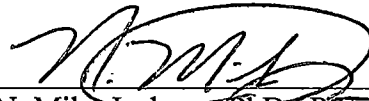


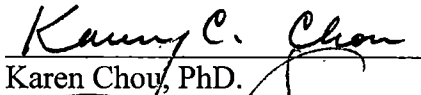
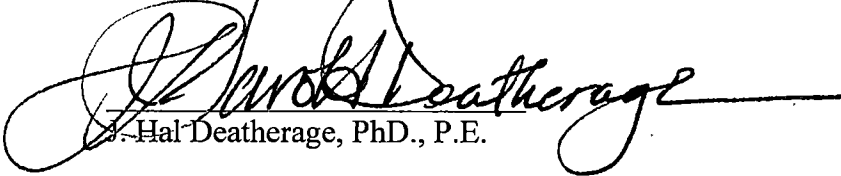
To the Graduate Council:

I am submitting herewith a thesis written by Stuart Malley entitled "Innovative Technology Evaluated during the Construction of the NCAT Pavement Test Track". I have examined the final copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Masters of Science, with a major in Civil Engineering.



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And recommend its acceptance:


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Interim Vice Provost and
Dean of the Graduate School

**Innovative Technology Evaluated during the Construction of the
NCAT Pavement Test Track**

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

**Stuart Malley
August 2001**

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Abstract

The National Center for Asphalt Technology has constructed a 1.7-mile oval Test Track. The Test Track contains 46 test sections. It is located near Auburn Alabama. The purpose of the Test Track is to evaluate the rutting susceptibility of Hot Mix Asphalt pavements. The goal of the Test Track is to evaluate the performance of the various mixes in the laboratory and under field conditions. The laboratory data will be compared to the field data to establish a pavement performance model. The model can then be used to predict pavement performance. This innovation can help save taxpayer dollars in future paving operations.

Ten different agencies are participating in this first round of testing. One of the agencies, the Tennessee Department of Transportation, funded a University of Tennessee Graduate Research Assistant to be on-site during the construction of the test sections.

The Test Track was constructed over a two-year period. The subsequent traffic applied to the track will be equivalent to approximately 20 years of traffic on a normal interstate pavement. The accelerated schedule will help to answer pertinent design questions in a shorter time and under controlled conditions. The objective of this document is to summarize the construction of the Test Track and present some of the innovative technology used during construction. The Test Track is an internationally known project and the results of the testing are expected to be very useful to future paving operations.

An evaluation of innovative technology was performed during the construction of the Test Track. They include a truck-sampling device, a belt sampling device, release agents, infrared technology, and new density measuring devices. The density-measuring device was evaluated for the purposes of this paper. It is a Pavement Quality Indicator. It was evaluated for its ability to estimate roadway density. The Pavement Quality Indicator performed similar to a traditional nuclear gauge.

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1.0 INTRODUCTION

In a continued effort to evaluate the performance of Hot Mix Asphalt (HMA), the Tennessee Department of Transportation (TDOT) contracted with the National Center for Asphalt Technology (NCAT) and the University of Tennessee (UTK) to conduct full-scale accelerated testing of HMA at the NCAT Pavement Test Track. This research is conducted under TDOT project number (TNSPR) RES1135 contract number CUT181.

The NCAT Pavement Test Track is an accelerated testing facility designed for the evaluation of rutting susceptibility of HMA mixes. As part of this Phase I study, TDOT funded the on-site presence of a UT Graduate Research Assistant during the construction of the Test Track. Other members of the research team, including TDOT representatives, visited the Test Track periodically during construction.

The objective of this document is three-fold. First is the documentation of construction activities at the NCAT Pavement Test Track. Second is an explanation of the testing and monitoring program following construction. The third is to summarize the innovative technology evaluated during the construction of the Test Track. The innovative technology summarized in this document include 1) Robotic Truck Sampling Device, 2) Aggregate Belt Sampler, 3) Release Agents, 4) Infrared Thermal Imaging, and 5) Performance Quality Indicator (PQI). Included in the final portion of this document is an evaluation of the PQI.

1.1 History

According to the Federal Highway Administrations (FHWA) Highways Statistics of 1990 there are approximately 2.2 million miles of paved roads in the U.S. Approximately 94% of these roads are surfaced with asphalt. Ray Brown, Director of NCAT, estimates that increasing the life of a pavement by 1% (30 to 60 days) will result in a savings of \$2,000,000 per year for each state Department of Transportation (DOT) (Brown 1998). The increase seems slight but the resulting savings are tremendous. The past two statements show the importance of extending the life of asphalt roadways that will in turn lower the overall cost of maintaining the nations infrastructure.

In the United States, the first asphalt road was constructed in 1870 in Newark, New Jersey. The first Hot Mix Asphalt (HMA) was placed in Washington D.C. in 1876. It was placed on Pennsylvania Avenue, it covered 54,000 square yards (Huang, 1993). This early HMA road surface lasted approximately 11 years without major distress. The Pennsylvania Avenue project showed the inherent value of paved road surfaces and promoted efforts to improve the technology and performance of asphalt mixtures (Gillespie, 1992). Logan Waller Page was a pioneer in developing better performing asphalt. Page was director of the Road Materials Laboratory at the Lawrence Scientific School of Harvard University. In 1893 Page enrolled in the French Laboratory of Bridges and Roads. Upon his return, he introduced the French testing methods to the roadwork performed in the United States (Gillespie 1992).

Since these first humble steps in asphalt construction, testing of the materials has evolved into full-scale pavement test tracks, such as the Test Track.

The most publicized test track was constructed and managed by the American Association of State Highway Officials (AASHO). The AASHO Road Test was a large experiment that took place from the 1950's into the early 1960's. The testing included both asphalt and concrete pavements. Six tracks were constructed to test a variety of pavement problems. The total cost of the AASHO Road Test was approximately \$27 million in 1961 dollars (Highway Research Board Special Report 61A, 1961). Many other test tracks have been constructed over the years. They include the Bates Road Test, The Malad Road Test, The WASHO Road Test, MNRoad, and, most recently, WesTrack (Gillispie, 1992). Testing programs are still being used nearly 100 years later and this brings us to the development of the latest accelerated full-scale test track, the NCAT Pavement Test Track.

1.2 Background

1.2.1 General Information

In October of 1998, construction began on the NCAT Pavement Test Track. The Test Track is managed by NCAT; this includes all construction, performance testing, and analysis of data. The objective of the Test Track is to evaluate the rutting susceptibility of HMA mixes in an accelerated period of time. The original intent of the Test Track was to perform testing of the new SUPERPAVE™ design system to verify its performance. It subsequently changed to include many different design

methods. The ultimate goal is to extend the life of the pavement and produce a cost-effective product.

The NCAT Pavement Test Track is located near Auburn, Alabama. It is located on a 309-acre parcel of land owned by Auburn University. An aerial photograph of the facility is shown in Figure 1. The 1.7-mile oval Test Track contains 46 test sections. The sections vary in length, with 44 approximately 200 feet long and two approximately 100-feet long. The test sections located on the two tangents consist of two 12-foot wide lanes with 4-foot wide shoulders on each side. The sections located on the curves expand to a width of approximately 16-feet in the middle of the curves and taper back to 12-feet to connect with the tangents. The

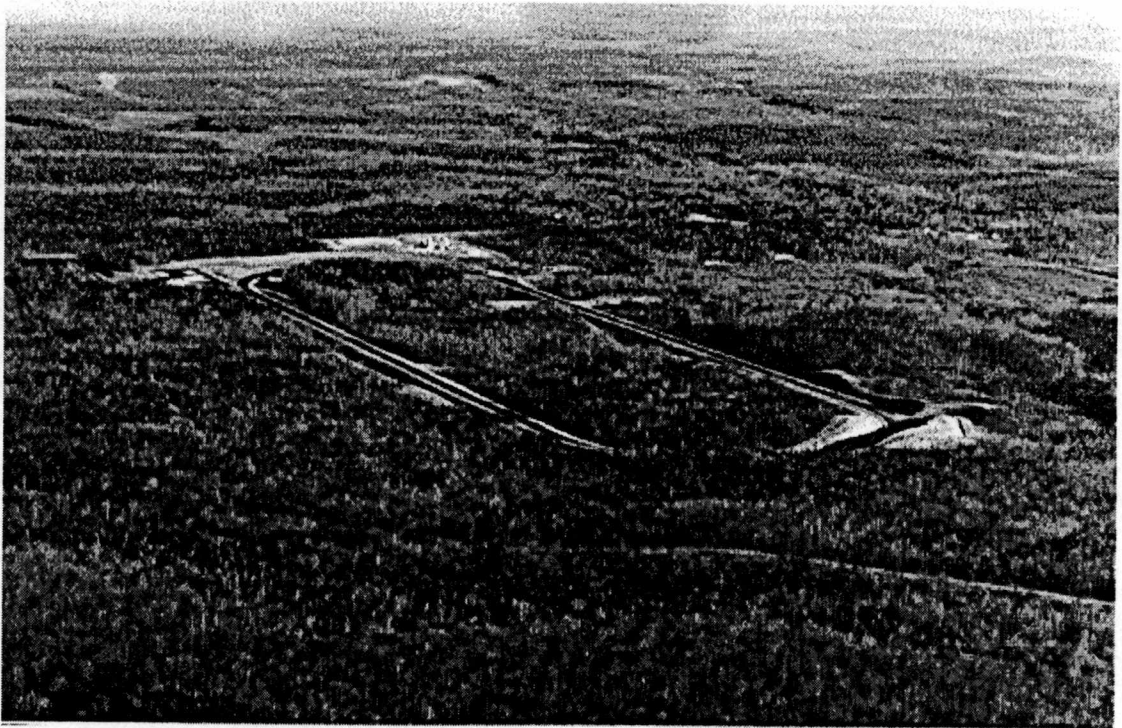


Figure 1. Aerial View of the NCAT Pavement Test Track

outside lane was designed to be the test lane, this is where the test traffic is applied. The inside lane was designed for maintenance of traffic and sampling purposes, verification, and fine-tuning of the HMA during construction.

1.2.2 Participating Organizations

The organizations/agencies that are participating in this first phase of testing include nine DOTs and the Federal Highway Administration (FHWA). The state agencies include TDOT, the Alabama Department of Transportation (ALDOT), the Florida Department of Transportation (FDOT), The Georgia Department of Transportation (GDOT), the Indiana Department of Transportation (INDOT), the Mississippi Department of Transportation (MDOT), the North Carolina Department of Transportation (NCDOT), the Oklahoma Department of Transportation (ODOT), and the South Carolina Department of Transportation (SCDOT).

1.2.3 Construction and Operating Cost

The total cost to construct the facility was initially estimated at \$7.5 million. This cost included \$1.4 million for the 4700 square foot laboratory and the 2300 square foot maintenance facility, \$2.3 million for the construction of the Test Track through the improved sub-grade, and \$3.8 million for the paving of the bituminous coated aggregate base courses and HMA surface courses (Brown, 1998). The state of Alabama funded the majority of the construction cost. This included the laboratory and maintenance facility and the construction of the track up through the structural build-up.

The project ran into cost overruns. The original design called for a common mix to be placed on the curves. The cost to construct the curves was to be shared by all the sponsors. ALDOT decided before construction to make use of the curves for evaluation of Alabama mixes. This added additional cost to the project. The cost to construct the curves was shared by the sponsors but ALDOT provided the additional funds for the extra twenty test sections. Another factor affecting the cost of the project was a significant increase in the cost in petroleum products during the construction period. The actual cost of the project was approximately \$8.4 million, approximately \$1 million over budget (Powell, 2001).

The participating agencies funds paid for the operation and maintenance budget with a portion allocated for construction. The cost to each participant, such as TDOT, was \$495,000 for two test sections. This included the cost of construction and evaluation of the performance of selected mixes on the two test sections. As previously mentioned this included a portion of the cost to construct the sections located in the curves. Each participating agency was responsible for supplying the materials that were placed on their respective test sections. This additional cost to some agencies was over \$100,000. The funds paid by each agency for the cost of operation, maintenance, and analysis were put into a pooled-fund study, which is in conjunction with the FHWA, project number SP&R-03 (085). The final cost, including construction, operation and maintenance for two years, is estimated at \$10 million (Deyo, 2000).

1.2.4 Design Methods and Materials

Four different design methods were implemented at the Test Track. This first phase of testing on the Test Track included 59 different designs of HMA. Among these were three Open Graded Friction Courses (OGFC), eight Stone Matrix Asphalt (SMA) mixes, one Hveem designed mix, and 47 Superpave™ designed mixes.

Four different types of Asphalt Cement (AC) were used in the 59 mix designs. Ergon, Inc. supplied three different AC products, a PG67-22 unmodified, a PG76-22 modified with Styrene-Butadiene (SBR), and a PG76-22 modified with Styrene-Butadiene-Styrene (SBS). Koch Materials Company supplied a PG70-28 SBS AC that was used exclusively for the ODOT test sections. Sixty-nine different aggregate products were used to construct the 46 test sections. It should be noted that the respective material producers donated 100% of these aggregates, a list of which can be found on the website www.pavetrack.com.

1.2.5 Pavement Sections

The typical pavement section includes 12 inches of improved subgrade, 6 inches of mineral aggregate base, 5 inches of bituminous coated aggregate base, 15 inches of Superpave™ base, and 4 inches of experimental surface and binder mix. A typical section is illustrated in Figure 2. The pavement structure, excluding the top 4 inches of experimental surface and binder mix, was designed to accommodate approximately 157 million Equivalent Single Axle Load (ESALs), which was calculated using the 1993 American Association of State Highway and Transportation

Officials (AASHTO) design guide. The actual traffic applied to the Test Track will be approximately 6% of the design capacity, or 10 million ESALs over a two-year proposed loading period. This intended over-design is to prevent full depth structural failure of the pavement sections, thus emphasizing the rutting characteristics of the experimental surface mixes.

An identification system for each section was established before construction. This system is designed for incorporation into a database. The test sections are labeled with a counterclockwise northing numbering system. The test sections within the east curve are numbered E1 through E10. The test sections within the north tangent are numbered N1 through N13. The test sections within the west curve are numbered W1 through W10, and the test sections within the south tangent are numbered S1 through S13. Paving of the test sections began with Section E2.

4 inches	Experimental Surface and Binder Mix
15 inches	37.5 mm SuperpaveTM Base Mix
5 inches	Bituminous Coated Aggregate Base
6 inches	Mineral Aggregate Base (Crushed Granite)
12 inches	Improved Subgrade

Figure 2. Typical Pavement Section for the NCAT Pavement Test Track.

Section E1, which is near the truck exit ramp, was the last test section to be paved.

Figure 3 exhibits the relative location of each of the Phase 1 test sections on the track.

The TDOT test sections are Sections S4 and S5. A further discussion of the TDOT test sections is included in section 3.0 of this document.

1.2.6 Test Section Summary

Table 1 summarizes the materials and design methods for each mix placed in the corresponding test section. As noted in Table 1, the TDOT test sections (Sections S4 and S5) were designed as coarse graded limestone and gravel mixes, respectively.

These mixes contain polymer modified PG76-22 SBS AC.

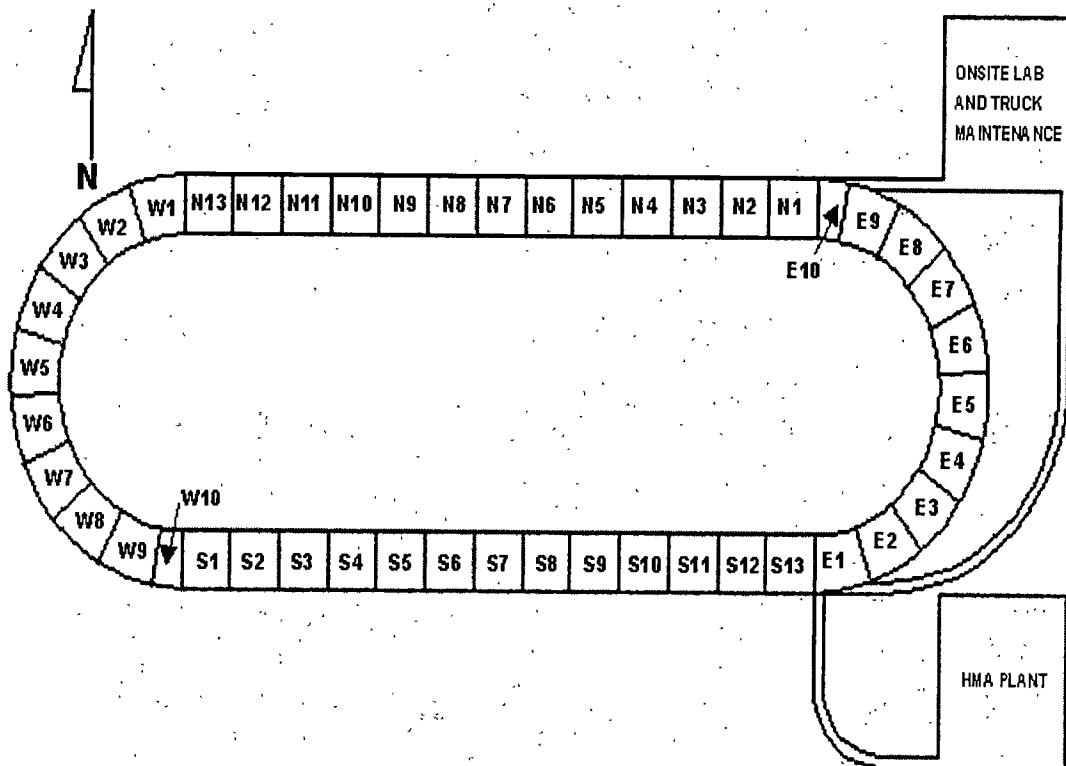


Figure 3. Phase 1 Test Section Layout at the NCAT Pavement Test Track.

The aggregate type listed in Table 1 accounts for the major proportion of the mix. Many mixes use varying aggregate types. This can be seen in the section summary sheets located in Appendix A. The summary sheets include the construction mix design, gradation, asphalt content, mix volumetrics, and various construction properties.

As previously noted, the primary purpose of the Test Track is to study the rutting susceptibility of HMA. However, many of the test sections were designed to answer questions for various studies. The sections E2 through E10 are part of a study to evaluate the effect of gradation and AC type on mix performance. The nine sections contain the same aggregate type, granite. The first three were designed with grading Below the Restricted Zone (BRZ), the next three Through the Restricted Zone (TRZ), and the final three are Above the Restricted Zone (ARZ). Within each set of three gradings, the asphalt type was also varied. They include unmodified AC, an SB, an SBR and an SBS modified AC. Specific studies for the various agencies will answer questions comparing traditional mix designs to the Superpave™ design. These include the OGFC, SMA and Hveem mix design methods. Another study looks at the effect of having excess AC in the mix. These are sections N1 through N10. It should be noted that the information in the column headed Notes of Table 1 denotes an intentional increase in the binder content above the laboratory-designed optimum. This will allow for a characterization of the method of determining the optimum AC content. Summaries of the test section mix properties are provided in Appendix A.

Table 1. Materials and Design Methods for Phase 1 Test Sections

Section ID	Aggregate Type	Design Method	Max. Agg. Size	Design Gradation	Binder Grade	AC Modif.	Notes
E1	Quartzite	SUPERPAVE	12.5 mm	BRZ	PG67-22	Neat	
E2	Granite	SUPERPAVE	12.5 mm	BRZ	PG67-22	Neat	
E3	Granite	SUPERPAVE	12.5 mm	BRZ	PG76-22	SBR	
E4	Granite	SUPERPAVE	12.5 mm	BRZ	PG76-22	SBS	
E5	Granite	SUPERPAVE	12.5 mm	TRZ	PG76-22	SBS	
E6	Granite	SUPERPAVE	12.5 mm	TRZ	PG76-22	Neat	
E7	Granite	SUPERPAVE	12.5 mm	TRZ	PG76-22	SBR	
E8	Granite	SUPERPAVE	12.5 mm	ARZ	PG67-22	Neat	
E9	Granite	SUPERPAVE	12.5 mm	ARZ	PG76-22	SBS	
E10	Granite	SUPERPAVE	12.5 mm	ARZ	PG76-22	SBR	
N1	Limestone-slag	SUPERPAVE	12.5 mm	ARZ	PG76-22	SBS	
N2	Limestone-slag	SUPERPAVE	12.5 mm	ARZ	PG76-22	SBS	+ 0.5% AC
N3	Limestone-slag	SUPERPAVE	12.5 mm	ARZ	PG67-22	Neat	+ 0.5% AC
N4	Limestone-slag	SUPERPAVE	12.5 mm	ARZ	PG67-22	Neat	
N5	Limestone-slag	SUPERPAVE	12.5 mm	BRZ	PG67-22	Neat	+ 0.5% AC
N6	Limestone-slag	SUPERPAVE	12.5 mm	BRZ	PG67-22	Neat	
N7	Limestone-slag	SUPERPAVE	12.5 mm	BRZ	PG76-22	SBR	+ 0.5% AC
N8	Limestone-slag	SUPERPAVE	12.5 mm	BRZ	PG76-22	SBR	
N9	Limestone-slag	SUPERPAVE	12.5 mm	BRZ	PG76-22	SBS	+ 0.5% AC
N10	Limestone-slag	SUPERPAVE	12.5 mm	BRZ	PG76-22	SBS	
N11 Binder	Granite	SUPERPAVE	19 mm	BRZ	PG67-22	Neat	
N11 Surface	Granite	SUPERPAVE	12.5 mm	BRZ	PG76-22	SBS	
N12 Binder	Granite	SUPERPAVE	19 mm	BRZ	PG67-22	Neat	
N12 Surface	Granite	SMA	12.5 mm	SMA	PG76-22	SBS	
N13 Binder	Gravel	SUPERPAVE	19 mm	BRZ	PG67-22	Neat	
N13 Surface	Gravel	SMA	12.5 mm	SMA	PG76-22	SBS	
S1 Binder	Granite	SUPERPAVE	19 mm	BRZ	PG76-22	SBS	
S1 Surface	Granite	SUPERPAVE	12.5 mm	BRZ	PG76-22	SBS	
S2 Binder	Gravel	SUPERPAVE	19 mm	BRZ	PG76-22	SBS	
S2 Surface	Gravel	SUPERPAVE	12.5 mm	BRZ	PG70-22	SBS	
S3 Binder	Limestone	SUPERPAVE	19 mm	BRZ	PG76-22	SBS	
S3 Surface	Gravel	SUPERPAVE	9.5 mm	BRZ	PG76-22	SBS	
S4 Binder	Limestone	SUPERPAVE	19 mm	BRZ	PG76-22	SBS	
S4 Surface	Limestone	SUPERPAVE	12.5 mm	BRZ	PG76-22	SBS	
S5 Binder	Gravel	SUPERPAVE	19 mm	BRZ	PG76-22	SBS	
S5 Surface	Gravel	SUPERPAVE	12.5 mm	BRZ	PG76-22	SBS	
S6	Oolite Limestone	SUPERPAVE	12.5 mm	ARZ	PG67-22	Neat	
S7	Oolite Limestone	SUPERPAVE	12.5 mm	BRZ	PG67-22	Neat	
S8 Binder	Granite Gneiss	SUPERPAVE	19 mm	BRZ	PG67-22	Neat	
S8 Surface	Granite Gneiss	SUPERPAVE	9.5 mm	ARZ	PG76-22	SBS	
S9	Limestone	SUPERPAVE	12.5 mm	ARZ	PG76-22	SBS	
S10	Limestone	SUPERPAVE	12.5 mm	BRZ	PG76-22	SBS	
S11 Binder	Granite Gneiss	SUPERPAVE	19 mm	BRZ	PG76-22	SBS	
S11 Surface	Granite Gneiss	SUPERPAVE	12.5 mm	BRZ	PG76-22	SBS	
S12	Limestone	Hveem	12.5 mm	Hveem	PG70-28	SBS	
S13	Granite	SUPERPAVE	12.5 mm	BRZ	PG70-28	SBS	
W1	Granite	SMA	12.5 mm	SMA	PG76-22	SBR	
W2	Limestone-slag	SMA	12.5 mm	SMA	PG76-22	SBR	
W3 Binder	Granite	SUPERPAVE	12.5 mm	BRZ	PG76-22	SBR	
W3 Surface	Limestone-slag	OGFC	12.5 mm	OGFC	PG76-22	SBS	
W4 Binder	Limestone	SMA	12.5 mm	SMA	PG76-22	SBR	
W4 Surface	Limestone-slag	OGFC	12.5 mm	OGFC	PG76-22	SBR	
W5 Binder	Limestone	SMA	12.5 mm	SMA	PG67-22	SBS	
W5 Surface	Granite	OGFC	19 mm	OGFC	PG76-22	SBS	
W6	Limestone-slag	SUPERPAVE	12.5 mm	TRZ	PG67-22	Neat	
W7	Limestone	SMA	19 mm	SMA	PG70-22	SBR	
W8	Sandstone	SMA	19 mm	SMA	PG76-22	SBR	
W9	Quartzite	SUPERPAVE	12.5 mm	BRZ	PG67-22	Neat	
W10	Quartzite	SUPERPAVE	12.5 mm	BRZ	PG76-22	SBR	

2.0 CONSTRUCTION

2.1 General Information

Construction of the Test Track was performed under the direction of ALDOT and in accordance with ALDOT Standard Specifications for Highway Construction. Basic construction inspection and quality assurance testing was performed by Volkert Engineering, Inc. NCAT personnel and the various contractor personnel also provided supplemental inspection and testing services during the construction of the Test Track.

Construction of the Test Track took approximately two years. It started with the clearing and grubbing of the site, and finished with the stripping of the track. The estimated quantities for the track include approximately 53,000 tons of HMA and over 100,000 cubic yards of excavation. The structural build up of the track included an improved roadbed, an aggregate base, a bituminous-coated aggregate base, and base courses. The construction of the test sections included the trial mixes, the placement, and the subsequent laboratory testing. The construction process began in October of 1998 and was completed in August of 2000.

2.2 Clearing and Grubbing

Prior to construction, the site was a dense forested area as shown in Figure 4. Construction began with the clearing and grubbing of the site. The site for the Test Track was a moderately hilly location. The infield of the track was not cleared due to the presence of natural wetlands. It provides an environmentally friendly

research location. The entire track cannot be seen from the lab. The only way to view the entire track is from the air. At the same time the clearing and grubbing was taking place, an eight foot chain link fence was installed around the property to help control wildlife. A photograph of the site after clearing and grubbing, and prior to significant earthwork, is presented in Figure 5.

2.3 Earthwork

The next phase of construction was the earthwork. Large quantities of soil and rock had to be moved due to extensive topographical relief across the site. The amount of earthwork was also increased by the selected orientation of the Test Track



Figure 4. NCAT Pavement Test Track Site Before Clearing and Grubbing, June 1998.



Figure 5. NCAT Pavement Test Track After Clearing and Grubbing, October 1998.

on the site. This was done to reduce the environmental impact. The tangents were oriented in an east to west direction to keep the pavement temperature as uniform as possible for all of the sponsored test sections. This layout required cuts of approximately 40 feet and fills of approximately 50 feet at different locations on the site. Figure 6 exhibits the embankment placement along the north tangent of the Test Track. In the vicinity of the TDOT test sections (Sections S4 and S5), cuts of up to 15 feet and embankment fill depths of up to 30 feet were required within the test section right-of-way. The total volume of material moved is estimated at over 100,000 cubic yards. All earthwork was performed in accordance with ALDOT Standard Specifications for Highway Construction, Section 210.



Figure 6. Embankment Placement Along the North Tangent, January 1999.

2.4 Plant Installation

Astec Inc. provided a new Turbo 400 Double Barrel Drum-Mix Plant. This is a state of the art plant. The plant is capable of producing 400 tons of HMA per hour. It is a mobile plant. Each component of the plant is built onto a trailer. The entire plant can be moved in 36 hours (Astec, 2000). The plant contained five cold feed bins, two storage silos, a bag house, a Recycled Asphalt Pavement (RAP) feeder, a counter-flow mixing drum, an HMA storage bin, and a control tower. The control tower is fully automated. The counter-flow drum has an inside-drying chamber for the aggregate and an outside mixing chamber for the addition of the AC, additives, and RAP (Astec, 2000). The plant produced consistent mix throughout the entire

project. The plant meets the requirements spelled out in AASHTO M 156-97. Figure 7 illustrates the on-site plant at the Test Track.

2.5 Improved Subgrade and Aggregate Base Course

The next step in the construction process was the placement of 12 inches of improved subgrade and 6 inches of mineral aggregate (crushed granite) base course. These layers were constructed in accordance with ALDOT Standard Specifications for Highway Construction, Sections 230 and 301, respectively. The improved subgrade was constructed from the borrow located on site.

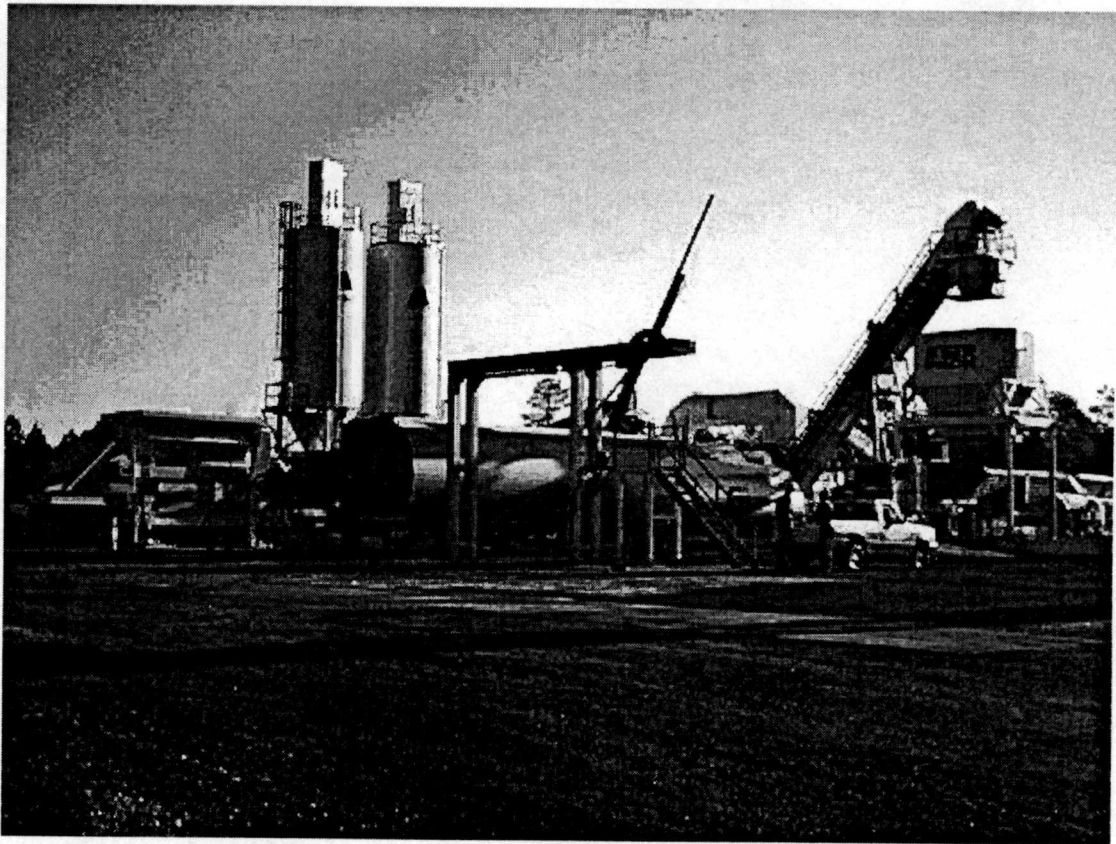


Figure 7. Astec Industries, Inc. M400 Double Drum HMA Plant.

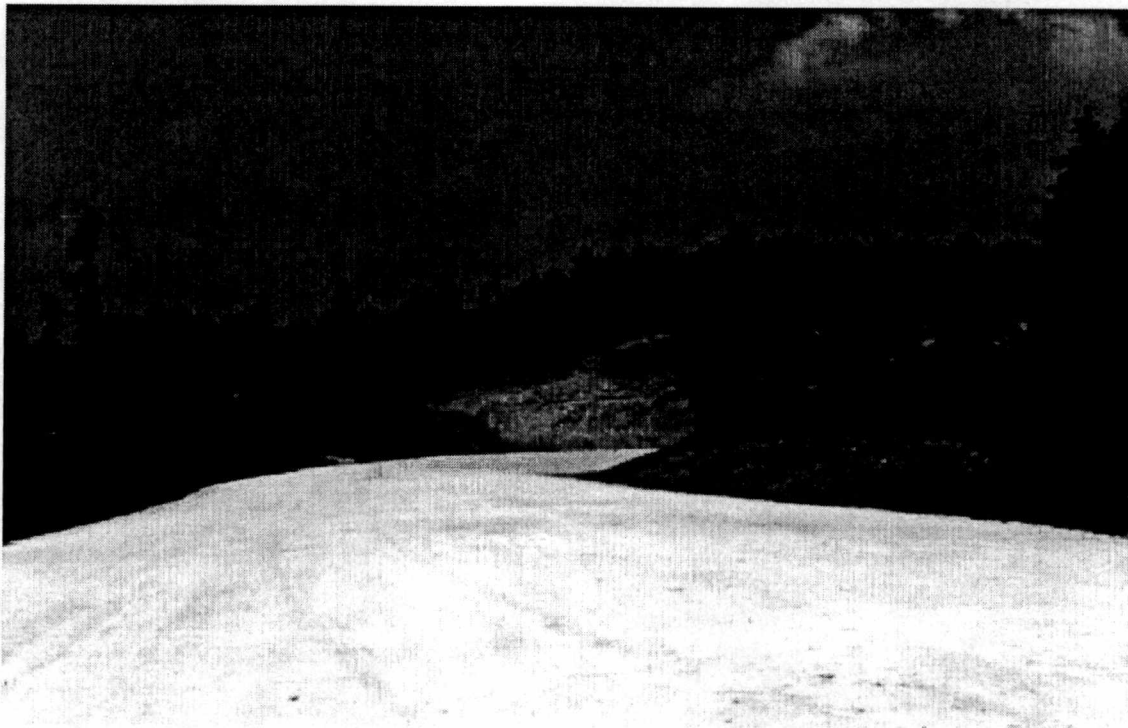


Figure 8. Photo After Placement of 12 Inches of Improved Subgrade, June 1999.

Photographs taken after placement of the improved subgrade and the mineral aggregate base course are presented in Figures 8 and 9, respectively. Approximately 31,000 tons of aggregate base was placed in the build-up.

2.6 Bituminous-Coated Aggregate Base Course

The next step in the construction process was the placement of approximately five inches of bituminous-coated aggregate base. This layer is designed to be permeable and was constructed in accordance with ALDOT Standard Specifications for Highway Construction, Section 327. The layer consists of a very coarse graded aggregate structure with a light coating of asphalt binder. A geo-synthetic fabric



Figure 9. Photo After Placement of 6 Inches of Aggregate Base Course, September 1999.

was placed between the aggregate base layer and the bituminous-coated aggregate base to keep the finer material from infiltrating the drainage layer. A photograph of the bituminous-coated aggregate base is shown in Figure 10. The placement of the bituminous-coated aggregate base course began in November, 1999 and was completed in January, 2000. Approximately 7,500 tons of this material was placed around the track.

After the placement of the bituminous-coated base coarse, edge drains were installed. These was installed to divert water away from the soil and aggregate layers. The edge drains encompass the inside of the track and were placed along the tangents

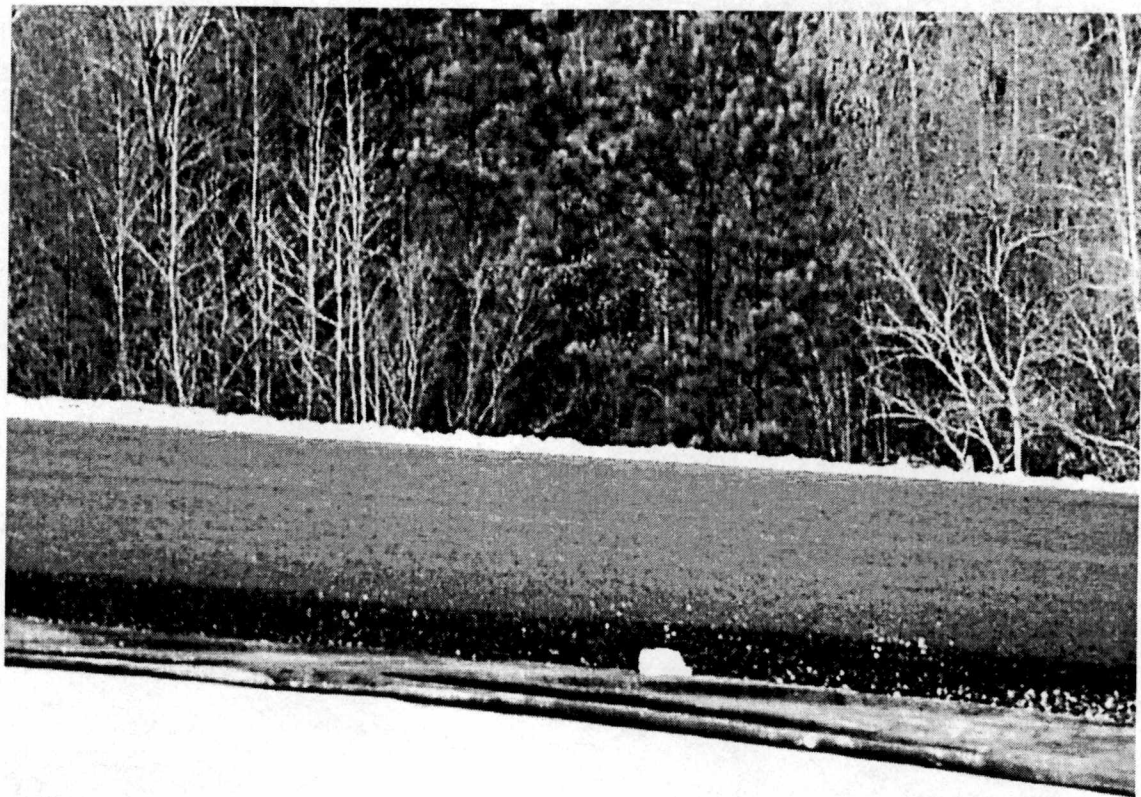


Figure 10. Placement of 5 Inches of Bituminous Coated Aggregate Base Course, December 1999.

on the outside of the track. The edge drains were installed in accordance with ALDOT Standard Specifications for Highway Construction, Section 605.

2.7 37.5 mm Superpave™ Base Course

The final step before the placement of the top four inches of experimental binder and surface mixes was the placement of approximately 15 inches of 37.5 mm Superpave™ Base. The layer consists of two mixes. The first was nine inches of 37.5mm lower binder, ESAL range F. The second was six inches of 37.5mm upper binder, ESAL range F. The difference between the two mixes was the number of gyrations used for the design. Approximately 31,000 tons of HMA was placed in

these two layers. This layer was designed in accordance with ALDOT Standard Specifications for Highway construction, Section 424. The construction of these layers began in January of 2000 and was completed in March of 2000. A photograph of the full pavement section, up through the SuperpaveTM Base courses is presented in Figure 11. The ropes in the photograph were installed during completion of the final lift of the base layer. They were then removed to allow for the installation of the temperature sensors. This practice was repeated for all subsequent layers that required the installation of these sensors. It should be noted that ALDOT Standard Specifications of Highway Materials, Section 410, was used to control all HMA paving operations.

2.8 Surface and Binder Courses

The placement of the top four inches of HMA, the mix to be evaluated for rutting susceptibility on each test section, began on March 21st, 2000. The surface and binder courses were designed and constructed in accordance with the sponsoring agency's specifications. The surface and binder mixes were placed on the test sections using conventional paving methods. The typical paving operation, which generally included a material transfer device, conventional paving equipment, a vibratory steel drum roller and a pneumatic tire roller is shown in Figure 12. The final estimate of quantities for the test sections include 8000 tons of HMA placed and 2500 tons used in trial mixes.



Figure 11. Full Pavement Section up Through the 15 Inches of 37.5 mm Superpave™ Base Course, January 2000.

In most typical paving operations, the asphalt plant is allowed to stabilize after production of approximately 50 tons of HMA before any laboratory testing is performed to verify the mix properties. Unfortunately, it was not possible to produce and waste such a large quantity of HMA during placement of the test sections due to time and monetary constraints associated with transporting materials to the Test Track.

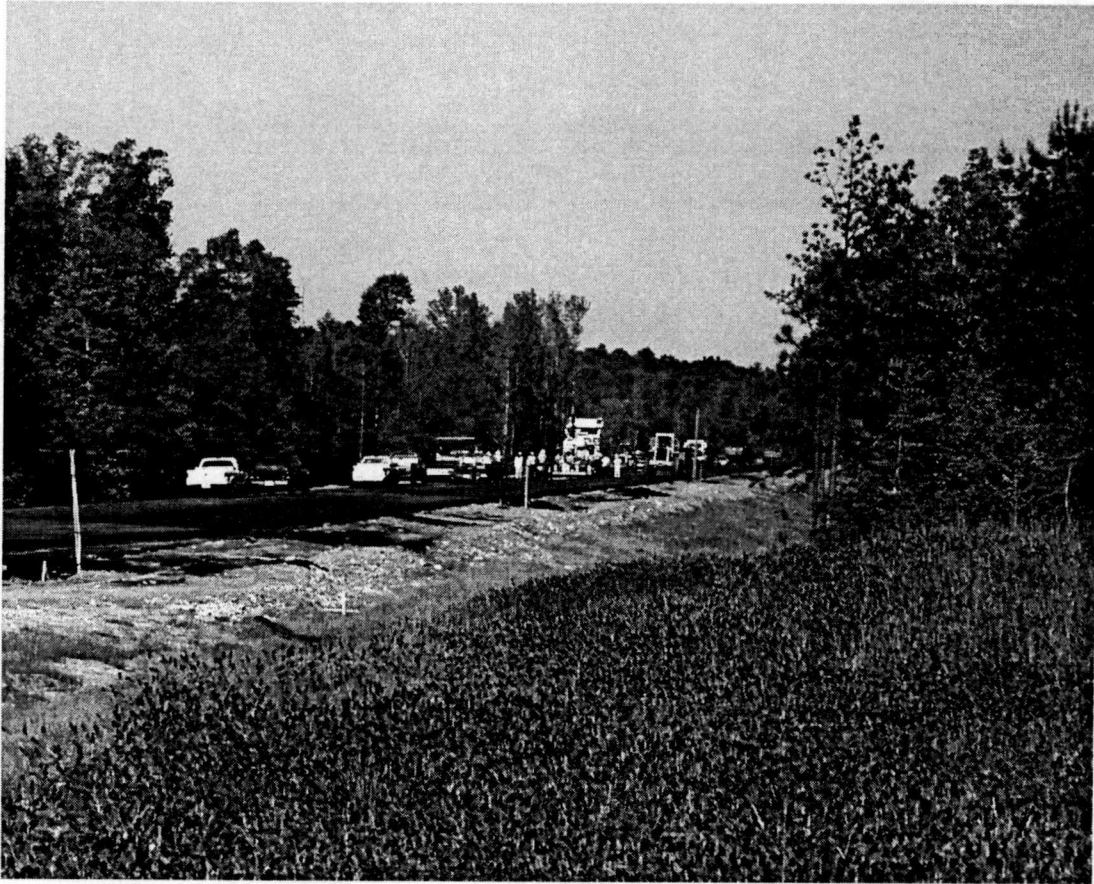


Figure 12. Paving Operation of Typical Test Section.

After the construction of the final test section, a detailed smoothness analysis was performed on the Test Track. As a result, portions of the joints connecting the test sections were ground to produce a smoother riding surface.

The asphalt plant generally produced enough mix for the lift in less than thirty minutes. This produced enough mix before and after placement to ensure that the test section mix was consistent. Initially, it was thought that the contractor would pave the inside lane, halt production, then pave the outside lane after the inside lanes mix

properties were confirmed. Current construction practices made this inefficient and not a cost-effective method.

The sections were instead placed in lifts, this includes both the inside and outside lane of a section. Generally, the lifts were two inches thick unless otherwise directed by the sponsoring agency. This created a challenge in scheduling. The contractor would place from three to six lifts per day. The contractor was also limited by constraints placed by NCAT. The construction equipment was not allowed to roll over a section that had been placed during that day's construction. It had to be allowed to cool overnight before the contractor was allowed to move back and place the top lift of the section. Typically, the contractor would pave three to four binder layers in front of the surface sections. It can be described as a stair stepping process. The direction of paving was also a factor. The paving operation proceeded in a counter-clockwise direction to ensure that minimal construction traffic was applied to the sections already constructed. As previously mentioned, paving began with section E2 and ended with section E1 due to the relative location of the haul road of the plant.

Each test section was subdivided into sub-lots. Each sub-lot was tested to ensure mix properties. The typical test section contained four sub-lots. The exceptions were the sections containing OGFC mixes. These were subdivided into six sub-lots. The inside lane, lower lift was designated as sub-lot one and the outside

lane, lower lift was designated as sub-lot two. This pattern remained consistent for all subsequent lifts. Figure 13 illustrates a typical cross section as laid out by sub-lots.

Sub-lot 3	Sub-lot 4
Sub-lot 1	Sub-lot 2
Inside Lane	Outside Lane

Figure 13. Typical Cross Section of a Test Section Subdivided into Sub-lots

2.9 Trial Mixes and Mix Adjustments

The proposed method of fine-tuning the mixes during placement of the inside lane was found to be infeasible. Trial mixes were run on every mix placed at the Test Track, for the purpose of verifying and fine-tuning the mix before placement. The trial mix was either placed on the entry road to the Test Track or wasted into a stockpile. It took approximately 70 tons of mix to perform a trial run. Whenever possible the mix was placed at various locations around the site to establish a rolling pattern. This approach was found to work well and allowed the paving contractor to maintain a reasonable production schedule. This practice also helped to contribute to a quality product being placed on the roadway.

2.10 Laboratory Testing of HMA

NCAT personnel and contractors conducted Quality Assurance/Quality Control (QA/QC) testing of the HMA during the paving of the individual test

sections. It took the efforts of five technicians to perform the testing required. The objective was to supply the results to the contractor within two hours of production. This was the approximate time it would take the contractor to set up the equipment to place the next test section. The bulk of the staff was cooperative education students from Auburn University.

This QA/QC included sampling, splitting, and testing, as necessary to ensure compliance with sponsoring agency specifications. The basic laboratory tests conducted on each test section mix for QA/QC purposes included the following:

- Solvent extraction used for gradation purposes only (ALDOT BMTP 371)
- AC content using both a nuclear AC content gauge and an ignition furnace (AASHTO T 287-97 and AASHTO T 308-99, respectively)
- Theoretical maximum specific gravity (AASHTO T 209-99)
- HMA moisture content (AASHTO T 110-94)
- Drain down test, where applicable (AASHTO T 305-97)
- Laboratory compaction for the purpose of verifying volumetrics (AASHTO T 166-00 and AASHTO TP 4-00)
- Extraction for AC content determination (AASHTO T 164-97)

HMA was collected and subdivided into one-gallon and five-gallon buckets for testing and evaluation after construction. Approximately one ton of mix was sampled from each different mix. A portion of the mix was also placed into storage

for future testing. The other portion was compacted into test specimens in the laboratory. The mix was heated back to compaction temperature for approximately 30 minutes prior to laboratory compaction. The consensus idea behind the compaction of the fresh mix was to capture the properties as they are in the pavement. Re-heating was considered to alter the properties of the mix (Brown 2000). Usually, in less than 2 hours, 70 Superpave™ gyratory specimens and 20 Pavement Technology, Inc. (PTI) Asphalt Vibratory Compactor beam specimens were prepared. Six additional technicians were needed to fulfill this commitment. Some mixes required additional time due to limited on-site laboratory personnel and equipment.

2.11 In-Place Density Testing

In order to monitor the in-place density of the different test sections, the frequency of density testing was increased beyond that which would typically be required for roadway construction. All in place density testing was performed in accordance with ASTM D 2950. A Troxler 3440 nuclear gauge was used for acceptance. The procedure for determining the in-place pavement density included dividing each lane of each test section into three fifty-foot increments, with 25 feet on either end of the section. Random locations were selected using standard practices as defined in Section 410 of ALDOT Standard Specifications for Highway Construction. Random numbers were assigned to each testing increment. The random numbers were used as the distance from the beginning edge of the test section. The first 25-foot increment was deemed unsuitable for testing due to the possibility of segregation. Figure 14 illustrates the breakdown of the incremental testing on each

test section. This breakdown will be used for all subsequent performance testing of the mixes as well. Three pavement cores from the inside lane of each lift, sub-lots one and three, were used to calibrate the nuclear and PQI density gauges. The calibrated density gauge was then used to monitor the density of the outside test lane. It should be noted that due to this testing frequency, difficulties were encountered with overheating of the electronics in the density gauges. This resulted in questionable density measurements on the roadway during construction of some test sections, including the TDOT test sections.

Non- Testing Increment	Test Increment A	Test Increment B Traffic →	Test Increment C	Destructive Testing Increment
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Figure 14. Breakdown of Testing Increments per Test Section.

2.12 Finishing Touches

The track was completed by the addition of striping and rumble strips. The striping was placed according to ALDOT Standard Specifications for Highway Construction, Section 703. The Test Track was marked the same as a traditional interstate. It includes two lanes of traffic in the same direction. The outer limits of each lane were marked with solid paint lines. The paint line separating the two lanes was marked on 20-foot intervals approximately five foot in length. The exit and entrance were also marked according to ALDOT specifications. The rumble strips were ground into the pavement around the entire track. This was a new process to

ALDOT and was tested at the Test Track. Other states have had good success with the ground rumble strips. The rumble strips were constructed according to ALDOT Standard Specifications for Highway Construction, Section 720. Immediately following the construction of the test sections, the instrumentation was installed. The instrumentation installed at the Test Track is discussed in Section 4.3 of this document.

3.0 TDOT Test Sections

As previously noted, the two test sections purchased by TDOT are located on the south tangent of the Test Track and are identified as Sections S4 and S5. The TDOT test sections consist of mixes that are representative of pavements placed on the interstate in Tennessee during the 1999 paving season. Section S4 includes two mixes consisting predominantly of crushed limestone, the common aggregate found in middle and east Tennessee. Section S5 includes two mixes consisting predominantly of gravel aggregate commonly found in west Tennessee. TDOT used two different mixes per section (surface and binder courses). The mixes were designed in accordance with the TDOT Standard Specifications for Road and Bridge Construction, Special Provision Sections 411S and 307S, for Superpave™ surface and binder mixes, respectively. Both of the 307S mixes contain RAP. TDOT elected to use lift thicknesses that are representative of common practice in the state of Tennessee. The selected TDOT lift thicknesses include a 2-1/2 inch thick 307S binder layer beneath a 1-1/2 inch thick 411S surface layer. Placement and Compaction operations of TDOT Test Section S4 can be seen in Figures 15 and 16.

Seventeen different aggregate products were used in the four different TDOT mixes selected for this study. The binder used for the TDOT mixes is an Ergon PG76-22 with an SBS modifier and Morelife 2200 liquid anti-strip at a dosage rate of 0.75%. Eight aggregate suppliers donated their products for the construction of the



Figure 15. Placement of TDOT Test Section S4 Surface Mix, July 2000.

TDOT sponsored test sections. These include Rodgers Group Inc., Vulcan Materials Co., Ford Construction Co., Memphis Stone and Gravel, Fullen Dock, American Limestone, Ingram Sand, and Cumberland Mountain Sand. The aggregate trucking contract was awarded to Needmore Trucking Company of Opelika, AL. Eighty-two truckloads of aggregate were shipped to the Test Track facility from Tennessee. The total cost for transportation was \$82,512.42 and was paid by TDOT.

The TDOT Job Mix Formulas (JMF) selected for Sections S4 and S5 are provided in Appendix E. It should be noted that these original JMF's were slightly modified on-site to obtain suitable volumetric properties in accordance with TDOT specifications.



Figure 16. Compaction of TDOT Test Section S4 Surface Mix, July 2000.

TDOT personnel, who were on site during paving of the TDOT test sections made the final decision for the changes to each mix and also made the final acceptance of the in-place pavement. TDOT personnel were also involved in the acceptance testing during placement of Sections S4 and S5. NCAT did not have the capability of performing chemical extractions on-site for determining AC content. TDOT preferred using the vacuum extraction method for determining the AC content of each mix, and thus provided the necessary equipment and personnel to perform this testing for the mixes placed on the TDOT test sections. The final plant settings for the TDOT sponsored sections, Sections S4 and S5, are summarized in Table 2.

Placement of the two TDOT sponsored sections began on July 5, 2000. Three days were required to complete paving of the binder and surface layers for these two test sections. Both binder mixes were placed on July 5th, with the S4 surface layer placed on July 6th and the S5 surface layer placed on July 7th. As previously noted, mix placement was performed in general accordance with TDOT specifications. The average in-place mat densities for the TDOT test sections are summarized in Table 3.

Table 2. Summary of Final Plant Settings for TDOT Mixes.

Test Section and Mix Type	Material	Source	Percentage of Mix
TDOT Test Section S4, 307S Superpave™ 19mm Binder Mix w/ Predominantly Crushed Limestone Aggregate From Middle Tennessee and 15% RAP	#6's	Gordonsville TN	30%
	#78's	Gordonsville TN	25%
	Manufactured Sand	Danley TN	20%
	Natural Sand	Hillsboro TN	15%
	RAP	Gordonsville TN	15%
	PG76-22 SBS Modified	Ergon	4.30%
TDOT Test Section S4, 411S Superpave™ 12.5mm Surface Mix w/ Predominantly Crushed Limestone Aggregate From Middle Tennessee	5/8 D Rock	Springfield TN	45%
	#10's Soft Screenings	Danley TN	10%
	#10's Hard Screenings	Springfield TN	15%
	Manufactured Sand	Danley TN	15%
	Natural Sand	Ingram TN	15%
	PG76-22 SBS Modified	Ergon	5.30%
TDOT Test Section S5, 307S Superpave™ 19mm Binder Mix w/ Predominantly Gravel Aggregate From West Tennessee and 12% RAP	#57's	Gilbertsville KY	33%
	#7's	Dyersburg TN	26%
	#10's	Gilbertsville KY	14%
	Manufactured Sand	Dyersburg TN	15%
	RAP	Dyersburg TN	12%
	PG76-22 SBS Modified	Ergon	4.60%
TDOT Test Section S5, 411S Superpave™ 12.5mm Surface Mix w/ Predominantly Gravel Aggregate From West Tennessee	5/8 D Rock 100% FF	Memphis TN	60%
	#10's	Fullen Dock	21%
	Natural Sand	Memphis TN	19%
	PG76-22 SBS Modified	Ergon	5.50%

Table 3. Average In-Place Densities for TDOT Test Sections.

Test Section and Mix Type	% G _{mm}
S4 Binder, 19mm Limestone Mix	93.6%
S4 Surface, 12.5mm Limestone Mix	94.3%
S5 Binder 19 mm Gravel Mix	91.1%
S5 Surface 12.5 mm Gravel Mix	94.9%

4.0 Post Construction Operation, Monitoring, and Evaluation

The testing and evaluation phase of the Test Track will include the application of 10 million ESAL's, a full characterization of the mixes placed during construction, and studies to determine a prediction model for pavement performance using laboratory means.

4.1 Truck Traffic Loading

The test sections will be loaded with 10 million ESAL's over approximately a two-year period. The applied traffic will consist of four trucks, each providing approximately 10 ESAL's per pass. The ESAL's for each truck was calculated using the 1993 AASHTO Design Guide. The design speed of the trucks is 45 mph. This design speed was selected to reduce the curve radii and superelevation required on the Test Track, which in turn helped reduce initial construction costs. Figures 17 and 18 exhibit the tractor-trailer combination that is being used at the Test Track. The triple trailers being used on three of the trucks were relocated from the WesTrack facility in Reno, Nevada. The fourth truck was built for use at the Test Track. It should be noted that the fourth truck was constructed using air-ride shocks, the first three used springs.



Figure 17. Tractor-Trailer Combination, NCAT Pavement Test Track, September 2000.

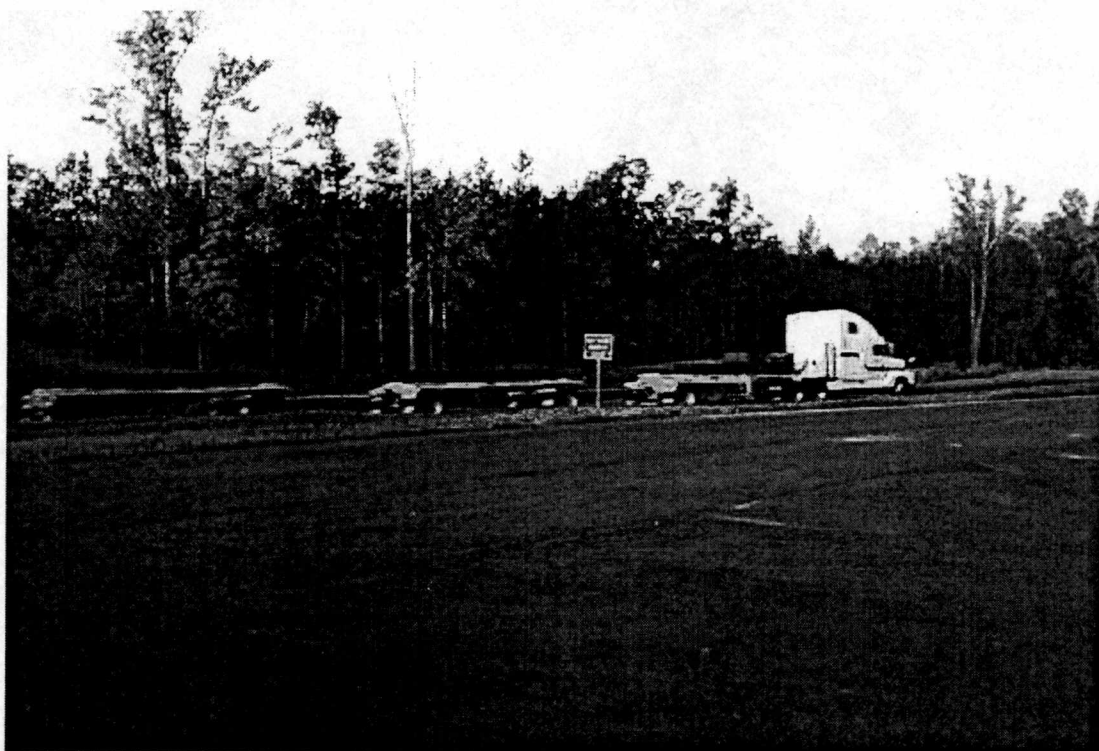


Figure 18. Tractor-Trailers Used at the NCAT Pavement Test Track.

Researchers at the Test Track will monitor many different parameters of the traffic phase. These include fuel consumption, tire wear, engine maintenance, and many other factors affecting efficiency of the trucks. These factors will be compared to the condition of the track to determine if, and to what extent the cost of trucking operations increase as the pavement degrades. Covenant Transport was awarded the contract to supply tractors and drivers for the Test Track. It should be noted that Covenant Transport is using human operated tractors as opposed to the computer-controlled vehicles formerly used at the WesTrack facility in Reno.

4.2 Follow-Up Testing of Aggregate Properties

While traffic is being applied to the Test Track, a full compliment of aggregate testing will be performed at the NCAT laboratory. The purpose of this testing will be to verify the properties of the materials used in the mixes. Chemical analysis will be run on each source of aggregate using the X-Ray Fluorescence (XRF) technique. This testing will allow researchers at NCAT to investigate any potential problems with the aggregate in each mix. The physical testing to be conducted on the aggregates includes:

Coarse Aggregate Physical Testing

- Uncompacted Void Content (AASHTO TP 56-99)
- Unit Weight (AASHTO T 19/T 19M-00)
- Gradation (AASHTO T 11-91 and AASHTO T 27-99)
- Specific Gravity and Absorption (AASHTO T 85-00)
- Fractured Face Count (ASTM D 5821-95)
- Flat and Elongated Particles (ASTM D 4791-99)
- British Polish Number, BPN (AASHTO T 279-96)
- Freeze-Thaw Susceptibility (AASHTO T 103-91)
- Sulfate Soundness (AASHTO T 104-99)
- Los Angeles Degradation (AASHTO T 96-99)
- Mico-Deval (AASHTO TP 58-00)

Fine Aggregate Physical Testing

- Gradation (AASHTO T 11-91 and AASHTO T 27-99)
- Specific Gravity and Absorption (AASHTO T 84-00)
- Fine Aggregate Angularity (AASHTO T 304-96)
- Sulfate Soundness (AASHTO T 104-99)
- Sand Equivalency (AASHTO T 176-00)
- Methylene Blue (AASHTO TP 57-99)

4.3 Instrumentation

Instrumentation was installed in the Test Track to characterize the environmental conditions affecting the performance of the test sections. Pavement instrumentation included moisture sensors, multi-depth HMA temperature sensors, a computerized weather station, and a Vehicle Identification System (VIS). Each test section contains both temperature and moisture sensors at varying depths. Temperature sensors were placed on the surface, between the surface and binder layers (1-1/2 inches below the surface for the TDOT test sections), below the binder layer (4 inches below the surface), and 8 inches below the surface. Moisture sensors were placed below the bituminous-coated aggregate base course. The weather station is located on-site, near the laboratory facility.

The VIS has a sensor located at one location on the Test Track for documentation of the number of ESALs applied to each test section. Each time a truck passes, the VIS will record the date and the time. Each truck has a unique identifiable strobe signal to distinguish it from the other trucks operating at the Test Track. The strobe monitor is located on the North tangent of the track. The location will allow NCAT staff to accurately track when a truck has exited or entered the track. The trucks and trailers were weighed before trafficking began to calculate the exact number of ESALs each truck and trailer combination produces.

All instruments are connected to a centralized computer data acquisition system to accommodate continuous monitoring and correlation with pavement

performance monitoring. The system includes five computers, 26 data loggers and solar panels, and an extensive amount of wiring.

4.4 Pavement Performance Monitoring

Traffic will be applied to the Test Track six days per week. Pavement performance monitoring will be conducted on the non-traffic day of each week. On this day, data will be collected for rutting, cracking, and other surface distresses. Approximately once a month, testing including road profilometer, falling weight deflectometer, and friction resistance are performed. On this monthly cycle, cores are taken from each section. The cores are taken in the wheel path of the outside lane. They are taken outside the 150 feet designated for non-destructive testing, or the last 25-feet of the section. The data from the cores can be used to evaluate densification of mixes as traffic is applied. This monthly cycle is repeated for the first three months, at which time the testing frequency will be performed quarterly. At the completion of the 2-year traffic loading, the test results will be analyzed to establish the relative performance over time of each test section.

Before traffic was initiated on the Test Track, a thorough evaluation of each section was conducted. This evaluation included skid testing, road profilometer testing, density testing and visual observations for any surface irregularities. Random locations were identified in each of the three test increments on the test sections, as depicted in Figure 14. These locations are identified for the purpose of continually monitoring density and transverse profile of each section. All destructive testing will

be performed within the last 25-foot test increment of each test section. The layout of the testing increments is discussed in Section 2.10 of this paper. The overall rutting characteristics of the Test Track will be monitored using a state-of-the-art laser profiler.

A South Dakota Style Road Profiler was bought for use at the Test Track. Roadware produces the laser profiler van under the trade name ARAN©. The van is equipped with a three-point laser system for identifying rutting characteristics. The van is incapable of showing the true rutting characteristics with only three lasers. It measures the ruts according to the change in elevation from the height measured by the center laser to the height measured by the outer two lasers. This technique only shows a displacement of the pavement surface. It does not give a determination of shoving or structural failure. The van is equipped with accelerometers that make it capable of gathering roughness, texture, and ride number data. The ride number can in turn be used to calculate the International Roughness Index (IRI). A picture of the ARAN© van is shown in Figure 19.

After the completion of the 10-million ESALs, a forensic study will be performed. Sections of the pavement will be removed to determine the performance of the different components of each section. Trenches will be cut into the pavement to establish the depth of each rut (Powell 2000). This will allow researchers to analyze how each of the components of the mix performed.



Figure 19. RoadWare ARAN© Road Profiler.

4.5 Performance Modeling

The Test Track includes many different studies. One of the tasks charged to NCAT is the evaluation of different laboratory rutting machines. The objective is to find a laboratory device that best predicts pavement performance and create a performance model. Loaded wheel testers, such as PTI's Asphalt Pavement Analyzer (APA) and a Hamburg style loaded wheel tester from Wessex England, are to be evaluated. Each device will be evaluated using the asphalt pills compacted during construction. Compacted specimens will also be tested for laboratory strength and relative performance characteristics, including the following:

- Moisture Susceptibility (AASHTO T 283-89 (1993))
- Tri-Axial Compression, no standardized test method yet defined
- Fatigue (AASHTO TP 8-94)
- Loaded Wheel Testing, no standardized test method yet defined
- Indirect Tensile Strength (AASHTO TP 9-96)
- Simple Shear Test (AASHTO TP 7-94)
- Frequency Sweep and Repeated Shear, no standardized test method yet defined
- Modulus Testing (AASHTO TP 31-96)
- Gyrotory Testing Machine (AASHTO TP 4-00).

After the traffic has been applied to the track, a comparison of each of the devices performance will be compared to the performance on the road. The results of this study will be presented in the final report by NCAT.

5.0 Innovative Technology

The following paragraphs document some of the newer technology observed and evaluated by the research team during construction of the Test Track. The innovative technology evaluated during construction of the Test Track include a new HMA sampling device, an aggregate belt sampler, release agents, infrared thermal imaging device, and an alternative density measuring device.

5.1 New HMA Sampling Device

PTI's Robotic Truck Sampling Device (RTSD) was evaluated for obtaining truck samples at the asphalt plant. The RTSD is a hydraulically driven, hollow-cylinder sampling device. The device is used to reduce errors in testing caused by improper sampling techniques. The RTSD takes the sample from the center of the dump, the theoretical area of least segregation. The probe is heated in asphalt applications to further prevent segregation (PTI 2000).

A common problem in the HMA industry is segregation during loading, transportation and placement. The HMA is loaded into trucks from a silo that allows the mix to free-fall. During the loading process the HMA is allowed to fall, sometimes greater than 10-feet. Stokes law states that due to gravitational forces, the mass, size and weight of a particle will affect the rate of decent. A stockpile in the back of a haul truck will segregate in a similar manner. The larger particles will tend to fall to the sides of the stockpile, while the finer material will stay toward the top of

a stockpile. This can cause errors in sampling that produces incorrect mix evaluations. Decreasing the distance the particles will fall can reduce the degree of segregation. As the stockpile grows the center of the pile will retain a more even distribution of the particles and reduce segregation. The top and sides of a stockpile will segregate to fine and coarse material, respectively.

The method for obtaining truck samples is defined in AASHTO T 168. This method requires a technician to climb into the bed of the truck. The technician is then to strike off the top of the stockpile before obtaining a sample. The major problem with this method is that it is not always followed. Technicians will commonly stand on the sampling platform to obtain the sample. Too often the sample is taken directly from the top of a stockpile, thus producing errors in the sample gradations. The RTSD is designed to obtain the sample from the center of the dump. In theory, this will reduce the sampling errors.

Based on a verification study conducted during construction of the Test Track, it was found that the RTSD provided greater consistency than traditional shovel sampling techniques (Powell 2000). An evaluation was performed using the RTSD in direct comparison with conventional shovel sampling. Parallel samples were obtained from the same truck. It was observed, using engineering judgement, that the RTSD resulted in less variability than shovel samples. After this comparison was



Figure 20. Pavement Technology, Inc. (PTI) Robotic Truck Sampling Device (RTSD).

performed, the decision was made by NCAT personnel to use the RTSD for all acceptance testing. It should be noted that there is currently no specification that covers the use of the RTSD. Figure 20 exhibits the RTSD in operation at the Test Track. A report using statistical means as to the performance of the RTSD is expected to be distributed by NCAT in the fall of 2001.

5.2 New Aggregate Belt Sampling Device

Astec Industries, Inc. installed a Clean Sweep belt-sampling device on the Astec Industries Inc. asphalt plant at the Test Track. This device was designed to aid in the evaluation of aggregate at crushing operations. John B. Long Co. of Knoxville TN produces the Clean Sweep belt sampler. The Clean Sweep belt sampler is placed

on the conveyor system of the aggregate feed. Prior to the introduction of the aggregate to the dryer-drum and after the scalping screens. Future models are expected to be able to perform an unwashed gradation on the aggregate and make real time data available to the plant operator. The Clean Sweep belt sampler was not used for acceptance testing at the Test Track. To date, there are no specifications that allow for a sweep sampling system. ASTM D 75-97 Standard Practice for Sampling Aggregates calls for the technician to stop the belt, install templates across the width of the belt and obtain the entire sample between the templates.

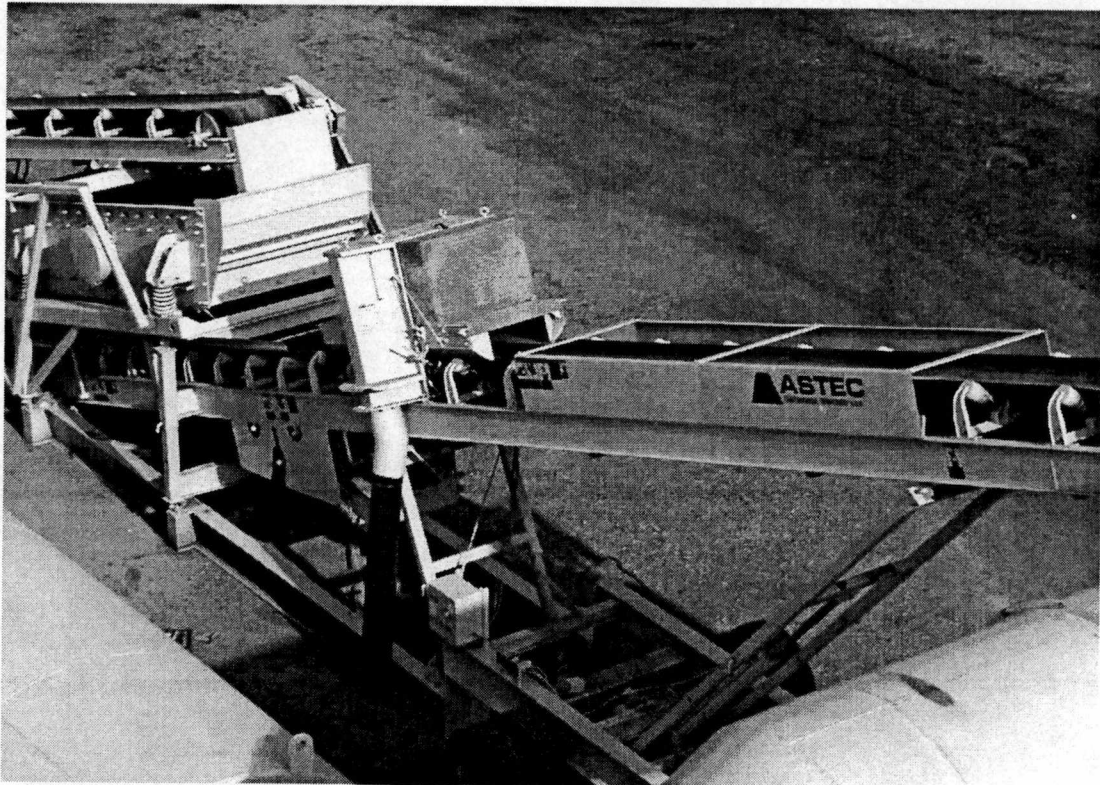


Figure 21. Clean Sweep Belt Sampling Device.

NCAT researchers plan to further evaluate this device. The results will be published at a later date. The initial data obtained from the Test Track suggest a good correlation exists between the Clean Sweep belt sampler and the predicted blended gradation. The Clean Sweep belt-sampling device installed on the Astec, Industries, Inc. asphalt plant at the Test Track is shown in Figure 21.

5.3 Release Agents

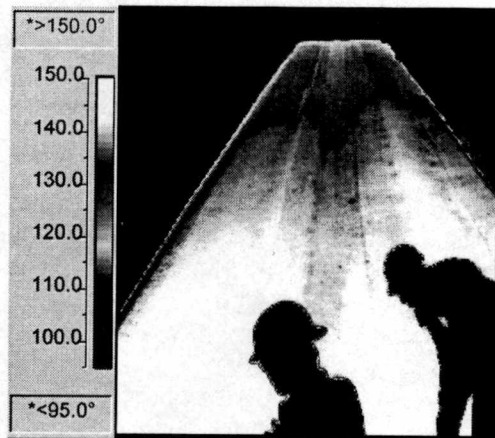
Wacker, Inc. supplied a new release agent for use with the pneumatic tire roller used at the Test Track. The Wacker release agent is a silicone and water mixture. It proved to be very useful during placement of some test sections, including the TDOT Sections S4 and S5. Evidence of the benefits of this product was demonstrated when a roller operator did not use the release agent during the construction of one of the test sections. Due to the absence of the release agent, a considerable amount of "pick up" was observed. The Wacker release agent was applied and the problem was quickly corrected.

In addition to the Wacker, Inc. product, another release agent was used on the haul trucks and equipment at the plant. It is a Synthetics Inc. product by the brand name of SPX-7. No performance testing was conducted at the Test Track to verify that these two products perform as the manufacturer's claim. However, by observation alone, these two products seemed to function extremely well during construction of the test sections.

5.4 Infrared Thermal Imaging

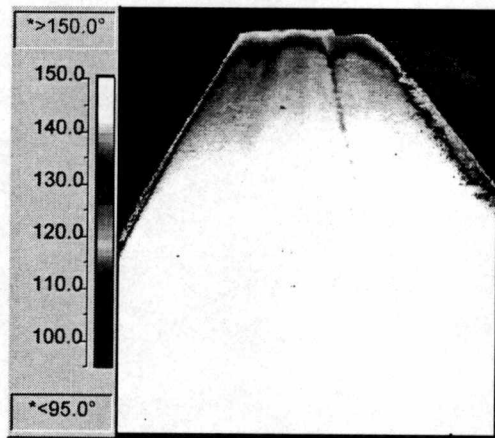
An Inframetrics infrared camera was supplied to the researchers at NCAT. The camera is used to identify temperature differential damage. This phenomenon occurs when the mix cools at different locations during transport. The mix will cool on the sides of the haul truck. The result is that the cooler mix will fall from the truck last. The cooler material is never re-mixed with the hotter material. This will cause a cyclic occurrence in the pavement. The camera is capable of capturing video or still photos. A computer program is then used to identify specific temperatures in the images (Brock, T-134).

The paving operation was monitored continuously during the placement of the TDOT test sections. The on-site presence of an Auburn Graduate Research Assistant during the construction of the test sections also provided an opportunity to monitor the pavement with an Inframetrics thermal imaging camera. This instrument was used to watch for potential problems with temperature segregation during the transport and placement of HMA on the test sections. Figure 22 exhibits example thermal images of Section S4 during placement. Based on the thermal images made during paving, it can be reported that no significant segregation or cold spots were identified within the TDOT test sections during construction. This can be attributed to a great extent to the presence of the material transfer device and short haul distance during paving.



A.) TDOT Test Section S4 Surface Mix

Aggregate: Crushed Limestone
 Gradation: BRZ
 Nominal Max Agg Size: 12.5 mm
 Binder: PG76-22
 Polymer: SBS



B.) TDOT Test Section S4 Binder Mix

Aggregate: Crushed Limestone
 Gradation: BRZ
 Nominal Max Agg Size: 19 mm
 Binder: PG76-22
 Polymer: SBS

**Figure 22. Inframetrics Thermal Images from TDOT Test Section S4,
 (A.) S4 411S Surface Mix and (B.) S4 307S Binder Mix.**

A study by Washington State University researchers concluded that temperature differentials of up to 80°F occurred during a typical paving operation. The result will be colder mix placed at the end of each truck dump. This material is difficult to compact thus resulting in a rougher ride. It was predicted that the service life of a pavement could be cut in half by this temperature differential. Traditional ideas have followed the idea of re-mixing for segregation alone. The past research shows that re-mixing to accommodate temperature segregation is more effective in reducing failures (Brock T-134). Researchers at NCAT are continuing to investigate this device.

5.5 Pavement Quality Indicator

TransTech Inc. supplied NCAT with a PQI gauge and asked for a field evaluation. The TransTech model 300 PQI, electrical impedance density measuring device was used along side a traditional nuclear density gauge to measure the in-place density of all 46 test sections. The PQI was used in the same locations as the nuclear density gauge. This was done to determine the adequacy of the device as compared to the nuclear gauge. The PQI is an electrical impedance-measuring device that will measure density from the electrical interference produced by a given mix. The PQI uses dielectric constant to estimate the density of a given compacted mix. A dielectric material is an electrical insulator (McGraw-Hill 1994). The device measures the changes in electrical capacitance. Each mix matrix will produce a different dielectric constant.

One of the benefits of the PQI is that it requires no special training or licensing. Measurements can be made in a matter of seconds in contrast to the minutes required by the nuclear gauge. The device is marketed as a tool for establishing real time QA/QC of an asphalt-paving job. The PQI weighs approximately ten pounds in contrast to the heavier nuclear gauge. The PQI requires no expensive monitoring program or disposal fees. A draw back of the device is its inability to handle various environmental conditions. It is unable to measure density in the presence of moisture. This makes the device useful only with HMA applications. It cannot be used to measure density of soils, which is a capability of a nuclear gauge. Despite its drawbacks, this could be a very useful tool that may eliminate the need for the potentially hazardous and expensive nuclear density equipment at some future date. The TransTech PQI Density Gauge is shown in Figure 23.

5.5.1 Testing Procedure

The PQI was evaluated for accuracy when compared to the traditional nuclear gauge. The objective was to analyze the gauges and determine if the PQI performs similar to the nuclear gauge under field conditions. In this analysis, a Troxler 3440 Nuclear Density Gauge was used as the state acceptance gauge.

Random locations were selected using standard practices as defined in Section 410 of ALDOT Standard Specifications for Highway Construction. A total of 232

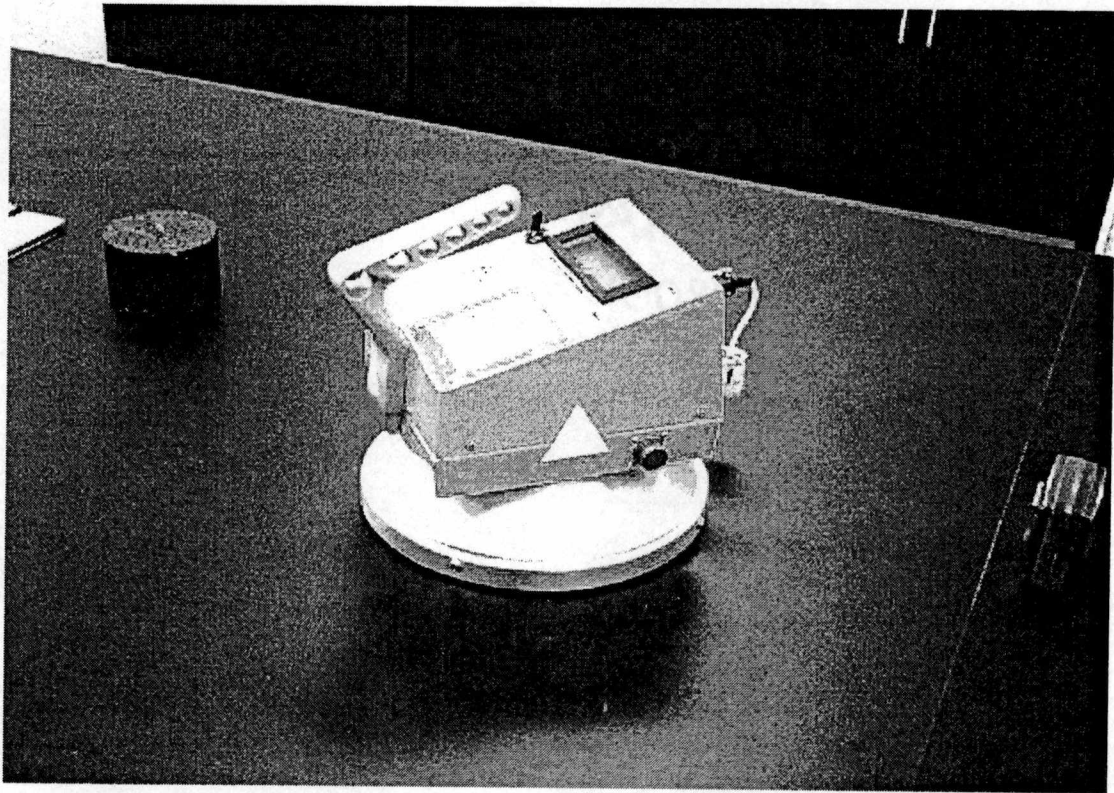


Figure 23. TransTech, PQI Impedance Density Gauge.

locations were selected for these test purposes. The intent of the nuclear gauge was to ensure the adequate quality in the construction of each test section.

Density measurements were taken in accordance with ASTM D 2950-98. All the measured values used in the following analysis were taken on the inside lane, sub lots one and three. A total of six cores were taken from each test section, three in the lower lift and three in the upper lift.

Due to the changes in mix properties, the PQI will have to be calibrated to each mix. The device was calibrated to the mix using the same procedure as the nuclear gauge. After the density measurements were made with the two gauges, the cores were then drilled and removed from the road. The densities of the cores were measured in accordance with AASHTO T 166. The average density of the cores were compared to the average measured value of the gauge and an average offset for each section was calculated. The offset is the difference between average core density and the average gauge measured density for each mix. This average offset is then applied to all the measurements made for that section and is used to determine a corrected gauge measured density.

It should be noted that the Saturated Surface Dry (SSD) method does not give the actual density of the compacted specimen, only an approximation. The measurements were corrected to the cores to ensure the measured densities were compared to the actual density of the in-place mix. An analysis was ran comparing the PQI and nuclear gauges to the cores taken from sub-lots one and three from each test section. While no method is proven absolute, the core bulk specific gravity, measured by the SSD method (AASHTO T 166-00), is multiplied by the weight of water to give a density in pounds per cubic foot and is considered to be the correct value

5.5.2 Initial Observations

Initial field observations suggested that the PQI had a much greater variability to the core density than the nuclear gauge. A statistical analysis was performed using the calculated offset values. The results can be seen in Table 4. The gauge was initially thought to be a very ineffective tool by the technicians collecting the data. The need for larger corrections was of concern. The average offset along with the standard deviation values produced this initial concern. The uncorrected densities for the PQI were further from the actual core densities than the nuclear gauge. The data can be found in Appendix B.

Table 4. Comparison of Offsets for Each Density Gauge

	Nuclear Gauge Offset	PQI Gauge Offset	Absolute Difference Between Offsets
Average	-0.4	7.3	8.5
Standard Deviation	2.2	8.0	5.9
Variance	4.7	63.1	34.5
Max	4.8	19.8	18.2
Min	-4.4	-7.6	0.2
Range	9.2	27.4	18.0

5.5.3 Regression Analysis

The PQI and nuclear gauge were evaluated using a linear regression to obtain a coefficient of determination, R^2 . The R^2 -value is a measure of the predictability of the variance and the nature of the correlation (Merks 1985). This included all aggregate and mix types to conclude the overall performance of the two gauges.

Each gauge was evaluated in three different scenarios. The uncorrected gauge measurements were compared to the core densities. Next the corrected measurements were compared to the core densities. Last was to compare the gauges to each other.

The initial comparison produced R^2 values of 0.02 and 0.77 for the PQI and the nuclear gauge, respectively when comparing the uncorrected measurements to the core densities. The data plots are shown in Figures 24 and 25, respectively. This suggests the nuclear gauge has a good correlation to the actual densities while the PQI has a poor correlation. The corrected gauge measurements were then compared to the core densities. R^2 values for the PQI and nuclear gauge were 0.96 and 0.97, respectively. This shows that when the offset is applied to each of the gauges, each produces results consistent with the actual density. The data plots are shown in Figures 26 and 27, respectively. The next step was to perform an analysis between the two density gauges. The corrected densities produced an R^2 value of 0.97 while the uncorrected densities produced a value of 0.12. The data plots are shown in Figures 28 and 29, respectively. This backs up the previous conclusion. The PQI gauge did perform as expected when the offset was applied. However, it did not give a true measure of density from the raw data. The data for the uncorrected and corrected density measurements can be found in Appendix C and Appendix D, respectively.

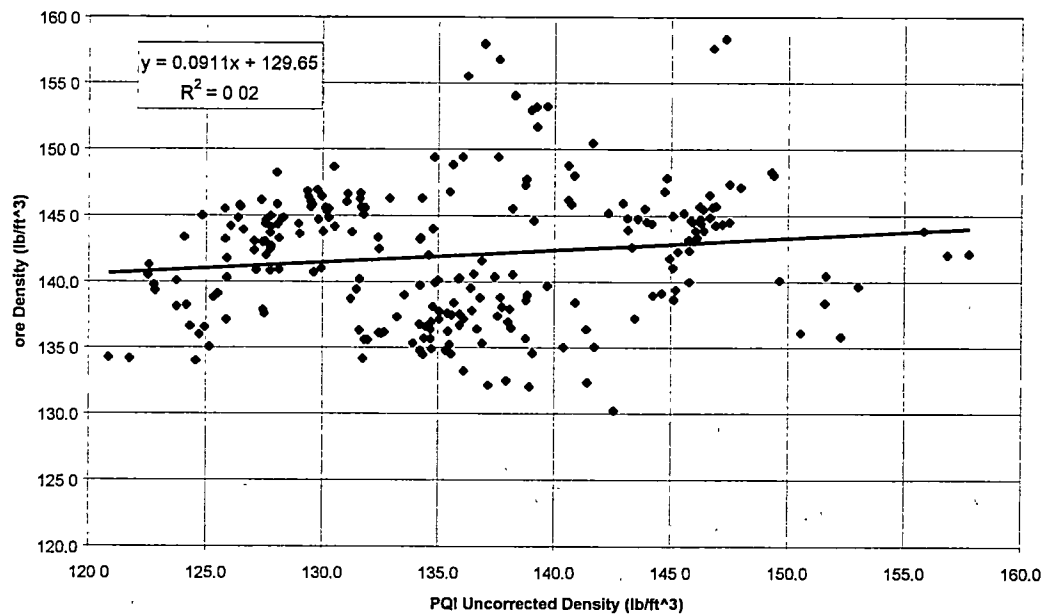


Figure 24. Linear Regression Comparing Uncorrected PQI Density Measurements and Core Densities.

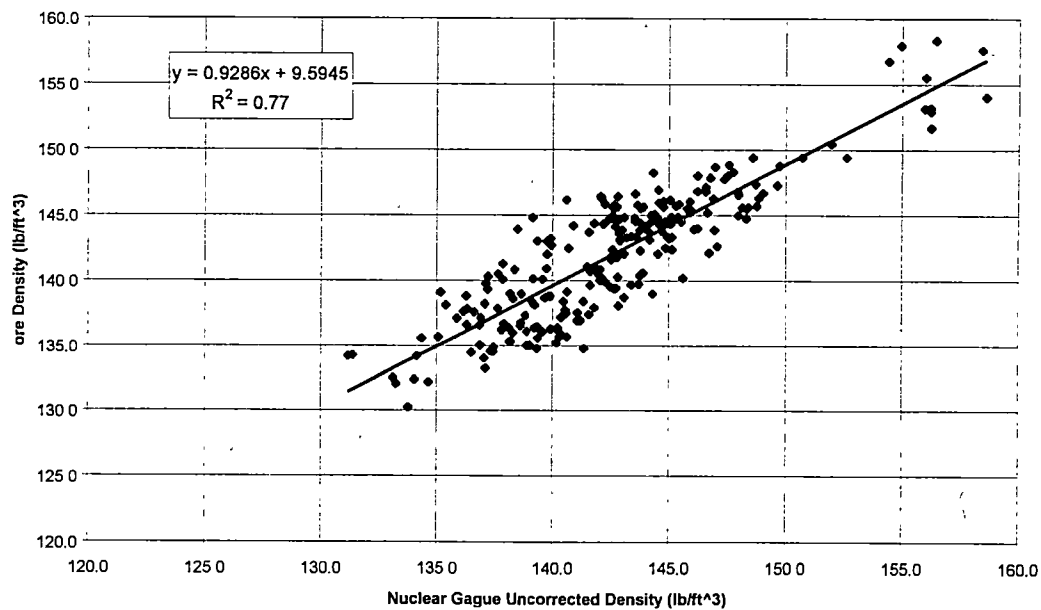


Figure 25. Linear Regression Comparing Uncorrected Nuclear Gauge Density Measurements and Core Densities.

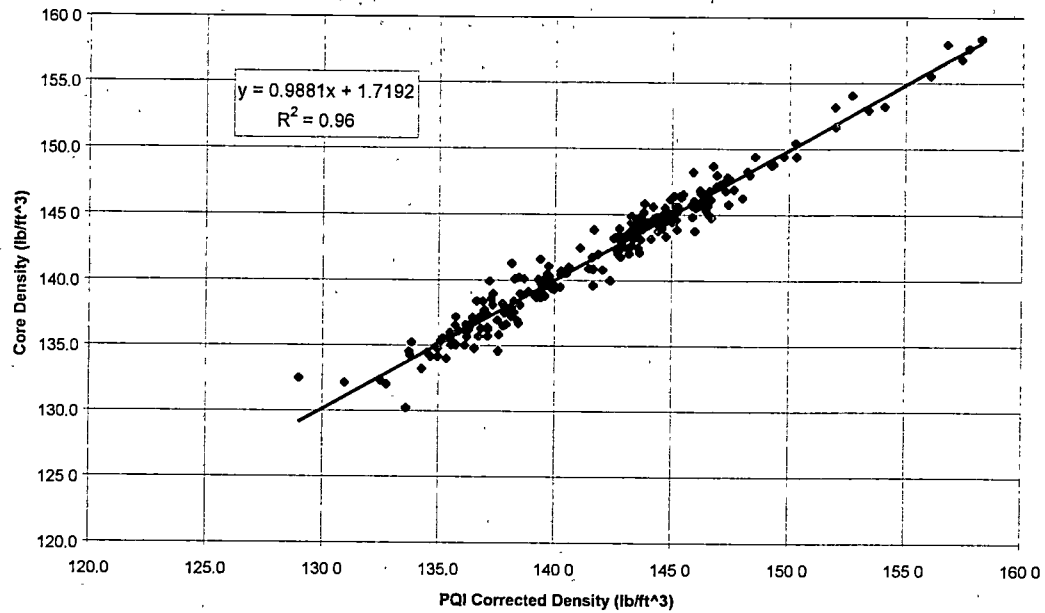


Figure 26. Linear Regression Comparing Corrected PQI Density Measurements and Core Densities.

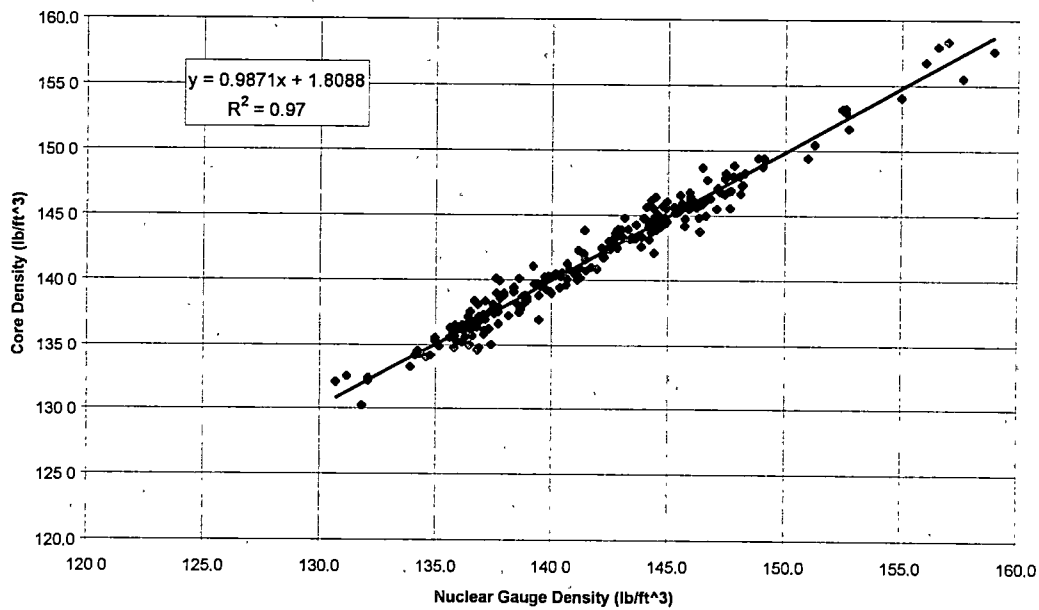


Figure 27. Linear Regression Comparing Corrected Nuclear Gauge Density Measurements and Core Densities.

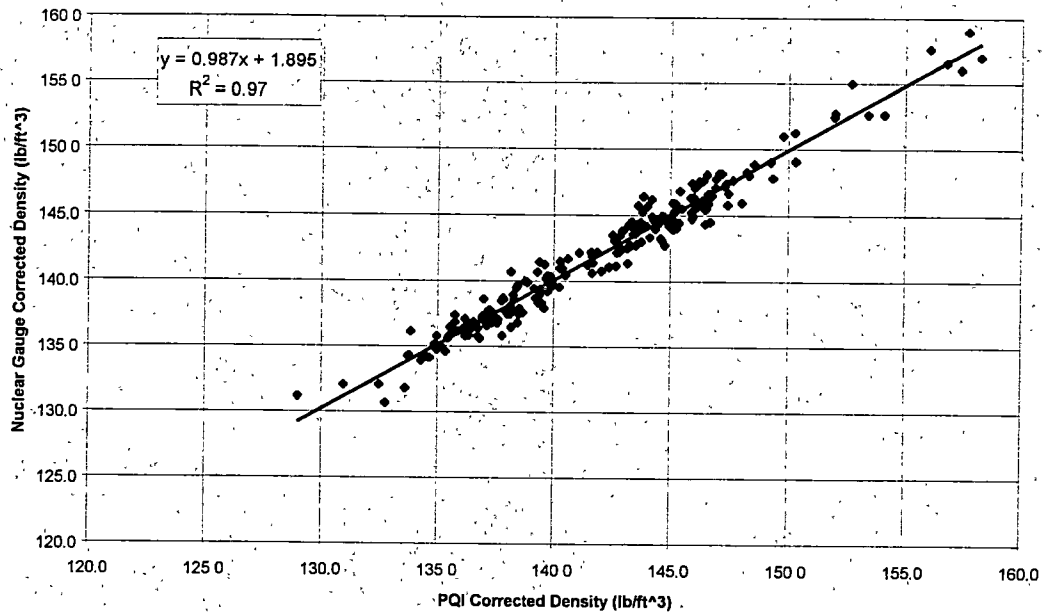


Figure 28. Linear Regression comparing Corrected PQI Density Measurements and Nuclear Gauge Measurements.

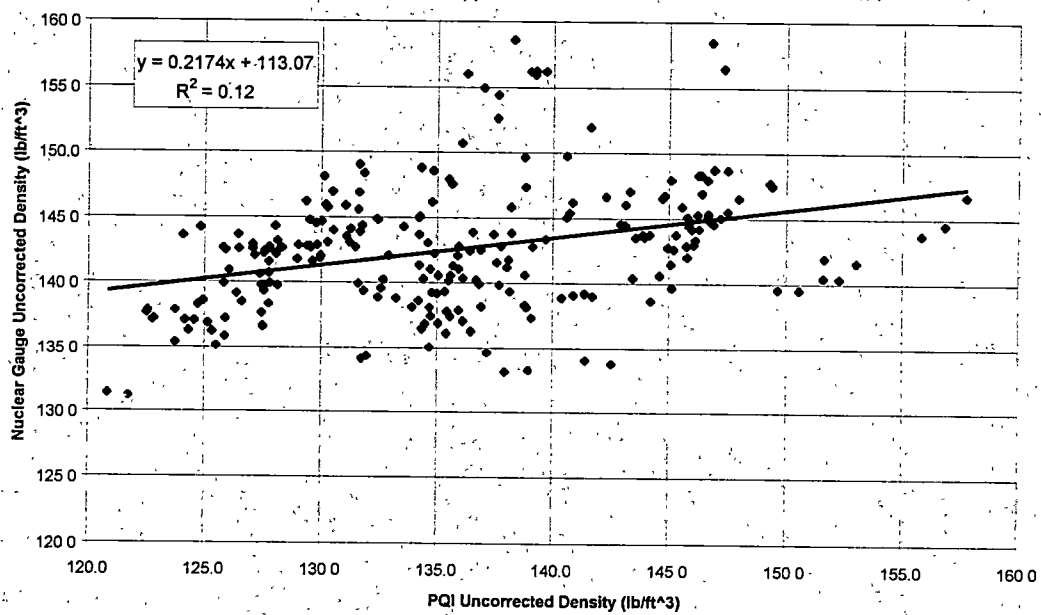


Figure 29. Linear Regression Comparing Uncorrected PQI Density Measurements and Nuclear Gauge Measurements.

5.5.4 Hypothesis Testing

Statistical analysis was performed to compare the mean density measure from the two different devices. A standard hypothesis test was used to confirm or deny that the means of the two sample sets are equal. In the initial analysis, the null hypothesis, H_0 , was defined as the average difference between measurements is zero. The alternate hypothesis, H_1 , defines that the average difference between was not zero. H_0 is accepted if the calculated p-value from MS Excel is larger than the significant level of five percent. Otherwise, H_0 is rejected and H_1 is accepted.

The first part of this analysis was to characterize the uncorrected density measurements. The results of this can be seen in Table 5. The null hypothesis, H_0 , implies the two means of the two data sets are equal. It can be summarized in the equation $H_0: \mu_1 = \mu_2$. This infers that the gauges would read within the same range as the measured density of the cores. The alternative hypothesis, H_1 , is that H_0 is not true. It can be summarized by the equation $H_1: \mu_1 \neq \mu_2$. As can be seen in Table 5, H_1 is the accepted hypothesis. Neither gauge measures the same density, as given by the core measurement within a five-percent significance level. In each case of this analysis the alternative hypothesis was accepted and the means were statistically different between the two populations.

Table 5. Hypothesis Test for Uncorrected Density Measurements.

	Core Density analyzed with PQI Uncorrected Density	Core Density analyzed with Nuclear Gauge Uncorrected Density	Nuclear Gauge Uncorrected Density analyzed with PQI Uncorrected Density
p-value	3.0E-22	3.2E-04	2.8E-31
$H_0 : \mu_1 = \mu_2$	Reject	Reject	Reject
$H_1 : \mu_1 \neq \mu_2$	Accept	Accept	Accept

The same statistical method was used to evaluate the corrected measured values and core densities. The same H_0 and H_1 were defined. In this analysis the null hypothesis was accepted as the p-values from MS Excel all exceeded the five-percent significance level. The results of the analysis indicated that both gauges gave the same mean as the core densities. It can be concluded that the gauges will perform as expected with relation to the core density and to each other. The results can be seen in Table 6.

Table 6. Hypothesis Test for Corrected Density Measurements.

	Core Density analyzed with PQI Corrected Density	Core Density analyzed with Nuclear Gauge Corrected Density	Nuclear Gauge Corrected Density analyzed with PQI Corrected Density
p-value	0.61	0.76	0.41
$H_0 : \mu_1 = \mu_2$	Accept	Accept	Accept
$H_1 : \mu_1 \neq \mu_2$	Reject	Reject	Reject

5.5.5 Absolute Difference between Measurements

The difference between the measured densities of each gauge was evaluated. This was done using the absolute difference between the measured densities. Traditional statistical methods were used to evaluate these data sets. The average, standard deviation, and the variance of the population were used to compare the PQI, nuclear gauge and the cores. The data from the uncorrected measurements suggests the PQI is susceptible to greater variability than the nuclear gauge. The values for this can be seen in Table 7. The corrected values were compared in the same manner. The two gauges produced relatively close comparisons, suggesting the gauges are similar. This data analysis can be seen in Table 8. In each case the standard deviation is almost as much as the average. Each of the two gauges produces high variances. The PQI consistently produced a higher variability than the nuclear gauge.

Table 7. Statistics of Absolute Difference in Uncorrected Measured Data.

	Absolute Difference Between Core and PQI Uncorrected Density (lb/ft³)	Absolute Difference Between Core and Nuclear Gauge Uncorrected Density (lb/ft³)	Absolute Difference Between Nuclear Gauge and PQI Uncorrected Density (lb/ft³)
Average	8.5	2.1	8.4
Standard Deviation	6.4	1.4	5.6
Variance	40.4	1.9	31.0
Maximum	21.0	6.6	20.3
Minimum	0.0	0.0	0.0

Table 8. Statistics of Absolute Difference in Corrected Measured Data.

	Absolute Difference Between Core and PQI Corrected Density (lb/ft³)	Absolute Difference Between Core and Nuclear Gauge Corrected Density (lb/ft³)	Absolute Difference Between Nuclear Gauge and PQI Corrected Density (lb/ft³)
Average	0.75	0.69	0.75
Standard Deviation	0.64	0.58	0.58
Variance	0.41	0.33	0.33
Maximum	3.51	2.58	2.60
Minimum	0.02	0.00	0.00

5.5.6 Conclusions

The nuclear gauge is the accepted practice for estimating density of HMA on road surfaces. The PQI is limited in applications when compared to the nuclear gauge. The PQI offers a safer working environment and is also environmentally friendly. The nuclear gauge requires special state permits and licensing in contrast to the PQI. The PQI can be carried across state lines where the nuclear gauge is only licensed for each specific state.

A study performed by FDOT in December of 1999 was performed in a similar manner. It compared Troxler, CPN and PQI gauges on two test sections. It produced similar results as seen from this study. The nuclear gauges had less variability with respect to the core densities. When all the data was compiled, FDOT recommended the PQI be allowed for use as a QA/QC tool (Sholar 1999).

The analysis shows the PQI measures at a greater difference to the actual density than a traditional nuclear gauge when an offset is not applied. The greater difference from the measured value to the actual value does not effect the ability to apply an offset to obtain a correct value. The Student-t analysis shows that both gauges will perform as expected when the offsets are applied. It is then concluded that the PQI will work as well as a traditional nuclear gauge.

6.0 Conclusions and Summary

A summary of an accelerated pavement Test Track was presented herein. The Test Track was constructed in Auburn Alabama. TDOT contracted with NCAT and UT to conduct full-scale accelerated testing of HMA at the NCAT Pavement Test Track. The 1.7-mile Test Track was constructed with 46 test sections for evaluation with respect to rutting susceptibility. Ten different government agencies participated in this effort. The Test Track was constructed to each agency's specifications. The testing phase will take approximately two years to complete. At which time 10,000,000 ESALs will have been introduced to each test section.

As part of this Phase I study, TDOT funded the on-site presence of a UT Graduate Research Assistant during the construction of the test sections. Other members of the research team, including TDOT representatives also visited the Test Track periodically during construction. The observations of the research team, including the design and construction of the Test Track are summarized in this final document. A preliminary accounting of the properties of the HMA placed within each test section, and some of the newer technology observed and evaluated by the research team during construction of the Test Track are also documented herein.

Construction of the Test Track began in October of 1998. Paving of the TDOT sponsored sections (Sections S4 and S5) was completed on July 7, 2000. The TDOT test sections were paved with mixes that are representative of those placed on the interstate in Tennessee during the 1999 paving season. Section S4 includes two

mixes consisting predominantly of crushed limestone. Section S5 includes two mixes consisting predominantly of west Tennessee River gravel. The mixes were designed in accordance with the TDOT Standard Specifications for Road and Bridge Construction, Special Provision Sections 411S and 307S, for Superpave™ Surface and Binder Mixes. The 307S binder mixes contain RAP, as is common in Tennessee. The lift thicknesses for the mixes placed on the TDOT test sections are 2-1/2 inches of 307S binder mix under 1-1/2 inches of 411S surface mix.

Truck traffic was initiated on the Test Track on September 18, 2000, and will continue for approximately 2 years, or until a total of 10 million ESALs have been applied. Pavement performance will be monitored weekly during this 2-year period.

An extensive laboratory-testing program is currently being performed to verify the properties of the materials and mixes placed on the test sections. This ongoing laboratory-testing program will provide data to be used to correlate the full-scale, accelerated pavement performance results with accelerated laboratory test methods.

As innovative technologies become available, it is sometimes difficult to prove the validity of these devices. The construction of the Test Track provided an optimum proving ground. The constant evaluation of new technology and design practices can only help to advance paving technology in the future. Many innovative testing and sampling techniques were evaluated during the construction of the Test Track. The analysis of most of these devices will be published by NCAT. This paper

provided an initial evaluation of the PQI. This evaluation proved that the PQI can work as well as accepted practices.

Many new mix design methods are being tested by the various state agencies.

The commitment to expand the research to produce a longer more durable asphalt pavement can save future generations tremendous amounts of tax payer dollars. The information obtained from this Test Track can potentially change the way we think of HMA in the future.

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Appendices

Appendix A
Summary of Final Section Properties

Source: Powell (2001)

Section E2

Laboratory Diary

General Description of Mix and Materials

Design Method:	Superpave
Compactive Effort:	100 gyrations
Binder Performance Grade:	67-22
Modifier Type:	NA
Aggregate Type:	Granite
Gradation Type:	BRZ

Avg. Lab Properties of Plant Produced Mix

<u>Sieve Size:</u>	<u>% Passing:</u>
1"	100
3/4"	100
1/2"	96
3/8"	74
No. 4	41
No. 8	29
No. 16	22
No. 30	18
No. 50	12
No. 100	7
No. 200	4.1

Asphalt Binder Content:	4.7%
Compacted Pile Bulk Gravity:	2.434
Theoretical Maximum Gravity:	2.505
Computed Air Voids:	2.8%

Construction Diary

Relevant Conditions for Construction

Completion Date:	Tuesday, April 11, 2000
24 Hour High Temperature (F):	76
24 Hour Low Temperature (F):	50
24 Hour Rainfall (in):	0.00
Lift Type:	dual
Design Thickness of Test Mix (in):	4.0

Plant Configuration and Placement Details

<u>Component:</u>	<u>% Setting:</u>
Liquid Binder Setting	4.8%
Granite 7	48.0%
Granite 89	17.0%
Granite M10	20.0%
Granite W10	15.0%

Approximate Length (ft):	213
Surveyed Thickness of Section (in):	4.2
Std Dev of Section Thickness (in):	0.2
Type of Tack Coat Utilized:	CQS-1h
Target Tack Application Rate:	0.03 gal / sy
Avg Mat Temperature Behind Paver (F):	297
Average Section Compaction:	94.7%

General Notes:

- 1) Mixes are listed chronologically in order of completion date (i.e., construction began with E2 and ended with E1).
- 2) Sections are referenced by quadrant and sequence number, where "E2" refers to section 2 of the east quadrant.
- 3) "dual" lift type indicates that the lower and upper lifts were constructed with the same experimental mix.
- 4) The total thickness of all experimental sections is 4 inches by design, with the exception of S8, S9, S10, S11.
- 5) ARZ, TRZ, and BRZ refer to gradations intended to pass above, through, and below the restricted zone.
- 6) SMA and OGFC refer to stone matrix asphalt and open-graded friction course, respectively.

Section E3

Laboratory Diary

General Description of Mix and Materials

Design Method:	Superpave
Compactive Effort:	100 gyrations
Binder Performance Grade:	76-22
Modifier Type:	SBR
Aggregate Type:	Granite
Gradation Type:	BRZ

Avg. Lab Properties of Plant Produced Mix

<u>Sieve Size:</u>	<u>% Passing:</u>
1"	100
3/4"	100
1/2"	94
3/8"	73
No. 4	41
No. 8	29
No. 16	23
No. 30	18
No. 50	12
No. 100	7
No. 200	4.2

Asphalt Binder Content:	4.8%
Compacted Pill Bulk Gravity:	2.419
Theoretical Maximum Gravity:	2.519
Computed Air Voids:	4.0%

Construction Diary

Relevant Conditions for Construction

Completion Date:	Tuesday, April 11, 2000
24 Hour High Temperature (F):	76
24 Hour Low Temperature (F):	50
24 Hour Rainfall (in):	0.00
Lift Type:	dual
Design Thickness of Test Mix (in):	4.0

Plant Configuration and Placement Details

<u>Component:</u>	<u>% Setting:</u>
Liquid Binder Setting	4.7%
Granite 7	48.0%
Granite 89	19.0%
Granite M10	18.0%
Granite W10	15.0%

Approximate Length (ft):	189
Surveyed Thickness of Section (in):	4.1
Std Dev of Section Thickness (in):	0.3
Type of Tack Coat Utilized:	CQS-1h
Target Tack Application Rate:	0.03 gal / sy
Avg Mat Temperature Behind Paver (F):	325
Average Section Compaction:	93.5%

General Notes:

- 1) Mixes are listed chronologically in order of completion date (i.e., construction began with E2 and ended with E1).
- 2) Sections are referenced by quadrant and sequence number, where "E2" refers to section 2 of the east quadrant.
- 3) "dual" lift type indicates that the lower and upper lifts were constructed with the same experimental mix.
- 4) The total thickness of all experimental sections is 4 inches by design, with the exception of S8, S9, S10, S11.
- 5) ARZ, TRZ, and BRZ refer to gradations intended to pass above, through, and below the restricted zone.
- 6) SMA and OGFC refer to stone matrix asphalt and open-graded friction course, respectively.

Section E4

Laboratory Diary

General Description of Mix and Materials

Design Method: Superpave
 Compactive Effort: 100 gyrations
 Binder Performance Grade: 76-22
 Modifier Type: SBS
 Aggregate Type: Granite
 Gradation Type: BRZ

Avg. Lab Properties of Plant Produced Mix

<u>Sieve Size:</u>	<u>% Passing:</u>
1"	100
3/4"	100
1/2"	95
3/8"	75
No. 4	42
No. 8	29
No. 16	23
No. 30	18
No. 50	13
No. 100	8
No. 200	4.6

Asphalt Binder Content: 4.7%
 Compacted Pile Bulk Gravity: 2.416
 Theoretical Maximum Gravity: 2.512
 Computed Air Voids: 3.8%

Construction Diary

Relevant Conditions for Construction

Completion Date: Wednesday, April 12, 2000
 24 Hour High Temperature (F): 75
 24 Hour Low Temperature (F): 51
 24 Hour Rainfall (in): 0.00
 Lift Type: dual
 Design Thickness of Test Mix (in): 4.0

Plant Configuration and Placement Details

<u>Component:</u>	<u>% Setting:</u>
Liquid Binder Setting	4.7%
Granite 7	48.0%
Granite 89	19.0%
Granite M10	18.0%
Granite W10	15.0%

Approximate Length (ft): 204
 Surveyed Thickness of Section (in): 4.1
 Std Dev of Section Thickness (in): 0.1
 Type of Tack Coat Utilized: CQS-1h
 Target Tack Application Rate: 0.03 gal / sy
 Avg Mat Temperature Behind Paver (F): 321
 Average Section Compaction: 93.8%

General Notes:

- 1) Mixes are listed chronologically in order of completion date (i.e., construction began with E2 and ended with E1).
- 2) Sections are referenced by quadrant and sequence number, where "E2" refers to section 2 of the east quadrant.
- 3) "dual" lift type indicates that the lower and upper lifts were constructed with the same experimental mix.
- 4) The total thickness of all experimental sections is 4 inches by design, with the exception of S8, S9, S10, S11.
- 5) ARZ, TRZ, and BRZ refer to gradations intended to pass above, through, and below the restricted zone.
- 6) SMA and OGFC refer to stone matrix asphalt and open-graded friction course, respectively.

Section E5

Laboratory Diary

General Description of Mix and Materials

Design Method:	Superpave
Compactive Effort:	100 gyrations
Binder Performance Grade:	76-22
Modifier Type:	SBS
Aggregate Type:	Granite
Gradation Type:	TRZ

Avg. Lab Properties of Plant Produced Mix

<u>Sieve Size:</u>	<u>% Passing:</u>
1"	100
3/4"	100
1/2"	98
3/8"	83
No. 4	54
No. 8	40
No. 16	30
No. 30	24
No. 50	16
No. 100	9
No. 200	5.1

Asphalt Binder Content:	5.1%
Compacted Pill Bulk Gravity:	2.407
Theoretical Maximum Gravity:	2.500
Computed Air Voids:	3.7%

Construction Diary

Relevant Conditions for Construction

Completion Date:	Thursday, April 13, 2000
24 Hour High Temperature (F):	75
24 Hour Low Temperature (F):	51
24 Hour Rainfall (in):	0.00
Lift Type:	dual
Design Thickness of Test Mix (in):	4.0

Plant Configuration and Placement Details

<u>Component:</u>	<u>% Setting:</u>
Liquid Binder Setting	5.0%
Granite 7	33.0%
Granite 89	23.0%
Granite M10	24.0%
Granite W10	20.0%

Approximate Length (ft):	201
Surveyed Thickness of Section (in):	4.2
Std Dev of Section Thickness (in):	0.2
Type of Tack Coat Utilized:	CQS-1h
Target Tack Application Rate:	0.03 gal / sy
Avg Mat Temperature Behind Paver (F):	317
Average Section Compaction:	92.7%

General Notes:

- 1) Mixes are listed chronologically in order of completion date (i.e., construction began with E2 and ended with E1).
- 2) Sections are referenced by quadrant and sequence number, where "E2" refers to section 2 of the east quadrant.
- 3) "dual" lift type indicates that the lower and upper lifts were constructed with the same experimental mix.
- 4) The total thickness of all experimental sections is 4 inches by design, with the exception of S8, S9, S10, S11.
- 5) ARZ, TRZ, and BRZ refer to gradations intended to pass above, through, and below the restricted zone.
- 6) SMA and OGFC refer to stone matrix asphalt and open-graded friction course, respectively.

Section E6

Laboratory Diary

General Description of Mix and Materials

Design Method: Superpave
 Compactive Effort: 100 gyrations
 Binder Performance Grade: 67-22
 Modifier Type: NA
 Aggregate Type: Granite
 Gradation Type: TRZ

Avg. Lab Properties of Plant Produced Mix

<u>Sieve Size:</u>	<u>% Passing:</u>
1"	100
3/4"	100
1/2"	96
3/8"	81
No. 4	52
No. 8	37
No. 16	28
No. 30	22
No. 50	15
No. 100	8
No. 200	4.3

Asphalt Binder Content: 5.0%
 Compacted Pile Bulk Gravity: 2.411
 Theoretical Maximum Gravity: 2.510
 Computed Air Voids: 3.9%

Construction Diary

Relevant Conditions for Construction

Completion Date: Thursday, April 13, 2000
 24 Hour High Temperature (F): 75
 24 Hour Low Temperature (F): 51
 24 Hour Rainfall (in): 0.00
 Lift Type: dual
 Design Thickness of Test Mix (in): 4.0

Plant Configuration and Placement Details

<u>Component:</u>	<u>% Setting:</u>
Liquid Binder Setting	5.0%
Granite 7	33.0%
Granite 89	23.0%
Granite M10	24.0%
Granite W10	20.0%

Approximate Length (ft): 211
 Surveyed Thickness of Section (in): 4.2
 Std Dev of Section Thickness (in): 0.1
 Type of Tack Coat Utilized: CQS-1h
 Target Tack Application Rate: 0.03 gal / sy
 Avg Mat Temperature Behind Paver (F): 299
 Average Section Compaction: 92.9%

General Notes:

- 1) Mixes are listed chronologically in order of completion date (i.e., construction began with E2 and ended with E1).
- 2) Sections are referenced by quadrant and sequence number, where "E2" refers to section 2 of the east quadrant.
- 3) "dual" lift type indicates that the lower and upper lifts were constructed with the same experimental mix.
- 4) The total thickness of all experimental sections is 4 inches by design, with the exception of S8, S9, S10, S11.
- 5) ARZ, TRZ, and BRZ refer to gradations intended to pass above, through, and below the restricted zone.
- 6) SMA and OGFC refer to stone matrix asphalt and open-graded friction course, respectively.

Section E7

Laboratory Diary

General Description of Mix and Materials

Design Method:	Superpave
Compactive Effort:	100 gyrations
Binder Performance Grade:	76-22
Modifier Type:	SBR
Aggregate Type:	Granite
Gradation Type:	TRZ

Avg. Lab Properties of Plant Produced Mix

<u>Sieve Size:</u>	<u>% Passing:</u>
1"	100
3/4"	100
1/2"	97
3/8"	83
No. 4	53
No. 8	38
No. 16	29
No. 30	22
No. 50	16
No. 100	9
No. 200	5.2

Asphalt Binder Content:	4.8%
Compacted Pili Bulk Gravity:	2.413
Theoretical Maximum Gravity:	2.504
Computed Air Voids:	3.6%

Construction Diary

Relevant Conditions for Construction

Completion Date:	Monday, April 17, 2000
24 Hour High Temperature (F):	75
24 Hour Low Temperature (F):	51
24 Hour Rainfall (in):	0.00
Lift Type:	dual
Design Thickness of Test Mix (in):	4.0

Plant Configuration and Placement Details

<u>Component:</u>	<u>% Setting:</u>
Liquid Binder Setting	5.0%
Granite 7	33.0%
Granite 89	23.0%
Granite M10	24.0%
Granite W10	20.0%

Approximate Length (ft):	193
Surveyed Thickness of Section (in):	4.2
Std Dev of Section Thickness (in):	0.2
Type of Tack Coat Utilized:	CQS-1h
Target Tack Application Rate:	0.03 gal / sy
Avg Mat Temperature Behind Paver (F):	320
Average Section Compaction:	93.2%

General Notes:

- 1) Mixes are listed chronologically in order of completion date (i.e., construction began with E2 and ended with E1).
- 2) Sections are referenced by quadrant and sequence number, where "E2" refers to section 2 of the east quadrant.
- 3) "dual" lift type indicates that the lower and upper lifts were constructed with the same experimental mix.
- 4) The total thickness of all experimental sections is 4 inches by design, with the exception of S8, S9, S10, S11.
- 5) ARZ, TRZ, and BRZ refer to gradations intended to pass above, through, and below the restricted zone.
- 6) SMA and OGFC refer to stone matrix asphalt and open-graded friction course, respectively.

Section E8

Laboratory Diary

General Description of Mix and Materials

Design Method: Superpave
 Compactive Effort: 100 gyrations
 Binder Performance Grade: 67-22
 Modifier Type: NA
 Aggregate Type: Granite
 Gradation Type: ARZ

Avg. Lab Properties of Plant Produced Mix

<u>Sieve Size:</u>	<u>% Passing:</u>
1"	100
3/4"	100
1/2"	98
3/8"	86
No. 4	66
No. 8	51
No. 16	38
No. 30	28
No. 50	18
No. 100	10
No. 200	5.2
Asphalt Binder Content:	5.6%
Compacted Pile Bulk Gravity:	2.372
Theoretical Maximum Gravity:	2.477
Computed Air Voids:	4.2%

Construction Diary

Relevant Conditions for Construction

Completion Date: Tuesday, April 18, 2000
 24 Hour High Temperature (F): 85
 24 Hour Low Temperature (F): 50
 24 Hour Rainfall (in): 0.00
 Lift Type: dual
 Design Thickness of Test Mix (in): 4.0

Plant Configuration and Placement Details

<u>Component:</u>	<u>% Setting:</u>
Liquid Binder Setting	5.7%
Granite 7	30.0%
Granite 89	10.0%
Granite M10	24.0%
Granite W10	36.0%

Approximate Length (ft): 208
 Surveyed Thickness of Section (in): 4.2
 Std Dev of Section Thickness (in): 0.1
 Type of Tack Coat Utilized: CQS-1h
 Target Tack Application Rate: 0.03 gal / sy
 Avg Mat Temperature Behind Paver (F): 290
 Average Section Compaction: 92.7%

General Notes:

- 1) Mixes are listed chronologically in order of completion date (i.e., construction began with E2 and ended with E1).
- 2) Sections are referenced by quadrant and sequence number, where "E2" refers to section 2 of the east quadrant.
- 3) "dual" lift type indicates that the lower and upper lifts were constructed with the same experimental mix.
- 4) The total thickness of all experimental sections is 4 inches by design, with the exception of S8, S9, S10, S11.
- 5) ARZ, TRZ, and BRZ refer to gradations intended to pass above, through, and below the restricted zone.
- 6) SMA and OGFC refer to stone matrix asphalt and open-graded friction course, respectively.

Section E9

Laboratory Diary

General Description of Mix and Materials

Design Method: Superpave
 Compactive Effort: 100 gyrations
 Binder Performance Grade: 76-22
 Modifier Type: SBS
 Aggregate Type: Granite
 Gradation Type: ARZ

Avg. Lab Properties of Plant Produced Mix

<u>Sieve Size:</u>	<u>% Passing:</u>
1"	100
3/4"	100
1/2"	97
3/8"	85
No. 4	64
No. 8	49
No. 16	36
No. 30	27
No. 50	18
No. 100	10
No. 200	5.2

Asphalt Binder Content:	5.4%
Compacted Pile Bulk Gravity:	2.371
Theoretical Maximum Gravity:	2.480
Computed Air Voids:	4.4%

Construction Diary

Relevant Conditions for Construction

Completion Date: Tuesday, April 18, 2000
 24 Hour High Temperature (F): 85
 24 Hour Low Temperature (F): 50
 24 Hour Rainfall (in): 0.00
 Lift Type: dual
 Design Thickness of Test Mix (in): 4.0

Plant Configuration and Placement Details

<u>Component:</u>	<u>% Setting:</u>
Liquid Binder Setting	5.7%
Granite 7	30.0%
Granite 89	10.0%
Granite M10	24.0%
Granite W10	36.0%

Approximate Length (ft): 198
 Surveyed Thickness of Section (in): 4.1
 Std Dev of Section Thickness (in): 0.1
 Type of Tack Coat Utilized: CQS-1h
 Target Tack Application Rate: 0.03 gal / sy
 Avg Mat Temperature Behind Paver (F): 315
 Average Section Compaction: 92.9%

General Notes:

- 1) Mixes are listed chronologically in order of completion date (i.e., construction began with E2 and ended with E1).
- 2) Sections are referenced by quadrant and sequence number, where "E2" refers to section 2 of the east quadrant.
- 3) "dual" lift type indicates that the lower and upper lifts were constructed with the same experimental mix.
- 4) The total thickness of all experimental sections is 4 inches by design, with the exception of S8, S9, S10, S11.
- 5) ARZ, TRZ, and BRZ refer to gradations intended to pass above, through, and below the restricted zone.
- 6) SMA and OGFC refer to stone matrix asphalt and open-graded friction course, respectively.

Section E10

Laboratory Diary

General Description of Mix and Materials

Design Method:	Superpave
Compactive Effort:	100 gyrations
Binder Performance Grade:	76-22
Modifier Type:	SBR
Aggregate Type:	Granite
Gradation Type:	ARZ

Avg. Lab Properties of Plant Produced Mix

<u>Sieve Size:</u>	<u>% Passing:</u>
1"	100
3/4"	100
1/2"	97
3/8"	87
No. 4	67
No. 8	51
No. 16	38
No. 30	29
No. 50	19
No. 100	10
No. 200	5.6
Asphalt Binder Content:	5.8%
Compacted Pill Bulk Gravity:	2.380
Theoretical Maximum Gravity:	2.467
Computed Air Voids:	3.5%

Construction Diary

Relevant Conditions for Construction

Completion Date:	Thursday, April 20, 2000
24 Hour High Temperature (F):	85
24 Hour Low Temperature (F):	54
24 Hour Rainfall (in):	0.00
Lift Type:	dual
Design Thickness of Test Mix (in):	4.0

Plant Configuration and Placement Details

<u>Component:</u>	<u>% Setting:</u>
Liquid Binder Setting	5.7%
Granite 7	30.0%
Granite 89	10.0%
Granite M10	24.0%
Granite W10	36.0%

Approximate Length (ft):	99
Surveyed Thickness of Section (in):	4.4
Std Dev of Section Thickness (in):	0.3
Type of Tack Coat Utilized:	CQS-1h
Target Tack Application Rate:	0.03 gal / sy
Avg Mat Temperature Behind Paver (F):	326
Average Section Compaction:	93.0%

General Notes:

- 1) Mixes are listed chronologically in order of completion date (i.e., construction began with E2 and ended with E1).
- 2) Sections are referenced by quadrant and sequence number, where "E2" refers to section 2 of the east quadrant.
- 3) "dual" lift type indicates that the lower and upper lifts were constructed with the same experimental mix.
- 4) The total thickness of all experimental sections is 4 inches by design, with the exception of S8, S9, S10, S11.
- 5) ARZ, TRZ, and BRZ refer to gradations intended to pass above, through, and below the restricted zone.
- 6) SMA and OGFC refer to stone matrix asphalt and open-graded friction course, respectively.

Section N1

Laboratory Diary

General Description of Mix and Materials

Design Method:	Superpave
Compactive Effort:	100 gyrations
Binder Performance Grade:	76-22
Modifier Type:	SBS
Aggregate Type:	Lms/Slag
Gradation Type:	ARZ

Avg. Lab Properties of Plant Produced Mix

<u>Sieve Size:</u>	<u>% Passing:</u>
1"	100
3/4"	100
1/2"	100
3/8"	92
No. 4	69
No. 8	52
No. 16	33
No. 30	22
No. 50	15
No. 100	10
No. 200	6.7

Asphalt Binder Content:	7.4%
Compacted Pill Bulk Gravity:	2.306
Theoretical Maximum Gravity:	2.365
Computed Air Voids:	2.5%

Construction Diary

Relevant Conditions for Construction

Completion Date:	Tuesday, April 25, 2000
24 Hour High Temperature (F):	75
24 Hour Low Temperature (F):	55
24 Hour Rainfall (in):	0.00
Lift Type:	dual
Design Thickness of Test Mix (in):	4.0

Plant Configuration and Placement Details

<u>Component:</u>	<u>% Setting:</u>
Liquid Binder Setting	7.2%
Slag 78	32.0%
Slag 8910	28.0%
Limestone Manufactured Sand	40.0%

Approximate Length (ft):	201
Surveyed Thickness of Section (in):	3.9
Std Dev of Section Thickness (in):	0.3
Type of Tack Coat Utilized:	CQS-1h
Target Tack Application Rate:	0.03 gal / sy
Avg Mat Temperature Behind Paver (F):	306
Average Section Compaction:	95.1%

General Notes:

- 1) Mixes are listed chronologically in order of completion date (i.e., construction began with E2 and ended with E1).
- 2) Sections are referenced by quadrant and sequence number, where "E2" refers to section 2 of the east quadrant.
- 3) "dual" lift type indicates that the lower and upper lifts were constructed with the same experimental mix.
- 4) The total thickness of all experimental sections is 4 inches by design, with the exception of S8, S9, S10, S11.
- 5) ARZ, TRZ, and BRZ refer to gradations intended to pass above, through, and below the restricted zone.
- 6) SMA and OGFC refer to stone matrix asphalt and open-graded friction course, respectively.

Section N2

Laboratory Diary

General Description of Mix and Materials

Design Method:	Superpave
Compactive Effort:	100 gyrations
Binder Performance Grade:	76-22
Modifier Type:	SBS
Aggregate Type:	Lms/Slag
Gradation Type:	ARZ

Avg. Lab Properties of Plant Produced Mix

<u>Sieve Size:</u>	<u>% Passing:</u>
1"	100
3/4"	100
1/2"	99
3/8"	90
No. 4	66
No. 8	50
No. 16	33
No. 30	22
No. 50	16
No. 100	11
No. 200	7.6

Asphalt Binder Content:	7.8%
Compacted Pill Bulk Gravity:	2.300
Theoretical Maximum Gravity:	2.352
Computed Air Voids:	2.2%

Construction Diary

Relevant Conditions for Construction

Completion Date:	Tuesday, April 25, 2000
24 Hour High Temperature (F):	75
24 Hour Low Temperature (F):	55
24 Hour Rainfall (in):	0.00
Lift Type:	dual
Design Thickness of Test Mix (in):	4.0

Plant Configuration and Placement Details

<u>Component:</u>	<u>% Setting:</u>
Liquid Binder Setting	7.7%
Slag 78	32.0%
Slag 8910	28.0%
Limestone Manufactured Sand	40.0%

Approximate Length (ft):	200
Surveyed Thickness of Section (in):	4.3
Std Dev of Section Thickness (in):	0.3
Type of Tack Coat Utilized:	CQS-1h
Target Tack Application Rate:	0.03 gal / sy
Avg Mat Temperature Behind Paver (F):	316
Average Section Compaction:	94.7%

General Notes:

- 1) Mixes are listed chronologically in order of completion date (i.e., construction began with E2 and ended with E1).
- 2) Sections are referenced by quadrant and sequence number, where "E2" refers to section 2 of the east quadrant.
- 3) "dual" lift type indicates that the lower and upper lifts were constructed with the same experimental mix.
- 4) The total thickness of all experimental sections is 4 inches by design, with the exception of S8, S9, S10, S11.
- 5) ARZ, TRZ, and BRZ refer to gradations intended to pass above, through, and below the restricted zone.
- 6) SMA and OGFC refer to stone matrix asphalt and open-graded friction course, respectively.

Section N3

Laboratory Diary

General Description of Mix and Materials

Design Method:	Superpave
Compactive Effort:	100 gyrations
Binder Performance Grade:	67-22
Modifier Type:	NA
Aggregate Type:	Lms/Slag
Gradation Type:	ARZ

Avg. Lab Properties of Plant Produced Mix

<u>Sieve Size:</u>	<u>% Passing:</u>
1"	100
3/4"	100
1/2"	99
3/8"	91
No. 4	68
No. 8	51
No. 16	33
No. 30	22
No. 50	15
No. 100	10
No. 200	6.5

Asphalt Binder Content:	7.6%
Compacted Pill Bulk Gravity:	2.294
Theoretical Maximum Gravity:	2.369
Computed Air Voids:	3.2%

Construction Diary

Relevant Conditions for Construction

Completion Date:	Wednesday, April 26, 2000
24 Hour High Temperature (F):	85
24 Hour Low Temperature (F):	55
24 Hour Rainfall (in):	0.00
Lift Type:	dual
Design Thickness of Test Mix (in):	4.0

Plant Configuration and Placement Details

<u>Component:</u>	<u>% Setting:</u>
Liquid Binder Setting	7.5%
Slag 78	32.0%
Slag 8910	28.0%
Limestone Manufactured Sand	40.0%

Approximate Length (ft):	200
Surveyed Thickness of Section (in):	4.2
Std Dev of Section Thickness (in):	0.1
Type of Tack Coat Utilized:	CQS-1h
Target Tack Application Rate:	0.03 gal / sy
Avg Mat Temperature Behind Paver (F):	295
Average Section Compaction:	94.1%

General Notes:

- 1) Mixes are listed chronologically in order of completion date (i.e., construction began with E2 and ended with E1).
- 2) Sections are referenced by quadrant and sequence number, where "E2" refers to section 2 of the east quadrant.
- 3) "dual" lift type indicates that the lower and upper lifts were constructed with the same experimental mix.
- 4) The total thickness of all experimental sections is 4 inches by design, with the exception of S8, S9, S10, S11.
- 5) ARZ, TRZ, and BRZ refer to gradations intended to pass above, through, and below the restricted zone.
- 6) SMA and OGFC refer to stone matrix asphalt and open-graded friction course, respectively.

Section N4

Laboratory Diary

General Description of Mix and Materials

Design Method:	Superpave
Compactive Effort:	100 gyrations
Binder Performance Grade:	67-22
Modifier Type:	NA
Aggregate Type:	Lms/Slag
Gradation Type:	ARZ

Avg. Lab Properties of Plant Produced Mix

<u>Sieve Size:</u>	<u>% Passing:</u>
1"	100
3/4"	100
1/2"	99
3/8"	91
No. 4	68
No. 8	52
No. 16	35
No. 30	23
No. 50	15
No. 100	9
No. 200	6.0

Asphalt Binder Content:	6.8%
Compacted Pill Bulk Gravity:	2.296
Theoretical Maximum Gravity:	2.400
Computed Air Voids:	4.3%

Construction Diary

Relevant Conditions for Construction

Completion Date:	Thursday, May 18, 2000
24 Hour High Temperature (F):	85
24 Hour Low Temperature (F):	55
24 Hour Rainfall (in):	0.00
Lift Type:	dual
Design Thickness of Test Mix (in):	4.0

Plant Configuration and Placement Details

<u>Component:</u>	<u>% Setting:</u>
Liquid Binder Setting	7.1%
Slag 78	32.0%
Slag 8910	28.0%
Limestone Manufactured Sand	40.0%

Approximate Length (ft):	199
Surveyed Thickness of Section (in):	4.2
Std Dev of Section Thickness (in):	0.1
Type of Tack Coat Utilized:	CQS-1h
Target Tack Application Rate:	0.03 gal / sy
Avg Mat Temperature Behind Paver (F):	288
Average Section Compaction:	93.4%

General Notes:

- 1) Mixes are listed chronologically in order of completion date (i.e., construction began with E2 and ended with E1).
- 2) Sections are referenced by quadrant and sequence number, where "E2" refers to section 2 of the east quadrant.
- 3) "dual" lift type indicates that the lower and upper lifts were constructed with the same experimental mix.
- 4) The total thickness of all experimental sections is 4 inches by design, with the exception of S8, S9, S10, S11.
- 5) ARZ, TRZ, and BRZ refer to gradations intended to pass above, through, and below the restricted zone.
- 6) SMA and OGFC refer to stone matrix asphalt and open-graded friction course, respectively.

Section N5

Laboratory Diary

General Description of Mix and Materials

Design Method:	Superpave
Compactive Effort:	100 gyrations
Binder Performance Grade:	67-22
Modifier Type:	NA
Aggregate Type:	Lms/Slag
Gradation Type:	BRZ

Avg. Lab Properties of Plant Produced Mix

<u>Sieve Size:</u>	<u>% Passing:</u>
1"	100
3/4"	100
1/2"	99
3/8"	84
No. 4	52
No. 8	38
No. 16	26
No. 30	18
No. 50	14
No. 100	11
No. 200	8.3

Asphalt Binder Content:	6.9%
Compacted Pill Bulk Gravity:	2.285
Theoretical Maximum Gravity:	2.355
Computed Air Voids:	3.0%

Construction Diary

Relevant Conditions for Construction

Completion Date:	Thursday, May 18, 2000
24 Hour High Temperature (F):	89
24 Hour Low Temperature (F):	68
24 Hour Rainfall (in):	0.00
Lift Type:	dual
Design Thickness of Test Mix (in):	4.0

Plant Configuration and Placement Details

<u>Component:</u>	<u>% Setting:</u>
Liquid Binder Setting	6.9%
Slag 78	53.0%
Slag 8910	17.0%
Limestone Modified 8910	30.0%

Approximate Length (ft):	201
Surveyed Thickness of Section (in):	4.4
Std Dev of Section Thickness (in):	0.3
Type of Tack Coat Utilized:	CQS-1h
Target Tack Application Rate:	0.03 gal / sy
Avg Mat Temperature Behind Paver (F):	282
Average Section Compaction:	93.8%

General Notes:

- 1) Mixes are listed chronologically in order of completion date (i.e., construction began with E2 and ended with E1).
- 2) Sections are referenced by quadrant and sequence number, where "E2" refers to section 2 of the east quadrant.
- 3) "dual" lift type indicates that the lower and upper lifts were constructed with the same experimental mix.
- 4) The total thickness of all experimental sections is 4 inches by design, with the exception of S8, S9, S10, S11.
- 5) ARZ, TRZ, and BRZ refer to gradations intended to pass above, through, and below the restricted zone.
- 6) SMA and OGFC refer to stone matrix asphalt and open-graded friction course, respectively.

Section N6

Laboratory Diary

General Description of Mix and Materials

Design Method:	Superpave
Compactive Effort:	100 gyrations
Binder Performance Grade:	67-22
Modifier Type:	NA
Aggregate Type:	Lms/Slag
Gradation Type:	BRZ

Avg. Lab Properties of Plant Produced Mix

<u>Sieve Size:</u>	<u>% Passing:</u>
1"	100
3/4"	100
1/2"	99
3/8"	85
No. 4	54
No. 8	37
No. 16	25
No. 30	17
No. 50	13
No. 100	10
No. 200	8.2
Asphalt Binder Content:	6.8%
Compacted Pile Bulk Gravity:	2.270
Theoretical Maximum Gravity:	2.348
Computed Air Voids:	3.3%

Construction Diary

Relevant Conditions for Construction

Completion Date:	Thursday, June 01, 2000
24 Hour High Temperature (F):	92
24 Hour Low Temperature (F):	67
24 Hour Rainfall (in):	0.00
Lift Type:	dual
Design Thickness of Test Mix (in):	4.0

Plant Configuration and Placement Details

<u>Component:</u>	<u>% Setting:</u>
Liquid Binder Setting	6.5%
Slag 78	53.0%
Slag 8910	17.0%
Limestone Modified 8910	30.0%

Approximate Length (ft):	197
Surveyed Thickness of Section (in):	4.1
Std Dev of Section Thickness (in):	0.2
Type of Tack Coat Utilized:	CQS-1h
Target Tack Application Rate:	0.03 gal / sy
Avg Mat Temperature Behind Paver (F):	289
Average Section Compaction:	94.4%

General Notes:

- 1) Mixes are listed chronologically in order of completion date (i.e., construction began with E2 and ended with E1).
- 2) Sections are referenced by quadrant and sequence number, where "E2" refers to section 2 of the east quadrant.
- 3) "dual" lift type indicates that the lower and upper lifts were constructed with the same experimental mix.
- 4) The total thickness of all experimental sections is 4 inches by design, with the exception of S8, S9, S10, S11.
- 5) ARZ, TRZ, and BRZ refer to gradations intended to pass above, through, and below the restricted zone.
- 6) SMA and OGFC refer to stone matrix asphalt and open-graded friction course, respectively.

Section N7

Laboratory Diary

General Description of Mix and Materials

Design Method:	Superpave
Compactive Effort:	100 gyrations
Binder Performance Grade:	76-22
Modifier Type:	SBR
Aggregate Type:	Lms/Slag
Gradation Type:	BRZ

Avg. Lab Properties of Plant Produced Mix

<u>Sieve Size:</u>	<u>% Passing:</u>
1"	100
3/4"	100
1/2"	98
3/8"	83
No. 4	52
No. 8	36
No. 16	24
No. 30	17
No. 50	13
No. 100	10
No. 200	7.8

Asphalt Binder Content:	6.9%
Compacted Pill Bulk Gravity:	2.281
Theoretical Maximum Gravity:	2.330
Computed Air Voids:	2.1%

Construction Diary

Relevant Conditions for Construction

Completion Date:	Thursday, June 01, 2000
24 Hour High Temperature (F):	92
24 Hour Low Temperature (F):	67
24 Hour Rainfall (in):	0.00
Lift Type:	dual
Design Thickness of Test Mix (in):	4.0

Plant Configuration and Placement Details

<u>Component:</u>	<u>% Setting:</u>
Liquid Binder Setting	6.9%
Slag 78	53.0%
Slag 8910	17.0%
Limestone Modified 8910	30.0%

Approximate Length (ft):	203
Surveyed Thickness of Section (in):	3.9
Std Dev of Section Thickness (in):	0.1
Type of Tack Coat Utilized:	CQS-1h
Target Tack Application Rate:	0.03 gal / sy
Avg Mat Temperature Behind Paver (F):	323
Average Section Compaction:	93.9%

General Notes:

- 1) Mixes are listed chronologically in order of completion date (i.e., construction began with E2 and ended with E1).
- 2) Sections are referenced by quadrant and sequence number, where "E2" refers to section 2 of the east quadrant.
- 3) "dual" lift type indicates that the lower and upper lifts were constructed with the same experimental mix.
- 4) The total thickness of all experimental sections is 4 inches by design, with the exception of S8, S9, S10, S11.
- 5) ARZ, TRZ, and BRZ refer to gradations intended to pass above, through, and below the restricted zone.
- 6) SMA and OGFC refer to stone matrix asphalt and open-graded friction course, respectively.

Section N8

Laboratory Diary

General Description of Mix and Materials

Design Method:	Superpave
Compactive Effort:	100 gyrations
Binder Performance Grade:	76-22
Modifier Type:	SBR
Aggregate Type:	Lms/Slag
Gradation Type:	BRZ

Avg. Lab Properties of Plant Produced Mix

<u>Sieve Size:</u>	<u>% Passing:</u>
1"	100
3/4"	100
1/2"	99
3/8"	85
No. 4	55
No. 8	37
No. 16	24
No. 30	17
No. 50	13
No. 100	10
No. 200	7.5
Asphalt Binder Content:	6.6%
Compacted Pile Bulk Gravity:	2.256
Theoretical Maximum Gravity:	2.351
Computed Air Voids:	4.0%

Construction Diary

Relevant Conditions for Construction

Completion Date:	Monday, June 05, 2000
24 Hour High Temperature (F):	77
24 Hour Low Temperature (F):	60
24 Hour Rainfall (in):	0.08
Lift Type:	dual
Design Thickness of Test Mix (in):	4.0

Plant Configuration and Placement Details

<u>Component:</u>	<u>% Setting:</u>
Liquid Binder Setting	6.4%
Slag 78	53.0%
Slag 8910	17.0%
Limestone Modified 8910	30.0%
Approximate Length (ft):	203
Surveyed Thickness of Section (in):	3.9
Std Dev of Section Thickness (in):	0.2
Type of Tack Coat Utilized:	CQS-1h
Target Tack Application Rate:	0.03 gal / sy
Avg Mat Temperature Behind Paver (F):	319
Average Section Compaction:	94.7%

General Notes:

- 1) Mixes are listed chronologically in order of completion date (i.e., construction began with E2 and ended with E1).
- 2) Sections are referenced by quadrant and sequence number, where "E2" refers to section 2 of the east quadrant.
- 3) "dual" lift type indicates that the lower and upper lifts were constructed with the same experimental mix.
- 4) The total thickness of all experimental sections is 4 inches by design, with the exception of S8, S9, S10, S11.
- 5) ARZ, TRZ, and BRZ refer to gradations intended to pass above, through, and below the restricted zone.
- 6) SMA and OGFC refer to stone matrix asphalt and open-graded friction course, respectively.

Section N9

Laboratory Diary

General Description of Mix and Materials

Design Method:	Superpave
Compactive Effort:	100 gyrations
Binder Performance Grade:	76-22
Modifier Type:	SBS
Aggregate Type:	Lms/Slag
Gradation Type:	BRZ

Avg. Lab Properties of Plant Produced Mix

<u>Sieve Size:</u>	<u>% Passing:</u>
1"	100
3/4"	100
1/2"	99
3/8"	87
No. 4	57
No. 8	40
No. 16	26
No. 30	19
No. 50	14
No. 100	11
No. 200	8.8

Asphalt Binder Content:	6.7%
Compacted Pile Bulk Gravity:	2.279
Theoretical Maximum Gravity:	2.354
Computed Air Voids:	3.2%

Construction Diary

Relevant Conditions for Construction

Completion Date:	Wednesday, June 07, 2000
24 Hour High Temperature (F):	84
24 Hour Low Temperature (F):	60
24 Hour Rainfall (in):	0.00
Lift Type:	dual
Design Thickness of Test Mix (in):	4.0

Plant Configuration and Placement Details

<u>Component:</u>	<u>% Setting:</u>
Liquid Binder Setting	6.4%
Slag 78	53.0%
Slag 8910	17.0%
Limestone Modified 8910	30.0%

Approximate Length (ft):	197
Surveyed Thickness of Section (in):	3.9
Std Dev of Section Thickness (in):	0.2
Type of Tack Coat Utilized:	CQS-1h
Target Tack Application Rate:	0.03 gal / sy
Avg Mat Temperature Behind Paver (F):	314
Average Section Compaction:	94.5%

General Notes:

- 1) Mixes are listed chronologically in order of completion date (i.e., construction began with E2 and ended with E1).
- 2) Sections are referenced by quadrant and sequence number, where "E2" refers to section 2 of the east quadrant.
- 3) "dual" lift type indicates that the lower and upper lifts were constructed with the same experimental mix.
- 4) The total thickness of all experimental sections is 4 inches by design, with the exception of S8, S9, S10, S11.
- 5) ARZ, TRZ, and BRZ refer to gradations intended to pass above, through, and below the restricted zone.
- 6) SMA and OGFC refer to stone matrix asphalt and open-graded friction course, respectively.

Section N10.

Laboratory Diary

General Description of Mix and Materials

Design Method: Superpave
 Compactive Effort: 100 gyrations
 Binder Performance Grade: 76-22
 Modifier Type: SBS
 Aggregate Type: Lms/Slag
 Gradation Type: BRZ

Avg. Lab Properties of Plant Produced Mix

<u>Sieve Size:</u>	<u>% Passing:</u>
1"	100
3/4"	100
1/2"	98
3/8"	84
No. 4	51
No. 8	34
No. 16	23
No. 30	17
No. 50	13
No. 100	10
No. 200	7.7

Asphalt Binder Content: 6.8%
 Compacted Pile Bulk Gravity: 2.257
 Theoretical Maximum Gravity: 2.339
 Computed Air Voids: 3.5%

Construction Diary

Relevant Conditions for Construction

Completion Date: Wednesday, June 07, 2000
 24 Hour High Temperature (F): 84
 24 Hour Low Temperature (F): 60
 24 Hour Rainfall (in): 0.00
 Lift Type: dual
 Design Thickness of Test Mix (in): 4.0

Plant Configuration and Placement Details

<u>Component:</u>	<u>% Setting:</u>
Liquid Binder Setting	6.9%
Slag 78	53.0%
Slag 8910	17.0%
Limestone Modified 8910	30.0%

Approximate Length (ft): 206
 Surveyed Thickness of Section (in): 4.2
 Std Dev of Section Thickness (in): 0.3
 Type of Tack Coat Utilized: CQS-1h
 Target Tack Application Rate: 0.03 gal / sy
 Avg Mat Temperature Behind Paver (F): 324
 Average Section Compaction: 94.7%

General Notes:

- 1) Mixes are listed chronologically in order of completion date (i.e., construction began with E2 and ended with E1).
- 2) Sections are referenced by quadrant and sequence number, where "E2" refers to section 2 of the east quadrant.
- 3) "dual" lift type indicates that the lower and upper lifts were constructed with the same experimental mix.
- 4) The total thickness of all experimental sections is 4 inches by design, with the exception of S8, S9, S10, S11.
- 5) ARZ, TRZ, and BRZ refer to gradations intended to pass above, through, and below the restricted zone.
- 6) SMA and OGFC refer to stone matrix asphalt and open-graded friction course, respectively.

Section N11 (Lower Layer)

Laboratory Diary

General Description of Mix and Materials

Design Method:	Superpave
Compactive Effort:	100 gyrations
Binder Performance Grade:	67-22
Modifier Type:	NA
Aggregate Type:	Granite
Gradation Type:	BRZ

Avg. Lab Properties of Plant Produced Mix

<u>Sieve Size:</u>	<u>% Passing:</u>
1"	100
3/4"	100
1/2"	81
3/8"	70
No. 4	46
No. 8	34
No. 16	27
No. 30	21
No. 50	15
No. 100	10
No. 200	6.3

Asphalt Binder Content:	4.1%
Compacted Pill Bulk Gravity:	2.448
Theoretical Maximum Gravity:	2.529
Computed Air Voids:	3.2%

Construction Diary

Relevant Conditions for Construction

Completion Date:	Tuesday, June 06, 2000
24 Hour High Temperature (F):	85
24 Hour Low Temperature (F):	68
24 Hour Rainfall (in):	0.00
Lift Type:	lower
Design Thickness of Test Mix (in):	2.5

Plant Configuration and Placement Details

<u>Component:</u>	<u>% Setting:</u>
Liquid Binder Setting	4.3%
Granite 6	27.0%
Granite 7	17.0%
Granite 89	20.0%
Granite M10	24.0%
Granite W10	11.0%
Antistrip Hydrated Lime	1.0%

Approximate Length (ft):	195
Surveyed Thickness of Section (in):	NA
Std Dev of Section Thickness (in):	NA
Type of Tack Coat Utilized:	PG 67-22
Target Tack Application Rate:	0.03 gal / sy
Avg Mat Temperature Behind Paver (F):	296
Average Section Compaction:	92.7%

General Notes:

- 1) Mixes are listed chronologically in order of completion date (i.e., construction began with E2 and ended with E1).
- 2) Sections are referenced by quadrant and sequence number, where "E2" refers to section 2 of the east quadrant.
- 3) "dual" lift type indicates that the lower and upper lifts were constructed with the same experimental mix.
- 4) The total thickness of all experimental sections is 4 inches by design, with the exception of S8, S9, S10, S11.
- 5) ARZ, TRZ, and BRZ refer to gradations intended to pass above, through, and below the restricted zone.
- 6) SMA and OGFC refer to stone matrix asphalt and open-graded friction course, respectively.

Section N11 (Upper Layer)

Laboratory Diary

General Description of Mix and Materials

Design Method: Superpave
 Compactive Effort: 100 gyrations
 Binder Performance Grade: 76-22
 Modifier Type: SBS
 Aggregate Type: Granite
 Gradation Type: TRZ

Avg. Lab Properties of Plant Produced Mix

<u>Sieve Size</u>	<u>% Passing</u>
1"	100
3/4"	100
1/2"	97
3/8"	80
No. 4	52
No. 8	37
No. 16	30
No. 30	24
No. 50	18
No. 100	11
No. 200	7.2
Asphalt Binder Content	4.3%
Compacted Pile Bulk Gravity	2.434
Theoretical Maximum Gravity	2.519
Computed Air Voids	3.4%

Construction Diary

Relevant Conditions for Construction

Completion Date: Monday, June 12, 2000
 24 Hour High Temperature (F): 83
 24 Hour Low Temperature (F): 54
 24 Hour Rainfall (in): 0.00
 Lift Type: upper
 Design Thickness of Test Mix (in): 4.0

Plant Configuration and Placement Details

<u>Component</u>	<u>% Setting</u>
Liquid Binder Setting	4.5%
Granite 7	38.0%
Granite 89	18.0%
Granite M10	32.0%
Granite W10	11.0%
Antistrip Hydrated Lime	1.0%

Approximate Length (ft): 195
 Surveyed Thickness of Section (in): 4.1
 Std Dev of Section Thickness (in): 0.1
 Type of Tack Coat Utilized: PG 67-22
 Target Tack Application Rate: 0.03 gal / sy
 Avg Mat Temperature Behind Paver (F): 327
 Average Section Compaction: 93.1%

General Notes:

- 1) Mixes are listed chronologically in order of completion date (i.e., construction began with E2 and ended with E1).
- 2) Sections are referenced by quadrant and sequence number, where "E2" refers to section 2 of the east quadrant.
- 3) "dual" lift type indicates that the lower and upper lifts were constructed with the same experimental mix.
- 4) The total thickness of all experimental sections is 4 inches by design, with the exception of S8, S9, S10, S11.
- 5) ARZ, TRZ, and BRZ refer to gradations intended to pass above, through, and below the restricted zone.
- 6) SMA and OGFC refer to stone matrix asphalt and open-graded friction course, respectively.

Section N12 (Lower Layer)

Laboratory Diary

General Description of Mix and Materials

Design Method:	Superpave
Compactive Effort:	100 gyrations
Binder Performance Grade:	67-22
Modifier Type:	NA
Aggregate Type:	Granite
Gradation Type:	BRZ

Avg. Lab Properties of Plant Produced Mix

<u>Sieve Size:</u>	<u>% Passing:</u>
1"	100
3/4"	99
1/2"	83
3/8"	72
No. 4	49
No. 8	36
No. 16	28
No. 30	22
No. 50	16
No. 100	10
No. 200	6.5

Asphalt Binder Content:	4.2%
Compacted Pill Bulk Gravity:	2.445
Theoretical Maximum Gravity:	2.535
Computed Air Voids:	3.5%

Construction Diary

Relevant Conditions for Construction

Completion Date:	Tuesday, June 06, 2000
24 Hour High Temperature (F):	85
24 Hour Low Temperature (F):	68
24 Hour Rainfall (in):	0.00
Lift Type:	lower
Design Thickness of Test Mix (in):	2.5

Plant Configuration and Placement Details

<u>Component:</u>	<u>% Setting:</u>
Liquid Binder Setting	4.3%
Granite 6	27.0%
Granite 7	17.0%
Granite 89	20.0%
Granite M10	24.0%
Granite W10	11.0%
Antistrip Hydrated Lime	1.0%

Approximate Length (ft):	201
Surveyed Thickness of Section (in):	NA
Std Dev of Section Thickness (in):	NA
Type of Tack Coat Utilized:	PG 67-22
Target Tack Application Rate:	0.03 gal / sy
Avg Mat Temperature Behind Paver (F):	293
Average Section Compaction:	92.4%

General Notes:

- 1) Mixes are listed chronologically in order of completion date (i.e., construction began with E2 and ended with E1).
- 2) Sections are referenced by quadrant and sequence number, where "E2" refers to section 2 of the east quadrant.
- 3) "dual" lift type indicates that the lower and upper lifts were constructed with the same experimental mix.
- 4) The total thickness of all experimental sections is 4 inches by design, with the exception of S8, S9, S10, S11.
- 5) ARZ, TRZ, and BRZ refer to gradations intended to pass above, through, and below the restricted zone.
- 6) SMA and OGFC refer to stone matrix asphalt and open-graded friction course, respectively.

Section N12 (Upper Layer)

Laboratory Diary

General Description of Mix and Materials

Design Method: SMA
 Compactive Effort: 50 blows
 Binder Performance Grade: 76-22
 Modifier Type: SBS
 Aggregate Type: Granite
 Gradation Type: SMA

Avg. Lab Properties of Plant Produced Mix

<u>Sieve Size:</u>	<u>% Passing:</u>
1"	100
3/4"	100
1/2"	96
3/8"	73
No. 4	32
No. 8	23
No. 16	21
No. 30	19
No. 50	17
No. 100	14
No. 200	11.8

Asphalt Binder Content: 6.2%
 Compacted Pill Bulk Gravity: 2.335
 Theoretical Maximum Gravity: 2.401
 Computed Air Voids: 2.7%

Construction Diary

Relevant Conditions for Construction

Completion Date: Monday, June 12, 2000
 24 Hour High Temperature (F): 93
 24 Hour Low Temperature (F): 67
 24 Hour Rainfall (in): 0.00
 Lift Type: upper
 Design Thickness of Test Mix (in): 4.0

Plant Configuration and Placement Details

<u>Component:</u>	<u>% Setting:</u>
Liquid Binder Setting	6.1%
Granite 7	60.0%
Granite 89	22.0%
Granite M10	10.0%
Stabilizer Fiber	0.4%
Filler Fly Ash	7.0%
Antistrip Hydrated Lime	1.0%

Approximate Length (ft): 201
 Surveyed Thickness of Section (in): 3.9
 Std Dev of Section Thickness (in): 0.2
 Type of Tack Coat Utilized: PG 67-22
 Target Tack Application Rate: 0.03 gal / sy
 Avg Mat Temperature Behind Paver (F): 343
 Average Section Compaction: 94.6%

General Notes:

- 1) Mixes are listed chronologically in order of completion date (i.e., construction began with E2 and ended with E1).
- 2) Sections are referenced by quadrant and sequence number, where "E2" refers to section 2 of the east quadrant.
- 3) "dual" lift type indicates that the lower and upper lifts were constructed with the same experimental mix.
- 4) The total thickness of all experimental sections is 4 inches by design, with the exception of S8, S9, S10, S11.
- 5) ARZ, TRZ, and BRZ refer to gradations intended to pass above, through, and below the restricted zone.
- 6) SMA and OGFC refer to stone matrix asphalt and open-graded friction course, respectively.

Section N13 (Lower Layer)

Laboratory Diary

General Description of Mix and Materials

Design Method:	Superpave
Compactive Effort:	100 gyrations
Binder Performance Grade:	76-22
Modifier Type:	SBS
Aggregate Type:	Gravel
Gradation Type:	BRZ

Avg. Lab Properties of Plant Produced Mix

<u>Sieve Size:</u>	<u>% Passing:</u>
1"	100
3/4"	100
1/2"	88
3/8"	73
No. 4	51
No. 8	33
No. 16	25
No. 30	20
No. 50	13
No. 100	8
No. 200	6.3
Asphalt Binder Content:	5.0%
Compacted Pile Bulk Gravity:	2.310
Theoretical Maximum Gravity:	2.384
Computed Air Voids:	3.1%

General Notes:

- 1) Mixes are listed chronologically in order of completion date (i.e., construction began with E2 and ended with E1).
- 2) Sections are referenced by quadrant and sequence number, where "E2" refers to section 2 of the east quadrant.
- 3) "dual" lift type indicates that the lower and upper lifts were constructed with the same experimental mix.
- 4) The total thickness of all experimental sections is 4 inches by design, with the exception of S8, S9, S10, S11.
- 5) ARZ, TRZ, and BRZ refer to gradations intended to pass above, through, and below the restricted zone.
- 6) SMA and OGFC refer to stone matrix asphalt and open-graded friction course, respectively.

Construction Diary

Relevant Conditions for Construction

Completion Date:	Wednesday, June 07, 2000
24 Hour High Temperature (F):	84
24 Hour Low Temperature (F):	60
24 Hour Rainfall (in):	0.00
Lift Type:	lower
Design Thickness of Test Mix (in):	2.5

Plant Configuration and Placement Details

<u>Component:</u>	<u>% Setting:</u>
Liquid Binder Setting	4.9%
Gravel 3/4" Crushed Gravel	38.0%
Gravel 3/8" Crushed Gravel	43.0%
Limestone Modified 8910	8.0%
Gravel Coarse Sand	10.0%
Antistrip Hydrated Lime	1.0%

Approximate Length (ft):	199
Surveyed Thickness of Section (in):	NA
Std Dev of Section Thickness (in):	NA
Type of Tack Coat Utilized:	CQS-1h
Target Tack Application Rate:	0.03 gal / sy
Avg Mat Temperature Behind Paver (F):	318
Average Section Compaction:	92.5%

Section N13 (Upper Layer)

Laboratory Diary

General Description of Mix and Materials

Design Method:	SMA
Compactive Effort:	50 blows
Binder Performance Grade:	76-22
Modifier Type:	SBS
Aggregate Type:	Gravel
Gradation Type:	SMA

Avg. Lab Properties of Plant Produced Mix

<u>Sieve Size:</u>	<u>% Passing:</u>
1"	100
3/4"	100
1/2"	99
3/8"	74
No. 4	30
No. 8	25
No. 16	23
No. 30	21
No. 50	17
No. 100	13
No. 200	11.5

Asphalt Binder Content:	6.8%
Compacted Pill Bulk Gravity:	2.175
Theoretical Maximum Gravity:	2.266
Computed Air Voids:	4.0%

Construction Diary

Relevant Conditions for Construction

Completion Date:	Monday, June 12, 2000
24 Hour High Temperature (F):	93
24 Hour Low Temperature (F):	67
24 Hour Rainfall (in):	0.00
Lift Type:	upper
Design Thickness of Test Mix (in):	4.0

Plant Configuration and Placement Details

<u>Component:</u>	<u>% Setting:</u>
Liquid Binder Setting	6.7%
Gravel 1/2" Crushed Gravel	72.5%
Gravel 3/8" Crushed Gravel	10.0%
Gravel Coarse Sand	9.5%
Stabilizer Fiber	0.5%
Filler Fly Ash	8.0%

Approximate Length (ft):	199
Surveyed Thickness of Section (in):	4.0
Std Dev of Section Thickness (in):	0.2
Type of Tack Coat Utilized:	CQS-1h
Target Tack Application Rate:	0.03 gal / sy
Avg Mat Temperature Behind Paver (F):	325
Average Section Compaction:	92.0%

General Notes:

- 1) Mixes are listed chronologically in order of completion date (i.e., construction began with E2 and ended with E1).
- 2) Sections are referenced by quadrant and sequence number, where "E2" refers to section 2 of the east quadrant.
- 3) "dual" lift type indicates that the lower and upper lifts were constructed with the same experimental mix.
- 4) The total thickness of all experimental sections is 4 inches by design, with the exception of S8, S9, S10, S11.
- 5) ARZ, TRZ, and BRZ refer to gradations intended to pass above, through, and below the restricted zone.
- 6) SMA and OGFC refer to stone matrix asphalt and open-graded friction course, respectively.

Section W1

Laboratory Diary

General Description of Mix and Materials

Design Method:	SMA
Compactive Effort:	50 blows
Binder Performance Grade:	76-22
Modifier Type:	SBR
Aggregate Type:	Granite
Gradation Type:	SMA

Avg. Lab Properties of Plant Produced Mix

<u>Sieve Size:</u>	<u>% Passing:</u>
1"	100
3/4"	100
1/2"	95
3/8"	68
No. 4	28
No. 8	20
No. 16	18
No. 30	16
No. 50	14
No. 100	12
No. 200	9.7

Asphalt Binder Content:	6.1%
Compacted Pill Bulk Gravity:	2.337
Theoretical Maximum Gravity:	2.422
Computed Air Voids:	3.5%

Construction Diary

Relevant Conditions for Construction

Completion Date:	Tuesday, June 13, 2000
24 Hour High Temperature (F):	92
24 Hour Low Temperature (F):	73
24 Hour Rainfall (in):	0.00
Lift Type:	dual
Design Thickness of Test Mix (in):	4.0

Plant Configuration and Placement Details

<u>Component:</u>	<u>% Setting:</u>
Liquid Binder Setting	6.2%
Granite 7	73.0%
Granite 89	11.0%
Granite M10	10.0%
Stabilizer Fiber	0.4%
Filler Fly Ash	6.0%

Approximate Length (ft):	202
Surveyed Thickness of Section (in):	3.9
Std Dev of Section Thickness (in):	0.1
Type of Tack Coat Utilized:	CQS-1h
Target Tack Application Rate:	0.03 gal / sy
Avg Mat Temperature Behind Paver (F):	328
Average Section Compaction:	95.0%

General Notes:

- 1) Mixes are listed chronologically in order of completion date (i.e., construction began with E2 and ended with E1).
- 2) Sections are referenced by quadrant and sequence number, where "E2" refers to section 2 of the east quadrant.
- 3) "dual" lift type indicates that the lower and upper lifts were constructed with the same experimental mix.
- 4) The total thickness of all experimental sections is 4 inches by design, with the exception of S8, S9, S10, S11.
- 5) ARZ, TRZ, and BRZ refer to gradations intended to pass above, through, and below the restricted zone.
- 6) SMA and OGFC refer to stone matrix asphalt and open-graded friction course, respectively.

Section W2

Laboratory Diary

General Description of Mix and Materials

Design Method:	SMA
Compactive Effort:	50 blows
Binder Performance Grade:	76-22
Modifier Type:	SBR
Aggregate Type:	Lms/Slag
Gradation Type:	SMA

Avg. Lab Properties of Plant Produced Mix

<u>Sieve Size:</u>	<u>% Passing:</u>
1"	100
3/4"	100
1/2"	98
3/8"	77
No. 4	35
No. 8	24
No. 16	17
No. 30	15
No. 50	13
No. 100	12
No. 200	10.7

Asphalt Binder Content:	8.0%
Compacted Pill Bulk Gravity:	2.158
Theoretical Maximum Gravity:	2.243
Computed Air Voids:	3.8%

Construction Diary

Relevant Conditions for Construction

Completion Date:	Thursday, June 15, 2000
24 Hour High Temperature (F):	89
24 Hour Low Temperature (F):	76
24 Hour Rainfall (in):	0.17
Lift Type:	dual
Design Thickness of Test Mix (in):	4.0

Plant Configuration and Placement Details

<u>Component:</u>	<u>% Setting:</u>
Liquid Binder Setting	7.7%
Slag	78
Limestone	89
Limestone	Manufactured Sand
Stabilizer	Fiber
Filler	Fly Ash

Approximate Length (ft):	200
Surveyed Thickness of Section (in):	4.0
Std Dev of Section Thickness (in):	0.1
Type of Tack Coat Utilized:	CQS-1h
Target Tack Application Rate:	0.03 gal / sy
Avg Mat Temperature Behind Paver (F):	323
Average Section Compaction:	94.3%

General Notes:

- 1) Mixes are listed chronologically in order of completion date (i.e., construction began with E2 and ended with E1).
- 2) Sections are referenced by quadrant and sequence number, where "E2" refers to section 2 of the east quadrant.
- 3) "dual" lift type indicates that the lower and upper lifts were constructed with the same experimental mix.
- 4) The total thickness of all experimental sections is 4 inches by design, with the exception of S8, S9, S10, S11.
- 5) ARZ, TRZ, and BRZ refer to gradations intended to pass above, through, and below the restricted zone.
- 6) SMA and OGFC refer to stone matrix asphalt and open-graded friction course, respectively.

Section W3 (Lower Layer)

Laboratory Diary

General Description of Mix and Materials

Design Method:	Superpave
Compactive Effort:	100 gyrations
Binder Performance Grade:	76-22
Modifier Type:	SBR
Aggregate Type:	Granite
Gradation Type:	BRZ

Avg. Lab Properties of Plant Produced Mix

<u>Sieve Size:</u>	<u>% Passing:</u>
1"	100
3/4"	100
1/2"	96
3/8"	76
No. 4	41
No. 8	29
No. 16	23
No. 30	18
No. 50	12
No. 100	7
No. 200	4.1

Asphalt Binder Content:	4.7%
Compacted Pill Bulk Gravity:	2.394
Theoretical Maximum Gravity:	2.510
Computed Air Voids:	4.6%

Construction Diary

Relevant Conditions for Construction

Completion Date:	Thursday, June 15, 2000
24 Hour High Temperature (F):	89
24 Hour Low Temperature (F):	76
24 Hour Rainfall (in):	0.00
Lift Type:	lower
Design Thickness of Test Mix (in):	3.3

Plant Configuration and Placement Details

<u>Component:</u>	<u>% Setting:</u>
Liquid Binder Setting	4.7%
Granite 7	48.0%
Granite 89	19.0%
Granite M10	18.0%
Granite W10	15.0%

Approximate Length (ft):	205
Surveyed Thickness of Section (in):	NA
Std Dev of Section Thickness (in):	NA
Type of Tack Coat Utilized:	CQS-1h
Target Tack Application Rate:	0.03 gal / sy
Avg Mat Temperature Behind Paver (F):	315
Average Section Compaction:	93.2%

General Notes:

- 1) Mixes are listed chronologically in order of completion date (i.e., construction began with E2 and ended with E1).
- 2) Sections are referenced by quadrant and sequence number, where "E2" refers to section 2 of the east quadrant.
- 3) "dual" lift type indicates that the lower and upper lifts were constructed with the same experimental mix.
- 4) The total thickness of all experimental sections is 4 inches by design, with the exception of S8, S9, S10, S11.
- 5) ARZ, TRZ, and BRZ refer to gradations intended to pass above, through, and below the restricted zone.
- 6) SMA and OGFC refer to stone matrix asphalt and open-graded friction course, respectively.

Section W3 (Upper Layer)

Laboratory Diary

General Description of Mix and Materials

Design Method: OGFC
 Compactive Effort: 50 blows
 Binder Performance Grade: 76-22
 Modifier Type: SBR
 Aggregate Type: Lms/Slag
 Gradation Type: OGFC

Avg. Lab Properties of Plant Produced Mix

<u>Sieve Size:</u>	<u>% Passing:</u>
1"	100
3/4"	100
1/2"	98
3/8"	68
No. 4	19
No. 8	13
No. 16	11
No. 30	10
No. 50	9
No. 100	8
No. 200	6.8

Asphalt Binder Content: 7.6%
 Compacted Pill Bulk Gravity: NA
 Theoretical Maximum Gravity: NA
 Computed Air Voids: NA

Construction Diary

Relevant Conditions for Construction

Completion Date: Monday, June 19, 2000
 24 Hour High Temperature (F): 90
 24 Hour Low Temperature (F): 78
 24 Hour Rainfall (in): 0.00
 Lift Type: upper
 Design Thickness of Test Mix (in): 4.0

Plant Configuration and Placement Details

<u>Component:</u>	<u>% Setting:</u>
Liquid Binder Setting	8.5%
Limestone 7	20.0%
Slag 78	75.0%
Stabilizer Fiber	0.4%
Filler Fly Ash	5.0%

Approximate Length (ft): 205
 Surveyed Thickness of Section (in): 4.0
 Std Dev of Section Thickness (in): 0.1
 Type of Tack Coat Utilized: CQS-1h
 Target Tack Application Rate: 0.03 gal / sy
 Avg Mat Temperature Behind Paver (F): 304
 Average Section Compaction: NA

General Notes:

- 1) Mixes are listed chronologically in order of completion date (i.e., construction began with E2 and ended with E1).
- 2) Sections are referenced by quadrant and sequence number, where "E2" refers to section 2 of the east quadrant.
- 3) "dual" lift type indicates that the lower and upper lifts were constructed with the same experimental mix.
- 4) The total thickness of all experimental sections is 4 inches by design, with the exception of S8, S9, S10, S11.
- 5) ARZ, TRZ, and BRZ refer to gradations intended to pass above, through, and below the restricted zone.
- 6) SMA and OGFC refer to stone matrix asphalt and open-graded friction course, respectively.

Section W4 (Lower Layer)

Laboratory Diary

General Description of Mix and Materials

Design Method:	SMA
Compactive Effort:	50 blows
Binder Performance Grade:	76-22
Modifier Type:	SBR
Aggregate Type:	Limestone
Gradation Type:	SMA

Avg. Lab Properties of Plant Produced Mix

<u>Sieve Size:</u>	<u>% Passing:</u>
1"	100
3/4"	100
1/2"	96
3/8"	72
No. 4	24
No. 8	18
No. 16	15
No. 30	13
No. 50	13
No. 100	12
No. 200	11.1
Asphalt Binder Content:	6.2%
Compacted Pile Bulk Gravity:	2.392
Theoretical Maximum Gravity:	2.459
Computed Air Voids:	2.7%

Construction Diary

Relevant Conditions for Construction

Completion Date:	Thursday, June 15, 2000
24 Hour High Temperature (F):	89
24 Hour Low Temperature (F):	76
24 Hour Rainfall (in):	0.17
Lift Type:	lower
Design Thickness of Test Mix (in):	3.3

Plant Configuration and Placement Details

<u>Component:</u>	<u>% Setting:</u>
Liquid Binder Setting	6.2%
Limestone 7	82.0%
Limestone Modified 8910	11.0%
Stabilizer Fiber	0.4%
Filler Fly Ash	7.0%

Approximate Length (ft):	199
Surveyed Thickness of Section (in):	NA
Std Dev of Section Thickness (in):	NA
Type of Tack Coat Utilized:	CQS-1h
Target Tack Application Rate:	0.03 gal / sy
Avg Mat Temperature Behind Paver (F):	321
Average Section Compaction:	95.3%

General Notes:

- 1) Mixes are listed chronologically in order of completion date (i.e., construction began with E2 and ended with E1).
- 2) Sections are referenced by quadrant and sequence number, where "E2" refers to section 2 of the east quadrant.
- 3) "dual" lift type indicates that the lower and upper lifts were constructed with the same experimental mix.
- 4) The total thickness of all experimental sections is 4 inches by design, with the exception of S8, S9, S10, S11.
- 5) ARZ, TRZ, and BRZ refer to gradations intended to pass above, through, and below the restricted zone.
- 6) SMA and OGFC refer to stone matrix asphalt and open-graded friction course, respectively.

Section W4 (Upper Layer)

Laboratory Diary

General Description of Mix and Materials

Design Method:	OGFC
Compactive Effort:	NA
Binder Performance Grade:	76-22
Modifier Type:	SBR
Aggregate Type:	Granite
Gradation Type:	OGFC

Avg. Lab Properties of Plant Produced Mix

<u>Sieve Size:</u>	<u>% Passing:</u>
1"	100
3/4"	100
1/2"	95
3/8"	66
No. 4	23
No. 8	14
No. 16	13
No. 30	12
No. 50	11
No. 100	10
No. 200	8.6

Asphalt Binder Content:	6.1%
Compacted Pile Bulk Gravity:	NA
Theoretical Maximum Gravity:	NA
Computed Air Voids:	NA

Construction Diary

Relevant Conditions for Construction

Completion Date:	Tuesday, June 20, 2000
24 Hour High Temperature (F):	90
24 Hour Low Temperature (F):	74
24 Hour Rainfall (in):	0.00
Lift Type:	upper
Design Thickness of Test Mix (in):	4.0

Plant Configuration and Placement Details

<u>Component:</u>	<u>% Setting:</u>
Liquid Binder Setting	6.3%
Granite 7	75.0%
Granite 89	19.0%
Stabilizer Fiber	0.5%
Filler Fly Ash	6.0%

Approximate Length (ft):	199
Surveyed Thickness of Section (in):	4.1
Std Dev of Section Thickness (in):	0.1
Type of Tack Coat Utilized:	CQS-1h
Target Tack Application Rate:	0.03 gal / sy
Avg Mat Temperature Behind Paver (F):	321
Average Section Compaction:	NA

General Notes:

- 1) Mixes are listed chronologically in order of completion date (i.e., construction began with E2 and ended with E1).
- 2) Sections are referenced by quadrant and sequence number, where "E2" refers to section 2 of the east quadrant.
- 3) "dual" lift type indicates that the lower and upper lifts were constructed with the same experimental mix.
- 4) The total thickness of all experimental sections is 4 inches by design, with the exception of S8, S9, S10, S11.
- 5) ARZ, TRZ, and BRZ refer to gradations intended to pass above, through, and below the restricted zone.
- 6) SMA and OGFC refer to stone matrix asphalt and open-graded friction course, respectively.

Section W5 (Lower Layer)

Laboratory Diary

General Description of Mix and Materials

Design Method:	SMA
Compactive Effort:	50 blows
Binder Performance Grade:	76-22
Modifier Type:	SBS
Aggregate Type:	Limestone
Gradation Type:	SMA

Avg. Lab Properties of Plant Produced Mix

<u>Sieve Size:</u>	<u>% Passing:</u>
1"	100
3/4"	100
1/2"	96
3/8"	75
No. 4	25
No. 8	19
No. 16	15
No. 30	14
No. 50	14
No. 100	13
No. 200	12.4

Asphalt Binder Content:	5.7%
Compacted Pill Bulk Gravity:	2.391
Theoretical Maximum Gravity:	2.487
Computed Air Voids:	3.9%

Construction Diary

Relevant Conditions for Construction

Completion Date:	Monday, June 19, 2000
24 Hour High Temperature (F):	90
24 Hour Low Temperature (F):	78
24 Hour Rainfall (in):	0.17
Lift Type:	lower
Design Thickness of Test Mix (in):	3.3

Plant Configuration and Placement Details

<u>Component:</u>	<u>% Setting:</u>
Liquid Binder Setting	5.8%
Limestone 7	82.0%
Limestone Modified 8910	11.0%
Stabilizer Fiber	0.4%
Filler Fly Ash	7.0%

Approximate Length (ft):	203
Surveyed Thickness of Section (in):	NA
Std Dev of Section Thickness (in):	NA
Type of Tack Coat Utilized:	CQS-1h
Target Tack Application Rate:	0.03 gal / sy
Avg Mat Temperature Behind Paver (F):	336
Average Section Compaction:	94.2%

General Notes:

- 1) Mixes are listed chronologically in order of completion date (i.e., construction began with E2 and ended with E1).
- 2) Sections are referenced by quadrant and sequence number, where "E2" refers to section 2 of the east quadrant.
- 3) "dual" lift type indicates that the lower and upper lifts were constructed with the same experimental mix.
- 4) The total thickness of all experimental sections is 4 inches by design, with the exception of S8, S9, S10, S11.
- 5) ARZ, TRZ, and BRZ refer to gradations intended to pass above, through, and below the restricted zone.
- 6) SMA and OGFC refer to stone matrix asphalt and open-graded friction course, respectively.

Section W5 (Upper Layer)

Laboratory Diary

General Description of Mix and Materials

Design Method:	OGFC
Compactive Effort:	NA
Binder Performance Grade:	76-22
Modifier Type:	SBS
Aggregate Type:	Granite
Gradation Type:	OGFC

Avg. Lab Properties of Plant Produced Mix

<u>Sieve Size:</u>	<u>% Passing:</u>
1"	100
3/4"	100
1/2"	95
3/8"	67
No. 4	22
No. 8	15
No. 16	12
No. 30	11
No. 50	11
No. 100	10
No. 200	8.5

Asphalt Binder Content:	6.2%
Compacted Pill Bulk Gravity:	NA
Theoretical Maximum Gravity:	NA
Computed Air Voids:	NA

Construction Diary

Relevant Conditions for Construction

Completion Date:	Tuesday, June 20, 2000
24 Hour High Temperature (F):	90
24 Hour Low Temperature (F):	74
24 Hour Rainfall (in):	0.00
Lift Type:	upper
Design Thickness of Test Mix (in):	4.0

Plant Configuration and Placement Details

<u>Component:</u>	<u>% Setting:</u>
Liquid Binder Setting	6.2%
Granite 7	75.0%
Granite 89	19.0%
Stabilizer Fiber	0.5%
Filler Fly Ash	6.0%

Approximate Length (ft):	203
Surveyed Thickness of Section (in):	4.3
Std Dev of Section Thickness (in):	0.1
Type of Tack Coat Utilized:	CQS-1h
Target Tack Application Rate:	0.03 gal / sy
Avg Mat Temperature Behind Paver (F):	330
Average Section Compaction:	NA

General Notes:

- 1) Mixes are listed chronologically in order of completion date (i.e., construction began with E2 and ended with E1).
- 2) Sections are referenced by quadrant and sequence number, where "E2" refers to section 2 of the east quadrant.
- 3) "dual " lift type indicates that the lower and upper lifts were constructed with the same experimental mix.
- 4) The total thickness of all experimental sections is 4 inches by design, with the exception of S8, S9, S10, S11.
- 5) ARZ, TRZ, and BRZ refer to gradations intended to pass above, through, and below the restricted zone.
- 6) SMA and OGFC refer to stone matrix asphalt and open-graded friction course, respectively.

Section W6

Laboratory Diary

General Description of Mix and Materials

Design Method:	Superpave
Compactive Effort:	100 gyrations
Binder Performance Grade:	67-22
Modifier Type:	NA
Aggregate Type:	Lms/Slag
Gradation Type:	TRZ

Avg. Lab Properties of Plant Produced Mix

<u>Sieve Size:</u>	<u>% Passing:</u>
1"	100
3/4"	100
1/2"	99
3/8"	89
No. 4	65
No. 8	45
No. 16	28
No. 30	18
No. 50	13
No. 100	10
No. 200	7.8

Asphalt Binder Content:	6.8%
Compacted Pile Bulk Gravity:	2.291
Theoretical Maximum Gravity:	2.354
Computed Air Voids:	2.7%

Construction Diary

Relevant Conditions for Construction

Completion Date:	Tuesday, June 20, 2000
24 Hour High Temperature (F):	90
24 Hour Low Temperature (F):	74
24 Hour Rainfall (in):	0.00
Lift Type:	dual
Design Thickness of Test Mix (in):	4.0

Plant Configuration and Placement Details

<u>Component:</u>	<u>% Setting:</u>
Liquid Binder Setting	6.8%
Slag 78	39.0%
Limestone Modified 8910	25.0%
Slag 8910	26.0%
Limestone Manufactured Sand	10.0%

Approximate Length (ft):	203
Surveyed Thickness of Section (in):	4.1
Std Dev of Section Thickness (in):	0.1
Type of Tack Coat Utilized:	CQS-1h
Target Tack Application Rate:	0.03 gal / sy
Avg Mat Temperature Behind Paver (F):	320
Average Section Compaction:	92.1%

General Notes:

- 1) Mixes are listed chronologically in order of completion date (i.e., construction began with E2 and ended with E1).
- 2) Sections are referenced by quadrant and sequence number, where "E2" refers to section 2 of the east quadrant.
- 3) "dual" lift type indicates that the lower and upper lifts were constructed with the same experimental mix.
- 4) The total thickness of all experimental sections is 4 inches by design, with the exception of S8, S9, S10, S11.
- 5) ARZ, TRZ, and BRZ refer to gradations intended to pass above, through, and below the restricted zone.
- 6) SMA and OGFC refer to stone matrix asphalt and open-graded friction course, respectively.

Section W7

Laboratory Diary

General Description of Mix and Materials

Design Method:	SMA
Compactive Effort:	50 blows
Binder Performance Grade:	76-22
Modifier Type:	SBR
Aggregate Type:	Limestone
Gradation Type:	SMA

Avg. Lab Properties of Plant Produced Mix

<u>Sieve Size:</u>	<u>% Passing:</u>
1"	100
3/4"	100
1/2"	96
3/8"	69
No. 4	22
No. 8	17
No. 16	14
No. 30	12
No. 50	12
No. 100	12
No. 200	10.9
Asphalt Binder Content:	5.9%
Compacted Pill Bulk Gravity:	2.378
Theoretical Maximum Gravity:	2.480
Computed Air Voids:	4.1%

Construction Diary

Relevant Conditions for Construction

Completion Date:	Wednesday, June 21, 2000
24 Hour High Temperature (F):	91
24 Hour Low Temperature (F):	72
24 Hour Rainfall (in):	0.00
Lift Type:	dual
Design Thickness of Test Mix (in):	4.0

Plant Configuration and Placement Details

<u>Component:</u>	<u>% Setting:</u>
Liquid Binder Setting	6.1%
Limestone 7	82.0%
Limestone Modified 8910	11.0%
Stabilizer Fiber	0.4%
Filler Fly Ash	7.0%

Approximate Length (ft):	207
Surveyed Thickness of Section (in):	4.2
Std Dev of Section Thickness (in):	0.1
Type of Tack Coat Utilized:	CQS-1h
Target Tack Application Rate:	0.03 gal / sy
Avg Mat Temperature Behind Paver (F):	323
Average Section Compaction:	93.5%

General Notes:

- 1) Mixes are listed chronologically in order of completion date (i.e., construction began with E2 and ended with E1).
- 2) Sections are referenced by quadrant and sequence number, where "E2" refers to section 2 of the east quadrant.
- 3) "dual" lift type indicates that the lower and upper lifts were constructed with the same experimental mix.
- 4) The total thickness of all experimental sections is 4 inches by design, with the exception of S8, S9, S10, S11.
- 5) ARZ, TRZ, and BRZ refer to gradations intended to pass above, through, and below the restricted zone.
- 6) SMA and OGFC refer to stone matrix asphalt and open-graded friction course, respectively.

Section W8

Laboratory Diary

General Description of Mix and Materials

Design Method:	SMA
Compactive Effort:	50 blows
Binder Performance Grade:	76-22
Modifier Type:	SBR
Aggregate Type:	Sandstone
Gradation Type:	SMA

Avg. Lab Properties of Plant Produced Mix

<u>Sieve Size:</u>	<u>% Passing:</u>
1"	100
3/4"	100
1/2"	99
3/8"	80
No. 4	33
No. 8	25
No. 16	22
No. 30	20
No. 50	18
No. 100	15
No. 200	12.9

Asphalt Binder Content:	7.5%
Compacted Pile Bulk Gravity:	2.272
Theoretical Maximum Gravity:	2.355
Computed Air Voids:	3.5%

Construction Diary

Relevant Conditions for Construction

Completion Date:	Wednesday, June 21, 2000
24 Hour High Temperature (F):	91
24 Hour Low Temperature (F):	72
24 Hour Rainfall (in):	0.00
Lift Type:	dual
Design Thickness of Test Mix (in):	4.0

Plant Configuration and Placement Details

<u>Component:</u>	<u>% Setting:</u>
Liquid Binder Setting	7.0%
Limestone 7	30.0%
Slag 78	34.0%
Sand Stone 8	19.0%
Stabilizer Fiber	0.4%
Filler Fly Ash	8.0%
Sand Stone Sand	9.0%

Approximate Length (ft):	197
Surveyed Thickness of Section (in):	4.0
Std Dev of Section Thickness (in):	0.1
Type of Tack Coat Utilized:	CQS-1h
Target Tack Application Rate:	0.03 gal / sy
Avg Mat Temperature Behind Paver (F):	322
Average Section Compaction:	94.5%

General Notes:

- 1) Mixes are listed chronologically in order of completion date (i.e., construction began with E2 and ended with E1).
- 2) Sections are referenced by quadrant and sequence number, where "E2" refers to section 2 of the east quadrant.
- 3) "dual" lift type indicates that the lower and upper lifts were constructed with the same experimental mix.
- 4) The total thickness of all experimental sections is 4 inches by design, with the exception of S8, S9, S10, S11.
- 5) ARZ, TRZ, and BRZ refer to gradations intended to pass above, through, and below the restricted zone.
- 6) SMA and OGFC refer to stone matrix asphalt and open-graded friction course, respectively.

Section W9

Laboratory Diary

General Description of Mix and Materials

Design Method:	Superpave
Compactive Effort:	100 gyrations
Binder Performance Grade:	67-22
Modifier Type:	NA
Aggregate Type:	Qtz gravel
Gradation Type:	BRZ

Avg. Lab Properties of Plant Produced Mix

<u>Sieve Size:</u>	<u>% Passing:</u>
1"	100
3/4"	100
1/2"	96
3/8"	80
No. 4	51
No. 8	34
No. 16	22
No. 30	16
No. 50	12
No. 100	9
No. 200	6.7

Asphalt Binder Content:	5.0%
Compacted Pill Bulk Gravity:	2.380
Theoretical Maximum Gravity:	2.465
Computed Air Voids:	3.4%

Construction Diary

Relevant Conditions for Construction

Completion Date:	Thursday, June 22, 2000
24 Hour High Temperature (F):	92
24 Hour Low Temperature (F):	75
24 Hour Rainfall (in):	0.00
Lift Type:	dual
Design Thickness of Test Mix (in):	4.0

Plant Configuration and Placement Details

<u>Component:</u>	<u>% Setting:</u>
Liquid Binder Setting	5.1%
Gravel 1/2" Crushed Gravel	74.0%
Gravel 3/8" Crushed Gravel	10.0%
Limestone Modified 8910	16.0%

Approximate Length (ft):	203
Surveyed Thickness of Section (in):	4.0
Std Dev of Section Thickness (in):	0.1
Type of Tack Coat Utilized:	CQS-1h
Target Tack Application Rate:	0.03 gal / sy
Avg Mat Temperature Behind Paver (F):	310
Average Section Compaction:	93.6%

General Notes:

- 1) Mixes are listed chronologically in order of completion date (i.e., construction began with E2 and ended with E1).
- 2) Sections are referenced by quadrant and sequence number, where "E2" refers to section 2 of the east quadrant.
- 3) "dual" lift type indicates that the lower and upper lifts were constructed with the same experimental mix.
- 4) The total thickness of all experimental sections is 4 inches by design, with the exception of S8, S9, S10, S11.
- 5) ARZ, TRZ, and BRZ refer to gradations intended to pass above, through, and below the restricted zone.
- 6) SMA and OGFC refer to stone matrix asphalt and open-graded friction course, respectively.

Section W10

Laboratory Diary

General Description of Mix and Materials

Design Method:	Superpave
Compactive Effort:	100 gyrations
Binder Performance Grade:	76-22
Modifier Type:	SBR
Aggregate Type:	Qtz gravel
Gradation Type:	BRZ

Avg. Lab Properties of Plant Produced Mix

<u>Sieve Size:</u>	<u>% Passing:</u>
1"	100
3/4"	100
1/2"	96
3/8"	81
No. 4	51
No. 8	33
No. 16	22
No. 30	16
No. 50	12
No. 100	9
No. 200	6.5

Asphalt Binder Content:	5.0%
Compacted Pill Bulk Gravity:	2.361
Theoretical Maximum Gravity:	2.460
Computed Air Voids:	4.0%

Construction Diary

Relevant Conditions for Construction

Completion Date:	Friday, June 23, 2000
24 Hour High Temperature (F):	98
24 Hour Low Temperature (F):	78
24 Hour Rainfall (in):	0.00
Lift Type:	dual
Design Thickness of Test Mix (in):	4.0

Plant Configuration and Placement Details

<u>Component:</u>	<u>% Setting:</u>
Liquid Binder Setting	4.9%
Gravel 1/2" Crushed Gravel	74.0%
Gravel 3/8" Crushed Gravel	10.0%
Limestone Modified 8910	16.0%

Approximate Length (ft):	102
Surveyed Thickness of Section (in):	3.9
Std Dev of Section Thickness (in):	0.1
Type of Tack Coat Utilized:	CQS-1h
Target Tack Application Rate:	0.03 gal / sy
Avg Mat Temperature Behind Paver (F):	326
Average Section Compaction:	93.3%

General Notes:

- 1) Mixes are listed chronologically in order of completion date (i.e., construction began with E2 and ended with E1).
- 2) Sections are referenced by quadrant and sequence number, where "E2" refers to section 2 of the east quadrant.
- 3) "dual" lift type indicates that the lower and upper lifts were constructed with the same experimental mix.
- 4) The total thickness of all experimental sections is 4 inches by design, with the exception of S8, S9, S10, S11.
- 5) ARZ, TRZ, and BRZ refer to gradations intended to pass above, through, and below the restricted zone.
- 6) SMA and OGFC refer to stone matrix asphalt and open-graded friction course, respectively.

Section S1 (Lower Layer)

Laboratory Diary

General Description of Mix and Materials

Design Method:	Superpave
Compactive Effort:	100 gyrations
Binder Performance Grade:	76-22
Modifier Type:	SBS
Aggregate Type:	Granite
Gradation Type:	BRZ

Avg. Lab Properties of Plant Produced Mix

<u>Sieve Size:</u>	<u>% Passing:</u>
1"	100
3/4"	97
1/2"	66
3/8"	48
No. 4	32
No. 8	24
No. 16	20
No. 30	16
No. 50	11
No. 100	7
No. 200	4.1

Asphalt Binder Content:	5.0%
Compacted Pill Bulk Gravity:	2.408
Theoretical Maximum Gravity:	2.484
Computed Air Voids:	3.1%

Construction Diary

Relevant Conditions for Construction

Completion Date:	Thursday, June 22, 2000
24 Hour High Temperature (F):	92
24 Hour Low Temperature (F):	75
24 Hour Rainfall (in):	0.00
Lift Type:	lower
Design Thickness of Test Mix (in):	2.5

Plant Configuration and Placement Details

<u>Component:</u>	<u>% Setting:</u>
Liquid Binder Setting	4.7%
Granite 6M	52.0%
Granite 789	20.0%
Granite Manufactured Sand	10.0%
Granite Regular Screenings	18.0%

Approximate Length (ft):	200
Surveyed Thickness of Section (in):	NA
Std Dev of Section Thickness (in):	NA
Type of Tack Coat Utilized:	CQS-1h
Target Tack Application Rate:	0.03 gal / sy
Avg Mat Temperature Behind Paver (F):	329
Average Section Compaction:	93.7%

General Notes:

- 1) Mixes are listed chronologically in order of completion date (i.e., construction began with E2 and ended with E1).
- 2) Sections are referenced by quadrant and sequence number, where "E2" refers to section 2 of the east quadrant.
- 3) "dual" lift type indicates that the lower and upper lifts were constructed with the same experimental mix.
- 4) The total thickness of all experimental sections is 4 inches by design, with the exception of S8, S9, S10, S11.
- 5) ARZ, TRZ, and BRZ refer to gradations intended to pass above, through, and below the restricted zone.
- 6) SMA and OGFC refer to stone matrix asphalt and open-graded friction course, respectively.

Section S1 (Upper Layer)

Laboratory Diary

General Description of Mix and Materials

Design Method:	Superpave
Compactive Effort:	100 gyrations
Binder Performance Grade:	76-22
Modifier Type:	SBS
Aggregate Type:	Granite
Gradation Type:	BRZ

Avg. Lab Properties of Plant Produced Mix

<u>Sieve Size:</u>	<u>% Passing:</u>
1"	100
3/4"	100
1/2"	95
3/8"	86
No. 4	54
No. 8	36
No. 16	28
No. 30	21
No. 50	15
No. 100	9
No. 200	5.5

Asphalt Binder Content:	5.0%
Compacted Pill Bulk Gravity:	2.378
Theoretical Maximum Gravity:	2.452
Computed Air Voids:	3.0%

Construction Diary

Relevant Conditions for Construction

Completion Date:	Monday, June 26, 2000
24 Hour High Temperature (F):	92
24 Hour Low Temperature (F):	75
24 Hour Rainfall (in):	0.00
Lift Type:	upper
Design Thickness of Test Mix (in):	4.0

Plant Configuration and Placement Details

<u>Component:</u>	<u>% Setting:</u>
Liquid Binder Setting	5.2%
Granite 6M	10.0%
Granite 789	53.0%
Granite Manufactured Sand	12.0%
Granite Regular Screenings	25.0%

Approximate Length (ft):	200
Surveyed Thickness of Section (in):	3.9
Std Dev of Section Thickness (in):	0.0
Type of Tack Coat Utilized:	CQS-1h
Target Tack Application Rate:	0.03 gal / sy
Avg Mat Temperature Behind Paver (F):	335
Average Section Compaction:	94.8%

General Notes:

- 1) Mixes are listed chronologically in order of completion date (i.e., construction began with E2 and ended with E1).
- 2) Sections are referenced by quadrant and sequence number, where "E2" refers to section 2 of the east quadrant.
- 3) "dual" lift type indicates that the lower and upper lifts were constructed with the same experimental mix.
- 4) The total thickness of all experimental sections is 4 inches by design, with the exception of S8, S9, S10, S11.
- 5) ARZ, TRZ, and BRZ refer to gradations intended to pass above, through, and below the restricted zone.
- 6) SMA and OGFC refer to stone matrix asphalt and open-graded friction course, respectively.

Section S2 (Lower Layer)

Laboratory Diary

General Description of Mix and Materials

Design Method:	Superpave
Compactive Effort:	100 gyrations
Binder Performance Grade:	76-22
Modifier Type:	SBS
Aggregate Type:	Gravel
Gradation Type:	BRZ

Avg. Lab Properties of Plant Produced Mix

<u>Sieve Size:</u>	<u>% Passing:</u>
1"	100
3/4"	100
1/2"	86
3/8"	69
No. 4	46
No. 8	30
No. 16	23
No. 30	19
No. 50	11
No. 100	7
No. 200	5.5

Asphalt Binder Content:	4.9%
Compacted Pile Bulk Gravity:	2.282
Theoretical Maximum Gravity:	2.388
Computed Air Voids:	4.4%

Construction Diary

Relevant Conditions for Construction

Completion Date:	Thursday, June 22, 2000
24 Hour High Temperature (F):	92
24 Hour Low Temperature (F):	75
24 Hour Rainfall (in):	0.00
Lift Type:	lower
Design Thickness of Test Mix (in):	2.5

Plant Configuration and Placement Details

<u>Component:</u>	<u>% Setting:</u>
Liquid Binder Setting	4.9%
Gravel 3/4" Crushed Gravel	38.0%
Gravel 3/8" Crushed Gravel	43.0%
Limestone Modified 8910	8.0%
Gravel Coarse Sand	10.0%
Antistrip Hydrated Lime	1.0%

Approximate Length (ft):	200
Surveyed Thickness of Section (in):	NA
Std Dev of Section Thickness (in):	NA
Type of Tack Coat Utilized:	CQS-1h
Target Tack Application Rate:	0.03 gal / sy
Avg Mat Temperature Behind Paver (F):	329
Average Section Compaction:	93.0%

General Notes:

- 1) Mixes are listed chronologically in order of completion date (i.e., construction began with E2 and ended with E1).
- 2) Sections are referenced by quadrant and sequence number, where "E2" refers to section 2 of the east quadrant.
- 3) "dual" lift type indicates that the lower and upper lifts were constructed with the same experimental mix.
- 4) The total thickness of all experimental sections is 4 inches by design, with the exception of S8, S9, S10, S11.
- 5) ARZ, TRZ, and BRZ refer to gradations intended to pass above, through, and below the restricted zone.
- 6) SMA and OGFC refer to stone matrix asphalt and open-graded friction course, respectively.

Section S2 (Upper Layer)

Laboratory Diary

General Description of Mix and Materials

Design Method:	Superpave
Compactive Effort:	100 gyrations
Binder Performance Grade:	76-22
Modifier Type:	SBS
Aggregate Type:	Gravel
Gradation Type:	BRZ

Avg. Lab Properties of Plant Produced Mix

<u>Sieve Size:</u>	<u>% Passing:</u>
1"	100
3/4"	100
1/2"	100
3/8"	96
No. 4	67
No. 8	41
No. 16	29
No. 30	22
No. 50	15
No. 100	10
No. 200	8.4

Asphalt Binder Content:	6.0%
Compacted Pile Bulk Gravity:	2.233
Theoretical Maximum Gravity:	2.342
Computed Air Voids:	4.7%

Construction Diary

Relevant Conditions for Construction

Completion Date:	Tuesday, June 27, 2000
24 Hour High Temperature (F):	92
24 Hour Low Temperature (F):	75
24 Hour Rainfall (in):	0.00
Lift Type:	upper
Design Thickness of Test Mix (in):	4.0

Plant Configuration and Placement Details

<u>Component:</u>	<u>% Setting:</u>
Liquid Binder Setting	6.3%
Gravel 1/2" Crushed Gravel	15.0%
Gravel 3/8" Crushed Gravel	72.0%
Agg Lime Agricultural Lime	5.0%
Gravel Coarse Sand	7.0%
Antistrip Hydrated Lime	1.0%

Approximate Length (ft):	200
Surveyed Thickness of Section (in):	3.9
Std Dev of Section Thickness (in):	0.0
Type of Tack Coat Utilized:	CQS-1h
Target Tack Application Rate:	0.03 gal / sy
Avg Mat Temperature Behind Paver (F):	325
Average Section Compaction:	93.8%

General Notes:

- 1) Mixes are listed chronologically in order of completion date (i.e., construction began with E2 and ended with E1).
- 2) Sections are referenced by quadrant and sequence number, where "E2" refers to section 2 of the east quadrant.
- 3) "dual" lift type indicates that the lower and upper lifts were constructed with the same experimental mix.
- 4) The total thickness of all experimental sections is 4 inches by design, with the exception of S8, S9, S10, S11.
- 5) ARZ, TRZ, and BRZ refer to gradations intended to pass above, through, and below the restricted zone.
- 6) SMA and OGFC refer to stone matrix asphalt and open-graded friction course, respectively.

Section S3 (Lower Layer)

Laboratory Diary

General Description of Mix and Materials

Design Method:	Superpave
Compactive Effort:	100 gyrations
Binder Performance Grade:	76-22
Modifier Type:	SBS
Aggregate Type:	Limestone
Gradation Type:	BRZ

Avg. Lab Properties of Plant Produced Mix

<u>Sieve Size:</u>	<u>% Passing:</u>
1"	100
3/4"	97
1/2"	86
3/8"	80
No. 4	47
No. 8	27
No. 16	20
No. 30	16
No. 50	12
No. 100	9
No. 200	7.3

Asphalt Binder Content:	4.2%
Compacted Pill Bulk Gravity:	2.461
Theoretical Maximum Gravity:	2.559
Computed Air Voids:	3.8%

Construction Diary

Relevant Conditions for Construction

Completion Date:	Monday, June 26, 2000
24 Hour High Temperature (F):	92
24 Hour Low Temperature (F):	75
24 Hour Rainfall (in):	0.00
Lift Type:	lower
Design Thickness of Test Mix (in):	2.5

Plant Configuration and Placement Details

<u>Component:</u>	<u>% Setting:</u>
Liquid Binder Setting	4.4%
Limestone 67	26.0%
Limestone Modified 8910	28.0%
Limestone 89	40.0%
Gravel Coarse Sand	5.0%
Antistrip Hydrated Lime	1.0%

Approximate Length (ft):	201
Surveyed Thickness of Section (in):	NA
Std Dev of Section Thickness (in):	NA
Type of Tack Coat Utilized:	CQS-1h
Target Tack Application Rate:	0.03 gal / sy
Avg Mat Temperature Behind Paver (F):	332
Average Section Compaction:	92.8%

General Notes:

- 1) Mixes are listed chronologically in order of completion date (i.e., construction began with E2 and ended with E1).
- 2) Sections are referenced by quadrant and sequence number, where "E2" refers to section 2 of the east quadrant.
- 3) "dual" lift type indicates that the lower and upper lifts were constructed with the same experimental mix.
- 4) The total thickness of all experimental sections is 4 inches by design, with the exception of S8, S9, S10, S11.
- 5) ARZ, TRZ, and BRZ refer to gradations intended to pass above, through, and below the restricted zone.
- 6) SMA and OGFC refer to stone matrix asphalt and open-graded friction course, respectively.

Section S3 (Upper Layer)

Laboratory Diary

General Description of Mix and Materials

Design Method:	Superpave
Compactive Effort:	100 gyrations
Binder Performance Grade:	76-22
Modifier Type:	SBS
Aggregate Type:	Lms/gravel
Gradation Type:	BRZ

Avg. Lab Properties of Plant Produced Mix

<u>Sieve Size:</u>	<u>% Passing:</u>
1"	100
3/4"	100
1/2"	100
3/8"	100
No. 4	70
No. 8	43
No. 16	29
No. 30	21
No. 50	15
No. 100	11
No. 200	8.9

Asphalt Binder Content:	5.6%
Compacted Pill Bulk Gravity:	2.329
Theoretical Maximum Gravity:	2.414
Computed Air Voids:	3.5%

Construction Diary

Relevant Conditions for Construction

Completion Date:	Thursday, July 06, 2000
24 Hour High Temperature (F):	98
24 Hour Low Temperature (F):	78
24 Hour Rainfall (in):	0.00
Lift Type:	upper
Design Thickness of Test Mix (in):	4.0

Plant Configuration and Placement Details

<u>Component:</u>	<u>% Setting:</u>
Liquid Binder Setting	5.9%
Gravel 3/8" Crushed Gravel	47.0%
Limestone Modified 8910	34.0%
Limestone 89	14.0%
Gravel Coarse Sand	4.0%
Antistrip Hydrated Lime	1.0%

Approximate Length (ft):	201
Surveyed Thickness of Section (in):	4.0
Std Dev of Section Thickness (in):	0.1
Type of Tack Coat Utilized:	CQS-1h
Target Tack Application Rate:	0.03 gal / sy
Avg Mat Temperature Behind Paver (F):	316
Average Section Compaction:	92.7%

General Notes:

- 1) Mixes are listed chronologically in order of completion date (i.e., construction began with E2 and ended with E1).
- 2) Sections are referenced by quadrant and sequence number, where "E2" refers to section 2 of the east quadrant.
- 3) "dual" lift type indicates that the lower and upper lifts were constructed with the same experimental mix.
- 4) The total thickness of all experimental sections is 4 inches by design, with the exception of S8, S9, S10, S11.
- 5) ARZ, TRZ, and BRZ refer to gradations intended to pass above, through, and below the restricted zone.
- 6) SMA and OGFC refer to stone matrix asphalt and open-graded friction course, respectively.

Section S4 (Lower Layer)

Laboratory Diary

General Description of Mix and Materials

Design Method:	Superpave
Compactive Effort:	100 gyrations
Binder Performance Grade:	76-22
Modifier Type:	SBS
Aggregate Type:	Lms/RAP
Gradation Type:	ARZ

Avg. Lab Properties of Plant Produced Mix

<u>Sieve Size:</u>	<u>% Passing:</u>
1"	100
3/4"	99
1/2"	88
3/8"	69
No. 4	48
No. 8	38
No. 16	30
No. 30	24
No. 50	15
No. 100	9
No. 200	6.5

Asphalt Binder Content:	4.1%
Compacted Pill Bulk Gravity:	2.466
Theoretical Maximum Gravity:	2.567
Computed Air Voids:	3.9%

Construction Diary

Relevant Conditions for Construction

Completion Date:	Wednesday, July 05, 2000
24 Hour High Temperature (F):	96
24 Hour Low Temperature (F):	71
24 Hour Rainfall (in):	0.00
Lift Type:	lower
Design Thickness of Test Mix (in):	2.5

Plant Configuration and Placement Details

<u>Component:</u>	<u>% Setting:</u>
Liquid Binder Setting	4.3%
Limestone 6	30.0%
Limestone 78	25.0%
Sand Manufactured	20.0%
Sand Natural	15.0%
Recycle RAP	10.0%

Approximate Length (ft):	198
Surveyed Thickness of Section (in):	NA
Std Dev of Section Thickness (in):	NA
Type of Tack Coat Utilized:	CQS-1h
Target Tack Application Rate:	0.03 gal / sy
Avg Mat Temperature Behind Paver (F):	322
Average Section Compaction:	93.6%

General Notes:

- 1) Mixes are listed chronologically in order of completion date (i.e., construction began with E2 and ended with E1).
- 2) Sections are referenced by quadrant and sequence number, where "E2" refers to section 2 of the east quadrant.
- 3) "dual" lift type indicates that the lower and upper lifts were constructed with the same experimental mix.
- 4) The total thickness of all experimental sections is 4 inches by design, with the exception of S8, S9, S10, S11.
- 5) ARZ, TRZ, and BRZ refer to gradations intended to pass above, through, and below the restricted zone.
- 6) SMA and OGFC refer to stone matrix asphalt and open-graded friction course, respectively.

Section S4 (Upper Layer)

Laboratory Diary

General Description of Mix and Materials

Design Method:	Superpave
Compactive Effort:	100 gyrations
Binder Performance Grade:	76-22
Modifier Type:	SBS
Aggregate Type:	Limestone
Gradation Type:	ARZ

Avg. Lab Properties of Plant Produced Mix

<u>Sieve Size:</u>	<u>% Passing:</u>
1"	100
3/4"	100
1/2"	98
3/8"	88
No. 4	63
No. 8	46
No. 16	33
No. 30	23
No. 50	13
No. 100	9
No. 200	7.8

Asphalt Binder Content:	5.3%
Compacted Pill Bulk Gravity:	2.394
Theoretical Maximum Gravity:	2.449
Computed Air Voids:	2.2%

Construction Diary

Relevant Conditions for Construction

Completion Date:	Thursday, July 06, 2000
24 Hour High Temperature (F):	98
24 Hour Low Temperature (F):	78
24 Hour Rainfall (in):	0.00
Lift Type:	upper
Design Thickness of Test Mix (in):	4.0

Plant Configuration and Placement Details

<u>Component:</u>	<u>% Setting:</u>
Liquid Binder Setting	5.3%
Limestone 10's (Hard)	15.0%
Limestone 10's (Soft)	10.0%
Limestone 5/8 D Rock	45.0%
Sand Manufactured	15.0%
Sand Natural	15.0%

Approximate Length (ft):	198
Surveyed Thickness of Section (in):	4.0
Std Dev of Section Thickness (in):	0.1
Type of Tack Coat Utilized:	CQS-1h
Target Tack Application Rate:	0.03 gal / sy
Avg Mat Temperature Behind Paver (F):	322
Average Section Compaction:	94.3%

General Notes:

- 1) Mixes are listed chronologically in order of completion date (i.e., construction began with E2 and ended with E1).
- 2) Sections are referenced by quadrant and sequence number, where "E2" refers to section 2 of the east quadrant.
- 3) "dual" lift type indicates that the lower and upper lifts were constructed with the same experimental mix.
- 4) The total thickness of all experimental sections is 4 inches by design, with the exception of S8, S9, S10, S11.
- 5) ARZ, TRZ, and BRZ refer to gradations intended to pass above, through, and below the restricted zone.
- 6) SMA and OGFC refer to stone matrix asphalt and open-graded friction course, respectively.

Section S5 (Lower Layer)

Laboratory Diary

General Description of Mix and Materials

Design Method: Superpave
 Compactive Effort: 100 gyrations
 Binder Performance Grade: 76-22
 Modifier Type: SBS
 Aggregate Type: Lms/Gravel/RAP
 Gradation Type: BRZ

Avg. Lab Properties of Plant Produced Mix

<u>Sieve Size:</u>	<u>% Passing:</u>
1"	100
3/4"	95
1/2"	83
3/8"	73
No. 4	53
No. 8	36
No. 16	27
No. 30	21
No. 50	15
No. 100	12
No. 200	8.7

Asphalt Binder Content: 4.0%
 Compacted Pill Bulk Gravity: 2.369
 Theoretical Maximum Gravity: 2.446
 Computed Air Voids: 3.1%

Construction Diary

Relevant Conditions for Construction

Completion Date: Wednesday, July 05, 2000
 24 Hour High Temperature (F): 96
 24 Hour Low Temperature (F): 76
 24 Hour Rainfall (in): 0.00
 Lift Type: lower
 Design Thickness of Test Mix (in): 2.5

Plant Configuration and Placement Details

<u>Component:</u>	<u>% Setting:</u>
Liquid Binder Setting	4.6%
Gravel 10	14.0%
Gravel 57	33.0%
Gravel 7	26.0%
Sand Manufactured	15.0%
Recycle RAP	12.0%

Approximate Length (ft): 203
 Surveyed Thickness of Section (in): NA
 Std Dev of Section Thickness (in): NA
 Type of Tack Coat Utilized: CQS-1h
 Target Tack Application Rate: 0.03 gal / sy
 Avg Mat Temperature Behind Paver (F): 331
 Average Section Compaction: 91.5%

General Notes:

- 1) Mixes are listed chronologically in order of completion date (i.e., construction began with E2 and ended with E1).
- 2) Sections are referenced by quadrant and sequence number, where "E2" refers to section 2 of the east quadrant.
- 3) "dual" lift type indicates that the lower and upper lifts were constructed with the same experimental mix.
- 4) The total thickness of all experimental sections is 4 inches by design, with the exception of S8, S9, S10, S11.
- 5) ARZ, TRZ, and BRZ refer to gradations intended to pass above, through, and below the restricted zone.
- 6) SMA and OGFC refer to stone matrix asphalt and open-graded friction course, respectively.

Section S5 (Upper Layer)

Laboratory Diary

General Description of Mix and Materials

Design Method:	Superpave
Compactive Effort:	100 gyrations
Binder Performance Grade:	76-22
Modifier Type:	SBS
Aggregate Type:	Gravel
Gradation Type:	TRZ

Avg. Lab Properties of Plant Produced Mix

<u>Sieve Size:</u>	<u>% Passing:</u>
1"	100
3/4"	100
1/2"	95
3/8"	82
No. 4	61
No. 8	45
No. 16	33
No. 30	22
No. 50	10
No. 100	7
No. 200	5.0

Asphalt Binder Content:	5.6%
Compacted Pill Bulk Gravity:	2.332
Theoretical Maximum Gravity:	2.413
Computed Air Voids:	3.4%

Construction Diary

Relevant Conditions for Construction

Completion Date:	Friday, July 07, 2000
24 Hour High Temperature (F):	100
24 Hour Low Temperature (F):	79
24 Hour Rainfall (in):	0.00
Lift Type:	upper
Design Thickness of Test Mix (in):	4.0

Plant Configuration and Placement Details

<u>Component:</u>	<u>% Setting:</u>
Liquid Binder Setting	5.5%
Gravel 10	21.0%
Gravel 5/8 D Rock	60.0%
Sand Natural	19.0%

Approximate Length (ft):	203
Surveyed Thickness of Section (in):	4.1
Std Dev of Section Thickness (in):	0.1
Type of Tack Coat Utilized:	CQS-1h
Target Tack Application Rate:	0.03 gal / sy
Avg Mat Temperature Behind Paver (F):	323
Average Section Compaction:	94.9%

General Notes:

- 1) Mixes are listed chronologically in order of completion date (i.e., construction began with E2 and ended with E1).
- 2) Sections are referenced by quadrant and sequence number, where "E2" refers to section 2 of the east quadrant.
- 3) "dual" lift type indicates that the lower and upper lifts were constructed with the same experimental mix.
- 4) The total thickness of all experimental sections is 4 inches by design, with the exception of S8, S9, S10, S11.
- 5) ARZ, TRZ, and BRZ refer to gradations intended to pass above, through, and below the restricted zone.
- 6) SMA and OGFC refer to stone matrix asphalt and open-graded friction course, respectively.

Section S6

Laboratory Diary

General Description of Mix and Materials

Design Method: Superpave
 Compactive Effort: 100 gyrations
 Binder Performance Grade: 67-22
 Modifier Type: NA
 Aggregate Type: Lms/RAP
 Gradation Type: ARZ

Avg. Lab Properties of Plant Produced Mix

<u>Sieve Size:</u>	<u>% Passing:</u>
1"	100
3/4"	100
1/2"	95
3/8"	87
No. 4	74
No. 8	53
No. 16	41
No. 30	33
No. 50	24
No. 100	12
No. 200	5.9

Asphalt Binder Content: 6.2%
 Compacted Pill Bulk Gravity: 2.250
 Theoretical Maximum Gravity: 2.356
 Computed Air Voids: 4.5%

Construction Diary

Relevant Conditions for Construction

Completion Date: Friday, July 07, 2000
 24 Hour High Temperature (F): 100
 24 Hour Low Temperature (F): 79
 24 Hour Rainfall (in): 0.00
 Lift Type: dual
 Design Thickness of Test Mix (in): 4.0

Plant Configuration and Placement Details

<u>Component:</u>	<u>% Setting:</u>
Liquid Binder Setting	6.6%
Limestone C22 Screenings	45.0%
Limestone 78	20.0%
Limestone 9	20.0%
Recycle RAP	15.0%

Approximate Length (ft): 198
 Surveyed Thickness of Section (in): 4.1
 Std Dev of Section Thickness (in): 0.1
 Type of Tack Coat Utilized: CQS-1h
 Target Tack Application Rate: 0.03 gal / sy
 Avg Mat Temperature Behind Paver (F): 332
 Average Section Compaction: 92.9%

General Notes:

- 1) Mixes are listed chronologically in order of completion date (i.e., construction began with E2 and ended with E1).
- 2) Sections are referenced by quadrant and sequence number, where "E2" refers to section 2 of the east quadrant.
- 3) "dual" lift type indicates that the lower and upper lifts were constructed with the same experimental mix.
- 4) The total thickness of all experimental sections is 4 inches by design, with the exception of S8, S9, S10, S11.
- 5) ARZ, TRZ, and BRZ refer to gradations intended to pass above, through, and below the restricted zone.
- 6) SMA and OGFC refer to stone matrix asphalt and open-graded friction course, respectively.

Section S7

Laboratory Diary

General Description of Mix and Materials

Design Method:	Superpave
Compactive Effort:	100 gyrations
Binder Performance Grade:	67-22
Modifier Type:	NA
Aggregate Type:	Lms/RAP
Gradation Type:	BRZ

Avg. Lab Properties of Plant Produced Mix

<u>Sieve Size:</u>	<u>% Passing:</u>
1"	100
3/4"	100
1/2"	96
3/8"	88
No. 4	71
No. 8	34
No. 16	25
No. 30	20
No. 50	16
No. 100	10
No. 200	6.2

Asphalt Binder Content:	6.6%
Compacted Pill Bulk Gravity:	2.245
Theoretical Maximum Gravity:	2.321
Computed Air Voids:	3.3%

Construction Diary

Relevant Conditions for Construction

Completion Date:	Saturday, July 08, 2000
24 Hour High Temperature (F):	100
24 Hour Low Temperature (F):	79
24 Hour Rainfall (in):	0.00
Lift Type:	dual
Design Thickness of Test Mix (in):	4.0

Plant Configuration and Placement Details

<u>Component:</u>	<u>% Setting:</u>
Liquid Binder Setting	6.9%
Limestone C20 Screenings	16.0%
Limestone 78	20.0%
Limestone 9	51.0%
Recycle RAP	13.0%

Approximate Length (ft):	202
Surveyed Thickness of Section (in):	4.0
Std Dev of Section Thickness (in):	0.1
Type of Tack Coat Utilized:	CQS-1h
Target Tack Application Rate:	0.03 gal / sy
Avg Mat Temperature Behind Paver (F):	313
Average Section Compaction:	93.2%

General Notes:

- 1) Mixes are listed chronologically in order of completion date (i.e., construction began with E2 and ended with E1).
- 2) Sections are referenced by quadrant and sequence number, where "E2" refers to section 2 of the east quadrant.
- 3) "dual" lift type indicates that the lower and upper lifts were constructed with the same experimental mix.
- 4) The total thickness of all experimental sections is 4 inches by design, with the exception of S8, S9, S10, S11.
- 5) ARZ, TRZ, and BRZ refer to gradations intended to pass above, through, and below the restricted zone.
- 6) SMA and OGFC refer to stone matrix asphalt and open-graded friction course, respectively.

Section S8 (Lower Layer)

Laboratory Diary

General Description of Mix and Materials

Design Method:	Superpave
Compactive Effort:	100 gyrations
Binder Performance Grade:	67-22
Modifier Type:	NA
Aggregate Type:	Granite
Gradation Type:	BRZ

Avg. Lab Properties of Plant Produced Mix

<u>Sieve Size:</u>	<u>% Passing:</u>
1"	100
3/4"	100
1/2"	87
3/8"	70
No. 4	39
No. 8	26
No. 16	18
No. 30	14
No. 50	12
No. 100	10
No. 200	7.1

Asphalt Binder Content:	3.7%
Compacted Pile Bulk Gravity:	2.598
Theoretical Maximum Gravity:	2.667
Computed Air Voids:	2.6%

Construction Diary

Relevant Conditions for Construction

Completion Date:	Friday, July 07, 2000
24 Hour High Temperature (F):	100
24 Hour Low Temperature (F):	79
24 Hour Rainfall (in):	0.00
Lift Type:	lower
Design Thickness of Test Mix (in):	2.0

Plant Configuration and Placement Details

<u>Component:</u>	<u>% Setting:</u>
Liquid Binder Setting	3.9%
Granite 67	32.0%
Granite 78M	41.0%
Granite Manufactured Sand	21.0%
Granite Regular Screenings	5.0%
Antistrip Hydrated Lime	1.0%

Approximate Length (ft):	197
Surveyed Thickness of Section (in):	NA
Std Dev of Section Thickness (in):	NA
Type of Tack Coat Utilized:	CQS-1h
Target Tack Application Rate:	0.03 gal / sy
Avg Mat Temperature Behind Paver (F):	331
Average Section Compaction:	93.8%

General Notes:

- 1) Mixes are listed chronologically in order of completion date (i.e., construction began with E2 and ended with E1).
- 2) Sections are referenced by quadrant and sequence number, where "E2" refers to section 2 of the east quadrant.
- 3) "dual" lift type indicates that the lower and upper lifts were constructed with the same experimental mix.
- 4) The total thickness of all experimental sections is 4 inches by design, with the exception of S8, S9, S10, S11.
- 5) ARZ, TRZ, and BRZ refer to gradations intended to pass above, through, and below the restricted zone.
- 6) SMA and OGFC refer to stone matrix asphalt and open-graded friction course, respectively.

Section S8 (Upper Layer)

Laboratory Diary

General Description of Mix and Materials

Design Method:	Superpave
Compactive Effort:	100 gyrations
Binder Performance Grade:	76-22
Modifier Type:	SBS
Aggregate Type:	Granite
Gradation Type:	BRZ

Avg. Lab Properties of Plant Produced Mix

<u>Sieve Size:</u>	<u>% Passing:</u>
1"	100
3/4"	100
1/2"	100
3/8"	93
No. 4	58
No. 8	38
No. 16	25
No. 30	19
No. 50	15
No. 100	12
No. 200	7.8

Asphalt Binder Content:	4.2%
Compacted Pill Bulk Gravity:	2.576
Theoretical Maximum Gravity:	2.647
Computed Air Voids:	2.7%

Construction Diary

Relevant Conditions for Construction

Completion Date:	Saturday, July 08, 2000
24 Hour High Temperature (F):	103
24 Hour Low Temperature (F):	79
24 Hour Rainfall (in):	0.00
Lift Type:	upper
Design Thickness of Test Mix (in):	3.6

Plant Configuration and Placement Details

<u>Component:</u>	<u>% Setting:</u>
Liquid Binder Setting	4.2%
Granite 78M	49.0%
Granite Manufactured Sand	45.0%
Granite Regular Screenings	5.0%
Antistrip Hydrated Lime	1.0%

Approximate Length (ft):	197
Surveyed Thickness of Section (in):	3.8
Std Dev of Section Thickness (in):	0.1
Type of Tack Coat Utilized:	CQS-1h
Target Tack Application Rate:	0.03 gal / sy
Avg Mat Temperature Behind Paver (F):	322
Average Section Compaction:	91.8%

General Notes:

- 1) Mixes are listed chronologically in order of completion date (i.e., construction began with E2 and ended with E1).
- 2) Sections are referenced by quadrant and sequence number, where "E2" refers to section 2 of the east quadrant.
- 3) "dual" lift type indicates that the lower and upper lifts were constructed with the same experimental mix.
- 4) The total thickness of all experimental sections is 4 inches by design, with the exception of S8, S9, S10, S11.
- 5) ARZ, TRZ, and BRZ refer to gradations intended to pass above, through, and below the restricted zone.
- 6) SMA and OGFC refer to stone matrix asphalt and open-graded friction course, respectively.

Section S9

Laboratory Diary

General Description of Mix and Materials

Design Method:	Superpave
Compactive Effort:	100 gyrations
Binder Performance Grade:	67-22
Modifier Type:	NA
Aggregate Type:	Granite
Gradation Type:	BRZ

Avg. Lab Properties of Plant Produced Mix

<u>Sieve Size:</u>	<u>% Passing:</u>
1"	100
3/4"	100
1/2"	93
3/8"	82
No. 4	53
No. 8	36
No. 16	27
No. 30	20
No. 50	14
No. 100	9
No. 200	5.7

Asphalt Binder Content:	4.7%
Compacted Pili Bulk Gravity:	2.419
Theoretical Maximum Gravity:	2.510
Computed Air Voids:	3.6%

Construction Diary

Relevant Conditions for Construction

Completion Date:	Monday, July 10, 2000
24 Hour High Temperature (F):	101
24 Hour Low Temperature (F):	75
24 Hour Rainfall (in):	0.00
Lift Type:	dual
Design Thickness of Test Mix (in):	3.0

Plant Configuration and Placement Details

<u>Component:</u>	<u>% Setting:</u>
Liquid Binder Setting	4.8%
Granite 67	15.0%
Granite 78M	47.0%
Granite Dry Screenings	20.0%
Granite Washed Screenings	18.0%

Approximate Length (ft):	206
Surveyed Thickness of Section (in):	3.0
Std Dev of Section Thickness (in):	0.1
Type of Tack Coat Utilized:	CQS-1h
Target Tack Application Rate:	0.03 gal / sy
Avg Mat Temperature Behind Paver (F):	331
Average Section Compaction:	93.4%

General Notes:

- 1) Mixes are listed chronologically in order of completion date (i.e., construction began with E2 and ended with E1).
- 2) Sections are referenced by quadrant and sequence number, where "E2" refers to section 2 of the east quadrant.
- 3) "dual" lift type indicates that the lower and upper lifts were constructed with the same experimental mix.
- 4) The total thickness of all experimental sections is 4 inches by design, with the exception of S8, S9, S10, S11.
- 5) ARZ, TRZ, and BRZ refer to gradations intended to pass above, through, and below the restricted zone.
- 6) SMA and OGFC refer to stone matrix asphalt and open-graded friction course, respectively.

Section S10

Laboratory Diary

General Description of Mix and Materials

Design Method:	Superpave
Compactive Effort:	100 gyrations
Binder Performance Grade:	67-22
Modifier Type:	NA
Aggregate Type:	Granite
Gradation Type:	ARZ

Avg. Lab Properties of Plant Produced Mix

<u>Sieve Size:</u>	<u>% Passing:</u>
1"	100
3/4"	100
1/2"	95
3/8"	88
No. 4	69
No. 8	52
No. 16	38
No. 30	27
No. 50	19
No. 100	11
No. 200	6.6

Asphalt Binder Content:	5.2%
Compacted Pill Bulk Gravity:	2.407
Theoretical Maximum Gravity:	2.488
Computed Air Voids:	3.2%

Construction Diary

Relevant Conditions for Construction

Completion Date:	Tuesday, July 11, 2000
24 Hour High Temperature (F):	98
24 Hour Low Temperature (F):	78
24 Hour Rainfall (in):	0.00
Lift Type:	dual
Design Thickness of Test Mix (in):	3.0

Plant Configuration and Placement Details

<u>Component:</u>	<u>% Setting:</u>
Liquid Binder Setting	5.3%
Granite 67	11.0%
Granite 78M	25.0%
Granite Dry Screenings	32.0%
Granite Washed Screenings	32.0%

Approximate Length (ft):	195
Surveyed Thickness of Section (in):	3.1
Std Dev of Section Thickness (in):	0.1
Type of Tack Coat Utilized:	CQS-1h
Target Tack Application Rate:	0.03 gal / sy
Avg Mat Temperature Behind Paver (F):	300
Average Section Compaction:	93.7%

General Notes:

- 1) Mixes are listed chronologically in order of completion date (i.e., construction began with E2 and ended with E1).
- 2) Sections are referenced by quadrant and sequence number, where "E2" refers to section 2 of the east quadrant.
- 3) "dual" lift type indicates that the lower and upper lifts were constructed with the same experimental mix.
- 4) The total thickness of all experimental sections is 4 inches by design, with the exception of S8, S9, S10, S11.
- 5) ARZ, TRZ, and BRZ refer to gradations intended to pass above, through, and below the restricted zone.
- 6) SMA and OGFC refer to stone matrix asphalt and open-graded friction course, respectively.

Section S11 (Lower Layer)

Laboratory Diary

General Description of Mix and Materials

Design Method:	Superpave
Compactive Effort:	100 gyrations
Binder Performance Grade:	67-22
Modifier Type:	NA
Aggregate Type:	Granite
Gradation Type:	BRZ

Avg. Lab Properties of Plant Produced Mix

<u>Sieve Size:</u>	<u>% Passing:</u>
1"	100
3/4"	100
1/2"	86
3/8"	70
No. 4	38
No. 8	26
No. 16	18
No. 30	14
No. 50	12
No. 100	10
No. 200	7.2

Asphalt Binder Content:	3.6%
Compacted Pill Bulk Gravity:	2.600
Theoretical Maximum Gravity:	2.662
Computed Air Voids:	2.3%

Construction Diary

Relevant Conditions for Construction

Completion Date:	Monday, July 10, 2000
24 Hour High Temperature (F):	101
24 Hour Low Temperature (F):	75
24 Hour Rainfall (in):	0.00
Lift Type:	lower
Design Thickness of Test Mix (in):	2.0

Plant Configuration and Placement Details

<u>Component:</u>	<u>% Setting:</u>
Liquid Binder Setting	3.9%
Granite 67	37.0%
Granite 78M	41.0%
Granite Manufactured Sand	16.0%
Granite Regular Screenings	5.0%
Antistrip Hydrated Lime	1.0%

Approximate Length (ft):	202
Surveyed Thickness of Section (in):	NA
Std Dev of Section Thickness (in):	NA
Type of Tack Coat Utilized:	CQS-1h
Target Tack Application Rate:	0.03 gal / sy
Avg Mat Temperature Behind Paver (F):	324
Average Section Compaction:	94.6%

General Notes:

- 1) Mixes are listed chronologically in order of completion date (i.e., construction began with E2 and ended with E1).
- 2) Sections are referenced by quadrant and sequence number, where "E2" refers to section 2 of the east quadrant.
- 3) "dual" lift type indicates that the lower and upper lifts were constructed with the same experimental mix.
- 4) The total thickness of all experimental sections is 4 inches by design, with the exception of S8, S9, S10, S11.
- 5) ARZ, TRZ, and BRZ refer to gradations intended to pass above, through, and below the restricted zone.
- 6) SMA and OGFC refer to stone matrix asphalt and open-graded friction course, respectively.

Section S11 (Upper Layer)

Laboratory Diary

General Description of Mix and Materials

Design Method:	Superpave
Compactive Effort:	100 gyrations
Binder Performance Grade:	76-22
Modifier Type:	SBS
Aggregate Type:	Granite
Gradation Type:	BRZ

Avg. Lab Properties of Plant Produced Mix

<u>Sieve Size:</u>	<u>% Passing:</u>
1"	100
3/4"	100
1/2"	100
3/8"	92
No. 4	62
No. 8	47
No. 16	30
No. 30	22
No. 50	17
No. 100	13
No. 200	7.5

Asphalt Binder Content:	3.9%
Compacted Pile Bulk Gravity:	2.567
Theoretical Maximum Gravity:	2.649
Computed Air Voids:	3.1%

Construction Diary

Relevant Conditions for Construction

Completion Date:	Wednesday, July 12, 2000
24 Hour High Temperature (F):	101
24 Hour Low Temperature (F):	79
24 Hour Rainfall (in):	0.00
Lift Type:	upper
Design Thickness of Test Mix (in):	3.6

Plant Configuration and Placement Details

<u>Component:</u>	<u>% Setting:</u>
Liquid Binder Setting	4.2%
Granite 78M	49.0%
Granite Manufacture Sand	45.0%
Granite Regular Screenings	5.0%
Antistrip Hydrated Lime	1.0%

Approximate Length (ft):	202
Surveyed Thickness of Section (in):	3.6
Std Dev of Section Thickness (in):	0.1
Type of Tack Coat Utilized:	CQS-1h
Target Tack Application Rate:	0.03 gal / sy
Avg Mat Temperature Behind Paver (F):	334
Average Section Compaction:	93.2%

General Notes:

- 1) Mixes are listed chronologically in order of completion date (i.e., construction began with E2 and ended with E1).
- 2) Sections are referenced by quadrant and sequence number, where "E2" refers to section 2 of the east quadrant.
- 3) "dual" lift type indicates that the lower and upper lifts were constructed with the same experimental mix.
- 4) The total thickness of all experimental sections is 4 inches by design, with the exception of S8, S9, S10, S11.
- 5) ARZ, TRZ, and BRZ refer to gradations intended to pass above, through, and below the restricted zone.
- 6) SMA and OGFC refer to stone matrix asphalt and open-graded friction course, respectively.

Section S12

Laboratory Diary

General Description of Mix and Materials

Design Method:	Hveem
Compactive Effort:	NA
Binder Performance Grade:	70-28
Modifier Type:	SB
Aggregate Type:	Limestone
Gradation Type:	TRZ

Avg. Lab Properties of Plant Produced Mix

<u>Sieve Size:</u>	<u>% Passing:</u>
1"	100
3/4"	100
1/2"	97
3/8"	82
No. 4	63
No. 8	46
No. 16	32
No. 30	23
No. 50	16
No. 100	10
No. 200	7.0

Asphalt Binder Content:	4.5%
Compacted Pill Bulk Gravity:	2.399
Theoretical Maximum Gravity:	2.494
Computed Air Voids:	3.8%

Construction Diary

Relevant Conditions for Construction

Completion Date:	Thursday, July 13, 2000
24 Hour High Temperature (F):	100
24 Hour Low Temperature (F):	79
24 Hour Rainfall (in):	0.67
Lift Type:	dual
Design Thickness of Test Mix (in):	4.0

Plant Configuration and Placement Details

<u>Component:</u>	<u>% Setting:</u>
Liquid Binder Setting	4.7%
Limestone 5/8" Chips	35.0%
Limestone Coarse Screenings	32.0%
Sand Natural	8.0%
Sand Stone Sand	25.0%

Approximate Length (ft):	199
Surveyed Thickness of Section (in):	3.8
Std Dev of Section Thickness (in):	0.1
Type of Tack Coat Utilized:	CQS-1h
Target Tack Application Rate:	0.03 gal / sy
Avg Mat Temperature Behind Paver (F):	318
Average Section Compaction:	93.9%

General Notes:

- 1) Mixes are listed chronologically in order of completion date (i.e., construction began with E2 and ended with E1).
- 2) Sections are referenced by quadrant and sequence number, where "E2" refers to section 2 of the east quadrant.
- 3) "dual" lift type indicates that the lower and upper lifts were constructed with the same experimental mix.
- 4) The total thickness of all experimental sections is 4 inches by design, with the exception of S8, S9, S10, S11.
- 5) ARZ, TRZ, and BRZ refer to gradations intended to pass above, through, and below the restricted zone.
- 6) SMA and OGFC refer to stone matrix asphalt and open-graded friction course, respectively.

Section S13

Laboratory Diary

General Description of Mix and Materials

Design Method:	Superpave
Compactive Effort:	100 gyrations
Binder Performance Grade:	70-28
Modifier Type:	SB
Aggregate Type:	Granite
Gradation Type:	ARZ

Avg. Lab Properties of Plant Produced Mix

<u>Sieve Size:</u>	<u>% Passing:</u>
1"	100
3/4"	100
1/2"	93
3/8"	80
No. 4	68
No. 8	50
No. 16	37
No. 30	27
No. 50	19
No. 100	11
No. 200	6.6

Asphalt Binder Content:	5.3%
Compacted Pill Bulk Gravity:	2.290
Theoretical Maximum Gravity:	2.405
Computed Air Voids:	4.8%

Construction Diary

Relevant Conditions for Construction

Completion Date:	Thursday, July 13, 2000
24 Hour High Temperature (F):	100
24 Hour Low Temperature (F):	79
24 Hour Rainfall (in):	0.67
Lift Type:	dual
Design Thickness of Test Mix (in):	4.0

Plant Configuration and Placement Details

<u>Component:</u>	<u>% Setting:</u>
Liquid Binder Setting	5.3%
Granite 1/2" Chips	16.0%
Granite 3/4" Chips	22.0%
Granite Regular Screenings	22.0%
Sand Manufactured	40.0%

Approximate Length (ft):	201
Surveyed Thickness of Section (in):	4.0
Std Dev of Section Thickness (in):	0.1
Type of Tack Coat Utilized:	CQS-1h
Target Tack Application Rate:	0.03 gal / sy
Avg Mat Temperature Behind Paver (F):	322
Average Section Compaction:	93.4%

General Notes:

- 1) Mixes are listed chronologically in order of completion date (i.e., construction began with E2 and ended with E1).
- 2) Sections are referenced by quadrant and sequence number, where "E2" refers to section 2 of the east quadrant.
- 3) "dual" lift type indicates that the lower and upper lifts were constructed with the same experimental mix.
- 4) The total thickness of all experimental sections is 4 inches by design, with the exception of S8, S9, S10, S11.
- 5) ARZ, TRZ, and BRZ refer to gradations intended to pass above, through, and below the restricted zone.
- 6) SMA and OGFC refer to stone matrix asphalt and open-graded friction course, respectively.

Section E1

Laboratory Diary

General Description of Mix and Materials

Design Method:	Superpave
Compactive Effort:	100 gyrations
Binder Performance Grade:	67-22
Modifier Type:	NA
Aggregate Type:	Quartzite
Gradation Type:	ARZ

Avg. Lab Properties of Plant Produced Mix

<u>Sieve Size:</u>	<u>% Passing:</u>
1"	100
3/4"	100
1/2"	99
3/8"	92
No. 4	73
No. 8	54
No. 16	38
No. 30	25
No. 50	14
No. 100	9
No. 200	7.4

Asphalt Binder Content:	5.3%
Compacted Pill Bulk Gravity:	2.363
Theoretical Maximum Gravity:	2.444
Computed Air Voids:	3.3%

Construction Diary

Relevant Conditions for Construction

Completion Date:	Friday, July 14, 2000
24 Hour High Temperature (F):	100
24 Hour Low Temperature (F):	80
24 Hour Rainfall (in):	0.00
Lift Type:	dual
Design Thickness of Test Mix (in):	4.0

Plant Configuration and Placement Details

<u>Component:</u>	<u>% Setting:</u>
Liquid Binder Setting	5.3%
Gravel 1/2" Crushed Gravel	36.0%
Gravel 3/8" Crushed Gravel	18.0%
Limestone Manufactured Sand	30.0%
Sand Natural	13.0%
Filler Fly Ash	3.0%

Approximate Length (ft):	199
Surveyed Thickness of Section (in):	4.1
Std Dev of Section Thickness (in):	0.1
Type of Tack Coat Utilized:	CQS-1h
Target Tack Application Rate:	0.03 gal / sy
Avg Mat Temperature Behind Paver (F):	303
Average Section Compaction:	94.0%

General Notes:

- 1) Mixes are listed chronologically in order of completion date (i.e., construction began with E2 and ended with E1).
- 2) Sections are referenced by quadrant and sequence number, where "E2" refers to section 2 of the east quadrant.
- 3) "dual" lift type indicates that the lower and upper lifts were constructed with the same experimental mix.
- 4) The total thickness of all experimental sections is 4 inches by design, with the exception of S8, S9, S10, S11.
- 5) ARZ, TRZ, and BRZ refer to gradations intended to pass above, through, and below the restricted zone.
- 6) SMA and OGFC refer to stone matrix asphalt and open-graded friction course, respectively.

Appendix B

Calculated Offsets for Density Gauges

Table 9. Calculated Offsets for Density Gauges.

Section	Nuclear Gauge Offset	PQI Gauge Offset	Absolute Difference Between Offsets
E1	0.0	17.3	17.4
E10	-0.5	-2.8	2.4
E4	0.7	2.6	1.9
E5	-2.5	-1.2	1.3
E6	-0.5	-0.3	0.2
E7	1.1	0.8	0.3
E8	-1.6	-2.7	1.2
E9	0.0	-1.9	1.8
N1	-1.7	-5.8	4.1
N10	-3.0	0.6	3.6
N11 Binder	2.7	19.4	16.7
N11 Surface	1.4	16.9	15.5
N12 Binder	1.8	14.5	12.7
N12 Surface	1.5	13.3	11.9
N13 Binder	1.4	13.6	12.2
N13 Surface	2.9	12.9	10.0
N2	-2.1	-1.7	0.4
N3	-1.4	-1.8	0.4
N4	-3.6	4.5	8.1
N5	-2.7	-4.5	1.8
N6	-1.0	0.6	1.5
N7	-3.8	-0.9	2.9
N8	-2.6	-5.5	2.9
N9	-2.2	2.3	4.5
S1 Binder	4.8	18.0	13.2
S1 Surface	1.3	15.7	14.4
S10	-0.4	14.0	14.4
S11 Binder	0.5	10.9	10.4
S11 Surface	-3.6	14.4	18.0
S12	-1.8	9.7	11.5
S13	2.7	16.4	13.7
S2 Binder	-2.5	10.8	13.2
S2 Surface	0.5	10.6	10.1
S3 Binder	-0.7	8.7	9.4
S3 Surface	-4.4	8.0	12.4

Section	Nuclear Gauge Offset	PQI Gauge Offset	Absolute Difference Between Offsets
S4 Binder	0.3	13.7	13.5
S4 Surface	-2.2	12.4	14.5
S5 Binder	-0.1	10.7	10.8
S5 Surface	-0.1	14.5	14.6
S6	-3.2	2.6	5.8
S7	-2.8	-1.0	1.8
S8 Binder	1.6	19.8	18.2
S8 Surface	-3.5	12.7	16.3
S9	1.3	17.1	15.7
W1	3.5	14.5	10.9
W10	3.0	16.0	13.0
W2	-2.3	-7.6	5.3
W3 Binder	2.7	16.8	14.1
W4 Binder	-0.4	0.2	0.6
W5 Binder	-0.8	2.8	3.7
W6	-3.3	-2.1	1.2
W7	-0.3	5.9	6.2
W8	1.0	2.4	1.4
W9	2.2	15.6	13.3

Appendix C

Uncorrected Density Measurements for the PQI and Nuclear Gauges

Table 10. Core Densities, PQI Uncorrected Measured Densities, and Nuclear Gauge Uncorrected Measured Densities

Section	lot	Station	Offset	Core Density (lb/ft ³)	PQI Density Uncorrected (lb/ft ³)	Nuclear Gauge Density Uncorrected (lb/ft ³)	Absolute Difference Between Core and Measured PQI Uncorrected Density (lb/ft ³)	Absolute Difference Between Core and Nuclear Gauge Uncorrected Density (lb/ft ³)	Absolute Difference Between Nuclear Gauge Uncorrected and PQI Uncorrected Density (lb/ft ³)
E1	1	46+06	15.0' RT	143.1	127.1	142.9	16.0	0.2	15.8
E1	1	46+68	12.9' RT	142.4	127.1	142.6	15.3	0.2	15.5
E1	1	47+05	16.8' RT	141.8	125.9	142.5	15.9	0.7	16.6
E1	3	45+92	10.6' RT	143.3	124.1	143.6	19.3	0.3	19.5
E1	3	46+31	15.6' RT	145.0	124.8	144.2	20.2	0.8	19.4
E10	1	145+85	14.2' RT	143.1	146.0	144.2	2.9	1.1	1.8
E10	1	145+98	16.3' RT	144.4	146.3	144.2	1.9	0.2	2.1
E10	1	146+20	14.2' RT	143.9	146.1	143.0	2.2	0.9	3.1
E10	3	145+82	7.6' RT	144.9	146.7	145.4	1.8	0.5	1.3
E10	3	146+02	13.4' RT	140.0	145.8	142.0	5.8	2.0	3.7
E10	3	146+19	6.7' RT	144.3	146.9	144.6	2.6	0.3	2.3
E4	3	52+16	16.3' RT	147.9	144.8	146.8	3.1	1.1	2.0
E4	3	52+31	14.6' RT	146.8	144.7	146.6	2.1	0.2	1.8
E5	3	54+16	17.0' RT	145.5	146.4	148.3	0.9	2.9	2.0
E5	3	54+43	14.4' RT	143.9	146.4	147.0	2.5	3.1	0.5
E5	3	54+94	12.3' RT	146.6	146.6	148.0	0.1	1.4	1.3

Table 10. Core Densities, PQI Uncorrected Measured Densities, and Nuclear Gauge Uncorrected Measured Densities

Section	lot	Station	Offset	Core Density (lb/ft ³)	PQI Density Uncorrected (lb/ft ³)	Nuclear Gauge Density Uncorrected (lb/ft ³)	Absolute Difference Between Core and Measured PQI Uncorrected Density (lb/ft ³)	Absolute Difference Between Core and Nuclear Gauge Uncorrected Density (lb/ft ³)	Absolute Difference Between Nuclear Gauge Uncorrected and PQI Uncorrected Density (lb/ft ³)
E6	3	153+00	8.6' RT	145.7	146.2	145.3	0.5	0.4	0.9
E6	3	153+43	7.5' RT	145.2	145.5	145.9	0.3	0.7	0.4
E6	3	153+85	6.3' RT	147.4	147.5	148.7	0.1	1.3	1.2
E7	3	151+27	7.1' RT	145.5	143.9	143.8	1.7	1.8	0.1
E7	3	151+70	13.7' RT	144.4	144.2	143.8	0.2	0.6	0.4
E7	3	151+85	16.4' RT	144.5	144.0	143.5	0.6	1.0	0.4
E8	1	148+90	11.0' RT	144.8	146.3	148.3	1.5	3.6	2.1
E8	1	149+69	16.9' RT	142.3	145.3	143.8	3.0	1.5	1.5
E8	1	149+85	16.9' RT	142.4	145.8	145.1	3.4	2.7	0.6
E8	3	148+81	10.6' RT	143.4	146.1	143.4	2.8	0.0	2.8
E8	3	149+90	6.2' RT	144.5	147.5	145.5	3.0	1.0	2.0
E8	3	149.76	7.9' RT	144.4	147.2	145.1	2.8	0.7	2.1
E9	1	147+17	12.7' RT	141.8	145.0	142.8	3.2	1.0	2.2
E9	1	147+65	10.4' RT	144.5	145.9	144.8	1.4	0.3	1.1
E9	1	148+26	17.1' RT	144.9	146.6	145.1	1.8	0.2	1.5
E9	3	146+91	7.4' RT	143.2	145.8	142.9	2.6	0.3	2.9

Table 10. Core Densities, PQI Uncorrected Measured Densities, and Nuclear Gauge Uncorrected Measured Densities

Section	lot	Station	Offset	Core Density (lb/ft ³)	PQI Density Uncorrected (lb/ft ³)	Nuclear Gauge Density Uncorrected (lb/ft ³)	Absolute Difference Between Core and Measured PQI Uncorrected Density (lb/ft ³)	Absolute Difference Between Core and Nuclear Gauge Uncorrected Density (lb/ft ³)	Absolute Difference Between Nuclear Gauge Uncorrected and PQI Uncorrected Density (lb/ft ³)
E9	3	147+56	11.5' RT	144.7	145.8	144.4	1.2	0.2	1.4
E9	3	148+22	15.9' RT	145.6	146.8	144.8	1.1	0.9	2.0
N1	1	143+82	13.5' RT	142.1	157.8	146.7	15.6	4.6	11.0
N1	1	144+33	9.0' RT	142.0	156.9	144.5	14.8	2.5	12.3
N1	1	145+24	7.4' RT	143.8	155.8	143.8	12.0	0.1	12.1
N1	3	143+96	10.6' RT	138.8	136.8	139.9	2.0	1.1	3.1
N1	3	144+55	11.7' RT	141.6	136.9	142.5	4.7	0.9	5.6
N1	3	145+20	6.9' RT	136.7	135.9	137.9	0.8	1.2	2.0
N10	1	126+68	9.4' RT	136.8	134.2	138.6	2.6	1.8	4.4
N10	1	126+83	6.7' RT	137.5	135.6	140.6	1.9	3.1	5.0
N10	3	126+10	12.9' RT	137.4	137.5	141.6	0.1	4.2	4.0
N10	3	126+37	14.0' RT	136.4	136.7	140.2	0.3	3.8	3.5
N10	3	126+92	14.2' RT	137.0	138.0	141.2	1.0	4.2	3.2
N11 Binder	1	124+16	13.0' RT	145.7	126.5	142.6	19.2	3.1	16.1
N11 Binder	1	124+32	13.9' RT	145.8	126.4	143.6	19.3	2.1	17.2
N11 Binder	1	124+95	9.6' RT	145.5	125.8	142.7	19.7	2.9	16.9

Table 10. Core Densities, PQI Uncorrected Measured Densities, and Nuclear Gauge Uncorrected Measured Densities

Section	lot	Station	Offset	Core Density (lb/ft ³)	PQI Density Uncorrected (lb/ft ³)	Nuclear Gauge Density Uncorrected (lb/ft ³)	Absolute Difference Between Core and Measured PQI Uncorrected Density (lb/ft ³)	Absolute Difference Between Core and Nuclear Gauge Uncorrected Density (lb/ft ³)	Absolute Difference Between Nuclear Gauge Uncorrected and PQI Uncorrected Density (lb/ft ³)
N11 Surface	3	123+94	9.9' RT	144.8	128.2	142.6	16.5	2.2	14.4
N11 Surface	3	124+39	6.9' RT	146.1	129.5	144.8	16.6	1.3	15.3
N11 Surface	3	125+06	6.4' RT	146.9	129.4	146.2	17.5	0.6	16.9
N12 Binder	1	121+98	12.9' RT	144.8	130.3	143.1	14.6	1.8	12.8
N12 Binder	1	122+39	7.4' RT	144.7	129.8	142.9	14.9	1.8	13.1
N12 Binder	1	123+22	14.1' RT	145.6	131.7	143.9	14.0	1.7	12.2
N12 Surface	3	121+82	13.4' RT	142.5	127.8	140.7	14.7	1.8	12.9
N12 Surface	3	122+95	12.2' RT	140.9	128.1	139.8	12.8	1.2	11.6
N13 Binder	1	119+90	7.0' RT	138.1	123.8	135.4	14.4	2.7	11.7
N13 Binder	1	120+32	6.2' RT	138.2	124.2	137.1	14.0	1.1	12.9
N13 Binder	1	121+10	8.5' RT	136.6	124.3	136.3	12.3	0.3	12.0
N13 Surface	3	120+37	6.9' RT	134.2	121.8	131.2	12.4	3.0	9.4
N13 Surface	3	121+24	13.8' RT	134.3	120.8	131.4	13.4	2.9	10.5
N2	1	142+04	11.9' RT	139.1	144.6	140.6	5.5	1.5	4.0
N2	1	142+33	6.7' RT	139.0	144.2	138.7	5.3	0.3	5.6
N2	1	142+85	8.3' RT	138.7	145.1	139.7	6.4	1.0	5.5

Table 10. Core Densities, PQI Uncorrected Measured Densities, and Nuclear Gauge Uncorrected Measured Densities

Section	lot	Station	Offset	Core Density (lb/ft ³)	PQI Density Uncorrected (lb/ft ³)	Nuclear Gauge Density Uncorrected (lb/ft ³)	Absolute Difference Between Core and Measured PQI Uncorrected Density (lb/ft ³)	Absolute Difference Between Core and Nuclear Gauge Uncorrected Density (lb/ft ³)	Absolute Difference Between Nuclear Gauge Uncorrected and PQI Uncorrected Density (lb/ft ³)
N2	3	142+22	14.1' RT	140.4	137.4	143.8	3.0	3.4	6.3
N2	3	142+67	14.3' RT	140.6	138.2	143.8	2.4	3.3	5.6
N2	3	143+21	7.4' RT	137.6	135.9	141.1	1.6	3.5	5.1
N3	1	139+87	6.7' RT	141.1	145.1	141.5	4.0	0.4	3.6
N3	1	140+22	8.8' RT	137.2	143.5	140.4	6.2	3.2	3.0
N3	1	140+84	6.5' RT	139.4	145.2	142.7	5.8	3.3	2.5
N3	3	140+02	9.4' RT	136.2	135.4	137.8	0.8	1.6	2.4
N3	3	140+46	7.2' RT	136.6	134.5	136.8	2.1	0.2	2.4
N3	3	140+99	6.9' RT	137.2	135.0	136.9	2.1	0.3	1.9
N4	1	137+98	9.0' RT	140.6	136.5	143.9	4.1	3.3	7.4
N4	1	138+60	13.1' RT	139.5	136.4	142.5	3.1	3.0	6.1
N4	1	139+25	6.5' RT	140.3	135.9	142.8	4.4	2.5	6.9
N4	3	137+81	14.6' RT	136.3	131.6	139.9	4.7	3.6	8.3
N4	3	138+67	14.6' RT	139.0	133.6	144.3	5.5	5.3	10.8
N4	3	138+93	13.7' RT	139.7	134.2	143.7	5.5	4.0	9.5
N5	1	136+18	8.8' RT	140.1	149.6	139.6	9.5	0.5	10.1

Table 10. Core Densities, PQI Uncorrected Measured Densities, and Nuclear Gauge Uncorrected Measured Densities

Section	lot	Station	Offset	Core Density (lb/ft ³)	PQI Density Uncorrected (lb/ft ³)	Nuclear Gauge Density Uncorrected (lb/ft ³)	Absolute Difference Between Core and Measured PQI Uncorrected Density (lb/ft ³)	Absolute Difference Between Core and Nuclear Gauge Uncorrected Density (lb/ft ³)	Absolute Difference Between Nuclear Gauge Uncorrected and PQI Uncorrected Density (lb/ft ³)
N5	1	136+60	11.3' RT	139.6	153.0	141.6	13.4	2.0	11.4
N5	1	136+94	12.0' RT	140.5	151.7	142.0	11.2	1.5	9.7
N5	3	135+80	13.8' RT	134.8	134.2	141.3	0.6	6.6	7.1
N5	3	136+30	6.0' RT	135.7	134.4	140.3	1.3	4.6	5.9
N5	3	137+26	14.7' RT	139.9	134.9	142.3	5.1	2.3	7.4
N6	1	133+77	8.7' RT	134.6	139.1	137.3	4.5	2.7	1.8
N6	1	134+57	6.3' RT	139.0	138.9	138.1	0.1	0.8	0.7
N6	1	135+15	10.1' RT	138.6	138.8	138.3	0.2	0.3	0.5
N6	3	133+81	6.8' RT	140.1	135.0	139.2	5.1	0.9	4.2
N6	3	134+82	7.8' RT	136.9	134.7	141.0	2.2	4.1	6.3
N7	1	131+94	9.9' RT	134.8	135.3	139.3	0.5	4.5	4.0
N7	1	132+39	6.9' RT	137.2	136.1	140.4	1.1	3.2	4.3
N7	1	133+06	6.4' RT	136.5	138.1	139.3	1.6	2.9	1.2
N7	3	131+81	8.3' RT	135.7	138.8	140.6	3.1	4.9	1.8
N7	3	132+71	6.0' RT	135.2	135.5	140.2	0.3	4.9	4.7
N8	1	130+14	6.1' RT	137.3	133.2	138.8	4.1	1.5	5.6

Table 10. Core Densities, PQI Uncorrected Measured Densities, and Nuclear Gauge Uncorrected Measured Densities

Section	lot	Station	Offset	Core Density (lb/ft ³)	PQI Density Uncorrected (lb/ft ³)	Nuclear Gauge Density Uncorrected (lb/ft ³)	Absolute Difference Between Core and Measured PQI Uncorrected Density (lb/ft ³)	Absolute Difference Between Core and Nuclear Gauge Uncorrected Density (lb/ft ³)	Absolute Difference Between Nuclear Gauge Uncorrected and PQI Uncorrected Density (lb/ft ³)
N8	1	130+44	9.6' RT	136.1	132.5	138.9	3.7	2.7	6.4
N8	1	130+95	13.9' RT	138.1	134.8	139.3	3.4	1.1	4.5
N8	3	130+06	6.8' RT	136.1	150.6	139.5	14.4	3.4	11.0
N8	3	130+33	13.6' RT	138.4	151.6	140.5	13.2	2.1	11.1
N8	3	130+96	10.6' RT	135.8	152.3	140.4	16.5	4.6	11.9
N9	1	128+21	13.1' RT	138.8	137.7	139.8	1.1	1.0	2.2
N9	1	128+77	7.7' RT	137.7	135.0	140.5	2.7	2.8	5.5
N9	3	127+81	10.9' RT	140.2	135.9	142.1	4.4	1.9	6.2
N9	3	128+41	6.6' RT	138.4	135.7	141.3	2.7	2.9	5.7
S1 Binder	1	20+22	8.6' RT	144.2	126.1	140.9	18.2	3.3	14.9
S1 Binder	1	20+32	7.8' RT	144.8	126.4	139.2	18.4	5.7	12.8
S1 Binder	1	21+19	11.8' RT	143.9	126.6	138.5	17.3	5.5	11.9
S1 Surface	3	19+83	7.7' RT	145.5	130.3	145.8	15.2	0.3	15.5
S1 Surface	3	21+00	10.9' RT	145.6	129.5	142.8	16.1	2.9	13.3
S10	1	37+97	6.3' RT	143.8	131.3	144.1	12.5	0.4	12.8
S10	1	38+77	8.7' RT	144.2	130.5	144.0	13.6	0.2	13.5

Table 10. Core Densities, PQI Uncorrected Measured Densities, and Nuclear Gauge Uncorrected Measured Densities

Section	lot	Station	Offset	Core Density (lb/ft ³)	PQI Density Uncorrected (lb/ft ³)	Nuclear Gauge Density Uncorrected (lb/ft ³)	Absolute Difference Between Core and Measured PQI Uncorrected Density (lb/ft ³)	Absolute Difference Between Core and Nuclear Gauge Uncorrected Density (lb/ft ³)	Absolute Difference Between Nuclear Gauge Uncorrected and PQI Uncorrected Density (lb/ft ³)
S10	1	38+98	13.1' RT	145.1	131.8	144.4	13.3	0.7	12.6
S10	3	37+86	10.0' RT	146.0	131.1	145.9	15.0	0.1	14.8
S10	3	38+41	14.1' RT	146.7	131.7	149.0	15.0	2.4	17.4
S10	3	38+93	13.4' RT	146.3	131.6	146.9	14.6	0.6	15.3
S11 Binder	1	40+58	12.9' RT	158.3	147.3	156.5	11.0	1.9	9.1
S11 Binder	1	40+82	12.1' RT	157.6	146.8	158.4	10.8	0.8	11.6
S11 Surface	3	40+13	7.2' RT	152.9	139.0	156.2	13.9	3.3	17.2
S11 Surface	3	40+61	7.7' RT	153.2	139.7	156.2	13.5	3.0	16.5
S11 Surface	3	41+23	8.8' RT	154.1	138.3	158.6	15.8	4.5	20.3
S12	1	41+85	14.0' RT	145.6	138.2	145.8	7.4	0.3	7.7
S12	1	42+37	8.3' RT	143.2	134.2	145.0	9.0	1.8	10.8
S12	1	43+15	6.2' RT	147.3	138.8	149.7	8.5	2.4	10.9
S12	3	41+81	10.5' RT	142.5	132.4	144.8	10.0	2.4	12.4
S12	3	42+41	10.5' RT	146.8	135.5	148.0	11.3	1.2	12.5
S12	3	43+22	6.5' RT	146.3	134.3	148.8	12.0	2.5	14.5
S13	1	44+19	11.8' RT	141.3	122.6	137.8	18.7	3.4	15.3

Table 10. Core Densities, PQI Uncorrected Measured Densities, and Nuclear Gauge Uncorrected Measured Densities

Section	lot	Station	Offset	Core Density (lb/ft ³)	PQI Density Uncorrected (lb/ft ³)	Nuclear Gauge Density Uncorrected (lb/ft ³)	Absolute Difference Between Core and Measured PQI Uncorrected Density (lb/ft ³)	Absolute Difference Between Core and Nuclear Gauge Uncorrected Density (lb/ft ³)	Absolute Difference Between Nuclear Gauge Uncorrected and PQI Uncorrected Density (lb/ft ³)
S13	1	44+47	9.5' RT	140.1	123.8	137.8	16.3	2.2	14.1
S13	3	43+85	10.1' RT	139.3	122.8	137.2	16.5	2.1	14.4
S13	3	44+64	12.7' RT	139.8	122.8	137.1	17.0	2.6	14.4
S13	3	45+09	12.2' RT	140.5	122.5	137.7	18.0	2.9	15.1
S2 Binder	1	22+18	9.7' RT	134.0	124.6	137.0	9.4	3.0	12.5
S2 Binder	1	22+43	13.5' RT	136.5	124.9	138.6	11.6	2.1	13.6
S2 Binder	1	23+06	13.4' RT	136.0	124.7	138.3	11.3	2.3	13.5
S2 Surface	3	22+22	8.1' RT	135.1	125.1	136.9	9.9	1.8	11.7
S2 Surface	3	22+55	13.8' RT	137.1	125.9	135.9	11.3	1.3	10.0
S3 Binder	1	23+87	12.4' RT	147.8	138.8	147.4	9.0	0.4	8.6
S3 Binder	1	24+71	13.6' RT	150.5	141.6	152.0	8.8	1.5	10.4
S3 Binder	1	25+22	12.5' RT	148.8	140.6	149.8	8.2	1.0	9.2
S3 Surface	3	23+83	13.1' RT	139.4	131.5	142.7	8.0	3.3	11.3
S3 Surface	3	24+38	13.3' RT	140.2	131.6	145.6	8.6	5.4	14.0
S3 Surface	3	24+83	7.4' RT	138.7	131.2	143.1	7.5	4.4	11.8
S4 Binder	1	26+03	6.3' RT	149.4	134.8	148.6	14.6	0.8	13.8

Table 10. Core Densities, PQI Uncorrected Measured Densities, and Nuclear Gauge Uncorrected Measured Densities

Section	lot	Station	Offset	Core Density (lb/ft ³)	PQI Density Uncorrected (lb/ft ³)	Nuclear Gauge Density Uncorrected (lb/ft ³)	Absolute Difference Between Core and Measured PQI Uncorrected Density (lb/ft ³)	Absolute Difference Between Core and Nuclear Gauge Uncorrected Density (lb/ft ³)	Absolute Difference Between Nuclear Gauge Uncorrected and PQI Uncorrected Density (lb/ft ³)
S4 Binder	1	26+32	13.6' RT	149.4	136.0	150.7	13.4	1.3	14.7
S4 Binder	1	27+26	9.6' RT	148.8	135.6	147.6	13.2	1.3	12.0
S4 Surface	3	26+22	12.0' RT	145.6	131.8	148.4	13.8	2.8	16.5
S4 Surface	3	27+09	7.0' RT	143.4	132.4	144.9	11.0	1.6	12.5
S5 Binder	1	28+26	12.9' RT	141.0	130.0	141.8	11.1	0.8	11.9
S5 Binder	1	28+58	9.8' RT	140.7	129.6	141.6	11.1	0.9	12.0
S5 Binder	1	29+11	12.7' RT	137.9	127.4	137.6	10.4	0.2	10.2
S5 Binder	2	28+85	7.8' LT	137.6	127.5	136.6	10.1	1.0	9.1
S5 Surface	3	28+08	10.6' RT	143.6	129.0	142.8	14.6	0.8	13.8
S5 Surface	3	28+49	11.7' RT	143.3	128.1	143.2	15.2	0.1	15.1
S5 Surface	3	28+84	6.9' RT	140.9	127.1	142.1	13.7	1.2	14.9
S6	1	29+86	8.8' RT	135.3	133.9	138.1	1.4	2.8	4.2
S6	1	31+10	12.0' RT	136.4	134.7	138.1	1.7	1.7	3.4
S6	3	30+18	7.7' RT	136.1	132.6	139.6	3.5	3.5	7.0
S6	3	30+52	8.8' RT	136.2	132.7	140.3	3.5	4.1	7.6
S6	3	31+20	6.3' RT	135.6	131.8	139.4	3.8	3.8	7.5

Table 10. Core Densities, PQI Uncorrected Measured Densities, and Nuclear Gauge Uncorrected Measured Densities

Section	lot	Station	Offset	Core Density (lb/ft ³)	PQI Density Uncorrected (lb/ft ³)	Nuclear Gauge Density Uncorrected (lb/ft ³)	Absolute Difference Between Core and Measured PQI Uncorrected Density (lb/ft ³)	Absolute Difference Between Core and Nuclear Gauge Uncorrected Density (lb/ft ³)	Absolute Difference Between Nuclear Gauge Uncorrected and PQI Uncorrected Density (lb/ft ³)
S7	1	32+06	9.0' RT	134.5	135.5	137.4	1.0	2.9	1.9
S7	1	32+44	13.1' RT	135.3	136.9	138.2	1.6	2.8	1.3
S7	1	32+79	6.5' RT	133.2	136.1	137.1	2.9	3.9	1.0
S7	3	31+99	7.4' RT	134.9	134.7	137.5	0.2	2.6	2.7
S7	3	32+49	6.6' RT	134.5	134.3	136.5	0.1	2.0	2.2
S8 Binder	1	34+05	13.1' RT	158.0	137.0	155.0	21.0	3.0	18.0
S8 Binder	1	34+47	11.1' RT	155.5	136.3	156.0	19.3	0.5	19.8
S8 Binder	1	35+09	12.0' RT	156.8	137.6	154.4	19.2	2.3	16.8
S8 Surface	3	33+90	13.6' RT	151.7	139.2	156.3	12.4	4.6	17.0
S8 Surface	3	34+73	13.6' RT	153.2	139.2	156.0	14.0	2.8	16.7
S8 Surface	3	34+91	6.0' RT	149.4	137.6	152.6	11.9	3.2	15.1
S9	1	35+81	13.0' RT	148.2	128.0	144.3	20.2	3.9	16.3
S9	1	36+50	12.8' RT	145.8	129.5	142.7	16.3	3.1	13.1
S9	1	37+24	8.4' RT	146.9	129.8	144.6	17.2	2.4	14.8
S9	3	35+89	10.1' RT	145.6	130.1	148.2	15.5	2.6	18.0
S9	3	36+74	6.4' RT	145.3	130.2	146.0	15.1	0.6	15.8

Table 10. Core Densities, PQI Uncorrected Measured Densities, and Nuclear Gauge Uncorrected Measured Densities

Section	Lot	Station	Offset	Core Density (lb/ft ³)	PQI Density Uncorrected (lb/ft ³)	Nuclear Gauge Density Uncorrected (lb/ft ³)	Absolute Difference Between Core and Measured PQI Uncorrected Density (lb/ft ³)	Absolute Difference Between Core and Nuclear Gauge Uncorrected Density (lb/ft ³)	Absolute Difference Between Nuclear Gauge Uncorrected and PQI Uncorrected Density (lb/ft ³)
S9	3	36+91	13.4' RT	148.7	130.5	147.0	18.2	1.7	16.5
W1	1	118+13	15.2' RT	146.4	130.0	142.1	16.5	4.4	12.1
W1	1	118+69	7.1' RT	146.6	131.1	143.5	15.5	3.1	12.4
W1	1	119+18	9.6' RT	146.3	132.9	142.1	13.4	4.2	9.2
W1	3	118+05	11.8' RT	138.8	125.3	136.3	13.5	2.6	10.9
W1	3	118+69	16.4' RT	140.3	125.9	137.2	14.4	3.1	11.3
W1	3	119+09	6.9' RT	139.1	125.5	135.2	13.6	3.9	9.7
W10	1	18+87	6.9' RT	143.7	127.8	141.6	16.0	2.1	13.8
W10	1	19+06	15.8' RT	143.0	127.4	139.8	15.6	3.2	12.4
W10	1	19+17	13.4' RT	142.7	127.8	139.9	14.9	2.7	12.1
W2	1	116+00	9.7' RT	132.0	139.0	133.3	6.9	1.2	5.7
W2	1	116+56	14.6' RT	135.1	141.7	139.0	6.7	4.0	2.7
W2	1	116+77	9.5' RT	132.2	137.2	134.6	5.0	2.5	2.5
W2	3	116+23	11.8' RT	132.5	137.9	133.1	5.4	0.6	4.8
W2	3	116+63	11.9' RT	130.2	142.5	133.8	12.3	3.5	8.8
W2	3	117+04	6.6' RT	132.4	141.4	134.0	9.1	1.7	7.4

Table 10. Core Densities, PQI Uncorrected Measured Densities, and Nuclear Gauge Uncorrected Measured Densities

Section	lot	Station	Offset	Core Density (lb/ft ³)	PQI Density Uncorrected (lb/ft ³)	Nuclear Gauge Density Uncorrected (lb/ft ³)	Absolute Difference Between Core and Measured PQI Density (lb/ft ³)	Absolute Difference Between Core and Nuclear Gauge Uncorrected Density (lb/ft ³)	Absolute Difference Between Nuclear Gauge Uncorrected and PQI Uncorrected Density (lb/ft ³)
W3 Binder	1	113+83	7.3' RT	144.8	128.3	142.7	16.5	2.2	14.3
W3 Binder	1	114+35	9.2' RT	146.2	127.4	140.6	18.8	5.6	13.2
W3 Binder	1	115+10	14.0' RT	143.2	125.8	139.9	17.4	3.3	14.1
W3 Binder	3	113+96	15.4' RT	146.4	129.4	142.8	17.0	3.6	13.4
W3 Binder	3	114+34	12.6' RT	143.8	130.0	144.7	13.8	0.9	14.7
W3 Binder	3	114+97	16.2' RT	144.7	127.6	142.4	17.1	2.3	14.8
W4 Binder	1	111+96	13.8' RT	148.0	149.4	147.5	1.4	0.5	1.9
W4 Binder	1	112+45	13.2' RT	148.3	149.3	147.8	1.0	0.5	1.5
W4 Binder	1	112+85	7.0' RT	147.1	148.0	146.6	0.8	0.6	1.4
W4 Binder	3	111+85	13.5' RT	145.0	145.1	148.0	0.1	3.0	2.9
W4 Binder	3	112+57	10.7' RT	145.2	142.3	146.7	2.9	1.4	4.4
W4 Binder	3	112+81	9.1' RT	144.8	143.1	144.5	1.7	0.3	1.4
W5 Binder	1	110+05	13.3' RT	148.0	140.9	146.2	7.2	1.8	5.4
W5 Binder	1	110+70	6.3' RT	146.2	140.6	145.1	5.6	1.1	4.5
W5 Binder	1	111+09	9.4' RT	144.6	139.1	142.8	5.5	1.8	3.7
W5 Binder	3	10+03	7.7' RT	145.7	146.9	148.8	1.2	3.1	1.8

Table 10. Core Densities, PQI Uncorrected Measured Densities, and Nuclear Gauge Uncorrected Measured Densities

Section	lot	Station	Offset	Core Density (lb/ft ³)	PQI Density Uncorrected (lb/ft ³)	Nuclear Gauge Density Uncorrected (lb/ft ³)	Absolute Difference Between Core and Measured PQI Uncorrected Density (lb/ft ³)	Absolute Difference Between Core and Nuclear Gauge Uncorrected Density (lb/ft ³)	Absolute Difference Between Nuclear Gauge Uncorrected and PQI Uncorrected Density (lb/ft ³)
W5 Binder	3	110+31	14.7' RT	142.6	143.3	147.1	0.7	4.5	3.8
W5 Binder	3	110+95	13.9' RT	143.9	143.2	146.1	0.8	2.1	2.9
W6	1	11+15	7.2' RT	135.0	140.4	138.9	5.4	3.8	1.5
W6	1	11+51	6.2' RT	136.4	141.4	139.2	5.0	2.8	2.2
W6	1	12+05	7.9' RT	138.4	140.9	139.1	2.5	0.7	1.8
W6	3	11+19	7.1' RT	139.7	139.7	143.4	0.0	3.7	3.7
W6	3	11+44	15.6' RT	137.9	138.1	141.8	0.2	3.9	3.7
W6	3	11+94	8.1' RT	138.1	137.8	142.8	0.3	4.7	5.1
W7	1	13+04	11.0' RT	144.8	143.6	143.5	1.2	1.2	0.0
W7	1	13+56	13.7' RT	145.8	140.7	145.4	5.1	0.4	4.7
W7	1	13+90	12.8' RT	146.0	142.9	144.6	3.0	1.4	1.7
W7	3	13+08	13.9' RT	142.0	134.6	143.1	7.4	1.0	8.5
W7	3	13+43	7.2' RT	143.3	134.3	145.1	9.1	1.8	10.9
W7	3	13+78	6.4' RT	144.0	134.8	146.2	9.2	2.2	11.4
W8	1	14+95	9.7' RT	135.7	134.7	135.1	1.0	0.6	0.4
W8	1	15+55	10.1' RT	137.6	135.4	136.2	2.2	1.5	0.8

Table 10. Core Densities, PQI Uncorrected Measured Densities, and Nuclear Gauge Uncorrected Measured Densities

Section	lot	Station	Offset	Core Density (lb/ft ³)	PQI Density Uncorrected (lb/ft ³)	Nuclear Gauge Density Uncorrected (lb/ft ³)	Absolute Difference Between Core and Measured PQI Uncorrected Density (lb/ft ³)	Absolute Difference Between Core and Nuclear Gauge Uncorrected Density (lb/ft ³)	Absolute Difference Between Nuclear Gauge Uncorrected and PQI Uncorrected Density (lb/ft ³)
W8	1	15+84	13.6' RT	137.8	136.4	136.3	1.4	1.5	0.1
W8	3	15+05	10.7' RT	134.2	131.8	134.1	2.4	0.0	2.4
W8	3	15+36	15.0' RT	135.6	132.0	134.4	3.6	1.2	2.4
W9	1	16+90	7.1' RT	140.8	127.7	138.3	13.1	2.5	10.6
W9	1	17+66	10.8' RT	142.0	127.6	139.8	14.4	2.2	12.2
W9	1	18+08	11.8' RT	144.4	129.0	141.8	15.4	2.6	12.8
W9	3	17+23	8.5' RT	145.0	127.8	142.6	17.2	2.4	14.8
W9	3	17+69	7.1' RT	144.4	127.5	142.2	16.8	2.2	14.7
W9	3	18+09	7.8' RT	144.1	127.8	142.7	16.4	1.4	14.9

Appendix D

Corrected Density Measurements for the PQI and Nuclear Gauges

Table 11. Core Densities, PQI Corrected Measured Densities, and Nuclear Gauge Corrected Measured Densities.

Section	Lot	Station	Offset	Core Density (lb/ft ³)	PQI Density Corrected (lb/ft ³)	Nuclear Gauge Density Corrected (lb/ft ³)	Absolute Difference Between Core and PQI Corrected Density (lb/ft ³)	Absolute Difference Between Core and Nuclear Gauge Corrected Density (lb/ft ³)	Absolute Difference Between Nuclear Gauge Corrected and PQI Corrected Density (lb/ft ³)
E1	1	46+06	15.0' RT	143.1	142.8	142.6	0.3	0.4	0.1
E1	1	46+68	12.9' RT	142.4	142.8	142.3	0.4	0.0	0.5
E1	1	47+05	16.8' RT	141.8	141.6	142.2	0.2	0.5	0.6
E1	3	45+92	10.6' RT	143.3	143.0	143.9	0.4	0.5	0.9
E1	3	46+31	15.6' RT	145.0	143.7	144.5	1.3	0.5	0.8
E10	1	145+85	14.2' RT	143.1	143.7	144.2	0.6	1.1	0.5
E10	1	145+98	16.3' RT	144.4	144.0	144.2	0.4	0.2	0.2
E10	1	146+20	14.2' RT	143.9	143.8	143.0	0.1	0.9	0.7
E10	3	145+82	7.6' RT	144.9	143.3	144.4	1.6	0.5	1.2
E10	3	146+02	13.4' RT	140.0	142.4	141.1	2.4	1.1	1.3
E10	3	146+19	6.7' RT	144.3	143.5	143.6	0.8	0.6	0.1
E4	3	52+16	16.3' RT	147.9	147.4	147.4	0.5	0.4	0.1
E4	3	52+31	14.6' RT	146.8	147.3	147.2	0.5	0.4	0.1
E5	3	54+16	17.0' RT	145.5	145.2	145.9	0.3	0.4	0.7
E5	3	54+43	14.4' RT	143.9	145.2	144.5	1.4	0.6	0.7
E5	3	54+94	12.3' RT	146.6	145.5	145.5	1.1	1.0	0.0

Table 11. Core Densities, PQI Corrected Measured Densities, and Nuclear Gauge Corrected Measured Densities.

Section	Lot	Station	Offset	Core Density (lb/ft ³)	PQI Density Corrected (lb/ft ³)	Nuclear Gauge Density Corrected (lb/ft ³)	Absolute Difference Between Core and PQI Corrected Density (lb/ft ³)	Absolute Difference Between Core and Nuclear Gauge Corrected Density (lb/ft ³)	Absolute Difference Between Nuclear Gauge Corrected and PQI Corrected Density (lb/ft ³)
E6	3	153+00	8.6' RT	145.7	145.9	144.8	0.2	1.0	1.1
E6	3	153+43	7.5' RT	145.2	145.2	145.4	0.0	0.2	0.1
E6	3	153+85	6.3' RT	147.4	147.2	148.2	0.2	0.8	1.0
E7	3	151+27	7.1' RT	145.5	144.7	144.9	0.8	0.6	0.2
E7	3	151+70	13.7' RT	144.4	145.0	144.9	0.6	0.5	0.1
E7	3	151+85	16.4' RT	144.5	144.8	144.7	0.2	0.1	0.1
E8	1	148+90	11.0' RT	144.8	143.6	145.7	1.1	1.0	2.1
E8	1	149+69	16.9' RT	142.3	142.7	141.2	0.4	1.1	1.5
E8	1	149+85	16.9' RT	142.4	143.1	142.5	0.8	0.1	0.6
E8	3	148+81	10.6' RT	143.4	143.3	142.8	0.1	0.6	0.5
E8	3	149+90	6.2' RT	144.5	144.6	144.9	0.1	0.4	0.3
E8	3	149.76	7.9' RT	144.4	144.3	144.5	0.0	0.1	0.2
E9	1	147+17	12.7' RT	141.8	142.8	142.3	1.0	0.5	0.6
E9	1	147+65	10.4' RT	144.5	143.8	144.3	0.7	0.2	0.5
E9	1	148+26	17.1' RT	144.9	144.5	144.6	0.3	0.3	0.1
E9	3	146+91	7.4' RT	143.2	144.1	143.4	1.0	0.2	0.8

Table 11. Core Densities, PQI Corrected Measured Densities, and Nuclear Gauge Corrected Measured Densities.

Section	Lot	Station	Offset	Core Density (lb/ft ³)	PQI Density Corrected (lb/ft ³)	Nuclear Gauge Density Corrected (lb/ft ³)	Absolute Difference Between Core and PQI Corrected Density (lb/ft ³)	Absolute Difference Between Core and Nuclear Gauge Corrected Density (lb/ft ³)	Absolute Difference Between Nuclear Gauge Corrected and PQI Corrected Density (lb/ft ³)
E9	3	147+56	11.5' RT	144.7	144.2	144.9	0.5	0.2	0.7
E9	3	148+22	15.9' RT	145.6	145.1	145.2	0.5	0.4	0.1
N1	1	143+82	13.5' RT	142.1	143.6	144.4	1.5	2.3	0.8
N1	1	144+33	9.0' RT	142.0	142.7	142.2	0.7	0.2	0.5
N1	1	145+24	7.4' RT	143.8	141.7	141.4	2.2	2.4	0.3
N1	3	143+96	10.6' RT	138.8	139.3	138.8	0.5	0.0	0.5
N1	3	144+55	11.7' RT	141.6	139.4	141.5	2.2	0.2	2.1
N1	3	145+20	6.9' RT	136.7	138.4	136.8	1.7	0.1	1.6
N10	1	126+68	9.4' RT	136.8	136.5	136.6	0.3	0.1	0.2
N10	1	126+83	6.7' RT	137.5	137.8	138.6	0.3	1.1	0.8
N10	3	126+10	12.9' RT	137.4	137.1	137.5	0.3	0.1	0.4
N10	3	126+37	14.0' RT	136.4	136.2	136.2	0.2	0.3	0.0
N10	3	126+92	14.2' RT	137.0	137.5	137.1	0.6	0.2	0.4
N11 Binder	1	124+16	13.0' RT	145.7	145.9	145.3	0.2	0.4	0.6
N11 Binder	1	124+32	13.9' RT	145.8	145.9	146.3	0.1	0.6	0.5
N11 Binder	1	124+95	9.6' RT	145.5	145.2	145.3	0.3	0.2	0.1

Table 11. Core Densities, PQI Corrected Measured Densities, and Nuclear Gauge Corrected Measured Densities.

Section	Lot	Station	Offset	Core Density (lb/ft ³)	PQI Density Corrected (lb/ft ³)	Nuclear Gauge Density Corrected (lb/ft ³)	Absolute Difference Between Core and PQI Corrected Density (lb/ft ³)	Absolute Difference Between Core and Nuclear Gauge Corrected Density (lb/ft ³)	Absolute Difference Between Nuclear Gauge Corrected and PQI Corrected Density (lb/ft ³)
N11 Surface	3	123+94	9.9' RT	144.8	145.1	144.0	0.4	0.8	1.1
N11 Surface	3	124+39	6.9' RT	146.1	146.4	146.1	0.3	0.1	0.2
N11 Surface	3	125+06	6.4' RT	146.9	146.2	147.6	0.6	0.7	1.4
N12 Binder	1	121+98	12.9' RT	144.8	144.7	144.9	0.1	0.0	0.1
N12 Binder	1	122+39	7.4' RT	144.7	144.3	144.7	0.4	0.0	0.4
N12 Binder	1	123+22	14.1' RT	145.6	146.1	145.7	0.5	0.0	0.5
N12 Surface	3	121+82	13.4' RT	142.5	141.1	142.2	1.4	0.3	1.1
N12 Surface	3	122+95	12.2' RT	140.9	141.5	141.2	0.6	0.3	0.2
N13 Binder	1	119+90	7.0' RT	138.1	137.3	136.8	0.8	1.3	0.5
N13 Binder	1	120+32	6.2' RT	138.2	137.7	138.5	0.5	0.3	0.7
N13 Binder	1	121+10	8.5' RT	136.6	137.9	137.7	1.3	1.1	0.2
N13 Surface	3	120+37	6.9' RT	134.2	134.7	134.1	0.5	0.0	0.5
N13 Surface	3	121+24	13.8' RT	134.3	133.8	134.3	0.5	0.0	0.5
N2	1	142+04	11.9' RT	139.1	138.9	139.9	0.3	0.8	1.0
N2	1	142+33	6.7' RT	139.0	138.5	137.9	0.5	1.0	0.6
N2	1	142+85	8.3' RT	138.7	139.4	139.0	0.7	0.3	0.5

Table 11. Core Densities, PQI Corrected Measured Densities, and Nuclear Gauge Corrected Measured Densities.

Section	Lot	Station	Offset	Core Density (lb/ft ³)	PQI Density Corrected (lb/ft ³)	Nuclear Gauge Density Corrected (lb/ft ³)	Absolute Difference Between Core and PQI Corrected Density (lb/ft ³)	Absolute Difference Between Core and Nuclear Gauge Corrected Density (lb/ft ³)	Absolute Difference Between Nuclear Gauge Corrected and PQI Corrected Density (lb/ft ³)
N2	3	142+22	14.1' RT	140.4	139.7	140.4	0.6	0.0	0.6
N2	3	142+67	14.3' RT	140.6	140.5	140.5	0.0	0.1	0.1
N2	3	143+21	7.4' RT	137.6	138.2	137.7	0.7	0.1	0.6
N3	1	139+87	6.7' RT	141.1	139.7	139.2	1.3	1.9	0.5
N3	1	140+22	8.8' RT	137.2	138.1	138.1	0.9	0.9	0.0
N3	1	140+84	6.5' RT	139.4	139.9	140.4	0.5	1.0	0.5
N3	3	140+02	9.4' RT	136.2	137.1	137.3	0.9	1.0	0.2
N3	3	140+46	7.2' RT	136.6	136.2	136.3	0.4	0.3	0.2
N3	3	140+99	6.9' RT	137.2	136.7	136.4	0.4	0.8	0.3
N4	1	137+98	9.0' RT	140.6	140.4	141.0	0.2	0.4	0.6
N4	1	138+60	13.1' RT	139.5	140.2	139.5	0.7	0.0	0.7
N4	1	139+25	6.5' RT	140.3	139.8	139.9	0.5	0.4	0.1
N4	3	137+81	14.6' RT	136.3	136.8	135.6	0.5	0.7	1.2
N4	3	138+67	14.6' RT	139.0	138.8	140.0	0.2	1.0	1.2
N4	3	138+93	13.7' RT	139.7	139.4	139.4	0.3	0.3	0.0
N5	1	136+18	8.8' RT	140.1	138.3	138.6	1.8	1.5	0.3

Table 11. Core Densities, PQI Corrected Measured Densities, and Nuclear Gauge Corrected Measured Densities.

Section	Lot	Station	Offset	Core Density (lb/ft ³)	PQI Density Corrected (lb/ft ³)	Nuclear Gauge Density Corrected (lb/ft ³)	Absolute Difference Between Core and PQI Corrected Density (lb/ft ³)	Absolute Difference Between Core and Nuclear Gauge Corrected Density (lb/ft ³)	Absolute Difference Between Nuclear Gauge Corrected and PQI Corrected Density (lb/ft ³)
N5	1	136+60	11.3' RT	139.6	141.7	140.6	2.0	1.0	1.0
N5	1	136+94	12.0' RT	140.5	140.3	141.0	0.2	0.5	0.7
N5	3	135+80	13.8' RT	134.8	136.5	136.9	1.8	2.1	0.3
N5	3	136+30	6.0' RT	135.7	136.7	135.8	1.0	0.1	0.9
N5	3	137+26	14.7' RT	139.9	137.2	137.8	2.8	2.2	0.6
N6	1	133+77	8.7' RT	134.6	137.6	136.8	3.0	2.2	0.8
N6	1	134+57	6.3' RT	139.0	137.3	137.6	1.6	1.4	0.3
N6	1	135+15	10.1' RT	138.6	137.3	137.8	1.3	0.8	0.5
N6	3	133+81	6.8' RT	140.1	138.7	137.6	1.4	2.5	1.1
N6	3	134+82	7.8' RT	136.9	138.4	139.5	1.4	2.5	1.1
N7	1	131+94	9.9' RT	134.8	135.0	135.8	0.2	1.0	0.8
N7	1	132+39	6.9' RT	137.2	135.7	136.8	1.4	0.3	1.1
N7	1	133+06	6.4' RT	136.5	137.8	135.8	1.3	0.7	1.9
N7	3	131+81	8.3' RT	135.7	137.1	136.6	1.4	0.9	0.5
N7	3	132+71	6.0' RT	135.2	133.8	136.1	1.4	0.9	2.3
N8	1	130+14	6.1' RT	137.3	136.9	137.0	0.4	0.3	0.1

Table 11. Core Densities, PQI Corrected Measured Densities, and Nuclear Gauge Corrected Measured Densities.

Section	Lot	Station	Offset	Core Density (lb/ft ³)	PQI Density Corrected (lb/ft ³)	Nuclear Gauge Density Corrected (lb/ft ³)	Absolute Difference Between Core and PQI Corrected Density (lb/ft ³)	Absolute Difference Between Core and Nuclear Gauge Corrected Density (lb/ft ³)	Absolute Difference Between Nuclear Gauge Corrected and PQI Corrected Density (lb/ft ³)
N8	1	130+44	9.6' RT	136.1	136.2	137.1	0.0	1.0	0.9
N8	1	130+95	13.9' RT	138.1	138.5	137.5	0.4	0.7	1.0
N8	3	130+06	6.8' RT	136.1	135.9	136.2	0.3	0.1	0.3
N8	3	130+33	13.6' RT	138.4	136.9	137.1	1.5	1.3	0.2
N8	3	130+96	10.6' RT	135.8	137.6	137.1	1.8	1.2	0.5
N9	1	128+21	13.1' RT	138.8	139.6	137.9	0.8	0.9	1.7
N9	1	128+77	7.7' RT	137.7	137.0	138.6	0.8	0.9	1.7
N9	3	127+81	10.9' RT	140.2	138.4	139.7	1.8	0.5	1.3
N9	3	128+41	6.6' RT	138.4	138.2	138.9	0.2	0.5	0.7
S1 Binder	1	20+22	8.6' RT	144.2	144.0	145.7	0.2	1.5	1.7
S1 Binder	1	20+32	7.8' RT	144.8	144.3	144.0	0.5	0.8	0.4
S1 Binder	1	21+19	11.8' RT	143.9	144.6	143.3	0.6	0.7	1.3
S1 Surface	3	19+83	7.7' RT	145.5	146.0	147.1	0.5	1.6	1.1
S1 Surface	3	21+00	10.9' RT	145.6	145.2	144.1	0.4	1.6	1.2
S10	1	37+97	6.3' RT	143.8	144.4	144.3	0.7	0.5	0.1
S10	1	38+77	8.7' RT	144.2	143.7	144.2	0.5	0.0	0.5

Table 11. Core Densities, PQI Corrected Measured Densities, and Nuclear Gauge Corrected Measured Densities.

Section	Lot	Station	Offset	Core Density (lb/ft ³)	PQI Density Corrected (lb/ft ³)	Nuclear Gauge Density Corrected (lb/ft ³)	Absolute Difference Between Core and PQI Corrected Density (lb/ft ³)	Absolute Difference Between Core and Nuclear Gauge Corrected Density (lb/ft ³)	Absolute Difference Between Nuclear Gauge Corrected and PQI Corrected Density (lb/ft ³)
S10	1	38+98	13.1' RT	145.1	144.9	144.6	0.2	0.5	0.4
S10	3	37+86	10.0' RT	146.0	145.9	145.0	0.1	1.1	1.0
S10	3	38+41	14.1' RT	146.7	146.5	148.1	0.1	1.4	1.6
S10	3	38+93	13.4' RT	146.3	146.5	146.0	0.3	0.3	0.6
S11 Binder	1	40+58	12.9' RT	158.3	158.2	157.0	0.1	1.3	1.3
S11 Binder	1	40+82	12.1' RT	157.6	157.7	159.0	0.1	1.3	1.3
S11 Surface	3	40+13	7.2' RT	152.9	153.4	152.6	0.5	0.3	0.8
S11 Surface	3	40+61	7.7' RT	153.2	154.1	152.6	0.9	0.6	1.5
S11 Surface	3	41+23	8.8' RT	154.1	152.7	155.0	1.4	0.9	2.3
S12	1	41+85	14.0' RT	145.6	146.5	144.4	0.9	1.2	2.1
S12	1	42+37	8.3' RT	143.2	142.5	143.5	0.7	0.3	1.0
S12	1	43+15	6.2' RT	147.3	147.1	148.2	0.2	0.9	1.1
S12	3	41+81	10.5' RT	142.5	143.6	142.8	1.1	0.3	0.7
S12	3	42+41	10.5' RT	146.8	146.6	145.9	0.2	0.9	0.7
S12	3	43+22	6.5' RT	146.3	145.4	146.8	0.9	0.5	1.4
S13	1	44+19	11.8' RT	141.3	138.1	140.7	3.2	0.6	2.5

Table 11. Core Densities, PQI Corrected Measured Densities, and Nuclear Gauge Corrected Measured Densities.

Section	Lot	Station	Offset	Core Density (lb/ft ³)	PQI Density Corrected (lb/ft ³)	Nuclear Gauge Density Corrected (lb/ft ³)	Absolute Difference Between Core and PQI Corrected Density (lb/ft ³)	Absolute Difference Between Core and Nuclear Gauge Corrected Density (lb/ft ³)	Absolute Difference Between Nuclear Gauge Corrected and PQI Corrected Density (lb/ft ³)
S13	1	44+47	9.5' RT	140.1	139.3	140.7	0.8	0.6	1.4
S13	3	43+85	10.1' RT	139.3	140.0	139.7	0.7	0.4	0.2
S13	3	44+64	12.7' RT	139.8	139.9	139.7	0.2	0.1	0.3
S13	3	45+09	12.2' RT	140.5	139.7	140.2	0.8	0.3	0.5
S2 Binder	1	22+18	9.7' RT	134.0	135.3	134.6	1.3	0.6	0.7
S2 Binder	1	22+43	13.5' RT	136.5	135.7	136.1	0.8	0.4	0.4
S2 Binder	1	23+06	13.4' RT	136.0	135.5	135.8	0.5	0.2	0.3
S2 Surface	3	22+22	8.1' RT	135.1	135.7	137.4	0.7	2.3	1.7
S2 Surface	3	22+55	13.8' RT	137.1	136.5	136.4	0.7	0.7	0.1
S3 Binder	1	23+87	12.4' RT	147.8	147.5	146.7	0.3	1.1	0.8
S3 Binder	1	24+71	13.6' RT	150.5	150.3	151.3	0.2	0.8	1.0
S3 Binder	1	25+22	12.5' RT	148.8	149.3	149.1	0.5	0.3	0.2
S3 Surface	3	23+83	13.1' RT	139.4	139.5	138.4	0.1	1.1	1.1
S3 Surface	3	24+38	13.3' RT	140.2	139.6	141.2	0.6	1.0	1.6
S3 Surface	3	24+83	7.4' RT	138.7	139.2	138.7	0.5	0.0	0.5
S4 Binder	1	26+03	6.3' RT	149.4	148.6	148.9	0.9	0.6	0.3

Table 11. Core Densities, PQI Corrected Measured Densities, and Nuclear Gauge Corrected Measured Densities.

Section	Lot	Station	Offset	Core Density (lb/ft ³)	PQI Density Corrected (lb/ft ³)	Nuclear Gauge Density Corrected (lb/ft ³)	Absolute Difference Between Core and PQI Corrected Density (lb/ft ³)	Absolute Difference Between Core and Nuclear Gauge Corrected Density (lb/ft ³)	Absolute Difference Between Nuclear Gauge Corrected and PQI Corrected Density (lb/ft ³)
S4 Binder	1	26+32	13.6' RT	149.4	149.8	151.0	0.4	1.6	1.2
S4 Binder	1	27+26	9.6' RT	148.8	149.4	147.8	0.5	1.0	1.5
S4 Surface	3	26+22	12.0' RT	145.6	144.2	146.2	1.4	0.6	2.0
S4 Surface	3	27+09	7.0' RT	143.4	144.8	142.7	1.4	0.6	2.0
S5 Binder	1	28+26	12.9' RT	141.0	140.6	141.7	0.4	0.7	1.1
S5 Binder	1	28+58	9.8' RT	140.7	140.3	141.5	0.4	0.8	1.2
S5 Binder	1	29+11	12.7' RT	137.9	138.1	137.5	0.2	0.4	0.6
S5 Binder	2	28+85	7.8' LT	137.6	138.2	136.5	0.6	1.1	1.7
S5 Surface	3	28+08	10.6' RT	143.6	143.5	142.7	0.1	0.9	0.8
S5 Surface	3	28+49	11.7' RT	143.3	142.6	143.1	0.7	0.2	0.5
S5 Surface	3	28+84	6.9' RT	140.9	141.6	141.9	0.8	1.1	0.3
S6	1	29+86	8.8' RT	135.3	135.6	135.9	0.3	0.6	0.3
S6	1	31+10	12.0' RT	136.4	136.3	135.9	0.1	0.6	0.5
S6	3	30+18	7.7' RT	136.1	136.2	135.8	0.1	0.3	0.4
S6	3	30+52	8.8' RT	136.2	136.3	136.5	0.1	0.3	0.2
S6	3	31+20	6.3' RT	135.6	135.4	135.6	0.2	0.0	0.2

Table 11. Core Densities, PQI Corrected Measured Densities, and Nuclear Gauge Corrected Measured Densities.

Section	Lot	Station	Offset	Core Density (lb/ft ³)	PQI Density Corrected (lb/ft ³)	Nuclear Gauge Density Corrected (lb/ft ³)	Absolute Difference Between Core and PQI Corrected Density (lb/ft ³)	Absolute Difference Between Core and Nuclear Gauge Corrected Density (lb/ft ³)	Absolute Difference Between Nuclear Gauge Corrected and PQI Corrected Density (lb/ft ³)
S7	1	32+06	9.0' RT	134.5	133.7	134.2	0.8	0.3	0.5
S7	1	32+44	13.1' RT	135.3	135.1	135.0	0.3	0.4	0.1
S7	1	32+79	6.5' RT	133.2	134.3	133.9	1.1	0.7	0.4
S7	3	31+99	7.4' RT	134.9	134.9	135.2	0.0	0.3	0.3
S7	3	32+49	6.6' RT	134.5	134.5	134.2	0.0	0.3	0.3
S8 Binder	1	34+05	13.1' RT	158.0	156.8	156.6	1.2	1.4	0.2
S8 Binder	1	34+47	11.1' RT	155.5	156.1	157.6	0.5	2.1	1.6
S8 Binder	1	35+09	12.0' RT	156.8	157.4	156.0	0.6	0.7	1.4
S8 Surface	3	33+90	13.6' RT	151.7	152.0	152.7	0.3	1.0	0.7
S8 Surface	3	34+73	13.6' RT	153.2	152.0	152.5	1.2	0.7	0.5
S8 Surface	3	34+91	6.0' RT	149.4	150.3	149.1	0.9	0.3	1.2
S9	1	35+81	13.0' RT	148.2	145.9	147.5	2.3	0.8	1.6
S9	1	36+50	12.8' RT	145.8	147.4	145.8	1.6	0.0	1.6
S9	1	37+24	8.4' RT	146.9	147.7	147.7	0.7	0.8	0.0
S9	3	35+89	10.1' RT	145.6	146.4	147.7	0.8	2.1	1.3
S9	3	36+74	6.4' RT	145.3	146.5	145.5	1.1	0.1	1.0

Table 11. Core Densities, PQI Corrected Measured Densities, and Nuclear Gauge Corrected Measured Densities.

Section	Lot	Station	Offset	Core Density (lb/ft ³)	PQI Density Corrected (lb/ft ³)	Nuclear Gauge Density Corrected (lb/ft ³)	Absolute Difference Between Core and PQI Corrected Density (lb/ft ³)	Absolute Difference Between Core and Nuclear Gauge Corrected Density (lb/ft ³)	Absolute Difference Between Nuclear Gauge Corrected and PQI Corrected Density (lb/ft ³)
S9	3	36+91	13.4' RT	148.7	146.8	146.5	1.9	2.2	0.3
W1	1	118+13	15.2' RT	146.4	145.1	146.0	1.3	0.5	0.9
W1	1	118+69	7.1' RT	146.6	146.2	147.4	0.4	0.8	1.2
W1	1	119+18	9.6' RT	146.3	148.0	146.0	1.7	0.3	2.0
W1	3	118+05	11.8' RT	138.8	139.2	139.5	0.3	0.6	0.3
W1	3	118+69	16.4' RT	140.3	139.7	140.4	0.6	0.1	0.7
W1	3	119+09	6.9' RT	139.1	139.3	138.4	0.2	0.7	1.0
W10	1	18+87	6.9' RT	143.7	143.2	144.3	0.5	0.6	1.0
W10	1	19+06	15.8' RT	143.0	142.9	142.5	0.1	0.5	0.4
W10	1	19+17	13.4' RT	142.7	143.3	142.6	0.6	0.0	0.6
W2	1	116+00	9.7' RT	132.0	132.8	130.7	0.7	1.4	2.1
W2	1	116+56	14.6' RT	135.1	135.5	136.5	0.5	1.4	0.9
W2	1	116+77	9.5' RT	132.2	131.0	132.1	1.2	0.1	1.1
W2	3	116+23	11.8' RT	132.5	129.0	131.2	3.5	1.3	2.2
W2	3	116+63	11.9' RT	130.2	133.6	131.8	3.4	1.6	1.8
W2	3	117+04	6.6' RT	132.4	132.5	132.1	0.1	0.3	0.4

Table 11. Core Densities, PQI Corrected Measured Densities, and Nuclear Gauge Corrected Measured Densities.

Section	Lot	Station	Offset	Core Density (lb/ft ³)	PQI Density Corrected (lb/ft ³)	Nuclear Gauge Density Corrected (lb/ft ³)	Absolute Difference Between Core and PQI Corrected Density (lb/ft ³)	Absolute Difference Between Core and Nuclear Gauge Corrected Density (lb/ft ³)	Absolute Difference Between Nuclear Gauge Corrected and PQI Corrected Density (lb/ft ³)
W3 Binder	1	113+83	7.3' RT	144.8	145.9	146.3	1.1	1.5	0.4
W3 Binder	1	114+35	9.2' RT	146.2	144.9	144.3	1.2	1.9	0.7
W3 Binder	1	115+10	14.0' RT	143.2	143.4	143.6	0.2	0.4	0.2
W3 Binder	3	113+96	15.4' RT	146.4	145.4	144.5	1.1	2.0	0.9
W3 Binder	3	114+34	12.6' RT	143.8	146.0	146.4	2.2	2.6	0.4
W3 Binder	3	114+97	16.2' RT	144.7	143.5	144.1	1.1	0.6	0.5
W4 Binder	1	111+96	13.8' RT	148.0	148.3	148.1	0.3	0.0	0.3
W4 Binder	1	112+45	13.2' RT	148.3	148.2	148.3	0.1	0.0	0.1
W4 Binder	1	112+85	7.0' RT	147.1	146.9	147.1	0.2	0.0	0.2
W4 Binder	3	111+85	13.5' RT	145.0	146.6	146.6	1.6	1.6	0.0
W4 Binder	3	112+57	10.7' RT	145.2	143.8	145.3	1.4	0.1	1.5
W4 Binder	3	112+81	9.1' RT	144.8	144.6	143.1	0.2	1.7	1.5
W5 Binder	1	110+05	13.3' RT	148.0	146.9	147.8	1.1	0.2	0.9
W5 Binder	1	110+70	6.3' RT	146.2	146.7	146.6	0.5	0.5	0.0
W5 Binder	1	111+09	9.4' RT	144.6	145.2	144.4	0.6	0.2	0.8
W5 Binder	3	10+03	7.7' RT	145.7	146.5	145.5	0.8	0.2	1.0

Table 11. Core Densities, PQI Corrected Measured Densities, and Nuclear Gauge Corrected Measured Densities.

Section	Lot	Station	Offset	Core Density (lb/ft ³)	PQI Density Corrected (lb/ft ³)	Nuclear Gauge Density Corrected (lb/ft ³)	Absolute Difference Between Core and PQI Corrected Density (lb/ft ³)	Absolute Difference Between Core and Nuclear Gauge Corrected Density (lb/ft ³)	Absolute Difference Between Nuclear Gauge Corrected and PQI Corrected Density (lb/ft ³)
W5 Binder	3	110+31	14.7' RT	142.6	142.9	143.8	0.3	1.2	0.9
W5 Binder	3	110+95	13.9' RT	143.9	142.8	142.8	1.2	1.1	0.1
W6	1	11+15	7.2' RT	135.0	136.1	136.4	1.1	1.4	0.3
W6	1	11+51	6.2' RT	136.4	137.1	136.8	0.7	0.4	0.3
W6	1	12+05	7.9' RT	138.4	136.6	136.7	1.8	1.8	0.0
W6	3	11+19	7.1' RT	139.7	139.8	139.3	0.1	0.4	0.5
W6	3	11+44	15.6' RT	137.9	138.1	137.7	0.2	0.2	0.4
W6	3	11+94	8.1' RT	138.1	137.8	138.7	0.3	0.6	0.9
W7	1	13+04	11.0' RT	144.8	146.7	144.5	1.9	0.2	2.2
W7	1	13+56	13.7' RT	145.8	143.8	146.4	2.0	0.6	2.6
W7	1	13+90	12.8' RT	146.0	146.0	145.6	0.1	0.4	0.4
W7	3	13+08	13.9' RT	142.0	143.2	141.4	1.1	0.7	1.8
W7	3	13+43	7.2' RT	143.3	142.8	143.4	0.5	0.1	0.6
W7	3	13+78	6.4' RT	144.0	143.4	144.5	0.7	0.5	1.2
W8	1	14+95	9.7' RT	135.7	136.2	136.3	0.5	0.6	0.1
W8	1	15+55	10.1' RT	137.6	136.9	137.3	0.7	0.3	0.4

Table 11. Core Densities, PQI Corrected Measured Densities, and Nuclear Gauge Corrected Measured Densities.

Section	Lot	Station	Offset	Core Density (lb/ft ³)	PQI Density Corrected (lb/ft ³)	Nuclear Gauge Density Corrected (lb/ft ³)	Absolute Difference Between Core and PQI Corrected Density (lb/ft ³)	Absolute Difference Between Core and Nuclear Gauge Corrected Density (lb/ft ³)	Absolute Difference Between Nuclear Gauge Corrected and PQI Corrected Density (lb/ft ³)
W8	1	15+84	13.6' RT	137.8	138.0	137.5	0.2	0.3	0.5
W8	3	15+05	10.7' RT	134.2	135.0	134.8	0.8	0.6	0.2
W8	3	15+36	15.0' RT	135.6	135.2	135.0	0.4	0.6	0.2
W9	1	16+90	7.1' RT	140.8	142.1	140.8	1.2	0.0	1.3
W9	1	17+66	10.8' RT	142.0	141.9	142.2	0.1	0.2	0.3
W9	1	18+08	11.8' RT	144.4	143.3	144.2	1.1	0.1	0.9
W9	3	17+23	8.5' RT	145.0	144.6	144.6	0.4	0.4	0.0
W9	3	17+69	7.1' RT	144.4	144.4	144.2	0.0	0.2	0.1
W9	3	18+09	7.8' RT	144.1	144.6	144.7	0.4	0.6	0.1

STATE OF TENNESSEE ASPHALT JOB MIX FORMULA

Project Ref. No. _____ Test Track _____ Date 03/15/2000
 Project No. _____ Gravel _____ Region _____
 Contract No. _____ County _____
 Contractor _____ Subcontractor _____
 State Route No. _____ Date of Letting _____

Type BPMB-HM Section 307-S 19.0 mm w/RAP Article 01.01-01.02

Serial No.: _____ Design No.: _____

Material	Size or Grade	Producer and Location	Percent Used
#57s Gilbertsville	1"-Pan	Vulcan Mtls, Gibertsville	28.62
#7s Ford, Troy	1/2"-Pan	Ford, Troy	21.942
#10s Gilbt.	3/8"-Pan	Vulcan Mtls, Gibertsville, Ky	15.218
Man. Sand	3/8"-Pan	Ford Const., Troy, TN	14.31
Rap 51 Byp.	1/2"-Pan	Hwy 51 Bypass, Ripley, TN	15.03
Asphalt Cement	PG76-22	Ergon	3.88
Percent AC in RAP: 4.8	Optimum AC Content: 4.6	Total	100.00
Anti-Strip Additive: Morelife 2200	Dosage: 0.75%		

% Fracture Face of CA: N/A	% Glassy Particles on CA: N/A
Fine Agg. Angularity: 43.4	Eff. Gravity of Agg. 2.608

Theo. Gravity: 2.437	TSR: 72.4	Asphalt Sp. Gravity 1.032
LOI: N/A	Lbs/Ft ³ 152.0	D.A.R.: 1.17
Ignition Oven Corr. Factor: 0.72	Percent Virgin AC: 84.3	

Mixing Temp Range: 320-360	Compaction Temp Range: 300-340
Mixing Temperature: 340	Compaction Temperature: 320

Sieve Size	Percents Used							
	#57s Gilbertsville	#7s Ford, Troy	#10s Gilbt.	Man. Sand		Rap 51 Byp		
	30.0	23.0	17.0	15.0		15.0	% Req. 100	Design Range
2"	100.0	100.0	100.0	100.0		100.0	100.0	100.0
1.5"	100.0	100.0	100.0	100.0		100.0	100.0	100.0
1"	100.0	100.0	100.0	100.0		100.0	100.0	100.0
3/4"	80.0	100.0	100.0	100.0		100.0	94.0	90-100
5/8"								
1/2"	35.0	98.0	100.0	100.0		99.0	79.90	72-87
3/8"	14.0	87.0	100.0	100.0		93.0	70.20	62-80
No.4	3.0	38.0	96.0	69.0		71.0	47.00	42-60
No.8	2.0	18.0	72.0	35.0		53.0	30.20	28-49
No.16	1.0	12.0	45.0	26.0		42.0	20.90	*
No.30	1.0	6.0	38.0	16.0		30.0	15.00	13-25
No.50	1.0	5.0	28.0	12.0		12.0	9.80	*
No.100	1.0	4.0	21.0	8.0		7.0	7.00	*
No.200	1.0	3.0	16.0	6.0		5.0	5.40	2-6.5

Requested: _____
 Contractor, LT No. and Phone

Approved: _____
 Region Mtls. Supervisor

Approved _____
 Region Const. Supervisor

Approved: _____
 Engineer of Mtls and Tests

STATE OF TENNESSEE ASPHALT JOB MIX FORMULA

Project Ref. No. **100% FF Gravel** County _____ Date: **02/22/2000**
 Project No. **411-S Gravel for Test Track** Contract No. _____ Region **IV**
 Type _____ Sec. No. **411-S** Article _____
 Contractor _____ Subcontractor _____
 State Route No. _____ TOTAL MIX INCLUDING BITUMEN Date of Letting _____

Material	Screen	% Passing	Producer and Address					% Used
C.A.	5/8"-#200		Memphis Stone and Gravel					52.92
Sand	3/8"-#200		Memphis Stone and Gravel Pit					17.96
Screenings	3/8"-#200		Fullen Dock pit # 382					23.63
Ag Lime								0.00
RAP								0.00
Asphalt Cement	PG 76-22		Ergon					5.50
Anti-Strip	TYPE: Morelife 2200		DOSAGE RATE: 0.75					
% Fractured Faces on +4 Material:			100% % Glassy Particles on +4 Material					100%
100 PERCENT MINERAL AGGREGATE								
SCREEN	Ttl. Passing	Requested Percent						
Temp		330 F	C.A. Percent	Med C.A. Percent	Screenings Percent	Sand Percent	RAP Percent	Calculated Mix
			60.0	19.0	21.0	0.0	0	
% A.C.		5.50		(Washed Gradations)				
	Compaction Temp: 310-320 F			LOI:				
	Mixing Temp: 330-340 F			Theo: 2.417				
2"								
1 1/4"		0.0						0.0
1"		0.0						0.0
3/4"		100.0	100.0	100.0	100.0	0.0	0.0	100.0
1/2"		95.0	91.0	100.0	100.0	0.0	0.0	95.0
3/8"		78.8	62.1	100.0	100.0	0.0	0.0	78.8
No.4		58.4	28.0	99.4	95.4	0.0	0.0	58.4
No.8		39.3	13.5	84.7	62.7	0.0	0.0	39.3
No.16		28.2	7.4	70.3	42.7	0.0	0.0	28.2
No.30		18.7	4.9	48.9	26.6	0.0	0.0	18.7
No.50		7.9	2.8	8.2	19.5	0.0	0.0	7.9
No.100		4.6	1.60	0.20	14.50	0.00	0.00	4.56
No.200		3.5	1.10	0.10	11.30	0.00	0.00	3.46

Requested: _____ Contractor

Approved: _____ Region Materials Engineer

Approved _____ Region Construction Engineer

Approved: _____ Engineer of Materials and Tests

STATE OF TENNESSEE ASPHALT JOB MIX FORMULA

Project Ref. No. _____ Test Track _____ Date 03/17/2000
 Project No. 307S Limestone _____ Region _____
 Contract No. _____ County _____
 Contractor _____ Subcontractor _____
 State Route No. _____ Date of Letting _____

Type BPMB-HM Section 307-S 19.0 mm w/ RAP Article 01.01-01.02

Serial No.: _____ Design No.: _____

Material	Size or Grade	Producer and Location	Percent Used
C.A.	1"-Pan	Rogers Group, Gordonsville	23.9
78's	1/2"-Pan	Rogers Group, Gordonsville	23.9
Man. Sand	3/8"-Pan	Vulcan, Danley	19.12
Nat. Sand	3/8"-Pan	Cumberland Sand, Hillboro, TN	14.34

RAP	1/2"-Pan	Rogers Group, Gordonsville	15.06
Asphalt Cement	PG 76-22	Ergon	3.68

Percent AC in RAP: 4.8 Optimum AC Content: 4.4 Total 100.00

Anti-Strip Additive: Morelife 2200 Dosage: 0.75%

% Fracture Face of CA: N/A % Glassy Particles on CA: N/A

Fine Agg. Angularity: 43.6 Eff. Gravity of Agg. 2.730

Theo. Gravity: 2.546 TSR: 67.3 Asphalt Sp. Gravity 1.032

LOI: N/A Lbs/Ft³ 158.9 D.A.R.: 0.82

Ignition Oven Corr. Factor: 0.34 Percent Virgin AC: 83.6

Mixing Temp Range: #VALUE! Compaction Temp Range: #VALUE!

Mixing Temperature: 340 Compaction Temperature: 320

Sieve Size	Percents Used							
	C.A.	78's	Man. Sand	Nat. Sand		RAP		
	25.0	25.0	20.0	15.0		15	% Req. 100	Design Range
2"	100.0	100.0	100.0	100.0		100.0	100.0	100.0
1.5"	100.0	100.0	100.0	100.0		100.0	100.0	100.0
1"	100.0	100.0	100.0	100.0		100.0	100.0	100.0
3/4"	90.0	100.0	100.0	100.0		100.0	97.5	90-100
5/8"								
1/2"	45.0	90.0	100.0	100.0		95.0	83.00	72-87
3/8"	24.0	70.0	100.0	100.0		90.0	72.00	62-80
No.4	5.0	16.0	99.8	98.0		66.0	49.80	42-60
No.8	4.0	6.0	85.5	90.0		47.0	10.20	28-49
No.16	3.5	5.0	43.2	80.0		34.0	27.90	*
No.30	3.0	4.0	19.9	67.0		29.0	20.10	13-25
No.50	2.5	3.5	8.9	19.0		17.0	8.70	*
No.100	2.0	2.5	4.3	4.5		11.0	4.30	*
No.200	1.5	2.3	3.8	2.8		9.8	3.60	2-6.5

Requested: _____
 Contractor, LT No. and Phone

Approved: _____
 Region Mtls. Supervisor

Approved: _____
 Region Const. Supervisor

Approved: _____
 Engineer of Mtls and Tests

STATE OF TENNESSEE ASPHALT JOB MIX FORMULA

Project Ref. No. Test Track, Limestone 411S Date 03/09/2000
 Project No. _____ Region 3
 Contract No. _____ County _____
 Contractor _____ Subcontractor _____
 State Route No. _____ Date of Letting 01/01/2000

Type BPMB-HM Section 411-S 12.5 mm Article 01.01-01.02

Serial No.: _____ Design No.: _____

Material	Size or Grade	Producer and Location	Percent Used
D Rock	5/8"-Pan	American Limestone, Springfield	42.525
Hard Scrns.	3/8"-Pan	American Limestone, Springfield	14.175
Soft Scrns.	3/8"-Pan	Vulcan Mtls, Danley, TN	14.175
Natural Sand	3/8"-Pan	Ingram Sand, Nashville	14.175
Manuf. Sand	5/8"-Pan	Vulcan Mtls, Danley, TN	9.45

Asphalt Cement PG 76-22 Ergon, Nashville, TN 5.5

Percent AC in RAP: _____ Optimum AC Content: 5.5 Total 100.00

Anti-Strip Additive: _____ Pavabond Lite Dosage: 0.30%

% Fracture Face of CA: N/A % Glassy Particles on CA: N/A

Fine Agg. Angularity: 42.7 Eff. Gravity of Agg. 2.630

Theo. Gravity: 2.434 TSR: 90.4 Asphalt Sp. Gravity 1.032

LOI: 20.8 Lbs/Ft³ 151.9 D.A.R.: 0.83

Ignition Oven Corr. Factor: 0.34 Percent Virgin AC: 100.0

Mixing Temp Range: 320-360 Compaction Temp Range: 300-340

Mixing Temperature: 340 Compaction Temperature: 320

Sieve Size	Percents Used						% Req. 100	Design Range
	D Rock	Hard Scrns.	Soft Scrns.	Natural Sand	Manuf. Sand			
2"	100.0	100.0	100.0	100.0	100.0		100.0	100.0
1.5"	100.0	100.0	100.0	100.0	100.0		100.0	100.0
1"	100.0	100.0	100.0	100.0	100.0		100.0	100.0
3/4"	100.0	100.0	100.0	100.0	100.0		100.0	100.0
5/8"								
1/2"	96.0	100.0	100.0	100.0	100.0		98.20	90-100
3/8"	74.0	100.0	100.0	100.0	100.0		88.30	76-91
No.4	25.0	98.0	92.0	98.1	99.8		64.40	50-71
No.8	10.0	71.0	60.0	92.0	85.5		46.60	33-58
No.16	8.0	37.4	49.0	78.0	43.2		32.60	*
No.30	6.0	20.0	27.0	62.0	19.9		21.00	16-29
No.50	5.0	13.0	24.0	15.0	8.9		10.90	*
No.100	4.0	6.0	18.0	1.5	4.3		6.10	*
No.200	3.0	4.0	15.0	1.0	1.9		4.50	2-6.5

Requested: _____
 Contractor, LT No. and Phone

Approved: _____
 Region Mtls. Supervisor

Approved _____
 Region Const. Supervisor

Approved: _____
 Engineer of Mtls and Tests

Vita

Stuart Malley was born in Columbus, Georgia on September 24, 1971. He attended Harris County High School where he graduated in June 1989. He attended Columbus College for two years. At this time he enlisted into the United States Air Force. He served as a nuclear weapons technician until October 1994. He then enlisted into the Tennessee Air National Guard as a telephone systems specialist. He served until October 2000. During this time he enrolled at the University of Tennessee, Knoxville (UTK), where he received a Bachelor of Science in Civil Engineering in August 1999. The following Fall semester he enrolled into the graduate school at UTK. In March of 2000, he was assigned to the NCAT Pavement Test Track to document the construction of that facility under a TDOT research project with UTK. A few weeks after his arrival at the Test Track he was offered the position of Assistant Track Manager, where he worked until November 2000. He then accepted a position with Vulcan Materials Company in Birmingham Alabama and is currently working as a Research Engineer with the duties of Laboratory Manager. In this time frame, he completed his Master's of Science in Civil Engineering. He received his degree in August 2001.