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Dr. N. Mike Jackson, Major Professor

We have read this thesis
And recommend its acceptance:

Accepted for the Council:

Associate Vice Chancellor and
Dean of The Graduate School

# Evaluation of Laboratory Compaction of Hot Mix Asphalt

A Thesis
Presented for the
Master of Science
Degree
The University of Tennessee, Knoxville

Eric A. Ownby
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# Dedication

This thesis is dedicated to my loving wife, Toby Ownby.

## Acknowledgements

There are many people to whom I am ever grateful for making the impossible a reality. The faculty and staff at The University of Tennessee have provided me with the education and opportunities that few people ever receive. One such person is Dr. Mike Jackson who not only believed in me but has also been a friend and a mentor. Also, a special thank you and good bye goes to Curtis Allin who has been an inspiration to every civil engineering student for the past thirty-nine years.

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Lastly, a great debt is owed to my wife, Toby Ownby, who has allowed me to postpone our first year of marriage for the pursuit of a dream. Without her love and patience I would never have seen this dream come true.

# Abstract

As mix design evolves from conventional Marshall design to Superpave and beyond, it is becoming necessary to develop test methods to evaluate the performance of Hot Mix Asphalt (HMA). One such method being developed is the Pavement Technology, Inc. (PTI) Asphalt Pavement Analyzer (APA). However, if the APA is to be used for performance testing, it is imperative that the specimens to be tested in this device are representative of the HMA to be compacted on the roadway. In light of this observation, three laboratory compaction methods employed in the design of HMA were evaluated. The compaction methods evaluated include the rotating base Marshall compactor, the Superpave Gyratory Compactor (SGC), and the PTI vibratory compactor (Model AVC-III). Volumetric properties of compacted specimens obtained from these three laboratory methods were compared with properties obtained from the roadway.

The results of this study demonstrate that the Marshall compactor and the SGC do not produce samples with densities comparable to those currently achieved on the roadway at the time of construction. On the other hand, it is demonstrated that the compaction obtained on the roadway in Tennessee is statistically equivalent to the compaction obtained in the laboratory with the PTI vibratory compactor.

Further, it was observed during the course of this study that the PTI vibratory compactor might be a valuable tool for the evaluation of the relative compactibility of HMA. Further research is warranted to evaluate the potential of this laboratory tool to identify HMA mixes susceptible to compaction problems on the roadway.

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# 1.0 Introduction

## 1.1 Objective

The objective of this study was to evaluate three laboratory compaction methods employed in the design of Hot Mix Asphalt (HMA). The compaction methods evaluated in this study include the rotating base Marshall compactor, the Superpave Gyratory Compactor (SGC), and the Pavement Technology, Inc. (PTI) vibratory compactor. Volumetric properties of compacted specimens produced by these three laboratory methods were compared with the volumetric properties of HMA compacted on the roadway. The results of this study are documented herein.

## 1.2 Background

The Strategic Highway Research Program (SHRP), which was conducted between October 1987 and March 1993 included $50 million of asphalt related research. From this international research effort, the Superior Performing Asphalt Pavements (Superpave) mixture design and analysis system was developed. Superpave provides a new system for specifying component materials, and design and analysis of asphalt mixtures. The Superpave system includes test equipment, test methods, and design criteria (McGennis, etal., 1995).

With any mix design and analysis process, the compaction method used to prepare specimens is a significant component. The purpose of the laboratory compaction process is to simulate the actual compaction produced in the field. Factors such as

particle orientation and volumetric properties should be carefully considered in the selection of a laboratory compaction method (Monismith, etal., 1994).

It is standard practice in most of the United States to design HMA by the Marshall mix design method in general accordance with ASTM D 1559-89 and The Asphalt Institute (TAI) Manual Series Number 2 (MS-2). However, the Marshall compaction method was developed with close correspondence between the density achieved in the laboratory and the density observed on the roadway after exposure to traffic (Roberts, et al., 1996). Further, it has been documented that the impact compaction used in Marshall design does not simulate construction compaction (Von Quintus, et al., 1991).

Gyratory compaction was identified as the most suitable method of compaction for the new Superpave mix design system. The SGC was selected because it orients the aggregate particles in a way that is similar to that observed in the field (Roberts et al. 1996). The SGC was also chosen because it has the capability to compact 150 mm (6 inch) diameter specimens and can therefore accommodate larger aggregates (up to 50 mm, 2 inches maximum) in the mixture. Although the SGC orients aggregates similar to field compaction, recent studies suggest that the SGC also has a tendency to compact mixes in excess of what can be achieved with conventional paving equipment (Musselman, et al., 1998). Superpave mixtures appear difficult to compact properly using traditional rolling methods and/or patterns (Haddock and Walker, 1998). In response to the observed shortcomings of both the Marshall and SGC methods of compaction, PTI has developed a vibratory compactor intended to more closely simulate actual roadway compaction in the laboratory.

As mix design evolves from conventional Marshall design to the new Superpave system and beyond, it will be necessary to identify practical laboratory test methods that will help predict the performance of HMA on the roadway. Performance testing has been deemed necessary for broad acceptance of the Superpave mix design system. However, no single laboratory performance test has been embraced by the industry as of yet One potential performance test recently developed is the PTI Asphalt Pavement Analyzer (APA). The APA is capable of providing empirical data regarding permanent deformation (rutting) and fatigue cracking. However, if the APA is to be used in this capacity, it is imperative that the specimens to be tested in this device are representative of the HMA, as compacted on the roadway.

The majority of densification of HMA by traffic occurs within the first year after construction (Stroup-Gardiner, 1997). This is because permanent deformation is partially the result of further densification on the roadway and initiates as soon as the pavement is open to traffic. Therefore, it is reasoned that rutting should be evaluated in the laboratory with specimens compacted to the density anticipated on the roadway immediately after construction. The Marshall and SGC methods of compaction produce laboratory specimens representative of compaction on the roadway after exposure to traffic for a period of approximately one year. This difference in compaction on the roadway immediately after construction versus after exposure to traffic is illustrated in Figure 1. Notice in Figure 1 that as the number of gyrations of the gyratory compactor increases, the percent voids decreases. Also, note that there are several reference points in the plot. The first point in the figure indicates the percent voids found immediately after construction of the roadway. The second represents the voids of a typical laboratory

compacted Marshall specimen (75 blows). Also shown in Figure 1 is the percent air voids of cores obtained from the wheel path after 6 months, 15 months, and 36 months of traffic exposure. It is believed that the PTI vibratory compactor will help minimize differences between design specimens produced in the laboratory and compacted HMA on the roadway.

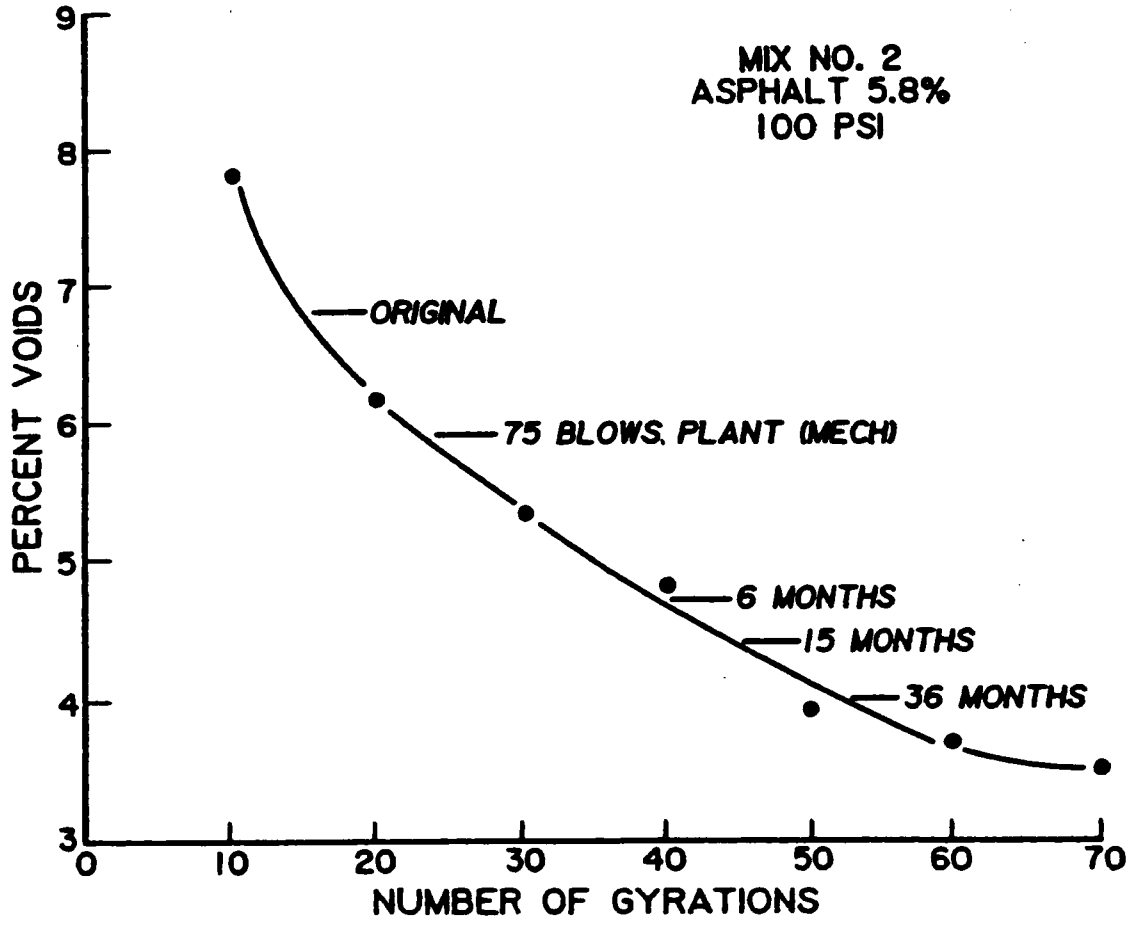



**Figure 1.** **Compaction on the Roadway Immediately Following Construction Versus After Exposure to Traffic (Roberts, et al., 1996)**

# 2.0 Research Program

## 2.1 Research Plan

The research plan for this study provided for the evaluation of surface course mixes from up to eight test sections within the state of Tennessee. Paving projects from each of the four different regions of TDOT were selected. A variety of projects were selected to provide variability in local materials, contractors and equipment. With the assistance of a TDOT and FHWA research advisory committee, two projects from each region were selected for inclusion in this study.

The test sections selected for this study were located within roadway paving projects constructed during the 1997 paving season. As previously noted, two test sections were identified for each of the four TDOT Regions of the state. The specific paving projects, included in this study, are identified in Table 1. Test section site vicinity maps, pavement design cross sections are provided in Figures A.1 through A.14 of Appendix A. The approved mix designs for the respective test sections are also provided in Appendix A.

TDOT mix types are referred to in Table 1. The mix design numbers represent the following:

411 – Surface Mixture

307 – Binder Mixture

D – Marshall Mix Design

S – Superpave Mix Design

**Table 1. Identification of Test Sections**

| TDOT Region | County | TDOT Mix Type | Test Section Location | TDOT Contract No. | TDOT Project No. |
|---|---|---|---|---|---|
| I | Union | 411S | SR 33, East Bound Lane | 4885 | 87001-4248-04 |
| I | Knox | 411D | SR 131, North Bound Lane | 4851 | 47027-4210-04 |
| II | Marion | 411D | I-24, West Bound, Outside Lane | 5774 | 58100-8119-04 |
| II | Pickett | 411S | SR 28* | 4870 | 69001-4514-04 |
| III | Lincoln | 411S | SR 15, West Bound, Inside Lane | 4770 | 52002-4529-04 |
| III | Maury | 411S | SR 243, South Bound Lane | 4865 | 60017-4214-04 |
| IV | Madison | 411S | SR 18, North Bound Lane | 4714 | 57010-4208-04 |
| IV | Madison | 307S | SR 18, South Bound Lane | 4714 | 57010-4208-04 |
| IV | Lauderdale | 411S | US 51, North Bound, Inside Lane | 4853 | 49001-4267-04 |
| IV | Lauderdale | 307S | US 51, North Bound, Outside Lane | 4853 | 49001-4267-04 |

*Project not visited.

## 2.2 Project Reconnaissance

Members of the research team visited each project. The objective of this project reconnaissance was to observe and document the paving operation and obtain representative samples of the loose mix and roadway cores for further testing. A secondary objective of this activity was to document the location of the specific test sections for future inspection and testing. The project reconnaissance also included a visit to each asphalt plant to observe the mix being produced and obtain documentation of the mix design.

### 2.2.1 Asphalt Plant Site Visit

At the asphalt plant, a random haul truck was identified and sampled in accordance with ASTM D 979-96. The temperature and appearance of the mix was documented and the selected haul truck was followed to the project location. A summary of the date each paving project was sampled is provided in Table 2.

### 2.2.2 Roadway Site Visit

Upon arrival at the roadway project site, the location of the placement of the mix from the selected haul truck was clearly identified as the project test section. The beginning of each test section was established approximately 25 feet ahead of the front of the paving machine, insuring that no mix from the previous truck was placed within the limits of the test section. Six additional stations were marked at approximately 50 foot intervals for identification of data collection locations. Local landmarks or permanent station markers were noted for future reference.

**Table 2. Summary of Projects and Sampling Dates**

| TDOT Region | County | TDOT Mix Type | Sampling Date |
|---|---|---|---|
| I | Union | 411S | 9/16/97 |
| I | Knox | 411D | 10/10/97 |
| II | Marion | 411D | 10/14/97 |
| II | Pickett* | 411S | N/A |
| III | Lincoln | 411S | 9/15/97 |
| III | Maury | 411S | 9/23/97 |
| IV | Madison | 411S | 8/12/97 |
| IV | Madison | 307S | 8/6/97 |
| IV | Lauderdale | 411S | 10/15/97 |
| IV | Lauderdale | 307S | 9/16/97 |

*Project not visited.

2.2.2.1 Paving Equipment

A paving train is the combination of paving equipment used for the lay-down and compaction of HMA. A typical paving train may consist of a haul vehicle (dump truck), a transfer vehicle (optional), a paving machine, a breakdown roller (steel wheel with vibratory option), a pneumatic roller (rubber tire), and a finish roller (steel wheel with no vibratory). A typical paving train is shown in Figure 2. In some cases, the pneumatic roller may be eliminated from the paving train. The Knox County project was one such case.

The paving equipment and operations at each test section were observed as part of this study. The make and model of the compaction equipment were documented. The number of passes and the mode of operation for each roller were also documented.

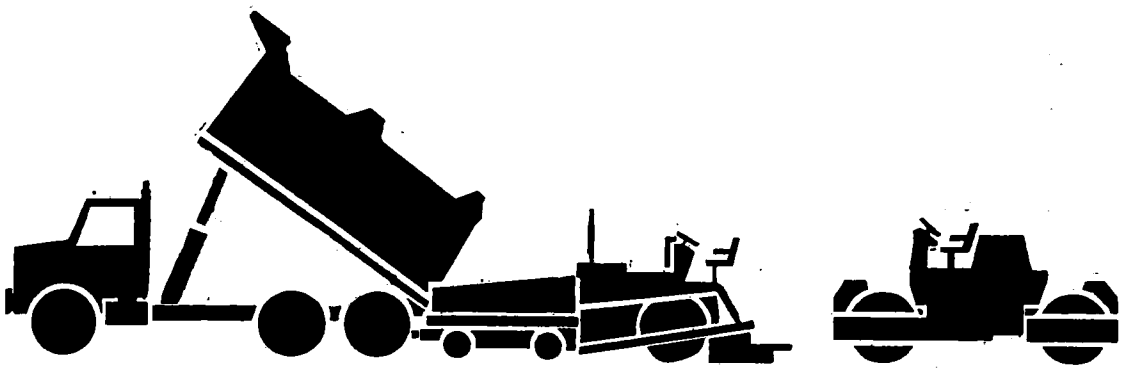


**Figure 2. Typical Paving Train**

2.2.2.2 Roadway Sampling and Data Collection

Data from the compacted HMA was obtained at each of the six data collection stations. Data was obtained at the right wheel path, the center of the lane, and the left wheel path. Pavement surface temperatures were recorded immediately following the paving machine and behind each roller at all six data collection stations (18 total readings). Upon completion of compaction, nuclear density readings were obtained at all six data collection stations (18 total readings). Finally, pavement cores were obtained in general accordance with ASTM D 5361-95. The cores were cut at alternating locations from the right wheel path, the center of the lane, and the left wheel path (6 total cores). A schematic diagram of the general data collection and core sampling locations is provided in Figure 3. A summary of the specific type of data collected at each test section is provided in Table 3. The loose HMA samples and the roadway cores were transported to the Civil Engineering Materials Laboratory at the University of Tennessee for further testing and evaluation.

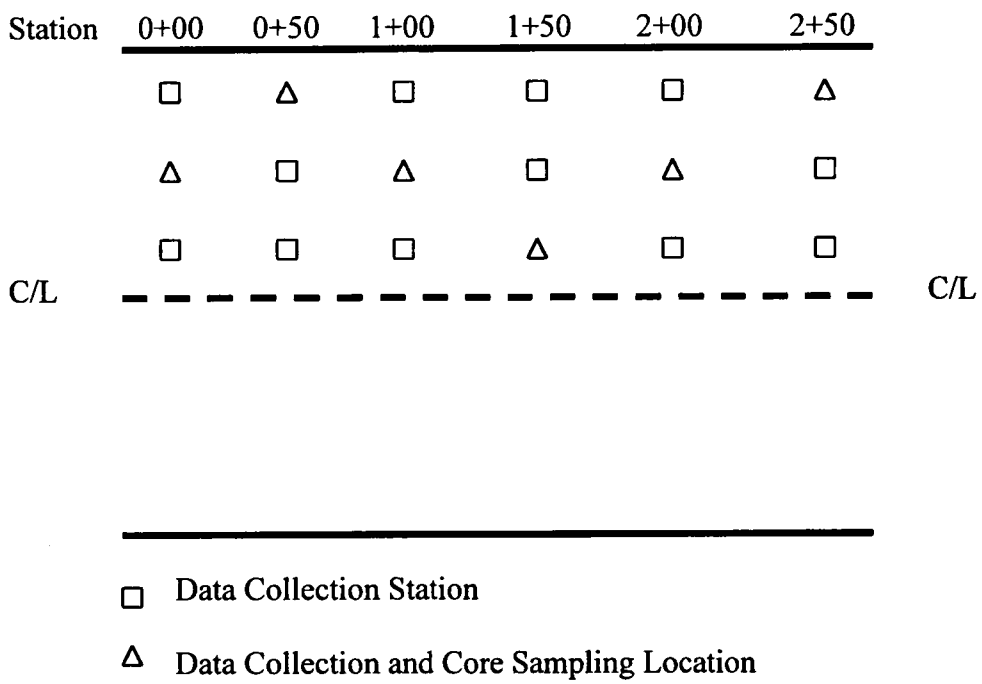



**Figure 3. General Data Collection and Core Sampling Locations**

**Table 3. Summary of Data Collected at Each Test Section**

| Data Collected | Procedure | Location and Frequency |
|---|---|---|
| Loose Mix Temperature | Infrared Thermometer | Truck at Plant/Paver at Roadway |
| Loose Mix Sampling | Sampling Platform | Truck at Plant |
| Compacted HMA Temperature | Infrared Thermometer | 6 Right Wheel Path/6 Center of Lane/6 Left Wheel Path (18 Total Readings) |
| Compacted HMA Density | Nuclear Density Gauge | 6 Right Wheel Path/6 Center of Lane/6 Left Wheel Path (18 Total Readings) |
| Pavement Cores | Water Cooled Core Drill | Alternating From Right Wheel Path, Center of Lane, and Left Wheel Path |

It should be noted that the planned project reconnaissance was not conducted for the Pickett County project in TDOT Region II. Due to unavoidable scheduling conflicts, it was not possible for our research team to coordinate a site visit during construction of this project. However, due to the exceptional efforts of the TDOT Region IV Materials and Tests personnel, both the binder and surface course materials were sampled and tested for the two projects in this Region.

## 2.3 Laboratory Test Program

The laboratory testing phase of this study consisted of the following tasks: (1) sample preparation; (2) the determination of the theoretical maximum specific gravity of the loose HMA samples; (3) laboratory compaction of the loose mix; (4) determination of the bulk specific gravity of the laboratory compacted specimens and roadway cores; (5) determination of the asphalt content of the HMA samples by the NCAT ignition oven method; (6) calculation of volumetric properties of the mixes; (7) saw cutting of the laboratory compacted specimens; and (8) determination of the bulk specific gravity for each segment of the saw-cut specimens. Each of these tasks is described in greater detail in the following paragraphs. The laboratory test program is outlined in Table 4.

**Table 4. Outline of Laboratory Test Program**

| Test Specimen | Test Procedure | Referenced Standard |
|---|---|---|
| Loose Mix: | Bulk Sampling of Mix | ASTM D 979-89 |
| | Sample Size Reduction | AASHTO T248-83 |
| | Theoretical Maximum Specific Gravity | ASTM D 2041-95 |
| | Asphalt Content (Ignition Oven) | AASHTO TP53-95 |
| | Compaction: Marshall Compactor | ASTM D 1559-89 |
| | Gyratory Compactor | AASHTO TP4 |
| | Vibratory Compactor | PTI Model AVC-III |
| Cores | Sampling of Compacted Mixtures | ASTM 5361-95 |
| | Bulk Specific Gravity (SSD) | ASTM D 2726-96 |
| Marshall Pills: | Bulk Specific Gravity (SSD) | ASTM D 2726-96 |
| | Bulk Specific Gravity (w/ Parafilm) | ASTM D 1188-96 |
| Gyratory Pills: | Bulk Specific Gravity (SSD) | ASTM D 2726-96 |
| | Bulk Specific Gravity (w/ Parafilm) | ASTM D 1188-96 |
| Vibratory Beams: | Bulk Specific Gravity (SSD) | ASTM D 2726-96 |
| | Bulk Specific Gravity (w/ Parafilm) | ASTM D 1188-96 |
| Saw-cut Marshall Pills | Bulk Specific Gravity (SSD) | ASTM D 2726-96 |
| Saw-cut Gyratory Pills | Bulk Specific Gravity (SSD) | ASTM D 2726-96 |
| Saw-cut Beams | Bulk Specific Gravity (SSD) | ASTM D 2726-96 |

### 2.3.1 Sample Preparation

Prior to testing of the loose HMA, the samples were re-heated in the laboratory to a workable state. During this activity, the laboratory ovens were maintained at approximately 93°C ($200^0$F) to minimize excessive loss of volatiles from the binder during the re-heating process. The samples were subsequently reduced to prescribed testing quantities in accordance with the procedures outlined in AASHTO T248-83.

### 2.3.2 Theoretical Maximum Specific Gravity

The theoretical maximum specific gravity ($G_{mm}$) was determined for each mix in accordance with ASTM D 2041-95. Based on the theoretical maximum specific gravity,

the Theoretical Maximum Density (TMD) for each mix was calculated. Three different samples were tested for each mix and an average of the three was used in comparing the respective compaction methods to the results observed on the roadway.

### 2.3.3 Asphalt Content

While quartering samples for the theoretical maximum specific gravity test, representative samples were also obtained for asphalt content determination. The asphalt content of each mix was determined with the NCAT Ignition Oven in accordance with AASHTO TP53. Since these mixes were not batched in the Civil Engineering Materials Laboratory at the University of Tennessee, the ignition oven correction factors for the respective mixes were obtained from the respective contractor and TDOT laboratories. The correction factors determined by the contractors were then used in calculating the asphalt content for the mixes tested in the Laboratory at the University of Tennessee. No correction factor was available for the Lincoln County project therefore a correction factor of 0.35 was assumed. The assumed correction factor was based on data from mixtures containing similar aggregate characteristics.

### 2.3.4 Laboratory Compaction

Laboratory test specimens were compacted with the rotating base Marshall compactor, the SGC, and the PTI vibratory compactor. The mass of mix used in fabricating specimens with each compaction method was calculated based on the volume of the mold and the measured TMD for each mix. For each of the respective mix design procedures, the desired Voids in the Total Mix (VTM) to be achieved by laboratory

compaction is specified. The Marshall method is designed to yield between 3% and 5% VTM. Superpave is designed to yield no less than 2% VTM at $N_{max}$ and 4% VTM at $N_{des}$. The PTI vibratory compactor is intended to achieve the level of compaction typically obtained on the roadway immediately after construction (about 7%-10% VTM). Prior to compaction, all materials, molds and tools were pre-heated to a standard temperature of approximately 149°C (300°F).

2.3.4.1 Marshall Compaction

Marshall mix design utilizes a 4.54 kg (10 lb.) hammer with a 98.4 mm (3 7/8 inch) diameter foot, and an 18 inch drop height. A compaction effort of 75 blows per side was used for all mixes evaluated in this study. A 100 mm (4 inch) diameter cylindrical specimen with a height of approximately 63 mm (2.5 inches) is produced. Since TDOT uses a rotating base Marshall compactor, this is the type of hammer that was used in this study. It should be noted that due to the 4 inch mold, the maximum aggregate size should not exceed 1 inch. For mixes containing aggregates larger than 1 inch, a 150 mm (6-inch) diameter mold should be used. None of the mixes evaluated in this study contained nominal maximum aggregate sizes greater than 1 inch.

2.3.4.2 Superpave Gyratory Compaction (SGC)

Superpave mixes are designed and evaluated by use of the SGC. The Civil Engineering Materials Laboratory at University of Tennessee is equipped with a Pine Instrument Company, Model AFGC125X Gyratory Compactor. Samples of HMA were re-heated and compacted in a 150 mm (6 inch) diameter mold to produce specimens with

an approximate height of 115 mm (4.5 inches). A standard pressure of 600 kPa (90 psi) is used for Superpave gyratory compacted samples. Specimens were compacted to $N_{max}$. The standard number of gyrations used by TDOT for all Superpave mixes placed in Tennessee to date were used in this study. All density calculations are expressed as percent of theoretical maximum density ($\%G_{mm}$). The standard gyrations used by TDOT are summarized in Table 5.

The relationship for % $G_{mm}$ is as follows:

$$\%G_{mm} = \frac{G_{mb}}{G_{mm}} \times 100\,\% \qquad (1)$$

Where, $G_{mb}$ = bulk specific gravity of the compacted mixture,
and $G_{mm}$ = theoretical maximum density

**Table 5. Summary of Gyrations Used by TDOT for Superpave Mixes**

| Level of Compaction | Gyrations | Specified $\%G_{mm}$ |
|---|---|---|
| $N_{initial}$ | 8 | <89% |
| $N_{design}$ | 96 | 96% |
| $N_{max}$ | 152 | <98% |

2.3.4.3 PTI Vibratory Compaction

A PTI Model AVC III Asphalt Vibratory Compactor was used in this study. The PTI Model AVC III compactor has been modified from the more common AVC II compactor by adding a second vibrating mechanism and increasing the size of the pneumatic ram from 4 to 6 inches. The PTI vibratory compactor was used to produce 305 mm x 127 mm x 76 mm (12 inch x 5 inch x 3 inch) beam specimens. The pressure of the compactor was set at 125 psi down pressure with 25 psi back-pressure, resulting in a net cylinder pressure of 100 psi. The back-pressure is used to allow the bearing plate to rebound as the vibrators oscillate, simulating the recoil of the base and sub-grade layers during compaction on the roadway. As previously noted, it is believed that the PTI vibratory compactor will help minimize differences between design specimens in the laboratory and compacted HMA on the roadway.

## 2.3.5 Calculation of Volumetric Properties

For each project, three test specimens were produced by each method of compaction. The compacted specimens were then tested for determination of volumetric properties of the compacted mix. Average values from the three specimens were used for analysis purposes. The volumetric properties of Density (reported as $\%G_{mm}$), Voids in the Total Mix (VTM), Voids in the Mineral Aggregate (VMA), and Voids Filled with Asphalt (VFA) were calculated for each mix. Although bulk specific gravities were determined by both the Saturated Surface Dry (SSD) method and the Parafilm method, the volumetric properties of density, VTM, VMA, and VFA were calculated based on the SSD method. It has been suggested that the SSD method of bulk specific gravity

determination be used in the Superpave mix design. However, the Parafilm method may add 1-2% voids. This may better represent the volume of voids found at the roadway, but the results are less consistent than the SSD method. This could be due to in part by technician error while applying the parafilm. The following relationships are used in calculating VTM, VMA, and VFA:

$$VTM = \left(1 - \frac{G_{mb}}{G_{mm}}\right) \times 100 \quad (2)$$

$$VMA = 100 \times \left(1 - \frac{G_{mb}(1 - P_b)}{G_{se}}\right) \quad (3)$$

Where: $P_b$ = Asphalt Content, and
$G_{se}$ = Effective Specific Gravity of Aggregate

$$VFA = \frac{VMA - VTM}{VMA} \times 100 \quad (4)$$

Calculations were also made using both bulk and effective specific gravity values of the blended aggregate. However, for analysis and comparison of results, only the effective specific gravity values were used. The effective specific gravity of the aggregate blend was calculated based on the asphalt contents determined in the laboratory. The effective specific gravity of the blended aggregate was calculated by equation 5.

$$G_{se} = \frac{1 - P_b}{\frac{1}{G_{mm}} - \frac{P_b}{G_b}} \quad (5)$$

Where, $G_b$ = Specific gravity of asphalt cement.

Most comparisons and observations made in this study were made relative to percent of theoretical maximum specific gravity (% $G_{mm}$). It should be noted that for comparison purposes, the bulk specific gravity values at $N_{des}$ for the gyratory compacted specimens were estimated from the laboratory-measured values at $N_{max}$. Finally, the volumetric properties of all laboratory compacted specimens were compared with the volumetric properties obtained from the roadway cores.

### 2.3.6 Saw Cutting of Test Specimens

Aggregate orientation and distribution are key factors in obtaining laboratory compacted specimens which are representative of compacted HMA on the roadway. It has been documented that gyratory compaction produces an aggregate orientation and distribution similar to that found in roadway core samples (Roberts, et al., 1996). It has also been documented that Marshall compaction does not simulate construction compaction (Von Quintus, et al., 1991). It is not yet known if the PTI vibratory compactor results in an aggregate orientation and distribution similar to that found in roadway core samples.

To gain a view of the internal aggregate orientation and distribution, the compacted specimens were saw-cut with a water-cooled concrete saw. The Marshall pills, vibratory beams, and gyratory pills were cut into 8, 16, and 12 approximately equal

size specimens, respectively. The general saw-cut pattern for the respective specimens is provided in Figures 4 through 6. The saw-cut specimens were visually inspected and re-tested for bulk specific gravity to evaluate aggregate orientation and relative uniformity of volumetric properties throughout.

## 2.4 Test Results and Observations

For the purpose of this discussion, the different test sections are referred to by the county in which they are located. Mixes are referred to by TDOT mix designation. The mix number indicates whether the mix is a surface mix (411) or a binder mix (307). The letter following the mix number indicates whether it is a Superpave mix design (S) or a conventional dense-graded Marshall mix design (D). The roadway and laboratory data are contained in Appendix B and summarized in the following sections.

### 2.4.1 Observations from Project Reconnaissance

As previously noted, members of the research team visited each project. The objective of this project reconnaissance was to observe and document the paving operation and obtain samples of the loose mix and roadway cores for further testing. The observations made during the reconnaissance phase for each project are documented in the following sections.

#### 2.4.1.1 Asphalt Plant Visit

To evaluate the asphalt production and compaction conditions within the state of Tennessee, it was vital to review a variety of contractors and the equipment they utilize.

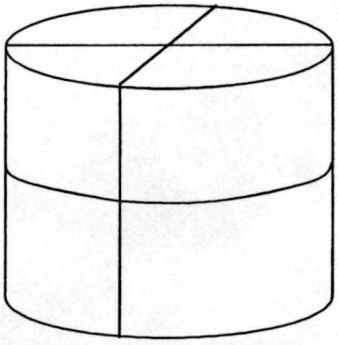


**Figure 4. Marshall Specimen Saw-Cut Pattern**

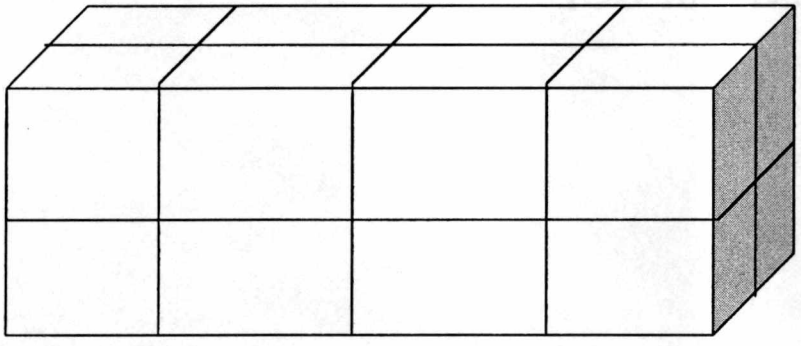


**Figure 5. Vibratory Specimen Saw-Cut Pattern**

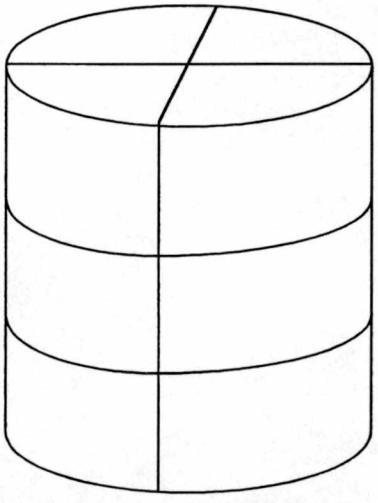


**Figure 6. Gyratory Specimen Saw-Cut Pattern**

As expected, there were a variety of asphalt production facilities encountered. Two extremes are shown in Figures 7 and 8. Figure 7 shows an older model Simplicity portable batch plant located in Maury County. Figure 8 shows a state of the art ASTEC double barrel drum plant located in Knox County. Each plant varied with respect to their cold feed bins, dust collection systems, mix surge silos, and their automation capabilities.

2.4.1.2 Roadway Site Visit

2.4.1.2.1 Equipment: Types of equipment and roller patterns varied from project to project in this study. According to some TDOT personnel, the Superpave mixes seem more difficult to compact than does the traditional HMA mixtures. TDOT specifications require a test strip be constructed to determine the appropriate roller patterns and number of passes that will achieve the target density. To achieve adequate compaction of some Superpave mixtures, contractors have found it necessary to alter traditional rolling techniques by using one or a combination of larger rollers, more rollers, and applying more passes (Haddock and Walker, 1998). Most projects conformed to the typical three roller paving train specified by TDOT, except the contractor on the Knox County (411D mix) project used only breakdown and finish rollers. A summary of the equipment used on each project can be found in Tables 6 through 8. Table 9 provides a summary of different pressures produced by the steel wheel rollers observed on the respective test sections. All pneumatic rollers observed were reported to have tire pressures of approximately 110 psi. It is generally assumed that the contact pressure for pneumatic tires is approximately equal to the tire pressure.



**Figure 7. Maury County – Simplicity Portable Batch Plant**



**Figure 8. Knox County – ASTEC Double Barrel Drum Plant**

**Table 6. Breakdown Rollers and Observed Coverage**

| Project | TDOT Mix | Breakdown Roller Make & Model | Vibratory (Y/N) | Coverage (Passes) |
|---|---|---|---|---|
| Union County | 411S | Ingersoll-Rand DD-110 | Y | 2 |
| Knox County | 411D | Ingersoll-Rand DD-110 | N | 2 |
| Marion County | 411D | Ingersoll-Rand DD-130 | Y | 2 |
| Lincoln County | 411S | Ingersoll-Rand DD-110 | N | 3 |
| Maury County | 411S | Ingersoll-Rand DD-110 | N | 2-3 |
| Madison County | 411S | Ingersoll-Rand ST 105 | N | 3 |
| Lauderdale County | 411S | Caterpillar CB 534C | Y | 3 |

**Table 7. Pneumatic Rollers and Observed Coverage**

| Project | TDOT Mix | Pneumatic Roller Make & Model | Coverage (Passes) |
|---|---|---|---|
| Union County | 411S | Ingram P-11 | 4 |
| Knox County | 411D | Not Used | N/A |
| Marion County | 411D | Caterpillar PS 130 | 2 |
| Lincoln County | 411S | BOMAG BW12-R | 3 |
| Maury County | 411S | BOMAG BW12-R | 3 |
| Madison County | 411S | Caterpillar PS 130 | 3 |
| Lauderdale County | 411S | Caterpillar PS 130 | 3 |

**Table 8. Finish Rollers and Observed Coverage**

| Project | TDOT Mix | Finish Roller Make & Model | Coverage (Passes) |
|---|---|---|---|
| Union County | 411S | Ingersoll-Rand DD-90 | 2 |
| Knox County | 411D | Ingersoll-Rand DD-110 | 4 |
| Marion County | 411D | Gallion 712 | 1+ |
| Lincoln County | 411S | Ingersoll-Rand DD-110 | 3 |
| Maury County | 411S | Ingersoll-Rand ST 105 | 3 |
| Madison County | 411S | Caterpillar CB 534C | 3 |
| Lauderdale County | 411S | Ferguson 8-12B | 2 |

**Table 9. Summary of Applied Pressures from Observed Rollers**

| Equipment Make & Model | Compression Roller Kg/cm | Compression Roller Lbs/in | Guide Roller kg/cm | Guide Roller Lbs/in | Vibratory Option (Y/N) |
|---|---|---|---|---|---|
| Caterpillar CB 534C* | 28.5 | 159 | - | - | Y |
| Ferguson 8-12B** | 51.3 | 287 | 32.0 | 180 | N |
| Gallion 712** | 47.0 | 263 | 32.3 | 181 | N |
| Ingersoll-Rand DD-90** | 50.0 | 280 | 46.4 | 260 | Y |
| Ingersoll-Rand DD-110** | 49.7 | 278 | 45.5 | 255 | Y |
| Ingersoll-Rand DD-130** | 55.0 | 308 | 50.5 | 283 | Y |
| Ingersoll-Rand ST 105** | 55.2 | 309 | 39.1 | 219 | N |

* Operating weight includes lubricants, coolant, 79 kg/175lb operator, full fuel tank, full hydraulic system, and half-full water tank, without canopy.

** With full water ballast.

2.4.1.2.2 Roadway Density: It is generally assumed that good design and construction practices will be followed and design compaction will be achieved on the roadway (Von Quintus, et al., 1991). Permanent deformation caused by traffic densification of relatively high air void mixtures is usually not considered during mixture design. However, it has been documented that the typical design compaction of 3%-5% air voids (VTM) or 95%-97% $G_{mm}$ is not generally achieved on the roadway immediately following construction. The roadway density data obtained in this study confirms this observation. Roadway cores were obtained in general accordance with ASTM 5361-95. The cores were transported to the Civil Engineering Materials Laboratory at the University of Tennessee for further testing and evaluation. The results of the laboratory testing of the roadway pavement cores are provided in Appendix B in Tables B.1 through B.9. The mean % $G_{mm}$ observed on the roadway for all test sections included in this

study was about 91% (9% VTM). As previously noted, the target % $G_{mm}$ for design purposes is about 96% (4% VTM) for both the Marshall and Superpave methods. The target for the PTI vibratory compactor is about 93% (7% VTM). Table 10 provides a summary of the % $G_{mm}$ targeted for design purposes versus the average % $G_{mm}$ from the roadway cores (determined by the SSD method). Based on these results, it is apparent that density on the roadway in Tennessee, immediately after construction, is well below that which is targeted in design. This applies to both the Marshall and Superpave design methods. The observed roadway density is much closer to that achieved in the laboratory with the PTI vibratory compactor.

2.4.1.2.3 Temperature/Density Observations: As part of this study, temperatures were obtained at various locations on the pavement mat as the HMA was compacted. Nuclear density data was obtained after compaction of the mat was complete. Tables B.10 through B.29 of Appendix B provide summaries of the surface temperature and density values from the roadway. Based on this data, there was a significant variation in temperature from one side of the test section to the other. There was also a significant variation from the beginning of the test section to the end.

**Table 10. Summary of Design %$G_{mm}$ versus Roadway Core %$G_{mm}$**

| Design %$G_{mm}$ Marshall Compactor | Design %$G_{mm}$ SGC | Design %$G_{mm}$ PTI Vibratory Compactor | Average %$G_{mm}$ Observed From Roadway Cores |
|---|---|---|---|
| 96% (4% VTM) | 96% (4% VTM) | 93% (7% VTM) | 91% (9% VTM) |

This variation is suspected to be mostly the result of time delay in temperature readings as well as the effects of water from the respective rollers. Another variable that may have caused inconsistencies is the environmental conditions such as ambient temperature, wind, and rain. It is recognized that the temperature readings were taken with a infrared thermometer and therefore was only a surface reading.

The average temperature of the pavement behind the breakdown roller and the corresponding average nuclear density (in terms of % $G_{mm}$) are summarized for each test section in Table 11. At best, this data is inconclusive, but does demonstrate the extreme variability observed in construction operations and mix placement.

**Table 11. Average Temperature and Nuclear Density Test Results**

| Test Section | Date | Average Temperature Behind Breakdown Roller, °F (Station 0+00) | Average Nuclear Density, %$G_{mm}$ (Station 0+00) |
|---|---|---|---|
| Union County 411S | 09/16/97 | 247 | 94.0 |
| Knox County 411D | 10/16/97 | 204 | 88.4 |
| Marion County 411D | 10/14/97 | 228 | 95.6 |
| Maury County 411S | 09/23/97 | 207 | 90.8 |
| Lincoln County 411S | 09/15/97 | 291 | 86.6 |
| Madison County 411S | 08/12/97 | 271 | 92.5 |
| Lauderdale County 411S | 10/15/97 | 188 | 92.9 |

### 2.4.2 Theoretical Maximum Specific Gravity Test Results

As noted, the theoretical maximum specific gravity was determined for each mix in accordance with ASTM D 2041-95. Three different samples were tested for each mix and an average of the three was used in comparing the respective compaction methods to the results observed on the roadway. The theoretical maximum specific gravity test results are presented in Appendix B in Tables B.36 through B.44. The average values used in comparing the respective compaction methods are summarized in Table 12.

### 2.4.3 Asphalt Content Test Results

The asphalt content of each mix was determined with the NCAT Ignition Oven in accordance with AASHTO TP53. The correction factors provided by others were then used in calculating the asphalt content for the respective mixes. The NCAT Ignition Oven test results are also provided in the Appendix B in Tables B.36 through B.44. As shown in Table 13, there were some great variations in the design and actual asphalt contents. This may be caused in part by the variations in the types of asphalt plants used to produce HMA.

### 2.4.4 Laboratory Compaction Test Results

Laboratory test specimens were compacted with the rotating base Marshall compactor, the SGC, and the PTI vibratory compactor. The volumetric properties of the compacted specimens obtained from these three laboratory methods were then compared with properties obtained from the roadway. Tables 14 and 15 provide a summary of the $\%G_{mm}$ determined by both the SSD method and the parafilm method. As can be seen in

**Table 12. Theoretical Maximum Specific Gravity Test Results**

| Test Section | Theoretical Maximum Specific Gravity, $G_{mm}$ |
|---|---|
| Union County 411S | 2.480 |
| Knox County 411D | 2.414 |
| Marion County 411D | 2.269 |
| Lincoln County 411S | 2.486 |
| Maury County 411S | 2.392 |
| Madison County 411S | 2.314 |
| Madison County 307S | 2.520 |
| Lauderdale County 411S | 2.303 |
| Lauderdale County 307S | 2.402 |

**Table 13. Summary of Asphalt Content Test Results**

| Test Section | Asphalt Content (%) | |
|---|---|---|
| | Design | Actual |
| Union County 411S | 5.9 | 6.3 |
| Knox County 411D | 6.5 | 6.5 |
| Marion County 411D | 6.9 | 7.7 |
| Lincoln County 411S* | 5.3 | 4.6 |
| Maury County 411S | 5.9 | 6.6 |
| Madison County 411S | 6.6 | 7.8 |
| Madison County 307S | 4.5 | 4.1 |
| Lauderdale County 411S | 6.1 | 6.5 |
| Lauderdale County 307S | 5.6 | 3.9 |

*Correction Factor Estimated as 0.35

Tables 14 and 15, the PTI vibratory compactor consistently produces laboratory specimens with densities closest to those obtained on the roadway immediately after construction.

### 2.4.5 Statistical Analysis of Compaction Test Results

A statistical analysis of the average % $G_{mm}$ (SSD bulk specific gravity) for the laboratory compacted specimens and the cores obtained from the roadway was performed. The mean values and standard deviations are summarized in Table 16. The results of hypothesis testing, comparing the mean % $G_{mm}$ from each method of laboratory compaction with the mean % $G_{mm}$ for the roadway cores taken from each test section, are summarized in Table 17.

Test statistics and p-values were calculated using the SAS statistical software package. The output from SAS is contained in Appendix C. The p-value is a measure of how well a given sample agrees with an assumed null hypothesis ($H_o$). A small p-value (close to zero) indicates that the sample is not consistent with the null hypothesis. In this case, the null hypothesis would be rejected. On the other hand, a p-value larger than about 0.05 generally indicates a reasonable amount of agreement with the null hypothesis.

**Table 14. Summary of Average %$G_{mm}$ for Laboratory Compacted Specimens (SSD) Versus Roadway Cores and Nuclear Density Test Data**

| Test Section | Laboratory (SSD) | | | Roadway | |
|---|---|---|---|---|---|
| | Average %$G_{mm}$ Marshall | Average %$G_{mm}$ Gyratory ($N_{des}$) | Average %$G_{mm}$ Vibratory | Average %$G_{mm}$ Nuclear | Average %$G_{mm}$ Cores |
| Union County 411S | 98.3 | 98.2 | 94.8 | 94.0 | 92.7 |
| Knox County 411D | 95.4 | 94.7 | 91.6 | 88.4 | 89.5 |
| Marion County 411D | 99.0 | 99.9 | 94.5 | 95.6 | 94.4 |
| Maury County 411S | 97.3 | 96.0 | 90.7 | 90.8 | 90.7 |
| Lincoln County 411S | 94.1 | 93.1 | 90.6 | 86.6 | 88.3 |
| Madison County 411S | 97.3 | 96.9 | 93.7 | 92.5 | 91.9 |
| Madison County 307S | 96.6 | 96.7 | 92.2 | 93.5 | 91.8 |
| Lauderdale Co. 411S | 96.3 | 96.9 | 94.1 | 92.9 | 93.3 |
| Lauderdale Co. 307S | 95.8 | 94.2 | 90.2 | 89.2 | 90.7 |

**Table 15. Summary of Average %$G_{mm}$ for Laboratory Compacted Specimens (Parafilm) Versus Roadway Cores and Nuclear Density Test Data**

| Test Section | Laboratory (Parafilm) | | | Roadway | |
|---|---|---|---|---|---|
| | Average %$G_{mm}$ Marshall | Average %$G_{mm}$ Gyratory ($N_{des}$) | Average %$G_{mm}$ Vibratory | Average %$G_{mm}$ Nuclear | Average %$G_{mm}$ Cores |
| Union County 411S | 96.3 | 97.3 | 92.4 | 94.0 | 92.7 |
| Knox County 411D | 93.6 | 93.6 | 89.4 | 88.4 | 89.5 |
| Marion County 411D | 97.1 | 99.4 | 92.7 | 95.6 | 94.4 |
| Maury County 411S | 95.2 | 92.7 | 90.8 | 90.8 | 90.7 |
| Lincoln County 411S | 91.5 | 91.0 | 86.8 | 86.6 | 88.3 |
| Madison County 411S | 95.8 | 95.7 | 91.9 | 92.5 | 91.9 |
| Madison County 307S | 94.6 | 94.6 | 88.8 | 93.5 | 91.8 |
| Lauderdale Co. 411S | 94.4 | 95.7 | 92.0 | 92.9 | 93.3 |
| Lauderdale Co. 307S | 93.5 | 92.2 | 86.9 | 89.2 | 90.7 |

**Table 16. Summary of Simple Statistics**

| Specimen | Mean | Standard Deviation |
|---|---|---|
| Marshall Hammer | 96.7 | 1.5 |
| Gyratory Compactor | 96.3 | 2.1 |
| Vibratory Compactor | 92.5 | 1.8 |
| Field Cores | 90.9 | 2.5 |

**Table 17. Summary of Hypothesis Testing**

| Statistical Procedure | Tested Hypothesis, $H_o$ | $\alpha$ / Critical Value | p-value / Test Value |
|---|---|---|---|
| Analysis of Variance | $\mu_{Marshall} = \mu_{Gyratory} = \mu_{Vibratory} = \mu_{core}$ | 0.05 | 0.0001 |
| General Linear Model | $\mu_{Marshall} = \mu_{Gyratory} = \mu_{Vibratory} = \mu_{core}$ | 0.05 | 0.0001 |
| Levene's Test | $\sigma^2_{Marshall} = \sigma^2_{Gyratory} = \sigma^2_{Vibratory} = \sigma^2_{core}$ | 0.05 | 0.3297 |
| Dunnett's Procedure | $\mu_{Marshall} = \mu_{core}$ | 2.339 | 5.8000 |
| | $\mu_{Gyratory} = \mu_{core}$ | | 5.4189 |
| | $\mu_{Vibratory} = \mu_{core}$ | | 1.6211 |

In performing a statistical analysis of the compaction test data, it was first necessary to evaluate the means of each data set included in the model. The null hypothesis for this analysis stated that the mean % $G_{mm}$ for each of the compaction methods are equal ($H_o$: $\mu_{Marshall} = \mu_{Gyratory} = \mu_{Vibratory} = \mu_{cores}$). As shown in Table 17, the p-value (0.0001) produced in the Analysis Of Variance (ANOVA) rejected the null hypothesis. Based on this analysis, it is demonstrated that the mean % $G_{mm}$ values for the different compaction methods are not equal. A General Linear Model was also employed to confirm the results of the ANOVA procedure. As presented in Table 17, a p-value of 0.0001 for the General Linear Model confirmed the ANOVA output.

In order to have a correct model it is also necessary to have populations with statistically negligible differences in variances (equal variances). Levene's test for homoscedasticity was used to evaluate the variances of means of each compaction method considered in this model. As shown in Table 17, the alpha considered was 0.05 and the resulting p-value was determined to be 0.3297. Therefore, it can be concluded with a 95% confidence level of that the variances are statistically equal.

Finally, a Dunnett's test was used to compare the % $G_{mm}$ values produced by each method of laboratory compaction with the % $G_{mm}$ values obtained from the roadway cores (control group). The difference between the means of each of the laboratory compaction methods was compared with the means produced by roadway compaction. The minimum difference to be considered equal for a 95% level of confidence (alpha of 0.05) was 2.339. As noted in Table 17, the mean % $G_{mm}$ for the Marshall and SGC specimens were found to differ from the mean % $G_{mm}$ for the roadway cores by 5.8 and 5.4, respectively. However the difference between the mean % $G_{mm}$ produced by the PTI vibratory compactor and the mean % $G_{mm}$ for the roadway cores was 1.6. This difference, being less than the minimum significant difference, demonstrates that the means are considered statistically equal. Therefore, it can be said with a 95% level of confidence that the vibratory compactor produces samples with an average % $G_{mm}$ equal to that obtained on the roadway, immediately after construction.

### 2.4.6 Statistical Analysis of Nuclear Density and Core Density

As a side issue, the density obtained on the roadway by the nuclear density gauge was compared to that obtained by the roadway cores. A regression analysis was

performed and the results are provided in Appendix C. With the omission of three outlying data points, a coefficient of determination value ($r^2$) of 0.69 was obtained. Therefore implying that there is a relatively strong relationship between the nuclear density data and the density of the roadway cores. This is expected because the nuclear gauge is calibrated with the roadway cores during the construction of the test strip.

### 2.4.7 Comparison of Volumetric Properties

All volumetric properties summarized in this discussion were calculated based on the SSD bulk specific gravity of the compacted mix. Calculations based on the SSD and parafilm methods are provided in Appendix B in Tables B.45 through B.71. It should be noted that the parafilm method typically results in a % $G_{mm}$ of approximately 2% less than that determined by the SSD method (approximately 2% increase in %VTM)

The minimum %VMA requirements for the mixes included in this study range between 13 and 14%. A range of 65-75% VFA is typical for these mix designs. Tables 18 through 20 provide a summary of volumetric calculations performed on each mix and compaction method. As previously noted, this data demonstrates that the %VTM calculated from the roadway cores is consistently closest to the design compaction obtained with the PTI vibratory compactor. Although all specimens meet the minimum criteria for %VMA, the PTI vibratory compactor also produces specimens relatively closest to the %VMA calculated from the roadway cores. The vibratory compacted specimens are also relatively closest to the %VFA calculated from the roadway cores.

**Table 18. Summary of Volumetric Calculations (%VTM)**

| TDOT Region | County | TDOT Mix Type | %VTM | | | |
|---|---|---|---|---|---|---|
| | | | Marshall Samples | Gyratory $N_{design}$ | Vibratory Samples | Roadway Cores |
| I | Union | 411S | 1.7 | 1.8 | 5.2 | 7.4 |
| I | Knox | 411D | 4.6 | 5.3 | 8.4 | 10.5 |
| II | Marion | 411D | 1.0 | 0.1 | 5.5 | 5.6 |
| III | Maury | 411S | 2.7 | 4.0 | 5.2 | 9.4 |
| III | Lincoln | 411S | 5.9 | 6.9 | 9.3 | 11.7 |
| IV | Madison | 411S | 2.7 | 3.1 | 6.3 | 8.1 |
| IV | Madison | 307D | 3.4 | 3.3 | 7.8 | 8.2 |
| IV | Lauderdale | 411S | 3.7 | 3.1 | 5.9 | 6.9 |
| IV | Lauderdale | 307D | 4.2 | 5.8 | 9.8 | 9.3 |
| Average | | | 3.3 | 3.7 | 7.1 | 8.6 |

**Table 19. Summary of Volumetric Calculations (%VMA)**

| TDOT Region | County | TDOT Mix Type | %VMA | | | |
|---|---|---|---|---|---|---|
| | | | Marshall Samples | Gyratory $N_{design}$ | Vibratory Samples | Roadway Cores |
| I | Union | 411S | 16.7 | 16.0 | 19.7 | 21.6 |
| I | Knox | 411D | 19.1 | 18.9 | 22.3 | 24.1 |
| II | Marion | 411D | 17.8 | 16.8 | 21.5 | 20.5 |
| III | Maury* | 411S | 17.7 | 18.7 | 23.2 | 23.3 |
| III | Lincoln* | 411S | 16.5 | 17.3 | 19.5 | 21.6 |
| IV | Madison | 411S | 19.7 | 18.9 | 22.8 | 24.2 |
| IV | Madison | 411D | 13.0 | 11.2 | 17.0 | 17.3 |
| IV | Lauderdale | 411S | 22.8 | 21.2 | 24.5 | 25.3 |
| IV | Lauderdale | 411D | 12.9 | 12.9 | 18.0 | 17.5 |
| Average | | | 17.4 | 16.9 | 20.9 | 21.7 |

**Table 20. Summary of Volumetric Calculations (%VFA)**

| TDOT Region | County | TDOT Mix Type | %VFA | | | |
|---|---|---|---|---|---|---|
| | | | Marshall Samples | Gyratory Samples | Vibratory Samples | Roadway Cores |
| I | Union | 411S | 90.0 | 88.7 | 73.5 | 65.7 |
| I | Knox | 411D | 76.0 | 72.0 | 62.3 | 56.4 |
| II | Marion | 411D | 94.3 | 99.4 | 74.5 | 72.5 |
| III | Maury | 411S | 84.5 | 78.7 | 77.5 | 59.8 |
| III | Lincoln | 411S | 63.9 | 60.1 | 52.0 | 45.7 |
| IV | Madison | 411S | 86.5 | 83.6 | 72.1 | 66.5 |
| IV | Madison | 411D | 73.9 | 70.5 | 54.0 | 52.6 |
| IV | Lauderdale | 411S | 83.7 | 85.4 | 75.8 | 72.8 |
| IV | Lauderdale | 411D | 67.4 | 55.2 | 45.7 | 47.0 |
| Average | | | 80.0 | 77.1 | 65.3 | 59.9 |

### 2.4.8 Comparison of Saw-Cut Specimens

Tables B.75 through B.103 in Appendix B provide summaries of the volumetric evaluation of segments cut from the Marshall Pills, gyratory Pills, and vibratory beams. Ranges of approximately 2.5, 2.2, and 4.1 % $G_{mm}$ were found from top to bottom or from one side to another of the Marshall Pills, gyratory Pills, and vibratory beams respectively. These variations are summarized in Table 21. Ranges appear to be greater in the vibratory beams than in the other specimens. It should be noted that the Marshall and gyratory pills compacted from the Madison County 307S mix were eliminated from the averages due to suspected damage to the samples during testing.

The uniformity of the distribution of the aggregate within the compacted vibratory specimens was also visually inspected. Based on this visual inspection, it was discovered

**Table 21. Summary of Ranges in $\%G_{mm}$ for Saw-Cut Specimens**

| Project | Marshall Segments | Gyratory Segments | Vibratory Segments |
|---|---|---|---|
| Union County 411S | 1.1 | 1.1 | 3.5 |
| Knox County 411D | 3.6 | 3.3 | 6.8 |
| Marion County 411D | 1.4 | 0.5 | 2.4 |
| Maury County 411S | 7.3 | 2.2 | 4.8 |
| Lincoln County 411S | 1.5 | 2.7 | 3.9 |
| Madison County 411S | 2.8 | 2.9 | 2.9 |
| Madison County 307S* | 0.6 | 2.5 | 2.7 |
| Lauderdale County 411S | 2.1 | 2.4 | 3.5 |
| Lauderdale County 307S | 4.8 | 3.7 | 6.0 |
| Average | 2.8 | 2.4 | 4.1 |

*Outlying values were omitted from the lab data.

that the larger aggregates tend to migrate toward the edges of the specimen during compaction. This tendency was observed to be exaggerated when working with coarse and gap-graded mixes. The more fine-graded mixes exhibit a more uniform distribution of aggregate throughout the specimen. Figures 9 and 10 exhibit the aggregate distributions in Superpave surface and binder mixes respectively. The Superpave mixes tend to be more coarse and gap-graded and exhibit more segregation (less uniformity). This indicates that extreme care is warranted during the placement of the mix into the mold when working with these types of mixes. This observation appears to explain the increased range in % $G_{mm}$ noted above for the vibratory specimens versus the Marshall and SGC specimens.

Aggregate orientation within laboratory specimens must also be representative of compacted mix found at the roadway in order to evaluate performance in the APA. Upon inspection of each saw-cut specimen, it was observed that the aggregate orientation of the Marshall compacted specimens is unlike that observed from actual roadway compaction.

As a result of the combination of kneading and vibratory action produced by roadway compaction equipment, relatively flat or elongated particles tend to lay horizontal. Due to the vertical impact of the Marshall compactor, Marshall specimens do not posses this characteristic. However, it was observed that both the gyratory and vibratory compactors force the relatively flat or elongated particle to lay horizontal as observed on the roadway.




**Figure 9. Vibratory Beam Saw-Cut Specimens**

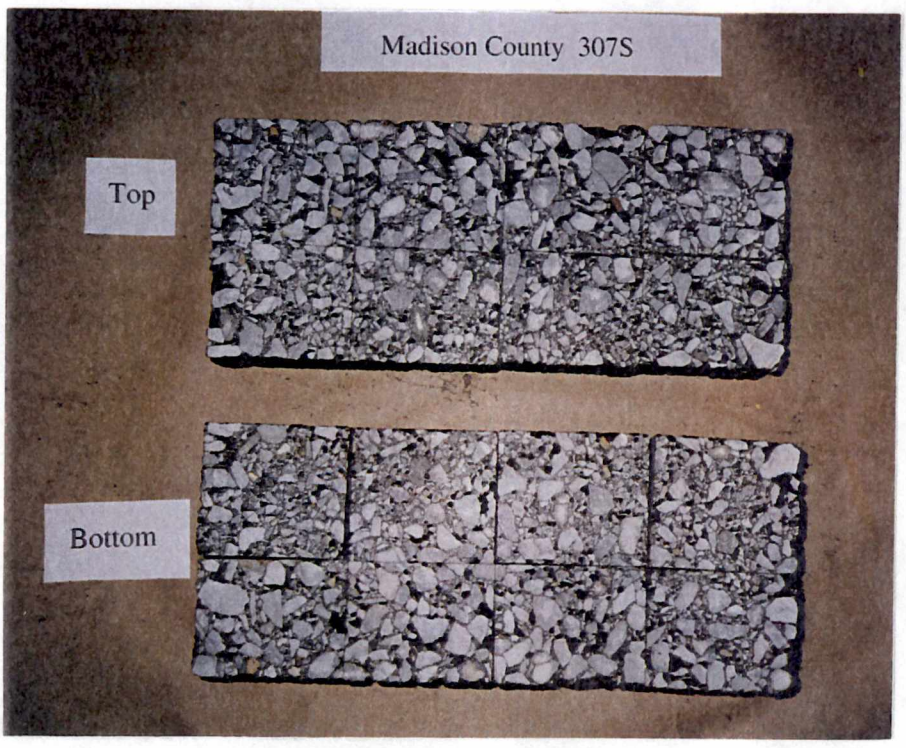



**Figure 10. Vibratory Beam Saw-Cut Specimens**

## 3.0 Conclusions

As mix design evolves from conventional Marshall design to Superpave and beyond, it is necessary to develop test methods to evaluate the performance of HMA. One such method being developed is the PTI, Inc. APA. However, if the APA is to be used for performance testing, it is imperative that the specimens to be tested in this device are representative of the HMA to be compacted on the roadway. In light of this observation, three laboratory compaction methods employed in the design of HMA were evaluated in this study. The compaction methods evaluated include the rotating base Marshall compactor, the Superpave Gyratory Compactor (SGC), and the PTI vibratory compactor. Volumetric properties of compacted specimens obtained from these three laboratory methods were compared with properties obtained from the roadway.

The results of this study demonstrate that the Marshall compactor and the Superpave gyratory compactor do not produce samples with densities comparable to those currently achieved on the roadway at the time of construction. On the other hand, it was demonstrated that the % $G_{mm}$ obtained from roadway cores in Tennessee is statistically equivalent to the compaction obtained with the PTI vibratory compactor. In summary, the PTI Model AVC III vibratory compactor yields laboratory samples with similar volumetric properties to observed roadway conditions, immediately after compaction.

Volumetric properties were observed to be relatively uniform throughout the vibratory compacted specimens. However, the vibratory specimens do exhibit greater variability throughout a given specimen than was observed in the Marshall or Gyratory compacted specimens. Segregation does appear to be a potential problem with the

vibratory compaction method. This is especially true when working with coarse and gap-graded mixes. It should be noted that this observed segregation could most likely be minimized by careful placement of the mix in the mold prior to compaction. It is recommended that further testing be conducted to identify the extent of this potential problem.

Finally, it was observed during the course of this study that the PTI vibratory compactor might be a valuable tool for the evaluation of the relative compactibility of HMA. As documented by Haddock and Walker, many of the new Superpave mixtures are experiencing difficulty in achieving compaction on the roadway. It is very possible that mixes that exhibit difficulty achieving a minimum level of compaction in the laboratory with the PTI vibratory compactor will also be difficult to compact on the roadway with conventional compaction equipment. It is premature to draw definitive conclusions regarding this possibility, however further research is warranted. During the early stages of implementation of the Superpave mix design system, it would be extremely beneficial to possess a laboratory tool capable of detecting mixtures that are prone to compactablity problems.

# 4.0 Recommendations

The results of this study suggest that the PTI Model AVC III vibratory compactor can be a valuable tool in preparing laboratory specimens for performance testing of HMA. The beam specimens obtained from this compactor are ideal for use with the PTI APA. Based on the results of this study, it is recommended that additional TDOT mixes be compacted with the vibratory compactor in order to expand the limited database developed herein. Future mixes should be tested in the APA to begin the long-term process of developing a correlation between laboratory APA results and actual pavement performance on the roadway. It is also recommended that the test sections identified in this study be monitored for long-term mix performance. Pavement cores should be obtained periodically from these test sections to further evaluate the difference in compaction immediately following construction and continued compaction due to traffic. Finally, it is recommended that an investigation be initiated to evaluate the potential for the PTI Model AVC III vibratory compactor to be used as a laboratory tool to evaluate the compactibility of mixes on the roadway. Such a test would be extremely valuable during the implementation of Superpave mix design.

# References

# References

"AASHTO T-248-83 Standard Methods for Reducing Field Samples of Aggregate to Testing Size", *Standard Specifications for Transportation Materials and Methods of Sampling and Testing, Part II,* American Association of State Highway and Transportation Officials, Washington, D.C., 1986.

"AASHTO TP4 Provisional Standard Method for Preparation of Compacted Specimens of Modified and Unmodified Hot Mix Asphalt by Means of the SHRP Gyratory Compactor", American Association of State Highway and Transportation Officials, Washington, D.C., 1993.

"AASHTO TP-53-95 Provisional Standard Test Method for Determining the Asphalt Content of Hot Mix Asphalt (HMA) by the Ignition Method", American Association of State Highway and Transportation Officials, Washington, D.C., June 1996.

"ASTM D 979-95 Standard Practice for Sampling Bituminous Paving Mixtures", *Annual Book of ASTM Standards*, Volume 4.03, American Standard for Testing Materials, Philadelphia, PA, 1997.

"ASTM D 1188-96 Standard Test Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using the Paraffin-Coated Specimens", *Annual Book of ASTM Standards*, Volume 4.03, American Standard for Testing Materials, Philadelphia, PA, 1997.

"ASTM D 1559-89 Standard Test Method for Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus", *Annual Book of ASTM Standards*, Volume 4.03, American Standard for Testing Materials, Philadelphia, PA, 1997.

"ASTM D 2041-95 Standard Test Method for Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures", *Annual Book of ASTM Standards*, Volume 4.03, American Standard for Testing Materials, Philadelphia, PA, 1997.

"ASTM D 2726-96 Standard Test Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Saturated Surface-Dry Specimens", *Annual Book of ASTM Standards*, Volume 4.03, American Standard for Testing Materials, Philadelphia, PA, 1997.

"ASTM D 5361-95 Standard Practice for Sampling Compacted Bituminous Mixtures for Laboratory Testing", *Annual Book of ASTM Standards*, Volume 4.03, American Standard for Testing Materials, Philadelphia, PA, 1997.

Stroup-Gardiner, M., Newcomb, D. E., Olson, R., and Teig, J., *Traffic Densification of Asphalt Concrete Pavements*, Transportation Research Record 1575, Transportation Research Board, National Research Council, Washington D.C., 1997.

Haddock, J.E., and Walker, R.P., *Construction of Superpave Hot Mix Asphalt Pavements In Indiana*, Transportation Research Record 980817, Transportation Research Board, National Research Council, Washington, D.C., 1998.

McGennis, R. B., Anderson, R. M., Kennedy, T. W., and Solaimanian, M., *Background Of Superpave Asphalt Mixture and Design and Analysis*, FHWA-SA-95-003, Federal Highway Administration, Washington, D.C., 1995.

Mix Design Methods for Asphalt Concrete and Other Hot Mix Types. The Asphalt Institute, MS-2, May 1984.

Monismith, C. L., and Hicks, R. G., *Accelerated Performance-Related Tests for Asphalt-Aggregate Mixes and Their Use in Mix Design and Analysis Systems*, Report SHRP-A-417, National Research Council, Washington, D.C., 1994.

Musselman, J.A., Choubane, B., Page, G.C., and Upshaw, P.B., *Superpave Implementation: Florida's Early Experience*, Transportation Research Record, Transportation Research Board, National Research Council, Washington D.C., 1998.

Roberts, F. L., Kandhal, P. S., Brown, E. R., Lee, Y., and Kennedy T. W., *Hot Mix Asphalt Materials, Mixture Design, and Construction*, NAPA Education Foundation, Lanham, MD, 1996.

Von Quintus, H.L., Scherocman, C. S., Hughes, C. S., and Kennedy, T. W., *Asphalt-Aggregate Mixture Analysis System* – AAMAS, Report 338, National Cooperative Highway Research Program, Washington, D.C., 1991.

# Appendices

# Appendix A

## Test Section Information (Maps, Drawings, and Mix Designs)

| Project | Contract No. | Project No. |
|---|---|---|
| Union County | 4885 | 87001-4248-04 |
| Knox County | 4851 | 47027-4210-04 |
| Marion County | 5774 | 58100-8119-04 |
| Lincoln County | 4770 | 52002-4529-04 |
| Maury County | 4865 | 60017-4214-04 |
| Madison County | 4714 | 57010-4208-04 |
| Lauderdale County | 4853 | 49001-4267-04 |

**Union County**

**Contract No.: 4885 Project No.: 87001-4248-04**

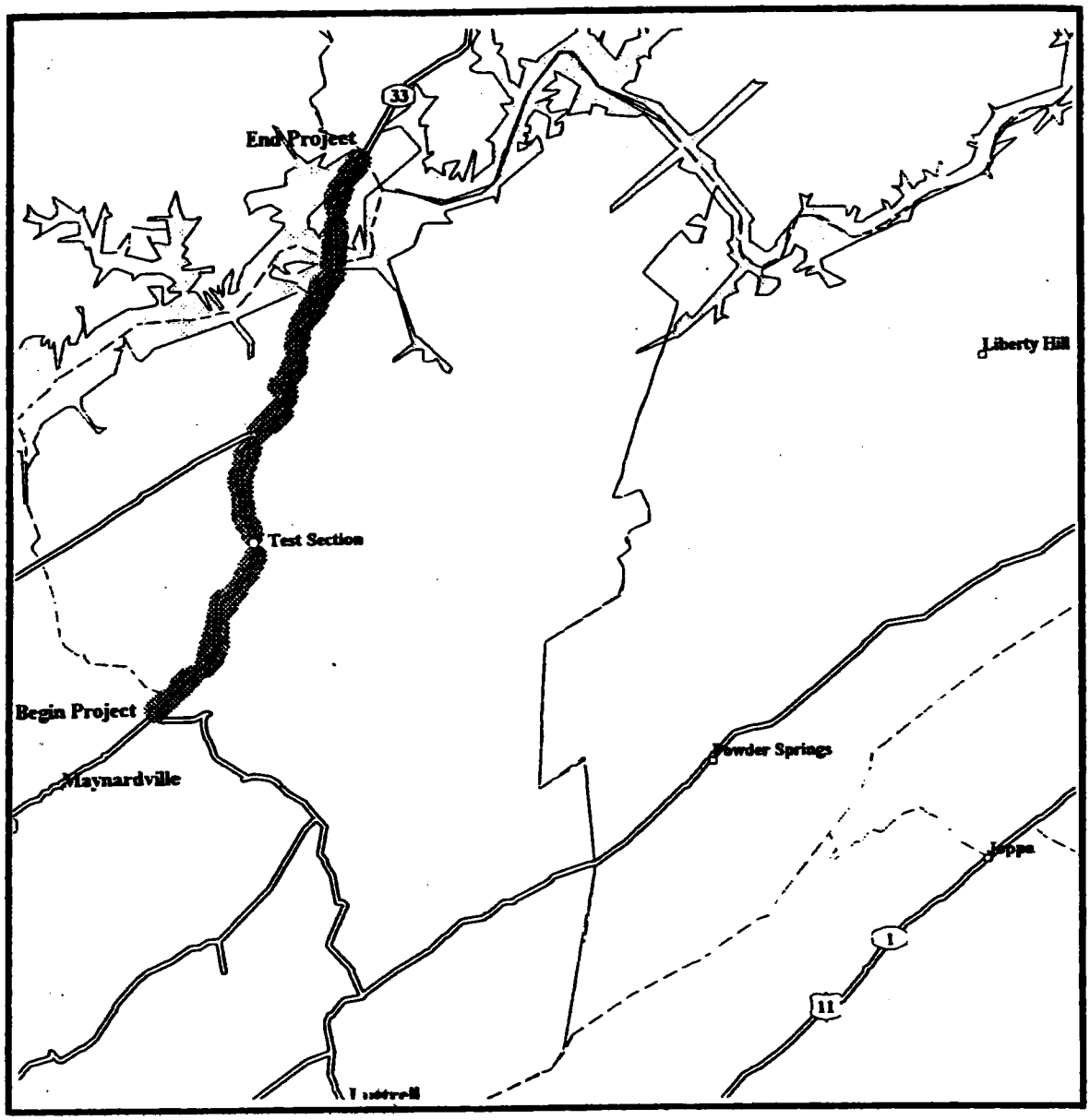
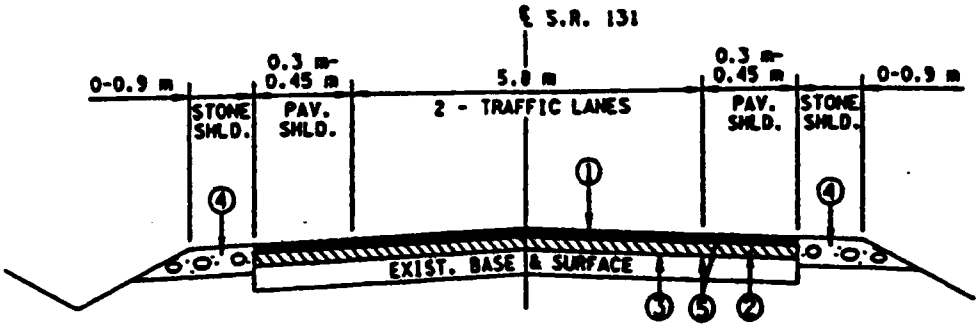



**Figure A.1 Site Vicinity Map**
**Union County**
**Contract No.: 4885**
**Project No.: 87001-4248-04**




**TYPICAL CROSS-SECTION OF IMPROVEMENT**

LOG MILE 25.04 TO LOG MILE 25.41
EXCLUSION LOG MILE 25.41 TO LOG MILE 25.63 (NO SURFACING REQ'D.)
LOG MILE 25.63 TO LOG MILE 29.44

| PROPOSED PAVEMENT SCHEDULE | |
|---|---|
| ① BITUM. SURFACE 30 mm TH. (APPROX. 68 kg/m²) | |
| 411M01.01 | MIN. AGG. FOR ASPHALTIC CONC. SURFACE (ACS) GRADING 'D' |
| 411M01.02 | ASP. CEMENT FOR ASP. CONC. SURFACE (ACS) GRADING 'D' |
| ② BITUM. PLANT MIX LEV. COURSE (APPROX. 27 kg/m²) | |
| 307M03.05 | MIN. AGG. FOR ASPHALTIC CONC. LEV. COURSE (HOT MIX) (BPMLC-HM) GRADING 'CS' |
| 307M03.06 | ASP. CEMENT FOR ASP. CONC. LEVELING COURSE (HOT MIX) (BPMLC-HM) GRADING 'CS' |
| ③ BITUMINOUS BINDER (SPOT LEVELING)(APPROX. 30 TONNE/km) | |
| 307M03.16 | (BPMB-HM) GRADING 'B-M2' |
| ④ MINERAL AGGREGATE BASE - (SHOULDERS) 50 mm THICK | |
| 303M01 | MINERAL AGG., TYPE 'A' BASE, GRADING 'D' |
| ⑤ TACK COAT @ 0.09 L/m² | |
| 403M01 | BITUMINOUS MATERIAL FOR TACK COAT (TC) |

**Figure A.2 Pavement Cross Section**
**Union County**
**Contract No.: 4885**
**Project No.: 87001-4248-04**

# Union County Mix Design

FORM DT-9256

RE: FORM T-118

# STATE OF TENNESSEE
# JOB MIX FORMULA

AUG 0 8 1997

Steve Borden

Date: JULY 30 ,1997

Project Ref. No. SP | County UNION / CLAIBORNE | Region 1

Proj. No. 87001-4248-04 | Contract No. 4885

Type 411-S | Sec. No. 411-0.5 | Addle

Contractor TN ASPHALT COMP. | Subcontractor:

State Rt. | TOTAL MIX INCLUDING BITUMEN | Date of Letting 6-13-97

| MATERIAL | Screen % Passing | PRODUCER AND ADDRESS | % USED |
|---|---|---|---|
| C.A. | | | 0.00 |
| Med. C.A. | TN. #7 | VULCAN MTLS. ENKA N.C. | 56.46 |
| Screenings | #10 | VULCAN MTLS. TAZEWELL TN. | 23.53 |
| Sand | NAT | NOLICHUCKY SAND CO . GREENVILLE TN. | 14.12 |
| Min.Filler | | | 0.00 |
| RAP | | | 0.00 |
| Asphalt Cement | PG 64-22 | SHELL OIL CO. KNOXVILLE TN. | 5.90 |
| Anti-Strip | TYPE: PAVEBOND LITE | DOSAGE RATE: 0.05 % | |
| Fine Agg. Angularity | 46.9 | | |
| %Fractured Faces on+4.75 Matl. | 98 | % Glassy Particles on + 4.75 Matl. N/A | 100 % |

## 100 PERCENT MINERAL AGGREGATE

| SCREEN | Tol. Passing Design Range | Requested Percent | |
|---|---|---|---|
| Temp | | 154.4C/310F | |
| % A.C. | | 5.9 | |
| | Compaction Temp: | 146.1 | |
| | Mixing Temp: | 154.4 | |
| | min-max | | |
| 50mm (2") | | 100.0 | |
| 37.5mm (1 1/2") | | 100.0 | |
| 25mm (1") | | 100.0 | |
| 19mm (3/4") | 100 | 100.0 | |
| 16mm (5/8") | | 100.0 | |
| 12.5mm (1/2") | 90-100 | 95.9 | |
| 9.5mm (3/8") | 90 | 83.4 | |
| 4.75mm (#4) | | 50.8 | |
| 2.36mm (#8) | 28-58 | 33.2 | |
| 1.18mm (#16) | | 23.7 | |
| 600um (#30) | | 12.6 | |
| 300um (#50) | | 6.9 | |
| 150um (#100) | | 4.9 | |
| 75um (#200) | 2-10 | 4.0 | |

## AGGREGATE ANALYSIS TOTAL PERCENT PASSING

| C.A. Percent | Med. C.A. Percent | Screenings Percent | Sand Percent | Min. Filler Percent | RAP Percent | Calculated Mix |
|---|---|---|---|---|---|---|
| | 60 | 25.0 | 15.0 | | | 100.0 |
| | Washed Gradations | | | | | |
| | L.O.I.: 9.7 % | | | | | |
| | Theo.: 2.472 | | | 2472 | kg/m3 | |
| | T.S.R.: 85.7 % | | | | | |
| | 100.0 | 100 | 100 | | | 100.0 |
| | 100.0 | 100.0 | 100.0 | | | 100.0 |
| | 100.0 | 100.0 | 100.0 | | | 100.0 |
| | 100.0 | 100.0 | 100.0 | | | 100.0 |
| | 100.0 | 100.0 | 100.0 | | | 100.0 |
| | 93.1 | 100.0 | 100.0 | | | 95.9 |
| | 72.4 | 100.0 | 100.0 | | | 83.4 |
| | 25.1 | 83.0 | 99.7 | | | 50.8 |
| | 7.9 | 54.7 | 98.5 | | | 33.2 |
| | 4.0 | 34.7 | 84.3 | | | 23.7 |
| | 3.1 | 23.4 | 32.4 | | | 12.6 |
| | 2.7 | 17.2 | 6.6 | | | 6.9 |
| | 2.2 | 13.6 | 1.5 | | | 4.9 |
| | 1.7 | 11.6 | 0.7 | | | 4.0 |

SREIAL NO. M-1(97)341

DESIGN NO. DV-(97)252

Requested TENNESSEE ASPHALT CO. Deana Morris

Approved Jack E Hunt
Contractor
Region Construction Engineer

Approved
Region Materials Engineer

Approved 8-6-97
for Engineer of Materials and Tests

DATE: July 29,1997
TYPE OF MIX: 411-S
PROJ. #: SP-87001-4248-04
CONT. #: 4885
COUNTY: UNION / CLAIBORNE

## MARSHALL MIX DESIGN

CONTRACTOR: TN ASPHALT COMP.
SUBCONTRACTOR:
SP. GR. AC: 1.0310
EFF S.G. MIX: 2.710

| SAMPLE NO | % AC A | % AGG B | IN AIR C | SSD D | IN H2O E | BULK VOL. F | BULK SP.GR. G | THEO. GRAV. H | EFF S.G. I | % AIR VOIDS J | VMA K | VOIDS FILLED L | UNIT WT. M | STABILTY lbs F | FLOW (.025)mm G |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 5.90 | 94.10 | 1245.1 | 1246.6 | 726.7 | 519.9 | 2.395 | 2.472 | 2.710 | 3.1 | 16.8 | | 23.95 | 15.10 | 3.000 |
| 2 | 5.90 | 94.10 | 1243.6 | 1244.9 | 726.2 | 518.7 | 2.398 | 2.472 | 2.710 | 3.0 | 16.7 | | 23.98 | 14.20 | 2.875 |
| 3 | 5.90 | 94.10 | 1243.7 | 1245.1 | 726.6 | 518.5 | 2.399 | 2.472 | 2.710 | 3.0 | 16.7 | | 23.99 | 15.30 | 2.875 |
| | | | | | | AVG: | 2.397 | | | 3.0 | 16.8 | 81.9 | 23.97 | 14.87 | 2.917 |
| 4 | | 100.00 | | | | 0.0 | #DIV/0! | 2.710 | 2.710 | #DIV/0! | #DIV/0! | | #DIV/0! | | |
| 5 | | 100.00 | | | | 0.0 | #DIV/0! | 2.710 | 2.710 | #DIV/0! | #DIV/0! | | #DIV/0! | | |
| 6 | | 100.00 | | | | 0.0 | #DIV/0! | 2.710 | 2.710 | #DIV/0! | #DIV/0! | | #DIV/0! | | |
| | | | | | | AVG: | #DIV/0! | | | #DIV/0! | #DIV/0! | #DIV/0! | #DIV/0! | 0.00 | 0.000 |
| 7 | | 100.00 | | | | 0.0 | #DIV/0! | 2.710 | 2.710 | #DIV/0! | #DIV/0! | | #DIV/0! | | |
| 8 | | 100.00 | | | | 0.0 | #DIV/0! | 2.710 | 2.710 | #DIV/0! | #DIV/0! | | #DIV/0! | | |
| 9 | | 100.00 | | | | 0.0 | #DIV/0! | 2.710 | 2.710 | #DIV/0! | #DIV/0! | | #DIV/0! | | |
| | | | | | | AVG: | #DIV/0! | | | #DIV/0! | #DIV/0! | #DIV/0! | #DIV/0! | 0.00 | 0.000 |
| 10 | | 100.00 | | | | 0.0 | #DIV/0! | 2.710 | 2.710 | #DIV/0! | #DIV/0! | | #DIV/0! | | |
| 11 | | 100.00 | | | | 0.0 | #DIV/0! | 2.710 | 2.710 | #DIV/0! | #DIV/0! | | #DIV/0! | | |
| 12 | | 100.00 | | | | 0.0 | #DIV/0! | 2.710 | 2.710 | #DIV/0! | #DIV/0! | | #DIV/0! | | |
| | | | | | | AVG: | #DIV/0! | | | #DIV/0! | #DIV/0! | #DIV/0! | #DIV/0! | 0.00 | 0.000 |
| 13 | | 100.00 | | | | 0.0 | #DIV/0! | 2.710 | 2.710 | #DIV/0! | #DIV/0! | | #DIV/0! | | |
| 14 | | 100.00 | | | | 0.0 | #DIV/0! | 2.710 | 2.710 | #DIV/0! | #DIV/0! | | #DIV/0! | | |
| 15 | | 100.00 | | | | 0.0 | #DIV/0! | 2.710 | 2.710 | #DIV/0! | #DIV/0! | | #DIV/0! | | |
| | | | | | | AVG: | #DIV/0! | | | #DIV/0! | #DIV/0! | #DIV/0! | #DIV/0! | 0.00 | 0.000 |

| | | | | |
|---|---|---|---|---|
| AGG. LOSS ON IGNITION (LOI): | 9.7 % | THEORETICAL GRAVITY: | 2.472 | AMOUNT & TYPE ADDITIVE: | PAVEBOND LITE |
| RECOMMENDED A.C. CONTENT: | 5.9 % | DUST TO A.C. RATIO (DAR): | 0.70 % | GRMS. FOR 2.5" SPECIMEN: | 1255 |
| AGGREGATE ABSORPTION: | 0.7 % | AGG. BULK SP. GR.: | 2.66 | AGG. APPARENT SP. GR.: | 2.742 |
| | | | | TSR: | |

*EFF. GRAV. AGGS. (I) = $\frac{B}{\frac{100}{H} - \frac{A}{SG\ A.C.}}$

*THEO. GRAV. (H) = $\frac{100}{\frac{A}{SG\ A.C.} + \frac{B}{I}}$

## SUPERPAVE ASPHALT MIX DESIGN SUMMARY

BLEND NAME Blend 1 CONTRACT NO. 4885 DATE 8/21/97
TYPE OF MIX 411.5 12.5 mm COUNTY Union - Claiborne REGION 1
PROJECT NO. 87001-4248-04 LAYER Surface LOG-IN
PROJECT REFERENCE NO. SP CONTRACTOR Tennessee Asphalt Co

| SAMPLE | ASPHALT CONTENT | BULK GRAV. MEASURED | BULK GRAV. AT Ndes | THEO. GRAV. OF MIX | AIR VOIDS AT Ndes | VMA BULK GRAV. | VMA EFF. GRAV. | VFA BULK GRAV. | VFA EFF. GRAV. | % TMD AT Ni | % TMD AT Nmax | EFF AC CONTENT | DUST PROPORTION | PROJ. OPTIMUM |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 5.5 | 2.379 | 2.353 | 2.487 | 5.4 | 16.4 | 17.9 | 67.3 | 70.1 | 87.3 | 95.6 | 4.8 | 0.8 | 6.0 |
| | 6.0 | 2.405 | 2.375 | 2.469 | 3.8 | 16.1 | 17.6 | 76.3 | 78.4 | 87.6 | 97.4 | 5.3 | 0.8 | 5.9 |
| | 6.5 | 2.408 | 2.380 | 2.451 | 2.9 | 16.3 | 17.9 | 82.3 | 83.8 | 88.6 | 98.3 | 5.8 | 0.7 | 6.1 |
| | | | | | | | | | | | | | | |
| OPT. | 5.9 | 2.401 | 2.373 | 2.472 | 4.0 | 16.0 | 17.6 | 75.2 | 77.4 | 87.5 | 97.1 | 5.2 | 0.8 | 5.9 |

| MTLS. | TOTAL % PASSING 1 | 2 | 3 | 4 | 5 | JMF |
|---|---|---|---|---|---|---|
| % | 60 | 25 | 15 | | | |
| 1.5" (37.5mm) | | | | | | |
| 1" (25.0mm) | | | | | | |
| 3/4" (19.0mm) | 100 | | | | | 100 |
| 1/2" (12.5mm) | 93.1 | | | | | 95.9 |
| 3/8" (9.5mm) | 72.6 | 100 | 100 | | | 83.4 |
| #4 (4.75mm) | 25.1 | 83 | 99.7 | | | 50.8 |
| #8 (2.36mm) | 7.9 | 54.7 | 98.5 | | | 33.2 |
| #16 (1.18mm) | 4.0 | 34.7 | 84.3 | | | 23.7 |
| #30 (600mm) | 3.1 | 23.4 | 32.4 | | | 12.6 |
| #50 (300mm) | 2.7 | 17.2 | 6.6 | | | 4.9 |
| #100 (150mm) | 2.2 | 13.6 | 1.5 | | | 4.9 |
| #200 (75mm) | 1.7 | 11.6 | 0.7 | | | 4.0 |

| PROPERTY | SHRP | MARSHALL |
|---|---|---|
| EFFECTIVE GRAV. | 2.710 | 2.710 |
| RICE GRAV. AT OPT. | 2.472 | 2.472 |
| ASPHALT ABS. | 0.69 | 0.69 |
| % AC AT 4% VTM | 5.9 | 5.5-5.6 Estimated |
| | | |
| | | |
| | | |
| | | |

| BLEND PROPERTIES | |
|---|---|
| FINE AGG. ANG. | 46.9 |
| TSR | 85.7 |
| WET ST (psi) | 101.8 |
| GSI | |
| RUT DEPTH (in) | |
| $G_{sb}$ | 2.660 |
| $G_{se}$ | 2.742 |
| WATER ABS. | 1.12 |

### MATERIALS AND PRODUCERS

1) TN #7 Granite Vulcan Mills, Erca, NC
2) #10 Vulcan Mtls, Tazewell, TN
3) Nat. Sand, Nolichucky S&G, Greeneville, TN
4)
5)
Asphalt Shell AC, Knoxville, TN
Anti-Strip Pave Bond Lite, 0.5% dosage

## Mixture Summary Report for Trial Aggregate Blend Analysis

| | | | |
|---|---|---|---|
| **Project Name:** | SP-1 (97)3 | **N Initial:** | 8 |
| **Workbook Name:** | SUPER PAVE WORK SHEETS | **N Design:** | 96 |
| **Technician:** | REGION 1 LAB | **N Max:** | 152 |
| **Date:** | 5/8/97 | **Nom. Sieve Size:** | 12.5 mm |
| **Asphalt Grade:** | PG 64-22 | **Compaction Temperature:** | 146 °C |
| | | **Mixture Temperature:** | 154°C |
| **Design ESAL's (millions):** | 5 | **Depth from Surface (mm):** | 150 |
| **Design Temperature:** | 38°C | **Mold Size:** | 150 mm |

| Property | Results | | | | Criteria |
|---|---|---|---|---|---|
| | B1 | B2 | B3 | B4 | |
| %AC | 5.5 | 6.0 | 6.5 | 5.9 | |
| %Air Voids ($V_a$) | 5.4 | 3.8 | 2.9 | 4.0 | 4.0 % |
| %VMA | 17.9 | 17.6 | 17.9 | 17.6 | 14.0 % Min. |
| %VFA | 70.1 | 78.4 | 83.8 | 77.4 | 65.0 % Min.<br>75.0 % Max. |
| Dust/Asphalt Ratio | 0.7 | 0.7 | 0.6 | 0.7 | 0.6-1.2 % |
| Max. Specific Gravity ($G_{mm}$) | 2.487 | 2.469 | 2.451 | 2.472 | |
| Bulk Specific Gravity ($G_{mb}$) | 2.379 | 2.405 | 2.408 | 2.401 | |
| $\%G_{mm}$ @ $N_{ini}$ | 87.3 | 87.6 | 88.6 | 87.5 | 89.0 % Max. |
| $\%G_{mm}$ @ $N_{max}$ | 95.6 | 97.4 | 98.3 | 97.1 | 98.0 % Max. |
| Effective Sp. Gravity of Blend ($G_{se}$) | 2.710 | 2.710 | 2.711 | 2.709 | — |
| Sp. Gravity of Binder ($G_b$) | 1.031 | 1.031 | 1.031 | 1.031 | — |
| Sp. Gravity of Aggregate ($Gs_b$) | 2.710 | 2.710 | 2.710 | 2.710 | — |

**Knox County**

**Contract No.: 4851 Project No.: 87001-4248-04**

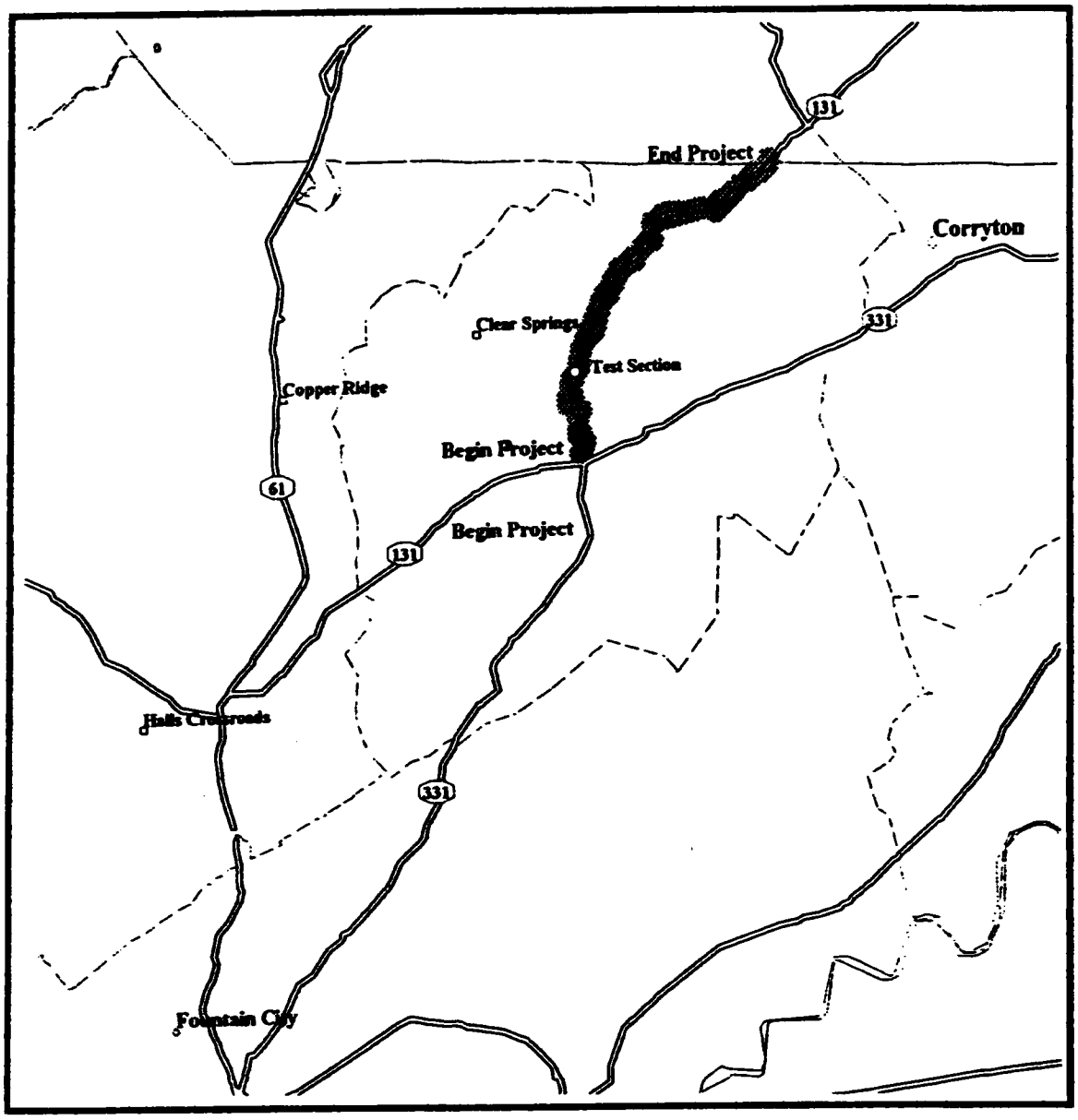
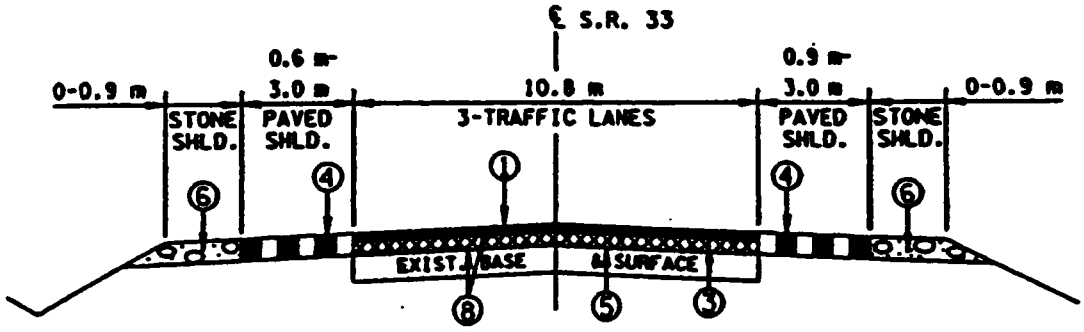



**Figure A.3 Site Vicinity Map**
**Knox County**
**Contract No.: 4851**
**Project No.: 47027-4210-04**




| PROPOSED PAVEMENT SCHEDULE | |
|---|---|
| ① BITUM. SURFACE 40 mm TH. (APPROX. 91 kg/m²) | |
| 411M0.01 | MIN. AGG. SUPER PAYE SURFACE MIX |
| 411M0.02 | ASP. CEMENT SUPER PAVE SURFACE MIX |
| ② BITUMINOUS BINDER 40 mm TH. (APPROX. 96 kg/m²) | |
| 307M03.J6 | (BPMB-HM) GRADING 'B-M2' |
| ③ BITUM. PLANT MIX LEV. COURSE (APPROX. 27 kg/m²) | |
| 307M03.05 | MIN. AGG. FOR ASPHALTIC CONC. LEV. COURSE (HOT MIX) (BPMLC-HM) GRADING 'CS' |
| 307M03.06 | ASP. CEMENT FOR ASP. CONC. LEVELING COURSE (HOT MIX) (BPMLC-HM) GRADING 'CS' |
| ④ BITUM. SURFACING 50 mm TH. (APPROX. 110 kg/m²) | |
| 411M03.J0 | ASP. CONC. SURF. (HOT MIX) GR. 'E' SHOULDERS |
| ⑤ BITUM. SURFACING (SPOT LEVELING) (APPROX. 30 TONNE/km) | |
| 411M03.J0 | ASP. CONC. SURF. (HOT MIX) GR. 'E' SHOULDERS |
| ⑥ MINERAL AGGREGATE BASE - (SHOULDERS) 60 mm THICK | |
| 303M01 | MINERAL AGG., TYPE 'A' BASE, GRADING 'D' |
| ⑦ MINERAL AGGREGATE BASE - (SHOULDERS) 100 mm THICK | |
| 303M01 | MINERAL AGG., TYPE 'A' BASE, GRADING 'D' |
| ⑧ TACK COAT @ 0.09 L/m² | |
| 403M01 | BITUMINOUS MATERIAL FOR TACK COAT (TC) |

**Figure A.4 Pavement Cross Section**
**Knox County**
**Contract No.: 4851**
**Project No.: 47027-4210-04**

# Knox County Mix Design

## STATE OF TENNESSEE ASPHALT JOB MIX FORMULA

Project Ref. No. SP | County KNOX | Region 1

Project No. 47027-4210-04 | Contract No. 4851 | Date 8-11-97

Type ASPHALT SURFACE | Sec. No. 411-D | Article No. 01.01

Contractor RENFRO CONSTRUCTION | Subcontractor

State Rte. No. 131 | TOTAL MIX INCLUDING BITUMEN | Date Of Letting 7-97

SER. No. M-1(97)371 | DES. No. DV-1(97)274

| material | screen | producer and address | percent used |
|---|---|---|---|
| c.a. | | | |
| med c.a. | 16-75 | NOLICHUCKY SAND CO. GREENVILLE | 42.075 |
| screenings | 9.5-75 | AMERICAN LIMESTONE F.O.R. | 23.375 |
| sand | 9.5-75 | NOLICHUCKY SAND CO. GREENVILLE | 28.05 |
| rap material | | | |
| asphalt | AC-20 | SHELL OIL, KNOXVILLE | 6.5 |

additive type PAVEBOND LITE | dosage rate 0.5%

fractured face count on +4 mat. 92.1 | glassy particle on +4 mat. N/A

THEO. GRAV. 2.360 | D.A.R. 0.523 | L.O.I. 11.2

| 100 PERCENT MINERAL AGGREGATE | | | | AGGREGATE ANALYSIS TOTAL %PASSING | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| screen | design range | req. percent | tolerance % | c.a. % | m.c.a. % | scr. % | sand% | rap% | cal mix |
| temp | 135-163 | 149 | | | 45 | 25 | 30 | | 10 |
| %a.c. | 5.3-7.0 | 6.5 | | | | | | | |
| 2" | | | | | | | | | |
| 1 1/2" | | | SEE | | | | | | |
| 1" | | | TABLE | | | | | | |
| 3/4" | | | 4 | | | | | | |
| 5/8" | 100 | 100 | 0 | | 100 | 100 | 100 | | 100 |
| 1/2" | 95-100 | 96 | 7 | | 90.4 | 100 | 100 | | 95.7 |
| 3/8" | 80-93 | 85 | - | | 66.7 | 100 | 100 | | 85.0 |
| no 4 | 54-76 | 60 | 0 | | 20.1 | 84 | 99.2 | | 59.8 |
| no. 8 | 35-57 | 48 | 2 | | 12.8 | 53.8 | 95.4 | | 47.8 |
| no 30 | 17-29 | 17 | | | 9 | 23.4 | 24.3 | | 17.2 |
| no 50 | 10-18 | 10 | | | 7.8 | 18.5 | 6.9 | | 10.2 |
| no100 | 3-10 | 5 | | | 3.5 | 10.7 | 1.2 | | 4.6 |
| no200 | 0-6.5 | 3.4 | | | 2.3 | 8.7 | 0.6 | | 3.4 |

REQUESTED William A. Smith 8-18-96 | APPROVED [signature]

RENFRO CONSTRUCTION CO. | region materials engineer

APPROVED George Russell | APPROVED

region construction engineer | engineer of materials and tests

## ASPHALT MIX DESIGN SUMMARY

| | |
|---|---|
| DESIGN NO. | D1-(97)274 |
| TYPE OF MIX | 411-D |
| PROJECT REF. NO. | SP |
| PROJECT NO. | 47027-4210-04 |
| CONTRACTOR | RENFRO CONSTRUCTION |

| | |
|---|---|
| DATE | 8-11-97 |
| SERIAL NO. | M.1(97)371 |
| CONTRACT NO. | 4851 |
| REGION | 1 |
| COUNTY | KNOX |

| sample no. | a.c. content | sp. gr. of mar | theo. grav. | % theo. grav. | voids in mix | VMA | voids filled | stability | flow | no. of hammer blows |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 5.7 | 2.247 | 2.386 | 94.2 | 5.8 | 18.2 | 67.9 | 3883.333 | 12.333 | 75 |
| 2 | 6.1 | 2.252 | 2.373 | 94.9 | 5.1 | 18.4 | 72.2 | 3875 | 13.333 | 75 |
| 3 | 6.5 | 2.262 | 2.36 | 95.8 | 4.2 | 18.3 | 77.5 | 3741.667 | 12.167 | 75 |
| 4 | 6.9 | 2.26 | 2.347 | 96.3 | 3.7 | 18.8 | 80.2 | 3650 | 12 | 75 |
| Rec 1 | 6.5 | 2.278 | 2.378 | 95.8 | 4.2 | 18.5 | 77.3 | 3687 | 12.3 | |
| L 13 | | | | | | | | | | |

### TOTAL % PASSING

| MTLS | P.GRAV | 10'S | nat.sand | | | MIX | LAB |
|---|---|---|---|---|---|---|---|
| % | 45 | 25 | 30 | | | 100 | |
| 2" | | | | | | | |
| 1 1/2" | | | | | | | |
| 1" | | | | | | | |
| 3/4" | | | | | | | |
| 5/8" | 100 | 100 | 100 | | | 100 | 100 |
| 1/2" | 90.4 | 100 | 100 | | | 95.7 | 94.8 |
| 3/8" | 66.7 | 100 | 100 | | | 85.0 | 85.1 |
| no.4 | 20.1 | 84 | 99.2 | | | 59.8 | 60.2 |
| no.8 | 12.8 | 53.8 | 95.4 | | | 47.8 | 48.7 |
| no.30 | 9 | 23.4 | 24.3 | | | 17.2 | 18.1 |
| no.50 | 7.8 | 18.5 | 6.9 | | | 10.2 | 11.0 |
| no.100 | 3.5 | 10.7 | 1.2 | | | 4.6 | 4.9 |
| no.200 | 2.3 | 8.7 | 0.6 | | | 3.4 | 3.6 |

**Producer**

| |
|---|
| P.GRAVEL,NAT. SAND |
| NOLICHUCKY SAND CO. |
| GREENVILE |
| 10'S AMERICAN LIMESTONE |
| F.O.R. |
| |
| |

| | |
|---|---|
| bulk gr. | 2.571 |
| effective gr. | 2.590 |
| app. gr. | 2.613 |
| fractured face | 92.1 |
| glassy particles | N/A |
| LOI | 11.2 |
| a.c. in rap | N/A |
| DAR | 0.523 |
| TSR | 94.2 |
| ABS. | 1.3 |

| | | |
|---|---|---|
| Reccomended | 6.5 | asphalt content |
| theor. Density | 2.360 | |

| 411-D PLANT 1(P GRAVEL ONLY) | | | | MARSHALL MIX DESIGN FROM: RENFRO CONST. CO. | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| sample no. | % a.c. | % agg. | in air | ssd | in water | vol mar spe | sp. gr. mar. | theo grav. | eff. grav. | %voids | vma | voids filled | unit wt. | stability | flow |
| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O |
| | | | | | | D-E | C/F | SEE | SEE | 100- | 100- | a*g/sp.gr. | 62.4*g | | |
| | | | | | | | | BELOW | BELOW | g/h*100 | b*g/l | a.c.*100/ | | | |
| | | | | | | | | | | | | k | | STABILITY | FLOW |
| 1 | 5.7 | 94.3 | 1237.5 | 1242.2 | 687.2 | 555 | 2.2297297 | 2.3859972 | 2.59 | 5.8312 | 18.1933 | 67.948475 | 140.20432 | 3975 | 12.5 |
| 2 | | | 1239.6 | 1244.4 | 699.7 | 544.7 | 2.2757481 | 2.386 | | 5.8 | 18.2 | 67.9 | 140.2 | 3800 | 12.5 |
| 3 | | | 1242.5 | 1247.1 | 691.2 | 555.9 | 2.2351142 | | | | | | | 3875 | 12 |
| | | | | | | | 2.246864 | | | | | | | 3883.3333 | 12.333 |
| | | | | | | | 2.247 | | | | | | | | |
| 1 | 6.1 | 93.9 | 1240.6 | 1243.2 | 697 | 546.2 | 2.2713292 | 2.3728814 | 2.59 | 5.1149 | 18.3719 | 72.159055 | 140.49428 | 4000 | 15.5 |
| 2 | | | 1241.4 | 1245.3 | 693.2 | 552.1 | 2.2485057 | 2.373 | | 5.1 | 18.4 | 72.2 | 140.5 | 4100 | 12.5 |
| 3 | | | 1234 | 1238.5 | 686.3 | 552.2 | 2.2346976 | | | | | | | 3525 | 12 |
| | | | | | | | 2.2515108 | | | | | | | 3875 | 13.333 |
| | | | | | | | 2.252 | | | | | | | | |
| 1 | 6.5 | 93.5 | 1237.7 | 1240.3 | 698.3 | 542 | 2.2835793 | 2.3599089 | 2.59 | 4.1594 | 18.3499 | 77.543829 | 141.13324 | 4200 | 12.5 |
| 2 | | | 1228.1 | 1230.7 | 687.5 | 543.2 | 2.2608616 | 2.36 | | 4.2 | 18.3 | 77.5 | 141.1 | 3700 | 12 |
| 3 | | | 1237.6 | 1240.6 | 688.3 | 552.3 | 2.2408112 | | | | | | | 3325 | 12 |
| | | | | | | | 2.2617507 | | | | | | | 3741.6667 | 12.167 |
| | | | | | | | 2.262 | | | | | | | | |
| 1 | 6.9 | 93.1 | 1241.3 | 1244.6 | 699.4 | 545.2 | 2.2767792 | 2.3470775 | 2.59 | 3.7074 | 18.7599 | 80.237818 | 141.02791 | 3650 | 12.5 |
| 2 | | | 1237.2 | 1240.3 | 695.2 | 545.1 | 2.2696753 | 2.347 | | 3.7 | 18.8 | 80.2 | 141 | 3800 | 11.5 |
| 3 | | | 1246.2 | 1249.1 | 691.2 | 557.9 | 2.2337336 | | | | | | | 3500 | 12 |
| | | | | | | | 2.2600627 | | | | | | | 3650 | 12 |
| | | | | | | | 2.26 | | | | | | | | |
| EFFECTIVE GRAV. AGGS.= B/ | | | | | | | | | | | | | | | |
| | | (100/H)-(A/SP. GR. A.C.) | | | LOI= | | Rec. A.C. content = | | | DATE | | | No. of hammer blows | | |
| | | | | | Fr. Face= | | Theoretical gravity = | | | TYPE OF MIX | | | Sp. Gr. of A.C. | | 1.036 |
| | | | | | Gl. Part.= | | Dust to A.C. ratio = | | | CONTRACT NO. | | | | | |
| | | | | | ABS. = | | tensile strength ratio= | | | PR. REF. NO. | | | | | |
| | | | Bulk Specific Gravity = | | | | REGION = | | | COUNTY | | | | | |
| | | | Apparent Specific Gravity = | | | | amount +type add.= | | | | | | | | |
| | | | Grams for 2.5" spec. = | | | | | | | | | | | | |

411-0 PLANT 1(P GRAVEL ONLY) MARSHALL MIX DESIGN FROM: RENFRO CONST. CO.

| sample no. | % a.c. | % agg. | in air | ssd | in water | vol mar spe | sp. gr. mar. | theo grav. | eff. grav. | %voids | vma | voids filled | unit wt. | stability | flow |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O |
| | | | | | | D-E | C/F | SEE BELOW | SEE BELOW | 100-g/h*100 | b*g/l | a*g/sp.gr. a.c.*100/ k | 62.4*g | STABILITY | FLOW |
| 1 | 6.5 | 93.5 | 1241.2 | 1244.1 | 703.5 | 540.6 | 2.2959674 | 2.3870234 | 2.625 | 4.3932 | 18.7117 | 76.521914 | 142.40665 | 3950 | 12.5 |
| 2 | | | 1246.5 | 1249.4 | 699.8 | 549.6 | 2.2680131 | 2.387 | | 4.4 | 18.7 | 76.5 | 142.4 | 3575 | 11.5 |
| 3 | | | 1245.1 | 1248.3 | 702.8 | 545.5 | 2.2824931 | | | | | | | 3600 | 12 |
| | | | | | | | 2.2821579 | | | | | | | 3708.3333 | 12 |
| | | | | | | | 2.282 | | | | | | | | |
| 1 | | 100 | | | | 0 | ERR | 2.625 | 2.625 | ERR | ERR | ERR | ERR | | |
| 2 | | | | | | 0 | ERR | 2.625 | | ERR | ERR | ERR | ERR | | |
| 3 | | | | | | 0 | ERR | | | | | | | | |
| | | | | | | | ERR | | | | | | | 0 | 0 |
| | | | | | | | ERR | | | | | | | | |
| 1 | | 100 | | | | 0 | ERR | 2.625 | 2.625 | ERR | ERR | ERR | ERR | | |
| 2 | | | | | | 0 | ERR | 2.625 | | ERR | ERR | ERR | ERR | | |
| 3 | | | | | | 0 | ERR | | | | | | | | |
| | | | | | | | ERR | | | | | | | 0 | 0 |
| | | | | | | | ERR | | | | | | | | |
| 1 | | 100 | | | | 0 | ERR | 2.625 | 2.625 | ERR | ERR | ERR | ERR | | |
| 2 | | | | | | 0 | ERR | 2.625 | | ERR | ERR | ERR | ERR | | |
| 3 | | | | | | 0 | ERR | | | | | | | | |
| | | | | | | | ERR | | | | | | | 0 | 0 |
| | | | | | | | ERR | | | | | | | | |

EFFECTIVE GRAV. AGGS. = B/ (100/H)-(A/SP. GR. A.C.)

LOI=
Fr. Face=
Gl. Part.=
ABS. =
Bulk Specific Gravity =
Apparent Specific Gravity =
Grams for 2.5" spec. =

Rec. A.C. content =
Theoretical gravity =
Dust to A.C. ratio =
tensile strength ratio=
REGION =
amount +type add.=

DATE
TYPE OF MIX
CONTRACT NO.
PR. REF. NO.
COUNTY

No. of hammer blows
Sp. Gr. of A.C. 1.036

| 411-D PLANT 1 (P. GRAVEL) | TSR SHEET FOR RENFRO CONST. CO | | | | | |
|---|---|---|---|---|---|---|
| SAMPLE I.D. | 1 | 2 | 3 | 4 | 5 | 6 |
| DIAMETER D | 4 | 4 | 4 | 4 | 4 | 4 |
| THICKNESS T | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 |
| DRY MASS IN AIR A | 1203.2 | 1198.2 | 1199.4 | 1201.3 | 1197.4 | 1200.4 |
| SSD MASS B | 1206.1 | 1201.4 | 1202.3 | 1204.4 | 1200.1 | 1203.1 |
| MASS IN WATER C | 635.2 | 631.5 | 634.5 | 633 | 629.8 | 630.9 |
| VOLUME(B-C) E | 570.9 | 569.9 | 567.8 | 571.4 | 570.3 | 572.2 |
| BULK SP. GR.(A/E) F | 2.107549483 | 2.102474118 | 2.112363508 | 2.102380119 | 2.099596703 | 2.097867878 |
| BULK GR.(ROUNDED) | 2.106 | 2.102 | 2.112 | 2.102 | 2.1 | 2.098 |
| MAX SP. GR. G | 2.275 | 2.275 | 2.275 | 2.275 | 2.275 | 2.275 |
| %AIR VOIDS H | 7.340659341 | 7.604395604 | 7.164835165 | 7.604395604 | 7.692307692 | 7.78021978 |
| AIR VOIDS(ROUNDE | 7.3 | 7.6 | 7.2 | 7.6 | 7.7 | 7.8 |
| VOLUME AIR VOIDS I | 41.6757 | 43.3124 | 40.8616 | 43.4264 | 43.9131 | 44.6316 |
| VOLUME (ROUNDED) | 41.7 | 43.3 | 40.9 | 43.4 | 43.9 | 44.6 |
| LOAD | | | 2600 | 2250 | | 2100 |
| (1)for test (0)for control | 1 | 1 | 0 | 0 | 1 | 0 |
| SATURATED IN WATER (PLEASE GIVE TIME AND DATE) | | | | | | |
| SSD B' | 1233.5 | 1229.5 | | | 1229.4 | |
| VOL. ABS. WATER J' | 30.3 | 31.3 | 0 | 0 | 32 | 0 |
| SATURATION | 72.6616705 | 72.28637413 | 0 | 0 | 72.6929385 | 0 |
| SAT. (ROUNDED) | 72.7 | 72.3 | 0 | 0 | 72.9 | 0 |
| CONDITIONED IN WATER AT 140 DEGREES F | | | | | | |
| THICKNESS T" | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 |
| LOAD P" | 2550 | | 2100 | | 1900 | |
| DRY 2P/T*D*3.14 S(d) | 0 | 0 | 165.6050955 | 143.3121019 | 0 | 133.7579618 |
| WET 2P"/T"*D*3.14 S | 162.4203822 | 0 | 133.7579618 | 0 | 121.0191083 | 0 |
| DRY AVERAGE | 147.5583864 | | | | | |
| WET AVERAGE | 139.0658174 | | | | | |
| tensile strenght ratio | WETAVG./DRY AVG.*100 | | 94.24460432 | 94.2 | | |
| visual moisture damag | OK | | | | | |
| crack and break agg. | OK | | | | | |
| | | | | | | |
| PROJECT: | | | | | | |
| ADDITIVE: | PAVEBOND LITE | | | | | |
| DOSAGE: | | | | | | |
| COMP. METHOD: | MARSHALL HAMMER | | | | | |
| EFFORT: | | | | | | |
| DATE TESTED: | | | | | | |
| BY : | | | | | | |

**Marion County**

**Contract No.: 5774 Project No.: 58100-8119-04**

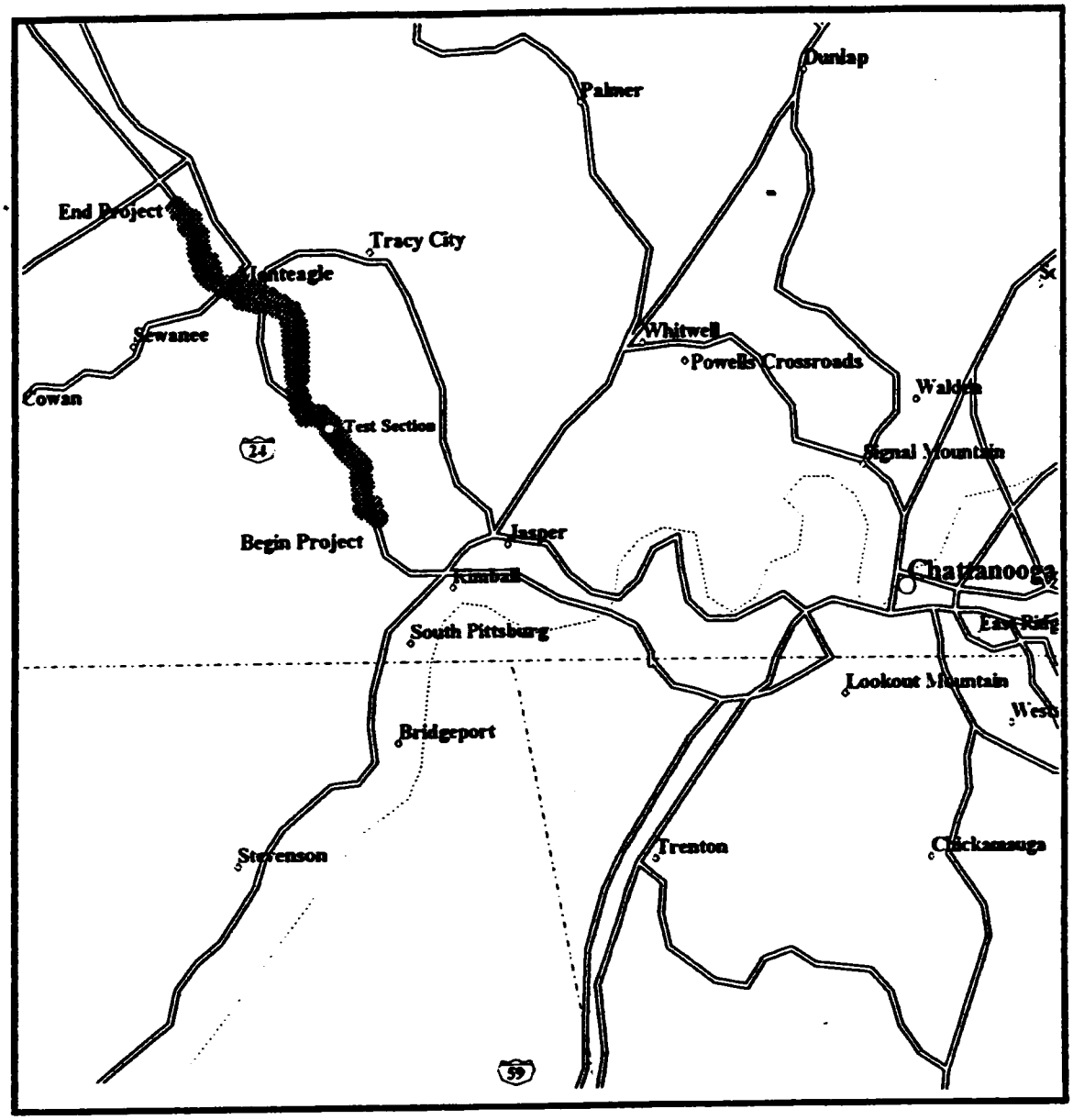
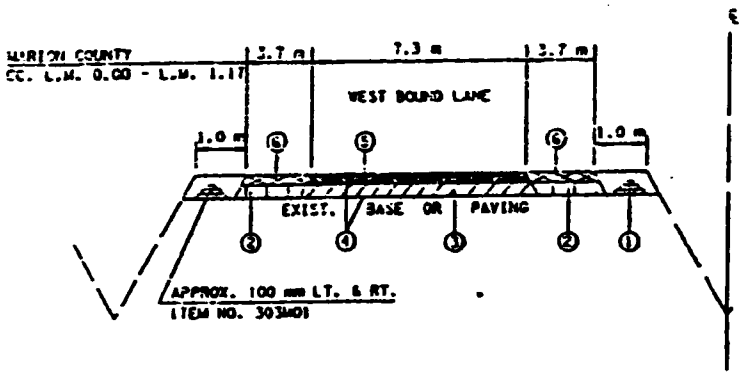



**Figure A.5 Site Vicinity Map**
**Marion County**
**Contract No.: 5774**
**Project No.: 58100-8119-04**

## PROPOSED TYPICAL SECTION




## PROPOSED PAVING SCHEDULE

① MINERAL AGGREGATE BASE FULL DEPTH ON SHOULDERS
303M01 MINERAL AGG., TYPE "A" BASE, GRADING "D"

② BITUMINOUS BINDER 70 mm ± THICK (APPROX. 168 ± kg/m2)
307M03.16 BITUMINOUS PLANT MIX BASE (HOT MIX) (BPMB-HM)
GRADING "B-M2"

③ BITUMINOUS BINDER 70 mm ± THICK (APPROX. 168 ± kg/m2)
307M04.22 POLYMER MODIFIED (HOT MIX) (BPMB-HM)
GRADING "B-M2"

④ TACK COAT @ 0.09 L/m2
403M01 BITUMINOUS MATERIAL FOR TACK COAT (TC)

⑤ BITUMINOUS SURFACE 30 mm ± THICK (APPROX. 68 ± kg/m2)
411M01.01 MINERAL AGG. FOR ASPHALTIC CONCRETE SURFACE (ACS)
GRADING "D"
411M01.27 POLYMER MODIFIED ASPHALT CEMENT GRADING "D"

⑥ STABILIZED SHOULDERS 30 mm ± THICK (APPROX. 66 kg/m2)
411M03.16 ASPHALTIC CONC. SURFACE (ACS) (HOT MIX)
GRADING "E" (SHOULDERS)

⑦ BITUMINOUS BINDER 50 mm ± THICK (APPROX. 120 ± kg/m2)
307M03.16 BITUMINOUS PLANT MIX BASE (HOT MIX) (BPMB-HM)
GRADING "B-M2"

⑧ BITUMINOUS BINDER 50 mm ± THICK (APPROX. 120 ± kg/m2)
307M04.22 POLYMER MODIFIED (HOT MIX) (BPMB-HM)
GRADING "B-M2"

**Figure A.6 Pavement Cross Section**
**Marion County**
**Contract No.: 5774**
**Project No.: 58100-8119-04**

# Marion County Mix Design

STATE OF TENNESSEE ASPHALT JOB MIX FORMULA

Date:

Project Ref. No. I - 24 County Marion Region
Proj. No. I M E - 24 - 2 (105) 133 Cont. #:
Type ACSC (HM) Sec. No. 411 - D Polymer Article
Contractor Vulcan Construction Co. Subcontractor:
State Rt. TOTAL MIX INCLUDING BITUMEN Date of Letting

| MATERIAL | | Screen % Passing | PRODUCER AND ADDRES |
|---|---|---|---|
| C.A. | | | |
| Med C.A. | 5/8's | 19mm - 75um | Vulcan Sand & Gravel, Chatt., TN |
| Screenings | 10's | 9.5mm - 75um | Vulcan Materials Co., Richard City |
| Sand | | 9.5mm - 75um | Southern Sand Co., So. Pittsburg, |
| | | | |
| Asphalt Cement | | Modified AC-20 | Amoco Oil Co. Chatt., TN |
| Anti-Strip | | TYPE: Pave Bond Lite | DOSAGE RATE: 0.3% |

% Fractured Faces on +4 Material: 92.3 % Glassy Particles on +4 Material 0.1%

| 100 PERCENT MINERAL AGGREGATE | | | | AGGREGATE ANALYSIS TOTAL PERCENT PASSIN | | | |
|---|---|---|---|---|---|---|---|
| SCREEN | Ttl. Passing Design Range | Requested Percent | Tolerance Percent | C.A. Percent | Med C.A. Percent | Screenings Percent | Mtn. Sand Percent |
| Temp | | 330 F | | | 55 | 25 | 20 |
| % A.C. | | 6.9 | | | (Washed Gradations) | | |
| | Compaction Temp: | | 315-320 | | Loss on Ignition: 10.8% | | |
| | Mixing Temp: | | 320-340 | | Theo: 2.283 | | |
| | | | | | Jm-2-162 | | |
| 50mm (2") | | | | | | | |
| 37.5mm(11/2") | | | | | | | |
| 25mm (1") | | | | | | | |
| 19mm (3/4") | | | | | | | |
| 16mm (5/8") | 100 | 100.0 | | | 100.0 | 100.0 | 100.0 |
| 12.5mm (1/2") | 95-100 | 99.5 | | | 99.0 | 100.0 | 100.0 |
| 9.5mm (3/8") | 80-93 | 91.4 | | | 84.3 | 100.0 | 100.0 |
| 4.75mm (#4) | 54-76 | 68.5 | | | 47.6 | 89.4 | 99.6 |
| 2.36mm (#8) | 35-57 | 48.8 | | | 27.6 | 59.0 | 94.1 |
| 600um (#30) | 17-29 | 27.1 | | | 10.4 | 27.9 | 72.2 |
| 300um (#50) | 10-18 | 13.8 | | | 7.3 | 19.8 | 24.0 |
| 150um (#100) | 3-10 | 7.6 | | | 6.2 | 14.1 | 3.1 |
| 75um (#200) | 0-6.5 | 5.2 | | | 4.3 | 10.7 | 0.9 |

Requested David W. Foster VMC Approved W. P. [illegible]
Contractor
Approved James A. Johnston Approved
Region Construction Engineer

DATE: June 12, 1997
TYPE OF MIX: 411 "D" w/ Polymer
PROJ. #: IME-24-2(105)133
CONT. #: 4774
COUNTY: Marion

REGION: II
CONTRACTOR: Vulcan Const. Co.
SP. GR. AC: 1.0240
EFF S.G. MIX: 2.612

WEIGHT - GRAMS
MARSHALL SPECIMEN

Test Performed By: David Foster

| SAMPLE NO | % AC A | % AGG B | IN AIR C | SSD D | IN H2O E | BULK VOL. F | BULK SP.GR. G | THEO. GRAV. H | EFF S.G. I | % AIR VOIDS J | VMA K | VOIDS FILLED L | UNIT WT. M | STABILITY lbs F | FLOW (0.1") G |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 6.0 | 94.0 | 1100.2 | 1104.3 | 593.7 | 510.6 | 2.155 | 2.311 | 2.512 | 6.8 | 19.4 | | 134.5 | 2400 | 11.0 |
| 2 | 6.0 | 94.0 | 1105.9 | 1108.7 | 593.6 | 515.1 | 2.147 | 2.311 | 2.512 | 7.1 | 19.7 | | 134.0 | 2550 | 10.5 |
| 3 | 6.0 | 94.0 | 1103.8 | 1106.5 | 593.4 | 513.1 | 2.151 | 2.311 | 2.512 | 6.9 | 19.5 | | 134.2 | 2675 | 10.0 |
| | | | | | | AVG: | 2.151 | | | 6.9 | 19.5 | 64.6 | 134.2 | 2542 | 10.5 |
| 4 | 6.5 | 93.5 | 1097.6 | 1100.1 | 591.0 | 509.1 | 2.156 | 2.295 | 2.512 | 6.1 | 19.8 | | 134.5 | 2580 | 10.5 |
| 5 | 6.5 | 93.5 | 1102.6 | 1104.9 | 595.3 | 509.6 | 2.164 | 2.295 | 2.512 | 5.7 | 19.5 | | 136.0 | 2500 | 11.0 |
| 4 | 6.5 | 93.5 | 1108.7 | 1111.2 | 597.2 | 514.0 | 2.157 | 2.295 | 2.512 | 6.0 | 19.7 | | 134.6 | 2375 | 11.5 |
| | | | | | | AVG: | 2.159 | | | 5.9 | 19.6 | 69.8 | 134.7 | 2478 | 11.0 |
| 7 | 7.0 | 93.0 | 1102.4 | 1104.2 | 602.1 | 502.1 | 2.196 | 2.280 | 2.512 | 3.7 | 18.7 | | 137.0 | 2075 | 12.5 |
| 8 | 7.0 | 93.0 | 1106.9 | 1107.6 | 604.3 | 503.3 | 2.199 | 2.280 | 2.512 | 3.6 | 18.6 | | 137.2 | 2105 | 13.0 |
| 9 | 7.0 | 93.0 | 1110.0 | 1111.2 | 605.7 | 505.5 | 2.196 | 2.280 | 2.512 | 3.7 | 18.7 | | 137.0 | 2250 | 12.0 |
| | | | | | | AVG: | 2.197 | | | 3.7 | 18.7 | 80.4 | 137.1 | 2143 | 12.5 |
| 10 | 7.5 | 92.5 | 1100.1 | 1101.0 | 609.0 | 492.0 | 2.236 | 2.265 | 2.512 | 1.3 | 17.7 | | 139.5 | 1950 | 12.5 |
| 11 | 7.5 | 92.5 | 1105.4 | 1105.9 | 606.4 | 497.5 | 2.222 | 2.265 | 2.512 | 1.9 | 18.2 | | 138.7 | 1900 | 12.5 |
| 12 | 7.5 | 92.5 | 1112.3 | 1106.5 | 611.2 | 495.3 | 2.246 | 2.265 | 2.512 | 0.8 | 17.3 | | 140.2 | 2050 | 14.0 |
| | | | | | | AVG: | 2.235 | | | 1.3 | 17.7 | 92.4 | 139.4 | 1967 | 13.0 |
| 13 | 6.9 | 93.1 | 1108.6 | 1110.1 | 604.7 | 505.4 | 2.194 | 2.283 | 2.512 | 3.9 | 18.7 | | 136.9 | 2375 | 11.5 |
| 14 | 6.9 | 93.1 | 1110.0 | 1111.6 | 604.1 | 507.5 | 2.187 | 2.283 | 2.512 | 4.2 | 18.9 | | 136.5 | 2300 | 12.0 |
| 15 | 6.9 | 93.1 | 1109.4 | 1111.2 | 604.3 | 506.9 | 2.189 | 2.283 | 2.512 | 4.1 | 18.9 | | 136.6 | 2590 | 13.0 |
| | | | | | | AVG: | 2.190 | | | 4.1 | 18.8 | 78.3 | 136.7 | 2422 | 12.2 |

| | | | |
|---|---|---|---|
| AGG. LOSS ON IGNITION (LOI): | 10.8 % | THEORETICAL GRAVITY: | 2.283 % |
| RECOMMENDED A.C. CONTENT: | 6.9 % | DUST TO A.C. RATIO (DAR): | 0.767 % |
| AGGREGATE ABSORPTION: | 2.977 % | AGG. BULK SP. GR.: | 2.402 % |

| | |
|---|---|
| AMOUNT & TYPE ADDITIVE: | none % |
| GRMS. FOR 2.5" SPECIMEN: | 1110 % |
| AGG. APPARENT SP. GR.: | 2.587 % |
| TSR: | 83.9 % |

*EFF. GRAV. AGGS. (I) = $\frac{\text{II}}{\frac{\text{100}}{\text{II}} - \frac{\text{A}}{\text{SG A.C.}}}$

*THEO. GRAV. (II) = $\frac{\text{100}}{\frac{\text{A}}{\text{SG A.C.}} + \frac{\text{B}}{\text{I}}}$

VULCAN MATERIALS COMPANY

ASTM D 4867

MOISTURE DAMAGE LABORATORY DATA SHEET

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Project | 411 "D" w/ Polymer | | | | | | |
| Additive | | Pavebond Lite | | Dosage | 0.3% | | |
| Compaction Method | | Marshall Hammer | | Effort | 38 Blows | | |
| Date Tested | | June 12, 1997 | | By | David Foster | | |
| Sample I.D. | | 1 | 2 | 3 | 4 | 5 | 6 |
| Diameter | D | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 |
| Thickness | t | 2.50 | 2.50 | 2.50 | 2.50 | 2.50 | 2.50 |
| Dry mass in air | A | 1078.3 | 1082.6 | 1072.3 | 1077.4 | 1079.5 | 1081.7 |
| SSD mass | B | 1080.4 | 1083.5 | 1073.6 | 1078.7 | 1081.2 | 1082.3 |
| Mass in water | C | 573.8 | 569.8 | 572.1 | 570.2 | 572.0 | 569.8 |
| Volume(B-C) | E | 506.6 | 513.7 | 501.5 | 508.5 | 509.2 | 512.5 |
| Bulk Sp.Gr.(A/E) | F | 2.129 | 2.107 | 2.138 | 2.119 | 2.120 | 2.111 |
| Max.Sp.Gr. | G | 2.283 | 2.283 | 2.283 | 2.283 | 2.283 | 2.283 |
| %Air Void(100(G-F)/G) | H | 6.8 | 7.7 | 6.3 | 7.2 | 7.1 | 7.5 |
| Volume Air Void(H*E/100 | I | 34.3 | 39.5 | 31.8 | 36.6 | 36.4 | 38.7 |
| Load | P | 0 | 2250 | 2425 | 2325 | 0 | 0 |
| Saturated | | 6 sec. @ | 25 | in. Hg | | | |
| SSD Mass | B' | 1101.4 | | | | 1104.7 | 1108.2 |
| Vol.Abs.water(B'-A) | J | 23.1 | | | | 25.2 | 26.5 |
| Saturation(100J/I) | | 67.4 | | | | 69.3 | 68.5 |
| Conditioned 24h in 140F water. | | | | | | | |
| Thickness | t' | 2.50 | 2.50 | 2.50 | 2.50 | 2.50 | 2.50 |
| Load | P' | 1975 | 0 | 0 | 0 | 1790 | 2110 |
| Dry 2P'/πD3.14 | Std | 0.0 | 143.2 | 154.4 | 148.0 | 0.0 | 0.0 |
| Wet 2P'/πD3.14 | Stm | 125.7 | 0.0 | 0.0 | 0.0 | 114.0 | 134.3 |
| TSR 100Stm/Std | | 83.9 | | | | | |
| Visual Moisture Damage | | 0 | 1 | 0 | 0 | 1 | 0 |
| Crack And Break Aggregate | | 1 | 1 | 2 | 1 | 0 | 1 |

**Lincoln County**

**Contract No.: 4770 Project No.: 52002-4529-04**

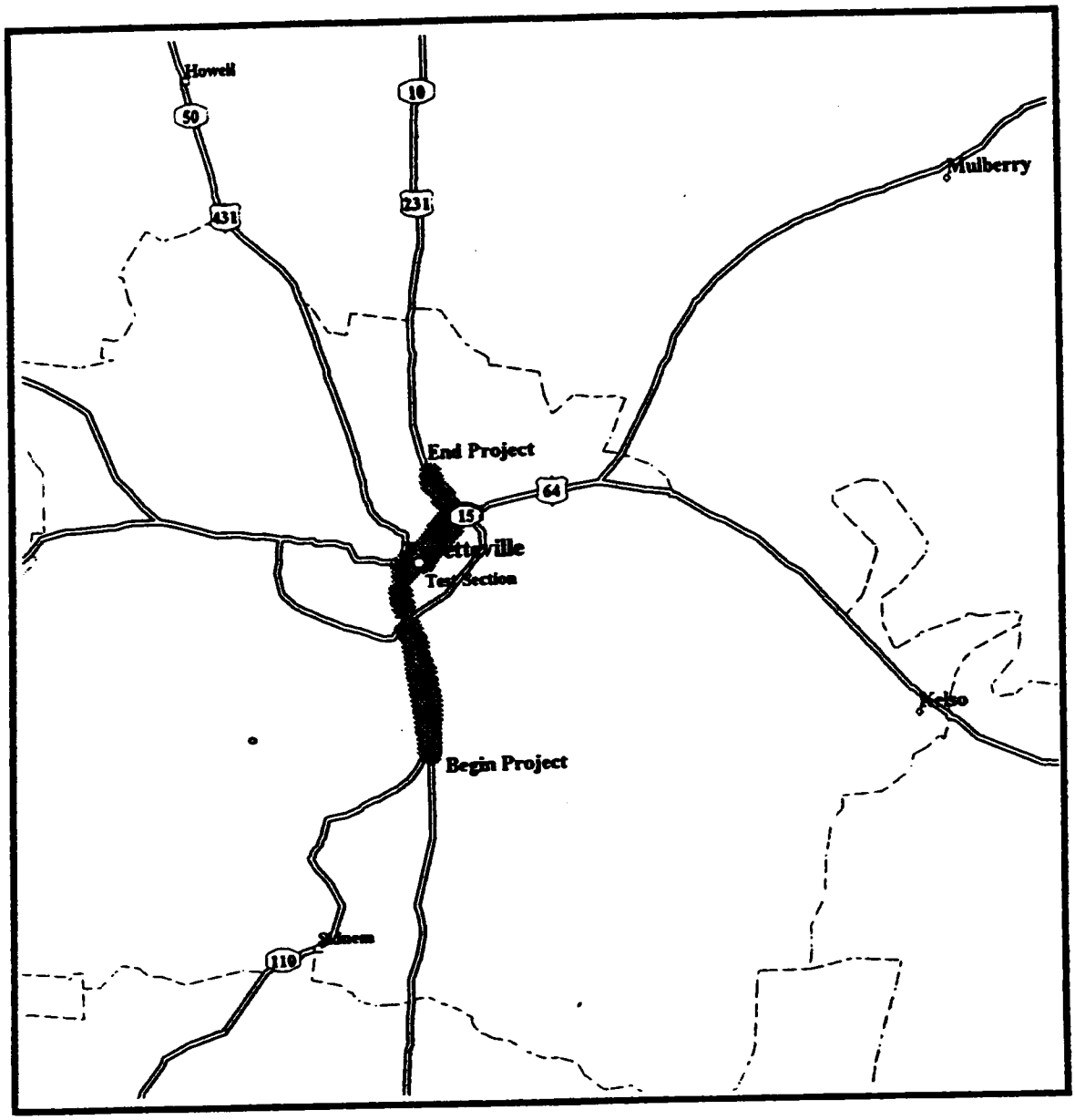
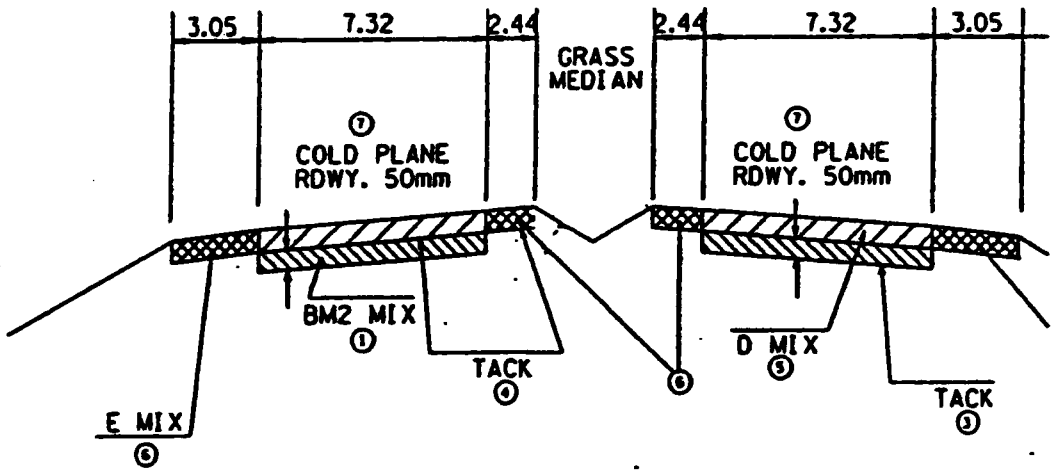



**Figure A.7 Site Vicinity Map**
**Lincoln County**
**Contract No.: 4770**
**Project No.: 52002-4529-04**




## PAVING SCHEDULE

① BINDER (108.6 kg/m2) 50mm
307M10.10 SUPER PAVE BINDER MIX (BPMB-HM)

② SCRATCH COURSE (APPROX. 20 kg/m2)
307M03.05 MIN.AGG.FOR (BPMLC-HM) GRADING "CS" MIX
307M03.06 ASPHALT CEMENT (BPMLC-HM) GRADING "CS" MIX

③ TACK COAT
403M01 BIT. MAT'L FOR TACK COAT (TC) @ 0.40 L/m2

④ TACK COAT
403M01 BIT. MAT'L FOR TACK COAT (TC) @ 0..10 L/m2

⑤ SURFACE @ 35 mm ± THICK (APPROX. 67.9 kg/m2)
411M10.01 MINERAL AGGREGATE, SUPER SURFACE MIX
411M10.02 ASPHALT CEMENT, SUPER SURFACE MIX

⑥ SURFACE/SHOULDER @ 35 mm ± THICK (APPROX. 66.0 kg/m2)
411M03.10 ASPH. CONC. (ACS) GRADING "E" MIX (SHOULDERS)

⑦ COLD PLANE @ 50 mm DEPTH

**Figure A.8 Pavement Cross Section**
**Lincoln County**
**Contract No.: 4770**
**Project No.: 52002-4529-04**

# Lincoln County Mix Design

# STATE OF TENNESSEE ASPHALT JOB MIX FORMULA

Date: 8/5/97

Project Ref. No. SP | County Lincoln | Region III
Proj. No. 52002-4529-04 | Layer Surface | Contract No. 4770
Type Superpave 12.5 mm | Sec. No. 411M10.01, 411M10.02 | Article SP 411-S
Contractor Lincoln Paving | Subcontractor
St. Route 10 | Total Mix including Bitumen | Date of Letting 6/13/97

| Material | Size Range or Type | Producer and Address | % Used |
|---|---|---|---|
| | | | 0.00 |
| "D" Rock | 5/8"-Pan | Burns Stone, Dickson, TN | 61.56 |
| Scr #10's | 3/8"-Pan | Lincoln Rock, Fayetteville, TN | 18.94 |
| Mtn. Sand | #4-Pan | Cumberland Mtn. Sand, Hillsboro, TN | 14.21 |
| RAP/Filler | | | 0.00 |
| Asphalt Cement | PG 64-22 | Southern States, Nashville, TN | 5.30 |
| Anti-Strip | Pave Bond Lite | Dosage Rate: 0.5% | |
| % Fractured Faces on +4 Material: | N/A | % Glassy Particles on +4 Material | N/A | 100.0 |

| 100 PERCENT MINERAL AGGREGATE Screen | Tol. Passing Design Range | Requested Percent | AGGREGATE ANALYSIS TOTAL PERCENT PASSING 0 Percent | "D" Rock Percent | Scr #10's Percent | Mtn. Sand Percent | RAP/Filler Percent | Calculated Mix |
|---|---|---|---|---|---|---|---|---|
| Temp | | 300 F | | 65.0 | 20.0 | 15.0 | 0.0 | 100.0 |
| % AC | | 5.3 | | | | | | |
| Compaction Temp: | | 320-290 | | | | | | |
| Mixing Temp: | | 320-315 | | | | | | |
| | | | | (Washed Gradations) | | | | |
| 2" | | 100 | | 100.0 | 100.0 | 100.0 | | 100.0 |
| 1 1/2" | | 100 | | 100.0 | 100.0 | 100.0 | | 100.0 |
| 1" | | 100 | | 100.0 | 100.0 | 100.0 | | 100.0 |
| 3/4" | | 100 | | 100.0 | 100.0 | 100.0 | | 100.0 |
| 1/2" | | 97 | | 95.4 | 100.0 | 100.0 | | 97.0 |
| 3/8" | | 81 | | 71.2 | 100.0 | 100.0 | | 81.3 |
| #4 | | 40 | | 10.6 | 92.2 | 99.0 | | 40.2 |
| #8 | | 28 | | 3.0 | 62.4 | 91.0 | | 28.1 |
| #16 | | 23 | | 2.8 | 43.8 | 80.0 | | 22.6 |
| #30 | | 17 | | 2.5 | 25.2 | 69.1 | | 17.0 |
| #50 | | 8 | | 2.0 | 18.2 | 21.8 | | 8.2 |
| #100 | | 4.4 | | 1.2 | 14.6 | 4.6 | | 4.4 |
| #200 | | 3.2 | | 0.8 | 11.9 | 2.0 | | 3.2 |

NCAT Furnace Corr. Factor: N/A
Loss On Ignition: 22.1
Theoretical Maximum Density: 2.440
AC in RAP: 0.0

Requested _____ Contractor

Approved _____ Region Materials Engineer

Approved _____ Region Construction Engineer

Approved _____ Engineer of Materials and Tests

# MARSHALL ASPHALT MIX DESIGN SUMMARY

DESIGN NO. _____
TYPE OF MIX Superpave 12.5 mm
PROJECT NO. 52002-4529-04
PROJECT REFERENCE NO. SP

CONTRACT NO. 4770
COUNTY Lincoln
LAYER Surface
CONTRACTOR Lincoln Paving

DATE 5-Aug-97
SERIAL NO. _____
REGION III

| SAMPLE NO. | ASPHALT CONTENT | SP. GR. of MAR. SAMP. | THEO. GR. OF MIX | % THEO. GRAV. | VOIDS IN TOTAL MIX | VOIDS IN MIN. AGG. | VOIDS FILLED W/ ASPHALT | MARSHALL STABILITY | MARSHALL FLOW | NO. BLOWS MAR. HAM. |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 4.8 | 2.328 | 2.457 | 94.76 | 5.24 | 16.1 | 67.4 | 2566.67 | 11.3 | 75 |
| 2 | 5.3 | 2.346 | 2.440 | 96.15 | 3.85 | 15.9 | 75.8 | 2466.67 | 15.3 | 75 |
| 3 | 5.8 | 2.359 | 2.422 | 97.41 | 2.59 | 15.9 | 83.6 | 2450.00 | 12.7 | 75 |
| 4 | 0 | #DIV/0! | 2.641 | #DIV/0! | #DIV/0! | #DIV/0! | #DIV/0! | #DIV/0! | #DIV/0! | 75 |
| OPT | 5.3 | 2.346 | 2.440 | 96.15 | 3.85 | 15.9 | 75.8 | 2466.67 | 15.3 | 75 |

| | TOTAL % PASSING | | | | | | | GRAD |
|---|---|---|---|---|---|---|---|---|
| MTLS. | 1 | 2 | 3 | 4 | 5 | JMF | LAB | CAL. |
| % | 0 | 65 | 20 | 15 | 0 | 100 | 100 | |
| 1.5" (37.5mm) | | 100 | 100 | 100 | | 100.0 | 100.0 | |
| 1" (25.0mm) | | 100 | 100 | 100 | | 100.0 | 100.0 | |
| 3/4" (19.0mm) | | 100 | 100 | 100 | | 100.0 | 100.0 | |
| 1/2" (12.5mm) | | 95.4 | 100 | 100 | | 97 | 96.6 | |
| 3/8" (9.5mm) | | 71.2 | 100 | 100 | | 81.3 | 81.6 | |
| #4 (4.75mm) | | 10.6 | 92.2 | 99 | | 40.2 | 43.6 | |
| #8 (2.36mm) | | 3 | 62.4 | 91 | | 28.1 | 28.4 | |
| #16 (1.18mm) | | 2.8 | 43.8 | 80 | | 22.6 | 22.4 | |
| #30 (600mm) | | 2.5 | 25.2 | 69.1 | | 17 | 17.2 | |
| #50 (300mm) | | 2 | 18.2 | 21.8 | | 8.2 | 8.9 | |
| #100 (150mm) | | 1.2 | 14.6 | 4.6 | | 4.4 | 5.0 | |
| #200 (75mm) | | 0.8 | 11.9 | 2 | | 3.2 | 3.9 | |

PRODUCERS

1) _____
2) Burns Stone, Dickson, TN
3) Lincoln Rock, Fayetteville, TN
4) Cumberland Mtn. Sand, Hillsboro, TN
5) _____
Asphalt Southern States, Nashville, TN
Anti-Strip Pave Bond Lite

Recommended 5.3 Asphalt Content
Rice Specific Gravity 2.440

Bulk Sp. Gr. 2.572
Eff. Sp. Gr. 2.641
App. Sp. Gr. 2.705

Absorption 1.90
Fract. Face N/A
Glassy Part. N/A

NCAT Corr. Factor N/A
L.O.I. 22.1
A.C. in RAP _____

DAR 0.73
Eff. AC Content 4.31
TSR 93.6
Conditioned Ten. Str. 722.5

## SUPERPAVE ASPHALT MIX DESIGN SUMMARY

BLEND NAME Blend 1 | CONTRACT NO. 4770 | DATE 8/15/97
TYPE OF MIX 411-S | COUNTY Lincoln | REGION III
PROJECT NO. 52002-4529-04 | LAYER Surface | LOG-IN
PROJECT REFERENCE NO. SP | CONTRACTOR Lincoln Paving

| SAMPLE | ASPHALT CONTENT | BULK GRAV. MEASURED | BULK GRAV. AT Ndes | THEO. GRAV. OF MIX | AIR VOIDS AT Ndes | VMA BULK GRAV. | VMA EFF. GRAV. | VFA BULK GRAV. | VFA EFF. GRAV. | % TMD AT Ni | % TMD AT Nmax | EFF AC CONTENT | DUST PROPORTION | PROJ. OPTIMUM |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 5.0 | 2.365 | 2.329 | 2.436 | 4.6 | 14.3 | 16.0 | 67.9 | 71.3 | 85.1 | 97.1 | 4.3 | 0.7 | 5.2 |
| 2 | 5.5 | 2.381 | 2.342 | 2.429 | 3.6 | 14.1 | 15.8 | 74.3 | 77.0 | 85.7 | 98.0 | 4.6 | 0.7 | 5.4 |
| 3 | 6.0 | 2.379 | 2.340 | 2.408 | 2.8 | 14.6 | 16.3 | 80.9 | 82.9 | 86.5 | 98.8 | 5.2 | 0.6 | 5.5 |
| | | | | | | | | | | | | | | |
| OPT. | 5.3 | 2.375 | 2.334 | 2.431 | 4.0 | 14.2 | 16.0 | 71.8 | 75.0 | 85.3 | 97.7 | 4.4 | 0.73 | 5.3 |

| | TOTAL % PASSING | | | | | |
|---|---|---|---|---|---|---|
| MILS | 1 | 2 | 3 | 4 | 5 | JMF |
| % | 65 | 20 | 15 | | | |
| 1.5" (37.5mm) | | | | | | |
| 1" (25.0mm) | | | | | | |
| 3/4" (19.0mm) | 100 | | | | | 100 |
| 1/2" (12.5mm) | 95.4 | | | | | 97.0 |
| 3/8" (9.5mm) | 71.2 | 100 | 100 | | | 81.3 |
| #4 (4.75mm) | 10.6 | 92.2 | 99.0 | | | 40.2 |
| #8 (2.36mm) | 3.0 | 62.4 | 91.0 | | | 28.1 |
| #16 (1.18mm) | 2.8 | 43.8 | 80.0 | | | 22.6 |
| #30 (600mm) | 2.5 | 25.2 | 69.1 | | | 17.0 |
| #50 (300mm) | 2.0 | 18.2 | 21.8 | | | 8.2 |
| #100 (150mm) | 1.2 | 14.6 | 4.6 | | | 4.4 |
| #200 (75mm) | 0.8 | 11.9 | 2.0 | | | 3.2 |

| PROPERTY | SHRP | MARSHALL |
|---|---|---|
| EFFECTIVE GRAV. | 2.631 | 2.641 |
| RICE GRAV. AT OPT. | 2.431 | 2.440 |
| ASPHALT ABS. | 0.81 | 0.95 |
| % AC AT 4% VTM | 5.3 | 5.2 |
| | | |
| | | |
| | | |
| | | |

} Contractor equip.

| BLEND PROPERTIES | |
|---|---|
| FINE AGG. ANG. | 44.10 |
| TSR | |
| WET ST (psi) | |
| GSI | |
| RUT DEPTH (in) | |
| $G_{se}$ | 2.576 |
| $G_{sb}$ | 2.706 |
| WATER ABS. | 1.86 |

### MATERIALS AND PRODUCERS

1) "D" Rock, Bucy Stone, Dickson, TN
2) #10's, Lincoln Rock, Fayetteville, TN
3) Mtn. Sand, Cumberland Mtn. Sand, Hillsboro, TN
4)
5)
Asphalt Southern States PG 64-22, Nashville, TN
Anti-Strip

## Mixture Summary Report for Varying %AC Analysis

| | | | |
|---|---|---|---|
| **Project Name:** | LINCOLN CO, PAVING C/N 477 | **N Initial:** | 8 |
| **Workbook Name:** | SHRPDES1.XLS | **N Design:** | 96 |
| **Technician:** | LANE | **N Max:** | 152 |
| **Date:** | 7/24/97 | **Nom. Sieve Size:** | 12.5 mm |
| **Asphalt Grade:** | PG64-22 | **Compaction Temperature:** | 149 °C |
| | | **Mixture Temperature:** | 154°C |
| **Design ESAL's (millions):** | 4 | **Depth from Surface (mm):** | 0 |
| **Design Temperature:** | 38°C | **Mold Size:** | 150 mm |

| | Results | | | | |
|---|---|---|---|---|---|
| **Property** | **5** | **5.5** | **6** | **Blend 4** | **Criteria** |
| %AC | 5.0 | 5.5 | 6.0 | | |
| %Air Voids ($V_a$) | 4.6 | 3.6 | 2.8 | | 4.0 % |
| %VMA | 14.3 | 14.1 | 14.6 | | 14.0 % Min. |
| %VFA | 67.9 | 74.3 | 80.9 | | 65.0 % Min.<br>75.0 % Max. |
| Dust/Asphalt Ratio | 0.7 | 0.7 | 0.6 | | 0.6-1.2 % |
| Max. Specific Gravity ($G_{mm}$) | 2.436 | 2.429 | 2.408 | 0.000 | |
| Bulk Specific Gravity ($G_{mb}$) | 2.365 | 2.361 | 2.379 | | |
| %$G_{mm}$ @ $N_{ini}$ | 85.1 | 85.7 | 86.5 | | 89.0 % Max. |
| %$G_{mm}$ @ $N_{max}$ | 97.1 | 98.0 | 98.8 | | 98.0 % Max. |
| Effective Sp. Gravity of Blend ($G_{se}$) | 2.624 | 2.637 | 2.632 | | --- |
| Sp. Gravity of Binder ($G_b$) | 1.032 | 1.032 | 1.032 | | --- |
| Sp. Gravity of Aggregate ($G_{sb}$) | 2.576 | 2.576 | 2.576 | | --- |

**Maury County**

**Contract No.: 4865 60017-4214-04**

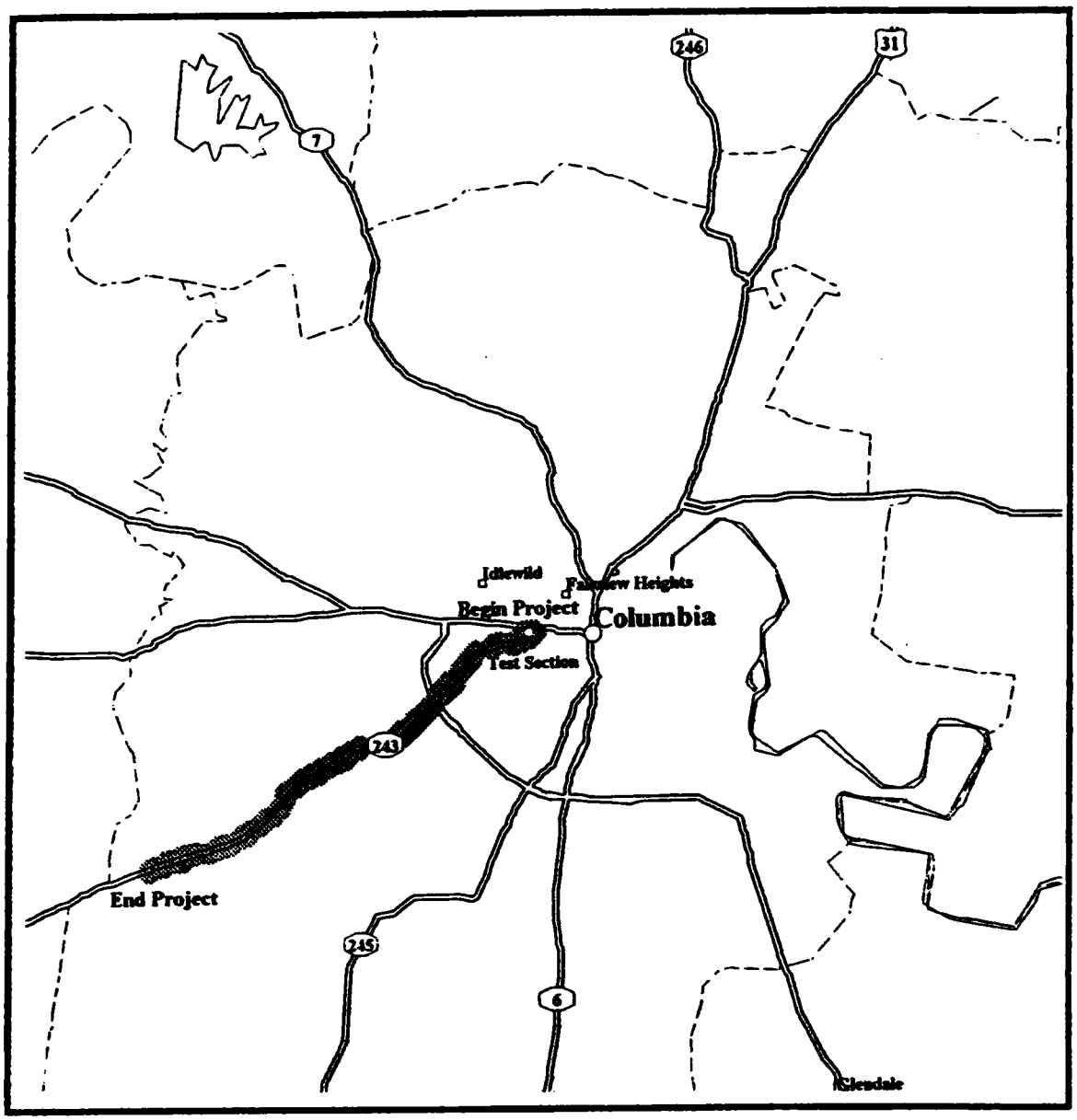
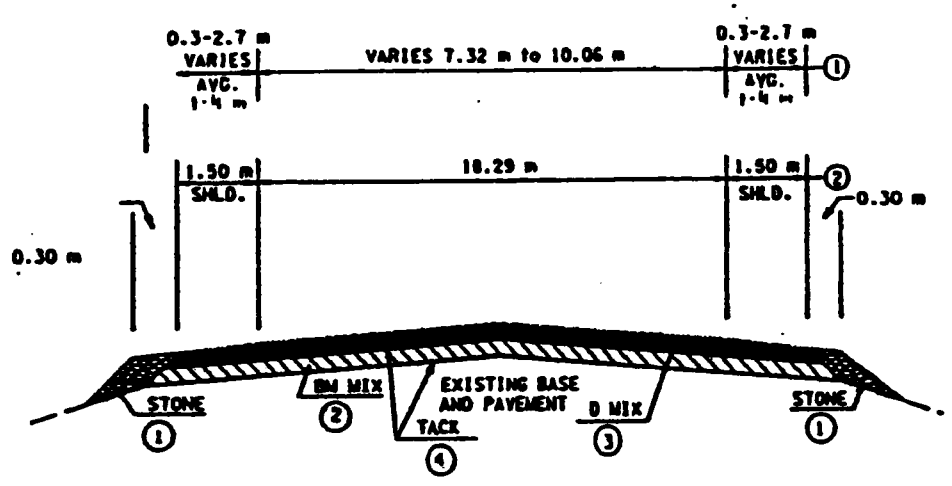



**Figure A.9 Site Vicinity Map**
**Maury County**
**Contract No.: 4865**
**Project No.: 60017-4214-04**




## PAVEMENT SCHEDULE

① STONE @ 80 mm ± THICK
303MD1 MIN. AGG.,TYPE A BASE,GRADING "D"

② BINDER @ 50 mm ± THICK (APPROX. 120.6 kg/m2)
307M10.10 SUPERPAVE BINDER MIX (SPMB-HM)

③ SURFACE @ 35 mm ± THICK (APPROX. 79.8 kg/m2)
411M10.01 MIN. AGG., SUPERPAVE SURFACE MIX
411M10.02 ASPHALT CEMENT, SUPERPAVE SURFACE MIX (PG64-22)

④ TACK COAT
403MD1 BIT. MAT'L FOR TACK COAT (TC) @ 0.09 L/m2

**Figure A.10 Pavement Cross Section**
**Maury County**
**Contract No.: 4865**
**Project No.: 60017-4214-04**

# Maury County Mix Design

# STATE OF TENNESSEE ASPHALT JOB MIX FORMULA

Date: 8/5/97

Project Ref. No. SP | County Maury | Region III
Proj. No. 60017-4214-04 | Layer Surface | Contract No. 4865
Type Superpave 12.5 mm | Sec. No. 411M10.01, 411M10.02 | Article SP 411-S
Contractor Lojac Enterprises | Subcontractor
St. Route 243 | Total Mix including Bitumen | Date of Letting 6/13/97

| Material | Size Range or Type | Producer and Address | % Used |
|---|---|---|---|
| | | | 0.00 |
| MCA "D" rock | 5/8"-Pan | Burns Stone, Dickson, TN | 54.58 |
| Scr #10's | 3/8"-Pan | Burns Stone, Dickson, TN | 11.29 |
| Man. Sand | 3/8"-Pan | Columbia Rock, Columbia, TN | 18.82 |
| Riv. Sand | 3/8"-Pan | Teague Sand, Perryville, TN | 9.41 |
| Asphalt Cement | PG 64-22 | Ergon, Nashville, TN | 5.90 |
| Anti-Strip | Pave Bond Lite | Dosage Rate: 0.3% | |
| % Fractured Faces on +4 Material: | N/A | % Glassy Particles on +4 Material | N/A | 100.0 |

| 100 PERCENT MINERAL AGGREGATE | | | AGGREGATE ANALYSIS TOTAL PERCENT PASSING | | | | | |
|---|---|---|---|---|---|---|---|---|
| Screen | Tit. Passing Design Range | Requested Percent | 0 Percent | MCA "D" rock Percent | Scr #10's Percent | Man. Sand Percent | Riv. Sand Percent | Calculated Mix |
| | | | | 58.0 | 12.0 | 20.0 | 10.0 | 100.0 |
| Temp | | 300 F | | | | | | |
| % AC | | 5.9 | | | | | | |
| Compaction Temp: | | 320-290 | | NCAT Furnace Corr. Factor: | | | N/A | |
| Mixing Temp: | | 320-315 | | Loss On Ignition: | | | 22.4 | |
| | | | | Theoretical Maximum Density: | | | 2.408 | |
| | | | | AC in RAP: | | | 0.0 | |
| | | | | (Washed Gradations) | | | | |
| 2" | | 100 | | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| 1 1/2" | | 100 | | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| 1" | | 100 | | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| 3/4" | | 100 | | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| 1/2" | | 98 | | 97.0 | 100.0 | 100.0 | 100.0 | 98.3 |
| 3/8" | | 83 | | 70.0 | 100.0 | 100.0 | 100.0 | 82.6 |
| #4 | | 47 | | 11.0 | 97.0 | 98.0 | 98.0 | 47.4 |
| #8 | | 31 | | 4.0 | 74.0 | 55.0 | 88.0 | 31.0 |
| #16 | | 22 | | 3.0 | 52.0 | 32.0 | 72.0 | 21.6 |
| #30 | | 14 | | 2.5 | 29.0 | 17.0 | 57.0 | 14.0 |
| #50 | | 7 | | 2.0 | 19.0 | 12.0 | 13.0 | 7.1 |
| #100 | | 4.6 | | 1.9 | 14.0 | 8.0 | 2.0 | 4.6 |
| #200 | | 3.4 | | 1.8 | 11.0 | 4.9 | 1.0 | 3.4 |

Requested _____ Contractor

Approved _____ Region Materials Engineer

Approved _____ Region Construction Engineer

Approved _____ Engineer of Materials and Tests

# MARSHALL ASPHALT MIX DESIGN SUMMARY

DESIGN NO. _____ CONTRACT NO. 4865 DATE 5-Aug-97
TYPE OF MIX Superpave 12.5 mm COUNTY Maury SERIAL NO. _____
PROJECT NO. 60017-4214-04 LAYER Surface REGION III
PROJECT REFERENCE NO. SP CONTRACTOR Lojac Enterprises

| SAMPLE NO. | ASPHALT CONTENT | SP. GR. of MAR. SAMP. | THEO. GR. OF MIX | % THEO. GRAV. | VOIDS IN TOTAL MIX | VOIDS IN MIN. AGG. | VOIDS FILLED W/ ASPHALT | MARSHALL STABILITY | MARSHALL FLOW | NO. BLOWS MAR. HAM. |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 5.4 | 2.271 | 2.425 | 93.64 | 6.36 | 18.2 | 65.1 | 12.53 | 2.7 | 75 |
| 2 | 5.9 | 2.320 | 2.408 | 96.33 | 3.67 | 16.9 | 78.3 | 11.95 | 3.0 | 75 |
| 3 | 6.4 | 2.327 | 2.391 | 97.31 | 2.69 | 17.1 | 84.2 | 10.16 | 3.0 | 75 |
| 4 | 0 | #DIV/0! | 2.627 | #DIV/0! | #DIV/0! | #DIV/0! | #DIV/0! | #DIV/0! | #DIV/0! | 75 |
| OPT | 5.9 | 2.320 | 2.408 | 96.33 | 3.67 | 16.9 | 78.3 | 11.95 | 3.0 | 75 |

| | TOTAL % PASSING | | | | | | | GRAD |
|---|---|---|---|---|---|---|---|---|
| MTLS. | 1 | 2 | 3 | 4 | 5 | JMF | LAB | CAL. |
| % | 0 | 58 | 12 | 20 | 10 | 100 | 100 | |
| 1.5" (37.5mm) | | 100 | 100 | 100 | 100 | 100.0 | 100.0 | |
| 1" (25.0mm) | | 100 | 100 | 100 | 100 | 100.0 | 100.0 | |
| 3/4" (19.0mm) | | 100 | 100 | 100 | 100 | 100.0 | 100.0 | |
| 1/2" (12.5mm) | | 97 | 100 | 100 | 100 | 98.3 | 98.3 | |
| 3/8" (9.5mm) | | 70 | 100 | 100 | 100 | 82.6 | 82.6 | |
| #4 (4.75mm) | | 11 | 97 | 98 | 98 | 47.4 | 49.0 | |
| #8 (2.36mm) | | 4 | 74 | 55 | 88 | 31 | 32.3 | |
| #16 (1.18mm) | | 3 | 52 | 32 | 72 | 21.6 | 23.0 | |
| #30 (600mm) | | 2.5 | 29 | 17 | 57 | 14 | 16.8 | |
| #50 (300mm) | | 2 | 19 | 12 | 13 | 7.1 | 9.5 | |
| #100 (150mm) | | 1.9 | 14 | 8 | 2 | 4.6 | 5.8 | |
| #200 (75mm) | | 1.8 | 11 | 4.9 | 1 | 3.4 | 4.0 | |

PRODUCERS

1) _____
2) Burns Stone, Dickson, TN
3) Burns Stone, Dickson, TN
4) Columbia Rock, Columbia, TN
5) Teague Sand, Perryville, TN
Asphalt Ergon, Nashville, TN
Anti-Strip Pave Bond Lite

Recommended 5.9 Asphalt Content
Rice Specific Gravity 2.408

Bulk Sp. Gr. 2.582 Absorption 1.78 NCAT Corr. Factor N/A DAR 0.68
Eff. Sp. Gr. 2.628 Fract. Face N/A L.O.I. 22.4 Eff. AC Content 5.24
App. Sp. Gr. 2.706 Glassy Part. N/A A.C. in RAP _____ TSR 85.0
Conditioned Ten. Str. 1033.1

## SUPERPAVE ASPHALT MIX DESIGN SUMMARY

BLEND NAME Blend 3 CONTRACT NO. 4865 DATE 8/15/97
TYPE OF MIX 411-S 12.5 mm COUNTY Maury REGION III
PROJECT NO. 60017-4214-04 LAYER Surface LOG-IN 54 APA
PROJECT REFERENCE NO. SP CONTRACTOR Logue Enterprises

| SAMPLE | ASPHALT CONTENT | BULK GRAV MEASURED | BULK GRAV. AT Ndes | THEO. GRAV. OF MIX | AIR VOIDS AT Ndes | VMA BULK GRAV. | VMA EFF. GRAV. | VFA BULK GRAV. | VFA EFF. GRAV. | % TMD AT Ni | % TMD AT Nmax | EFF AC CONTENT | DUST PROPORTION | PROJ. OPTIMUM |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 5.4 | 2.311 | 2.275 | 2.438 | 6.7 | 16.4 | 18.6 | 59.2 | 63.9 | 83.8 | 94.8 | 4.4 | 0.9 | 6.5 |
| | 5.6 | 2.350 | 2.312 | 2.431 | 4.9 | 15.2 | 17.4 | 68.0 | 72.0 | 85.2 | 96.7 | 4.6 | 0.9 | 5.9 |
| | 5.9 | 2.359 | 2.321 | 2.420 | 4.1 | 15.2 | 17.3 | 73.1 | 76.5 | 86.0 | 97.5 | 4.9 | 0.8 | 5.9 |
| | 6.3 | 2.360 | 2.323 | 2.407 | 3.5 | 15.5 | 17.7 | 77.4 | 80.2 | 86.3 | 98.1 | 5.3 | 0.8 | 6.1 |
| OPT. | 5.9 | 2.359 | 2.321 | 2.420 | 4.1 | 15.2 | 17.3 | 73.1 | 76.5 | 86.0 | 97.5 | 4.9 | 0.8 | 5.9 |

| | TOTAL % PASSING | | | | | |
|---|---|---|---|---|---|---|
| MTLS | 1 | 2 | 3 | 4 | 5 | JMF |
| % | 38 | 12 | 20 | 10 | | 100 |
| 1.5" (37.5mm) | | | | | | |
| 1" (25.0mm) | | | | | | |
| 3/4" (19.0mm) | 100 | | | | | 100 |
| 1/2" (12.5mm) | 97 | | | | | 98.3 |
| 3/8" (9.5mm) | 70 | 100 | 100 | 100 | | 82.6 |
| #4 (4.75mm) | 11 | 97 | 98 | 98 | | 47.4 |
| #8 (2.36mm) | 4 | 74 | 55 | 88 | | 31.0 |
| #16 (1.18mm) | 3 | 52 | 32 | 72 | | 21.6 |
| #30 (600mm) | 2.5 | 29 | 17 | 57 | | 14.0 |
| #50 (300mm) | 2 | 19 | 12 | 13 | | 7.1 |
| #100 (150mm) | 1.9 | 14 | 8 | 2 | | 4.6 |
| #200 (75mm) | 1.8 | 11 | 4.9 | 1 | | 3.4 |

| PROPERTY | SHRP | MARSHALL |
|---|---|---|
| EFFECTIVE GRAV. | 2.643 | 2.627 |
| RICE GRAV. AT OPT. | 2.420 | 2.408 |
| ASPHALT ABS. | 1.0 | 0.77 |
| % AC AT 4% VTM | 5.9 | 5.8 |
| | | |
| | | |
| | | |
| | | |

| BLEND PROPERTIES | |
|---|---|
| FINE AGG. ANG. | 45.5 |
| TSR | 85.0 |
| WET ST (psi) | 1616.6 |
| GSI | 1.10 |
| RUT DEPTH (in) | 0.455 |
| $G_{sb}$ | 2.575 |
| $G_{se}$ | 2.706 |
| WATER ABS. | 1.88 |

### MATERIALS AND PRODUCERS

1) 5/8" D Burns Stone, Dickson, TN
2) Hard #10's, Burns Stone, Dickson, TN
3) Man. Sand, Columbia Rock, Columbia, TN
4) Nat. Sand, Teague Sand, Perryville, TN
5)

Asphalt Ergon PG 64-22
Anti-Strip Pavebond Lite

## Mixture Summary Report for Varying %AC Analysis

| | | | |
|---|---|---|---|
| **Project Name:** | MAURY CO. 12.5 mm LOJAC, P | **N Initial:** | 8 |
| **Workbook Name:** | SHRPDES1.XLS | **N Design:** | 96 |
| **Technician:** | LANE and FORD | **N Max:** | 152 |
| **Date:** | 8/4/97 | **Nom. Sieve Size:** | 12.5 mm |
| **Asphalt Grade:** | PG64-22 | **Compaction Temperature:** | 149 °C |
| | | **Mixture Temperature:** | 154°C |
| **Design ESAL's (millions):** | 4 | **Depth from Surface (mm):** | 0 |
| **Design Temperature:** | 38°C | **Mold Size:** | 150 mm |

| | Results | | | | |
|---|---|---|---|---|---|
| **Property** | **5.4** | **5.6** | **5.9** | **6.3** | **Criteria** |
| %AC | 5.4 | 5.6 | 5.9 | 6.3 | |
| %Air Voids ($V_a$) | 6.7 | 4.9 | 4.1 | 3.5 | 4.0 % |
| %VMA | 16.4 | 15.2 | 15.2 | 15.5 | 14.0 % Min. |
| %VFA | 59.2 | 68.0 | 73.1 | 77.4 | 65.0 % Min.<br>75.0 % Max. |
| Dust/Asphalt Ratio | 0.9 | 0.9 | 0.8 | 0.8 | 0.6-1.2 % |
| Max. Specific Gravity ($G_{mm}$) | 2.438 | 2.431 | 2.420 | 2.407 | |
| Bulk Specific Gravity ($G_{mb}$) | 2.311 | 2.350 | 2.359 | 2.360 | |
| $\%G_{mm}$ @ $N_{in}$ | 83.8 | 85.2 | 86.0 | 86.3 | 89.0 % Max. |
| $\%G_{mm}$ @ $N_{max}$ | 94.8 | 96.7 | 97.5 | 98.1 | 98.0 % Max. |
| Effective Sp. Gravity of Blend ($G_{se}$) | 2.643 | 2.643 | 2.642 | 2.643 | — |
| Sp. Gravity of Binder ($G_b$) | 1.034 | 1.034 | 1.034 | 1.034 | — |
| Sp. Gravity of Aggregate ($Ge_b$) | 2.575 | 2.575 | 2.575 | 2.575 | — |

**Madison County**

**Contract No.: 4714 Project No.: 57010-4208-04**

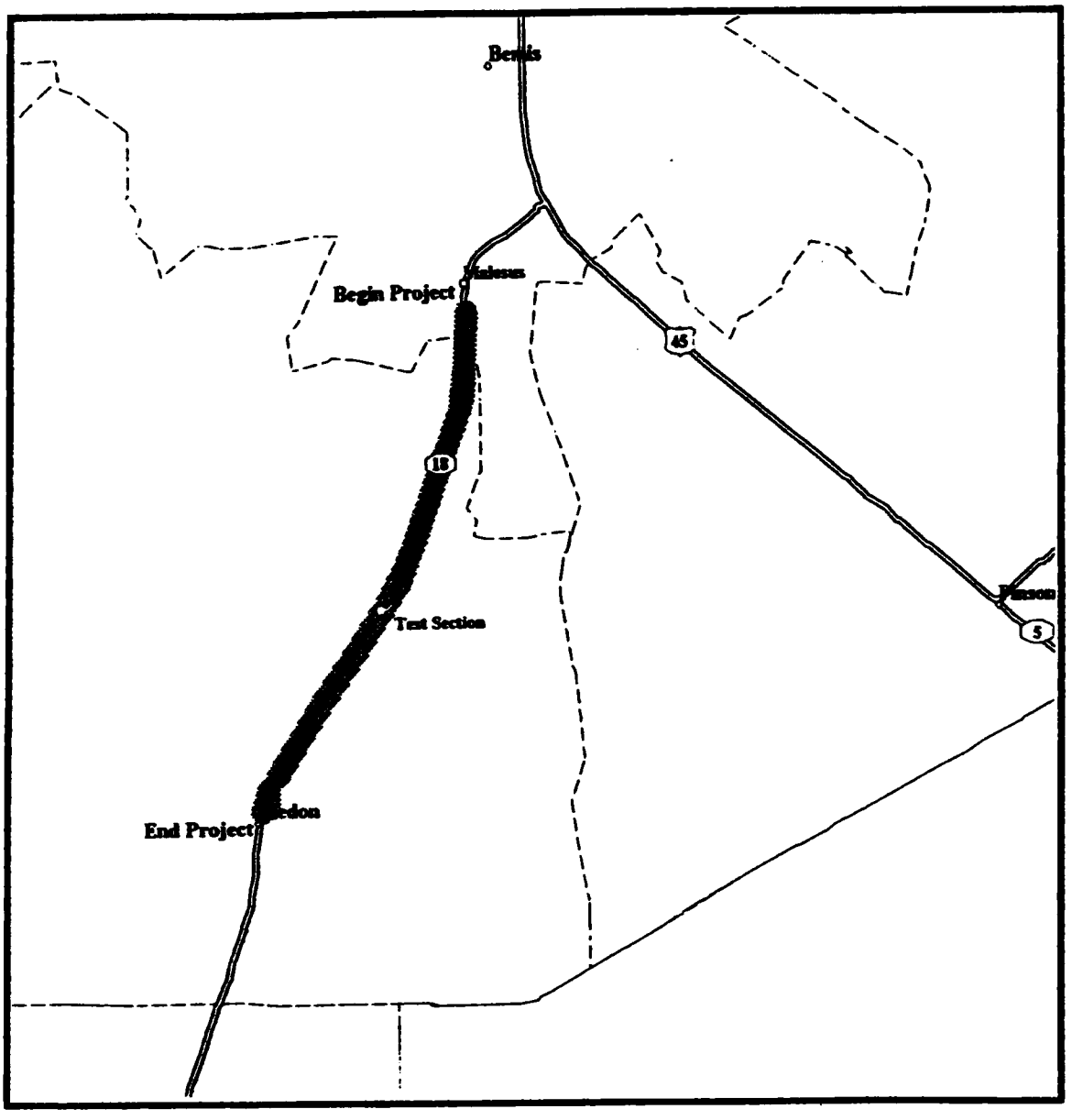
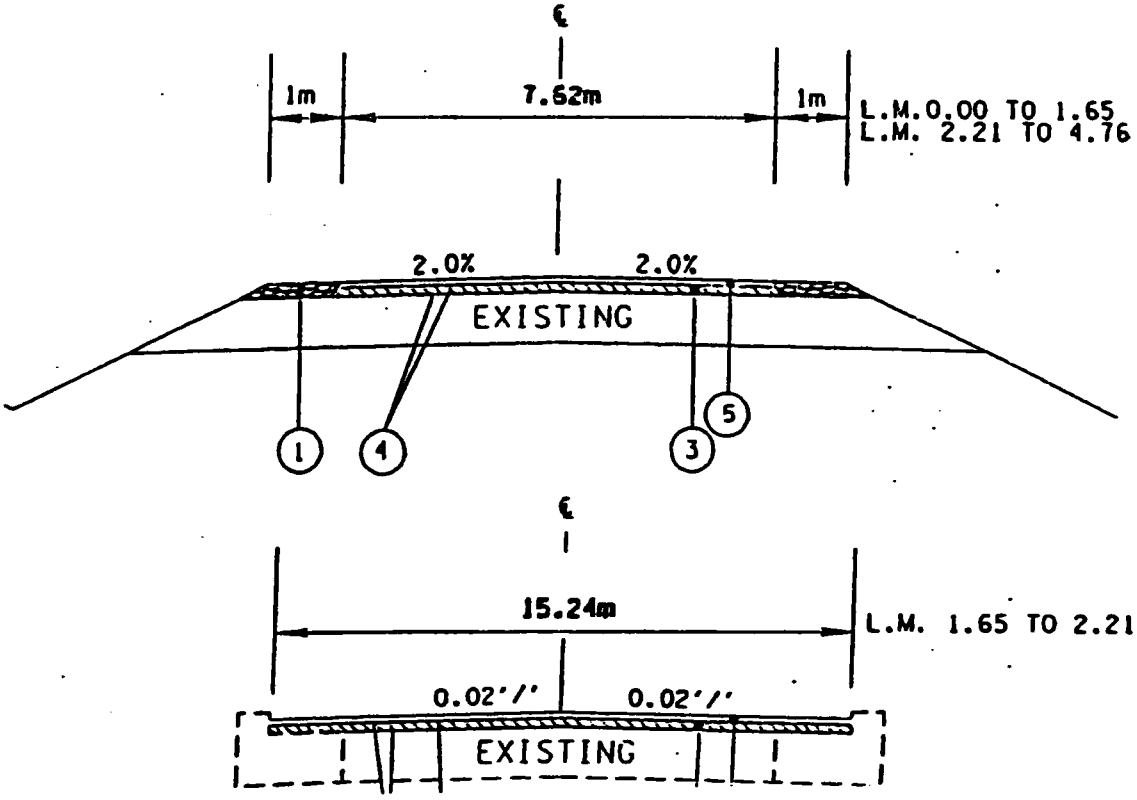



**Figure A.11 Site Vicinity Map**
**Madison County**
**Contract No.: 4714**
**Project No.: 57010-4208-04**




| |
|---|
| (2) BITUMINOUS BASE COURSE (BLACK BASE) @ 205mm +/- THICK (APPROX. 435.32kg./m2) |
| (3) BITUMINOUS COURSE ( BINDER) @ 50mm +/- THICK (APPROX. 120kg/m2) |
| (4) TACK COAT |
| (5) BITUMINOUSE SURFACE (ACS @ 35mm +/- THICK (APPROX. 84kg/m2) |
| (6) COLD PLANING (@ 100mm +/- THICK (APPROX. 2.24 kg/m2) |

**Figure A.12 Pavement Cross Section**
**Madison County**
**Contract No.: 4714**
**Project No.: 57010-4208-04**

# Madison County Mix Design

# (Surface)

# STATE OF TENNESSEE ASPHALT JOB MIX FORMULA

Date: 8/6/97

Project Ref. No. SP County Madison Region IV
Proj. No. 57010-4208-04 Layer Surface Contract No. 4714
Type Superpave 12.5 mm Sec. No. SP 411-S Article
Contractor Ford Construction Subcontractor
St. Route 18 Total Mix including Bitumen Date of Letting 4/25/97

| Material | Size Range or Type | Producer and Address | % Used |
|---|---|---|---|
| | | | 0.00 |
| "D" Rock | 5/8"-Pan | Adamsville Sand & Gravel, Adamsville, TN | 60.71 |
| #10 Block | 3/8"-Pan | Vulcan Materials, Parsons, TN | 11.21 |
| Screw Sand | 3/8"-Pan | Vulcan Materials, Holladay, TN | 12.14 |
| River Sand | 3/8"-Pan | Dement Sand, Denmark, TN | 9.34 |
| Asphalt Cement | PG 64-22 | Ergon, Memphis, TN | 6.60 |
| Anti-Strip | Perma-Tac | Dosage Rate: 0.3% | |
| % Fractured Faces on +4 Material: | 79.8 | % Glassy Particles on +4 Material N/A | 100.0 |

| 100 PERCENT MINERAL AGGREGATE | | | AGGREGATE ANALYSIS TOTAL PERCENT PASSING | | | | | |
|---|---|---|---|---|---|---|---|---|
| Screen | Tlt. Passing Design Range | Requested Percent | 0 Percent | "D" Rock Percent | #10 Block Percent | Screw Sand Percent | River Sand Percent | Calculated Mix |
| Temp | | 300 F | 0.0 | 65.0 | 12.0 | 13.0 | 10.0 | 100.0 |
| % AC | | 6.6 | | | | | | |
| Compaction Temp: | | 295-305 | | NCAT Furnace Corr. Factor: | | | 0.33 | |
| Mixing Temp: | | 305-315 | | Loss On Ignition: | | | 11.5 | |
| | | | | Theoretical Maximum Density: | | | 2.265 | |
| | | | | AC in RAP: | | | 0.0 | |
| | | | (Washed Gradations) | | | | | |
| 2" | | 100 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| 1 1/2" | | 100 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| 1" | | 100 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| 3/4" | | 100 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| 1/2" | | 97 | 100.0 | 95.0 | 100.0 | 100.0 | 100.0 | 96.8 |
| 3/8" | | 84 | 100.0 | 75.0 | 100.0 | 100.0 | 100.0 | 83.8 |
| #4 | | 54 | 100.0 | 35.0 | 73.0 | 93.8 | 100.0 | 53.7 |
| #8 | | 33 | 100.0 | 17.0 | 14.0 | 80.4 | 99.0 | 33.1 |
| #16 | | 24 | 100.0 | 13.0 | 8.0 | 51.1 | 81.0 | 24.2 |
| #30 | | 16 | 100.0 | 8.0 | 6.5 | 32.7 | 59.0 | 16.1 |
| #50 | | 9 | 100.0 | 6.0 | 6.0 | 22.4 | 14.0 | 8.9 |
| #100 | | 5.5 | 100.0 | 5.0 | 5.5 | 9.9 | 3.0 | 5.5 |
| #200 | | 4.3 | 100.0 | 4.0 | 4.5 | 7.0 | 2.0 | 4.3 |

Requested _____ Approved _____
Contractor Region Materials Engineer

Approved _____ Approved _____
Region Construction Engineer Engineer of Materials and Tests

# MARSHALL ASPHALT MIX DESIGN SUMMARY

DESIGN NO. _____ CONTRACT NO. 4714 DATE 6-Jun-97
TYPE OF MIX Superpave 12.5 mm COUNTY Madison SERIAL NO. _____
PROJECT NO. 57010-4208-04 LAYER Surface REGION IV
PROJECT REFERENCE NO. SP CONTRACTOR Ford Construction

| SAMPLE NO. | ASPHALT CONTENT | SP. GR. of MAR. SAMP. | THEO. GR. OF MIX | % THEO. GRAV. | VOIDS IN TOTAL MIX | VOIDS IN MIN. AGG. | VOIDS FILLED W/ ASPHALT | MARSHALL STABILITY | MARSHALL FLOW | NO. BLOWS MAR. HAM. |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 6.1 | 2.140 | 2.279 | 93.86 | 6.12 | 18.8 | 67.4 | 2266.67 | 12.5 | 75 |
| 2 | 6.6 | 2.150 | 2.265 | 94.96 | 5.04 | 18.8 | 73.2 | 2316.67 | 12.8 | 75 |
| 3 | 7.1 | 2.163 | 2.250 | 96.14 | 3.86 | 18.7 | 79.4 | 2133.33 | 13.0 | 75 |
| 4 | 0 | #DIV/0! | 2.473 | #DIV/0! | #DIV/0! | #DIV/0! | #DIV/0! | #DIV/0! | #DIV/0! | 75 |
| OPT | 6.6 | 2.150 | 2.265 | 94.96 | 5.04 | 18.8 | 73.2 | 2316.67 | 12.8 | 75 |

| | TOTAL % PASSING | | | | | | | GRAD |
|---|---|---|---|---|---|---|---|---|
| MTLS. | 1 | 2 | 3 | 4 | 5 | JMF | LAB | CAL. |
| % | 0 | 65 | 12 | 13 | 10 | 100 | 100 | |
| 1.5" (37.5mm) | | 100 | 100 | 100 | 100 | 100.0 | 100.0 | |
| 1" (25.0mm) | | 100 | 100 | 100 | 100 | 100.0 | 100.0 | |
| 3/4" (19.0mm) | | 100 | 100 | 100 | 100 | 100.0 | 100.0 | |
| 1/2" (12.5mm) | | 95 | 100 | 100 | 100 | 96.8 | 97.0 | |
| 3/8" (9.5mm) | | 75 | 100 | 100 | 100 | 83.8 | 84.1 | |
| #4 (4.75mm) | | 35 | 73 | 93.8 | 100 | 53.7 | 55.0 | |
| #8 (2.36mm) | | 17 | 14 | 80.4 | 99 | 33.1 | 33.9 | |
| #16 (1.18mm) | | 13 | 8 | 51.1 | 81 | 24.2 | 25.0 | |
| #30 (600mm) | | 8 | 6.5 | 32.7 | 59 | 16.1 | 17.3 | |
| #50 (300mm) | | 6 | 6 | 22.4 | 14 | 8.9 | 9.9 | |
| #100 (150mm) | | 5 | 5.5 | 9.9 | 3 | 5.5 | 6.4 | |
| #200 (75mm) | | 4 | 4.5 | 7 | 2 | 4.3 | 4.3 | |

PRODUCERS

1) _____
2) Adamsville Sand & Gravel, Adamsville, TN
3) Vulcan Materials, Parsons, TN
4) Vulcan Materials, Holladay, TN
5) Dement Sand, Denmark, TN
Asphalt Ergon, Memphis, TN
Anti-Strip Perma-Tac

Recommended 6.6 Asphalt Content
Rice Specific Gravity 2.265

Bulk Sp. Gr. 2.416 Absorption 3.54 NCAT Corr. Factor 0.33 DAR 0.65
Eff. Sp. Gr. 2.473 Fract. Face 79.8 L.O.I. 11.5 Eff. AC Content 5.68
App. Sp. Gr. 2.642 Glassy Part. N/A A.C. in RAP 0.0 TSR 99.8
Conditioned Ten. Str. 78.6

## SUPERPAVE ASPHALT MIX DESIGN SUMMARY

BLEND NAME Medium (Blend 2) CONTRACT NO. 4714 DATE 6/9/97
TYPE OF MIX 411-S COUNTY Madison REGION IV
PROJECT NO. 57010-4208-04 LAYER Surface LOG-IN
PROJECT REFERENCE NO. SP CONTRACTOR Ford Construction

| SAMPLE | ASPHALT CONTENT | BULK GRAV. MEASURED | BULK GRAV. AT Ndes | THEO. GRAV. OF MIX | AIR VOIDS AT Ndes | VMA BULK GRAV. | VMA EFF. GRAV. | VFA BULK GRAV. | VFA EFF. GRAV. | % TMD AT NI | % TMD AT Nmax | EFF AC CONTENT | DUST PROPORTION | PROJ. OPTIMUM |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 6.2 | 2.223 | 2.191 | 2.319 | 5.5 | 14.6 | 18.7 | 62.3 | 70.5 | 85.6 | 95.9 | 4.3 | 1.0 | 6.8 |
| 2 | 6.3 | 2.239 | 2.205 | 2.316 | 4.8 | 14.2 | 18.2 | 66.2 | 73.7 | 85.9 | 96.7 | 4.4 | 1.0 | 6.6 |
| 3 | 6.8 | 2.254 | 2.220 | 2.301 | 3.5 | 14.0 | 18.1 | 75.1 | 80.7 | 87.1 | 98.0 | 4.9 | 0.9 | 6.6 |
| 4 | 7.3 | 2.261 | 2.229 | 2.286 | 2.5 | 14.1 | 18.2 | 82.6 | 86.3 | 87.9 | 98.9 | 5.4 | 0.8 | 6.6 |
| OPT. | 6.6 | 2.246 | 2.214 | 2306 | 4.0 | 14.1 | 18.0 | 71.6 | 77.8 | 86.6 | 97.4 | 4.6 | 0.9 | 6.6 |

| | TOTAL % PASSING | | | | | |
|---|---|---|---|---|---|---|
| MTLS. | 1 | 2 | 3 | 4 | 5 | JMF |
| % | 0 | 65 | 12 | 13 | 10 | 100 |
| 1.5" (37.5mm) | | 100 | 100 | 100 | 100 | 100 |
| 1" (25.0mm) | | 100 | 100 | 100 | 100 | 100 |
| 3/4" (19.0mm) | | 100 | 100 | 100 | 100 | 100 |
| 1/2" (12.5mm) | | 95 | 100 | 100 | 100 | 96.8 |
| 3/8" (9.5mm) | | 75 | 100 | 99 | 100 | 83.6 |
| #4 (4.75mm) | | 35 | 73 | 93 | 100 | 53.6 |
| #8 (2.36mm) | | 17 | 12 | 82 | 99 | 33.1 |
| #16 (1.18mm) | | 13 | 8 | 55 | 81 | 24.7 |
| #30 (600mm) | | 8 | 6 | 39 | 59 | 16.9 |
| #50 (300mm) | | 6 | 5 | 27 | 14 | 9.4 |
| #100 (150mm) | | 5 | 4 | 14 | 3 | 5.9 |
| #200 (75mm) | | 4.0 | 3 | 6.5 | 2 | 4.0 |

| PROPERTY | SHRP | MARSHALL |
|---|---|---|
| EFFECTIVE GRAV. | 2.527 | 2.465 |
| RICE GRAV. AT OPT. | 2.506 | 2.458 |
| ASPHALT ABS. | 1.82 | 0.82 |
| | | |
| | | |
| | | |
| | | |
| | | |

| BLEND PROPERTIES | |
|---|---|
| FINE AGG. ANG. | 44.1 |
| TSR | 90.6 |
| WET ST (psi) | 186.9 |
| GSI | |
| RUT DEPTH (in) | |
| GSB | 2.416 |
| GSA | 2.642 |
| WATER ABS. | 3.5 |

PRODUCERS

1)
2) Brooks Adamsville S&G
3) #10's Block Vulcan, Parsons, TN
4) Screw Sand
5) River Sand, Dement Const, Denmark, TN
Asphalt PG 64-22 Ergon, Memphis, TN
Anti-Strip Perma Tac

## Mixture Summary Report for Varying %AC Analys

| | | | |
|---|---|---|---|
| **Project Name:** | Region IV CN 4714 12.5mm For | **N Initial:** | |
| **Workbook Name:** | TRLBLD1.XLS | **N Design:** | |
| **Technician:** | Region IV Lab and Ford Construc | **N Max:** | |
| **Date:** | 5/13/97 | **Nom. Sieve Size:** | |
| **Asphalt Grade:** | PG 64-22 | **Compaction Temperat** | |
| | | **Mixture Temperature:** | |
| **Design ESAL's (millions):** | 4 | **Depth from Surface (mr** | |
| **Design Temperature:** | 38°C | **Mold Size:** | |

| Property | Results | | | | |
|---|---|---|---|---|---|
| | 6.2 | 6.3 | 6.8 | 7.3 | |
| %AC | 6.2 | 6.3 | 6.8 | 7.3 | |
| %Air Voids ($V_a$) | 5.5 | 4.8 | 3.5 | 2.5 | |
| %VMA | 14.6 | 14.2 | 14.0 | 14.1 | |
| %VFA | 62.3 | 66.2 | 75.1 | 82.6 | |
| Dust/Asphalt Ratio | 1.0 | 1.0 | 0.9 | 0.8 | 0.6 |
| Max. Specific Gravity ($G_{mm}$) | 2.319 | 2.316 | 2.301 | 2.286 | |
| Bulk Specific Gravity ($G_{mb}$) | 2.223 | 2.239 | 2.254 | 2.261 | |
| $\%G_{mm}$ @ $N_{ini}$ | 85.6 | 85.9 | 87.1 | 87.9 | 89.0 |
| $\%G_{mm}$ @ $N_{max}$ | 95.9 | 96.7 | 98.0 | 98.9 | 98.0 |
| Effective Sp. Gravity of Blend ($G_{se}$) | 2.527 | 2.527 | 2.528 | 2.528 | — |
| Sp. Gravity of Binder ($G_b$) | 1.032 | 1.032 | 1.032 | 1.032 | — |
| Sp. Gravity of Aggregate ($Gs_b$) | 2.407 | 2.407 | 2.407 | 2.407 | — |

# Madison County Mix Design

# (Binder)

# STATE OF TENNESSEE ASPHALT JOB MIX FORMULA

Date: ~~6/5/97~~ 7/14/

Project Ref. No. SP | County Madison | Region IV
Proj. No. 57010-4208-04 | Layer Binder | Contract No. 4714
Type Superpave 19.0 mm | Sec. No. SP 307-S | Article
Contractor Ford Construction | Subcontractor
St. Route 18 | Total Mix including Bitumen | Date of Letting 4/25/97

| Material | Size Range or Type | Producer and Address | % Used |
|---|---|---|---|
| #6's | 1"-Pan | Vulcan Materials, Parsons, TN | 19.10 |
| #7's | 3/4"-Pan | Vulcan Materials, Parsons, TN | 28.65 |
| #10 Block | 3/8"-Pan | Vulcan Materials, Parsons, TN | 23.88 |
| Screw Sand | 3/8"-Pan | Vulcan Materials, Holladay, TN | 14.33 |
| Rap | 3/4"-Pan | Ford Construction Co., Jackson, TN | 10.11 |
| Asphalt Cement | PG 64-22 | Ergon, Memphis, TN | 3.95 |
| Anti-Strip | Perma-Tac | Dosage Rate: 0.3% | |
| % Fractured Faces on +4 Material: | N/A | % Glassy Particles on +4 Material | N/A | 100.0 |

| 100 PERCENT MINERAL AGGREGATE Screen | Tlt. Passing Design Range | Requested Percent | AGGREGATE ANALYSIS TOTAL PERCENT PASSING #6's Percent | #7's Percent | #10 Block Percent | Screw Sand Percent | Rap Percent | Calculated Mix |
|---|---|---|---|---|---|---|---|---|
| Temp | | 300 F | 20.0 | 30.0 | 25.0 | 15.0 | 10.0 | 100.0 |
| % AC | | 4.5 | | | | | | |
| Compaction Temp: | | 295-305 | NCAT Furnace Corr. Factor: N/A | | | | | |
| Mixing Temp: | | 305-315 | Loss On Ignition: N/A | | | | | |
| | | | Theoretical Maximum Density: 2.501 | | | | | |
| | | | AC in RAP: 5.5 | | | | | |
| | | | (Washed Gradations) | | | | | |
| 2" | | 100 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| 1 1/2" | | 100 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| 1" | | 100 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| 3/4" | | 99 | 95.0 | 100.0 | 100.0 | 100.0 | 100.0 | 99.0 |
| 1/2" | | 85 | 37.0 | 95.0 | 100.0 | 100.0 | 94.0 | 85.3 |
| 3/8" | | 67 | 9.0 | 57.0 | 100.0 | 100.0 | 82.0 | 67.1 |
| #4 | | 41 | 3.0 | 5.0 | 73.0 | 93.8 | 62.0 | 40.6 |
| #8 | | 22 | 3.0 | 4.0 | 14.0 | 80.4 | 48.0 | 22.2 |
| #16 | | 15 | 2.5 | 4.0 | 8.0 | 51.1 | 36.0 | 15.0 |
| #30 | | 11 | 2.5 | 3.5 | 6.5 | 32.7 | 27.0 | 10.8 |
| #50 | | 8 | 2.5 | 3.5 | 6.0 | 22.4 | 16.0 | 8.0 |
| #100 | | 5.9 | 2.5 | 3.5 | 5.5 | 9.9 | 14.5 | 5.9 |
| #200 | | 4.8 | 2.5 | 3.5 | 4.5 | 7.0 | 10.5 | 4.8 |

Requested _____ Contractor

Approved _____ Region Materials Engineer

Approved _____ Region Construction Engineer

Approved _____ Engineer of Materials and Tests

# MARSHALL ASPHALT MIX DESIGN SUMMARY

DESIGN NO. _____ CONTRACT NO. 4714 DATE 5-Jun-97
TYPE OF MIX Superpave 19.0 mm COUNTY Madison SERIAL NO. _____
PROJECT NO. 57010-4208-04 LAYER Binder REGION IV
PROJECT REFERENCE NO. SP CONTRACTOR Ford Construction

| SAMPLE NO. | ASPHALT CONTENT | SP. GR. of MAR. SAMP. | THEO. GR. OF MIX | % THEO. GRAV. | VOIDS IN TOTAL MIX | VOIDS IN MIN. AGG. | VOIDS FILLED W/ ASPHALT | MARSHALL STABILITY | MARSHALL FLOW | NO. BLOWS MAR. HAM. |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 4 | 2.362 | 2.519 | 93.74 | 6.26 | 15.4 | 59.4 | 2283.33 | 11.5 | 75 |
| 2 | 4.5 | 2.380 | 2.501 | 95.18 | 4.82 | 15.2 | 68.3 | 2216.67 | 11.3 | 75 |
| 3 | 5 | 2.400 | 2.482 | 96.68 | 3.32 | 14.9 | 77.8 | 2383.33 | 12.0 | 75 |
| 4 | 0 | #DIV/0! | 2.680 | #DIV/0! | #DIV/0! | #DIV/0! | #DIV/0! | #DIV/0! | #DIV/0! | 75 |
| OPT | 4.5 | 2.380 | 2.501 | 95.18 | 4.82 | 15.2 | 68.3 | 2216.67 | 11.3 | 75 |

| | TOTAL % PASSING | | | | | | | GRAD |
|---|---|---|---|---|---|---|---|---|
| MTLS. | 1 | 2 | 3 | 4 | 5 | JMF | LAB | CAL. |
| % | 20 | 30 | 25 | 15 | 10 | 100 | 100 | |
| 1 5" (37.5mm) | 100 | 100 | 100 | 100 | 100 | 100.0 | 100.0 | |
| 1" (25.0mm) | 100 | 100 | 100 | 100 | 100 | 100.0 | 100.0 | |
| 3/4" (19.0mm) | 95 | 100 | 100 | 100 | 100 | 99.0 | 98.4 | |
| 1/2" (12.5mm) | 37 | 95 | 100 | 100 | 94 | 65.3 | 66.6 | |
| 3/8" (9.5mm) | 9 | 57 | 100 | 100 | 82 | 67.1 | 70.6 | |
| #4 (4.75mm) | 3 | 5 | 73 | 93.8 | 62 | 40.6 | 46.1 | |
| #8 (2.36mm) | 3 | 4 | 14 | 80.4 | 48 | 22.2 | 22.1 | |
| #16 (1.18mm) | 2.5 | 4 | 8 | 51.1 | 36 | 15 | 15.0 | |
| #30 (600mm) | 2.5 | 3.5 | 6.5 | 32.7 | 27 | 10.8 | 11.0 | |
| #50 (300mm) | 2.5 | 3.5 | 6 | 22.4 | 16 | 8 | 8.2 | |
| #100 (150mm) | 2.5 | 3.5 | 5.5 | 9.9 | 14.5 | 5.9 | 5.8 | |
| #200 (75mm) | 2.5 | 3.5 | 4.5 | 7 | 10.5 | 4.6 | 4.1 | |

PRODUCERS
1) Vulcan Materials, Parsons, TN
2) Vulcan Materials, Parsons, TN
3) Vulcan Materials, Parsons, TN
4) Vulcan Materials, Holladay, TN
5) Ford Construction Co., Jackson, TN
Asphalt Ergon, Memphis, TN
Anti-Strip Perma-Tac

Recommended 4.5 Asphalt Content
Rice Specific Gravity 2.501

Bulk Sp. Gr. 2.657
Eff. Sp. Gr. 2.680
App. Sp. Gr. 2.732

Absorption 1.03
Fract. Face N/A
Glassy Part. N/A

NCAT Corr. Factor N/A
L.O.I. N/A
A.C. In RAP 5.5

DAR 0.89
Eff. AC Content 4.18
TSR 76.6
Conditioned Ten. Str. 150.7

## Mixture Summary Report for Trial Aggregate Blend Analysis

| | | | |
|---|---|---|---|
| **Project Name:** | Madison Co CN 4714 19.0mm Bi | **N Initial:** | 8 |
| **Workbook Name:** | RAPDES3.XLS | **N Design:** | 96 |
| **Technician:** | Reg IV Lab & Ford Const. | **N Max:** | 152 |
| **Date:** | 6/27/97 | **Nom. Sieve Size:** | 19 mm |
| **Asphalt Grade:** | PG 64-22 | **Compaction Temperature:** | 149 °C |
| | | **Mixture Temperature:** | 158°C |
| **Design ESAL's (millions):** | 4 | **Depth from Surface (mm):** | 38 |
| **Design Temperature:** | 38°C | **Mold Size:** | 150 mm |

| | Results | | | | |
|---|---|---|---|---|---|
| **Property** | **4.8% ac** | **5.0% ac** | **.3 % ac + dus** | **.8 % ac + dus** | **Criteria** |
| %AC | 4.8 | 5.0 | 4.3 | 4.8 | |
| %Air Voids ($V_a$) | 4.8 | 3.4 | 3.6 | 2.6 | 4.0 % |
| %VMA | 14.3 | 13.5 | 12.7 | 12.9 | 13.0 % Min. |
| %VFA | 66.7 | 74.9 | 71.6 | 80.0 | 65.0 % Min.<br>75.0 % Max. |
| Dust/Asphalt Ratio | 0.8 | 0.8 | 1.4 | 1.2 | 0.6-1.2 % |
| Max. Specific Gravity ($G_{mm}$) | 2.512 | 2.504 | 2.515 | 2.496 | |
| Bulk Specific Gravity ($G_{mb}$) | 2.440 | 2.463 | 2.470 | 2.476 | |
| $\%G_{mm}$ @ $N_{ini}$ | 82.9 | 84.1 | 84.1 | 84.8 | 89.0 % Max. |
| $\%G_{mm}$ @ $N_{max}$ | 97.1 | 98.4 | 98.2 | 99.2 | 98.0 % Max. |
| Effective Sp. Gravity of Blend ($G_{se}$) | 2.707 | 2.707 | 2.688 | 2.688 | — |
| Sp. Gravity of Binder ($G_b$) | 1.034 | 1.034 | 1.034 | 1.034 | — |
| Sp. Gravity of Aggregate ($Gs_b$) | 2.658 | 2.658 | 2.658 | 2.658 | — |

**Lauderdale County**

**Contract No.: 4853 Project No.: 49001-4267-04**

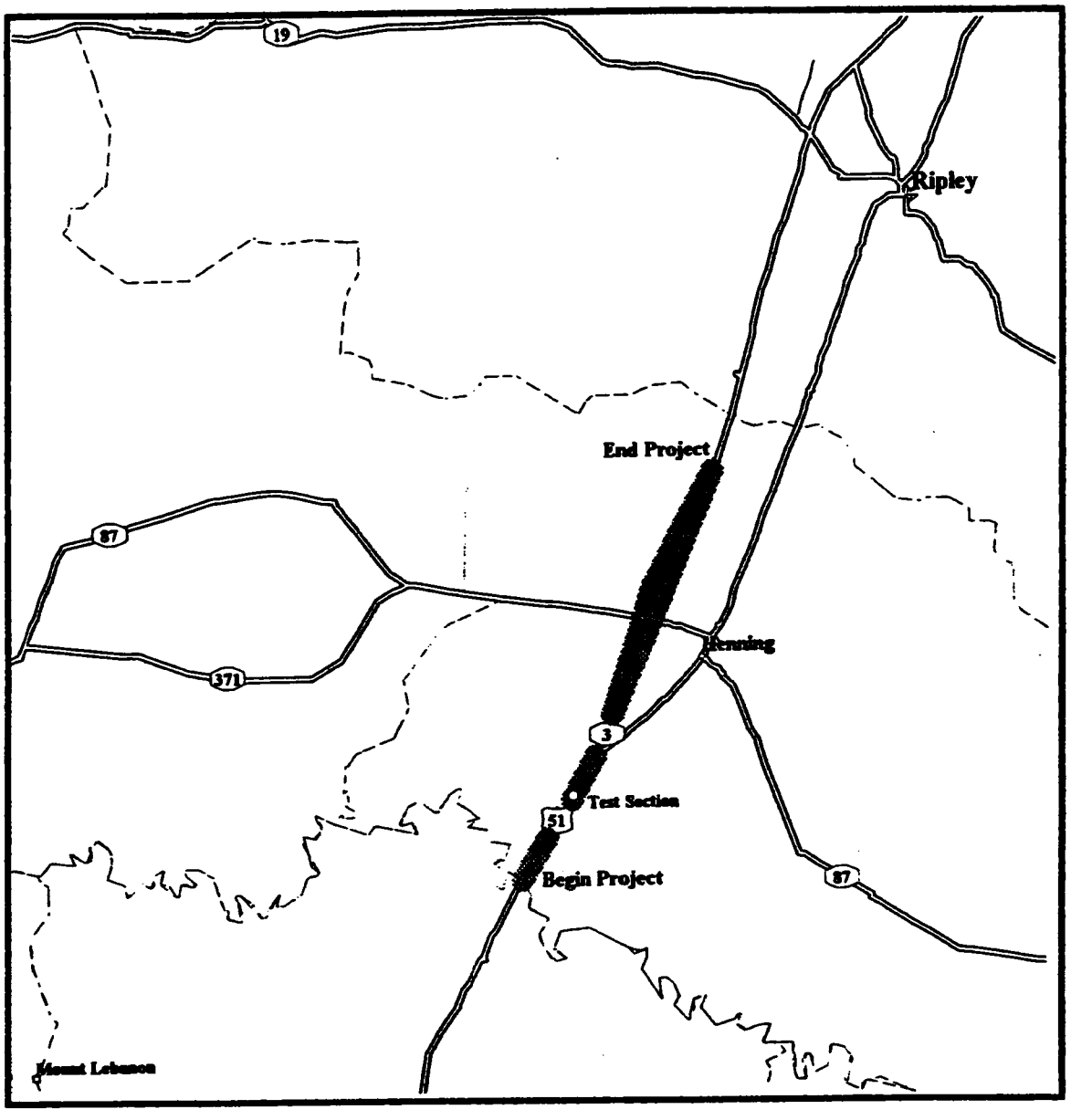
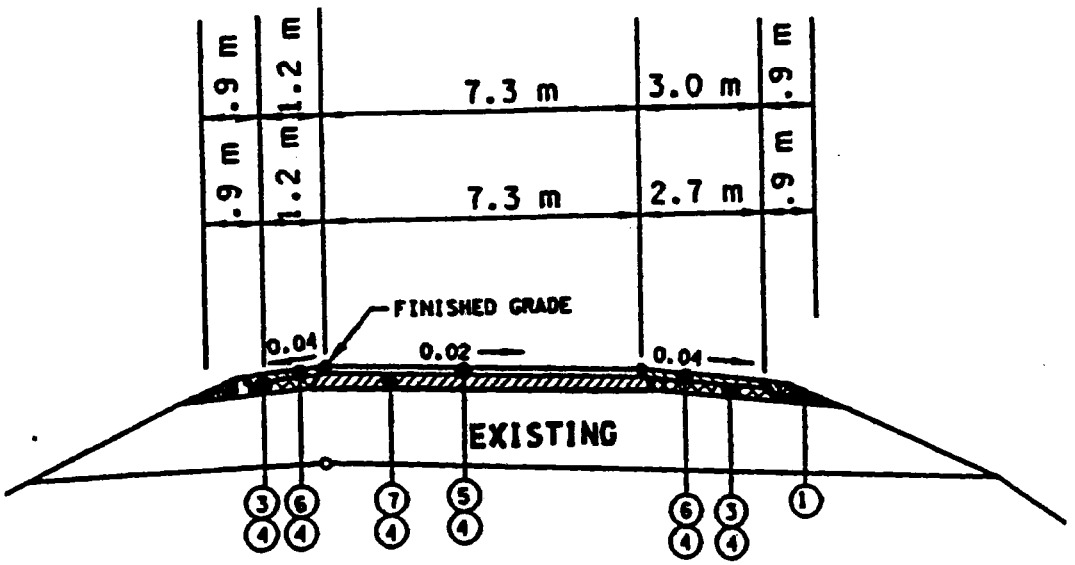



**Figure A.13 Site Vicinity Map**
**Lauderdale County**
**Contract No.: 4853**
**Project No.: 49001-4267-04**




| PROPOSED PAVEMENT DESIGN |
|---|
| (1) MINERAL AGGREGATE BASE @ 82mm +/- THICK<br>ITEM 303M02 MINERAL AGGREGATE. TYPE "B" BASE. GRADING "B" OR "C" |
| (2) BITUMINOUS BASE COURSE (BLACK BASE) @ 205mm +/- THICK(APPROX. 495.32kg/m2.)<br>ITEM 307M03.09 BITUMINOUS PLANT MIX BASE (HOT MIX) (SPMB HM) GRADING "A" |
| (3) BITUMINOUS COURSE ( BINDER) @ 50mm +/- THICK (APPROX. 120kg/m2)<br>ITEM 307M03.16 BITUMINOUS PLANT MIX BASE (HOT MIX) GRADING "B-42" |
| (4) TACK COAT<br>ITEM 403M01 BITUMINOUS MATERIAL FOR TACK COAT (TC) |
| (5) SUPERPAVE SURFACE (ACS @ 35mm +/- THICK (APPROX. 79.8kg/m2)<br>ITEM 411M10.01 MINERIAL AGGREGATE . SUPER PAVE SURFACE MIX<br>ITEM 411M10.02 ASPHALT CEMENT. SUPERPAVE SURFACE MIX (PG64-22) |
| (6) ASPHALT CONCRETE SURFACE (HM) @ 35mm +/- THICK (APPROX. 70.40kg/m2)<br>ITEM 411M03.10 ASPHALT CONCRETE SURFACE (HM) GRADING "E" (SHOULDERS) |
| (7) SUPERPAVE ( BINDER) @ 50mm +/- THICK (APPROX. 120kg/m2)<br>ITEM 307M10.10 SUPERPAVE BINDER MIX (SPMB-HM) |

**Figure A.14 Pavement Cross Section**
**Lauderdale County**
**Contract No.: 4853**
**Project No.: 49001-4267-04**

# Lauderdale County Mix Design

# (Surface)

# STATE OF TENNESSEE ASPHALT JOB MIX FORMULA

Date: 7/28/97

Project Ref. No. SP County Lauderdale Region IV
Proj. No. 49001-4267-04 Layer Surface Contract No. 4853
Type Superpave 12.5 mm Sec. No. 411M10.01, 411M10.02 Article SP 411-S
Contractor Ford Construction Subcontractor
St. Route 3 Total Mix including Bitumen Date of Letting 6/13/97

| Material | Size Range or Type | Producer and Address | % Used |
|---|---|---|---|
| | | | 0.00 |
| #7's D Rock | 5/8"-Pan | Ford Construction, Troy, TN | 65.73 |
| Block #10's | 3/8"-Pan | Vulcan Mtls., Parsons, TN | 9.39 |
| Fine #10's | 3/8"-Pan | Vulcan Mtls., Gilbertsville, KY | 9.39 |
| Nat. Sand | 3/8"-Pan | Ford Construction, Troy, TN | 9.39 |
| Asphalt Cement | PG 64-22 | Ergon, Memphis, TN | 6.10 |
| Anti-Strip | Perma-Tac | Dosage Rate: 0.3% | |
| % Fractured Faces on +4 Material: | 70.8 | % Glassy Particles on +4 Material | N/A 100.0 |

| 100 PERCENT MINERAL AGGREGATE | | | AGGREGATE ANALYSIS TOTAL PERCENT PASSING | | | | | |
|---|---|---|---|---|---|---|---|---|
| Screen | Tlt. Passing Design Range | Requested Percent | 0 Percent | #7's D Rock Percent | Block #10's Percent | Fine #10's Percent | Nat. Sand Percent | Calculated Mix |
| Temp | | 300 F | 0.0 | 70.0 | 10.0 | 10.0 | 10.0 | 100.0 |
| % AC | | 6.1 | | | | | | |
| Compaction Temp: | | 295-305 | | NCAT Furnace Corr. Factor: | | | N/A | |
| Mixing Temp: | | 305-315 | | Loss On Ignition: | | | 9.5 | |
| | | | | Theoretical Maximum Density: | | | 2.294 | |
| | | | | AC in RAP: | | | 0.0 | |
| | | | (Washed Gradations) | | | | | |
| 2" | | 100 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| 1 1/2" | | 100 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| 1" | | 100 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| 3/4" | | 100 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| 1/2" | | 99 | 100.0 | 98.0 | 100.0 | 100.0 | 100.0 | 98.6 |
| 3/8" | | 90 | 100.0 | 85.0 | 100.0 | 100.0 | 100.0 | 89.5 |
| #4 | | 58 | 100.0 | 44.0 | 73.0 | 96.0 | 99.0 | 57.6 |
| #8 | | 33 | 100.0 | 22.0 | 14.0 | 77.0 | 86.0 | 33.1 |
| #16 | | 24 | 100.0 | 15.0 | 8.0 | 57.0 | 73.0 | 24.3 |
| #30 | | 15 | 100.0 | 7.0 | 6.0 | 37.0 | 60.0 | 15.2 |
| #50 | | 8 | 100.0 | 4.0 | 5.0 | 30.0 | 12.0 | 7.5 |
| #100 | | 4.3 | 100.0 | 2.0 | 4.0 | 23.0 | 2.0 | 4.3 |
| #200 | | 3.7 | 100.0 | 2.0 | 3.0 | 18.0 | 2.0 | 3.7 |

Requested _____ Contractor

Approved _____ Region Materials Engineer

Approved _____ Region Construction Engineer

Approved _____ Engineer of Materials and Tests

# MARSHALL ASPHALT MIX DESIGN SUMMARY

DESIGN NO. _____
TYPE OF MIX Superpave 12.5 mm
PROJECT NO. 49001-4267-04
PROJECT REFERENCE NO. SP

CONTRACT NO. 4853
COUNTY Lauderdale
LAYER Surface
CONTRACTOR _____

DATE 28-Jul-97
SERIAL NO. _____
REGION IV
Ford Construction

| SAMPLE NO. | ASPHALT CONTENT | SP. GR. of MAR. SAMP. | THEO. GR. OF MIX | % THEO. GRAV. | VOIDS IN TOTAL MIX | VOIDS IN MIN. AGG. | VOIDS FILLED W/ ASPHALT | MARSHALL STABILITY | MARSHALL FLOW | NO. BLOWS MAR. HAM. |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 5.6 | 2.158 | 2.309 | 93.47 | 6.53 | 18.2 | 64.2 | 3541.67 | 19.0 | 75 |
| 2 | 6.1 | 2.191 | 2.294 | 95.50 | 4.50 | 17.4 | 74.2 | 2500.00 | 16.0 | 75 |
| 3 | 6.6 | 2.197 | 2.279 | 96.41 | 3.59 | 17.6 | 79.6 | 2158.33 | 19.2 | 75 |
| 4 | 7.1 | 2.202 | 2.264 | 97.26 | 2.74 | 17.9 | 84.7 | 1816.67 | 20.3 | 75 |
| OPT | 6.1 | 2.191 | 2.294 | 95.50 | 4.50 | 17.4 | 74.2 | 2500.00 | 16.0 | 75 |

| | TOTAL % PASSING | | | | | | | GRAD |
|---|---|---|---|---|---|---|---|---|
| MTLS. | 1 | 2 | 3 | 4 | 5 | JMF | LAB | CAL. |
| % | 0 | 70 | 10 | 10 | 10 | 100 | 100 | |
| 1.5" (37.5mm) | | 100 | 100 | 100 | 100 | 100.0 | 100.0 | |
| 1" (25.0mm) | | 100 | 100 | 100 | 100 | 100.0 | 100.0 | |
| 3/4" (19.0mm) | | 100 | 100 | 100 | 100 | 100.0 | 100.0 | |
| 1/2" (12.5mm) | | 98 | 100 | 100 | 100 | 98.6 | 99.3 | |
| 3/8" (9.5mm) | | 85 | 100 | 100 | 100 | 89.5 | 88.4 | |
| #4 (4.75mm) | | 44 | 73 | 96 | 99 | 57.6 | 56.3 | |
| #8 (2.36mm) | | 22 | 14 | 77 | 86 | 33.1 | 32.7 | |
| #16 (1.18mm) | | 15 | 8 | 57 | 73 | 24.3 | 23.0 | |
| #30 (600mm) | | 7 | 6 | 37 | 60 | 15.2 | 14.1 | |
| #50 (300mm) | | 4 | 5 | 30 | 12 | 7.5 | 7.4 | |
| #100 (150mm) | | 2 | 4 | 23 | 2 | 4.3 | 4.1 | |
| #200 (75mm) | | 2 | 3 | 18 | 2 | 3.7 | 3.6 | |

PRODUCERS

1) _____
2) Ford Construction, Troy, TN
3) Vulcan Mtls., Parsons, TN
4) Vulcan Mtls., Gilbertsville, KY
5) Ford Construction, Troy, TN

Asphalt Ergon, Memphis, TN
Anti-Strip Perma-Tac

Recommended 6.1 Asphalt Content
Rice Specific Gravity 2.294

Bulk Sp. Gr. 2.423
Eff. Sp. Gr. 2.491
App. Sp. Gr. 2.665

Absorption 3.76
Fract. Face 70.8
Glassy Part. N/A

NCAT Corr. Factor N/A
L.O.I. 9.5
A.C. In RAP 0.0

DAR 0.59
Eff. AC Content 5.00
TSR 92.4
Conditioned Ten. Str. 227.6

## SUPERPAVE ASPHALT MIX DESIGN SUMMARY

BLEND NAME Medium - Blend 2 CONTRACT NO. 4853 DATE 8/15/97
TYPE OF MIX 411-S 12.5mm COUNTY Lauderdale REGION IV
PROJECT NO. 49001-4267-04 LAYER Surface LOG-IN
PROJECT REFERENCE NO. SP CONTRACTOR

| SAMPLE | ASPHALT CONTENT | BULK GRAV. MEASURED | BULK GRAV AT Ndes | THEO. GRAV. OF MIX | AIR VOIDS AT Ndes | VMA BULK GRAV. | VMA EFF. GRAV. | VFA BULK GRAV. | VFA EFF. GRAV. | % TMD AT Ni | % TMD AT Nmax | EFF AC CONTENT | DUST PROPORTION | PROJ. OPTIMUM |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 6.1 | 2.237 | 2.206 | 2.300 | 4.1 | 14.6 | 16.7 | 71.6 | 75.4 | 86.6 | 97.3 | 4.9 | 0.7 | 6.2 |
| 2 | 6.2 | 2.228 | 2.198 | 2.297 | 4.3 | 15.0 | 17.5 | 71.0 | 75.4 | 86.2 | 97.0 | 5.0 | 0.7 | 6.3 |
| 3 | 6.0 | 2.261 | 2.230 | 2.285 | 2.4 | 14.0 | 17.1 | 83.1 | 86.0 | 88.0 | 99.0 | 5.4 | 0.7 | 6.0 |
| 4 | 7.1 | 2.264 | 2.234 | 2.270 | 1.6 | 14.4 | 16.9 | 89.0 | 90.5 | 88.5 | 99.7 | 5.9 | 0.6 | 6.1 |
| OPT. | 6.1 | 2.237 | 2.206 | 2.300 | 4.1 | 14.6 | 16.7 | 71.0 | 75.4 | 86.6 | 97.3 | 4.9 | 0.7 | 6.1 |

| | TOTAL % PASSING | | | | | |
|---|---|---|---|---|---|---|
| MTLS | 1 | 2 | 3 | 4 | 5 | JMF |
| % | 70 | 10 | 10 | 10 | | 100 |
| 1.5" (37.5mm) | | | | | | |
| 1" (25.0mm) | | | | | | |
| 3/4" (19.0mm) | 100 | | | | | 100 |
| 1/2" (12.5mm) | 98.0 | | | | | 98.6 |
| 3/8" (9.5mm) | 85.0 | 100 | 100 | 100 | | 89.5 |
| #4 (4.75mm) | 44.0 | 73 | 96 | 99 | | 57.6 |
| #8 (2.36mm) | 22.0 | 14 | 77 | 86 | | 33.1 |
| #16 (1.18mm) | 15.0 | 8 | 57 | 73 | | 24.3 |
| #30 (600mm) | 7 | 6 | 37 | 60 | | 15.2 |
| #50 (300mm) | 4 | 5 | 30 | 12 | | 7.5 |
| #100 (150mm) | 2 | 4 | 23 | 2 | | 4.3 |
| #200 (75mm) | 2 | 3 | 18 | 2 | | 3.7 |

| PROPERTY | SHRP | MARSHALL |
|---|---|---|
| EFFECTIVE GRAV. | 2.499 | 2.491 |
| RICE GRAV. AT OPT. | 2.300 | 2.294 |
| ASPHALT ABS. | 1.2 | 1.13 |
| % AC AT 4% VTM | 6.1 | 6.4 |
| | | |
| | | |
| | | |
| | | |

| BLEND PROPERTIES | |
|---|---|
| FINE AGG. ANG. | 44.3 |
| TSR | 92.4 |
| WET ST (psi) | 227.8 |
| GSI | — |
| RUT DEPTH (in) | — |
| $G_{sb}$ | 2.423 |
| $G_{se}$ | 2.665 |
| WATER ABS. | 3.75 |

### MATERIALS AND PRODUCERS

1) Gravel #7's, Ford Construction, Troy, TN
2) Block #10's, Vulcan Materials, Parsons, TN
3) Fine #10's, Vulcan Materials, Gilbertsville, KY
4) Nat. Sand, Ford Construction, Troy, TN
5)

Asphalt Exxon PG 64-22 Memphis, TN
Anti-Strip Perma Tac, 0.3% Dosage

## Mixture Summary Report for Varying %AC Analysis

| | | | |
|---|---|---|---|
| **Project Name:** | Region IV Lauderdale Co, CN 48 | **N Initial:** | 8 |
| **Workbook Name:** | SHRPDES1.XLS | **N Design:** | 96 |
| **Technician:** | Region IV Lab, and Danny Clark | **N Max:** | 152 |
| **Date:** | 7/7/97 | **Nom. Sieve Size:** | 12.5 mm |
| **Asphalt Grade:** | PG 64-22 | **Compaction Temperature:** | 149 °C |
| | | **Mixture Temperature:** | 154°C |
| **Design ESAL's (millions):** | 4 | **Depth from Surface (mm):** | 0 |
| **Design Temperature:** | 38°C | **Mold Size:** | 150 mm |

| Property | Results | | | | Criteria |
|---|---|---|---|---|---|
| | 6.1% | 6.2% | 6.6% | 7.1% | |
| %AC | 6.1 | 6.2 | 6.6 | 7.1 | |
| %Air Voids ($V_a$) | 4.1 | 4.3 | 2.4 | 1.6 | 4.0 % |
| %VMA | 14.6 | 15.0 | 14.0 | 14.4 | 14.0 % Min. |
| %VFA | 71.6 | 71.0 | 83.1 | 89.0 | 65.0 % Min.<br>75.0 % Max. |
| Dust/Asphalt Ratio | 0.7 | 0.7 | 0.7 | 0.6 | 0.6-1.2 % |
| Max. Specific Gravity ($G_{mm}$) | 2.300 | 2.297 | 2.285 | 2.270 | |
| Bulk Specific Gravity ($G_{mb}$) | 2.237 | 2.228 | 2.261 | 2.264 | |
| %$G_{mm}$ @ $N_{ini}$ | 86.6 | 86.2 | 88.0 | 88.5 | 89.0 % Max. |
| %$G_{mm}$ @ $N_{max}$ | 97.3 | 97.0 | 99.0 | 99.7 | 98.0 % Max. |
| Effective Sp. Gravity of Blend ($G_{se}$) | 2.499 | 2.499 | 2.499 | 2.498 | — |
| Sp. Gravity of Binder ($G_b$) | 1.034 | 1.034 | 1.034 | 1.034 | — |
| Sp. Gravity of Aggregate ($Ga_b$) | 2.424 | 2.424 | 2.424 | 2.424 | — |

# Lauderdale County Mix Design

# (Binder)

# STATE OF TENNESSEE ASPHALT JOB MIX FORMULA

Date: 7/29/97

Project Ref. No. SP County Lauderdale Region IV
Proj. No. 49001-4267-04 Layer Binder Contract No. 4853
Type Superpave 19.0 mm Sec. No. 307M10.10 Article SP 307-S
Contractor Ford Construction Subcontractor
St. Route 3 Total Mix Including Bitumen Date of Letting 6/13/97

| Material | Size Range or Type | Producer and Address | % Used |
|---|---|---|---|
| #57's | 1"-Pan | Vulcan Materials, Gilbertsville, KY | 23.60 |
| #7's "D" Rock | 3/4"-Pan | Ford Construction, Troy, TN | 37.76 |
| #10 Block | 3/8"-Pan | Vulcan Materials, Parsons, TN | 16.99 |
| #10 Fine | 3/8"-Pan | Vulcan Materials, Gilbertsville, KY | 16.05 |
| | | | 0.00 |
| Asphalt Cement | PG 64-22 | Ergon, Memphis, TN | 5.60 |
| Anti-Strip | Perma-Tac | Dosage Rate: 0.3% | |
| % Fractured Faces on +4 Material: | N/A | % Glassy Particles on +4 Material N/A | 100.0 |

| 100 PERCENT MINERAL AGGREGATE | | | AGGREGATE ANALYSIS TOTAL PERCENT PASSING | | | | | |
|---|---|---|---|---|---|---|---|---|
| Screen | Tlt. Passing Design Range | Requested Percent | #57's Percent | #7's "D" Rock Percent | #10 Block Percent | #10 Fine Percent | 0 Percent | Calculated Mix |
| Temp | | 300 F | 25.0 | 40.0 | 18.0 | 17.0 | | 100.0 |
| % AC | | 5.6 | | | | | | |
| Compaction Temp: | | 295-305 | | | | | | |
| Mixing Temp: | | 305-315 | | | | | | |
| | | | | | | | | |
| | | | (Washed Gradations) | | | | | |
| 2" | | 100 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| 1 1/2" | | 100 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| 1" | | 100 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| 3/4" | | 94 | 76.0 | 100.0 | 100.0 | 100.0 | 100.0 | 94.0 |
| 1/2" | | 87 | 50.0 | 98.0 | 100.0 | 100.0 | 100.0 | 86.7 |
| 3/8" | | 73 | 14.0 | 85.0 | 100.0 | 100.0 | 100.0 | 72.5 |
| #4 | | 48 | 2.0 | 44.0 | 73.0 | 96.0 | 100.0 | 47.6 |
| #8 | | 25 | 1.5 | 22.0 | 14.0 | 77.0 | 100.0 | 24.8 |
| #16 | | 17 | 1.0 | 15.0 | 8.0 | 57.0 | 100.0 | 17.4 |
| #30 | | 10 | 1.0 | 7.0 | 6.0 | 37.0 | 100.0 | 10.4 |
| #50 | | 8 | 1.0 | 4.0 | 5.0 | 30.0 | 100.0 | 7.9 |
| #100 | | 5.7 | 1.0 | 2.0 | 4.0 | 23.0 | 100.0 | 5.7 |
| #200 | | 4.7 | 1.0 | 2.0 | 3.0 | 18.0 | 100.0 | 4.7 |

| | |
|---|---|
| NCAT Furnace Corr. Factor: | N/A |
| Loss On Ignition: | N/A |
| Theoretical Maximum Density: | 2.374 |
| AC in RAP: | 0.0 |

Requested _____ Approved _____
Contractor Region Materials Engineer

Approved _____ Approved _____
Region Construction Engineer Engineer of Materials and Tests

# MARSHALL ASPHALT MIX DESIGN SUMMARY

DESIGN NO. _____
TYPE OF MIX Superpave 19.0 mm
PROJECT NO. 49001-4267-04
PROJECT REFERENCE NO. SP

CONTRACT NO. 4853
COUNTY Lauderdale
LAYER Binder
CONTRACTOR Ford Construction

DATE 29-Jul-97
SERIAL NO. _____
REGION IV

| SAMPLE NO. | ASPHALT CONTENT | SP. GR. of MAR. SAMP. | THEO. GR. OF MIX | % THEO. GRAV. | VOIDS IN TOTAL MIX | VOIDS IN MIN. AGG. | VOIDS FILLED W/ ASPHALT | MARSHALL STABILITY | MARSHALL FLOW | NO. BLOWS MAR. HAM. |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 5.1 | 2.297 | 2.390 | 96.07 | 3.93 | 15.2 | 74.2 | 3550.00 | 17.8 | 75 |
| 2 | 5.6 | 2.314 | 2.374 | 97.48 | 2.52 | 15.0 | 83.2 | 2983.33 | 19.3 | 75 |
| 3 | 6.1 | 2.323 | 2.358 | 98.51 | 1.49 | 15.2 | 90.2 | 2850.00 | 18.5 | 75 |
| 4 | 6.6 | 2.333 | 2.342 | 99.59 | 0.41 | 15.3 | 97.3 | 2433.33 | 18.3 | 75 |
| OPT | 5.6 | 2.314 | 2.374 | 97.48 | 2.52 | 15.0 | 83.2 | 2983.33 | 19.3 | 75 |

| MTLS. | TOTAL % PASSING 1 | 2 | 3 | 4 | 5 | JMF | LAB | GRAD CAL. |
|---|---|---|---|---|---|---|---|---|
| % | 25 | 40 | 18 | 17 | 0 | 100 | 100 | |
| 1.5" (37.5mm) | 100 | 100 | 100 | 100 | | 100.0 | 100.0 | |
| 1" (25.0mm) | 100 | 100 | 100 | 100 | | 100.0 | 100.0 | |
| 3/4" (19.0mm) | 76 | 100 | 100 | 100 | | 94.0 | 93.1 | |
| 1/2" (12.5mm) | 50 | 98 | 100 | 100 | | 86.7 | 85.4 | |
| 3/8" (9.5mm) | 14 | 85 | 100 | 100 | | 72.5 | 71.2 | |
| #4 (4.75mm) | 2 | 44 | 73 | 96 | | 47.6 | 47.4 | |
| #8 (2.36mm) | 1.5 | 22 | 14 | 77 | | 24.8 | 23.9 | |
| #16 (1.18mm) | 1 | 15 | 8 | 57 | | 17.4 | 16.8 | |
| #30 (600mm) | 1 | 7 | 6 | 37 | | 10.4 | 10.9 | |
| #50 (300mm) | 1 | 4 | 5 | 30 | | 7.9 | 8.8 | |
| #100 (150mm) | 1 | 2 | 4 | 23 | | 5.7 | 6.3 | |
| #200 (75mm) | 1 | 2 | 3 | 18 | | 4.7 | 5.2 | |

PRODUCERS
1) Vulcan Materials, Gilbertsville, KY
2) Ford Construction, Troy, TN
3) Vulcan Materials, Parsons, TN
4) Vulcan Materials, Gilbertsville, KY
5) _____
Asphalt Ergon, Memphis, TN
Anti-Strip Perma-Tac

Recommended 5.6 Asphalt Content
Rice Specific Gravity 2.374

Bulk Sp. Gr. 2.503
Eff. Sp. Gr. 2.571
App. Sp. Gr. 2.699

Absorption 2.69
Fract. Face N/A
Glassy Part. N/A

NCAT Corr. Factor N/A
L.O.I. N/A
A.C. In RAP 0.0

DAR 0.93
Eff. AC Content 4.57
TSR 87.8
Conditioned Ten. Str. 132.4

## SUPERPAVE ASPHALT MIX DESIGN SUMMARY

BLEND NAME Blend 1 Coarse
TYPE OF MIX 307-S 19.0 mm
PROJECT NO. 49001-4267-04
PROJECT REFERENCE NO.

CONTRACT NO. 4853
COUNTY Lauderdale
LAYER Binder
CONTRACTOR Ford Construction Co.

DATE 8/15/97
REGION IV
LOG-IN

| SAMPLE | ASPHALT CONTENT | BULK GRAV. MEASURED | BULK GRAV. AT Ndes | THEO. GRAV. OF MIX | AIR VOIDS AT Ndes | VMA BULK GRAV | VMA EFF. GRAV. | VFA BULK GRAV. | VFA EFF GRAV | % TMD AT Ni | % TMD AT Nmax | EFF AC CONTENT | DUST PROPORTION | PROJ. OPTIMUM |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TB-1 | 4.5 | 2.318 | 2.277 | 2.438 | 6.6 | 14.0 | 16.5 | 52.8 | 60.0 | 82.7 | 95.1 | 3.4 | 1.55 | 5.5 |
| MD-1 | 5.0 | 2.305 | 2.264 | 2.421 | 6.5 | 14.9 | 17.4 | 56.7 | 62.9 | 82.6 | 95.2 | 3.9 | 1.35 | 6.0 |
| 2 | 5.5 | 2.336 | 2.296 | 2.404 | 4.5 | 14.2 | 16.7 | 68.3 | 73.1 | 84.3 | 97.2 | 4.4 | 1.19 | 5.7 |
| 3 | 6.0 | 2.321 | 2.280 | 2.387 | 4.5 | 15.2 | 17.7 | 70.7 | 74.8 | 84.6 | 97.3 | 4.9 | 1.07 | 6.2 |
| OPT. | 5.6 | 2.346 | 2.305 | 2.401 | 4.0 | 13.9 | 16.5 | 71.3 | 75.7 | 84.8 | 97.2 | 4.5 | 1.16 | 5.6 |

| | TOTAL % PASSING | | | | | |
|---|---|---|---|---|---|---|
| MTLS | 1 | 2 | 3 | 4 | 5 | JMF |
| % | 25 | 40 | 18 | 17 | | |
| 1.5" (37.5mm) | | | | | | |
| 1" (25.0mm) | 100 | | | | | 100 |
| 3/4" (19.0mm) | 76 | 100 | | | | 94.0 |
| 1/2" (12.5mm) | 50 | 98 | | | | 86.7 |
| 3/8" (9.5mm) | 14 | 85 | 100 | 100 | | 72.5 |
| #4 (4.75mm) | 2 | 44 | 73 | 96 | | 47.6 |
| #8 (2.36mm) | 1.5 | 22 | 14 | 77 | | 24.8 |
| #16 (1.18mm) | 1.0 | 15 | 8 | 57 | | 17.4 |
| #30 (600mm) | 1.0 | 7 | 6 | 37 | | 10.4 |
| #50 (300mm) | 1.0 | 4 | 5 | 30 | | 7.9 |
| #100 (150mm) | 1.0 | 2.0 | 4 | 23 | | 5.7 |
| #200 (75mm) | 1.0 | 2.0 | 3 | 18 | | 4.7 |

| PROPERTY | SHRP | MARSHALL |
|---|---|---|
| EFFECTIVE GRAV. | 2.605 | 2.571 |
| RICE GRAV. AT OPT. | 2.401 | 2.374 |
| ASPHALT ABS. | 1.6 | 1.0 |
| % AC AT 4% VTM | 5.6 | 5.0 |
| | | |
| | | |
| | | |
| | | |

| BLEND PROPERTIES | |
|---|---|
| FINE AGG. ANG. | 43.4 |
| TSR | 87.8 |
| WET ST (psi) | 132.4 |
| GSI | — |
| RUT DEPTH (in) | → |
| $G_{sb}$ | 2.529 |
| $G_{se}$ | 2.699 |
| WATER ABS. | 2.9 |

MATERIALS AND PRODUCERS

1) #57's, Vulcan Gilbertsville, KY
2) #7's Crushed Gravel, Ford Construction, Troy, TN
3) #10's Block, Vulcan, Parsons, TN
4) #10's Fine, Vulcan, Gilbertsville, KY
5)

Asphalt Ergon PG 64-22 Memphis, TN
Anti-Strip Perma-Tac 0.3% Dosage

## Mixture Summary Report for Varying %AC Analysis

| | | | |
|---|---|---|---|
| **Project Name:** | Lauderdale Co CN 4853 19.0mm | **N Initial:** | 8 |
| **Workbook Name:** | SHRPDES1.XLS | **N Design:** | 96 |
| **Technician:** | Region IV Design Team | **N Max:** | 152 |
| **Date:** | 7/14/97 | **Nom. Sieve Size:** | 19 mm |
| **Asphalt Grade:** | PG 64-22 | **Compaction Temperature:** | 149 °C |
| | | **Mixture Temperature:** | 149°C |
| **Design ESAL's (millions):** | 4 | **Depth from Surface (mm):** | 33 |
| **Design Temperature:** | 38°C | **Mold Size:** | 150 mm |

| Property | Results | | | | Criteria |
|---|---|---|---|---|---|
| | 4.5% | 5.0% | 5.5% | 6.0% | |
| %AC | 4.5 | 5.0 | 5.5 | 6.0 | |
| %Air Voids ($V_a$) | 6.6 | 6.5 | 4.5 | 4.5 | 4.0 % |
| %VMA | 14.0 | 14.9 | 14.2 | 15.2 | 13.0 % Min. |
| %VFA | 52.8 | 56.7 | 68.3 | 70.7 | 65.0 % Min.<br>75.0 % Max. |
| Dust/Asphalt Ratio | 1.55 | 1.35 | 1.19 | 1.07 | 0.6-1.2 % |
| Max. Specific Gravity ($G_{mm}$) | 2.438 | 2.421 | 2.404 | 2.387 | |
| Bulk Specific Gravity ($G_{mb}$) | 2.318 | 2.305 | 2.336 | 2.321 | |
| $\%G_{mm}$ @ $N_{ini}$ | 82.7 | 82.6 | 84.3 | 84.6 | 89.0 % Max. |
| $\%G_{mm}$ @ $N_{max}$ | 95.1 | 95.2 | 97.2 | 97.3 | 98.0 % Max. |
| Effective Sp. Gravity of Blend ($G_{se}$) | 2.605 | 2.605 | 2.605 | 2.605 | — |
| Sp. Gravity of Binder ($G_b$) | 1.033 | 1.033 | 1.033 | 1.033 | — |
| Sp. Gravity of Aggregate ($Gs_b$) | 2.529 | 2.529 | 2.529 | 2.529 | — |

# Appendix B

## Laboratory and Field Test Data

| | |
|---|---|
| **Tables B.1 – B.9** | **Roadway Core Bulk Specific Gravity Test Results** |
| **Tables B.10 – B.29** | **Roadway Surface Temperature and Density Test Results** |
| **Tables B.30 – B.38** | **Theoretical Maximum Specific Gravity and Asphalt Content Test Results** |
| **Tables B.39 – B.65** | **Bulk Specific Gravity Test Results for Laboratory Compacted Specimens** |
| **Tables B.66 – B.74** | **Back Calculated Gyratory Densities With Attached Height Data** |
| **Tables B.75 – B.103** | **Bulk Specific Gravity Test Results for Laboratory Compacted, Saw-Cut Specimens** |

**Table B.1 Roadway Core Bulk Specific Gravity and Density**

PROJECT: Union County - Region I
MIX: 411S
DATE: 9/16/97
TEMP. (C): 21

$\Delta T$ = 4
$G_{mm}$ = 2.480

| Sample No. | Weight In Air (g) | Weight In Water (g) | Weight, SSD (g) | Correction Factor (K) | Bulk Sp Gr | Density ($Kg/m^3$) | Density ($lb/ft^3$) | $\%G_{mm}$ |
|---|---|---|---|---|---|---|---|---|
| 1 | 1251.0 | 707.7 | 1254.8 | 1.00095 | 2.287 | 2280 | 142.3 | 92.2 |
| 2 | 1563.9 | 883.3 | 1565.2 | 1.00095 | 2.293 | 2287 | 142.7 | 92.5 |
| 3 | 1203.7 | 688.5 | 1207.8 | 1.00095 | 2.318 | 2311 | 144.3 | 93.5 |
| 4 | 1309.7 | 747.6 | 1314.8 | 1.00095 | 2.309 | 2302 | 143.7 | 93.1 |
| 5 | 1319.2 | 744.6 | 1326.0 | 1.00095 | 2.269 | 2262 | 141.2 | 91.5 |
| 6 | 1310.4 | 748.4 | 1317.8 | 1.00095 | 2.301 | 2294 | 143.2 | 92.8 |
| | | | | Avg = | 2.296 | 2289 | 142.9 | 92.6 |

**Table B.2 Roadway Core Bulk Specific Gravity and Density**

PROJECT: Knox County - Region I
MIX: 411D
DATE: 10/16/97
TEMP. (C): 25

$\Delta T =$ 0
$G_{mm} =$ 2.414

| Sample No. | Weight In Air (g) | Weight In Water (g) | Weight, SSD (g) | Correction Factor (K) | Bulk Sp Gr | Density ($Kg/m^3$) | Density ($lb/ft^3$) | $\%G_{mm}$ |
|---|---|---|---|---|---|---|---|---|
| 1 | 461.5 | 251.0 | 465.8 | 1 | 2.149 | 2142 | 133.7 | 89.0 |
| 2 | 570.6 | 315.1 | 578.6 | 1 | 2.165 | 2159 | 134.8 | 89.7 |
| 3 | 513.5 | 283.6 | 523.9 | 1 | 2.137 | 2131 | 133.0 | 88.5 |
| 4 | 489.6 | 271.2 | 495.0 | 1 | 2.188 | 2181 | 136.2 | 90.6 |
| 5 | 454.8 | 251.6 | 463.3 | 1 | 2.148 | 2142 | 133.7 | 89.0 |
| 6 | 525.9 | 292.5 | 533.3 | 1 | 2.184 | 2177 | 135.9 | 90.5 |
| 7 | 414.3 | 229.3 | 426.3 | 1 | 2.103 | 2097 | 130.9 | 87.1 |
| 8 | 473.0 | 260.0 | 476.9 | 1 | 2.181 | 2174 | 135.7 | 90.3 |
| 9 | 411.9 | 226.3 | 416.2 | 1 | 2.169 | 2163 | 135.0 | 89.9 |
| 10 | 376.8 | 208.2 | 381.1 | 1 | 2.179 | 2173 | 135.6 | 90.3 |

**Table B.3 Roadway Core Bulk Specific Gravity and Density**

PROJECT: Marion County - Region II
MIX: 411D
DATE: 10/23/97
TEMP. (C): 25

$\Delta T$ = 0
$G_{mm}$ = 2.269

| Sample No. | Weight In Air (g) | Weight In Water (g) | Weight, SSD (g) | Correction Factor (K) | Bulk Sp Gr | Density ($Kg/m^3$) | Density ($lb/ft^3$) | $\%G_{mm}$ |
|---|---|---|---|---|---|---|---|---|
| 1 | 623.9 | 334.6 | 625.4 | 1 | 2.145 | 2139 | 142.8 | 94.6 |
| 2 | 560.4 | 297.7 | 562.8 | 1 | 2.114 | 2108 | 142.6 | 93.2 |
| 3 | 621.5 | 336.6 | 622.6 | 1 | 2.172 | 2165 | 135.2 | 95.7 |
| 4 | 608.2 | 327.0 | 610.1 | 1 | 2.147 | 2141 | 133.6 | 94.6 |
| 5 | 589.6 | 317.9 | 591.2 | 1 | 2.157 | 2150 | 134.2 | 95.1 |
| 6 | 607.2 | 326.9 | 608.8 | 1 | 2.152 | 2146 | 133.9 | 94.8 |
| 7 | 633.6 | 338.4 | 636.0 | 1 | 2.129 | 2123 | 132.5 | 93.8 |
| 8 | 562.4 | 297.8 | 564.7 | 1 | 2.105 | 2099 | 131.0 | 92.8 |
| 9 | 545.4 | 289.9 | 547.7 | 1 | 2.117 | 2110 | 131.7 | 93.3 |
| 10 | 499.6 | 271.2 | 501.0 | 1 | 2.176 | 2170 | 135.5 | 95.9 |
| | | | | Average = | 2.174 | 2168 | 135.3 | 94.4 |

**Table B.4 Roadway Core Bulk Specific Gravity and Density**

PROJECT: Maury County - Region III
MIX: 411S
DATE: 9/23/97
TEMP. (C): 23

$\Delta T$ = 2
$G_{mm}$ = 2.392

| Sample No. | Weight In Air (g) | Weight In Water (g) | Weight, SSD (g) | Correction Factor (K) | Bulk Sp Gr | Density ($Kg/m^3$) | Density ($lb/ft^3$) | $\%G_{mm}$ |
|---|---|---|---|---|---|---|---|---|
| 1 | 1663.6 | 903.2 | 1668.1 | 1.000495 | 2.1749 | 2168 | 135.4 | 90.9 |
| 2 | 1114.0 | 610.2 | 1123.3 | 1.000495 | 2.1711 | 2165 | 135.1 | 90.8 |
| 3 | 1714.9 | 931.7 | 1726.5 | 1.000495 | 2.1576 | 2151 | 134.3 | 90.2 |
| 4 | 1266.9 | 699.2 | 1279.2 | 1.000495 | 2.1843 | 2178 | 136.0 | 91.3 |
| 5 | 1117.3 | 610.1 | 1129.6 | 1.000495 | 2.1507 | 2144 | 133.9 | 89.9 |
| 6 | 1315.7 | 718.4 | 1325.4 | 1.000495 | 2.1675 | 2161 | 134.9 | 90.6 |
| | | | | Avg = | 2.1677 | 2161 | 134.9 | 90.6 |

**Table B.5 Roadway Core Bulk Specific Gravity and Density**

PROJECT: Lincoln County - Region III
MIX: 411S
DATE: 9/15/97
TEMP. (C): 23

$\Delta T$ = 2
$G_{mm}$ = 2.486

| Sample No. | Weight In Air (g) | Weight In Water (g) | Weight, SSD (g) | Correction Factor (K) | Bulk Sp Gr | Density ($Kg/m^3$) | Density ($lb/ft^3$) | $\%G_{mm}$ |
|---|---|---|---|---|---|---|---|---|
| 1 | 1528.8 | 849.6 | 1535.5 | 1.000495 | 2.2300 | 2223 | 138.8 | 89.7 |
| 2 | 1293.2 | 735.7 | 1320.6 | 1.000495 | 2.2121 | 2205 | 137.7 | 89.0 |
| 3 | 1310.1 | 741.3 | 1341.7 | 1.000495 | 2.1831 | 2177 | 135.9 | 87.8 |
| 4 | 1484.9 | 827.4 | 1512.4 | 1.000495 | 2.1688 | 2162 | 135.0 | 87.2 |
| 5 | 1209.2 | 666.5 | 1216.8 | 1.000495 | 2.1984 | 2192 | 136.8 | 88.4 |
| 6 | 682.8 | 379.1 | 693.3 | 1.000495 | 2.1742 | 2168 | 135.3 | 87.5 |
| | | | | Avg = | 2.1944 | 2188 | 136.6 | 88.3 |

**Table B.6 Roadway Core Bulk Specific Gravity and Density**

PROJECT: Madison County - Region IV
MIX: 411S
DATE: 8/12/97
TEMP. (C): 25

$\Delta T$ = 0
$G_{mm}$ = 2.314

| Sample No. | Weight In Air (g) | Weight In Water (g) | Weight, SSD (g) | Correction Factor (K) | Bulk Sp Gr | Density ($Kg/m^3$) | Density ($lb/ft^3$) | $\%G_{mm}$ |
|---|---|---|---|---|---|---|---|---|
| 1 | 637.9 | 343.0 | 640.3 | 1 | 2.146 | 2139 | 133.5 | 92.7 |
| 2 | 660.0 | 354.2 | 663.5 | 1 | 2.134 | 2127 | 132.8 | 92.2 |
| 3 | 693.9 | 372.9 | 699.1 | 1 | 2.127 | 2121 | 132.4 | 91.9 |
| 4 | 599.6 | 322.4 | 604.8 | 1 | 2.123 | 2117 | 132.1 | 91.8 |
| 5 | 537.4 | 290.5 | 543.5 | 1 | 2.124 | 2118 | 132.2 | 91.8 |
| 6 | 540.5 | 291.5 | 548.4 | 1 | 2.104 | 2098 | 130.9 | 90.9 |
| | | | | Average | 2.126 | 2120 | 132.3 | 91.9 |

**Table B.7 Roadway Core Bulk Specific Gravity and Density**

PROJECT: Madison County - Region IV
MIX: 307S
DATE: 8/12/97
TEMP. (C): 25

$\Delta T$ = 0
$G_{mm}$ = 2.520

| Sample No. | Weight In Air (g) | Weight In Water (g) | Weight, SSD (g) | Correction Factor (K) | Bulk Sp Gr | Density ($Kg/m^3$) | Density ($lb/ft^3$) | $\%G_{mm}$ |
|---|---|---|---|---|---|---|---|---|
| 1 | 855.1 | 491.5 | 862.7 | 1 | 2.304 | 2297 | 143.4 | 91.4 |
| 2 | 912.7 | 524.8 | 918.5 | 1 | 2.318 | 2311 | 144.3 | 92.0 |
| 3 | 916.2 | 523.7 | 921.0 | 1 | 2.306 | 2299 | 143.5 | 91.5 |
| 4 | 972.8 | 559.5 | 975.0 | 1 | 2.341 | 2334 | 145.7 | 92.9 |
| 5 | 893.7 | 513.6 | 897.8 | 1 | 2.326 | 2319 | 144.8 | 92.3 |
| 6 | 856.4 | 487.8 | 862.8 | 1 | 2.284 | 2277 | 142.1 | 90.6 |
| | | | | Average | 2.313 | 2306 | 144.0 | 91.8 |

**Table B.8 Roadway Core Bulk Specific Gravity and Density**

PROJECT: Lauderdale County - Region IV $\Delta T =$ 0
MIX: 411S $G_{mm} =$ 2.303
DATE: 10/15/97
TEMP. (C): 25

| Sample No. | Weight In Air (g) | Weight In Water (g) | Weight, SSD (g) | Correction Factor (K) | Bulk Sp Gr | Density ($Kg/m^3$) | Density ($lb/ft^3$) | $\%G_{mm}$ |
|---|---|---|---|---|---|---|---|---|
| 1 | 649.8 | 348.2 | 653.2 | 1 | 2.130 | 2124 | 132.6 | 92.5 |
| 2 | 633.9 | 342.6 | 637.5 | 1 | 2.150 | 2143 | 133.8 | 93.3 |
| 3a | 1243.3 | 666.5 | 1252.5 | 1 | 2.122 | 2115 | 132.1 | 92.1 |
| 3b | 569.5 | 306.2 | 573.7 | 1 | 2.129 | 2123 | 132.5 | 92.4 |
| 4 | 494.0 | 266.9 | 496.8 | 1 | 2.149 | 2142 | 133.7 | 93.3 |
| 5 | 516.5 | 281.5 | 518.4 | 1 | 2.180 | 2174 | 135.7 | 94.7 |
| 6 | 547.7 | 295.7 | 549.8 | 1 | 2.155 | 2149 | 134.2 | 93.6 |
| | | | | Average | 2.145 | 2139 | 133.5 | 93.1 |

**Table B.9 Roadway Core Bulk Specific Gravity and Density**

PROJECT: Lauderdale County - Region IV
MIX: 307S
DATE: 10/15/97
TEMP. (C): 25

$\Delta T =$ 0
$G_{mm} =$ 2.402

| Sample No. | Weight In Air (g) | Weight In Water (g) | Weight, SSD (g) | Correction Factor (K) | Bulk Sp Gr | Density ($Kg/m^3$) | Density ($lb/ft^3$) | $\%G_{mm}$ |
|---|---|---|---|---|---|---|---|---|
| 1 | 1007.5 | 558.1 | 1015.7 | 1 | 2.202 | 2195 | 137.0 | 91.7 |
| 2 | 1044.8 | 580.5 | 1059.6 | 1 | 2.181 | 2174 | 135.7 | 90.8 |
| 3 | 1021.3 | 561.3 | 1030.0 | 1 | 2.179 | 2172 | 135.6 | 90.7 |
| 4 | 843.0 | 460.8 | 852.6 | 1 | 2.152 | 2145 | 133.9 | 89.6 |
| 5 | 780.2 | 429.7 | 789.1 | 1 | 2.171 | 2164 | 135.1 | 90.4 |
| 6 | 787.9 | 435.2 | 795.3 | 1 | 2.188 | 2181 | 136.2 | 91.1 |
| | | | | Average | 2.179 | 2172 | 135.6 | 90.7 |

**Table B.10 Roadway Temperature and Density Data**

PROJECT: Union County - Region I
MIX: 411S
DATE: 9/16/97

TEMPERATURE AT PLANT (°F): 290
TEMPERATURE AT ROADWAY (°F): 290
AMBIENT TEMPERATURE (°F): 85

**After Breakdown (Steel Wheeled) Roller**

| | Left | | | Center | | | Right | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Station | Temp. (°F) | %$G_{mm}$ Nuclear Guage | %Gmm Roadway Core | Temp. (°F) | %$G_{mm}$ Nuclear Guage | %Gmm Roadway Core | Temp. (°F) | %$G_{mm}$ Nuclear Guage | %Gmm Roadway Core | Average |
| 00+00 | 248 | | | 248 | | | 246 | | | 247 |
| 00+25 | 226 | | | 229 | | | 236 | | | 230 |
| 00+50 | 220 | | | 228 | | | 235 | | | 228 |
| 00+75 | 213 | | | 206 | | | 227 | | | 215 |
| 01+00 | 210 | | | 209 | | | 231 | | | 217 |
| 01+25 | 196 | | | 200 | | | 210 | | | 202 |
| Average | 219 | | | 220 | | | 231 | | | 223 |

**Table B.11 Roadway Temperature and Density Data**

PROJECT: Union County - Region I
MIX: 411S
DATE: 9/16/97

TEMPERATURE AT PLANT (°F): 290
TEMPERATURE AT ROADWAY (°F): 290
AMBIENT TEMPERATURE (°F): 85

**After Pneumatic (Rubber Tire) Roller**

| | Left | | | Center | | | Right | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Station | Temp. (°F) | %$G_{mm}$ Nuclear Guage | %Gmm Roadway Core | Temp. (°F) | %$G_{mm}$ Nuclear Guage | %Gmm Roadway Core | Temp. (°F) | %$G_{mm}$ Nuclear Guage | %Gmm Roadway Core | Average |
| 00+00 | 203 | | | 196 | | | 207 | | | 202 |
| 00+25 | 188 | | | 190 | | | 202 | | | 193 |
| 00+50 | 196 | | | 192 | | | 206 | | | 198 |
| 00+75 | 188 | | | 180 | | | 199 | | | 189 |
| 01+00 | 189 | | | 186 | | | 209 | | | 195 |
| 01+25 | 180 | | | 183 | | | 193 | | | 185 |
| Average | 191 | | | 188 | | | 203 | | | 194 |

**Table B.12 Roadway Temperature and Density Data**

PROJECT: Union County - Region I
MIX: 411S
DATE: 9/16/97

TEMPERATURE AT PLANT (°F): 290
TEMPERATURE AT ROADWAY (°F): 290
AMBIENT TEMPERATURE (°F): 85

**After Finish (Steel Wheel) Roller**

| | Left | | | Center | | | Right | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Station | Temp. (°F) | %$G_{mm}$ Nuclear Guage | %Gmm Roadway Core | Temp. (°F) | %$G_{mm}$ Nuclear Guage | %Gmm Roadway Core | Temp. (°F) | %$G_{mm}$ Nuclear Guage | %Gmm Roadway Core | Average |
| 00+00 | 165 | 92.8 | | 160 | 97.0 | | 167 | 97.2 | 92.3 | 164 |
| 00+25 | 153 | 91.5 | | 155 | 94.6 | 92.6 | 163 | 95.0 | | 157 |
| 00+50 | 157 | 93.0 | 93.6 | 158 | 96.7 | | 163 | 94.0 | | 159 |
| 00+75 | 154 | 92.1 | | 154 | 92.8 | 93.2 | 162 | 95.0 | | 157 |
| 01+00 | 156 | 89.6 | | 157 | 97.0 | | 169 | 94.4 | 91.6 | 161 |
| 01+25 | 152 | 91.7 | | 147 | 93.4 | 92.9 | 158 | 94.5 | | 152 |
| Average | 156 | 91.8 | 93.6 | 155 | 95.2 | 92.9 | 164 | 95.0 | 92.0 | 158 |

**Table B.13 Roadway Temperature and Density Data**

PROJECT: Knox County - Region I
MIX: 411D
DATE: 10/16/97

TEMPERATURE AT PLANT (°F): 305
TEMPERATURE AT ROADWAY (°F): 295
AMBIENT TEMPERATURE (°F): 65

**After Breakdown (Steel Wheeled) Roller**

| | Left | | | Center | | | Right | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Station | Temp. (°F) | $\%G_{mm}$ Nuclear Guage | %Gmm Roadway Core | Temp. (°F) | $\%G_{mm}$ Nuclear Guage | %Gmm Roadway Core | Temp. (°F) | $\%G_{mm}$ Nuclear Guage | %Gmm Roadway Core | Average |
| 00+00 | 208 | | | 195 | | | 210 | | | 204 |
| 00+25 | 208 | | | 199 | | | 195 | | | 201 |
| 00+50 | 197 | | | 198 | | | 198 | | | 198 |
| 00+75 | 193 | | | 189 | | | 198 | | | 193 |
| 01+00 | 187 | | | 191 | | | 191 | | | 190 |
| 01+25 | 179 | | | 161 | | | 184 | | | 175 |
| 01+50 | 0 | | | 0 | | | 0 | | | 0 |
| 01+75 | 0 | | | 0 | | | 0 | | | 0 |
| 02+00 | 0 | | | 0 | | | 0 | | | 0 |
| 02+25 | 0 | | | 0 | | | 0 | | | 0 |
| Average | 195 | | | 189 | | | 196 | | | 193 |

**Table B.14 Roadway Temperature and Density Data**

PROJECT: Knox County - Region I
MIX: 411D
DATE: 10/16/97

TEMPERATURE AT PLANT (°F): 305
TEMPERATURE AT ROADWAY (°F): 295
AMBIENT TEMPERATURE (°F): 65

**After Finish (Steel Wheel) Roller**

| | Left | | | Center | | | Right | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Station | Temp. (°F) | %$G_{mm}$ Nuclear Guage | %Gmm Roadway Core | Temp. (°F) | %$G_{mm}$ Nuclear Guage | %Gmm Roadway Core | Temp. (°F) | %$G_{mm}$ Nuclear Guage | %Gmm Roadway Core | Average |
| 00+00 | 163 | 0 | 0 | 150 | 88.0 | 89.0 | 175 | 0 | 0 | 163 |
| 00+25 | 167 | 0 | 0 | 163 | 90.2 | 89.7 | 160 | 0 | 0 | 163 |
| 00+50 | 166 | 0 | 0 | 164 | 87.7 | 88.5 | 163 | 0 | 0 | 164 |
| 00+75 | 154 | 0 | 0 | 163 | 86.5 | 90.6 | 161 | 0 | 0 | 159 |
| 01+00 | 159 | 0 | 0 | 161 | 87.8 | 89.0 | 160 | 0 | 0 | 160 |
| 01+25 | 152 | 0 | 0 | 141 | 86.1 | 90.5 | 160 | 0 | 0 | 151 |
| 01+50 | 0 | 0 | 0 | 0 | 92.2 | 87.1 | 0 | 0 | 0 | 0 |
| 01+75 | 0 | 0 | 0 | 0 | 86.7 | 90.3 | 0 | 0 | 0 | 0 |
| 02+00 | 0 | 0 | 0 | 0 | 89.0 | 89.9 | 0 | 0 | 0 | 0 |
| 02+25 | 0 | 0 | 0 | 0 | 90.0 | 90.3 | 0 | 0 | 0 | 0 |
| Average | 160 | 0 | 0 | 157 | 88.4 | 89.5 | 163 | 0 | 0 | 160 |

**Table B.15 Roadway Temperature and Density Data**

PROJECT: Marion County - Region II
MIX: 411D
DATE: 10/23/97

TEMPERATURE AT PLANT (°F): 330
TEMPERATURE AT ROADWAY (°F): 307
AMBIENT TEMPERATURE (°F): 45+

**After Breakdown (Steel Wheeled) Roller**

| | Left | | | Center | | | Right | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Station | Temp. (°F) | $\%G_{mm}$ Nuclear Guage | %Gmm Roadway Core | Temp. (°F) | $\%G_{mm}$ Nuclear Guage | %Gmm Roadway Core | Temp. (°F) | $\%G_{mm}$ Nuclear Guage | %Gmm Roadway Core | Average |
| 00+00 | 238 | | | 220 | | | 225 | | | 228 |
| 00+25 | 247 | | | 225 | | | 217 | | | 230 |
| 00+50 | 227 | | | 222 | | | 229 | | | 226 |
| 00+75 | 225 | | | 219 | | | 236 | | | 227 |
| 01+00 | 235 | | | 225 | | | 234 | | | 231 |
| 01+25 | 227 | | | 217 | | | 240 | | | 228 |
| Average | 233 | | | 221 | | | 230 | | | 228 |

**Table B.16 Roadway Temperature and Density Data**

PROJECT: Marion County - Region II
MIX: 411D
DATE: 10/23/97

TEMPERATURE AT PLANT (°F): 330
TEMPERATURE AT ROADWAY (°F): 307
AMBIENT TEMPERATURE (°F): 45+

**After Pneumatic (Rubber Tire) Roller**

| | Left | | | Center | | | Right | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Station | Temp. (°F) | %$G_{mm}$ Nuclear Guage | %Gmm Roadway Core | Temp. (°F) | %$G_{mm}$ Nuclear Guage | %Gmm Roadway Core | Temp. (°F) | %$G_{mm}$ Nuclear Guage | %Gmm Roadway Core | Average |
| 00+00 | 151 | | | 150 | | | 163 | | | 155 |
| 00+25 | 158 | | | 150 | | | 147 | | | 152 |
| 00+50 | 163 | | | 154 | | | 148 | | | 155 |
| 00+75 | 168 | | | 160 | | | 151 | | | 160 |
| 01+00 | 164 | | | 160 | | | 163 | | | 162 |
| 01+25 | 170 | | | 155 | | | 144 | | | 156 |
| Average | 162 | | | 155 | | | 153 | | | 157 |

**Table B.17 Roadway Temperature and Density Data**

PROJECT: Marion County - Region II
MIX: 411D
DATE: 10/23/97

TEMPERATURE AT PLANT (°F): 330
TEMPERATURE AT ROADWAY (°F): 307
AMBIENT TEMPERATURE (°F): 45+

**After Finish (Steel Wheel) Roller**

| | Left | | | Center | | | Right | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Station | Temp. (°F) | %$G_{mm}$ Nuclear Guage | %Gmm Roadway Core | Temp. (°F) | %$G_{mm}$ Nuclear Guage | %Gmm Roadway Core | Temp. (°F) | %$G_{mm}$ Nuclear Guage | %Gmm Roadway Core | Average |
| 00+00 | 138 | 93.1 | | 138 | 90.2 | | 138 | 97.3 | | 138 |
| 00+25 | 154 | 96.2 | | 145 | 93.5 | | 139 | 95.8 | | 146 |
| 00+50 | 163 | 96.6 | | 143 | 96.4 | | 136 | 96.3 | | 147 |
| 00+75 | 153 | 95.3 | | 145 | 94.3 | | 144 | 97.2 | | 147 |
| 01+00 | 154 | 96.6 | | 146 | 94.6 | | 145 | 95.1 | | 148 |
| 01+25 | 156 | 98.7 | | 149 | 97.2 | | 146 | 96.4 | | 150 |
| Average | 153 | 96.1 | 0.00 | 144 | 94.4 | 0.00 | 141 | 96.4 | 0.00 | 146 |

**Table B.18 Roadway Temperature and Density Data**

PROJECT: Maury County - Region III
MIX: 411S
DATE: 9/23/97

TEMPERATURE AT PLANT (°F): 282
TEMPERATURE AT ROADWAY (°F): 260
AMBIENT TEMPERATURE (°F): 75+

**After Breakdown (Steel Wheeled) Roller**

| | Left | | | Center | | | Right | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Station | Temp. (°F) | %$G_{mm}$ Nuclear Guage | %Gmm Roadway Core | Temp. (°F) | %$G_{mm}$ Nuclear Guage | %Gmm Roadway Core | Temp. (°F) | %$G_{mm}$ Nuclear Guage | %Gmm Roadway Core | Average |
| 00+00 | 215 | | | 197 | | | 208 | | | 207 |
| 00+25 | 227 | | | 230 | | | 221 | | | 226 |
| 00+50 | 227 | | | 227 | | | 220 | | | 225 |
| 00+75 | 229 | | | 228 | | | 220 | | | 226 |
| 01+00 | 232 | | | 225 | | | 224 | | | 227 |
| 01+25 | 238 | | | 243 | | | 235 | | | 239 |
| Average | 228 | | | 225 | | | 221 | | | 225 |

**Table B.19 Roadway Temperature and Density Data**

PROJECT: Maury County - Region III
MIX: 411S
DATE: 9/23/97

TEMPERATURE AT PLANT (°F): 282
TEMPERATURE AT ROADWAY (°F): 260
AMBIENT TEMPERATURE (°F): 75+

**After Pneumatic (Rubber Tire) Roller**

| | Left | | | Center | | | Right | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Station | Temp. (°F) | $\%G_{mm}$ Nuclear Guage | %Gmm Roadway Core | Temp. (°F) | $\%G_{mm}$ Nuclear Guage | %Gmm Roadway Core | Temp. (°F) | $\%G_{mm}$ Nuclear Guage | %Gmm Roadway Core | Average |
| 00+00 | 184 | | | 175 | | | 180 | | | 180 |
| 00+25 | 189 | | | 196 | | | 206 | | | 197 |
| 00+50 | 183 | | | 193 | | | 202 | | | 193 |
| 00+75 | 177 | | | 190 | | | 189 | | | 185 |
| 01+00 | 168 | | | 164 | | | 160 | | | 164 |
| 01+25 | 189 | | | 171 | | | 185 | | | 182 |
| Average | 182 | | | 182 | | | 187 | | | 183 |

**Table B.20 Roadway Temperature and Density Data**

PROJECT: Maury County - Region III
MIX: 411S
DATE: 9/23/97

TEMPERATURE AT PLANT (°F): 282
TEMPERATURE AT ROADWAY (°F): 260
AMBIENT TEMPERATURE (°F): 75+

**After Finish (Steel Wheel) Roller**

| | Left | | | Center | | | Right | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Station | Temp. (°F) | %$G_{mm}$ Nuclear Guage | %Gmm Roadway Core | Temp. (°F) | %$G_{mm}$ Nuclear Guage | %Gmm Roadway Core | Temp. (°F) | %$G_{mm}$ Nuclear Guage | %Gmm Roadway Core | Average |
| 00+00 | 158 | 89.8 | | 153 | 90.2 | | 150 | 91.0 | 91.0 | 154 |
| 00+25 | 161 | 88.4 | | 167 | 90.6 | 90.8 | 182 | 91.1 | | 170 |
| 00+50 | 154 | 90.7 | 90.2 | 164 | 92.5 | | 177 | 92.4 | | 165 |
| 00+75 | 149 | 89.4 | | 159 | 88.7 | 91.4 | 162 | 94.5 | | 157 |
| 01+00 | 142 | 91.3 | | 139 | 90.7 | | 136 | 91.6 | 89.9 | 139 |
| 01+25 | 166 | 91.6 | | 160 | 91.6 | 90.7 | 155 | 89.2 | | 160 |
| Average | 155 | 90.2 | 90.2 | 157 | 90.7 | 91.0 | 160 | 91.6 | 90.4 | 157 |

**Table B.21 Roadway Temperature and Density Data**

PROJECT: Lincoln County - Region III
MIX: 411S
DATE: 9/15/97

TEMPERATURE AT PLANT (°F): 330
TEMPERATURE AT ROADWAY (°F): 323 (after paver)
AMBIENT TEMPERATURE (°F): 80

**After Breakdown (Steel Wheeled) Roller**

| | Left | | | Center | | | Right | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Station | Temp. (°F) | %$G_{mm}$ Nuclear Guage | %Gmm Roadway Core | Temp. (°F) | %$G_{mm}$ Nuclear Guage | %Gmm Roadway Core | Temp. (°F) | %$G_{mm}$ Nuclear Guage | %Gmm Roadway Core | Average |
| 00+00 | 304 | | | 292 | | | 276 | | | 291 |
| 00+25 | 292 | | | 281 | | | 298 | | | 290 |
| 00+50 | 307 | | | 291 | | | 297 | | | 298 |
| 00+75 | 311 | | | 299 | | | 304 | | | 305 |
| 01+00 | 306 | | | 307 | | | 301 | | | 305 |
| 01+25 | 307 | | | 301 | | | 301 | | | 303 |
| Average | 305 | | | 295 | | | 296 | | | 299 |

**Table B.22 Roadway Temperature and Density Data**

PROJECT: Lincoln County - Region III
MIX: 411S
DATE: 9/15/97

TEMPERATURE AT PLANT (°F): 330
TEMPERATURE AT ROADWAY (°F): 323 (after paver)
AMBIENT TEMPERATURE (°F): 80

**After Pneumatic (Rubber Tire) Roller**

| | Left | | | Center | | | Right | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Station | Temp. (°F) | %$G_{mm}$ Nuclear Guage | %Gmm Roadway Core | Temp. (°F) | %$G_{mm}$ Nuclear Guage | %Gmm Roadway Core | Temp. (°F) | %$G_{mm}$ Nuclear Guage | %Gmm Roadway Core | Average |
| 00+00 | 237 | | | 222 | | | 234 | | | 231 |
| 00+25 | 232 | | | 249 | | | 265 | | | 249 |
| 00+50 | 235 | | | 240 | | | 247 | | | 241 |
| 00+75 | 233 | | | 240 | | | 253 | | | 242 |
| 01+00 | 245 | | | 238 | | | 250 | | | 244 |
| 01+25 | 253 | | | 235 | | | 245 | | | 244 |
| Average | 239 | | | 237 | | | 249 | | | 242 |

**Table B.23 Roadway Temperature and Density Data**

PROJECT: Lincoln County - Region III
MIX: 411S
DATE: 9/15/97

TEMPERATURE AT PLANT (°F): 330
TEMPERATURE AT ROADWAY (°F): 323 (after paver)
AMBIENT TEMPERATURE (°F): 80

**After Finish (Steel Wheel) Roller**

| | Left | | | Center | | | Right | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Station | Temp. (°F) | %$G_{mm}$ Nuclear Guage | %Gmm Roadway Core | Temp. (°F) | %$G_{mm}$ Nuclear Guage | %Gmm Roadway Core | Temp. (°F) | %$G_{mm}$ Nuclear Guage | %Gmm Roadway Core | Average |
| 00+00 | 206 | 83.4 | | 209 | 85.0 | | 216 | 88.1 | 89.7 | 210 |
| 00+25 | 201 | 86.1 | | 209 | 86.1 | 89.0 | 236 | 86.3 | | 215 |
| 00+50 | 202 | 86.7 | 87.8 | 202 | 87.8 | | 224 | 87.3 | | 209 |
| 00+75 | 204 | 86.8 | | 208 | 89.4 | 87.2 | 236 | 87.7 | | 216 |
| 01+00 | 220 | 84.9 | | 212 | 84.8 | | 230 | 85.5 | 88.4 | 221 |
| 01+25 | 223 | 86.9 | | 205 | 87.4 | 87.5 | 218 | 88.4 | | 215 |
| Average | 209 | 85.8 | 87.8 | 208 | 86.8 | 87.9 | 227 | 87.2 | 89.1 | 215 |

**Table B.24 Roadway Temperature and Density Data**

PROJECT: Madison County - Region IV
MIX: 411S
DATE: 8/12/97

TEMPERATURE AT PLANT (°F):
TEMPERATURE AT ROADWAY (°F): 335
AMBIENT TEMPERATURE (°F): 80

**After Breakdown (Steel Wheeled) Roller**

| | Left | | | Center | | | Right | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Station | Temp. (°F) | %$G_{mm}$ Nuclear Guage | %Gmm Roadway Core | Temp. (°F) | %$G_{mm}$ Nuclear Guage | %Gmm Roadway Core | Temp. (°F) | %$G_{mm}$ Nuclear Guage | %Gmm Roadway Core | Average |
| 00+00 | 273 | | | 269 | | | 271 | | | 271 |
| 00+25 | 270 | | | 264 | | | 266 | | | 267 |
| 00+50 | 271 | | | 258 | | | 265 | | | 265 |
| 00+75 | 256 | | | 227 | | | 240 | | | 241 |
| 01+00 | 241 | | | 239 | | | 248 | | | 243 |
| 01+25 | 206 | | | 231 | | | 209 | | | 215 |
| Average | 253 | | | 248 | | | 250 | | | 250 |

**Table B.25 Roadway Temperature and Density Data**

PROJECT: Madison County - Region IV
MIX: 411S
DATE: 8/12/97

TEMPERATURE AT PLANT (°F):
TEMPERATURE AT ROADWAY (°F): 335
AMBIENT TEMPERATURE (°F): 80

**After Pneumatic (Rubber Tire) Roller**

| | Left | | | Center | | | Right | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Station | Temp. (°F) | %$G_{mm}$ Nuclear Guage | %Gmm Roadway Core | Temp. (°F) | %$G_{mm}$ Nuclear Guage | %Gmm Roadway Core | Temp. (°F) | %$G_{mm}$ Nuclear Guage | %Gmm Roadway Core | Average |
| 00+00 | 189 | | | 177 | | | 196 | | | 187 |
| 00+25 | 183 | | | 178 | | | 188 | | | 183 |
| 00+50 | 182 | | | 163 | | | 187 | | | 177 |
| 00+75 | 173 | | | 151 | | | 173 | | | 166 |
| 01+00 | 166 | | | 145 | | | 181 | | | 164 |
| 01+25 | 136 | | | 136 | | | 159 | | | 144 |
| Average | 172 | | | 158 | | | 181 | | | 170 |

**Table B.26 Roadway Temperature and Density Data**

PROJECT: Madison County - Region IV
MIX: 411S
DATE: 8/12/97

TEMPERATURE AT PLANT (°F):
TEMPERATURE AT ROADWAY (°F): 335
AMBIENT TEMPERATURE (°F): 80

**After Finish (Steel Wheel) Roller**

| | Left | | | Center | | | Right | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Station | Temp. (°F) | %$G_{mm}$ Nuclear Guage | %Gmm Roadway Core | Temp. (°F) | %$G_{mm}$ Nuclear Guage | %Gmm Roadway Core | Temp. (°F) | %$G_{mm}$ Nuclear Guage | %Gmm Roadway Core | Average |
| 00+00 | 166 | 92.9 | | 150 | 92.3 | | 164 | 92.4 | 92.7 | 160 |
| 00+25 | 157 | 92.4 | | 158 | 93.0 | 92.2 | 167 | 94.1 | | 161 |
| 00+50 | 150 | 93.1 | 91.9 | 152 | 93.0 | | 171 | 92.9 | | 158 |
| 00+75 | 146 | 92.8 | | 150 | 92.9 | 91.8 | 166 | 93.0 | | 154 |
| 01+00 | 133 | 93.2 | | 135 | 92.8 | | 158 | 92.7 | 91.8 | 142 |
| 01+25 | 128 | 91.4 | | 130 | 90.3 | 90.9 | 145 | 90.0 | | 134 |
| Average | 147 | 92.6 | 91.9 | 146 | 92.4 | 91.6 | 162 | 92.5 | 92.3 | 151 |

**Table B.27 Roadway Temperature and Density Data**

PROJECT: Lauderdale County - Region IV
MIX: 411S
DATE: 10/15/97

TEMPERATURE AT PLANT (°F):
TEMPERATURE AT ROADWAY (°F): 285
AMBIENT TEMPERATURE (°F): 65 - Windy

**After Breakdown (Steel Wheeled) Roller**

| | Left | | | Center | | | Right | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Station | Temp. (°F) | $\%G_{mm}$ Nuclear Guage | %Gmm Roadway Core | Temp. (°F) | $\%G_{mm}$ Nuclear Guage | %Gmm Roadway Core | Temp. (°F) | $\%G_{mm}$ Nuclear Guage | %Gmm Roadway Core | Average |
| 00+00 | 202 | | | 185 | | | 176 | | | 188 |
| 00+25 | 209 | | | 199 | | | 192 | | | 200 |
| 00+50 | 212 | | | 198 | | | 204 | | | 205 |
| 00+75 | 198 | | | 194 | | | 215 | | | 202 |
| 01+00 | 190 | | | 185 | | | 207 | | | 194 |
| 01+25 | 202 | | | 202 | | | 206 | | | 203 |
| Average | 202 | | | 194 | | | 200 | | | 199 |

**Table B.28 Roadway Temperature and Density Data**

PROJECT: Lauderdale County - Region IV
MIX: 411S
DATE: 10/15/97

TEMPERATURE AT PLANT (°F):
TEMPERATURE AT ROADWAY (°F): 285
AMBIENT TEMPERATURE (°F): 65 - Windy

**After Pneumatic (Rubber Tire) Roller**

| | Left | | | Center | | | Right | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Station | Temp. (°F) | %$G_{mm}$ Nuclear Guage | %Gmm Roadway Core | Temp. (°F) | %$G_{mm}$ Nuclear Guage | %Gmm Roadway Core | Temp. (°F) | %$G_{mm}$ Nuclear Guage | %Gmm Roadway Core | Average |
| 00+00 | 141 | | | 125 | | | 132 | | | 133 |
| 00+25 | 142 | | | 137 | | | 143 | | | 141 |
| 00+50 | 140 | | | 131 | | | 143 | | | 138 |
| 00+75 | 142 | | | 126 | | | 144 | | | 137 |
| 01+00 | 137 | | | 129 | | | 147 | | | 138 |
| 01+25 | 140 | | | 137 | | | 147 | | | 141 |
| Average | 140 | | | 131 | | | 143 | | | 138 |

**Table B.29 Roadway Temperature and Density Data**

PROJECT: Lauderdale County - Region IV
MIX: 411S
DATE: 10/15/97

TEMPERATURE AT PLANT (°F):
TEMPERATURE AT ROADWAY (°F): 285
AMBIENT TEMPERATURE (°F): 65 - Windy

**After Finish (Steel Wheel) Roller**

| | Left | | | Center | | | Right | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Station | Temp. (°F) | %$G_{mm}$ Nuclear Guage | %Gmm Roadway Core | Temp. (°F) | %$G_{mm}$ Nuclear Guage | %Gmm Roadway Core | Temp. (°F) | %$G_{mm}$ Nuclear Guage | %Gmm Roadway Core | Average |
| 00+00 | 122 | 92.8 | - | 113 | 92.1 | 92.5 | 123 | 91.3 | - | 119 |
| 00+25 | 130 | 93.0 | - | 122 | 91.7 | 93.3 | 129 | 93.5 | - | 127 |
| 00+50 | 124 | 95.1 | - | 122 | 91.2 | 92.5 | 129 | 94.4 | - | 125 |
| 00+75 | 120 | 93.5 | 93.3 | 115 | 91.2 | - | 124 | 95.8 | - | 120 |
| 01+00 | 119 | 95.0 | 94.7 | 106 | 89.5 | - | 128 | 93.2 | - | 118 |
| 01+25 | 122 | 94.2 | 93.6 | 121 | 90.8 | - | 118 | 93.8 | - | 120 |
| Average | 123 | 93.9 | 93.9 | 117 | 91.1 | 92.8 | 125 | 93.6 | 0.0 | 122 |

**Table B.30 UT Theoretical Maximum Specific Gravity and Asphalt Content**

PROJECT: Union County - Region I
MIX: 411S
DATE: 9/16/97

Rice Specific Gravity, $G_{mm}$

| Sample No. | Dry Weight (g) | Weight of Bowl in Water (g) | Sample + Bowl in Water (g) | $G_{mm}$ |
|---|---|---|---|---|
| 1 | 1525.6 | 1265.9 | 2176.6 | 2.481 |
| 2 | 1474.6 | 1265.9 | 2145.4 | 2.478 |
| 3 | 1646.5 | 1265.9 | 2248.7 | 2.481 |
| | | | Average | 2.480 |

B.C. Content (NCAT) 6.38%
B.C. Content (Corrected) 6.10%

**Table B.31 UT Theoretical Maximum Specific Gravity and Asphalt Content**

PROJECT: Knox County - Region I
MIX: 411D
DATE: 10/16/97

Rice Specific Gravity, $G_{mm}$

| Sample No. | Dry Weight (g) | Weight of Bowl in Water (g) | Sample + Bowl in Water (g) | $G_{mm}$ |
|---|---|---|---|---|
| 1 | 2062.0 | 1265.9 | 2474.2 | 2.415 |
| 2 | 2066.8 | 1265.9 | 2475.3 | 2.411 |
| 3 | 1911.0 | 1265.9 | 2386.4 | 2.417 |
| | | | Average | 2.414 |

B.C. Content (NCAT) 6.70%
B.C. Content (Corrected) 6.51%

**Table B.32 UT Theoretical Maximum Specific Gravity and Asphalt Content**

PROJECT: Marion County - Region II
MIX: 411D
DATE: 10/23/97

Rice Specific Gravity, $G_{mm}$

| Sample No. | Dry Weight (g) | Weight of Bowl in Water (g) | Sample + Bowl in Water (g) | $G_{mm}$ |
|---|---|---|---|---|
| 1 | 1518.9 | 1265.9 | 2116.3 | 2.272 |
| 2 | 1331.1 | 1265.9 | 2011.3 | 2.273 |
| 3 | 1548.5 | 1265.9 | 2130.3 | 2.264 |
| | | | Average | 2.269 |

B.C. Content (NCAT) 8.15%
B.C. Content (Corrected) 7.73%

**Table B.33 UT Theoretical Maximum Specific Gravity and Asphalt Content**

PROJECT: Maury County - Region III
MIX: 411S
DATE: 9/23/97

Rice Specific Gravity, $G_{mm}$

| Sample No. | Dry Weight (g) | Weight of Bowl in Water (g) | Sample + Bowl in Water (g) | $G_{mm}$ |
|---|---|---|---|---|
| 1 | 1915.0 | 1265.8 | 2380.4 | 2.393 |
| 2 | 1877.5 | 1265.8 | 2356.7 | 2.387 |
| 3 | 1742.9 | 1265.8 | 2281.3 | 2.396 |
| | | | Average | 2.392 |

B.C. Content (NCAT) 6.65%
B.C. Content (Corrected) 5.76%

**Table B.34 UT Theoretical Maximum Specific Gravity and Asphalt Content**

PROJECT: Lincoln County - Region III
MIX: 411S
DATE: 9/15/97

Rice Specific Gravity, $G_{mm}$

| Sample No. | Dry Weight (g) | Weight of Bowl in Water (g) | Sample + Bowl in Water (g) | $G_{mm}$ |
|---|---|---|---|---|
| 1 | 1537.7 | 1265.8 | 2185.8 | 2.489 |
| 2 | 1536.2 | 1265.8 | 2183.7 | 2.485 |
| 3 | 1660.3 | 1265.8 | 2258.1 | 2.485 |
| | | | Average | 2.486 |

B.C. Content (NCAT) 4.64%
B.C. Content (Corrected) 4.31%

**Table B.35 UT Theoretical Maximum Specific Gravity and Asphalt Content**

PROJECT: Madison County - Region IV
MIX: 411S
DATE: 8/12/97

Rice Specific Gravity, $G_{mm}$

| Sample No. | Dry Weight (g) | Weight of Bowl in Water (g) | Sample + Bowl in Water (g) | $G_{mm}$ |
|---|---|---|---|---|
| 1 | 1742.4 | 1266.2 | 2254.0 | 2.309 |
| 2 | 1709.8 | 1266.2 | 2237.7 | 2.316 |
| 3 | 1502.3 | 1266.2 | 2120.5 | 2.318 |
| | | | Average | 2.314 |

B.C. Content (NCAT) 8.13%
B.C. Content (Corrected) 7.83%

**Table B.36 UT Theoretical Maximum Specific Gravity and Asphalt Content**

PROJECT: Madison County - Region IV
Mix: 307 S
DATE: 8/12/97

Rice Specific Gravity, $G_{mm}$

| Sample No. | Dry Weight (g) | Weight of Bowl in Water (g) | Sample + Bowl in Water (g) | $G_{mm}$ |
|---|---|---|---|---|
| 1 | 2625.0 | 1266.2 | 2849.7 | 2.520 |
| 2 | 2768.6 | 1266.2 | 2936.1 | 2.520 |
| 3 | | | | |
| | | | Average | 2.520 |

B.C. Content (NCAT) 4.36%
B.C. Content (Corrected) 4.07%

**Table B.37 UT Theoretical Maximum Specific Gravity and Asphalt Content**

PROJECT: Lauderdale County - Region IV
MIX: 411S
DATE: 10/15/97

Rice Specific Gravity, $G_{mm}$

| Sample No. | Dry Weight (g) | Weight of Bowl in Water (g) | Sample + Bowl in Water (g) | $G_{mm}$ |
|---|---|---|---|---|
| 1 | 1772.8 | 1266.2 | 2270.0 | 2.305 |
| 2 | 1706.5 | 1266.2 | 2232.3 | 2.305 |
| 3 | 1639.5 | 1266.2 | 2192.7 | 2.299 |
| | | | Average | 2.303 |

B.C. Content (NCAT) 6.89%
B.C. Content (Corrected) 6.49%

**Table B.38 UT Theoretical Maximum Specific Gravity and Asphalt Content**

PROJECT: Lauderdale County - Region IV
MIX: 307S
DATE: 10/15/97

Rice Specific Gravity, $G_{mm}$

| Sample No. | Dry Weight (g) | Weight of Bowl in Water (g) | Sample + Bowl in Water (g) | $G_{mm}$ |
|---|---|---|---|---|
| 1 | 1937.1 | 1266.2 | 2397.0 | 2.402 |
| 2 | 1764.7 | 1266.2 | 2297.8 | 2.407 |
| 3 | 1751.7 | 1266.2 | 2287.2 | 2.397 |
| | | | Average | 2.402 |

B.C. Content (NCAT) 4.59%
B.C. Content (Corrected) 3.93%

**Table B.39 UT Marshall Specimen Bulk Specific Gravities**

PROJECT: Union County - Region I  TEMP. (C): 25  ΔT = 0

MIX: 411S  $G_{mm}$ = 2.480

DATE: 9/16/97

Saturated Surface Dry Method

| Sample No. | Weight In Air (g) | Weight In Water (g) | Weight, SSD (g) | Correction Factor (K) | Bulk Sp Gr | Density ($Kg/m^3$) | Density ($lb/ft^3$) | %Gmm |
|---|---|---|---|---|---|---|---|---|
| 1 | 1208.9 | 715.2 | 1209.1 | 1 | 2.448 | 2440 | 152.3 | 98.7 |
| 2 | 1197.9 | 708.8 | 1198.0 | 1 | 2.449 | 2441 | 152.4 | 98.7 |
| 3 | 1165.4 | 684.3 | 1166.2 | 1 | 2.418 | 2411 | 150.5 | 97.5 |
| | | | | Avg = | 2.438 | 2431 | 151.8 | 98.3 |

Parafilm Method

| Sample No. | Weight In Air (g) | Sample w/ Parafilm in Air (g) | Weight In Water (g) | Specific Gravity of Parafilm | Correction Factor (K) | Bulk Sp Gr | Density ($Kg/m^3$) | Density ($lb/ft^3$) | %Gmm |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 1208.0 | 1216.6 | 705.4 | 0.9 | 1 | 2.408 | 2401 | 149.9 | 97.1 |
| 2 | 1197.9 | 1206.7 | 697.2 | 0.9 | 1 | 2.397 | 2390 | 149.2 | 96.7 |
| 3 | 1165.4 | 1173.8 | 670.6 | 0.9 | 1 | 2.360 | 2353 | 146.9 | 95.2 |
| | | | | | Avg = | 2.388 | 2381 | 148.6 | 96.3 |

**Table B.40 UT Gyratory Specimen Bulk Specific Gravities**

PROJECT: Union County - Region I
MIX: 411S
DATE: 9/16/97

TEMP. (C): 25

$\Delta T$ = 0
$G_{mm}$ = 2.480

Saturated Surface Dry Method

| Sample No. | Weight In Air (g) | Weight In Water (g) | Weight, SSD (g) | Correction Factor (K) | Bulk Sp Gr | Density ($Kg/m^3$) | Density ($lb/ft^3$) | %Gmm |
|---|---|---|---|---|---|---|---|---|
| 1 | 4904.8 | 2915.3 | 4905.3 | 1 | 2.465 | 2457 | 153.4 | 99.4 |
| 2 | 4899.9 | 2908.4 | 4900.6 | 1 | 2.460 | 2452 | 153.1 | 99.2 |
| 3 | 4898.4 | 2904.9 | 4898.8 | 1 | 2.457 | 2449 | 152.9 | 99.1 |
| | | | | Avg = | 2.460 | 2453 | 153.1 | 99.2 |

Parafilm Method

| Sample No. | Weight In Air (g) | Sample w/ Parafilm in Air (g) | Weight In Water (g) | Specific Gravity of Parafilm | Correction Factor (K) | Bulk Sp Gr | Density ($Kg/m^3$) | Density ($lb/ft^3$) | %Gmm |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 4904.8 | 4926.4 | 2896.9 | 0.9 | 1 | 2.446 | 2438 | 152.2 | 98.6 |
| 2 | 4899.9 | 4921.6 | 2882.1 | 0.9 | 1 | 2.431 | 2424 | 151.3 | 98.0 |
| 3 | 4898.4 | 4917.1 | 2881.2 | 0.9 | 1 | 2.431 | 2424 | 151.3 | 98.0 |
| | | | | | Avg = | 2.436 | 2429 | 151.6 | 98.2 |

**Table B.41 UT Vibratory Specimen Bulk Specific Gravities**

PROJECT: Union County - Region I
MIX: 411S
DATE: 9/16/97

TEMP. (C): 25

$\Delta T$ = 0
$G_{mm}$ = 2.480

Saturated Surface Dry Method

| Sample No. | Weight In Air (g) | Weight In Water (g) | Weight, SSD (g) | Correction Factor (K) | Bulk Sp Gr | Density ($Kg/m^3$) | Density ($lb/ft^3$) | %Gmm |
|---|---|---|---|---|---|---|---|---|
| 1 | 6542.0 | 3756.0 | 6552.3 | 1 | 2.340 | 2333 | 145.6 | 94.3 |
| 2 | 6575.7 | 3799.7 | 6582.8 | 1 | 2.363 | 2356 | 147.1 | 95.3 |
| 3 | 6598.4 | 3793.2 | 6603.0 | 1 | 2.348 | 2341 | 146.2 | 94.7 |
| | | | | Avg = | 2.350 | 2343 | 146.3 | 94.8 |

Parafilm Method

| Sample No. | Weight In Air (g) | Sample w/ Parafilm in Air (g) | Weight In Water (g) | Specific Gravity of Parafilm | Correction Factor (K) | Bulk Sp Gr | Density ($Kg/m^3$) | Density ($lb/ft^3$) | %Gmm |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 6542.0 | 6570.8 | 3658.8 | 0.9 | 1 | 2.272 | 2265 | 141.4 | 91.6 |
| 2 | 6575.7 | 6605.7 | 3721.1 | 0.9 | 1 | 2.306 | 2299 | 143.5 | 93.0 |
| 3 | 6598.4 | 6629.9 | 3719.8 | 0.9 | 1 | 2.295 | 2288 | 142.8 | 92.5 |
| | | | | | Avg = | 2.291 | 2284 | 142.6 | 92.4 |

**Table B.42 UT Marshall Specimen Bulk Specific Gravities**

PROJECT: Knox County - Region I  TEMP. (C): 25  $\Delta T =$ 0

MIX: 411D  $G_{mm} =$ 2.414

DATE: 10/16/97

Saturated Surface Dry Method

| Sample No. | Weight In Air (g) | Weight In Water (g) | Weight, SSD (g) | Correction Factor (K) | Bulk Sp Gr | Density ($Kg/m^3$) | Density ($lb/ft^3$) | %Gmm |
|---|---|---|---|---|---|---|---|---|
| 1 | 1186.3 | 673.9 | 1186.7 | 1 | 2.313 | 2306 | 144.0 | 95.8 |
| 2 | 1184.8 | 670.5 | 1185.4 | 1 | 2.301 | 2294 | 143.2 | 95.3 |
| 3 | 1183.1 | 668.6 | 1184.1 | 1 | 2.295 | 2288 | 142.8 | 95.1 |
| | | | | Avg = | 2.303 | 2296 | 143.3 | 95.4 |

Parafilm Method

| Sample No. | Weight In Air (g) | Sample w/ Parafilm in Air (g) | Weight In Water (g) | Specific Gravity of Parafilm | Correction Factor (K) | Bulk Sp Gr | Density ($Kg/m^3$) | Density ($lb/ft^3$) | %Gmm |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 1186.3 | 1190.6 | 667.1 | 0.9 | 1 | 2.250 | 2243 | 140.0 | 93.2 |
| 2 | 1184.8 | 1189.2 | 662.5 | 0.9 | 1 | 2.271 | 2264 | 141.3 | 94.1 |
| 3 | 1183.1 | 1187.8 | 658.8 | 0.9 | 1 | 2.259 | 2252 | 140.6 | 93.6 |
| | | | | | Avg = | 2.260 | 2253 | 140.6 | 93.6 |

**Table B.43 UT Gyratory Specimen Bulk Specific Gravities**

PROJECT: Knox County - Region I  TEMP. (C): 25  $\Delta T$ = 0

MIX: 411D  $G_{mm}$ = 2.414

DATE: 10/16/97

Saturated Surface Dry Method

| Sample No. | Weight In Air (g) | Weight In Water (g) | Weight, SSD (g) | Correction Factor (K) | Bulk Sp Gr | Density ($Kg/m^3$) | Density ($lb/ft^3$) | %Gmm |
|---|---|---|---|---|---|---|---|---|
| 1 | 4690.9 | 2661.2 | 4693.0 | 1 | 2.309 | 2302 | 143.7 | 95.6 |
| 2 | 4765.8 | 2703.5 | 4768.1 | 1 | 2.308 | 2301 | 143.7 | 95.6 |
| 3 | 4763.2 | 2699.4 | 4765.2 | 1 | 2.306 | 2299 | 143.5 | 95.5 |
| | | | | Avg = | 2.308 | 2301 | 143.6 | 95.6 |

Parafilm Method

| Sample No. | Weight In Air (g) | Sample w/ Parafilm in Air (g) | Weight In Water (g) | Specific Gravity of Parafilm | Correction Factor (K) | Bulk Sp Gr | Density ($Kg/m^3$) | Density ($lb/ft^3$) | %Gmm |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 4690.9 | 4701.1 | 2632.1 | 0.9 | 1 | 2.280 | 2273 | 141.9 | 94.4 |
| 2 | 4765.8 | 4776.1 | 2676.5 | 0.9 | 1 | 2.282 | 2275 | 142.1 | 94.5 |
| 3 | 4763.2 | 4775.0 | 2673.2 | 0.9 | 1 | 2.280 | 2274 | 141.9 | 94.5 |
| | | | | | Avg = | 2.281 | 2274 | 142.0 | 94.5 |

**Table B.44 UT Vibratory Specimen Bulk Specific Gravities**

PROJECT: Knox County - Region I  TEMP. (C): 25  $\Delta T$ = 0

MIX: 411D  $G_{mm}$ = 2.414

DATE: 10/16/97

Saturated Surface Dry Method

| Sample No. | Weight In Air (g) | Weight In Water (g) | Weight, SSD (g) | Correction Factor (K) | Bulk Sp Gr | Density ($Kg/m^3$) | Density ($lb/ft^3$) | %Gmm |
|---|---|---|---|---|---|---|---|---|
| 1 | 6190.9 | 3391.8 | 6208.8 | 1 | 2.198 | 2191 | 136.8 | 91.0 |
| 2 | 6265.8 | 3451.4 | 6287.1 | 1 | 2.210 | 2203 | 137.5 | 91.5 |
| 3 | 6255.4 | 3431.5 | 6239.9 | 1 | 2.227 | 2221 | 138.6 | 92.3 |
| | | | | Avg = | 2.212 | 2205 | 137.6 | 91.6 |

Parafilm Method

| Sample No. | Weight In Air (g) | Sample w/ Parafilm in Air (g) | Weight In Water (g) | Specific Gravity of Parafilm | Correction Factor (K) | Bulk Sp Gr | Density ($Kg/m^3$) | Density ($lb/ft^3$) | %Gmm |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 6190.9 | 6220.1 | 3311.9 | 0.9 | 1 | 2.153 | 2146 | 134.0 | 89.2 |
| 2 | 6265.8 | 6296.9 | 3381.4 | 0.9 | 1 | 2.175 | 2168 | 135.4 | 90.1 |
| 3* | 6255.4 | 6286.8 | 3334.7 | 0.9 | 1 | 2.144 | 2138 | 133.5 | 88.8 |
| | | | | | Avg = | 2.157 | 2151 | 134.3 | 89.4 |

* Knox County Sample 3 - Reheated for compaction

**Table B.45 UT Marshall Specimen Bulk Specific Gravities**

PROJECT: Marion County - Region II  TEMP. (C): 25  $\Delta T$ = 0

MIX: 411D  $G_{mm}$ = 2.269

DATE: 10/23/97

Saturated Surface Dry Method

| Sample No. | Weight In Air (g) | Weight In Water (g) | Weight, SSD (g) | Correction Factor (K) | Bulk Sp Gr | Density ($Kg/m^3$) | Density ($lb/ft^3$) | %Gmm |
|---|---|---|---|---|---|---|---|---|
| 1 | 1096.6 | 607.4 | 1097.0 | 1 | 2.240 | 2233 | 139.4 | 98.7 |
| 2 | 1101.9 | 612.5 | 1102.1 | 1 | 2.251 | 2244 | 140.1 | 99.2 |
| 3 | 1096.8 | 609.2 | 1097.3 | 1 | 2.247 | 2240 | 139.9 | 99.0 |
| | | | | Avg = | 2.246 | 2239 | 139.8 | 99.0 |

Parafilm Method

| Sample No. | Weight In Air (g) | Sample w/ Parafilm in Air (g) | Weight In Water (g) | Specific Gravity of Parafilm | Correction Factor (K) | Bulk Sp Gr | Density ($Kg/m^3$) | Density ($lb/ft^3$) | %Gmm |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 1096.6 | 1100.0 | 596.3 | 0.9 | 1 | 2.194 | 2187 | 136.5 | 96.7 |
| 2 | 1101.9 | 1106.0 | 602.7 | 0.9 | 1 | 2.209 | 2203 | 137.5 | 97.4 |
| 3 | 1096.8 | 1100.8 | 599.5 | 0.9 | 1 | 2.207 | 2201 | 137.4 | 97.3 |
| | | | | | Avg = | 2.203 | 2197 | 137.1 | 97.1 |

**Table B.46 UT Gyratory Specimen Bulk Specific Gravities**

PROJECT: Marion County - Region II TEMP. (C): 25 $\Delta T$ = 0

MIX: 411D $G_{mm}$ = 2.269

DATE: 10/23/97

Saturated Surface Dry Method

| Sample No. | Weight In Air (g) | Weight In Water (g) | Weight, SSD (g) | Correction Factor (K) | Bulk Sp Gr | Density ($Kg/m^3$) | Density ($lb/ft^3$) | %Gmm |
|---|---|---|---|---|---|---|---|---|
| 1 | 4503.6 | 2525.8 | 4510.5 | 1 | 2.269 | 2262 | 141.2 | 100.0 |
| 2 | 4489.4 | 2517.5 | 4490.1 | 1 | 2.276 | 2269 | 141.7 | 100.3 |
| 3 | 4478.4 | 2513.5 | 4479.4 | 1 | 2.278 | 2271 | 141.8 | 100.4 |
| | | | | Avg = | 2.274 | 2268 | 141.6 | 100.2 |

Parafilm Method

| Sample No. | Weight In Air (g) | Sample w/ Parafilm in Air (g) | Weight In Water (g) | Specific Gravity of Parafilm | Correction Factor (K) | Bulk Sp Gr | Density ($Kg/m^3$) | Density ($lb/ft^3$) | %Gmm |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 4503.6 | 4513.1 | 2511.1 | 0.9 | 1 | 2.261 | 2255 | 140.8 | 99.7 |
| 2 | 4489.4 | 4499.4 | 2503.2 | 0.9 | 1 | 2.262 | 2255 | 140.8 | 99.7 |
| 3 | 4478.4 | 4487.9 | 2497.0 | 0.9 | 1 | 2.261 | 2255 | 140.8 | 99.7 |
| | | | | | Avg = | 2.261 | 2255 | 140.8 | 99.7 |

**Table B.47 UT Vibratory Specimen Bulk Specific Gravities**

PROJECT: Marion County - Region II TEMP. (C): 25 $\Delta T$ = 0

MIX: 411D $G_{mm}$ = 2.269

DATE: 10/23/97

Saturated Surface Dry Method

| Sample No. | Weight In Air (g) | Weight In Water (g) | Weight, SSD (g) | Correction Factor (K) | Bulk Sp Gr | Density ($Kg/m^3$) | Density ($lb/ft^3$) | %Gmm |
|---|---|---|---|---|---|---|---|---|
| 1 | 6030.9 | 3230.9 | 6042.7 | 1 | 2.145 | 2138 | 133.5 | 94.5 |
| 2 | 6032.6 | 3230.9 | 6045.9 | 1 | 2.143 | 2137 | 133.4 | 94.4 |
| 3 | 6025.9 | 3227.6 | 6035.4 | 1 | 2.146 | 2140 | 133.6 | 94.6 |
| | | | | Avg = | 2.145 | 2138 | 133.5 | 94.5 |

Parafilm Method

| Sample No. | Weight In Air (g) | Sample w/ Parafilm in Air (g) | Weight In Water (g) | Specific Gravity of Parafilm | Correction Factor (K) | Bulk Sp Gr | Density ($Kg/m^3$) | Density ($lb/ft^3$) | %Gmm |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 6030.9 | 6062.5 | 3158.3 | 0.9 | 1 | 2.102 | 2096 | 130.8 | 92.6 |
| 2 | 6032.6 | 6065.1 | 3162.9 | 0.9 | 1 | 2.105 | 2099 | 131.0 | 92.8 |
| 3 | 6025.9 | 6052.6 | 3157.0 | 0.9 | 1 | 2.103 | 2096 | 130.9 | 92.7 |
| | | | | | Avg = | 2.103 | 2097 | 130.9 | 92.7 |

**Table B.48 UT Marshall Specimen Bulk Specific Gravities**

PROJECT: Maury County - Region III TEMP. (C): 25 ΔT = 0

MIX: 411S $G_{mm}$ = 2.392

DATE: 9/23/97

Saturated Surface Dry Method

| Sample No. | Weight In Air (g) | Weight In Water (g) | Weight, SSD (g) | Correction Factor (K) | Bulk Sp Gr | Density ($Kg/m^3$) | Density ($lb/ft^3$) | %Gmm |
|---|---|---|---|---|---|---|---|---|
| 1 | 1162.9 | 665.5 | 1165.1 | 1 | 2.328 | 2321 | 144.9 | 97.3 |
| 2 | 1165.0 | 664.9 | 1165.9 | 1 | 2.325 | 2318 | 144.7 | 97.2 |
| 3 | 1153.1 | 658.5 | 1154.1 | 1 | 2.327 | 2320 | 144.8 | 97.3 |
| | | | | Avg = | 2.327 | 2320 | 144.8 | 97.3 |

Parafilm Method

| Sample No. | Weight In Air (g) | Sample w/ Parafilm in Air (g) | Weight In Water (g) | Specific Gravity of Parafilm | Correction Factor (K) | Bulk Sp Gr | Density ($Kg/m^3$) | Density ($lb/ft^3$) | %Gmm |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 1162.7 | 1169.8 | 652.5 | 0.9 | 1 | 2.283 | 2276 | 142.1 | 95.4 |
| 2 | 1165.0 | 1172.9 | 651.7 | 0.9 | 1 | 2.274 | 2267 | 141.5 | 95.0 |
| 3 | 1153.1 | 1161.3 | 645.2 | 0.9 | 1 | 2.274 | 2268 | 141.6 | 95.1 |
| | | | | | Avg = | 2.277 | 2270 | 141.7 | 95.2 |

**Table B.49 UT Gyratory Specimen Bulk Specific Gravities**

PROJECT: Maury County - Region III TEMP. (C): 25 $\Delta T$ = 0

MIX: 411S $G_{mm}$ = 2.392

DATE: 9/23/97

Saturated Surface Dry Method

| Sample No. | Weight In Air (g) | Weight In Water (g) | Weight, SSD (g) | Correction Factor (K) | Bulk Sp Gr | Density ($Kg/m^3$) | Density ($lb/ft^3$) | %Gmm |
|---|---|---|---|---|---|---|---|---|
| 1 | 4692.5 | 2692.2 | 4696.6 | 1 | 2.341 | 2334 | 145.7 | 97.9 |
| 2 | 4753.0 | 2732.5 | 4754.4 | 1 | 2.351 | 2344 | 146.3 | 98.3 |
| 3 | 4665.3 | 2650.5 | 4677.2 | 1 | 2.302 | 2295 | 143.3 | 96.2 |
| | | | | Avg = | 2.331 | 2324 | 145.1 | 97.5 |

Parafilm Method

| Sample No. | Weight In Air (g) | Sample w/ Parafilm in Air (g) | Weight In Water (g) | Specific Gravity of Parafilm | Correction Factor (K) | Bulk Sp Gr | Density ($Kg/m^3$) | Density ($lb/ft^3$) | %Gmm |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 4692.5 | 4714.5 | 2651.0 | 0.9 | 1 | 2.301 | 2294 | 143.2 | 96.2 |
| 2 | 4753.0 | 4772.3 | 2689.5 | 0.9 | 1 | 2.306 | 2299 | 143.5 | 96.4 |
| 3 | 4665.3 | 3685.3 | 2598.9 | 0.9 | 1 | 2.145 | 2138 | 133.5 | 89.7 |
| | | | | | Avg = | 2.251 | 2244 | 140.1 | 94.1 |

**Table B.50 UT Vibratory Specimen Bulk Specific Gravities**

PROJECT: Maury County - Region III TEMP. (C): 25 $\Delta T$ = 0

MIX: 411S $G_{mm}$ = 2.392

DATE: 9/23/97

Saturated Surface Dry Method

| Sample No. | Weight In Air (g) | Weight In Water (g) | Weight, SSD (g) | Correction Factor (K) | Bulk Sp Gr | Density ($Kg/m^3$) | Density ($lb/ft^3$) | %Gmm |
|---|---|---|---|---|---|---|---|---|
| 1 | 6241.5 | 3467.8 | 6562.1 | 1 | 2.017 | 2011 | 125.5 | 84.3 |
| 2 | 6327.5 | 3527.6 | 6340.9 | 1 | 2.249 | 2242 | 140.0 | 94.0 |
| 3 | 6214.3 | 3468.2 | 6239 | 1 | 2.243 | 2236 | 139.6 | 93.8 |
| | | | | Avg = | 2.170 | 2163 | 135.0 | 90.7 |

Parafilm Method

| Sample No. | Weight In Air (g) | Sample w/ Parafilm in Air (g) | Weight In Water (g) | Specific Gravity of Parafilm | Correction Factor (K) | Bulk Sp Gr | Density ($Kg/m^3$) | Density ($lb/ft^3$) | %Gmm |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 6241.5 | 6273.9 | 3348.0 | 0.9 | 1 | 2.160 | 2153 | 134.4 | 90.3 |
| 2 | 6327.5 | 6359.2 | 3433.1 | 0.9 | 1 | 2.189 | 2182 | 136.2 | 91.5 |
| 3 | 6214.3 | 6246.2 | 3343.5 | 0.9 | 1 | 2.167 | 2161 | 134.9 | 90.6 |
| | | | | | Avg = | 2.172 | 2165 | 135.2 | 90.8 |

**Table B.51 UT Marshall Specimen Bulk Specific Gravities**

PROJECT: Lincoln County - Region III
MIX: 411S
DATE: 9/15/97

TEMP. (C): 25

$\Delta T$ = 0
$G_{mm}$ = 2.486

Saturated Surface Dry Method

| Sample No. | Weight In Air (g) | Weight In Water (g) | Weight, SSD (g) | Correction Factor (K) | Bulk Sp Gr | Density ($Kg/m^3$) | Density ($lb/ft^3$) | %Gmm |
|---|---|---|---|---|---|---|---|---|
| 1 | 1235.1 | 708.9 | 1237.7 | 1 | 2.336 | 2329 | 145.4 | 94.0 |
| 2 | 1210.9 | 695.6 | 1213.3 | 1 | 2.339 | 2332 | 145.6 | 94.1 |
| 3 | 1218.1 | 701.2 | 1221.6 | 1 | 2.341 | 2334 | 145.7 | 94.2 |
| | | | | Avg = | 2.338 | 2331 | 145.5 | 94.1 |

Parafilm Method

| Sample No. | Weight In Air (g) | Sample w/ Parafilm in Air (g) | Weight In Water (g) | Specific Gravity of Parafilm | Correction Factor (K) | Bulk Sp Gr | Density ($Kg/m^3$) | Density ($lb/ft^3$) | %Gmm |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 1235.1 | 1244.0 | 691.1 | 0.9 | 1 | 2.275 | 2268 | 141.6 | 91.5 |
| 2 | 1210.9 | 1220.0 | 679.4 | 0.9 | 1 | 2.283 | 2276 | 142.1 | 91.8 |
| 3 | 1218.0 | 1227.1 | 679.6 | 0.9 | 1 | 2.267 | 2260 | 141.1 | 91.2 |
| | | | | | Avg = | 2.275 | 2268 | 141.6 | 91.5 |

**Table B.52 UT Gyratory Specimen Bulk Specific Gravities**

PROJECT: Lincoln County - Region III TEMP. (C): 25 $\Delta T$ = 0

MIX: 411S $G_{mm}$ = 2.486

DATE: 9/15/97

Saturated Surface Dry Method

| Sample No. | Weight In Air (g) | Weight In Water (g) | Weight, SSD (g) | Correction Factor (K) | Bulk Sp Gr | Density ($Kg/m^3$) | Density ($lb/ft^3$) | %Gmm |
|---|---|---|---|---|---|---|---|---|
| 1 | 4952.6 | 2876.5 | 4972.6 | 1 | 2.363 | 2356 | 147.1 | 95.0 |
| 2 | 4931.9 | 2856.6 | 4950.9 | 1 | 2.355 | 2348 | 146.6 | 94.7 |
| 3 | 4939.8 | 2844.9 | 4961.7 | 1 | 2.334 | 2327 | 145.2 | 93.9 |
| | | | | Avg = | 2.350 | 2343 | 146.3 | 94.5 |

Parafilm Method

| Sample No. | Weight In Air (g) | Sample w/ Parafilm in Air (g) | Weight In Water (g) | Specific Gravity of Parafilm | Correction Factor (K) | Bulk Sp Gr | Density ($Kg/m^3$) | Density ($lb/ft^3$) | %Gmm |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 4952.5 | 4976.4 | 2804.6 | 0.9 | 1 | 2.309 | 2302 | 143.7 | 92.9 |
| 2 | 4931.9 | 4954.8 | 2784.6 | 0.9 | 1 | 2.300 | 2293 | 143.1 | 92.5 |
| 3 | 4939.8 | 4962.3 | 2772.8 | 0.9 | 1 | 2.282 | 2275 | 142.0 | 91.8 |
| | | | | | Avg = | 2.297 | 2290 | 143.0 | 92.4 |

**Table B.53 UT Vibratory Specimen Bulk Specific Gravities**

PROJECT: Lincoln County - Region III TEMP. (C): 25 $\Delta T$ = 0

MIX: 411S $G_{mm}$ = 2.486

DATE: 9/15/97

Saturated Surface Dry Method

| Sample No. | Weight In Air (g) | Weight In Water (g) | Weight, SSD (g) | Correction Factor (K) | Bulk Sp Gr | Density ($Kg/m^3$) | Density ($lb/ft^3$) | %Gmm |
|---|---|---|---|---|---|---|---|---|
| 1 | 6439.8 | 3674.4 | 6561.6 | 1 | 2.230 | 2224 | 138.8 | 89.7 |
| 2 | 6500.1 | 3700.6 | 6559.9 | 1 | 2.273 | 2266 | 141.5 | 91.4 |
| 3 | 6494.9 | 3690.9 | 6568.6 | 1 | 2.257 | 2250 | 140.5 | 90.8 |
| | | | | Avg = | 2.254 | 2247 | 140.3 | 90.7 |
| X* | 6586.9 | 3743.3 | 6665.7 | 1 | 2.254 | 2247 | 140.3 | 90.7 |

Parafilm Method

| Sample No. | Weight In Air (g) | Sample w/ Parafilm in Air (g) | Weight In Water (g) | Specific Gravity of Parafilm | Correction Factor (K) | Bulk Sp Gr | Density ($Kg/m^3$) | Density ($lb/ft^3$) | %Gmm |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 6439.8 | 6471.8 | 3407.7 | 0.9 | 1 | 2.126 | 2120 | 132.3 | 85.5 |
| 2 | 6493.4 | 6520.3 | 3505.8 | 0.9 | 1 | 2.176 | 2169 | 135.4 | 87.5 |
| 3 | 6494.9 | 6526.6 | 3497.6 | 0.9 | 1 | 2.169 | 2163 | 135.0 | 87.3 |
| | | | | | Avg = | 2.157 | 2151 | 134.3 | 86.8 |
| X* | 6586.9 | 6618.4 | 3550.1 | 0.9 | 1 | 2.172 | 2165 | 135.2 | 87.4 |

**Table B.54 UT Marshall Specimen Bulk Specific Gravities**

PROJECT: Madison County - Region IV  TEMP. (C): 25  $\Delta T =$ 0

MIX: 411S  $G_{mm} =$ 2.314

DATE: 8/12/97

Saturated Surface Dry Method

| Sample No. | Weight In Air (g) | Weight In Water (g) | Weight, SSD (g) | Correction Factor (K) | Bulk Sp Gr | Density ($Kg/m^3$) | Density ($lb/ft^3$) | %Gmm |
|---|---|---|---|---|---|---|---|---|
| 1 | 1138.0 | 634.4 | 1138.6 | 1 | 2.257 | 2250 | 140.5 | 97.5 |
| 2 | 1136.5 | 629.3 | 1137.1 | 1 | 2.238 | 2231 | 139.3 | 96.7 |
| 3 | 1138.3 | 635.5 | 1138.9 | 1 | 2.261 | 2254 | 140.7 | 97.7 |
| | | | | Avg = | 2.252 | 2245 | 140.2 | 97.3 |

Parafilm Method

| Sample No. | Weight In Air (g) | Sample w/ Parafilm in Air (g) | Weight In Water (g) | Specific Gravity of Parafilm | Correction Factor (K) | Bulk Sp Gr | Density ($Kg/m^3$) | Density ($lb/ft^3$) | %Gmm |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 1138.0 | 1146.3 | 625.5 | 0.9 | 1 | 2.224 | 2218 | 138.5 | 96.1 |
| 2 | 1136.5 | 1145.3 | 624.8 | 0.9 | 1 | 2.225 | 2219 | 138.5 | 96.2 |
| 3 | 1138.3 | 1149.5 | 619.3 | 0.9 | 1 | 2.199 | 2192 | 136.8 | 95.0 |
| | | | | | Avg = | 2.216 | 2209 | 137.9 | 95.8 |

**Table B.55 UT Gyratory Specimen Bulk Specific Gravities**

PROJECT: Madison County - Region IV  TEMP. (C): 25  $\Delta T =$ 0

MIX: 411S  $G_{mm} =$ 2.314

DATE: 8/12/97

Saturated Surface Dry Method

| Sample No. | Weight In Air (g) | Weight In Water (g) | Weight, SSD (g) | Correction Factor (K) | Bulk Sp Gr | Density ($Kg/m^3$) | Density ($lb/ft^3$) | %Gmm |
|---|---|---|---|---|---|---|---|---|
| 1 | 4634.5 | 2593.5 | 4636.0 | 1 | 2.269 | 2262 | 141.2 | 98.1 |
| 2 | 4612.2 | 2586.5 | 4613.5 | 1 | 2.275 | 2269 | 141.6 | 98.3 |
| 3 | 4594.4 | 2581.1 | 4594.8 | 1 | 2.282 | 2275 | 142.0 | 98.6 |
| | | | | Avg = | 2.275 | 2269 | 141.6 | 98.3 |

Parafilm Method

| Sample No. | Weight In Air (g) | Sample w/ Parafilm in Air (g) | Weight In Water (g) | Specific Gravity of Parafilm | Correction Factor (K) | Bulk Sp Gr | Density ($Kg/m^3$) | Density ($lb/ft^3$) | %Gmm |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 4634.5 | 4657.3 | 2563.4 | 0.9 | 1 | 2.240 | 2234 | 139.4 | 96.8 |
| 2 | 4612.2 | 4637.6 | 2554.6 | 0.9 | 1 | 2.245 | 2238 | 139.7 | 97.0 |
| 3 | 4594.2 | 4616.5 | 2553.9 | 0.9 | 1 | 2.254 | 2248 | 140.3 | 97.4 |
| | | | | | Avg = | 2.247 | 2240 | 139.8 | 97.1 |

**Table B.56 UT Vibratory Specimen Bulk Specific Gravities**

PROJECT: Madison County - Region IV
MIX: 411S
DATE: 8/12/97

TEMP. (C): 25

$\Delta T$ = 0
$G_{mm}$ = 2.314

Saturated Surface Dry Method

| Sample No. | Weight In Air (g) | Weight In Water (g) | Weight, SSD (g) | Correction Factor (K) | Bulk Sp Gr | Density ($Kg/m^3$) | Density ($lb/ft^3$) | %Gmm |
|---|---|---|---|---|---|---|---|---|
| 1 | 6118.8 | 3306.1 | 6136.7 | 1 | 2.162 | 2155 | 134.5 | 93.4 |
| 2 | 6117.4 | 3316 | 6131 | 1 | 2.173 | 2167 | 135.3 | 93.9 |
| 3 | | | | | | | | |
| | | | | Avg = | 2.167 | 2161 | 134.9 | 93.7 |

Parafilm Method

| Sample No. | Weight In Air (g) | Sample w/ Parafilm in Air (g) | Weight In Water (g) | Specific Gravity of Parafilm | Correction Factor (K) | Bulk Sp Gr | Density ($Kg/m^3$) | Density ($lb/ft^3$) | %Gmm |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 6118.8 | 6150.4 | 3220.4 | 0.9 | 1 | 2.114 | 2107 | 131.6 | 91.3 |
| 2 | 6117.4 | 6149.1 | 3254.8 | 0.9 | 1 | 2.140 | 2133 | 133.2 | 92.5 |
| 3 | | | | | | | | | |
| | | | | | Avg = | 2.127 | 2120 | 132.4 | 91.9 |

Vibratory beams compacted at 75 psi

**Table B.57 UT Marshall Specimen Bulk Specific Gravities**

PROJECT: Madison County - Region IV  TEMP. (C): 25  $\Delta T = 0$

MIX: 307S  $G_{mm} = 2.520$

DATE: 8/12/97

Saturated Surface Dry Method

| Sample No. | Weight In Air (g) | Weight In Water (g) | Weight, SSD (g) | Correction Factor (K) | Bulk Sp Gr | Density ($Kg/m^3$) | Density ($lb/ft^3$) | %Gmm |
|---|---|---|---|---|---|---|---|---|
| 1 | 1239.1 | 730.9 | 1240.6 | 1 | 2.431 | 2424 | 151.3 | 96.5 |
| 2 | 1244.3 | 735.1 | 1246.2 | 1 | 2.435 | 2427 | 151.5 | 96.6 |
| 3 | 1232.3 | 729.5 | 1235.0 | 1 | 2.438 | 2430 | 151.7 | 96.7 |
| | | | | Avg = | 2.434 | 2427.2 | 151.5 | 96.6 |

Parafilm Method

| Sample No. | Weight In Air (g) | Sample w/ Parafilm in Air (g) | Weight In Water (g) | Specific Gravity of Parafilm | Correction Factor (K) | Bulk Sp Gr | Density ($Kg/m^3$) | Density ($lb/ft^3$) | %Gmm |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 1239.1 | 1250.4 | 716.5 | 0.9 | 1 | 2.377 | 2370 | 147.9 | 94.3 |
| 2 | 1244.3 | 1254.2 | 716.0 | 0.9 | 1 | 2.360 | 2353 | 146.9 | 93.7 |
| 3 | 1232.2 | 1242.1 | 721.8 | 0.9 | 1 | 2.419 | 2412 | 150.6 | 96.0 |
| | | | | | Avg = | 2.385 | 2378.3 | 148.5 | 94.7 |

**Table B.58 UT Gyratory Specimen Bulk Specific Gravities**

PROJECT: Madison County - Region IV TEMP. (C): 25 $\Delta T = 0$

MIX: 307S $G_{mm} = 2.520$

DATE: 8/12/97

Saturated Surface Dry Method

| Sample No. | Weight In Air (g) | Weight In Water (g) | Weight, SSD (g) | Correction Factor (K) | Bulk Sp Gr | Density ($Kg/m^3$) | Density ($lb/ft^3$) | %Gmm |
|---|---|---|---|---|---|---|---|---|
| 1 | 5050.3 | 3017.3 | 5051.6 | 1 | 2.483 | 2475 | 154.5 | 98.5 |
| 2 | 5036.0 | 3013.7 | 5037.4 | 1 | 2.489 | 2481 | 154.9 | 98.8 |
| 3 | 5017.8 | 3000.4 | 5020.6 | 1 | 2.484 | 2476 | 154.6 | 98.6 |
| | | | | Avg = | 2.485 | 2478 | 154.7 | 98.6 |

Parafilm Method

| Sample No. | Weight In Air (g) | Sample w/ Parafilm in Air (g) | Weight In Water (g) | Specific Gravity of Parafilm | Correction Factor (K) | Bulk Sp Gr | Density ($Kg/m^3$) | Density ($lb/ft^3$) | %Gmm |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 5050.3 | 5067.0 | 2957.2 | 0.9 | 1 | 2.415 | 2408 | 150.3 | 95.8 |
| 2 | 5036.0 | 5068.7 | 2974.1 | 0.9 | 1 | 2.447 | 2439 | 152.3 | 97.1 |
| 3 | 5017.8 | 5051.7 | 2949.5 | 0.9 | 1 | 2.430 | 2423 | 151.3 | 96.4 |
| | | | | | Avg = | 2.431 | 2423 | 151.3 | 96.5 |

**Table B.59 UT Vibratory Specimen Bulk Specific Gravities**

PROJECT: Madison County - Region IV  TEMP. (C): 25  $\Delta T = 0$

MIX: 307S  $G_{mm} = 2.520$

DATE: 8/12/97

Saturated Surface Dry Method

| Sample No. | Weight In Air (g) | Weight In Water (g) | Weight, SSD (g) | Correction Factor (K) | Bulk Sp Gr | Density ($Kg/m^3$) | Density ($lb/ft^3$) | %Gmm |
|---|---|---|---|---|---|---|---|---|
| 1 | 6700.0 | 3844.5 | 6720.7 | 1 | 2.329 | 2322 | 145.0 | 92.4 |
| 2 | 6708.6 | 3839.4 | 6734.5 | 1 | 2.317 | 2310 | 144.2 | 92.0 |
| 3 | | | | 1 | | | | |
| | | | | Avg = | 2.323 | 2316 | 144.6 | 92.2 |
| X* | 6592.9 | 3870 | 6603.3 | | 2.412 | 2405 | 150.1 | 95.7 |

Parafilm Method

| Sample No. | Weight In Air (g) | Sample w/ Parafilm in Air (g) | Weight In Water (g) | Specific Gravity of Parafilm | Correction Factor (K) | Bulk Sp Gr | Density ($Kg/m^3$) | Density ($lb/ft^3$) | %Gmm |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 6700.0 | 6725.5 | 3728.4 | 0.9 | 1 | 2.257 | 2250 | 140.5 | 89.6 |
| 2 | 6708.6 | 6730.5 | 3682.9 | 0.9 | 1 | 2.219 | 2212 | 138.1 | 88.1 |
| 3 | | | | 0.9 | 1 | | | | |
| | | | | | Avg = | 2.238 | 2231 | 139.3 | 88.8 |
| X* | 6592.9 | 6623.8 | 3710.2 | 0.9 | 1 | 2.290 | 2283 | 142.5 | 90.9 |

**Table B.60 UT Marshall Specimen Bulk Specific Gravities**

PROJECT: Lauderdale County - Region IV TEMP. (C): 25 DT = 0

MIX: 411S $G_{mm}$ = 2.303

DATE: 10/15/97

Saturated Surface Dry Method

| Sample No. | Weight In Air (g) | Weight In Water (g) | Weight, SSD (g) | Correction Factor (K) | Bulk Sp Gr | Density ($Kg/m^3$) | Density ($lb/ft^3$) | %Gmm |
|---|---|---|---|---|---|---|---|---|
| 1 | 1150.6 | 625.4 | 1152.4 | 1 | 2.183 | 2177 | 135.9 | 94.8 |
| 2 | 1152.9 | 638.9 | 1154.1 | 1 | 2.238 | 2231 | 139.3 | 97.2 |
| 3 | 1172.1 | 647.9 | 1173.3 | 1 | 2.231 | 2224 | 138.8 | 96.9 |
| | | | | Avg = | 2.217 | 2211 | 138.0 | 96.3 |

(Parafilm Method

| Sample No. | Weight In Air (g) | Sample w/ Parafilm in Air (g) | Weight In Water (g) | Specific Gravity of Parafilm | Correction Factor (K) | Bulk Sp Gr | Density ($Kg/m^3$) | Density ($lb/ft^3$) | %Gmm |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 1150.6 | 1159.5 | 611.2 | 0.9 | 1 | 2.137 | 2131 | 133.0 | 92.8 |
| 2 | 1152.9 | 1161.8 | 628.0 | 0.9 | 1 | 2.201 | 2194 | 137.0 | 95.6 |
| 3 | 1172.1 | 1181.9 | 635.1 | 0.9 | 1 | 2.187 | 2181 | 136.1 | 95.0 |
| | | | | | Avg = | 2.175 | 2168 | 135.4 | 94.4 |

**Table B.61 UT Gyratory Specimen Bulk Specific Gravities**

PROJECT: Lauderdale County - Region IV TEMP. (C): 25 DT = 0

MIX: 411S $G_{mm}$ = 2.303

DATE: 10/15/97

Saturated Surface Dry Method

| Sample No. | Weight In Air (g) | Weight In Water (g) | Weight, SSD (g) | Correction Factor (K) | Bulk Sp Gr | Density ($Kg/m^3$) | Density ($lb/ft^3$) | %Gmm |
|---|---|---|---|---|---|---|---|---|
| 1 | 4571.8 | 2556.3 | 4575.2 | 1 | 2.265 | 2258 | 140.9 | 98.3 |
| 2 | 4565.6 | 2541.7 | 4567.8 | 1 | 2.253 | 2247 | 140.3 | 97.8 |
| 3 | 4551.8 | 2544.2 | 4554.7 | 1 | 2.264 | 2257 | 140.9 | 98.3 |
| | | | | Avg = | 2.261 | 2254 | 140.7 | 98.2 |

Parafilm Method

| Sample No. | Weight In Air (g) | Sample w/ Parafilm in Air (g) | Weight In Water (g) | Specific Gravity of Parafilm | Correction Factor (K) | Bulk Sp Gr | Density ($Kg/m^3$) | Density ($lb/ft^3$) | %Gmm |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 4571.8 | 4590.7 | 2524.2 | 0.9 | 1 | 2.235 | 2228 | 139.1 | 97.0 |
| 2 | 4565.6 | 4587.7 | 2508.2 | 0.9 | 1 | 2.222 | 2215 | 138.3 | 96.5 |
| 3 | 4551.8 | 4573.8 | 2516.8 | 0.9 | 1 | 2.239 | 2233 | 139.4 | 97.2 |
| | | | | | Avg = | 2.232 | 2225 | 138.9 | 96.9 |

**Table B.62 UT Vibratory Specimen Bulk Specific Gravities**

PROJECT: Lauderdale County - Region IV TEMP. (C): 25 DT = 0

MIX: 411S $G_{mm}$ = 2.303

DATE: 10/15/97

Saturated Surface Dry Method

| Sample No. | Weight In Air (g) | Weight In Water (g) | Weight, SSD (g) | Correction Factor (K) | Bulk Sp Gr | Density ($Kg/m^3$) | Density ($lb/ft^3$) | %Gmm |
|---|---|---|---|---|---|---|---|---|
| 1 | 6131.5 | 3291.2 | 6140.1 | 1 | 2.152 | 2146 | 134.0 | 93.5 |
| 2 | 6108.9 | 3301.3 | 6117.2 | 1 | 2.169 | 2163 | 135.0 | 94.2 |
| 3* | 6058.9 | 3284.7 | 6079.8 | 1 | 2.168 | 2161 | 134.9 | 94.1 |
| 4 | 6130.3 | 3323.2 | 6141.0 | 1 | 2.176 | 2169 | 135.4 | 94.5 |
| | | | | Avg = | 1.622 | 2160 | 134.8 | 94.1 |

Parafilm Method

| Sample No. | Weight In Air (g) | Sample w/ Parafilm in Air (g) | Weight In Water (g) | Specific Gravity of Parafilm | Correction Factor (K) | Bulk Sp Gr | Density ($Kg/m^3$) | Density ($lb/ft^3$) | %Gmm |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 6131.5 | 6162.6 | 3209.3 | 0.9 | 1 | 2.101 | 2094 | 130.7 | 91.2 |
| 2 | 6108.9 | 6090.0 | 3228.9 | 0.9 | 1 | 2.120 | 2113 | 131.9 | 92.0 |
| 3* | 6058.9 | 6139.1 | 3204.1 | 0.9 | 1 | 2.129 | 2123 | 132.5 | 92.4 |
| 4 | 6130.3 | 6162.6 | 3244.0 | 0.9 | 1 | 2.127 | 2120 | 132.4 | 92.3 |
| | | | | | Avg = | 1.587 | 1583 | 98.8 | 68.9 |

**Table B.63 UT Marshall Specimen Bulk Specific Gravities**

PROJECT: Lauderdale County - Region IV TEMP. (C): 25 $\Delta T$ = 0

MIX: 307S $G_{mm}$ = 2.402

DATE: 10/15/97

Saturated Surface Dry Method

| Sample No. | Weight In Air (g) | Weight In Water (g) | Weight, SSD (g) | Correction Factor (K) | Bulk Sp Gr | Density ($Kg/m^3$) | Density ($lb/ft^3$) | %Gmm |
|---|---|---|---|---|---|---|---|---|
| 1 | 1154.8 | 652.1 | 1156.9 | 1 | 2.288 | 2281 | 142.4 | 95.2 |
| 2 | 1162.2 | 663.8 | 1164.5 | 1 | 2.321 | 2314 | 144.5 | 96.6 |
| 3 | 1126.6 | 636.5 | 1127.8 | 1 | 2.293 | 2286 | 142.7 | 95.5 |
| | | | | Avg = | 2.301 | 2294 | 143.2 | 95.8 |

Parafilm Method

| Sample No. | Weight In Air (g) | Sample w/ Parafilm in Air (g) | Weight In Water (g) | Specific Gravity of Parafilm | Correction Factor (K) | Bulk Sp Gr | Density ($Kg/m^3$) | Density ($lb/ft^3$) | %Gmm |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 1154.8 | 1162.9 | 634.3 | 0.9 | 1 | 2.222 | 2216 | 138.3 | 92.5 |
| 2 | 1162.2 | 1170.8 | 649.1 | 0.9 | 1 | 2.269 | 2262 | 141.2 | 94.5 |
| 3 | 1126.6 | 1134.7 | 623.7 | 0.9 | 1 | 2.244 | 2237 | 139.7 | 93.4 |
| | | | | | Avg = | 2.245 | 2239 | 139.7 | 93.5 |

**Table B.64 UT Gyratory Specimen Bulk Specific Gravities**

PROJECT: Lauderdale County - Region IV  TEMP. (C): 25  $\Delta T$ = 0

MIX: 307S  $G_{mm}$ = 2.402

DATE: 10/15/97

Saturated Surface Dry Method

| Sample No. | Weight In Air (g) | Weight In Water (g) | Weight, SSD (g) | Correction Factor (K) | Bulk Sp Gr | Density ($Kg/m^3$) | Density ($lb/ft^3$) | %Gmm |
|---|---|---|---|---|---|---|---|---|
| 1 | 4719.2 | 2685.5 | 4724.4 | 1 | 2.315 | 2308 | 144.1 | 96.4 |
| 2 | 4698.8 | 2660.4 | 4703.9 | 1 | 2.299 | 2292 | 143.1 | 95.7 |
| 3 | 4691.6 | 2649.3 | 4698.0 | 1 | 2.290 | 2283 | 142.5 | 95.3 |
| | | | | Avg = | 2.301 | 2294 | 143.2 | 95.8 |

Parafilm Method

| Sample No. | Weight In Air (g) | Sample w/ Parafilm in Air (g) | Weight In Water (g) | Specific Gravity of Parafilm | Correction Factor (K) | Bulk Sp Gr | Density ($Kg/m^3$) | Density ($lb/ft^3$) | %Gmm |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 4719.2 | 4740.7 | 2635.1 | 0.9 | 1 | 2.267 | 2260 | 141.1 | 94.4 |
| 2 | 4698.8 | 4719.6 | 2607.5 | 0.9 | 1 | 2.249 | 2243 | 140.0 | 93.6 |
| 3 | 4691.6 | 4713.2 | 2597.1 | 0.9 | 1 | 2.243 | 2236 | 139.6 | 93.4 |
| | | | | | Avg = | 2.253 | 2246 | 140.2 | 93.8 |

**Table B.65 UT Vibratory Specimen Bulk Specific Gravities**

PROJECT: Lauderdale County - Region IV TEMP. (C): 25 $\Delta T$ = 0

MIX: 307S $G_{mm}$ = 2.402

DATE: 10/15/97

Saturated Surface Dry Method

| Sample No. | Weight In Air (g) | Weight In Water (g) | Weight, SSD (g) | Correction Factor (K) | Bulk Sp Gr | Density ($Kg/m^3$) | Density ($lb/ft^3$) | %Gmm |
|---|---|---|---|---|---|---|---|---|
| 1* | 6376.4 | 3461.0 | 6409.0 | 1 | 2.163 | 2156 | 134.6 | 90.0 |
| 2 | 6332.3 | 3456.3 | 6362.5 | 1 | 2.179 | 2172 | 135.6 | 90.7 |
| 3 | 6171.9 | 3363.3 | 6219.3 | 1 | 2.161 | 2155 | 134.5 | 90.0 |
| | | | | Avg = | 2.168 | 2161 | 134.9 | 90.2 |
| X** | 6342.0 | 3463.4 | 6374.1 | 1 | 2.179 | 2172 | 135.6 | 90.7 |

Parafilm Method

| Sample No. | Weight In Air (g) | Sample w/ Parafilm in Air (g) | Weight In Water (g) | Specific Gravity of Parafilm | Correction Factor (K) | Bulk Sp Gr | Density ($Kg/m^3$) | Density ($lb/ft^3$) | %Gmm |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 6376.4 | 6401.3 | 3334.2 | 0.9 | 1 | 2.098 | 2092 | 130.6 | 87.3 |
| 2 | 6332.3 | 6373.5 | 3318.5 | 0.9 | 1 | 2.104 | 2098 | 131.0 | 87.6 |
| 3 | 6171.9 | 6207.4 | 3169.2 | 0.9 | 1 | 2.058 | 2052 | 128.1 | 85.7 |
| | | | | | Avg = | 2.087 | 2081 | 129.9 | 86.9 |
| X** | 6342.0 | 6374.2 | 3316.6 | 0.9 | 1 | 2.099 | 2092 | 130.6 | 87.4 |

* Compacted without base plate (Density may be less)

** Compacted for 45 sec. At 65 psi

**Table B.66 Back Calculated Gyratory Densities**

PROJECT: Union County - Region I MIX: 411S DATE: 9/16/97

Saturated Surface Dry Method

| Sample No. | No. of Gyrations | Weight (grams) | Ht (mm) | Volume ($cm^3$) | Uncorrected Sp. Gr. | TMD | Uncorrected Density | Actual Density | Correction Factor | Corrected $\%G_{mm}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 8 | 4904.8 | 126.1 | 2228.4 | 2.201 | 2.480 | 88.8 | | 1.01422 | 90.0 |
| | 96 | 4904.8 | 115.0 | 2032.2 | 2.414 | 2.480 | 97.3 | | 1.01422 | 98.7 |
| | 152 | 4904.8 | 114.2 | 2018.1 | 2.430 | 2.480 | 98.0 | 2.465 | 1.01422 | 99.4 |
| 2 | 8 | 4899.9 | 127.7 | 2256.6 | 2.171 | 2.480 | 87.6 | | 1.01673 | 89.0 |
| | 96 | 4899.9 | 116.0 | 2049.9 | 2.390 | 2.480 | 96.4 | | 1.01673 | 98.0 |
| | 152 | 4899.9 | 114.6 | 2025.1 | 2.420 | 2.480 | 97.6 | 2.460 | 1.01673 | 99.2 |
| 3 | 8 | 4898.4 | 127 | 2244.3 | 2.183 | 2.480 | 88.0 | | 1.01580 | 89.4 |
| | 96 | 4898.4 | 115.8 | 2046.4 | 2.394 | 2.480 | 96.5 | | 1.01580 | 98.0 |
| | 152 | 4898.4 | 114.6 | 2025.1 | 2.419 | 2.480 | 97.5 | 2.457 | 1.01580 | 99.1 |
| | | | | | | | Average Corrected Density at $N_{design}$ | | | 98.2 |

Parafilm Method

| Sample No. | No. of Gyrations | Weight (grams) | Ht (mm) | Volume ($cm^3$) | Uncorrected Sp. Gr. | TMD | Uncorrected Density | Actual Density | Correction Factor | Corrected $\%G_{mm}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 8 | 4904.9 | 126.1 | 2228.4 | 2.201 | 2.480 | 88.8 | | 1.00639 | 89.3 |
| | 96 | 4904.9 | 115.0 | 2032.2 | 2.414 | 2.480 | 97.3 | | 1.00639 | 97.9 |
| | 152 | 4904.9 | 114.2 | 2018.1 | 2.430 | 2.480 | 98.0 | 2.446 | 1.00639 | 98.6 |
| 2 | 8 | 4900.0 | 127.7 | 2256.6 | 2.171 | 2.480 | 87.6 | | 1.00472 | 88.0 |
| | 96 | 4900.0 | 116.0 | 2049.9 | 2.390 | 2.480 | 96.4 | | 1.00472 | 96.8 |
| | 152 | 4900.0 | 114.6 | 2025.1 | 2.420 | 2.480 | 97.6 | 2.431 | 1.00472 | 98.0 |
| 3 | 8 | 4898.4 | 127 | 2244.3 | 2.183 | 2.480 | 88.0 | | 1.00505 | 88.5 |
| | 96 | 4898.4 | 115.8 | 2046.4 | 2.394 | 2.480 | 96.5 | | 1.00505 | 97.0 |
| | 152 | 4898.4 | 114.6 | 2025.1 | 2.419 | 2.480 | 97.5 | 2.431 | 1.00505 | 98.0 |
| | | | | | | | Average Corrected Density at $N_{design}$ | | | 97.3 |

# Union County – 411S

## Superpave Gyratory Compaction Height Data Sheets

Pine Instrument Company Gyratory Compactor MODE: Set Gyrations

Specimen Size: 150 mm
Pressure: 600 kPa
Specimen ID: 1

Date: 2/03/98
Time: 11:13
Technician: _____

SPECIMEN HEIGHT (mm) vs. GYRATION NO.

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 141.3 | 136.0 | 133.3 | 131.3 | 129.9 | 128.6 | 127.7 | 126.8 | 126.1 | 125.5 |
| 10 | 124.9 | 124.4 | 123.9 | 123.5 | 123.1 | 122.8 | 122.4 | 122.1 | 121.8 | 121.6 |
| 20 | 121.3 | 121.1 | 120.8 | 120.6 | 120.4 | 120.2 | 120.0 | 119.9 | 119.7 | 119.5 |
| 30 | 119.4 | 119.2 | 119.1 | 119.0 | 118.8 | 118.7 | 118.6 | 118.5 | 118.4 | 118.2 |
| 40 | 118.1 | 118.0 | 117.9 | 117.8 | 117.7 | 117.7 | 117.6 | 117.5 | 117.4 | 117.3 |
| 50 | 117.2 | 117.2 | 117.1 | 117.0 | 116.9 | 116.9 | 116.8 | 116.7 | 116.7 | 116.6 |
| 60 | 116.5 | 116.5 | 116.4 | 116.4 | 116.3 | 116.3 | 116.2 | 116.1 | 116.1 | 116.0 |
| 70 | 116.0 | 115.9 | 115.9 | 115.9 | 115.8 | 115.8 | 115.7 | 115.7 | 115.6 | 115.6 |
| 80 | 115.6 | 115.5 | 115.5 | 115.4 | 115.4 | 115.4 | 115.3 | 115.3 | 115.3 | 115.2 |
| 90 | 115.2 | 115.2 | 115.1 | 115.1 | 115.1 | 115.1 | 115.0 | 115.0 | 115.0 | 115.0 |
| 100 | 114.9 | 114.9 | 114.9 | 114.9 | 114.8 | 114.8 | 114.8 | 114.8 | 114.8 | 114.7 |
| 110 | 114.7 | 114.7 | 114.7 | 114.7 | 114.7 | 114.6 | 114.6 | 114.6 | 114.6 | 114.6 |
| 120 | 114.6 | 114.6 | 114.5 | 114.5 | 114.5 | 114.5 | 114.5 | 114.5 | 114.5 | 114.5 |
| 130 | 114.4 | 114.4 | 114.4 | 114.4 | 114.4 | 114.4 | 114.4 | 114.4 | 114.4 | 114.4 |
| 140 | 114.4 | 114.3 | 114.3 | 114.3 | 114.3 | 114.3 | 114.3 | 114.3 | 114.3 | 114.3 |
| 150 | 114.3 | 114.3 | 114.2 | | | | | | | |

Pine Instrument Company Gyratory Compactor — MODE: Set Gyrations

Specimen Size: 150 mm
Pressure: 600 kPa
Specimen ID: 2

Date: 2/03/98
Time: 11:22
Technician: _____

SPECIMEN HEIGHT (mm) vs. GYRATION NO.

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 144.1 | 138.2 | 135.3 | 133.2 | 131.7 | 130.4 | 129.3 | 128.4 | 127.7 | 127.0 |
| 10 | 126.4 | 125.9 | 125.4 | 124.9 | 124.5 | 124.2 | 123.8 | 123.5 | 123.2 | 122.9 |
| 20 | 122.6 | 122.4 | 122.2 | 121.9 | 121.7 | 121.5 | 121.3 | 121.2 | 121.0 | 120.8 |
| 30 | 120.7 | 120.5 | 120.4 | 120.2 | 120.1 | 120.0 | 119.8 | 119.7 | 119.6 | 119.5 |
| 40 | 119.4 | 119.3 | 119.2 | 119.1 | 119.0 | 118.9 | 118.8 | 118.7 | 118.6 | 118.5 |
| 50 | 118.4 | 118.3 | 118.3 | 118.2 | 118.1 | 118.0 | 118.0 | 117.9 | 117.8 | 117.8 |
| 60 | 117.7 | 117.6 | 117.6 | 117.5 | 117.4 | 117.4 | 117.3 | 117.3 | 117.2 | 117.2 |
| 70 | 117.1 | 117.0 | 117.0 | 116.9 | 116.9 | 116.8 | 116.8 | 116.7 | 116.7 | 116.7 |
| 80 | 116.6 | 116.6 | 116.5 | 116.5 | 116.4 | 116.4 | 116.4 | 116.3 | 116.3 | 116.2 |
| 90 | 116.2 | 116.2 | 116.1 | 116.1 | 116.0 | 116.0 | 116.0 | 115.9 | 115.9 | 115.9 |
| 100 | 115.8 | 115.8 | 115.8 | 115.7 | 115.7 | 115.7 | 115.6 | 115.6 | 115.6 | 115.6 |
| 110 | 115.5 | 115.5 | 115.5 | 115.4 | 115.4 | 115.4 | 115.4 | 115.3 | 115.3 | 115.3 |
| 120 | 115.3 | 115.2 | 115.2 | 115.2 | 115.2 | 115.1 | 115.1 | 115.1 | 115.1 | 115.0 |
| 130 | 115.0 | 115.0 | 115.0 | 115.0 | 114.9 | 114.9 | 114.9 | 114.9 | 114.8 | 114.8 |
| 140 | 114.8 | 114.8 | 114.8 | 114.8 | 114.7 | 114.7 | 114.7 | 114.7 | 114.7 | 114.6 |
| 150 | 114.6 | 114.6 | 114.6 | | | | | | | |

Pine Instrument Company Gyratory Compactor MODE: Set Gyrations

Specimen Size: 150 mm
Pressure: 600 kPa
Specimen ID: 3

Date: 2/03/98
Time: 11:34
Technician: _____

SPECIMEN HEIGHT (mm) vs. GYRATION NO.

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 142.3 | 136.9 | 134.1 | 132.2 | 130.7 | 129.6 | 128.6 | 127.8 | 127.0 | 126.4 |
| 10 | 125.8 | 125.3 | 124.8 | 124.4 | 124.0 | 123.6 | 123.3 | 123.0 | 122.7 | 122.4 |
| 20 | 122.2 | 121.9 | 121.7 | 121.5 | 121.3 | 121.1 | 120.9 | 120.7 | 120.6 | 120.4 |
| 30 | 120.3 | 120.1 | 120.0 | 119.9 | 119.7 | 119.6 | 119.5 | 119.4 | 119.3 | 119.1 |
| 40 | 119.0 | 118.9 | 118.8 | 118.7 | 118.7 | 118.6 | 118.5 | 118.4 | 118.3 | 118.2 |
| 50 | 118.1 | 118.1 | 118.0 | 117.9 | 117.8 | 117.8 | 117.7 | 117.6 | 117.6 | 117.5 |
| 60 | 117.4 | 117.4 | 117.3 | 117.3 | 117.2 | 117.1 | 117.1 | 117.0 | 117.0 | 116.9 |
| 70 | 116.9 | 116.8 | 116.8 | 116.7 | 116.7 | 116.6 | 116.6 | 116.5 | 116.5 | 116.4 |
| 80 | 116.4 | 116.4 | 116.3 | 116.3 | 116.2 | 116.2 | 116.2 | 116.1 | 116.1 | 116.0 |
| 90 | 116.0 | 116.0 | 115.9 | 115.9 | 115.9 | 115.8 | 115.8 | 115.8 | 115.7 | 115.7 |
| 100 | 115.7 | 115.6 | 115.6 | 115.6 | 115.6 | 115.5 | 115.5 | 115.5 | 115.5 | 115.4 |
| 110 | 115.4 | 115.4 | 115.4 | 115.3 | 115.3 | 115.3 | 115.3 | 115.2 | 115.2 | 115.2 |
| 120 | 115.2 | 115.1 | 115.1 | 115.1 | 115.1 | 115.1 | 115.0 | 115.0 | 115.0 | 115.0 |
| 130 | 115.0 | 114.9 | 114.9 | 114.9 | 114.9 | 114.9 | 114.9 | 114.8 | 114.8 | 114.8 |
| 140 | 114.8 | 114.8 | 114.8 | 114.7 | 114.7 | 114.7 | 114.7 | 114.7 | 114.7 | 114.7 |
| 150 | 114.7 | 114.6 | 114.6 | | | | | | | |

**Table B.67 Back Calculated Gyratory Densities**

PROJECT: Knox County - Reg. I  Mix: 411 D  DATE: 10/16/97

Saturated Surface Dry Method

| Sample No. | No. of Gyrations | Weight (grams) | Ht (mm) | Volume ($cm^3$) | Uncorrected Sp. Gr. | TMD | Uncorrected Density | Actual Density | Correction Factor | Corrected $\%G_{mm}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 8 | 4690.9 | 126.8 | 2240.7 | 2.093 | 2.414 | 86.7 | | 1.01597 | 88.1 |
| | 96 | 4690.9 | 118.0 | 2085.2 | 2.250 | 2.414 | 93.2 | | 1.01597 | 94.7 |
| | 152 | 4690.9 | 116.8 | 2064.0 | 2.273 | 2.414 | 94.1 | 2.309 | 1.01597 | 95.7 |
| 2 | 8 | 4765.8 | 129.3 | 2284.9 | 2.086 | 2.414 | 86.4 | | 1.01583 | 87.8 |
| | 96 | 4765.8 | 119.8 | 2117.0 | 2.251 | 2.414 | 93.3 | | 1.01583 | 94.7 |
| | 152 | 4765.8 | 118.7 | 2097.6 | 2.272 | 2.414 | 94.1 | 2.308 | 1.01583 | 95.6 |
| 3 | 8 | 4763.2 | 129.2 | 2283.2 | 2.086 | 2.414 | 86.4 | | 1.01636 | 87.8 |
| | 96 | 4763.2 | 119.9 | 2118.8 | 2.248 | 2.414 | 93.1 | | 1.01636 | 94.6 |
| | 152 | 4763.2 | 118.8 | 2099.4 | 2.269 | 2.414 | 94.0 | 2.306 | 1.01636 | 95.5 |
| | | | | | | | Average Corrected Density at $N_{design}$ | | | 94.7 |

Parafilm Method

| Sample No. | No. of Gyrations | Weight (grams) | Ht (mm) | Volume ($cm^3$) | Uncorrected Sp. Gr. | TMD | Uncorrected Density | Actual Density | Correction Factor | Corrected $\%G_{mm}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 8 | 4690.9 | 126.8 | 2240.7 | 2.093 | 2.414 | 86.7 | | 1.00321 | 87.0 |
| | 96 | 4690.9 | 118.0 | 2085.2 | 2.250 | 2.414 | 93.2 | | 1.00321 | 93.5 |
| | 152 | 4690.9 | 116.8 | 2064.0 | 2.273 | 2.414 | 94.1 | 2.280 | 1.00321 | 94.4 |
| 2 | 8 | 4765.8 | 129.3 | 2284.9 | 2.086 | 2.414 | 86.4 | | 1.00439 | 86.8 |
| | 96 | 4765.8 | 119.8 | 2117.0 | 2.251 | 2.414 | 93.3 | | 1.00439 | 93.7 |
| | 152 | 4765.8 | 118.7 | 2097.6 | 2.272 | 2.414 | 94.1 | 2.282 | 1.00439 | 94.5 |
| 3 | 8 | 4763.2 | 129.2 | 2283.2 | 2.086 | 2.414 | 86.4 | | 1.00490 | 86.8 |
| | 96 | 4763.2 | 119.9 | 2118.8 | 2.248 | 2.414 | 93.1 | | 1.00490 | 93.6 |
| | 152 | 4763.2 | 118.8 | 2099.4 | 2.269 | 2.414 | 94.0 | 2.280 | 1.00490 | 94.4 |
| | | | | | | | Average Corrected Density at $N_{design}$ | | | 93.6 |

# Knox County – 411D

## Superpave Gyratory Compaction Height Data Sheets

ine Instrument Company Gyratory Compactor MODE: Set Gyrations

ecimen Size: 150 mm
Pressure: 600 kPa
Specimen ID: 1

Date: 2/09/98
Time: 16:10
Technician: _____

SPECIMEN HEIGHT (mm) vs. GYRATION NO.

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 139.4 | 134.8 | 132.5 | 131.0 | 129.8 | 128.8 | 128.1 | 127.4 | 126.8 | 126.3 |
| 10 | 125.9 | 125.5 | 125.1 | 124.8 | 124.5 | 124.2 | 123.9 | 123.7 | 123.5 | 123.3 |
| 20 | 123.1 | 122.9 | 122.7 | 122.5 | 122.4 | 122.2 | 122.1 | 122.0 | 121.8 | 121.7 |
| 30 | 121.6 | 121.5 | 121.4 | 121.2 | 121.1 | 121.0 | 120.9 | 120.9 | 120.8 | 120.7 |
| 40 | 120.6 | 120.5 | 120.4 | 120.3 | 120.3 | 120.2 | 120.1 | 120.1 | 120.0 | 119.9 |
| 50 | 119.9 | 119.8 | 119.7 | 119.7 | 119.6 | 119.6 | 119.5 | 119.5 | 119.4 | 119.3 |
| 60 | 119.3 | 119.2 | 119.2 | 119.2 | 119.1 | 119.1 | 119.0 | 119.0 | 118.9 | 118.9 |
| 70 | 118.8 | 118.8 | 118.8 | 118.7 | 118.7 | 118.6 | 118.6 | 118.6 | 118.5 | 118.5 |
| 80 | 118.5 | 118.4 | 118.4 | 118.4 | 118.3 | 118.3 | 118.3 | 118.2 | 118.2 | 118.2 |
| 90 | 118.1 | 118.1 | 118.1 | 118.1 | 118.0 | 118.0 | 118.0 | 117.9 | 117.9 | 117.9 |
| 00 | 117.9 | 117.8 | 117.8 | 117.8 | 117.8 | 117.7 | 117.7 | 117.7 | 117.7 | 117.6 |
| 10 | 117.6 | 117.6 | 117.6 | 117.5 | 117.5 | 117.5 | 117.5 | 117.5 | 117.4 | 117.4 |
| 20 | 117.4 | 117.4 | 117.4 | 117.3 | 117.3 | 117.3 | 117.3 | 117.3 | 117.2 | 117.2 |
| 30 | 117.2 | 117.2 | 117.2 | 117.1 | 117.1 | 117.1 | 117.1 | 117.1 | 117.1 | 117.0 |
| 40 | 117.0 | 117.0 | 117.0 | 117.0 | 117.0 | 116.9 | 116.9 | 116.9 | 116.9 | 116.9 |
| 50 | 116.9 | 116.8 | 116.8 | | | | | | | |

'ine Instrument Company Gyratory Compactor MODE: Set Gyrations

pecimen Size: 150 mm
Pressure: 600 kPa
Specimen ID: 2

Date: 2/09/98
Time: 16:21
Technician: _____

SPECIMEN HEIGHT (mm) vs. GYRATION NO.

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 142.7 | 137.8 | 135.4 | 133.7 | 132.5 | 131.5 | 130.6 | 129.9 | 129.3 | 128.7 |
| 10 | 128.2 | 127.8 | 127.4 | 127.1 | 126.7 | 126.4 | 126.2 | 125.9 | 125.7 | 125.4 |
| 20 | 125.2 | 125.0 | 124.8 | 124.7 | 124.5 | 124.3 | 124.2 | 124.0 | 123.9 | 123.7 |
| 30 | 123.6 | 123.5 | 123.4 | 123.3 | 123.2 | 123.0 | 122.9 | 122.9 | 122.8 | 122.7 |
| 40 | 122.6 | 122.5 | 122.4 | 122.3 | 122.2 | 122.2 | 122.1 | 122.0 | 121.9 | 121.9 |
| 50 | 121.8 | 121.7 | 121.7 | 121.6 | 121.6 | 121.5 | 121.4 | 121.4 | 121.3 | 121.3 |
| 60 | 121.2 | 121.2 | 121.1 | 121.1 | 121.0 | 121.0 | 120.9 | 120.9 | 120.8 | 120.8 |
| 70 | 120.8 | 120.7 | 120.7 | 120.6 | 120.6 | 120.5 | 120.5 | 120.5 | 120.4 | 120.4 |
| 80 | 120.4 | 120.3 | 120.3 | 120.3 | 120.2 | 120.2 | 120.2 | 120.1 | 120.1 | 120.1 |
| 90 | 120.0 | 120.0 | 120.0 | 119.9 | 119.9 | 119.9 | 119.8 | 119.8 | 119.8 | 119.8 |
| 00 | 119.7 | 119.7 | 119.7 | 119.7 | 119.6 | 119.6 | 119.6 | 119.6 | 119.5 | 119.5 |
| 10 | 119.5 | 119.5 | 119.4 | 119.4 | 119.4 | 119.4 | 119.3 | 119.3 | 119.3 | 119.3 |
| 20 | 119.3 | 119.2 | 119.2 | 119.2 | 119.2 | 119.1 | 119.1 | 119.1 | 119.1 | 119.1 |
| 30 | 119.0 | 119.0 | 119.0 | 119.0 | 119.0 | 119.0 | 118.9 | 118.9 | 118.9 | 118.9 |
| 40 | 118.9 | 118.8 | 118.8 | 118.8 | 118.8 | 118.8 | 118.8 | 118.7 | 118.7 | 118.7 |
| 50 | 118.7 | 118.7 | 118.7 | | | | | | | |

ne Instrument Company Gyratory Compactor — MODE: Set Gyrations

ecimen Size: 150 mm
Pressure: 600 kPa
Specimen ID: 3

Date: 2/09/98
Time: 16:30
Technician: _____

SPECIMEN HEIGHT (mm) vs. GYRATION NO.

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 142.4 | 137.5 | 135.2 | 133.5 | 132.3 | 131.3 | 130.5 | 129.8 | 129.2 | 128.6 |
| 0 | 128.1 | 127.7 | 127.3 | 127.0 | 126.7 | 126.4 | 126.1 | 125.8 | 125.6 | 125.4 |
| :0 | 125.2 | 125.0 | 124.8 | 124.6 | 124.4 | 124.3 | 124.1 | 124.0 | 123.9 | 123.7 |
| )0 | 123.6 | 123.5 | 123.4 | 123.3 | 123.1 | 123.0 | 122.9 | 122.8 | 122.8 | 122.7 |
| :0 | 122.6 | 122.5 | 122.4 | 122.3 | 122.3 | 122.2 | 122.1 | 122.0 | 122.0 | 121.9 |
| :0 | 121.8 | 121.8 | 121.7 | 121.7 | 121.6 | 121.5 | 121.5 | 121.4 | 121.4 | 121.3 |
| ,0 | 121.3 | 121.2 | 121.2 | 121.1 | 121.1 | 121.0 | 121.0 | 121.0 | 120.9 | 120.9 |
| '0 | 120.8 | 120.8 | 120.7 | 120.7 | 120.7 | 120.6 | 120.6 | 120.5 | 120.5 | 120.5 |
| )0 | 120.4 | 120.4 | 120.4 | 120.3 | 120.3 | 120.3 | 120.2 | 120.2 | 120.2 | 120.1 |
| 90 | 120.1 | 120.1 | 120.1 | 120.0 | 120.0 | 120.0 | 119.9 | 119.9 | 119.9 | 119.9 |
| )0 | 119.8 | 119.8 | 119.8 | 119.8 | 119.7 | 119.7 | 119.7 | 119.7 | 119.6 | 119.6 |
| 10 | 119.6 | 119.6 | 119.5 | 119.5 | 119.5 | 119.5 | 119.5 | 119.4 | 119.4 | 119.4 |
| 20 | 119.4 | 119.4 | 119.3 | 119.3 | 119.3 | 119.3 | 119.3 | 119.2 | 119.2 | 119.2 |
| 30 | 119.2 | 119.2 | 119.1 | 119.1 | 119.1 | 119.1 | 119.1 | 119.1 | 119.0 | 119.0 |
| 40 | 119.0 | 119.0 | 119.0 | 118.9 | 118.9 | 118.9 | 118.9 | 118.9 | 118.9 | 118.9 |
| 50 | 118.8 | 118.8 | 118.8 | | | | | | | |

**Table B.68 Back Calculated Gyratory Densities**

PROJECT: Marion County - Region II MIX: 411D DATE: 10/23/97

Saturated Surface Dry Method

| Sample No. | No. of Gyrations | Weight (grams) | Ht (mm) | Volume ($cm^3$) | Uncorrected Sp. Gr. | TMD | Uncorrected Density | Actual Density | Correction Factor | Corrected $\%G_{mm}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 8 | 4503.6 | 123.4 | 2180.7 | 2.065 | 2.269 | 91.0 | | 1.01319 | 92.2 |
| | 96 | 4503.6 | 114.1 | 2016.3 | 2.234 | 2.269 | 98.4 | | 1.01319 | 99.7 |
| | 152 | 4503.6 | 113.8 | 2011.0 | 2.239 | 2.269 | 98.7 | 2.269 | 1.01319 | 100.0 |
| 2 | 8 | 4489.4 | 122.8 | 2170.1 | 2.069 | 2.269 | 91.2 | | 1.01684 | 92.7 |
| | 96 | 4489.4 | 113.8 | 2011.0 | 2.232 | 2.269 | 98.4 | | 1.01684 | 100.0 |
| | 152 | 4489.4 | 113.5 | 2005.7 | 2.238 | 2.269 | 98.6 | 2.276 | 1.01684 | 100.3 |
| 3 | 8 | 4478.4 | 123.0 | 2173.6 | 2.060 | 2.269 | 90.8 | | 1.01574 | 92.2 |
| | 96 | 4478.4 | 113.4 | 2003.9 | 2.235 | 2.269 | 98.5 | | 1.01574 | 100.0 |
| | 152 | 4478.4 | 113.0 | 1996.9 | 2.243 | 2.269 | 98.8 | 2.278 | 1.01574 | 100.4 |

Average Corrected Density at $N_{design}$ 99.9

Parafilm Method

| Sample No. | No. of Gyrations | Weight (grams) | Ht (mm) | Volume ($cm^3$) | Uncorrected Sp. Gr. | TMD | Uncorrected Density | Actual Density | Correction Factor | Corrected $\%G_{mm}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 8 | 4503.6 | 123.4 | 2180.7 | 2.065 | 2.269 | 91.0 | | 1.00961 | 91.9 |
| | 96 | 4503.6 | 114.1 | 2016.3 | 2.234 | 2.269 | 98.4 | | 1.00961 | 99.4 |
| | 152 | 4503.6 | 113.8 | 2011.0 | 2.239 | 2.269 | 98.7 | 2.261 | 1.00961 | 99.6 |
| 2 | 8 | 4489.4 | 122.8 | 2170.1 | 2.069 | 2.269 | 91.2 | | 1.01058 | 92.1 |
| | 96 | 4489.4 | 113.8 | 2011.0 | 2.232 | 2.269 | 98.4 | | 1.01058 | 99.4 |
| | 152 | 4489.4 | 113.5 | 2005.7 | 2.238 | 2.269 | 98.6 | 2.262 | 1.01058 | 99.7 |
| 3 | 8 | 4478.4 | 123.0 | 2173.6 | 2.060 | 2.269 | 90.8 | | 1.00816 | 91.5 |
| | 96 | 4478.4 | 113.4 | 2003.9 | 2.235 | 2.269 | 98.5 | | 1.00816 | 99.3 |
| | 152 | 4478.4 | 113.0 | 1996.9 | 2.243 | 2.269 | 98.8 | 2.261 | 1.00816 | 99.6 |

Average Corrected Density at $N_{design}$ 99.4

# Marion County - 411D

## Superpave Gyratory Compaction Height Data Sheets

Pine Instrument Company Gyratory Compactor — MODE: Set Gyrations

Specimen Size: 150 mm
Pressure: 600 kPa
Specimen ID: 1

Date: 2/10/98
Time: 1:02
Technician: _____

SPECIMEN HEIGHT (mm) vs. GYRATION NO.

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 138.4 | 132.9 | 130.3 | 128.4 | 126.9 | 125.8 | 124.8 | 124.0 | 123.4 | 122.7 |
| 10 | 122.2 | 121.7 | 121.3 | 120.8 | 120.5 | 120.1 | 119.8 | 119.5 | 119.2 | 119.0 |
| 20 | 118.8 | 118.5 | 118.3 | 118.1 | 117.9 | 117.8 | 117.6 | 117.4 | 117.3 | 117.1 |
| 30 | 117.0 | 116.9 | 116.7 | 116.6 | 116.5 | 116.4 | 116.3 | 116.2 | 116.1 | 116.0 |
| 40 | 115.9 | 115.8 | 115.7 | 115.7 | 115.6 | 115.5 | 115.4 | 115.4 | 115.3 | 115.2 |
| 50 | 115.2 | 115.1 | 115.0 | 115.0 | 114.9 | 114.9 | 114.8 | 114.8 | 114.7 | 114.7 |
| 60 | 114.7 | 114.6 | 114.6 | 114.6 | 114.5 | 114.5 | 114.5 | 114.5 | 114.4 | 114.4 |
| 70 | 114.4 | 114.4 | 114.3 | 114.3 | 114.3 | 114.3 | 114.3 | 114.3 | 114.2 | 114.2 |
| 80 | 114.2 | 114.2 | 114.2 | 114.2 | 114.2 | 114.2 | 114.2 | 114.1 | 114.1 | 114.1 |
| 90 | 114.1 | 114.1 | 114.1 | 114.1 | 114.1 | 114.1 | 114.1 | 114.1 | 114.1 | 114.0 |
| 100 | 114.0 | 114.0 | 114.0 | 114.0 | 114.0 | 114.0 | 114.0 | 114.0 | 114.0 | 114.0 |
| 110 | 114.0 | 114.0 | 114.0 | 114.0 | 114.0 | 114.0 | 114.0 | 114.0 | 113.9 | 113.9 |
| 120 | 113.9 | 113.9 | 113.9 | 113.9 | 113.9 | 113.9 | 113.9 | 113.9 | 113.9 | 113.9 |
| 130 | 113.9 | 113.9 | 113.9 | 113.9 | 113.9 | 113.9 | 113.9 | 113.9 | 113.9 | 113.9 |
| 140 | 113.9 | 113.9 | 113.9 | 113.9 | 113.8 | 113.8 | 113.8 | 113.8 | 113.8 | 113.8 |
| 150 | 113.8 | 113.8 | 113.8 | | | | | | | |

ine Instrument Company Gyratory Compactor MODE: Set Gyrations

pecimen Size: 150 mm
Pressure: 600 kPa
Specimen ID: 2

Date: 2/10/98
Time: 1:13
Technician: _____

SPECIMEN HEIGHT (mm) vs. GYRATION NO.

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 137.8 | 132.4 | 129.8 | 127.9 | 126.4 | 125.3 | 124.4 | 123.6 | 122.8 | 122.2 |
| .0 | 121.7 | 121.2 | 120.8 | 120.4 | 120.0 | 119.6 | 119.3 | 119.0 | 118.8 | 118.5 |
| 20 | 118.3 | 118.1 | 117.8 | 117.7 | 117.5 | 117.3 | 117.1 | 117.0 | 116.8 | 116.7 |
| 30 | 116.5 | 116.4 | 116.3 | 116.2 | 116.1 | 115.9 | 115.8 | 115.7 | 115.6 | 115.6 |
| 40 | 115.5 | 115.4 | 115.3 | 115.2 | 115.1 | 115.1 | 115.0 | 114.9 | 114.9 | 114.8 |
| 50 | 114.7 | 114.7 | 114.6 | 114.6 | 114.5 | 114.5 | 114.4 | 114.4 | 114.4 | 114.3 |
| 60 | 114.3 | 114.3 | 114.3 | 114.2 | 114.2 | 114.2 | 114.2 | 114.1 | 114.1 | 114.1 |
| 70 | 114.1 | 114.1 | 114.1 | 114.0 | 114.0 | 114.0 | 114.0 | 114.0 | 114.0 | 114.0 |
| 80 | 114.0 | 114.0 | 114.0 | 113.9 | 113.9 | 113.9 | 113.9 | 113.9 | 113.9 | 113.9 |
| 90 | 113.9 | 113.9 | 113.9 | 113.9 | 113.8 | 113.8 | 113.8 | 113.8 | 113.8 | 113.8 |
| 00 | 113.8 | 113.8 | 113.8 | 113.8 | 113.8 | 113.8 | 113.8 | 113.8 | 113.7 | 113.7 |
| 10 | 113.7 | 113.7 | 113.7 | 113.7 | 113.7 | 113.7 | 113.7 | 113.7 | 113.7 | 113.7 |
| 20 | 113.7 | 113.7 | 113.7 | 113.7 | 113.7 | 113.6 | 113.6 | 113.6 | 113.6 | 113.6 |
| 30 | 113.6 | 113.6 | 113.6 | 113.6 | 113.6 | 113.6 | 113.6 | 113.6 | 113.6 | 113.6 |
| 40 | 113.6 | 113.6 | 113.6 | 113.6 | 113.6 | 113.6 | 113.5 | 113.5 | 113.5 | 113.5 |
| 50 | 113.5 | 113.5 | 113.5 | | | | | | | |

Pine Instrument Company Gyratory Compactor — MODE: Set Gyrations

Specimen Size: 150 mm
Pressure: 600 kPa
Specimen ID: 3

Date: 2/10/98
Time: 1:22
Technician: _____

SPECIMEN HEIGHT (mm) vs. GYRATION NO.

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 137.8 | 132.4 | 129.8 | 128.0 | 126.6 | 125.4 | 124.5 | 123.7 | 123.0 | 122.4 |
| 10 | 121.8 | 121.4 | 120.9 | 120.5 | 120.1 | 119.8 | 119.5 | 119.2 | 118.9 | 118.7 |
| 20 | 118.4 | 118.2 | 118.0 | 117.8 | 117.6 | 117.4 | 117.3 | 117.1 | 117.0 | 116.8 |
| 30 | 116.7 | 116.5 | 116.4 | 116.3 | 116.2 | 116.1 | 116.0 | 115.9 | 115.8 | 115.7 |
| 40 | 115.6 | 115.5 | 115.4 | 115.3 | 115.2 | 115.2 | 115.1 | 115.0 | 115.0 | 114.9 |
| 50 | 114.8 | 114.8 | 114.7 | 114.6 | 114.6 | 114.5 | 114.5 | 114.4 | 114.4 | 114.3 |
| 60 | 114.3 | 114.2 | 114.2 | 114.2 | 114.1 | 114.1 | 114.0 | 114.0 | 114.0 | 113.9 |
| 70 | 113.9 | 113.9 | 113.9 | 113.8 | 113.8 | 113.8 | 113.8 | 113.7 | 113.7 | 113.7 |
| 80 | 113.7 | 113.6 | 113.6 | 113.6 | 113.6 | 113.6 | 113.5 | 113.5 | 113.5 | 113.5 |
| 90 | 113.5 | 113.5 | 113.5 | 113.4 | 113.4 | 113.4 | 113.4 | 113.4 | 113.4 | 113.4 |
| 100 | 113.4 | 113.4 | 113.4 | 113.3 | 113.3 | 113.3 | 113.3 | 113.3 | 113.3 | 113.3 |
| 110 | 113.3 | 113.3 | 113.3 | 113.3 | 113.3 | 113.3 | 113.2 | 113.2 | 113.2 | 113.2 |
| 120 | 113.2 | 113.2 | 113.2 | 113.2 | 113.2 | 113.2 | 113.2 | 113.2 | 113.2 | 113.2 |
| 130 | 113.2 | 113.2 | 113.1 | 113.1 | 113.1 | 113.1 | 113.1 | 113.1 | 113.1 | 113.1 |
| 140 | 113.1 | 113.1 | 113.1 | 113.1 | 113.1 | 113.1 | 113.1 | 113.1 | 113.1 | 113.1 |
| 150 | 113.1 | 113.1 | 113.0 | | | | | | | |

**Table B.69 Back Calculated Gyratory Densities**

PROJECT: Maury County - Region III MIX: 411S DATE: 9/23/97

Saturated Surface Dry Method

| Sample No. | No. of Gyrations | Weight (grams) | Ht (mm) | Volume ($cm^3$) | Uncorrected Sp. Gr. | TMD | Uncorrected Density | Actual Density | Correction Factor | Corrected $\%G_{mm}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 8 | 4692.5 | 131.1 | 2316.7 | 2.025 | 2.392 | 84.7 | | 1.02882 | 87.1 |
| | 96 | 4692.5 | 118.5 | 2094.1 | 2.241 | 2.392 | 93.7 | | 1.02882 | 96.4 |
| | 152 | 4692.5 | 116.7 | 2062.3 | 2.275 | 2.392 | 95.1 | 2.341 | 1.02882 | 97.9 |
| 2 | 8 | 4753.0 | 132.4 | 2339.7 | 2.031 | 2.392 | 84.9 | | 1.02968 | 87.4 |
| | 96 | 4753.0 | 119.5 | 2111.7 | 2.251 | 2.392 | 94.1 | | 1.02968 | 96.9 |
| | 152 | 4753.0 | 117.8 | 2081.7 | 2.283 | 2.392 | 95.5 | 2.351 | 1.02968 | 98.3 |
| 3 | 8 | 4665.3 | 130.8 | 2311.4 | 2.018 | 2.392 | 84.4 | | 1.01322 | 85.5 |
| | 96 | 4665.3 | 117.9 | 2083.5 | 2.239 | 2.392 | 93.6 | | 1.01322 | 94.8 |
| | 152 | 4665.3 | 116.2 | 2053.4 | 2.272 | 2.392 | 95.0 | 2.302 | 1.01322 | 96.2 |

Average Corrected Density at $N_{design}$ 96.0

Parafilm Method

| Sample No. | No. of Gyrations | Weight (grams) | Ht (mm) | Volume ($cm^3$) | Uncorrected Sp. Gr. | TMD | Uncorrected Density | Actual Density | Correction Factor | Corrected $\%G_{mm}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 8 | 4692.6 | 131.1 | 2316.7 | 2.026 | 2.392 | 84.7 | | 1.01122 | 85.6 |
| | 96 | 4692.6 | 118.5 | 2094.1 | 2.241 | 2.392 | 93.7 | | 1.01122 | 94.7 |
| | 152 | 4692.6 | 116.7 | 2062.3 | 2.275 | 2.392 | 95.1 | 2.301 | 1.01122 | 96.2 |
| 2 | 8 | 4753.0 | 132.4 | 2339.7 | 2.031 | 2.392 | 84.9 | | 1.00997 | 85.8 |
| | 96 | 4753.0 | 119.5 | 2111.7 | 2.251 | 2.392 | 94.1 | | 1.00997 | 95.0 |
| | 152 | 4753.0 | 117.8 | 2081.7 | 2.283 | 2.392 | 95.5 | 2.306 | 1.00997 | 96.4 |
| 3 | 8 | 4665.3 | 130.8 | 2311.4 | 2.018 | 2.392 | 84.4 | | 0.94412 | 79.7 |
| | 96 | 4665.3 | 117.9 | 2083.5 | 2.239 | 2.392 | 93.6 | | 0.94412 | 88.4 |
| | 152 | 4665.3 | 116.2 | 2053.4 | 2.272 | 2.392 | 95.0 | 2.145 | 0.94412 | 89.7 |

Average Corrected Density at $N_{design}$ 92.7

# Lincoln County – 411S

## Superpave Gyratory Compaction Height Data Sheets

Pine Instrument Company Gyratory Compactor — MODE: Set Gyrations

Specimen Size: 150 mm
Pressure: 600 kPa
Specimen ID: 1

Date: 2/02/98
Time: 15:01
Technician: _____

SPECIMEN HEIGHT (mm) vs. GYRATION NO.

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 156.3 | 150.2 | 147.0 | 144.7 | 142.9 | 141.5 | 140.4 | 139.4 | 138.6 | 137.8 |
| 10 | 137.1 | 136.5 | 136.0 | 135.5 | 135.0 | 134.6 | 134.2 | 133.8 | 133.5 | 133.1 |
| 20 | 132.8 | 132.5 | 132.3 | 132.0 | 131.7 | 131.5 | 131.3 | 131.1 | 130.8 | 130.6 |
| 30 | 130.5 | 130.3 | 130.1 | 129.9 | 129.8 | 129.6 | 129.4 | 129.3 | 129.1 | 129.0 |
| 40 | 128.9 | 128.7 | 128.6 | 128.5 | 128.4 | 128.3 | 128.1 | 128.0 | 127.9 | 127.8 |
| 50 | 127.7 | 127.6 | 127.5 | 127.4 | 127.3 | 127.2 | 127.1 | 127.0 | 126.9 | 126.9 |
| 60 | 126.8 | 126.7 | 126.6 | 126.5 | 126.5 | 126.4 | 126.3 | 126.2 | 126.2 | 126.1 |
| 70 | 126.0 | 125.9 | 125.9 | 125.8 | 125.8 | 125.7 | 125.6 | 125.6 | 125.5 | 125.4 |
| 80 | 125.4 | 125.3 | 125.3 | 125.2 | 125.2 | 125.1 | 125.0 | 125.0 | 124.9 | 124.9 |
| 90 | 124.8 | 124.8 | 124.7 | 124.7 | 124.7 | 124.6 | 124.6 | 124.5 | 124.5 | 124.4 |
| 100 | 124.4 | 124.3 | 124.3 | 124.2 | 124.2 | 124.2 | 124.1 | 124.1 | 124.0 | 124.0 |
| 110 | 124.0 | 123.9 | 123.9 | 123.8 | 123.8 | 123.8 | 123.7 | 123.7 | 123.7 | 123.6 |
| 120 | 123.6 | 123.6 | 123.5 | 123.5 | 123.5 | 123.4 | 123.4 | 123.4 | 123.3 | 123.3 |
| 130 | 123.3 | 123.2 | 123.2 | 123.2 | 123.1 | 123.1 | 123.1 | 123.1 | 123.0 | 123.0 |
| 140 | 123.0 | 122.9 | 122.9 | 122.9 | 122.9 | 122.8 | 122.8 | 122.8 | 122.7 | 122.7 |
| 150 | 122.7 | 122.7 | 122.7 | | | | | | | |

Pine Instrument Company Gyratory Compactor MODE: Set Gyrations

Specimen Size: 150 mm
Pressure: 600 kPa
Specimen ID: 2

Date: 2/02/98
Time: 15:27
Technician: _____

SPECIMEN HEIGHT (mm) vs. GYRATION NO.

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 154.6 | 148.7 | 145.7 | 143.5 | 141.8 | 140.5 | 139.4 | 138.4 | 137.6 | 136.9 |
| 10 | 136.3 | 135.7 | 135.1 | 134.7 | 134.2 | 133.8 | 133.4 | 133.1 | 132.7 | 132.4 |
| 20 | 132.1 | 131.9 | 131.6 | 131.3 | 131.1 | 130.9 | 130.7 | 130.5 | 130.3 | 130.1 |
| 30 | 129.9 | 129.7 | 129.5 | 129.4 | 129.2 | 129.0 | 128.9 | 128.8 | 128.6 | 128.5 |
| 40 | 128.4 | 128.2 | 128.1 | 128.0 | 127.9 | 127.8 | 127.6 | 127.5 | 127.4 | 127.3 |
| 50 | 127.2 | 127.1 | 127.0 | 126.9 | 126.8 | 126.8 | 126.7 | 126.6 | 126.5 | 126.4 |
| 60 | 126.3 | 126.3 | 126.2 | 126.1 | 126.0 | 126.0 | 125.9 | 125.8 | 125.7 | 125.7 |
| 70 | 125.6 | 125.5 | 125.5 | 125.4 | 125.4 | 125.3 | 125.2 | 125.2 | 125.1 | 125.1 |
| 80 | 125.0 | 124.9 | 124.9 | 124.8 | 124.8 | 124.7 | 124.7 | 124.6 | 124.6 | 124.5 |
| 90 | 124.5 | 124.4 | 124.4 | 124.3 | 124.3 | 124.2 | 124.2 | 124.2 | 124.1 | 124.1 |
| 100 | 124.0 | 124.0 | 123.9 | 123.9 | 123.9 | 123.8 | 123.8 | 123.7 | 123.7 | 123.7 |
| 110 | 123.6 | 123.6 | 123.5 | 123.5 | 123.5 | 123.4 | 123.4 | 123.4 | 123.3 | 123.3 |
| 120 | 123.3 | 123.2 | 123.2 | 123.2 | 123.1 | 123.1 | 123.1 | 123.0 | 123.0 | 123.0 |
| 130 | 123.0 | 122.9 | 122.9 | 122.9 | 122.8 | 122.8 | 122.8 | 122.7 | 122.7 | 122.7 |
| 140 | 122.7 | 122.6 | 122.6 | 122.6 | 122.5 | 122.5 | 122.5 | 122.5 | 122.4 | 122.4 |
| 150 | 122.4 | 122.4 | 122.4 | | | | | | | |

Pine Instrument Company Gyratory Compactor

MODE: Set Gyrations

Specimen Size: 150 mm
Pressure: 600 kPa
Specimen ID: 3

Date: 2/02/98
Time: 15:43
Technician: _____

SPECIMEN HEIGHT (mm) vs. GYRATION NO.

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 158.6 | 152.2 | 148.8 | 146.4 | 144.6 | 143.1 | 141.9 | 140.9 | 139.9 | 139.2 |
| 10 | 138.5 | 137.8 | 137.3 | 136.7 | 136.2 | 135.8 | 135.4 | 135.0 | 134.6 | 134.3 |
| 20 | 134.0 | 133.6 | 133.4 | 133.1 | 132.8 | 132.6 | 132.3 | 132.1 | 131.9 | 131.7 |
| 30 | 131.5 | 131.3 | 131.1 | 130.9 | 130.8 | 130.6 | 130.4 | 130.3 | 130.1 | 130.0 |
| 40 | 129.9 | 129.7 | 129.6 | 129.5 | 129.3 | 129.2 | 129.1 | 129.0 | 128.9 | 128.7 |
| 50 | 128.6 | 128.5 | 128.4 | 128.3 | 128.2 | 128.1 | 128.0 | 127.9 | 127.8 | 127.8 |
| 60 | 127.7 | 127.6 | 127.5 | 127.4 | 127.3 | 127.3 | 127.2 | 127.1 | 127.0 | 127.0 |
| 70 | 126.9 | 126.8 | 126.8 | 126.7 | 126.6 | 126.6 | 126.5 | 126.4 | 126.4 | 126.3 |
| 80 | 126.2 | 126.2 | 126.1 | 126.1 | 126.0 | 126.0 | 125.9 | 125.8 | 125.8 | 125.7 |
| 90 | 125.7 | 125.6 | 125.6 | 125.5 | 125.5 | 125.4 | 125.4 | 125.3 | 125.3 | 125.2 |
| 100 | 125.2 | 125.1 | 125.1 | 125.1 | 125.0 | 125.0 | 124.9 | 124.9 | 124.8 | 124.8 |
| 110 | 124.8 | 124.7 | 124.7 | 124.6 | 124.6 | 124.6 | 124.5 | 124.5 | 124.4 | 124.4 |
| 120 | 124.4 | 124.3 | 124.3 | 124.2 | 124.2 | 124.2 | 124.1 | 124.1 | 124.1 | 124.0 |
| 130 | 124.0 | 124.0 | 123.9 | 123.9 | 123.9 | 123.8 | 123.8 | 123.8 | 123.7 | 123.7 |
| 140 | 123.7 | 123.7 | 123.6 | 123.6 | 123.6 | 123.5 | 123.5 | 123.5 | 123.4 | 123.4 |
| 150 | 123.4 | 123.4 | 123.4 | | | | | | | |

**Table B.70 Back Calculated Gyratory Densities**

PROJECT: Lincoln County - Region III MIX: 411 S DATE: 9/15/97

Saturated Surface Dry Method

| Sample No. | No. of Gyrations | Weight (grams) | Ht (mm) | Volume ($cm^3$) | Uncorrected Sp. Gr. | TMD | Uncorrected Density | Actual Density | Correction Factor | Corrected $\%G_{mm}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 8 | 4952.6 | 138.6 | 2449.3 | 2.022 | 2.486 | 81.3 | | 1.03454 | 84.1 |
| | 96 | 4952.6 | 124.6 | 2201.9 | 2.249 | 2.486 | 90.5 | | 1.03454 | 93.6 |
| | 152 | 4952.6 | 122.7 | 2168.3 | 2.284 | 2.486 | 91.9 | 2.363 | 1.03454 | 95.1 |
| 2 | 8 | 4931.9 | 137.6 | 2431.6 | 2.028 | 2.486 | 81.6 | | 1.03283 | 84.3 |
| | 96 | 4931.9 | 124.2 | 2194.8 | 2.247 | 2.486 | 90.4 | | 1.03283 | 93.4 |
| | 152 | 4931.9 | 122.4 | 2163.0 | 2.280 | 2.486 | 91.7 | 2.355 | 1.03283 | 94.7 |
| 3 | 8 | 4939.8 | 139.9 | 2472.2 | 1.998 | 2.486 | 80.4 | | 1.03034 | 82.8 |
| | 96 | 4939.8 | 125.4 | 2216.0 | 2.229 | 2.486 | 89.7 | | 1.03034 | 92.4 |
| | 152 | 4939.8 | 123.4 | 2180.7 | 2.265 | 2.486 | 91.1 | 2.334 | 1.03034 | 93.9 |

Average Corrected Density at $N_{design}$ 93.1

Parafilm Method

| Sample No. | No. of Gyrations | Weight (grams) | Ht (mm) | Volume ($cm^3$) | Uncorrected Sp. Gr. | TMD | Uncorrected Density | Actual Density | Correction Factor | Corrected $\%G_{mm}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 8 | 4952.5 | 138.6 | 2449.3 | 2.022 | 2.486 | 81.3 | | 1.01092 | 82.2 |
| | 96 | 4952.5 | 124.6 | 2201.9 | 2.249 | 2.486 | 90.5 | | 1.01092 | 91.5 |
| | 152 | 4952.5 | 122.7 | 2168.3 | 2.284 | 2.486 | 91.9 | 2.309 | 1.01092 | 92.9 |
| 2 | 8 | 4932.1 | 137.6 | 2431.6 | 2.028 | 2.486 | 81.6 | | 1.00823 | 82.3 |
| | 96 | 4932.1 | 124.2 | 2194.8 | 2.247 | 2.486 | 90.4 | | 1.00823 | 91.1 |
| | 152 | 4932.1 | 122.4 | 2163.0 | 2.280 | 2.486 | 91.7 | 2.299 | 1.00823 | 92.5 |
| 3 | 8 | 4940.1 | 139.9 | 2472.2 | 1.998 | 2.486 | 80.4 | | 1.00732 | 81.0 |
| | 96 | 4940.1 | 125.4 | 2216.0 | 2.229 | 2.486 | 89.7 | | 1.00732 | 90.3 |
| | 152 | 4940.1 | 123.4 | 2180.7 | 2.265 | 2.486 | 91.1 | 2.282 | 1.00732 | 91.8 |

Average Corrected Density at $N_{design}$ 91.0

# Maury County – 411S

## Superpave Gyratory Compaction Height Data Sheets

>ine Instrument Company Gyratory Compactor MODE: Set Gyrations

ipecimen Size: 150 mm
Pressure: 600 kPa
Specimen ID: 1

Date: 2/04/98
Time: 10:27
Technician: _____

SPECIMEN HEIGHT (mm) vs. GYRATION NO.

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 147.0 | 141.3 | 138.5 | 136.5 | 135.0 | 133.7 | 132.7 | 131.8 | 131.1 | 130.4 |
| 10 | 129.8 | 129.3 | 128.8 | 128.3 | 127.9 | 127.5 | 127.2 | 126.9 | 126.6 | 126.3 |
| 20 | 126.0 | 125.7 | 125.5 | 125.2 | 125.0 | 124.8 | 124.6 | 124.4 | 124.2 | 124.0 |
| 30 | 123.9 | 123.7 | 123.5 | 123.4 | 123.2 | 123.1 | 122.9 | 122.8 | 122.7 | 122.6 |
| 40 | 122.4 | 122.3 | 122.2 | 122.1 | 122.0 | 121.9 | 121.7 | 121.7 | 121.5 | 121.5 |
| 50 | 121.4 | 121.3 | 121.2 | 121.1 | 121.0 | 120.9 | 120.8 | 120.8 | 120.7 | 120.6 |
| 60 | 120.5 | 120.4 | 120.4 | 120.3 | 120.2 | 120.2 | 120.1 | 120.0 | 120.0 | 119.9 |
| 70 | 119.8 | 119.8 | 119.7 | 119.7 | 119.6 | 119.5 | 119.5 | 119.4 | 119.4 | 119.3 |
| 80 | 119.3 | 119.2 | 119.2 | 119.1 | 119.1 | 119.0 | 119.0 | 118.9 | 118.9 | 118.8 |
| 90 | 118.8 | 118.7 | 118.7 | 118.6 | 118.6 | 118.5 | 118.5 | 118.5 | 118.4 | 118.4 |
| 00 | 118.3 | 118.3 | 118.2 | 118.2 | 118.2 | 118.1 | 118.1 | 118.0 | 118.0 | 118.0 |
| 10 | 117.9 | 117.9 | 117.9 | 117.8 | 117.8 | 117.7 | 117.7 | 117.7 | 117.6 | 117.6 |
| 20 | 117.6 | 117.5 | 117.5 | 117.5 | 117.4 | 117.4 | 117.4 | 117.4 | 117.3 | 117.3 |
| 30 | 117.3 | 117.2 | 117.2 | 117.2 | 117.1 | 117.1 | 117.1 | 117.1 | 117.0 | 117.0 |
| 40 | 117.0 | 116.9 | 116.9 | 116.9 | 116.9 | 116.8 | 116.8 | 116.8 | 116.8 | 116.7 |
| 50 | 116.7 | 116.7 | 116.7 | | | | | | | |

'ine Instrument Company Gyratory Compactor MODE: Set Gyrations

pecimen Size: 150 mm
Pressure: 600 kPa
Specimen ID: 2

Date: 2/04/98
Time: 10:38
Technician: _____

SPECIMEN HEIGHT (mm) vs. GYRATION NO.

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 148.2 | 142.6 | 139.9 | 137.9 | 136.4 | 135.1 | 134.1 | 133.2 | 132.4 | 131.8 |
| 10 | 131.2 | 130.6 | 130.1 | 129.6 | 129.2 | 128.8 | 128.4 | 128.1 | 127.8 | 127.5 |
| 20 | 127.2 | 126.9 | 126.7 | 126.4 | 126.2 | 125.9 | 125.7 | 125.5 | 125.3 | 125.2 |
| 30 | 125.0 | 124.8 | 124.6 | 124.5 | 124.3 | 124.2 | 124.0 | 123.9 | 123.8 | 123.6 |
| 40 | 123.5 | 123.4 | 123.3 | 123.1 | 123.0 | 122.9 | 122.8 | 122.7 | 122.6 | 122.5 |
| 50 | 122.4 | 122.3 | 122.2 | 122.1 | 122.0 | 122.0 | 121.9 | 121.8 | 121.7 | 121.6 |
| 60 | 121.6 | 121.5 | 121.4 | 121.3 | 121.3 | 121.2 | 121.1 | 121.1 | 121.0 | 120.9 |
| 70 | 120.9 | 120.8 | 120.7 | 120.7 | 120.6 | 120.6 | 120.5 | 120.5 | 120.4 | 120.3 |
| 80 | 120.3 | 120.2 | 120.2 | 120.1 | 120.1 | 120.0 | 120.0 | 119.9 | 119.9 | 119.8 |
| 90 | 119.8 | 119.7 | 119.7 | 119.7 | 119.6 | 119.6 | 119.5 | 119.5 | 119.4 | 119.4 |
| 00 | 119.4 | 119.3 | 119.3 | 119.2 | 119.2 | 119.2 | 119.1 | 119.1 | 119.1 | 119.0 |
| 10 | 119.0 | 118.9 | 118.9 | 118.9 | 118.8 | 118.8 | 118.8 | 118.7 | 118.7 | 118.7 |
| 20 | 118.6 | 118.6 | 118.6 | 118.5 | 118.5 | 118.5 | 118.5 | 118.4 | 118.4 | 118.4 |
| 30 | 118.3 | 118.3 | 118.3 | 118.2 | 118.2 | 118.2 | 118.2 | 118.1 | 118.1 | 118.1 |
| 40 | 118.1 | 118.0 | 118.0 | 118.0 | 117.9 | 117.9 | 117.9 | 117.9 | 117.8 | 117.8 |
| 50 | 117.8 | 117.8 | 117.8 | | | | | | | |

Pine Instrument Company Gyratory Compactor — MODE: Set Gyrations

Specimen Size: 150 mm
Pressure: 600 kPa
Specimen ID: 3

Date: 2/04/98
Time: 10:50
Technician: _____

SPECIMEN HEIGHT (mm) vs. GYRATION NO.

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 147.0 | 141.4 | 138.5 | 136.4 | 134.8 | 133.6 | 132.5 | 131.6 | 130.8 | 130.1 |
| 10 | 129.5 | 128.9 | 128.4 | 128.0 | 127.5 | 127.1 | 126.8 | 126.4 | 126.1 | 125.8 |
| 20 | 125.5 | 125.2 | 125.0 | 124.8 | 124.5 | 124.3 | 124.1 | 123.9 | 123.7 | 123.5 |
| 30 | 123.3 | 123.2 | 123.0 | 122.9 | 122.7 | 122.6 | 122.4 | 122.3 | 122.1 | 122.0 |
| 40 | 121.9 | 121.8 | 121.7 | 121.5 | 121.4 | 121.3 | 121.2 | 121.1 | 121.0 | 120.9 |
| 50 | 120.8 | 120.7 | 120.6 | 120.5 | 120.5 | 120.4 | 120.3 | 120.2 | 120.1 | 120.0 |
| 60 | 120.0 | 119.9 | 119.8 | 119.7 | 119.7 | 119.6 | 119.5 | 119.5 | 119.4 | 119.3 |
| 70 | 119.3 | 119.2 | 119.1 | 119.1 | 119.0 | 119.0 | 118.9 | 118.9 | 118.8 | 118.7 |
| 80 | 118.7 | 118.6 | 118.6 | 118.5 | 118.5 | 118.4 | 118.4 | 118.3 | 118.3 | 118.2 |
| 90 | 118.2 | 118.2 | 118.1 | 118.1 | 118.0 | 118.0 | 117.9 | 117.9 | 117.8 | 117.8 |
| 100 | 117.8 | 117.7 | 117.7 | 117.6 | 117.6 | 117.6 | 117.5 | 117.5 | 117.5 | 117.4 |
| 110 | 117.4 | 117.3 | 117.3 | 117.3 | 117.2 | 117.2 | 117.2 | 117.1 | 117.1 | 117.1 |
| 120 | 117.0 | 117.0 | 117.0 | 116.9 | 116.9 | 116.9 | 116.9 | 116.8 | 116.8 | 116.8 |
| 130 | 116.7 | 116.7 | 116.7 | 116.7 | 116.6 | 116.6 | 116.6 | 116.5 | 116.5 | 116.5 |
| 140 | 116.5 | 116.4 | 116.4 | 116.4 | 116.4 | 116.3 | 116.3 | 116.3 | 116.3 | 116.2 |
| 150 | 116.2 | 116.2 | 116.2 | | | | | | | |

**Table B.71 Back Calculated Gyratory Densities**

PROJECT: Madison County - Region IV MIX: 411S DATE: 8/12/97

Saturated Surface Dry Method

| Sample No. | No. of Gyrations | Weight (grams) | Ht (mm) | Volume ($cm^3$) | Uncorrected Sp. Gr. | TMD | Uncorrected Density | Actual Density | Correction Factor | Corrected $\%G_{mm}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 8 | 4634.5 | 132.5 | 2341.5 | 1.979 | 2.314 | 85.5 | | 1.02177 | 87.4 |
| | 96 | 4634.5 | 119.7 | 2115.3 | 2.191 | 2.314 | 94.7 | | 1.02177 | 96.7 |
| | 152 | 4634.5 | 118.1 | 2087.0 | 2.221 | 2.314 | 96.0 | 2.269 | 1.02177 | 98.1 |
| 2 | 8 | 4612.2 | 131.9 | 2330.9 | 1.979 | 2.314 | 85.5 | | 1.02245 | 87.4 |
| | 96 | 4612.2 | 119.0 | 2102.9 | 2.193 | 2.314 | 94.8 | | 1.02245 | 96.9 |
| | 152 | 4612.2 | 117.3 | 2072.9 | 2.225 | 2.314 | 96.2 | 2.275 | 1.02245 | 98.3 |
| 3 | 8 | 4594.4 | 130.8 | 2311.4 | 1.988 | 2.314 | 85.9 | | 1.01992 | 87.6 |
| | 96 | 4594.4 | 118.0 | 2085.2 | 2.203 | 2.314 | 95.2 | | 1.01992 | 97.1 |
| | 152 | 4594.4 | 116.2 | 2053.4 | 2.237 | 2.314 | 96.7 | 2.282 | 1.01992 | 98.6 |

Average Corrected Density at $N_{design}$ 96.9

Parafilm Method

| Sample No. | No. of Gyrations | Weight (grams) | Ht (mm) | Volume ($cm^3$) | Uncorrected Sp. Gr. | TMD | Uncorrected Density | Actual Density | Correction Factor | Corrected $\%G_{mm}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 8 | 4634.5 | 132.5 | 2341.5 | 1.979 | 2.314 | 85.5 | | 1.00871 | 86.3 |
| | 96 | 4634.5 | 119.7 | 2115.3 | 2.191 | 2.314 | 94.7 | | 1.00871 | 95.5 |
| | 152 | 4634.5 | 118.1 | 2087.0 | 2.221 | 2.314 | 96.0 | 2.240 | 1.00871 | 96.8 |
| 2 | 8 | 4612.2 | 131.9 | 2330.9 | 1.979 | 2.314 | 85.5 | | 1.00897 | 86.3 |
| | 96 | 4612.2 | 119.0 | 2102.9 | 2.193 | 2.314 | 94.8 | | 1.00897 | 95.6 |
| | 152 | 4612.2 | 117.3 | 2072.9 | 2.225 | 2.314 | 96.2 | 2.245 | 1.00897 | 97.0 |
| 3 | 8 | 4594.2 | 130.8 | 2311.4 | 1.988 | 2.314 | 85.9 | | 1.00745 | 86.5 |
| | 96 | 4594.2 | 118.0 | 2085.2 | 2.203 | 2.314 | 95.2 | | 1.00745 | 95.9 |
| | 152 | 4594.2 | 116.2 | 2053.4 | 2.237 | 2.314 | 96.7 | 2.254 | 1.00745 | 97.4 |

Average Corrected Density at $N_{design}$ 95.7

# Madison County – 411S

## Superpave Gyratory Compaction Height Data Sheets

Pine Instrument Company Gyratory Compactor

MODE: Set Gyrations

Specimen Size: 150 mm
Pressure: 600 kPa
Specimen ID: 1

Date: 1/20/98
Time: 18:26
Technician: _____

SPECIMEN HEIGHT (mm) vs. GYRATION NO.

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 149.9 | 143.7 | 140.5 | 138.3 | 136.7 | 135.4 | 134.2 | 133.3 | 132.5 | 131.8 |
| 10 | 131.2 | 130.6 | 130.1 | 129.6 | 129.2 | 128.8 | 128.4 | 128.1 | 127.8 | 127.5 |
| 20 | 127.2 | 126.9 | 126.7 | 126.4 | 126.2 | 126.0 | 125.8 | 125.6 | 125.4 | 125.2 |
| 30 | 125.0 | 124.9 | 124.7 | 124.6 | 124.4 | 124.3 | 124.1 | 124.0 | 123.9 | 123.7 |
| 40 | 123.6 | 123.5 | 123.4 | 123.3 | 123.1 | 123.0 | 122.9 | 122.8 | 122.7 | 122.6 |
| 50 | 122.5 | 122.5 | 122.4 | 122.3 | 122.2 | 122.1 | 122.0 | 121.9 | 121.9 | 121.8 |
| 60 | 121.7 | 121.6 | 121.6 | 121.5 | 121.4 | 121.4 | 121.3 | 121.2 | 121.2 | 121.1 |
| 70 | 121.0 | 121.0 | 120.9 | 120.9 | 120.8 | 120.8 | 120.7 | 120.6 | 120.6 | 120.5 |
| 80 | 120.5 | 120.4 | 120.4 | 120.3 | 120.3 | 120.2 | 120.2 | 120.1 | 120.1 | 120.1 |
| 90 | 120.0 | 120.0 | 119.9 | 119.9 | 119.8 | 119.8 | 119.7 | 119.7 | 119.7 | 119.6 |
| 100 | 119.6 | 119.5 | 119.5 | 119.5 | 119.4 | 119.4 | 119.4 | 119.3 | 119.3 | 119.2 |
| 110 | 119.2 | 119.2 | 119.1 | 119.1 | 119.1 | 119.0 | 119.0 | 119.0 | 118.9 | 118.9 |
| 120 | 118.9 | 118.9 | 118.8 | 118.8 | 118.8 | 118.7 | 118.7 | 118.7 | 118.6 | 118.6 |
| 130 | 118.6 | 118.6 | 118.5 | 118.5 | 118.5 | 118.5 | 118.4 | 118.4 | 118.4 | 118.3 |
| 140 | 118.3 | 118.3 | 118.3 | 118.2 | 118.2 | 118.2 | 118.2 | 118.1 | 118.1 | 118.1 |
| 150 | 118.1 | 118.1 | 118.1 | | | | | | | |

Pine Instrument Company Gyratory Compactor — MODE: Set Gyrations

Specimen Size: 150 mm
Pressure: 600 kPa
Specimen ID: 2

Date: 1/20/98
Time: 18:40
Technician: _____

SPECIMEN HEIGHT (mm) vs. GYRATION NO.

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 148.9 | 142.7 | 139.7 | 137.6 | 136.0 | 134.7 | 133.6 | 132.6 | 131.9 | 131.2 |
| 10 | 130.5 | 130.0 | 129.5 | 129.0 | 128.6 | 128.2 | 127.8 | 127.5 | 127.2 | 126.9 |
| 20 | 126.6 | 126.3 | 126.1 | 125.8 | 125.6 | 125.4 | 125.2 | 125.0 | 124.8 | 124.6 |
| 30 | 124.4 | 124.3 | 124.1 | 124.0 | 123.8 | 123.7 | 123.5 | 123.4 | 123.3 | 123.1 |
| 40 | 123.0 | 122.9 | 122.8 | 122.7 | 122.5 | 122.4 | 122.3 | 122.2 | 122.1 | 122.0 |
| 50 | 121.9 | 121.8 | 121.8 | 121.7 | 121.6 | 121.5 | 121.4 | 121.3 | 121.2 | 121.2 |
| 60 | 121.1 | 121.0 | 120.9 | 120.9 | 120.8 | 120.7 | 120.7 | 120.6 | 120.5 | 120.5 |
| 70 | 120.4 | 120.3 | 120.3 | 120.2 | 120.1 | 120.1 | 120.0 | 120.0 | 119.9 | 119.9 |
| 80 | 119.8 | 119.8 | 119.7 | 119.6 | 119.6 | 119.5 | 119.5 | 119.5 | 119.4 | 119.4 |
| 90 | 119.3 | 119.3 | 119.2 | 119.2 | 119.1 | 119.1 | 119.0 | 119.0 | 119.0 | 118.9 |
| 100 | 118.9 | 118.8 | 118.8 | 118.8 | 118.7 | 118.7 | 118.6 | 118.6 | 118.6 | 118.5 |
| 110 | 118.5 | 118.5 | 118.4 | 118.4 | 118.4 | 118.3 | 118.3 | 118.3 | 118.2 | 118.2 |
| 120 | 118.2 | 118.1 | 118.1 | 118.1 | 118.0 | 118.0 | 118.0 | 117.9 | 117.9 | 117.9 |
| 130 | 117.9 | 117.8 | 117.8 | 117.8 | 117.7 | 117.7 | 117.7 | 117.7 | 117.6 | 117.6 |
| 140 | 117.6 | 117.6 | 117.5 | 117.5 | 117.5 | 117.5 | 117.4 | 117.4 | 117.4 | 117.4 |
| 150 | 117.3 | 117.3 | 117.3 | | | | | | | |

Pine Instrument Company Gyratory Compactor MODE: Set Gyrations

Specimen Size: 150 mm
Pressure: 600 kPa
Specimen ID: 3

Date: 1/21/98
Time: 11:40
Technician: _____

SPECIMEN HEIGHT (mm) vs. GYRATION NO.

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 148.1 | 141.9 | 138.8 | 136.6 | 135.0 | 133.7 | 132.5 | 131.6 | 130.8 | 130.1 |
| 10 | 129.5 | 128.9 | 128.4 | 127.9 | 127.5 | 127.1 | 126.7 | 126.4 | 126.1 | 125.8 |
| 20 | 125.5 | 125.2 | 125.0 | 124.7 | 124.5 | 124.3 | 124.1 | 123.9 | 123.7 | 123.5 |
| 30 | 123.3 | 123.2 | 123.0 | 122.9 | 122.7 | 122.6 | 122.4 | 122.3 | 122.1 | 122.0 |
| 40 | 121.9 | 121.8 | 121.7 | 121.5 | 121.4 | 121.3 | 121.2 | 121.1 | 121.0 | 120.9 |
| 50 | 120.8 | 120.7 | 120.6 | 120.6 | 120.5 | 120.4 | 120.3 | 120.2 | 120.1 | 120.1 |
| 60 | 120.0 | 119.9 | 119.8 | 119.8 | 119.7 | 119.6 | 119.6 | 119.5 | 119.4 | 119.4 |
| 70 | 119.3 | 119.2 | 119.2 | 119.1 | 119.1 | 119.0 | 118.9 | 118.9 | 118.8 | 118.8 |
| 80 | 118.7 | 118.7 | 118.6 | 118.6 | 118.5 | 118.5 | 118.4 | 118.4 | 118.3 | 118.3 |
| 90 | 118.2 | 118.2 | 118.1 | 118.1 | 118.1 | 118.0 | 118.0 | 117.9 | 117.9 | 117.8 |
| 100 | 117.8 | 117.8 | 117.7 | 117.7 | 117.6 | 117.6 | 117.6 | 117.5 | 117.5 | 117.5 |
| 110 | 117.4 | 117.4 | 117.3 | 117.3 | 117.3 | 117.2 | 117.2 | 117.2 | 117.1 | 117.1 |
| 120 | 117.1 | 117.1 | 117.0 | 117.0 | 117.0 | 116.9 | 116.9 | 116.9 | 116.8 | 116.8 |
| 130 | 116.8 | 116.8 | 116.7 | 116.7 | 116.7 | 116.6 | 116.6 | 116.6 | 116.6 | 116.5 |
| 140 | 116.5 | 116.5 | 116.5 | 116.4 | 116.4 | 116.4 | 116.3 | 116.3 | 116.3 | 116.3 |
| 150 | 116.2 | 116.2 | 116.2 | | | | | | | |

**Table B.72 Back Calculated Gyratory Densities**

PROJECT: Madison County - Region IV MIX: 307 S DATE: 8/12/97

Saturated Surface Dry Method

| Sample No. | No. of Gyrations | Weight (grams) | Ht (mm) | Volume ($cm^3$) | Uncorrected Sp. Gr. | TMD | Uncorrected Density | Actual Density | Correction Factor | Corrected $\%G_{mm}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 8 | 5050.3 | 136.2 | 2406.9 | 2.098 | 2.520 | 83.3 | | 1.02348 | 85.2 |
| | 96 | 5050.3 | 120.1 | 2122.3 | 2.380 | 2.520 | 94.4 | | 1.02348 | 96.6 |
| | 152 | 5050.3 | 117.8 | 2081.7 | 2.426 | 2.520 | 96.3 | 2.483 | 1.02348 | 98.5 |
| 2 | 8 | 5036.0 | 136.3 | 2408.6 | 2.091 | 2.520 | 83.0 | | 1.02362 | 84.9 |
| | 96 | 5036.0 | 119.5 | 2111.7 | 2.385 | 2.520 | 94.6 | | 1.02362 | 96.9 |
| | 152 | 5036.0 | 117.2 | 2071.1 | 2.432 | 2.520 | 96.5 | 2.489 | 1.02362 | 98.8 |
| 3 | 8 | 5017.8 | 138.0 | 2438.7 | 2.058 | 2.520 | 81.7 | | 1.02877 | 84.0 |
| | 96 | 5017.8 | 120.0 | 2120.6 | 2.366 | 2.520 | 93.9 | | 1.02877 | 96.6 |
| | 152 | 5017.8 | 117.6 | 2078.2 | 2.415 | 2.520 | 95.8 | 2.484 | 1.02877 | 98.6 |

Average Corrected Density at $N_{design}$ 96.7

Parafilm Method

| Sample No. | No. of Gyrations | Weight (grams) | Ht (mm) | Volume ($cm^3$) | Uncorrected Sp. Gr. | TMD | Uncorrected Density | Actual Density | Correction Factor | Corrected $\%G_{mm}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 8 | 5050.3 | 136.2 | 2406.9 | 2.098 | 2.520 | 83.3 | | 0.99545 | 82.9 |
| | 96 | 5050.3 | 120.1 | 2122.3 | 2.380 | 2.520 | 94.4 | | 0.99545 | 94.0 |
| | 152 | 5050.3 | 117.8 | 2081.7 | 2.426 | 2.520 | 96.3 | 2.415 | 0.99545 | 95.8 |
| 2 | 8 | 5036.0 | 136.3 | 2408.6 | 2.091 | 2.520 | 83.0 | | 1.00635 | 83.5 |
| | 96 | 5036.0 | 119.5 | 2111.7 | 2.385 | 2.520 | 94.6 | | 1.00635 | 95.2 |
| | 152 | 5036.0 | 117.2 | 2071.1 | 2.432 | 2.520 | 96.5 | 2.447 | 1.00635 | 97.1 |
| 3 | 8 | 5017.8 | 138.0 | 2438.7 | 2.058 | 2.520 | 81.7 | | 1.00640 | 82.2 |
| | 96 | 5017.8 | 120.0 | 2120.6 | 2.366 | 2.520 | 93.9 | | 1.00640 | 94.5 |
| | 152 | 5017.8 | 117.6 | 2078.2 | 2.415 | 2.520 | 95.8 | 2.430 | 1.00640 | 96.4 |

Average Corrected Density at $N_{design}$ 94.6

# Madison County – 307S

## Superpave Gyratory Compaction Height Data Sheets

ine Instrument Company Gyratory Compactor MODE: Set Gyrations

ecimen Size: 150 mm
Pressure: 600 kPa
Specimen ID: Z

Date: 1/19/98
Time: 19:23
Technician: _____

SPECIMEN HEIGHT (mm) vs. GYRATION NO.

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 154.3 | 148.0 | 144.9 | 142.6 | 140.8 | 139.4 | 138.2 | 137.1 | 136.2 | 135.4 |
| 10 | 134.7 | 134.1 | 133.5 | 132.9 | 132.4 | 131.9 | 131.5 | 131.0 | 130.6 | 130.3 |
| 20 | 129.9 | 129.6 | 129.3 | 129.0 | 128.7 | 128.4 | 128.1 | 127.9 | 127.7 | 127.4 |
| 30 | 127.2 | 127.0 | 126.8 | 126.6 | 126.4 | 126.2 | 126.0 | 125.8 | 125.6 | 125.5 |
| 40 | 125.3 | 125.1 | 125.0 | 124.8 | 124.7 | 124.6 | 124.4 | 124.3 | 124.2 | 124.0 |
| 50 | 123.9 | 123.8 | 123.7 | 123.5 | 123.4 | 123.3 | 123.2 | 123.1 | 123.0 | 122.9 |
| 60 | 122.8 | 122.7 | 122.6 | 122.5 | 122.4 | 122.3 | 122.2 | 122.1 | 122.1 | 122.0 |
| 70 | 121.9 | 121.8 | 121.7 | 121.6 | 121.6 | 121.5 | 121.4 | 121.3 | 121.3 | 121.2 |
| 80 | 121.1 | 121.1 | 121.0 | 120.9 | 120.8 | 120.8 | 120.7 | 120.7 | 120.6 | 120.5 |
| 90 | 120.5 | 120.4 | 120.3 | 120.3 | 120.2 | 120.2 | 120.1 | 120.1 | 120.0 | 120.0 |
| 00 | 119.9 | 119.8 | 119.8 | 119.7 | 119.7 | 119.6 | 119.6 | 119.5 | 119.5 | 119.5 |
| 10 | 119.4 | 119.4 | 119.3 | 119.3 | 119.2 | 119.2 | 119.1 | 119.1 | 119.0 | 119.0 |
| 20 | 119.0 | 118.9 | 118.9 | 118.8 | 118.8 | 118.8 | 118.7 | 118.7 | 118.6 | 118.6 |
| 30 | 118.6 | 118.5 | 118.5 | 118.5 | 118.4 | 118.4 | 118.3 | 118.3 | 118.3 | 118.2 |
| 40 | 118.2 | 118.2 | 118.1 | 118.1 | 118.1 | 118.0 | 118.0 | 118.0 | 117.9 | 117.9 |
| 50 | 117.9 | 117.8 | 117.8 | | | | | | | |

ine Instrument Company Gyratory Compactor — MODE: Set Gyrations

ecimen Size: 150 mm
Pressure: 600 kPa
Specimen ID: 2

Date: 1/19/98
Time: 19:38
Technician: _____

SPECIMEN HEIGHT (mm) vs. GYRATION NO.

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 154.5 | 148.3 | 145.2 | 142.9 | 141.1 | 139.6 | 138.3 | 137.3 | 136.3 | 135.5 |
| 10 | 134.7 | 134.0 | 133.3 | 132.8 | 132.2 | 131.7 | 131.2 | 130.8 | 130.4 | 130.0 |
| 20 | 129.6 | 129.3 | 128.9 | 128.6 | 128.3 | 128.0 | 127.8 | 127.5 | 127.2 | 127.0 |
| 30 | 126.8 | 126.5 | 126.3 | 126.1 | 125.9 | 125.7 | 125.5 | 125.3 | 125.2 | 125.0 |
| 40 | 124.8 | 124.6 | 124.5 | 124.3 | 124.2 | 124.0 | 123.9 | 123.7 | 123.6 | 123.5 |
| 50 | 123.3 | 123.2 | 123.1 | 123.0 | 122.8 | 122.7 | 122.6 | 122.5 | 122.4 | 122.3 |
| 60 | 122.2 | 122.1 | 122.0 | 121.9 | 121.8 | 121.7 | 121.6 | 121.5 | 121.4 | 121.3 |
| 70 | 121.2 | 121.2 | 121.1 | 121.0 | 120.9 | 120.8 | 120.8 | 120.7 | 120.6 | 120.5 |
| 80 | 120.5 | 120.4 | 120.3 | 120.3 | 120.2 | 120.1 | 120.1 | 120.0 | 119.9 | 119.9 |
| 90 | 119.8 | 119.7 | 119.7 | 119.6 | 119.6 | 119.5 | 119.5 | 119.4 | 119.3 | 119.3 |
| 00 | 119.2 | 119.2 | 119.1 | 119.1 | 119.0 | 119.0 | 118.9 | 118.9 | 118.8 | 118.8 |
| 10 | 118.7 | 118.7 | 118.7 | 118.6 | 118.6 | 118.5 | 118.5 | 118.4 | 118.4 | 118.4 |
| 20 | 118.3 | 118.3 | 118.2 | 118.2 | 118.1 | 118.1 | 118.1 | 118.0 | 118.0 | 118.0 |
| 30 | 117.9 | 117.9 | 117.8 | 117.8 | 117.8 | 117.7 | 117.7 | 117.7 | 117.6 | 117.6 |
| 40 | 117.6 | 117.5 | 117.5 | 117.5 | 117.4 | 117.4 | 117.4 | 117.3 | 117.3 | 117.3 |
| 50 | 117.3 | 117.2 | 117.2 | | | | | | | |

ne Instrument Company Gyratory Compactor MODE: Set Gyrations

ecimen Size: 150 mm
Pressure: 600 kPa
Specimen ID: 3

Date: 1/19/98
Time: 20:16
Technician: _____

SPECIMEN HEIGHT (mm) vs. GYRATION NO.

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 159.3 | 151.9 | 148.3 | 145.5 | 143.5 | 141.7 | 140.3 | 139.1 | 138.0 | 137.0 |
| 0 | 136.2 | 135.4 | 134.7 | 134.1 | 133.5 | 133.0 | 132.4 | 132.0 | 131.5 | 131.1 |
| 0 | 130.7 | 130.3 | 130.0 | 129.6 | 129.3 | 129.0 | 128.7 | 128.4 | 128.1 | 127.9 |
| 0 | 127.6 | 127.4 | 127.1 | 126.9 | 126.7 | 126.5 | 126.3 | 126.1 | 125.9 | 125.7 |
| 0 | 125.6 | 125.4 | 125.2 | 125.1 | 124.9 | 124.7 | 124.6 | 124.5 | 124.3 | 124.2 |
| 0 | 124.0 | 123.9 | 123.8 | 123.7 | 123.5 | 123.4 | 123.3 | 123.2 | 123.1 | 123.0 |
| 0 | 122.9 | 122.7 | 122.6 | 122.5 | 122.4 | 122.3 | 122.3 | 122.2 | 122.1 | 122.0 |
| 0 | 121.9 | 121.8 | 121.7 | 121.6 | 121.5 | 121.5 | 121.4 | 121.3 | 121.2 | 121.1 |
| 0 | 121.1 | 121.0 | 120.9 | 120.9 | 120.8 | 120.7 | 120.6 | 120.6 | 120.5 | 120.4 |
| 0 | 120.4 | 120.3 | 120.3 | 120.2 | 120.1 | 120.1 | 120.0 | 120.0 | 119.9 | 119.8 |
| 0 | 119.8 | 119.7 | 119.7 | 119.6 | 119.6 | 119.5 | 119.5 | 119.4 | 119.4 | 119.3 |
| 0 | 119.3 | 119.2 | 119.2 | 119.1 | 119.1 | 119.0 | 119.0 | 118.9 | 118.9 | 118.8 |
| 0 | 118.8 | 118.7 | 118.7 | 118.7 | 118.6 | 118.6 | 118.5 | 118.5 | 118.5 | 118.4 |
| 0 | 118.4 | 118.3 | 118.3 | 118.3 | 118.2 | 118.2 | 118.1 | 118.1 | 118.1 | 118.0 |
| 0 | 118.0 | 118.0 | 117.9 | 117.9 | 117.9 | 117.8 | 117.8 | 117.8 | 117.7 | 117.7 |
| 0 | 117.7 | 117.6 | 117.6 | | | | | | | |

**Table B.73 Back Calculated Gyratory Densities**

PROJECT: Lauderdale County - Region IV MIX: 411S DATE: 10/15/97

Saturated Surface Dry Method

| Sample No. | No. of Gyrations | Weight (grams) | Ht (mm) | Volume ($cm^3$) | Uncorrected Sp. Gr. | TMD | Uncorrected Density | Actual Density | Correction Factor | Corrected $\%G_{mm}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 8 | 4571.8 | 130.1 | 2299.1 | 1.989 | 2.303 | 86.3 | | 1.02520 | 88.5 |
| | 96 | 4571.8 | 118.5 | 2094.1 | 2.183 | 2.303 | 94.8 | | 1.02520 | 97.2 |
| | 152 | 4571.8 | 117.1 | 2069.3 | 2.209 | 2.303 | 95.9 | 2.265 | 1.02520 | 98.3 |
| 2 | 8 | 4565.6 | 130.9 | 2313.2 | 1.974 | 2.303 | 85.7 | | 1.02552 | 87.9 |
| | 96 | 4565.6 | 119.1 | 2104.7 | 2.169 | 2.303 | 94.2 | | 1.02552 | 96.6 |
| | 152 | 4565.6 | 117.6 | 2078.2 | 2.197 | 2.303 | 95.4 | 2.253 | 1.02552 | 97.8 |
| 3 | 8 | 4551.8 | 129.3 | 2284.9 | 1.992 | 2.303 | 86.5 | | 1.02222 | 88.4 |
| | 96 | 4551.8 | 117.8 | 2081.7 | 2.187 | 2.303 | 94.9 | | 1.02222 | 97.1 |
| | 152 | 4551.8 | 116.3 | 2055.2 | 2.215 | 2.303 | 96.2 | 2.264 | 1.02222 | 98.3 |

Average Corrected Density at $N_{design}$ 96.9

Parafilm Method

| Sample No. | No. of Gyrations | Weight (grams) | Ht (mm) | Volume ($cm^3$) | Uncorrected Sp. Gr. | TMD | Uncorrected Density | Actual Density | Correction Factor | Corrected $\%G_{mm}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 8 | 4571.8 | 130.1 | 2299.1 | 1.989 | 2.303 | 86.3 | | 1.01163 | 87.4 |
| | 96 | 4571.8 | 118.5 | 2094.1 | 2.183 | 2.303 | 94.8 | | 1.01163 | 95.9 |
| | 152 | 4571.8 | 117.1 | 2069.3 | 2.209 | 2.303 | 95.9 | 2.235 | 1.01163 | 97.0 |
| 2 | 8 | 4565.6 | 130.9 | 2313.2 | 1.974 | 2.303 | 85.7 | | 1.01141 | 86.7 |
| | 96 | 4565.6 | 119.1 | 2104.7 | 2.169 | 2.303 | 94.2 | | 1.01141 | 95.3 |
| | 152 | 4565.6 | 117.6 | 2078.2 | 2.197 | 2.303 | 95.4 | 2.222 | 1.01141 | 96.5 |
| 3 | 8 | 4551.8 | 129.3 | 2284.9 | 1.992 | 2.303 | 86.5 | | 1.01093 | 87.4 |
| | 96 | 4551.8 | 117.8 | 2081.7 | 2.187 | 2.303 | 94.9 | | 1.01093 | 96.0 |
| | 152 | 4551.8 | 116.3 | 2055.2 | 2.215 | 2.303 | 96.2 | 2.239 | 1.01093 | 97.2 |

Average Corrected Density at $N_{design}$ 95.7

# Lauderdale County – 411S

## Superpave Gyratory Compaction Height Data Sheets

>ine Instrument Company Gyratory Compactor MODE: Set Gyrations

Specimen Size: 150 mm
Pressure: 600 kPa
Specimen ID: 1

Date: 2/06/98
Time: 16:10
Technician: _____

SPECIMEN HEIGHT (mm) vs. GYRATION NO.

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 145.8 | 140.1 | 137.3 | 135.3 | 133.8 | 132.6 | 131.6 | 130.8 | 130.1 | 129.4 |
| 10 | 128.9 | 128.4 | 127.9 | 127.5 | 127.1 | 126.7 | 126.4 | 126.1 | 125.8 | 125.5 |
| 20 | 125.3 | 125.0 | 124.8 | 124.6 | 124.4 | 124.2 | 124.0 | 123.8 | 123.6 | 123.5 |
| 30 | 123.3 | 123.2 | 123.0 | 122.9 | 122.7 | 122.6 | 122.5 | 122.4 | 122.2 | 122.1 |
| 40 | 122.0 | 121.9 | 121.8 | 121.7 | 121.6 | 121.5 | 121.4 | 121.3 | 121.2 | 121.1 |
| 50 | 121.0 | 121.0 | 120.9 | 120.8 | 120.7 | 120.7 | 120.6 | 120.5 | 120.4 | 120.4 |
| 60 | 120.3 | 120.2 | 120.2 | 120.1 | 120.0 | 120.0 | 119.9 | 119.9 | 119.8 | 119.8 |
| 70 | 119.7 | 119.6 | 119.6 | 119.5 | 119.5 | 119.4 | 119.4 | 119.3 | 119.3 | 119.2 |
| 80 | 119.2 | 119.2 | 119.1 | 119.1 | 119.0 | 119.0 | 118.9 | 118.9 | 118.9 | 118.8 |
| 90 | 118.8 | 118.7 | 118.7 | 118.7 | 118.6 | 118.6 | 118.5 | 118.5 | 118.5 | 118.4 |
| 00 | 118.4 | 118.4 | 118.3 | 118.3 | 118.3 | 118.2 | 118.2 | 118.2 | 118.1 | 118.1 |
| 10 | 118.1 | 118.0 | 118.0 | 118.0 | 118.0 | 117.9 | 117.9 | 117.9 | 117.8 | 117.8 |
| 20 | 117.8 | 117.8 | 117.7 | 117.7 | 117.7 | 117.7 | 117.6 | 117.6 | 117.6 | 117.6 |
| 30 | 117.5 | 117.5 | 117.5 | 117.5 | 117.4 | 117.4 | 117.4 | 117.4 | 117.4 | 117.3 |
| 40 | 117.3 | 117.3 | 117.3 | 117.2 | 117.2 | 117.2 | 117.2 | 117.2 | 117.1 | 117.1 |
| 50 | 117.1 | 117.1 | 117.1 | | | | | | | |

Test was paused 1 time(s).

ine Instrument Company Gyratory Compactor MODE: Set Gyrations

pecimen Size: 150 mm
Pressure: 600 kPa
Specimen ID: 2

Date: 2/06/98
Time: 16:21
Technician: _____

SPECIMEN HEIGHT (mm) vs. GYRATION NO.

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 146.2 | 140.7 | 138.0 | 136.1 | 134.6 | 133.4 | 132.5 | 131.6 | 130.9 | 130.3 |
| 10 | 129.7 | 129.2 | 128.7 | 128.3 | 127.9 | 127.5 | 127.2 | 126.9 | 126.6 | 126.3 |
| 20 | 126.0 | 125.8 | 125.5 | 125.3 | 125.1 | 124.9 | 124.7 | 124.5 | 124.4 | 124.2 |
| 30 | 124.0 | 123.9 | 123.7 | 123.6 | 123.4 | 123.3 | 123.2 | 123.0 | 122.9 | 122.8 |
| 40 | 122.7 | 122.6 | 122.5 | 122.4 | 122.3 | 122.2 | 122.1 | 122.0 | 121.9 | 121.8 |
| 50 | 121.7 | 121.6 | 121.5 | 121.5 | 121.4 | 121.3 | 121.2 | 121.2 | 121.1 | 121.0 |
| 60 | 120.9 | 120.9 | 120.8 | 120.7 | 120.7 | 120.6 | 120.6 | 120.5 | 120.4 | 120.4 |
| 70 | 120.3 | 120.3 | 120.2 | 120.2 | 120.1 | 120.0 | 120.0 | 119.9 | 119.9 | 119.8 |
| 80 | 119.8 | 119.8 | 119.7 | 119.7 | 119.6 | 119.6 | 119.5 | 119.5 | 119.4 | 119.4 |
| 90 | 119.4 | 119.3 | 119.3 | 119.2 | 119.2 | 119.2 | 119.1 | 119.1 | 119.0 | 119.0 |
| 00 | 119.0 | 118.9 | 118.9 | 118.9 | 118.8 | 118.8 | 118.8 | 118.7 | 118.7 | 118.7 |
| 10 | 118.6 | 118.6 | 118.6 | 118.5 | 118.5 | 118.5 | 118.5 | 118.4 | 118.4 | 118.4 |
| 20 | 118.3 | 118.3 | 118.3 | 118.2 | 118.2 | 118.2 | 118.2 | 118.1 | 118.1 | 118.1 |
| 30 | 118.1 | 118.0 | 118.0 | 118.0 | 118.0 | 117.9 | 117.9 | 117.9 | 117.9 | 117.8 |
| 40 | 117.8 | 117.8 | 117.8 | 117.8 | 117.7 | 117.7 | 117.7 | 117.7 | 117.6 | 117.6 |
| 50 | 117.6 | 117.6 | 117.6 | | | | | | | |

ine Instrument Company Gyratory Compactor MODE: Set Gyrations

Specimen Size: 150 mm
Pressure: 600 kPa
Specimen ID: 3

Date: 2/06/98
Time: 16:32
Technician: _____

SPECIMEN HEIGHT (mm) vs. GYRATION NO.

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 144.3 | 138.9 | 136.2 | 134.3 | 132.9 | 131.8 | 130.8 | 130.0 | 129.3 | 128.6 |
| 10 | 128.1 | 127.6 | 127.1 | 126.7 | 126.3 | 126.0 | 125.6 | 125.3 | 125.0 | 124.8 |
| 20 | 124.5 | 124.3 | 124.0 | 123.8 | 123.6 | 123.4 | 123.2 | 123.1 | 122.9 | 122.7 |
| 30 | 122.6 | 122.4 | 122.3 | 122.1 | 122.0 | 121.9 | 121.7 | 121.6 | 121.5 | 121.4 |
| 40 | 121.3 | 121.2 | 121.1 | 121.0 | 120.9 | 120.8 | 120.7 | 120.6 | 120.5 | 120.4 |
| 50 | 120.3 | 120.2 | 120.1 | 120.1 | 120.0 | 119.9 | 119.8 | 119.8 | 119.7 | 119.6 |
| 60 | 119.6 | 119.5 | 119.4 | 119.4 | 119.3 | 119.2 | 119.2 | 119.1 | 119.1 | 119.0 |
| 70 | 119.0 | 118.9 | 118.8 | 118.8 | 118.7 | 118.7 | 118.6 | 118.6 | 118.5 | 118.5 |
| 80 | 118.4 | 118.4 | 118.3 | 118.3 | 118.3 | 118.2 | 118.2 | 118.1 | 118.1 | 118.0 |
| 90 | 118.0 | 118.0 | 117.9 | 117.9 | 117.8 | 117.8 | 117.8 | 117.7 | 117.7 | 117.7 |
| 00 | 117.6 | 117.6 | 117.6 | 117.5 | 117.5 | 117.5 | 117.4 | 117.4 | 117.4 | 117.3 |
| 10 | 117.3 | 117.3 | 117.2 | 117.2 | 117.2 | 117.1 | 117.1 | 117.1 | 117.1 | 117.0 |
| 20 | 117.0 | 117.0 | 116.9 | 116.9 | 116.9 | 116.9 | 116.8 | 116.8 | 116.8 | 116.8 |
| 30 | 116.7 | 116.7 | 116.7 | 116.7 | 116.6 | 116.6 | 116.6 | 116.6 | 116.5 | 116.5 |
| 40 | 116.5 | 116.5 | 116.5 | 116.4 | 116.4 | 116.4 | 116.4 | 116.4 | 116.3 | 116.3 |
| 50 | 116.3 | 116.3 | 116.3 | | | | | | | |

**Table B.74 Back Calculated Gyratory Densities**

PROJECT: Lauderdale County - Region IV MIX: 307S DATE: 10/15/97

Saturated Surface Dry Method

| Sample No. | No. of Gyrations | Weight (grams) | Ht (mm) | Volume ($cm^3$) | Uncorrected Sp. Gr. | TMD | Uncorrected Density | Actual Density | Correction Factor | Corrected $\%G_{mm}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 8 | 4719.2 | 136.8 | 2417.5 | 1.952 | 2.402 | 81.3 | | 1.03331 | 84.0 |
| | 96 | 4719.2 | 121.3 | 2143.5 | 2.202 | 2.402 | 91.7 | | 1.03331 | 94.7 |
| | 152 | 4719.2 | 119.2 | 2106.4 | 2.240 | 2.402 | 93.3 | 2.315 | 1.03331 | 96.4 |
| 2 | 8 | 4698.8 | 136.4 | 2410.4 | 1.949 | 2.402 | 81.2 | | 1.03322 | 83.9 |
| | 96 | 4698.8 | 121.6 | 2148.8 | 2.187 | 2.402 | 91.0 | | 1.03322 | 94.1 |
| | 152 | 4698.8 | 119.5 | 2111.7 | 2.225 | 2.402 | 92.6 | 2.299 | 1.03322 | 95.7 |
| 3 | 8 | 4691.6 | 136.3 | 2408.6 | 1.948 | 2.402 | 81.1 | | 1.02558 | 83.2 |
| | 96 | 4691.6 | 121.0 | 2138.2 | 2.194 | 2.402 | 91.3 | | 1.02558 | 93.7 |
| | 152 | 4691.6 | 118.9 | 2101.1 | 2.233 | 2.402 | 93.0 | 2.290 | 1.02558 | 95.3 |

Average Corrected Density at $N_{design}$ 94.2

Corrected Gyratory Densities (Parafilm Method)

| Sample No. | No. of Gyrations | Weight (grams) | Ht (mm) | Volume ($cm^3$) | Uncorrected Sp. Gr. | TMD | Uncorrected Density | Actual Density | Correction Factor | Corrected $\%G_{mm}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 8 | 4719.2 | 136.8 | 2417.5 | 1.952 | 2.402 | 81.3 | | 1.01189 | 82.2 |
| | 96 | 4719.2 | 121.3 | 2143.5 | 2.202 | 2.402 | 91.7 | | 1.01189 | 92.7 |
| | 152 | 4719.2 | 119.2 | 2106.4 | 2.240 | 2.402 | 93.3 | 2.267 | 1.01189 | 94.4 |
| 2 | 8 | 4698.8 | 136.4 | 2410.4 | 1.949 | 2.402 | 81.2 | | 1.01075 | 82.0 |
| | 96 | 4698.8 | 121.6 | 2148.8 | 2.187 | 2.402 | 91.0 | | 1.01075 | 92.0 |
| | 152 | 4698.8 | 119.5 | 2111.7 | 2.225 | 2.402 | 92.6 | 2.249 | 1.01075 | 93.6 |
| 3 | 8 | 4691.6 | 136.3 | 2408.6 | 1.948 | 2.402 | 81.1 | | 1.00453 | 81.5 |
| | 96 | 4691.6 | 121.0 | 2138.2 | 2.194 | 2.402 | 91.3 | | 1.00453 | 91.8 |
| | 152 | 4691.6 | 118.9 | 2101.1 | 2.233 | 2.402 | 93.0 | 2.243 | 1.00453 | 93.4 |

Average Corrected Density at $N_{design}$ 92.2

## Lauderdale County – 307S

## Superpave Gyratory Compaction Height Data Sheets

'ine Instrument Company Gyratory Compactor MODE: Set Gyrations

pecimen Size: 150 mm
Pressure: 600 kPa
Specimen ID: 1

Date: 2/07/98
Time: 14:48
Technician: _____

SPECIMEN HEIGHT (mm) vs. GYRATION NO.

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 154.7 | 148.6 | 145.4 | 143.1 | 141.4 | 139.9 | 138.7 | 137.7 | 136.8 | 136.0 |
| 10 | 135.3 | 134.6 | 134.0 | 133.5 | 133.0 | 132.5 | 132.1 | 131.7 | 131.3 | 130.9 |
| 20 | 130.6 | 130.3 | 129.9 | 129.7 | 129.4 | 129.1 | 128.9 | 128.6 | 128.4 | 128.2 |
| 30 | 127.9 | 127.7 | 127.5 | 127.3 | 127.2 | 127.0 | 126.8 | 126.6 | 126.5 | 126.3 |
| 40 | 126.1 | 126.0 | 125.8 | 125.7 | 125.6 | 125.4 | 125.3 | 125.2 | 125.1 | 124.9 |
| 50 | 124.8 | 124.7 | 124.6 | 124.5 | 124.4 | 124.3 | 124.2 | 124.1 | 124.0 | 123.9 |
| 60 | 123.8 | 123.7 | 123.6 | 123.5 | 123.4 | 123.3 | 123.3 | 123.2 | 123.1 | 123.0 |
| 70 | 122.9 | 122.9 | 122.8 | 122.7 | 122.6 | 122.6 | 122.5 | 122.4 | 122.4 | 122.3 |
| 80 | 122.2 | 122.2 | 122.1 | 122.0 | 122.0 | 121.9 | 121.9 | 121.8 | 121.8 | 121.7 |
| 90 | 121.6 | 121.6 | 121.5 | 121.5 | 121.4 | 121.4 | 121.3 | 121.3 | 121.2 | 121.2 |
| 00 | 121.1 | 121.1 | 121.0 | 121.0 | 120.9 | 120.9 | 120.8 | 120.8 | 120.7 | 120.7 |
| 10 | 120.6 | 120.6 | 120.6 | 120.5 | 120.5 | 120.4 | 120.4 | 120.4 | 120.3 | 120.3 |
| 20 | 120.2 | 120.2 | 120.2 | 120.1 | 120.1 | 120.0 | 120.0 | 120.0 | 119.9 | 119.9 |
| 30 | 119.9 | 119.8 | 119.8 | 119.8 | 119.7 | 119.7 | 119.7 | 119.6 | 119.6 | 119.6 |
| 40 | 119.5 | 119.5 | 119.5 | 119.4 | 119.4 | 119.4 | 119.3 | 119.3 | 119.3 | 119.2 |
| 50 | 119.2 | 119.2 | 119.2 | | | | | | | |

Pine Instrument Company Gyratory Compactor

MODE: Set Gyrations

Specimen Size: 150 mm
Pressure: 600 kPa
Specimen ID: 2

Date: 2/07/98
Time: 14:58
Technician: _____

SPECIMEN HEIGHT (mm) vs. GYRATION NO.

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 152.3 | 146.8 | 144.1 | 142.1 | 140.5 | 139.3 | 138.2 | 137.2 | 136.4 | 135.7 |
| 10 | 135.0 | 134.4 | 133.8 | 133.3 | 132.8 | 132.4 | 132.0 | 131.6 | 131.2 | 130.9 |
| 20 | 130.6 | 130.3 | 130.0 | 129.7 | 129.4 | 129.1 | 128.9 | 128.6 | 128.4 | 128.2 |
| 30 | 128.0 | 127.8 | 127.6 | 127.4 | 127.2 | 127.1 | 126.9 | 126.7 | 126.6 | 126.4 |
| 40 | 126.3 | 126.1 | 126.0 | 125.8 | 125.7 | 125.6 | 125.5 | 125.3 | 125.2 | 125.1 |
| 50 | 125.0 | 124.9 | 124.8 | 124.7 | 124.6 | 124.5 | 124.4 | 124.3 | 124.2 | 124.1 |
| 60 | 124.0 | 123.9 | 123.8 | 123.7 | 123.6 | 123.6 | 123.5 | 123.4 | 123.3 | 123.2 |
| 70 | 123.2 | 123.1 | 123.0 | 122.9 | 122.9 | 122.8 | 122.7 | 122.7 | 122.6 | 122.5 |
| 80 | 122.5 | 122.4 | 122.3 | 122.3 | 122.2 | 122.2 | 122.1 | 122.0 | 122.0 | 121.9 |
| 90 | 121.9 | 121.8 | 121.8 | 121.7 | 121.7 | 121.6 | 121.6 | 121.5 | 121.5 | 121.4 |
| 100 | 121.4 | 121.3 | 121.3 | 121.2 | 121.2 | 121.1 | 121.1 | 121.1 | 121.0 | 121.0 |
| 110 | 120.9 | 120.9 | 120.8 | 120.8 | 120.8 | 120.7 | 120.7 | 120.6 | 120.6 | 120.6 |
| 120 | 120.5 | 120.5 | 120.4 | 120.4 | 120.4 | 120.3 | 120.3 | 120.3 | 120.2 | 120.2 |
| 130 | 120.2 | 120.1 | 120.1 | 120.1 | 120.0 | 120.0 | 120.0 | 119.9 | 119.9 | 119.9 |
| 140 | 119.8 | 119.8 | 119.8 | 119.8 | 119.7 | 119.7 | 119.7 | 119.6 | 119.6 | 119.6 |
| 150 | 119.6 | 119.5 | 119.5 | | | | | | | |

Pine Instrument Company Gyratory Compactor — MODE: Set Gyrations

Specimen Size: 150 mm
Pressure: 600 kPa
Specimen ID: 3

Date: 2/07/98
Time: 15:07
Technician: _____

SPECIMEN HEIGHT (mm) vs. GYRATION NO.

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 153.2 | 147.2 | 144.4 | 142.3 | 140.6 | 139.2 | 138.1 | 137.2 | 136.3 | 135.6 |
| 10 | 134.9 | 134.2 | 133.7 | 133.1 | 132.6 | 132.2 | 131.8 | 131.4 | 131.0 | 130.6 |
| 20 | 130.3 | 130.0 | 129.7 | 129.4 | 129.1 | 128.9 | 128.6 | 128.4 | 128.1 | 127.9 |
| 30 | 127.7 | 127.5 | 127.3 | 127.1 | 126.9 | 126.7 | 126.6 | 126.4 | 126.2 | 126.1 |
| 40 | 125.9 | 125.8 | 125.6 | 125.5 | 125.3 | 125.2 | 125.1 | 124.9 | 124.8 | 124.7 |
| 50 | 124.6 | 124.5 | 124.4 | 124.2 | 124.1 | 124.0 | 123.9 | 123.8 | 123.7 | 123.6 |
| 60 | 123.5 | 123.5 | 123.4 | 123.3 | 123.2 | 123.1 | 123.0 | 122.9 | 122.9 | 122.8 |
| 70 | 122.7 | 122.6 | 122.5 | 122.5 | 122.4 | 122.3 | 122.2 | 122.2 | 122.1 | 122.0 |
| 80 | 122.0 | 121.9 | 121.8 | 121.8 | 121.7 | 121.7 | 121.6 | 121.5 | 121.5 | 121.4 |
| 90 | 121.4 | 121.3 | 121.2 | 121.2 | 121.1 | 121.1 | 121.0 | 121.0 | 120.9 | 120.9 |
| 100 | 120.8 | 120.8 | 120.7 | 120.7 | 120.6 | 120.6 | 120.5 | 120.5 | 120.4 | 120.4 |
| 110 | 120.4 | 120.3 | 120.3 | 120.2 | 120.2 | 120.1 | 120.1 | 120.1 | 120.0 | 120.0 |
| 120 | 119.9 | 119.9 | 119.9 | 119.8 | 119.8 | 119.8 | 119.7 | 119.7 | 119.6 | 119.6 |
| 130 | 119.6 | 119.5 | 119.5 | 119.5 | 119.4 | 119.4 | 119.4 | 119.3 | 119.3 | 119.3 |
| 140 | 119.2 | 119.2 | 119.2 | 119.1 | 119.1 | 119.1 | 119.0 | 119.0 | 119.0 | 118.9 |
| 150 | 118.9 | 118.9 | 118.9 | | | | | | | |

**Table B.75 Marshall Specimen Segments - %Gmm**

PROJECT: Union County - Region I
MIX: 411S
DATE: 9/16/97

$\Delta T =$ 0
$G_{mm} =$ 2.480

Saturated Surface Dry Method

| Sample No. | Weight In Air (g) | Weight In Water (g) | Weight, SSD (g) | Correction Factor (K) | Bulk Sp Gr | $\%G_{mm}$ |
|---|---|---|---|---|---|---|
| T1 | 127.0 | 75.0 | 127.0 | 1 | 2.442 | 98.5 |
| T2 | 146.3 | 87.0 | 146.5 | 1 | 2.459 | 99.1 |
| T3 | 160.8 | 95.1 | 160.9 | 1 | 2.444 | 98.5 |
| T4 | 100.3 | 59.4 | 100.5 | 1 | 2.440 | 98.4 |
| B1 | 129.6 | 76.9 | 129.7 | 1 | 2.455 | 99.0 |
| B2 | 150.4 | 89.6 | 150.6 | 1 | 2.466 | 99.4 |
| B3 | 151.8 | 89.8 | 152.0 | 1 | 2.441 | 98.4 |
| B4 | 115.1 | 68.0 | 115.2 | 1 | 2.439 | 98.3 |

**Table B.76 Marshall Specimen Segments - %Gmm**

PROJECT: Knox County - Region I
MIX: 411D
DATE: 10/16/97

$\Delta T =$ 0
$G_{mm} =$ 2.414

Saturated Surface Dry Method

| Sample No. | Weight In Air (g) | Weight In Water (g) | Weight, SSD (g) | Correction Factor (K) | Bulk Sp Gr | $\%G_{mm}$ |
|---|---|---|---|---|---|---|
| T1 | 133.1 | 75.7 | 133.3 | 1 | 2.311 | 95.7 |
| T2 | 109.6 | 62.0 | 107.9 | 1 | 2.388 | 98.9 |
| T3 | 142.5 | 81.8 | 142.9 | 1 | 2.332 | 96.6 |
| T4 | 125.5 | 71.2 | 125.7 | 1 | 2.303 | 95.4 |
| B1 | 161.2 | 91.5 | 161.6 | 1 | 2.300 | 95.3 |
| B2 | 106.1 | 61.1 | 106.3 | 1 | 2.347 | 97.2 |
| B3 | 160.4 | 91.1 | 160.7 | 1 | 2.305 | 95.5 |
| B4 | 122.9 | 69.9 | 123.2 | 1 | 2.306 | 95.5 |

**Table B.77 Marshall Specimen Segments - %Gmm**

PROJECT: Marion County - Region II
MIX: 411D
DATE: 10/23/97

$\Delta T$ = 0
$G_{mm}$ = 2.269

Saturated Surface Dry Method

| Sample No. | Weight In Air (g) | Weight In Water (g) | Weight, SSD (g) | Correction Factor (K) | Bulk Sp Gr | $\%G_{mm}$ |
|---|---|---|---|---|---|---|
| T1 | 125.6 | 70.6 | 126.0 | 1 | 2.267 | 99.9 |
| T2 | 117.5 | 66.1 | 117.9 | 1 | 2.268 | 100.0 |
| T3 | 134.1 | 75.2 | 134.4 | 1 | 2.265 | 99.8 |
| T4 | 114.3 | 63.7 | 114.5 | 1 | 2.250 | 99.2 |
| B1 | 114.1 | 63.9 | 114.7 | 1 | 2.246 | 99.0 |
| B2 | 138.5 | 77.5 | 138.9 | 1 | 2.256 | 99.4 |
| B3 | 111.4 | 61.8 | 111.6 | 1 | 2.237 | 98.6 |
| B4 | 129.6 | 72.2 | 130.0 | 1 | 2.242 | 98.8 |

**Table B.78 Marshall Specimen Segments - %Gmm**

PROJECT: Maury County - Region III
MIX: 411S
DATE: 9/23/97

$\Delta T =$ 0
$G_{mm} =$ 2.392

Saturated Surface Dry Method

| Sample No. | Weight In Air (g) | Weight In Water (g) | Weight, SSD (g) | Correction Factor (K) | Bulk Sp Gr | $\%G_{mm}$ |
|---|---|---|---|---|---|---|
| T1 | 138.0 | 77.5 | 139.0 | 1 | 2.244 | 93.8 |
| T2 | 146.5 | 83.1 | 146.7 | 1 | 2.303 | 96.3 |
| T3 | 134.8 | 77.6 | 139.9 | 1 | 2.164 | 90.5 |
| T4 | 110.2 | 62.2 | 110.3 | 1 | 2.291 | 95.8 |
| B1 | 131.2 | 75.2 | 131.3 | 1 | 2.339 | 97.8 |
| B2 | 120.7 | 69.1 | 121.0 | 1 | 2.326 | 97.2 |
| B3 | 121.8 | 68.5 | 122.1 | 1 | 2.272 | 95.0 |
| B4 | 136.8 | 78.4 | 137.0 | 1 | 2.334 | 97.6 |

**Table B.79 Marshall Specimen Segments - %Gmm**

PROJECT: Lincoln County - Region III
MIX: 411S
DATE: 9/15/97

$\Delta T =$ 0
$G_{mm} =$ 2.486

Saturated Surface Dry Method

| Sample No. | Weight In Air (g) | Weight In Water (g) | Weight, SSD (g) | Correction Factor (K) | Bulk Sp Gr | $\%G_{mm}$ |
|---|---|---|---|---|---|---|
| T1 | 138.9 | 80.2 | 139.2 | 1 | 2.354 | 94.7 |
| T2 | 101.9 | 58.6 | 102.5 | 1 | 2.321 | 93.4 |
| T3 | 107.9 | 62.0 | 108.3 | 1 | 2.330 | 93.7 |
| T4 | 136.8 | 78.9 | 136.9 | 1 | 2.359 | 94.9 |
| B1 | 105.7 | 61.0 | 106.1 | 1 | 2.344 | 94.3 |
| B2 | 140.0 | 80.5 | 140.4 | 1 | 2.337 | 94.0 |
| B3 | 146.4 | 84.5 | 146.7 | 1 | 2.354 | 94.7 |
| B4 | 227.8 | 131.3 | 228.5 | 1 | 2.344 | 94.3 |

**Table B.80 Marshall Specimen Segments - %Gmm**

PROJECT: Madison County - Region IV
MIX: 411S
DATE: 8/12/97

$\Delta T$ = 0
$G_{mm}$ = 2.314

Saturated Surface Dry Method

| Sample No. | Weight In Air (g) | Weight In Water (g) | Weight, SSD (g) | Correction Factor (K) | Bulk Sp Gr | $\%G_{mm}$ |
|---|---|---|---|---|---|---|
| T1 | 139.4 | 78.8 | 139.7 | 1 | 2.289 | 98.9 |
| T2 | 125.0 | 70.2 | 125.3 | 1 | 2.269 | 98.0 |
| T3 | 132.5 | 74.6 | 133.3 | 1 | 2.257 | 97.5 |
| T4 | 126.5 | 70.1 | 127.0 | 1 | 2.223 | 96.1 |
| B1 | 155.5 | 87.6 | 155.6 | 1 | 2.287 | 98.8 |
| B2 | 129.8 | 73.1 | 130.2 | 1 | 2.273 | 98.2 |
| B3 | 108.1 | 60.9 | 108.3 | 1 | 2.281 | 98.6 |
| B4 | 101.3 | 56.8 | 101.8 | 1 | 2.251 | 97.3 |

**Table B.81 Marshall Specimen Segments - %Gmm**

PROJECT: Madison County - Region IV
MIX: 307S
DATE: 8/12/97

$\Delta T$ = 0
$G_{mm}$ = 2.520

Saturated Surface Dry Method

| Sample No. | Weight In Air (g) | Weight In Water (g) | Weight, SSD (g) | Correction Factor (K) | Bulk Sp Gr | $\%G_{mm}$ |
|---|---|---|---|---|---|---|
| T1 | 119.7 | 70.9 | 119.8 | 1 | 2.448 | 97.1 |
| T2 | 121.2 | 71.9 | 121.5 | 1 | 2.444 | 97.0 |
| T3 | 139.9 | 82.8 | 190.3 | 1 | 1.301 | 51.6 |
| T4 | 167.0 | 99.4 | 167.3 | 1 | 2.459 | 97.6 |
| B1 | 142.6 | 84.5 | 142.8 | 1 | 2.446 | 97.1 |
| B2 | 103.0 | 61.1 | 103.1 | 1 | 2.452 | 97.3 |
| B3 | 162.1 | 96.1 | 162.4 | 1 | 2.445 | 97.0 |
| B4 | 146.6 | 87.0 | 146.8 | 1 | 2.452 | 97.3 |

**Table B.82 Marshall Specimen Segments - %Gmm**

PROJECT: Lauderdale County - Region IV
MIX: 411S
DATE: 10/15/97

$\Delta T =$ 0
$G_{mm} =$ 2.303

Saturated Surface Dry Method

| Sample No. | Weight In Air (g) | Weight In Water (g) | Weight, SSD (g) | Correction Factor (K) | Bulk Sp Gr | $\%G_{mm}$ |
|---|---|---|---|---|---|---|
| T1 | 125.4 | 68.9 | 126.0 | 1 | 2.196 | 95.4 |
| T2 | 129.3 | 71.2 | 129.9 | 1 | 2.203 | 95.6 |
| T3 | 143.0 | 78.2 | 143.6 | 1 | 2.187 | 94.9 |
| T4 | 117.7 | 64.8 | 118.4 | 1 | 2.196 | 95.3 |
| B1 | 128.0 | 70.7 | 128.6 | 1 | 2.211 | 96.0 |
| B2 | 136.1 | 74.4 | 136.8 | 1 | 2.181 | 94.7 |
| B3 | 124.9 | 67.9 | 125.6 | 1 | 2.165 | 94.0 |
| B4 | 126.2 | 69.8 | 126.8 | 1 | 2.214 | 96.1 |

**Table B.83 Marshall Specimen Segments - %Gmm**

PROJECT: Lauderdale County - Region IV
MIX: 307S
DATE: 10/15/97

$\Delta T =$ 0
$G_{mm} =$ 2.402

Saturated Surface Dry Method

| Sample No. | Weight In Air (g) | Weight In Water (g) | Weight, SSD (g) | Correction Factor (K) | Bulk Sp Gr | $\%G_{mm}$ |
|---|---|---|---|---|---|---|
| T1 | 126.0 | 72.1 | 126.8 | 1 | 2.303 | 95.9 |
| T2 | 121.5 | 68.5 | 122.0 | 1 | 2.271 | 94.5 |
| T3 | 128.2 | 72.0 | 128.9 | 1 | 2.253 | 93.8 |
| T4 | 135.7 | 75.8 | 136.2 | 1 | 2.247 | 93.5 |
| B1 | 137.0 | 79.6 | 137.6 | 1 | 2.362 | 98.3 |
| B2 | 134.3 | 76.1 | 135.4 | 1 | 2.265 | 94.3 |
| B3 | 127.6 | 73.3 | 128.0 | 1 | 2.333 | 97.1 |
| B4 | 123.3 | 69.9 | 123.9 | 1 | 2.283 | 95.1 |

**Table B.84 Gyratory Specimen Segments - %Gmm**

PROJECT: Union County - Region I
MIX: 411S
DATE: 9/16/97

$\Delta T =$ 0
$G_{mm} =$ 2.480

Saturated Surface Dry Method

| Sample No. | Weight In Air (g) | Weight In Water (g) | Weight, SSD (g) | Correction Factor (K) | Bulk Sp Gr | $\%G_{mm}$ |
|---|---|---|---|---|---|---|
| T1 | 399.7 | 237.6 | 400.1 | 1 | 2.460 | 99.2 |
| T2 | 362.9 | 215.7 | 363.0 | 1 | 2.464 | 99.3 |
| T3 | 375.3 | 223.8 | 375.3 | 1 | 2.477 | 99.9 |
| T4 | 388.9 | 232.1 | 389.4 | 1 | 2.472 | 99.7 |
| M1 | 334.5 | 198.3 | 334.7 | 1 | 2.452 | 98.9 |
| M2 | 329.7 | 193.4 | 325.0 | 1 | 2.505 | 101.0 |
| M3 | 377.4 | 225.8 | 377.7 | 1 | 2.485 | 100.2 |
| M4 | 392.5 | 233.7 | 392.7 | 1 | 2.469 | 99.5 |
| B1 | 354.5 | 210.2 | 354.7 | 1 | 2.453 | 98.9 |
| B2 | 359.5 | 213.2 | 359.6 | 1 | 2.456 | 99.0 |
| B3 | 365.3 | 217.2 | 365.8 | 1 | 2.458 | 99.1 |
| B4 | 428.6 | 255.2 | 428.7 | 1 | 2.470 | 99.6 |

**Table B.85 Gyratory Specimen Segments - %Gmm**

PROJECT: Knox County - Region I
MIX: 411D
DATE: 10/16/97

$\Delta T =$ 0
$G_{mm} =$ 2.414

Saturated Surface Dry Method

| Sample No. | Weight In Air (g) | Weight In Water (g) | Weight, SSD (g) | Correction Factor (K) | Bulk Sp Gr | $\%G_{mm}$ |
|---|---|---|---|---|---|---|
| T1 | 354.9 | 201.0 | 355.5 | 1 | 2.297 | 95.2 |
| T2 | 373.1 | 211.4 | 373.7 | 1 | 2.299 | 95.2 |
| T3 | 352.7 | 202.2 | 353.6 | 1 | 2.330 | 96.5 |
| T4 | 383.2 | 216.5 | 383.8 | 1 | 2.290 | 94.9 |
| M1 | 302.6 | 171.8 | 303.0 | 1 | 2.306 | 95.5 |
| M2 | 383.4 | 219.3 | 384.0 | 1 | 2.328 | 96.4 |
| M3 | 385.0 | 221.1 | 385.5 | 1 | 2.342 | 97.0 |
| M4 | 280.2 | 158.9 | 280.6 | 1 | 2.302 | 95.4 |
| B1 | 384.4 | 217.5 | 385.0 | 1 | 2.295 | 95.1 |
| B2 | 371.6 | 212.7 | 372.2 | 1 | 2.330 | 96.5 |
| B3 | 362.8 | 206.5 | 363.4 | 1 | 2.312 | 95.8 |
| B4 | 337.6 | 188.7 | 338.0 | 1 | 2.261 | 93.7 |

**Table B.86 Gyratory Specimen Segments - %Gmm**

PROJECT: Marion County - Region II
MIX: 411D
DATE: 10/23/97

$\Delta T$ = 0
$G_{mm}$ = 2.269

Saturated Surface Dry Method

| Sample No. | Weight In Air (g) | Weight In Water (g) | Weight, SSD (g) | Correction Factor (K) | Bulk Sp Gr | $\%G_{mm}$ |
|---|---|---|---|---|---|---|
| T1 | 325.0 | 181.9 | 325.9 | 1 | 2.257 | 99.5 |
| T2 | 336.0 | 188.7 | 336.5 | 1 | 2.273 | 100.2 |
| T3 | 313.5 | 176.1 | 314.3 | 1 | 2.268 | 100.0 |
| T4 | 356.6 | 200.3 | 357.7 | 1 | 2.266 | 99.8 |
| M1 | 327.6 | 185.0 | 328.2 | 1 | 2.288 | 100.8 |
| M2 | 365.0 | 206.7 | 365.9 | 1 | 2.293 | 101.0 |
| M3 | 324.3 | 183.1 | 324.8 | 1 | 2.289 | 100.9 |
| M4 | 354.5 | 200.5 | 355.3 | 1 | 2.290 | 100.9 |
| B1 | 342.2 | 192.0 | 343.0 | 1 | 2.266 | 99.9 |
| B2 | 334.0 | 188.1 | 334.6 | 1 | 2.280 | 100.5 |
| B3 | 369.6 | 207.8 | 370.2 | 1 | 2.276 | 100.3 |
| B4 | 347.5 | 194.9 | 348.2 | 1 | 2.267 | 99.9 |

**Table B.87 Gyratory Specimen Segments - %Gmm**

PROJECT: Maury County - Region III
MIX: 411S
DATE: 9/23/97

$\Delta T =$ 0
$G_{mm} =$ 2.392

Saturated Surface Dry Method

| Sample No. | Weight In Air (g) | Weight In Water (g) | Weight, SSD (g) | Correction Factor (K) | Bulk Sp Gr | $\%G_{mm}$ |
|---|---|---|---|---|---|---|
| T1 | 332.2 | 191.1 | 332.4 | 1 | 2.351 | 98.3 |
| T2 | 271.0 | 156.6 | 271.2 | 1 | 2.365 | 98.9 |
| T3 | 308.5 | 176.5 | 309.5 | 1 | 2.320 | 97.0 |
| T4 | 328.0 | 187.2 | 328.9 | 1 | 2.315 | 96.8 |
| M1 | 335.1 | 193.1 | 335.3 | 1 | 2.357 | 98.5 |
| M2 | 410.3 | 236.4 | 410.6 | 1 | 2.355 | 98.5 |
| M3 | 456.3 | 264.0 | 456.7 | 1 | 2.368 | 99.0 |
| M4 | 359.2 | 207.7 | 359.7 | 1 | 2.363 | 98.8 |
| B1 | 375.8 | 215.5 | 376.1 | 1 | 2.340 | 97.8 |
| B2 | 347.9 | 199.4 | 348.2 | 1 | 2.338 | 97.7 |
| B3 | 378.6 | 217.3 | 378.8 | 1 | 2.344 | 98.0 |
| B4 | 375.3 | 214.4 | 375.7 | 1 | 2.327 | 97.3 |

**Table B.88 Gyratory Specimen Segments - %Gmm**

PROJECT: Lincoln County - Region III
MIX: 411S
DATE: 9/15/97

$\Delta T =$ 0
$G_{mm} =$ 2.486

Saturated Surface Dry Method

| Sample No. | Weight In Air (g) | Weight In Water (g) | Weight, SSD (g) | Correction Factor (K) | Bulk Sp Gr | $\%G_{mm}$ |
|---|---|---|---|---|---|---|
| T1 | 335.3 | 194.9 | 336.4 | 1 | 2.370 | 95.3 |
| T2 | 400.6 | 231.4 | 401.5 | 1 | 2.355 | 94.7 |
| T3 | 320.0 | 185.7 | 321.7 | 1 | 2.353 | 94.6 |
| T4 | 284.6 | 164.3 | 286.0 | 1 | 2.339 | 94.1 |
| M1 | 390.1 | 228.5 | 390.8 | 1 | 2.404 | 96.7 |
| M2 | 510.6 | 298.0 | 511.3 | 1 | 2.394 | 96.3 |
| M3 | 425.4 | 247.3 | 426.4 | 1 | 2.375 | 95.5 |
| M4 | 438.8 | 256.8 | 439.2 | 1 | 2.406 | 96.8 |
| B1 | 332.2 | 193.0 | 333.7 | 1 | 2.361 | 95.0 |
| B2 | 448.6 | 259.7 | 450.1 | 1 | 2.356 | 94.8 |
| B3 | 315.6 | 183.4 | 317.2 | 1 | 2.359 | 94.9 |
| B4 | 317.9 | 183.7 | 318.6 | 1 | 2.357 | 94.8 |

**Table B.89 Gyratory Specimen Segments - %Gmm**

PROJECT: Madison County - Region IV
MIX: 411S
DATE: 8/12/97

$\Delta T =$ 0
$G_{mm} =$ 2.314

Saturated Surface Dry Method

| Sample No. | Weight In Air (g) | Weight In Water (g) | Weight, SSD (g) | Correction Factor (K) | Bulk Sp Gr | $\%G_{mm}$ |
|---|---|---|---|---|---|---|
| T1 | 308.3 | 173.1 | 309.1 | 1 | 2.267 | 98.0 |
| T2 | 378.5 | 212.5 | 379.5 | 1 | 2.266 | 97.9 |
| T3 | 419.1 | 235.8 | 420.5 | 1 | 2.269 | 98.1 |
| T4 | 327.2 | 183.3 | 328.0 | 1 | 2.261 | 97.7 |
| M1 | 371.7 | 210.8 | 372.9 | 1 | 2.293 | 99.1 |
| M2 | 291.9 | 164.8 | 292.7 | 1 | 2.282 | 98.6 |
| M3 | 359.2 | 204.4 | 360.2 | 1 | 2.306 | 99.6 |
| M4 | 326.6 | 185.1 | 327.5 | 1 | 2.294 | 99.1 |
| B1 | 418.4 | 232.5 | 419.5 | 1 | 2.237 | 96.7 |
| B2 | 333.0 | 187.3 | 333.9 | 1 | 2.271 | 98.2 |
| B3 | 352.3 | 195.6 | 353.1 | 1 | 2.237 | 96.7 |
| B4 | 339.9 | 190.3 | 341.0 | 1 | 2.255 | 97.5 |

**Table B.90 Gyratory Specimen Segments - %Gmm**

PROJECT: Madison County - Region IV
MIX: 307S
DATE: 8/12/97

$\Delta T$ = 0
$G_{mm}$ = 2.520

Saturated Surface Dry Method

| Sample No. | Weight In Air (g) | Weight In Water (g) | Weight, SSD (g) | Correction Factor (K) | Bulk Sp Gr | $\%G_{mm}$ |
|---|---|---|---|---|---|---|
| T1 | 344.6 | 205.0 | 344.9 | 1 | 2.463 | 97.7 |
| T2 | 382.5 | 227.1 | 382.8 | 1 | 2.457 | 97.5 |
| T3 | 458.0 | 274.3 | 458.4 | 1 | 2.488 | 98.7 |
| T4 | 418.1 | 250.2 | 488.6 | 1 | 1.754 | 69.6 |
| M1 | 371.9 | 223.2 | 372.1 | 1 | 2.498 | 99.1 |
| M2 | 349.2 | 210.0 | 347.4 | 1 | 2.541 | 100.9 |
| M3 | 393.2 | 237.0 | 393.5 | 1 | 2.512 | 99.7 |
| M4 | 423.0 | 255.3 | 423.3 | 1 | 2.518 | 99.9 |
| B1 | 402.1 | 240.8 | 402.6 | 1 | 2.485 | 98.6 |
| B2 | 361.5 | 216.1 | 361.9 | 1 | 2.479 | 98.4 |
| B3 | 336.8 | 201.1 | 337.3 | 1 | 2.473 | 98.1 |
| B4 | 328.0 | 195.3 | 328.7 | 1 | 2.459 | 97.6 |
| | | | | | | |

**Table B.91 Gyratory Specimen Segments - %Gmm**

PROJECT: Lauderdale County - Region IV
MIX: 411S
DATE: 10/15/97

$\Delta T$ = 0
$G_{mm}$ = 2.303

Saturated Surface Dry Method

| Sample No. | Weight In Air (g) | Weight In Water (g) | Weight, SSD (g) | Correction Factor (K) | Bulk Sp Gr | $\%G_{mm}$ |
|---|---|---|---|---|---|---|
| T1 | 393.0 | 221.2 | 394.1 | 1 | 2.273 | 98.7 |
| T2 | 311.3 | 174.3 | 312.3 | 1 | 2.256 | 98.0 |
| T3 | 365.0 | 205.9 | 366.1 | 1 | 2.278 | 98.9 |
| T4 | 312.6 | 176.9 | 313.3 | 1 | 2.292 | 99.5 |
| M1 | 453.9 | 255.7 | 455.3 | 1 | 2.274 | 98.7 |
| M2 | 284.1 | 160.1 | 285.3 | 1 | 2.269 | 98.5 |
| M3 | 355.9 | 201.7 | 357.3 | 1 | 2.287 | 99.3 |
| M4 | 340.1 | 192.6 | 341.3 | 1 | 2.287 | 99.3 |
| B1 | 375.8 | 210.8 | 377.0 | 1 | 2.261 | 98.2 |
| B2 | 274.3 | 152.8 | 275.5 | 1 | 2.236 | 97.1 |
| B3 | 394.2 | 220.7 | 395.8 | 1 | 2.251 | 97.8 |
| B4 | 308.0 | 173.4 | 308.8 | 1 | 2.275 | 98.8 |

**Table B.92 Gyratory Specimen Segments - %Gmm**

PROJECT: Lauderdale County - Region IV $\Delta T =$ 0
MIX: 307S $G_{mm} =$ 2.402
DATE: 10/15/97

Saturated Surface Dry Method

| Sample No. | Weight In Air (g) | Weight In Water (g) | Weight, SSD (g) | Correction Factor (K) | Bulk Sp Gr | $\%G_{mm}$ |
|---|---|---|---|---|---|---|
| T1 | 346.0 | 199.1 | 347.9 | 1 | 2.325 | 96.8 |
| T2 | 328.4 | 188.9 | 330.3 | 1 | 2.322 | 96.7 |
| T3 | 342.9 | 196.1 | 344.2 | 1 | 2.315 | 96.4 |
| T4 | 344.5 | 196.2 | 345.5 | 1 | 2.307 | 96.1 |
| M1 | 334.2 | 192.9 | 335.2 | 1 | 2.349 | 97.8 |
| M2 | 345.3 | 199.0 | 346.2 | 1 | 2.346 | 97.7 |
| M3 | 352.0 | 201.2 | 352.9 | 1 | 2.320 | 96.6 |
| M4 | 306.7 | 175.2 | 307.8 | 1 | 2.313 | 96.3 |
| B1 | 464.8 | 265.7 | 466.4 | 1 | 2.316 | 96.4 |
| B2 | 268.8 | 152.4 | 269.8 | 1 | 2.290 | 95.3 |
| B3 | 276.5 | 155.0 | 277.3 | 1 | 2.261 | 94.1 |
| B4 | 388.8 | 219.9 | 390.1 | 1 | 2.284 | 95.1 |

**Table B.93 Vibratory Specimen Segments - %Gmm**

PROJECT: Union County - Region I
MIX: 411S
DATE: 9/16/97

$\Delta T$ = 0
$G_{mm}$ = 2.480

Saturated Surface Dry Method

| Sample No. | Weight In Air (g) | Weight In Water (g) | Weight, SSD (g) | Correction Factor (K) | Bulk Sp Gr | % Gmm |
|---|---|---|---|---|---|---|
| T1 | 380.0 | 218.5 | 380.4 | 1 | 2.347 | 94.6 |
| T2 | 399.5 | 228.8 | 399.7 | 1 | 2.338 | 94.3 |
| T3 | 350.3 | 201.2 | 350.6 | 1 | 2.345 | 94.5 |
| T4 | 360.9 | 207.5 | 361.1 | 1 | 2.350 | 94.7 |
| T5 | 390.9 | 226.6 | 391.3 | 1 | 2.373 | 95.7 |
| T6 | 408.0 | 237.2 | 408.4 | 1 | 2.383 | 96.1 |
| T7 | 374.9 | 217.7 | 375.2 | 1 | 2.380 | 96.0 |
| T8 | 396.8 | 231.2 | 396.9 | 1 | 2.395 | 96.6 |
| B1 | 330.1 | 188.0 | 330.7 | 1 | 2.313 | 93.3 |
| B2 | 354.1 | 201.7 | 354.7 | 1 | 2.314 | 93.3 |
| B3 | 348.2 | 198.2 | 348.6 | 1 | 2.315 | 93.4 |
| B4 | 353.5 | 201.7 | 354.2 | 1 | 2.318 | 93.5 |
| B5 | 349.8 | 198.8 | 350.4 | 1 | 2.307 | 93.0 |
| B6 | 369.5 | 209.5 | 370.1 | 1 | 2.301 | 92.8 |
| B7 | 370.7 | 211.3 | 371.3 | 1 | 2.317 | 93.4 |
| B8 | 388.4 | 222.7 | 389.0 | 1 | 2.336 | 94.2 |

**Table B.94 Vibratory Specimen Segments - %Gmm**

PROJECT: Knox County - Region I
MIX: 411D
DATE: 10/16/97

$\Delta T =$ 0
$G_{mm} =$ 2.414

Saturated Surface Dry Method

| Sample No. | Weight In Air (g) | Weight In Water (g) | Weight, SSD (g) | Correction Factor (K) | Bulk Sp Gr | % Gmm |
|---|---|---|---|---|---|---|
| T1 | 325.8 | 179.5 | 326.3 | 1 | 2.219 | 91.9 |
| T2 | 349.3 | 191.9 | 349.8 | 1 | 2.212 | 91.6 |
| T3 | 351.6 | 194.0 | 352.1 | 1 | 2.224 | 92.1 |
| T4 | 356.6 | 195.5 | 357.0 | 1 | 2.208 | 91.5 |
| T5 | 324.4 | 176.7 | 325.0 | 1 | 2.187 | 90.6 |
| T6 | 342.9 | 187.3 | 343.4 | 1 | 2.197 | 91.0 |
| T7 | 337.5 | 183.8 | 338.0 | 1 | 2.189 | 90.7 |
| T8 | 328.7 | 178.9 | 329.3 | 1 | 2.186 | 90.5 |
| B1 | 355.2 | 195.5 | 356.9 | 1 | 2.201 | 91.2 |
| B2 | 368.9 | 202.5 | 369.7 | 1 | 2.206 | 91.4 |
| B3 | 369.5 | 202.4 | 370.3 | 1 | 2.201 | 91.2 |
| B4 | 403.6 | 222.5 | 405.1 | 1 | 2.210 | 91.6 |
| B5 | 366.8 | 202.4 | 369.4 | 1 | 2.196 | 91.0 |
| B6 | 363.3 | 198.5 | 354.3 | 1 | 2.332 | 96.6 |
| B7 | 354.1 | 193.8 | 355.0 | 1 | 2.197 | 91.0 |
| B8 | 345.7 | 187.0 | 346.5 | 1 | 2.167 | 89.8 |

**Table B.95 Vibratory Specimen Segments - %Gmm**

PROJECT: Marion County - Region II
MIX: 411D
DATE: 10/23/97

$\Delta T =$ 0
$G_{mm} =$ 2.269

Saturated Surface Dry Method

| Sample No. | Weight In Air (g) | Weight In Water (g) | Weight, SSD (g) | Correction Factor (K) | Bulk Sp Gr | % Gmm |
|---|---|---|---|---|---|---|
| T1 | 297.9 | 159.9 | 298.6 | 1 | 2.148 | 94.7 |
| T2 | 307.7 | 165.1 | 308.3 | 1 | 2.149 | 94.7 |
| T3 | 285.7 | 153.9 | 286.3 | 1 | 2.158 | 95.1 |
| T4 | 333.9 | 180.1 | 334.8 | 1 | 2.158 | 95.1 |
| T5 | 315.2 | 170.3 | 315.7 | 1 | 2.168 | 95.5 |
| T6 | 320.9 | 173.9 | 321.5 | 1 | 2.174 | 95.8 |
| T7 | 316.7 | 172.1 | 317.3 | 1 | 2.181 | 96.1 |
| T8 | 347.1 | 188.2 | 347.8 | 1 | 2.175 | 95.8 |
| B1 | 361.8 | 193.3 | 362.8 | 1 | 2.135 | 94.1 |
| B2 | 375.8 | 200.8 | 376.7 | 1 | 2.136 | 94.2 |
| B3 | 324.0 | 173.9 | 325.0 | 1 | 2.144 | 94.5 |
| B4 | 387.4 | 207.6 | 388.4 | 1 | 2.143 | 94.4 |
| B5 | 375.6 | 200.8 | 377.5 | 1 | 2.126 | 93.7 |
| B6 | 391.0 | 211.5 | 392.4 | 1 | 2.161 | 95.3 |
| B7 | 367.2 | 198.3 | 368.3 | 1 | 2.160 | 95.2 |
| B8 | 431.9 | 232.2 | 433.3 | 1 | 2.148 | 94.7 |

**Table B.96 Vibratory Specimen Segments - %Gmm**

PROJECT: Maury County - Region III
MIX: 411S
DATE: 9/23/97

$\Delta T =$ 0
$G_{mm} =$ 2.392

Saturated Surface Dry Method

| Sample No. | Weight In Air (g) | Weight In Water (g) | Weight, SSD (g) | Correction Factor (K) | Bulk Sp Gr | % Gmm |
|---|---|---|---|---|---|---|
| T1 | 363.0 | 203.8 | 363.9 | 1 | 2.267 | 91.2 |
| T2 | 340.4 | 187.9 | 341 | 1 | 2.223 | 89.4 |
| T3 | 323.5 | 176.4 | 324.9 | 1 | 2.178 | 87.6 |
| T4 | 339.0 | 187.6 | 339.8 | 1 | 2.227 | 89.6 |
| T5 | 334.1 | 189.0 | 334.5 | 1 | 2.296 | 92.4 |
| T6 | 336.2 | 189.3 | 336.6 | 1 | 2.282 | 91.8 |
| T7 | 324.1 | 181.9 | 324.8 | 1 | 2.268 | 91.2 |
| T8 | 332.9 | 186.5 | 333.6 | 1 | 2.263 | 91.0 |
| B1 | 421.3 | 233.4 | 422.9 | 1 | 2.223 | 89.4 |
| B2 | 397.4 | 220.0 | 398.6 | 1 | 2.225 | 89.5 |
| B3 | 358.3 | 198.0 | 359.6 | 1 | 2.217 | 89.2 |
| B4 | 368.4 | 203.4 | 369.4 | 1 | 2.219 | 89.3 |
| B5 | 380.5 | 212.9 | 382.0 | 1 | 2.250 | 90.5 |
| B6 | 366.7 | 204.8 | 369.1 | 1 | 2.232 | 89.8 |
| B7 | 373.3 | 211.2 | 375.9 | 1 | 2.267 | 91.2 |
| B8 | 361.8 | 204.3 | 364.1 | 1 | 2.264 | 91.1 |

**Table B.97 Vibratory Specimen Segments - %Gmm**

PROJECT: Lincoln County - Region III
MIX: 411S
DATE: 9/15/97

$\Delta T$ = 0
$G_{mm}$ = 2.486

Saturated Surface Dry Method

| Sample No. | Weight In Air (g) | Weight In Water (g) | Weight, SSD (g) | Correction Factor (K) | Bulk Sp Gr | % Gmm |
|---|---|---|---|---|---|---|
| T1 | 325.9 | 187 | 332.7 | 1 | 2.237 | 90.0 |
| T2 | 371.1 | 208.9 | 377.1 | 1 | 2.206 | 88.7 |
| T3 | 332.3 | 186.1 | 335.9 | 1 | 2.218 | 89.2 |
| T4 | 345.0 | 198.4 | 352.7 | 1 | 2.236 | 89.9 |
| T5 | 330.2 | 185.8 | 337.1 | 1 | 2.182 | 87.8 |
| T6 | 363.5 | 204.4 | 366.7 | 1 | 2.240 | 90.1 |
| T7 | 330.9 | 186.1 | 333.6 | 1 | 2.243 | 90.2 |
| T8 | 380.1 | 215.6 | 387.2 | 1 | 2.215 | 89.1 |
| B1 | 385.2 | 219.8 | 389.4 | 1 | 2.271 | 91.4 |
| B2 | 401.6 | 227.4 | 404.3 | 1 | 2.270 | 91.3 |
| B3 | 378.3 | 213.7 | 380.9 | 1 | 2.263 | 91.0 |
| B4 | 364.7 | 207.3 | 367.3 | 1 | 2.279 | 91.7 |
| B5 | 383.7 | 217.0 | 386.1 | 1 | 2.269 | 91.3 |
| B6 | 409.7 | 230.2 | 412.5 | 1 | 2.247 | 90.4 |
| B7 | 387.3 | 218.0 | 388.9 | 1 | 2.266 | 91.2 |
| B8 | 435.3 | 246.5 | 438.1 | 1 | 2.272 | 91.4 |

**Table B.98 Vibratory Specimen Segments - %Gmm**

PROJECT: Lincoln County - Region III
MIX: 411S
DATE: 9/15/97

$\Delta T$ = 0
$G_{mm}$ = 2.486
Note: Compacted at 65 psi

Saturated Surface Dry Method

| Sample No. | Weight In Air (g) | Weight In Water (g) | Weight, SSD (g) | Correction Factor (K) | Bulk Sp Gr | % Gmm |
|---|---|---|---|---|---|---|
| T1 | 335.5 | 189.5 | 338.4 | 1 | 2.253 | 90.6 |
| T2 | 330.5 | 185.9 | 333.3 | 1 | 2.242 | 90.2 |
| T3 | 383.9 | 216.4 | 386.7 | 1 | 2.254 | 90.7 |
| T4 | 371.3 | 210.8 | 373.6 | 1 | 2.281 | 91.7 |
| T5 | 297.7 | 169.2 | 299.0 | 1 | 2.294 | 92.3 |
| T6 | 317.2 | 179.7 | 318.8 | 1 | 2.280 | 91.7 |
| T7 | 349.6 | 198.3 | 351.1 | 1 | 2.288 | 92.0 |
| T8 | 337.0 | 192.7 | 338.5 | 1 | 2.311 | 93.0 |
| B1 | 426.3 | 241.8 | 429.2 | 1 | 2.275 | 91.5 |
| B2 | 418.2 | 235.2 | 419.9 | 1 | 2.264 | 91.1 |
| B3 | 460.5 | 259.5 | 464.4 | 1 | 2.247 | 90.4 |
| B4 | 412.9 | 234.5 | 418.2 | 1 | 2.248 | 90.4 |
| B5 | 374.0 | 214.7 | 378.5 | 1 | 2.283 | 91.8 |
| B6 | 401.7 | 228.7 | 405.3 | 1 | 2.275 | 91.5 |
| B7 | 444.7 | 254.2 | 449.5 | 1 | 2.277 | 91.6 |
| B8 | 398.8 | 229.5 | 404.5 | 1 | 2.279 | 91.7 |

**Table B.99 Vibratory Specimen Segments - %Gmm**

PROJECT: Madison County - Region IV
MIX: 411S
DATE: 8/12/97

$\Delta T =$ 0
$G_{mm} =$ 2.314

Saturated Surface Dry Method

| Sample No. | Weight In Air (g) | Weight In Water (g) | Weight, SSD (g) | Correction Factor (K) | Bulk Sp Gr | % Gmm |
|---|---|---|---|---|---|---|
| T1 | 384.9 | 209.5 | 386.4 | 1 | 2.176 | 86.3 |
| T2 | 396.5 | 213.4 | 397.9 | 1 | 2.149 | 85.3 |
| T3 | 424.8 | 229.2 | 426.2 | 1 | 2.156 | 85.6 |
| T4 | 426.1 | 234.5 | 427.1 | 1 | 2.212 | 87.8 |
| T5 | 347.6 | 188.5 | 349.1 | 1 | 2.164 | 85.9 |
| T6 | 370.7 | 203.4 | 371.5 | 1 | 2.205 | 87.5 |
| T7 | 362.0 | 199.6 | 363.2 | 1 | 2.213 | 87.8 |
| T8 | 364.6 | 200.5 | 366.0 | 1 | 2.203 | 87.4 |
| B1 | 322.4 | 174.5 | 324.1 | 1 | 2.155 | 85.5 |
| B2 | 328.5 | 176.7 | 329.5 | 1 | 2.150 | 85.3 |
| B3 | 349.2 | 188.1 | 350.6 | 1 | 2.149 | 85.3 |
| B4 | 329.1 | 178.4 | 332.2 | 1 | 2.140 | 84.9 |
| B5 | 306.8 | 165.7 | 308.4 | 1 | 2.150 | 85.3 |
| B6 | 299.8 | 162.6 | 300.7 | 1 | 2.171 | 86.1 |
| B7 | 303.4 | 164.7 | 304.5 | 1 | 2.170 | 86.1 |
| B8 | 295.9 | 160.3 | 298.4 | 1 | 2.143 | 85.0 |

**Table B.100 Vibratory Specimen Segments - %Gmm**

PROJECT: Madison County - Region IV
MIX: 307S
DATE: 8/12/97

$\Delta T$ = 0
$G_{mm}$ = 2.520

Saturated Surface Dry Method

| Sample No. | Weight In Air (g) | Weight In Water (g) | Weight, SSD (g) | Correction Factor (K) | Bulk Sp Gr | % Gmm |
|---|---|---|---|---|---|---|
| T1 | 334.0 | 194.5 | 334.8 | 1 | 2.381 | 94.5 |
| T2 | 331.7 | 189.9 | 332.6 | 1 | 2.324 | 92.2 |
| T3 | 314.7 | 179.5 | 315.4 | 1 | 2.316 | 91.9 |
| T4 | 313.3 | 180.5 | 313.8 | 1 | 2.350 | 93.3 |
| T5 | 372.1 | 216.0 | 372.6 | 1 | 2.376 | 94.3 |
| T6 | 382.2 | 220.5 | 383.0 | 1 | 2.352 | 93.3 |
| T7 | 362.2 | 210.7 | 363.6 | 1 | 2.369 | 94.0 |
| T8 | 360.6 | 209.6 | 361.7 | 1 | 2.371 | 94.1 |
| B1 | 439.9 | 254.4 | 441.5 | 1 | 2.351 | 93.3 |
| B2 | 453.9 | 261.1 | 455.2 | 1 | 2.338 | 92.8 |
| B3 | 477.8 | 272.8 | 479.2 | 1 | 2.315 | 91.9 |
| B4 | 451.2 | 258.2 | 453.2 | 1 | 2.314 | 91.8 |
| B5 | 379.5 | 220.3 | 381.1 | 1 | 2.360 | 93.7 |
| B6 | 381.4 | 221.3 | 383.4 | 1 | 2.353 | 93.4 |
| B7 | 401.3 | 232.9 | 403.5 | 1 | 2.352 | 93.3 |
| B8 | 388.5 | 225.6 | 391.3 | 1 | 2.345 | 93.0 |

**Table B.101 Vibratory Specimen Segments - %Gmm**

PROJECT: Lauderdale County - Region IV
MIX: 411S
DATE: 10/15/97

$\Delta T =$ 0
$G_{mm} =$ 2.303

Saturated Surface Dry Method

| Sample No. | Weight In Air (g) | Weight In Water (g) | Weight, SSD (g) | Correction Factor (K) | Bulk Sp Gr | % Gmm |
|---|---|---|---|---|---|---|
| T1 | 332.1 | 180 | 333.8 | 1 | 2.159 | 93.8 |
| T2 | 338.5 | 183.3 | 340.3 | 1 | 2.156 | 93.6 |
| T3 | 313.0 | 167.7 | 314.6 | 1 | 2.131 | 92.5 |
| T4 | 348.0 | 189.0 | 349.8 | 1 | 2.164 | 94.0 |
| T5 | 317.0 | 172.2 | 317.8 | 1 | 2.177 | 94.5 |
| T6 | 317.9 | 172.3 | 319.4 | 1 | 2.161 | 93.8 |
| T7 | 304.0 | 166.9 | 305.2 | 1 | 2.198 | 95.4 |
| T8 | 336.3 | 185.4 | 337.5 | 1 | 2.211 | 96.0 |
| B1 | 387.2 | 208.3 | 388.6 | 1 | 2.148 | 93.2 |
| B2 | 389.8 | 209.3 | 391.3 | 1 | 2.142 | 93.0 |
| B3 | 362.4 | 195.3 | 363.6 | 1 | 2.153 | 93.5 |
| B4 | 405.7 | 218.8 | 407.5 | 1 | 2.150 | 93.4 |
| B5 | 361.0 | 193.8 | 362.9 | 1 | 2.135 | 92.7 |
| B6 | 367.9 | 199.8 | 369.4 | 1 | 2.169 | 94.2 |
| B7 | 351.2 | 191.9 | 352.6 | 1 | 2.185 | 94.9 |
| B8 | 387.4 | 211.6 | 389.0 | 1 | 2.184 | 94.8 |

**Table B.102 Vibratory Specimen Segments - %Gmm**

PROJECT: Lauderdale County - Region IV
MIX: 307S
DATE: 10/15/97

$\Delta T =$ 0
$G_{mm} =$ 2.402

Saturated Surface Dry Method

| Sample No. | Weight In Air (g) | Weight In Water (g) | Weight, SSD (g) | Correction Factor (K) | Bulk Sp Gr | % Gmm |
|---|---|---|---|---|---|---|
| T1 | 332.1 | 184.4 | 333.3 | 1 | 2.230 | 92.9 |
| T2 | 332.3 | 185.0 | 334.3 | 1 | 2.226 | 92.7 |
| T3 | 358.8 | 199.0 | 360.3 | 1 | 2.224 | 92.6 |
| T4 | 305.8 | 171.1 | 306.9 | 1 | 2.252 | 93.7 |
| T5 | 345.4 | 189.9 | 347.2 | 1 | 2.196 | 91.4 |
| T6 | 348.3 | 191.5 | 351.3 | 1 | 2.180 | 90.7 |
| T7 | 305.0 | 166.4 | 307.3 | 1 | 2.165 | 90.1 |
| T8 | 336.1 | 188.2 | 338.0 | 1 | 2.244 | 93.4 |
| B1 | 401.1 | 223.8 | 404.7 | 1 | 2.217 | 92.3 |
| B2 | 387.4 | 213.7 | 390.1 | 1 | 2.196 | 91.4 |
| B3 | 397.2 | 219.1 | 399.3 | 1 | 2.204 | 91.8 |
| B4 | 367.4 | 206.9 | 370.6 | 1 | 2.244 | 93.4 |
| B5 | 411.8 | 220.4 | 414.7 | 1 | 2.119 | 88.2 |
| B6 | 399.8 | 212.4 | 402.2 | 1 | 2.106 | 87.7 |
| B7 | 426.4 | 230.6 | 430.3 | 1 | 2.135 | 88.9 |
| B8 | 403.4 | 218.1 | 406.2 | 1 | 2.145 | 89.3 |

**Table B.103 Vibratory Specimen Segments - %Gmm**

PROJECT: Lauderdale County - Region IV
MIX: 307S
DATE: 10/15/97

$\Delta T$ = 0
$G_{mm}$ = 2.402
Sample compacted at 65 p

Saturated Surface Dry Method

| Sample No. | Weight In Air (g) | Weight In Water (g) | Weight, SSD (g) | Correction Factor (K) | Bulk Sp Gr | % Gmm |
|---|---|---|---|---|---|---|
| T1 | 353.1 | 195.2 | 354.4 | 1 | 2.218 | 92.3 |
| T2 | 371.8 | 199.5 | 374.7 | 1 | 2.122 | 88.3 |
| T3 | 327.3 | 175.6 | 330.9 | 1 | 2.108 | 87.7 |
| T4 | 396.7 | 217.8 | 399.7 | 1 | 2.181 | 90.8 |
| T5 | 333.6 | 187.7 | 334.8 | 1 | 2.268 | 94.4 |
| T6 | 347.4 | 193.7 | 348.7 | 1 | 2.241 | 93.3 |
| T7 | 333.0 | 185.5 | 334.2 | 1 | 2.239 | 93.2 |
| T8 | 380.7 | 211.1 | 382.2 | 1 | 2.225 | 92.6 |
| B1 | 332.7 | 182.0 | 335.3 | 1 | 2.170 | 90.4 |
| B2 | 367.4 | 199.3 | 369.5 | 1 | 2.159 | 89.9 |
| B3 | 354.3 | 190.3 | 356.3 | 1 | 2.134 | 88.9 |
| B4 | 416.0 | 225.2 | 418.6 | 1 | 2.151 | 89.5 |
| B5 | 351.2 | 197.7 | 353.6 | 1 | 2.253 | 93.8 |
| B6 | 369.9 | 209.2 | 371.9 | 1 | 2.274 | 94.7 |
| B7 | 374.5 | 208.9 | 377.4 | 1 | 2.223 | 92.5 |
| B8 | 420.6 | 236.4 | 424.2 | 1 | 2.240 | 93.2 |

# Appendix C

## Statistical Analyses

**Statistical Analysis of Roadway and Laboratory Density Data**

**Statistical Analysis of Nuclear and Core Density Data**

# Statistical Analysis of Roadway and Laboratory Density Data

Analysis of Variance Procedure

Scheffe's test for variable: DENSITY

NOTE: This test controls the type I experimentwise error rate but generally has a higher type II error rate than Tukey's for all pairwise comparisons.

Alpha= 0.05 Confidence= 0.95 df= 32 MSE= 4.049862
Critical Value of F= 2.90112
Minimum Significant Difference= 2.7987

Comparisons significant at the 0.05 level are indicated by '***'.

| METHOD Comparison | Simultaneous Lower Confidence Limit | Difference Between Means | Simultaneous Upper Confidence Limit | |
|---|---|---|---|---|
| Marshall - Gyratory | -2.4176 | 0.3811 | 3.1798 | |
| Marshall - Vib | 1.3802 | 4.1789 | 6.9776 | *** |
| Marshall - Field | 3.0013 | 5.8000 | 8.5987 | *** |
| Gyratory - Marshall | -3.1798 | -0.3811 | 2.4176 | |
| Gyratory - Vib | 0.9991 | 3.7978 | 6.5965 | *** |
| Gyratory - Field | 2.6202 | 5.4189 | 8.2176 | *** |
| Vib - Marshall | -6.9776 | -4.1789 | -1.3802 | *** |
| Vib - Gyratory | -6.5965 | -3.7978 | -0.9991 | *** |
| Vib - Field | -1.1776 | 1.6211 | 4.4198 | |
| Field - Marshall | -8.5987 | -5.8000 | -3.0013 | *** |
| Field - Gyratory | -8.2176 | -5.4189 | -2.6202 | *** |
| Field - Vib | -4.4198 | -1.6211 | 1.1776 | |

Analysis of Variance Procedure

Bonferroni (Dunn) T tests for variable: DENSITY

NOTE: This test controls the type I experimentwise error rate but generally has a higher type II error rate than Tukey's for all pairwise comparisons.

Alpha= 0.05 Confidence= 0.95 df= 32 MSE= 4.049862
Critical Value of T= 2.81234
Minimum Significant Difference= 2.668

Comparisons significant at the 0.05 level are indicated by '***'.

| METHOD Comparison | Simultaneous Lower Confidence Limit | Difference Between Means | Simultaneous Upper Confidence Limit | |
|---|---|---|---|---|
| Marshall - Gyratory | -2.2869 | 0.3811 | 3.0491 | |
| Marshall - Vib | 1.5109 | 4.1789 | 6.8469 | *** |
| Marshall - Field | 3.1320 | 5.8000 | 8.4680 | *** |
| Gyratory - Marshall | -3.0491 | -0.3811 | 2.2869 | |
| Gyratory - Vib | 1.1298 | 3.7978 | 6.4658 | *** |
| Gyratory - Field | 2.7509 | 5.4189 | 8.0869 | *** |
| Vib - Marshall | -6.8469 | -4.1789 | -1.5109 | *** |
| Vib - Gyratory | -6.4658 | -3.7978 | -1.1298 | *** |
| Vib - Field | -1.0469 | 1.6211 | 4.2891 | |
| Field - Marshall | -8.4680 | -5.8000 | -3.1320 | *** |
| Field - Gyratory | -8.0869 | -5.4189 | -2.7509 | *** |
| Field - Vib | -4.2891 | -1.6211 | 1.0469 | |

Analysis of Variance Procedure

Tukey's Studentized Range (HSD) Test for variable: DENSITY

NOTE: This test controls the type I experimentwise error rate.

Alpha= 0.05 Confidence= 0.95 df= 32 MSE= 4.049862
Critical Value of Studentized Range= 3.832
Minimum Significant Difference= 2.5703

Comparisons significant at the 0.05 level are indicated by '***'.

| METHOD Comparison | Simultaneous Lower Confidence Limit | Difference Between Means | Simultaneous Upper Confidence Limit | |
|---|---|---|---|---|
| Marshall - Gyratory | -2.1892 | 0.3811 | 2.9514 | |
| Marshall - Vib | 1.6086 | 4.1789 | 6.7492 | *** |
| Marshall - Field | 3.2297 | 5.8000 | 8.3703 | *** |
| Gyratory - Marshall | -2.9514 | -0.3811 | 2.1892 | |
| Gyratory - Vib | 1.2275 | 3.7978 | 6.3681 | *** |
| Gyratory - Field | 2.8486 | 5.4189 | 7.9892 | *** |
| Vib - Marshall | -6.7492 | -4.1789 | -1.6086 | *** |
| Vib - Gyratory | -6.3681 | -3.7978 | -1.2275 | *** |
| Vib - Field | -0.9492 | 1.6211 | 4.1914 | |
| Field - Marshall | -8.3703 | -5.8000 | -3.2297 | *** |
| Field - Gyratory | -7.9892 | -5.4189 | -2.8486 | *** |
| Field - Vib | -4.1914 | -1.6211 | 0.9492 | |

## Analysis of Variance Procedure

Dependent Variable: DENSITY

| Source | DF | Sum of Squares | Mean Square | F Value | Pr > F |
|---|---|---|---|---|---|
| Model | 3 | 219.74362222 | 73.24787407 | 18.09 | 0.0001 |
| Error | 32 | 129.59557778 | 4.04986181 | | |
| Corrected Total | 35 | 349.33920000 | | | |

| R-Square | C.V. | Root MSE | DENSITY Mean |
|---|---|---|---|
| 0.629027 | 2.139059 | 2.01242684 | 94.08000000 |

| Source | DF | Anova SS | Mean Square | F Value | Pr > F |
|---|---|---|---|---|---|
| METHOD | 3 | 219.74362222 | 73.24787407 | 18.09 | 0.0001 |

Levene's Test for Homoscedasticity

General Linear Models Procedure

Dependent Variable: V Squared Deviation from the Mean

| Source | DF | Sum of Squares | Mean Square | F Value | Pr > F |
|---|---|---|---|---|---|
| Model | 3 | 66.70422530 | 22.23474177 | 1.19 | 0.3297 |
| Error | 32 | 598.73704661 | 18.71053271 | | |
| Corrected Total | 35 | 665.44127191 | | | |

| R-Square | C.V. | Root MSE | V Mean |
|---|---|---|---|
| 0.100241 | 120.1587 | 4.32556733 | 3.59987716 |

| Source | DF | Type I SS | Mean Square | F Value | Pr > F |
|---|---|---|---|---|---|
| METHOD | 3 | 66.70422530 | 22.23474177 | 1.19 | 0.3297 |

| Source | DF | Type III SS | Mean Square | F Value | Pr > F |
|---|---|---|---|---|---|
| METHOD | 3 | 66.70422530 | 22.23474177 | 1.19 | 0.3297 |

General Linear Models Procedure

Dependent Variable: DENSITY

| Source | DF | Sum of Squares | Mean Square | F Value | Pr > F |
|---|---|---|---|---|---|
| Model | 3 | 219.74362222 | 73.24787407 | 18.09 | 0.0001 |
| Error | 32 | 129.59557778 | 4.04986181 | | |
| Corrected Total | 35 | 349.33920000 | | | |

| R-Square | C.V. | Root MSE | DENSITY Mean |
|---|---|---|---|
| 0.629027 | 2.139059 | 2.01242684 | 94.08000000 |

| Source | DF | Type I SS | Mean Square | F Value | Pr > F |
|---|---|---|---|---|---|
| METHOD | 3 | 219.74362222 | 73.24787407 | 18.09 | 0.0001 |

| Source | DF | Type III SS | Mean Square | F Value | Pr > F |
|---|---|---|---|---|---|
| METHOD | 3 | 219.74362222 | 73.24787407 | 18.09 | 0.0001 |

Analysis of Variance Procedure

Dunnett's T tests for variable: DENSITY

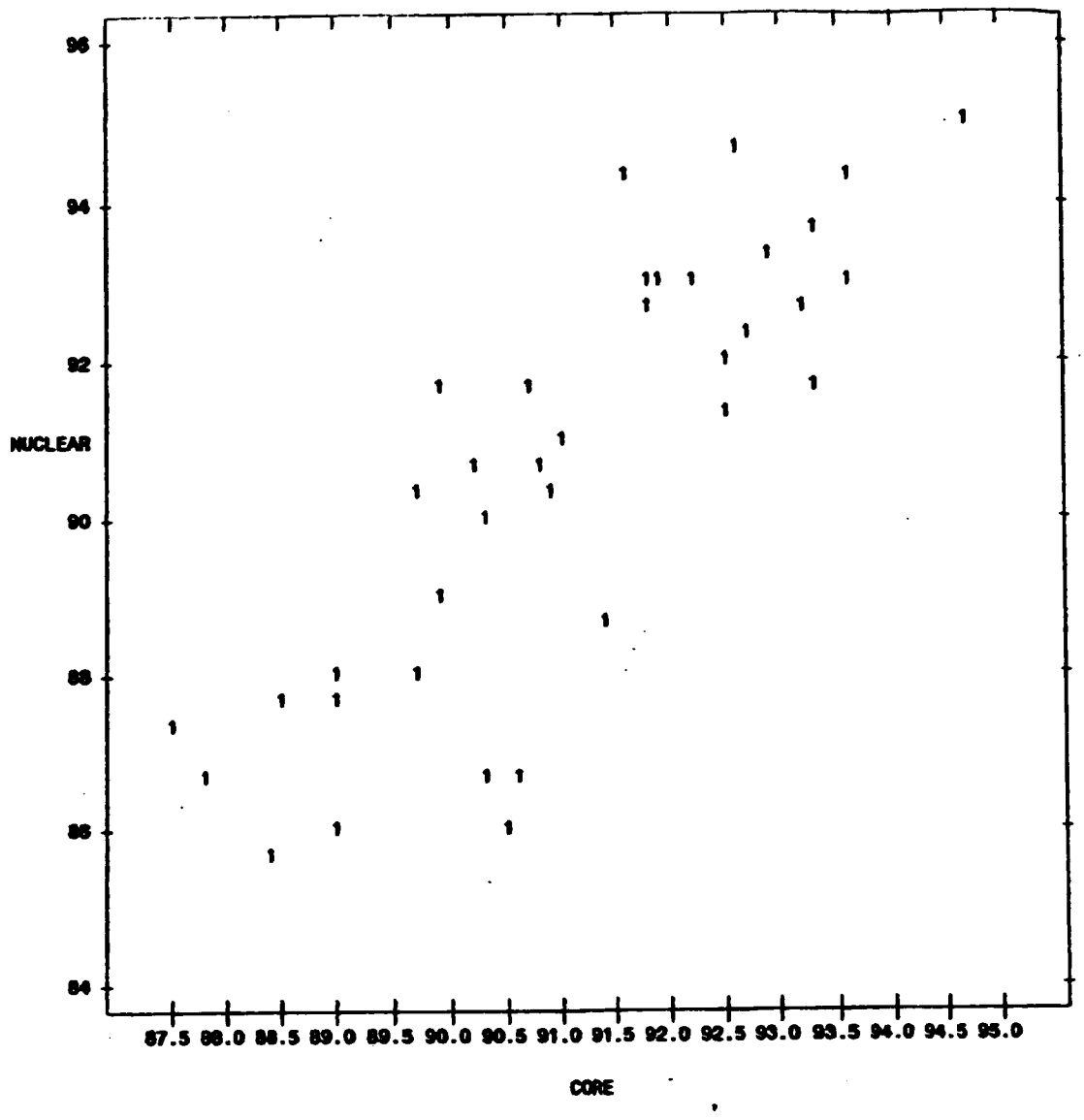
NOTE: This tests controls the type I experimentwise error for comparisons of all treatments against a control.

Alpha= 0.05 Confidence= 0.95 df= 32 MSE= 4.049862
Critical Value of Dunnett's T= 2.466
Minimum Significant Difference= 2.339

Comparisons significant at the 0.05 level are indicated by '***'.

| METHOD Comparison | Simultaneous Lower Confidence Limit | Difference Between Means | Simultaneous Upper Confidence Limit | |
|---|---|---|---|---|
| Marshall - Field | 3.4610 | 5.8000 | 8.1390 | *** |
| Gyratory - Field | 3.0798 | 5.4189 | 7.7579 | *** |
| Vib - Field | -0.7179 | 1.6211 | 3.9602 | |

# Statistical Analysis of Nuclear and Roadway Core Density Data


96
94
92
90
88
86
84
NUCLEAR
87.5 88.0 88.5 89.0 89.5 90.0 90.5 91.0 91.5 92.0 92.5 93.0 93.5 94.0 94.5 95.0
CORE

## Analysis of Variance

| Source | DF | Sum of Squares | Mean Square | F Value | Prob>F |
|---|---|---|---|---|---|
| Model | 1 | 192.74527 | 192.74527 | 76.898 | 0.0001 |
| Error | 35 | 87.72716 | 2.50649 | | |
| C Total | 36 | 280.47243 | | | |

| | | | |
|---|---|---|---|
| Root MSE | 1.58319 | R-square | 0.6872 |
| Dep Mean | 90.54865 | Adj R-sq | 0.6783 |
| C.V. | 1.74844 | | |

## Parameter Estimates

| Variable | DF | Parameter Estimate | Standard Error | T for H0: Parameter=0 | Prob > \|T\| |
|---|---|---|---|---|---|
| INTERCEP | 1 | -27.052849 | 13.41330451 | -2.017 | 0.0514 |
| CORE | 1 | 1.291442 | 0.14727060 | 8.769 | 0.0001 |

# Vita

Eric Ownby was born in Nashville Tennessee. After moving to East Tennessee, he completed grades K through 12 in the Knox County School System, where he graduated from Karns High School in 1989. His education continued upon return from the Persian Gulf in 1992. He began his Bachelor degree in Civil Engineering at Pellissippi State Technical Community College and finished at The University of Tennessee in August of 1997. Immediately following graduation, he began pursuing a Master Degree in Civil Engineering and officially received his Master degree in December of 1998.

He is presently employed as a laboratory manager and research engineer with Vulcan Materials Company, a major producer of construction materials.