fit,%
				Pvm't	Air		D_1	D_2	D_3	D_4	D_5	D_6	D_7	E_{ac}	E_{base}	$E_{subgrade}$	
Ts3	121+75	190.50	11:54	100.8	70.2	26,382	324	264	224	166	115	78	56	13,373	146	89	2.134
Ts3	121+75	190.50	11:54	100.8	70.2	38,962	498	406	346	259	179	119	85	13,994	130	86	2.026
Ts3	121+75	190.50	11:54	100.8	70.2	38,998	494	402	343	259	180	119	86	13,986	137	85	1.965
Ts5	119+25	38.10	11:57	108.0	72.0	25,995	443	337	271	183	122	81	58	5,736	112	82	2.381
Ts5	119+25	38.10	11:57	108.0	72.0	38,504	679	519	423	290	194	127	90	6,024	105	78	2.180
Ts5	119+25	38.10	11:57	108.0	72.0	38,504	672	514	420	289	194	128	91	6,142	108	77	2.202
Ts5	118+75	53.34	11:58	111.6	72.0	25,995	442	332	266	180	120	81	57	5,216	120	82	2.381
Ts5	118+75	53.34	11:58	111.6	72.0	38,468	663	506	411	281	187	124	88	5,983	110	79	2.345
Ts5	118+75	53.34	11:58	111.6	72.0	38,735	671	512	416	288	193	128	91	5,989	112	78	2.227
Ts5	118+25	68.58	11:59	113.4	72.0	26,062	412	319	257	179	118	77	55	7,051	113	86	2.282
Ts5	118+25	68.58	11:59	113.4	72.0	38,611	631	497	403	284	187	123	85	7,719	102	82	2.354
Ts5	118+25	68.58	11:59	113.4	72.0	38,735	628	494	401	286	189	124	86	7,825	106	81	2.202
Ts5	117+75	83.82	11:59	113.4	73.8	26,187	455	356	289	196	128	84	59	6,826	93	81	2.747
Ts5	117+75	83.82	11:59	113.4	73.8	38,308	684	540	441	305	200	129	90	7,452	85	77	2.373
Ts5	117+75	83.82	11:59	113.4	73.8	38,326	679	538	441	306	201	130	90	7,677	85	77	2.398
Ts5	117+25	99.06	12:00	113.4	73.8	25,924	450	348	280	197	128	82	57	6,855	95	81	2.218
Ts5	117+25	99.06	12:00	113.4	73.8	38,063	683	541	440	308	200	126	88	7,835	78	78	2.161
Ts5	117+25	99.06	12:00	113.4	73.8	38,397	679	538	439	310	203	128	89	8,071	81	78	2.002
Ts5	116+75	114.30	12:01	111.6	72.0	25,889	434	338	274	195	129	84	59	7,248	104	79	2.208
Ts5	116+75	114.30	12:01	111.6	72.0	38,277	656	526	429	301	200	130	91	8,232	88	77	2.421
Ts5	116+75	114.30	12:01	111.6	72.0	38,397	654	524	428	302	201	131	92	8,315	90	77	2.354
Ts5	116+25	129.54	12:02	109.8	72.0	25,978	430	348	285	199	132	87	61	8,563	92	79	2.809
Ts5	116+25	129.54	12:02	109.8	72.0	38,308	642	526	432	307	205	133	92	9,550	83	77	2.456
Ts5	116+25	129.54	12:02	109.8	72.0	38,326	639	523	431	309	207	134	93	9,689	85	76	2.438
Ts5	115+75	144.78	12:03	113.4	72.0	26,151	369	298	250	182	125	83	58	11,173	119	83	2.035
Ts5	115+75	144.78	12:03	113.4	72.0	37,921	553	447	378	279	192	127	89	11,344	116	78	1.994
Ts5	115+75	144.78	12:03	113.4	72.0	39,247	560	453	384	282	195	129	91	11,655	118	80	1.999
Ts5	115+25	160.02	12:03	113.4	72.0	26,098	359	269	220	159	107	72	51	6,822	165	92	2.235
Ts5	115+25	160.02	12:03	113.4	72.0	38,170	527	411	337	241	163	108	77	8,650	138	91	1.941
Ts5	115+25	160.02	12:03	113.4	72.0	38,486	523	411	337	242	164	109	78	9,130	139	91	1.973
Ts5	114+75	175.26	12:04	113.4	73.8	25,924	370	299	248	184	122	76	49	12,523	91	90	1.756
Ts5	114+75	175.26	12:04	113.4	73.8	38,099	566	464	385	287	191	118	76	12,632	83	85	1.649
Ts5	114+75	175.26	12:04	113.4	73.8	38,224	567	464	386	289	193	120	78	12,863	84	84	1.573
Ts5	114+25	190.50	12:05	113.4	73.8	25,444	371	306	262	193	133	90	64	12,656	108	76	2.370
Ts5	114+25	190.50	12:05	113.4	73.8	37,886	569	473	404	301	210	140	99	12,811	104	72	2.081
Ts5	114+25	190.50	12:05	113.4	73.8	37,957	565	471	401	300	209	140	99	12,952	107	72	2.110
Ss6	111+75	38.10	12:24	133.2	73.8	25,711	392	311	254	181	124	83	59	8,066	125	80	2.148
Ss6	111+75	38.10	12:24	133.2	73.8	38,468	598	483	397	283	194	129	91	9,025	112	78	2.174
Ss6	111+75	38.10	12:24	133.2	73.8	38,379	597	482	397	286	196	130	93	9,134	113	77	2.167
Ss6	111+25	53.34	12:25	136.8	75.6	25,906	417	323	269	195	133	88	61	7,698	122	76	2.028
Ss6	111+25	53.34	12:25	136.8	75.6	38,344	631	504	419	302	205	134	94	8,929	101	74	2.034
Ss6	111+25	53.34	12:25	136.8	75.6	38,450	631	504	420	304	207	136	95	8,962	103	74	2.011
Ss6	110+75	68.58	12:25	135.0	75.6	25,871	459	371	301	207	134	85	58	7,947	77	80	2.798
Ss6	110+75	68.58	12:25	135.0	75.6	37,921	702	572	468	323	210	131	89	8,318	68	76	2.636
Ss6	110+75	68.58	12:25	135.0	75.6	38,308	702	571	468	326	213	133	90	8,514	70	75	2.457
Ss6	110+25	83.82	12:26	133.2	75.6	25,479	475	355	288	203	132	83	56	5,733	96	76	2.237
Ss6	110+25	83.82	12:26	133.2	75.6	37,534	717	552	452	315	205	128	86	6,780	79	75	2.056
Ss6	110+25	83.82	12:26	133.2	75.6	37,957	711	550	449	319	208	129	87	7,049	82	75	1.921
Ss6	109+75	99.06	12:27	135.0	75.6	25,288	445	350	285	199	132	87	60	7,001	98	75	2.314
Ss6	109+75	99.06	12:27	135.0	75.6	37,761	686	549	451	315	209	136	93	7,844	83	73	2.394

Section	Proj. Sta.	Sect. Sta., m	Time	Temperature, C		Load, N	Deflections, um							Moduli, MPa			Fit,%
				Pvm't	Air		D_1	D_2	D_3	D_4	D_5	D_6	D_7	E_{ac}	E_{base}	$E_{subgrade}$	
Ss6	109+75	99.06	12:27	135.0	75.6	37,797	684	548	451	316	211	137	94	7,923	84	72	2.314
Ss6	109+25	114.30	12:28	135.0	75.6	25,479	500	378	303	210	137	88	62	5,263	92	73	2.045
Ss6	109+25	114.30	12:28	135.0	75.6	38,152	754	581	470	328	214	137	97	5,995	84	71	2.101
Ss6	109+25	114.30	12:28	135.0	75.6	37,570	749	579	468	329	216	138	97	6,041	84	69	2.044
Ss6	108+75	129.54	12:29	136.8	75.6	25,288	528	390	308	212	136	86	58	4,386	88	73	2.098
Ss6	108+75	129.54	12:29	136.8	75.6	37,623	797	608	486	332	214	134	92	5,274	75	71	1.971
Ss6	108+75	129.54	12:29	136.8	75.6	37,886	790	606	486	335	216	135	93	5,596	75	71	1.983
Ss6	108+25	144.78	12:29	136.8	75.6	25,395	522	394	314	213	141	93	65	4,502	94	69	2.252
Ss6	108+25	144.78	12:29	136.8	75.6	38,170	795	612	494	336	224	147	102	5,149	86	67	2.396
Ss6	108+25	144.78	12:29	136.8	75.6	37,636	777	600	485	333	221	145	102	5,325	87	67	2.250
Ss6	107+75	160.02	12:30	136.8	77.4	25,324	477	374	302	208	140	92	65	6,106	95	71	2.484
Ss6	107+75	160.02	12:30	136.8	77.4	37,534	728	581	475	329	221	145	101	6,839	83	68	2.540
Ss6	107+75	160.02	12:30	136.8	77.4	37,516	723	577	473	330	222	145	102	7,075	83	68	2.378
Ss6	107+25	175.26	12:31	136.8	75.6	25,342	432	351	290	205	137	90	64	8,909	88	74	2.602
Ss6	107+25	175.26	12:31	136.8	75.6	38,224	668	550	459	327	220	144	100	9,786	79	71	2.591
Ss6	107+25	175.26	12:31	136.8	75.6	37,921	658	541	452	326	220	144	100	10,098	80	71	2.439
Ss6	106+75	190.50	12:32	136.8	75.6	25,395	473	366	296	208	139	94	67	5,697	106	70	2.418
Ss6	106+75	190.50	12:32	136.8	75.6	38,063	723	572	467	329	221	147	104	6,609	93	67	2.335
Ss6	106+75	190.50	12:32	136.8	75.6	38,361	717	568	466	331	222	148	104	6,908	94	68	2.291
Ss4	104+25	38.10	12:34	138.6	75.6	25,568	551	430	340	219	142	91	63	4,942	71	72	3.436
Ss4	104+25	38.10	12:34	138.6	75.6	38,277	856	682	545	351	227	143	98	5,379	62	69	3.706
Ss4	104+25	38.10	12:34	138.6	75.6	37,587	847	677	541	351	227	144	99	5,367	62	68	3.698
Ss4	103+75	53.34	12:34	138.6	75.6	25,306	538	415	329	219	146	97	68	4,586	86	67	3.016
Ss4	103+75	53.34	12:34	138.6	75.6	37,672	818	646	517	345	230	150	103	5,320	75	65	3.112
Ss4	103+75	53.34	12:34	138.6	75.6	37,534	807	641	514	346	231	151	104	5,508	75	65	3.051
Ss4	103+25	68.58	12:35	140.4	75.6	25,746	559	425	334	228	151	99	68	4,319	87	66	2.176
Ss4	103+25	68.58	12:35	140.4	75.6	38,224	842	663	528	360	239	155	107	5,234	76	63	2.616
Ss4	103+25	68.58	12:35	140.4	75.6	38,241	840	665	531	362	241	157	107	5,391	75	63	2.739
Ss4	102+75	83.82	12:36	140.4	75.6	25,782	551	407	325	223	151	99	69	3,826	102	65	1.895
Ss4	102+75	83.82	12:36	140.4	75.6	38,241	832	637	512	348	236	155	107	4,632	88	63	2.203
Ss4	102+75	83.82	12:36	140.4	75.6	37,992	823	634	511	350	237	156	107	4,791	88	62	2.167
Ss4	102+25	99.06	12:37	140.4	75.6	25,889	495	378	303	209	145	97	68	4,736	115	68	2.120
Ss4	102+25	99.06	12:37	140.4	75.6	38,259	755	586	474	330	228	150	104	5,355	102	65	1.944
Ss4	102+25	99.06	12:37	140.4	75.6	38,170	754	586	475	331	229	151	105	5,406	102	64	1.978
Ss4	101+75	114.30	12:38	140.4	75.6	25,306	480	361	287	197	133	89	62	4,483	113	72	2.080
Ss4	101+75	114.30	12:38	140.4	75.6	37,708	729	571	454	306	206	135	94	5,606	90	72	2.806
Ss4	101+75	114.30	12:38	140.4	75.6	37,797	731	574	459	311	210	137	96	5,738	91	71	2.726
Ss4	101+25	129.54	12:39	142.2	75.6	25,199	531	392	313	214	148	102	73	3,440	115	64	2.363
Ss4	101+25	129.54	12:39	142.2	75.6	37,356	800	611	491	338	233	158	113	4,227	102	61	2.424
Ss4	101+25	129.54	12:39	142.2	75.6	37,654	794	609	491	340	235	160	114	4,396	104	61	2.342
Ss4	100+75	144.78	12:39	142.2	75.6	25,551	554	415	323	215	145	97	69	3,658	95	68	2.638
Ss4	100+75	144.78	12:39	142.2	75.6	38,081	832	634	499	337	226	149	103	4,188	89	65	2.465
Ss4	100+75	144.78	12:39	142.2	75.6	37,992	833	639	505	342	230	152	105	4,317	88	64	2.455
Ss4	100+25	160.02	12:40	142.2	75.6	25,426	464	355	286	205	142	96	67	5,079	128	67	1.601
Ss4	100+25	160.02	12:40	142.2	75.6	37,623	709	557	452	322	223	149	104	5,908	110	65	1.849
Ss4	100+25	160.02	12:40	142.2	75.6	38,046	708	558	454	324	226	151	105	6,189	111	65	1.793
Ss4	99+75	175.26	12:41	147.6	75.6	25,395	467	339	273	195	135	90	63	3,690	145	70	1.813
Ss4	99+75	175.26	12:41	147.6	75.6	37,814	701	525	426	303	210	139	96	4,662	128	68	1.605
Ss4	99+75	175.26	12:41	147.6	75.6	37,992	703	527	429	307	213	141	97	4,812	129	68	1.618
Ss4	99+25	190.50	12:42	147.6	75.6	25,324	383	294	241	180	129	89	64	5,699	191	72	1.566

Section	Proj. Sta.	Sect. Sta., m	Time	Temperature, C		Load, N	Deflections, um							Moduli, MPa			Fit,%
				Pvm't	Air		D_1	D_2	D_3	D_4	D_5	D_6	D_7	E_{ac}	E_{base}	$E_{subgrade}$	
Ss4	99+25	190.50	12:42	147.6	75.6	38,170	589	458	378	282	202	139	99	6,418	175	70	1.461
Ss4	99+25	190.50	12:42	147.6	75.6	37,832	582	455	377	281	202	139	99	6,877	171	69	1.427
Ss2	96+75	38.10	12:44	149.4	75.6	25,835	343	274	232	181	131	90	64	10,114	198	73	1.528
Ss2	96+75	38.10	12:44	149.4	75.6	38,308	530	431	366	280	202	139	97	11,118	166	71	1.484
Ss2	96+75	38.10	12:44	149.4	75.6	38,010	527	428	363	279	202	139	98	11,000	170	70	1.392
Ss2	96+25	53.34	12:45	149.4	75.6	25,533	381	304	256	190	134	90	62	9,616	137	73	1.644
Ss2	96+25	53.34	12:45	149.4	75.6	38,010	592	480	404	295	208	138	95	9,962	118	72	1.671
Ss2	96+25	53.34	12:45	149.4	75.6	38,010	590	478	403	296	210	139	96	10,084	120	71	1.556
Ss2	95+75	68.58	12:46	149.4	77.4	26,222	351	288	243	184	132	90	64	11,990	157	76	1.623
Ss2	95+75	68.58	12:46	149.4	77.4	38,290	541	448	379	284	202	137	97	12,223	133	73	1.798
Ss2	95+75	68.58	12:46	149.4	77.4	38,664	544	451	382	286	205	138	98	12,569	131	73	1.744
Ss2	95+25	83.82	12:46	149.4	77.4	25,057	352	285	243	184	133	92	65	10,633	165	70	1.583
Ss2	95+25	83.82	12:46	149.4	77.4	38,433	559	460	391	292	211	144	101	11,403	138	70	1.591
Ss2	95+25	83.82	12:46	149.4	77.4	37,939	557	459	389	292	212	144	101	11,129	142	68	1.504
Ss2	94+75	99.06	12:47	149.4	79.2	25,479	406	303	248	182	129	87	61	4,861	176	73	1.658
Ss2	94+75	99.06	12:47	149.4	79.2	38,081	615	470	389	284	201	136	94	5,998	156	71	1.598
Ss2	94+75	99.06	12:47	149.4	79.2	38,135	618	474	392	286	204	138	96	5,964	158	70	1.486
Ss2	94+25	114.30	12:48	149.4	79.2	25,288	411	333	274	199	140	94	64	8,224	124	69	1.927
Ss2	94+25	114.30	12:48	149.4	79.2	37,690	636	523	432	311	218	146	101	8,850	106	68	2.267
Ss2	94+25	114.30	12:48	149.4	79.2	37,761	634	523	432	312	220	147	100	9,030	106	67	2.270
Ss2	93+75	129.54	12:49	151.2	79.2	24,986	433	328	270	194	137	92	64	5,188	145	68	1.646
Ss2	93+75	129.54	12:49	151.2	79.2	37,797	665	513	423	304	213	141	97	6,222	124	68	1.538
Ss2	93+75	129.54	12:49	151.2	79.2	37,605	662	511	422	306	214	142	98	6,293	126	67	1.565
Ss2	93+25	144.78	12:50	151.2	79.2	25,253	362	275	229	170	121	82	58	6,502	188	78	1.625
Ss2	93+25	144.78	12:50	151.2	79.2	38,241	563	435	361	266	187	125	87	7,373	161	77	1.590
Ss2	93+25	144.78	12:50	151.2	79.2	37,623	558	432	359	265	186	125	87	7,385	161	76	1.656
Ss2	92+75	160.02	12:50	153.0	79.2	24,843	411	308	251	183	128	86	62	5,124	155	73	1.735
Ss2	92+75	160.02	12:50	153.0	79.2	37,587	637	490	402	290	201	132	91	6,431	127	72	1.557
Ss2	92+75	160.02	12:50	153.0	79.2	38,046	637	490	402	292	203	134	92	6,564	130	72	1.569
Ss2	92+25	175.26	12:51	153.0	79.2	25,128	383	308	258	191	137	93	65	8,751	148	69	1.465
Ss2	92+25	175.26	12:51	153.0	79.2	37,992	599	484	407	302	216	146	101	9,335	132	67	1.487
Ss2	92+25	175.26	12:51	153.0	79.2	38,028	596	482	405	304	219	147	102	9,394	137	67	1.341
Ss2	91+75	190.50	12:52	153.0	79.2	25,199	442	337	275	194	133	88	62	5,754	121	73	1.756
Ss2	91+75	190.50	12:52	153.0	79.2	37,779	692	537	442	311	213	139	96	6,357	105	69	1.765
Ss2	91+75	190.50	12:52	153.0	79.2	37,725	696	541	445	315	216	141	97	6,434	104	68	1.698
Ss1	89+25	38.10	12:54	154.8	79.2	25,817	411	315	261	180	126	84	58	6,476	134	79	2.172
Ss1	89+25	38.10	12:54	154.8	79.2	38,010	621	483	402	283	198	130	89	7,402	120	75	1.760
Ss1	89+25	38.10	12:54	154.8	79.2	38,135	615	482	401	284	199	130	89	7,699	121	75	1.715
Ss1	88+75	53.34	12:55	153.0	81.0	26,080	357	265	219	170	121	82	59	5,293	237	78	1.711
Ss1	88+75	53.34	12:55	153.0	81.0	37,636	544	419	344	257	182	122	86	6,848	177	77	1.426
Ss1	88+75	53.34	12:55	153.0	81.0	38,063	544	420	346	257	183	123	86	7,229	175	78	1.390
Ss1	88+25	68.58	12:57	153.0	81.0	25,395	398	313	260	193	136	92	64	7,735	146	70	1.605
Ss1	88+25	68.58	12:57	153.0	81.0	37,974	623	498	415	303	212	141	97	8,250	122	69	1.636
Ss1	88+25	68.58	12:57	153.0	81.0	37,957	622	497	414	304	214	142	99	8,192	125	68	1.588
Ss1	87+75	83.82	12:58	153.0	81.0	25,199	436	335	275	197	135	88	60	6,391	119	72	1.654
Ss1	87+75	83.82	12:58	153.0	81.0	37,761	671	529	436	309	212	137	93	7,392	100	71	1.639
Ss1	87+75	83.82	12:58	153.0	81.0	37,868	670	528	437	311	214	138	94	7,442	102	70	1.618
Ss1	87+25	99.06	12:58	154.8	81.0	25,657	408	316	260	191	133	88	60	7,260	137	74	1.522
Ss1	87+25	99.06	12:58	154.8	81.0	38,046	623	494	408	296	206	134	91	8,206	115	73	1.468
Ss1	87+25	99.06	12:58	154.8	81.0	37,868	617	490	405	296	206	134	90	8,358	116	72	1.479

Section	Proj. Sta.	Sect. Sta., m	Time	Temperature, C Pvm't	Air	Load, N	Deflections, um D_1	D_2	D_3	D_4	D_5	D_6	D_7	Moduli, MPa E_{ac}	E_{base}	$E_{subgrade}$	Fit,%
Ss1	86+75	114.30	12:59	158.4	81.0	25,479	361	283	239	182	132	90	64	8,338	188	71	1.431
Ss1	86+75	114.30	12:59	158.4	81.0	38,277	558	447	376	282	204	137	96	9,418	158	71	1.277
Ss1	86+75	114.30	12:59	158.4	81.0	38,010	563	451	379	285	206	139	98	9,034	160	70	1.313
Ss1	86+25	129.54	13:00	156.6	81.0	25,942	333	264	228	174	129	90	64	9,756	224	73	1.603
Ss1	86+25	129.54	13:00	156.6	81.0	38,468	515	412	356	270	199	137	98	10,281	196	71	1.502
Ss1	86+25	129.54	13:00	156.6	81.0	38,277	519	416	359	272	201	139	99	10,407	191	70	1.429
Ss1	85+75	144.78	13:01	154.8	81.0	25,871	333	269	231	180	135	95	68	10,513	227	70	1.274
Ss1	85+75	144.78	13:01	154.8	81.0	38,860	516	421	361	275	205	143	102	11,297	194	70	1.365
Ss1	85+75	144.78	13:01	154.8	81.0	37,868	511	419	360	274	205	144	103	11,229	193	68	1.360
Ss1	85+25	160.02	13:01	158.4	81.0	25,306	326	260	218	168	124	84	59	9,572	210	76	1.044
Ss1	85+25	160.02	13:01	158.4	81.0	37,992	515	411	346	260	190	129	90	9,322	186	75	1.179
Ss1	85+25	160.02	13:01	158.4	81.0	38,241	511	407	343	261	192	130	91	9,645	193	75	1.057
Ss1	84+75	175.26	13:02	156.6	81.0	25,217	380	306	256	189	134	90	63	9,239	139	72	1.654
Ss1	84+75	175.26	13:02	156.6	81.0	37,974	589	485	407	294	208	139	97	10,500	112	72	2.177
Ss1	84+75	175.26	13:02	156.6	81.0	37,992	590	486	408	297	210	141	98	10,494	114	71	2.041
Ss1	84+25	190.50	13:03	156.6	81.0	25,395	490	372	304	212	142	92	64	5,573	98	70	1.978
Ss1	84+25	190.50	13:03	156.6	81.0	38,063	758	592	486	334	224	144	99	6,226	83	68	2.061
Ss1	84+25	190.50	13:03	156.6	81.0	37,516	752	589	484	334	224	144	99	6,425	81	67	2.051
Ss3	81+75	38.10	13:06	154.8	82.8	25,217	495	359	284	195	131	87	62	3,625	118	73	2.044
Ss3	81+75	38.10	13:06	154.8	82.8	37,605	750	564	450	304	204	135	96	4,456	101	71	2.229
Ss3	81+75	38.10	13:06	154.8	82.8	38,152	749	565	451	307	207	137	97	4,588	104	71	2.113
Ss3	81+25	53.34	13:07	154.8	82.8	25,039	503	375	297	208	138	91	65	4,260	106	69	2.093
Ss3	81+25	53.34	13:07	154.8	82.8	37,690	764	595	475	325	214	140	99	5,484	85	69	2.532
Ss3	81+25	53.34	13:07	154.8	82.8	37,939	760	595	475	327	216	141	99	5,591	86	69	2.387
Ss3	80+75	68.58	13:08	153.0	82.8	25,253	512	395	311	206	134	88	63	4,987	83	74	3.226
Ss3	80+75	68.58	13:08	153.0	82.8	37,516	763	604	482	321	208	136	97	5,817	75	72	3.384
Ss3	80+75	68.58	13:08	153.0	82.8	37,779	764	606	485	325	212	139	98	5,879	77	71	3.233
Ss3	80+25	83.82	13:09	153.0	81.0	25,146	515	393	305	199	132	89	63	4,220	92	73	3.445
Ss3	80+25	83.82	13:09	153.0	81.0	37,850	781	611	483	316	211	140	99	5,006	83	70	3.571
Ss3	80+25	83.82	13:09	153.0	81.0	37,708	777	607	480	318	212	141	100	4,993	85	69	3.363
Ss3	79+75	99.06	13:09	154.8	82.8	25,164	583	433	338	218	138	87	61	3,859	71	72	2.476
Ss3	79+75	99.06	13:09	154.8	82.8	37,445	871	666	527	339	215	136	93	4,399	65	70	3.084
Ss3	79+75	99.06	13:09	154.8	82.8	37,374	865	661	523	341	217	137	95	4,483	67	69	2.761
Ss3	79+25	114.30	13:10	154.8	82.8	24,950	546	412	324	213	134	84	57	4,522	72	74	2.390
Ss3	79+25	114.30	13:10	154.8	82.8	37,587	823	637	507	338	214	132	87	5,314	65	72	2.392
Ss3	79+25	114.30	13:10	154.8	82.8	37,552	815	633	505	339	215	133	87	5,520	65	72	2.329
Ss3	78+75	129.54	13:11	156.6	82.8	25,128	531	401	317	207	133	85	59	4,628	77	75	2.737
Ss3	78+75	129.54	13:11	156.6	82.8	37,321	800	621	496	324	209	134	92	5,129	71	71	3.110
Ss3	78+75	129.54	13:11	156.6	82.8	37,552	797	622	498	327	212	135	93	5,352	71	71	3.036
Ss3	78+25	144.78	13:12	154.8	82.8	25,377	512	385	299	194	127	85	61	4,204	91	77	3.277
Ss3	78+25	144.78	13:12	154.8	82.8	37,992	763	590	464	305	200	132	93	4,973	85	74	3.336
Ss3	78+25	144.78	13:12	154.8	82.8	37,868	757	585	461	304	200	132	94	4,968	87	74	3.228
Ss3	77+75	160.02	13:12	156.6	82.8	25,551	468	358	282	187	125	83	59	5,023	103	79	2.951
Ss3	77+75	160.02	13:12	156.6	82.8	37,850	695	546	436	292	196	129	92	5,979	94	76	3.016
Ss3	77+75	160.02	13:12	156.6	82.8	38,010	693	546	437	294	198	130	94	6,155	94	76	3.076
Ss3	77+25	175.26	13:13	158.4	82.8	25,342	494	373	291	191	127	82	58	4,542	94	78	2.650
Ss3	77+25	175.26	13:13	158.4	82.8	37,672	744	575	452	300	196	126	89	5,246	83	76	2.762
Ss3	77+25	175.26	13:13	158.4	82.8	37,321	732	570	452	301	196	125	89	5,648	80	76	2.821
Ss3	76+75	190.50	13:14	158.4	82.8	25,164	536	386	293	191	124	79	55	3,369	90	79	1.797
Ss3	76+75	190.50	13:14	158.4	82.8	37,285	790	592	455	294	191	120	83	4,117	80	78	2.473

Section	Proj. Sta.	Sect. Sta., m	Time	Temperature, C		Load, N	Deflections, um							Moduli, MPa			Fit,%
				Pvm't	Air		D_1	D_2	D_3	D_4	D_5	D_6	D_7	E_{ac}	E_{base}	$E_{subgrade}$	
Ss3	76+75	190.50	13:14	158.4	82.8	37,481	786	588	454	297	193	122	84	4,156	83	77	2.236
Ss5	74+25	38.10	13:16	160.2	82.8	25,497	440	336	270	189	129	88	64	5,293	129	74	2.195
Ss5	74+25	38.10	13:16	160.2	82.8	37,445	651	514	415	288	196	132	95	6,522	109	74	2.704
Ss5	74+25	38.10	13:16	160.2	82.8	37,814	650	511	414	291	199	133	96	6,506	115	73	2.250
Ss5	73+75	53.34	13:17	163.8	82.8	25,288	486	348	265	170	111	73	51	3,504	104	87	2.492
Ss5	73+75	53.34	13:17	163.8	82.8	37,672	716	535	412	265	172	112	78	4,386	93	85	3.039
Ss5	73+75	53.34	13:17	163.8	82.8	37,708	713	536	414	266	173	114	78	4,423	95	84	3.167
Ss5	73+25	68.58	13:17	165.6	82.8	25,128	579	409	305	185	120	81	58	2,640	83	80	3.428
Ss5	73+25	68.58	13:17	165.6	82.8	37,725	842	619	469	293	189	124	89	3,359	80	77	3.369
Ss5	73+25	68.58	13:17	165.6	82.8	37,672	830	615	468	295	191	125	90	3,546	80	77	3.336
Ss5	72+75	83.82	13:18	163.8	82.8	25,057	660	470	353	224	145	94	66	2,460	74	66	2.447
Ss5	72+75	83.82	13:18	163.8	82.8	37,143	965	720	547	345	222	144	101	3,123	66	66	3.320
Ss5	72+75	83.82	13:18	163.8	82.8	37,232	954	711	543	348	224	145	103	3,226	68	65	2.981
Ss5	72+25	99.06	13:19	162.0	84.6	24,968	645	434	323	204	127	80	56	2,252	75	75	1.970
Ss5	72+25	99.06	13:19	162.0	84.6	37,196	946	673	505	318	197	124	85	2,799	68	74	2.142
Ss5	72+25	99.06	13:19	162.0	84.6	37,672	954	684	516	322	200	125	87	2,922	67	74	2.370
Ss5	71+75	114.30	13:20	160.2	84.6	24,843	739	496	363	213	132	85	60	1,863	62	72	2.485
Ss5	71+75	114.30	13:20	160.2	84.6	37,107	1072	765	572	335	207	131	94	2,417	56	70	3.536
Ss5	71+75	114.30	13:20	160.2	84.6	37,249	1057	760	569	338	209	132	95	2,537	57	70	3.452
Ss5	71+25	129.54	13:21	162.0	84.6	24,914	769	532	388	234	142	89	62	2,053	55	68	2.154
Ss5	71+25	129.54	13:21	162.0	84.6	36,880	1137	816	606	367	221	137	95	2,390	51	66	2.926
Ss5	71+25	129.54	13:21	162.0	84.6	37,089	1120	807	602	371	223	138	95	2,527	52	66	2.740
Ss5	70+75	144.78	13:22	162.0	84.6	25,181	651	489	372	231	140	86	59	3,508	55	73	3.325
Ss5	70+75	144.78	13:22	162.0	84.6	36,987	956	741	573	358	218	132	91	4,066	51	71	3.747
Ss5	70+75	144.78	13:22	162.0	84.6	37,018	945	734	569	361	219	133	91	4,234	51	71	3.541
Ss5	70+25	160.02	13:22	158.4	84.6	24,790	607	442	337	213	133	85	58	3,182	69	73	2.602
Ss5	70+25	160.02	13:22	158.4	84.6	36,720	912	687	531	335	209	132	91	3,663	62	70	3.216
Ss5	70+25	160.02	13:22	158.4	84.6	36,987	908	686	531	339	212	133	91	3,815	63	70	2.992
Ss5	69+75	175.26	13:23	160.2	84.6	25,217	637	480	365	221	137	87	62	3,342	60	73	4.295
Ss5	69+75	175.26	13:23	160.2	84.6	37,303	947	730	562	344	212	135	96	3,753	56	71	4.494
Ss5	69+75	175.26	13:23	160.2	84.6	37,623	943	730	563	348	215	137	98	3,888	57	70	4.398
Ss5	69+25	190.50	13:24	158.4	84.6	25,021	588	441	345	228	142	89	62	4,100	68	70	2.536
Ss5	69+25	190.50	13:24	158.4	84.6	36,969	870	677	532	351	217	136	96	4,793	60	69	3.102
Ss5	69+25	190.50	13:24	158.4	84.6	36,845	863	673	529	353	218	137	97	4,900	60	69	3.094