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Iowa DOT Roller Integrated Compaction Monitoring Technology Research and Implementation - Phase II (Hot Mix Asphalt)

June 2011

Final Report

IA9, Kossuth County, IA — May 18 to 26, 2010
US30, Harrison County, IA — July 14 to 27, 2010
US20, Ida County, IA — August 16 to 19, 2010






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16. Abstract

This report presents results and findings of the Phase II Iowa Department of Transportation Roller Integrated Compaction Monitoring (RICM) Technology Research and Implementation program. During this phase of the project, special provisions (SPs) were developed that required RICM technologies on three hot mix asphalt (HMA) overlay pilot projects in Iowa. The field results are presented for each project.

The bid item cost for implementing the RICM-HMA SPs on each project varied from 0.9% to 1.4% of total project cost. The SP on US30 Harrison County project required RICM roller coverage including temperature, pass count, and compaction measurements on one break down roller. The SP on US20 Ida County project required RICM roller coverage including temperature and pass count on one break down roller. The SP on IA9 Kossuth County project required roller pass count coverage for all compaction equipment. The SPs were successfully implemented on US30 and US20 projects and the information from the RICM rollers conveniently met the requirements of the SPs for roller coverage. The IA9 project encountered problems with roller data storage/export during construction leading to not meeting the coverage requirements of the project SP.

Testing was conducted on each project by the Iowa State University research team beyond the requirements of the project specifications to analyze asphalt density, RICM values, and asphalt surface temperature changes with pass count and time. Comparisons between RICM values and asphalt density/percent compaction yielded poor correlations, but relationship with falling weight deflectometer modulus values revealed good correlations. Influence of the foundation support conditions under the asphalt surface layer is a major contributor to characterizing correlations between RICM measurements and asphalt density measurements. Geostatistical analysis of pass coverage information revealed differences in pass coverage uniformity between projects. The key benefits of implementing RICM technology for HMA overly projects are documenting the pass coverage/uniformity and the compaction-time-surface temperature history. Future research should be conducted to evaluate this technology on full-depth HMA projects.

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LIST OF SYMBOLS

a,b	Regression coefficients
CCV	Continuous compaction value
COV	Coefficient of variation
d_0	Measured settlement under plate
E_{FWD}	Elastic modulus determined from Kuab falling weight deflectometer
f	Vibration frequency
F	Shape factor
G_{mb}	Bulk specific gravity
GPS	Global positioning system
h	Separation distance (in a semivariogram plot)
n	Number of test measurements
r	Radius of the plate
$QI_{Density}$	Quality index of density
R^2	Coefficient of determination
T	Surface Temperature
T_{FLIR}	Surface Temperature measured using FLIR thermal camera
T_{Roller}	Temperature measured using infrared camera mounted on the roller
y_0	Intercept
μ	Average or mean
v	Roller velocity
σ	Standard deviation
σ_0	Applied stress
η	Poisson's ratio
γ_d	Dry unit weight

EXECUTIVE SUMMARY

The *Iowa Department of Transportation Roller Integrated Compaction Monitoring (RICM) Research and Implementation* project was initiated in summer 2009 and is divided into three phases. Phase I of this research project involved conducting field demonstration projects with various RICM measurement technologies on three projects with earthwork and HMA construction and the results are presented in the Phase I report published in November 2010. This report presents results from Phase II of the research program which includes evaluation of the following special provisions (SPs) incorporated into the project specifications of three HMA projects:

(1) Intelligent Compaction – HMA, US30 Harrison County, NHSN-030-1(127)--2R-43 (Effective January 20, 2010) [SP-090048]
(2) Intelligent Compaction – HMA, US20 Ida County, NHSN-020-2(70) --2R-47 (Effective February 16, 2010) [SP-090057a]
(3) Intelligent Compaction – HMA Roller Pass Mapping, IA9 Kossuth County, STPN-009-4(44) --2J-55 (Effective February 16, 2010) [SP-090058]

A fourth SP was drafted for a project involving compaction of cohesive soils as listed below but was not implemented due to lack of available equipment at the time of the project.

(4) Intelligent Compaction – Embankment, Sac County, NHSX-020-2(89)--3H-81 (Effective April 20, 2010) [SP-090063]

This report presents an overview of the various in-situ testing methods used in the field studies, overview of the three SPs highlighting the main features and differences between the three SPs, and in-situ test results and analysis results from each pilot project, an evaluation of the three SPs, and recommendations for Phase III RICM implementation work for Iowa. Information from this report can be utilized for developing future education and training materials. The results and findings from this report should be of significant interest to the pavement, geotechnical, and construction engineering community and are anticipated to serve as a good knowledge base for implementation of RICM technologies and various new in-situ QC/QA testing methods into HMA construction practice.

Some significant findings from each pilot project are as follows:

Summary of Key Findings from US30 Harrison County Project:

- The RICM-HMA SP-090048 which required RICM coverage (with temperature, pass count, and roller-integrated CCV information on break down roller) was successfully implemented on the US30 Harrison County pilot project. Evaluation of RICM data coverage information indicated that the RICM data was collected over 85% of the project area on the intermediate course layer and over 95% of the project area on the surface course layers, thus conveniently exceeding the minimum 80% requirement in the SP.

- Field core density results indicated that 115 out of 117 samples exceeded the target minimum 95% compaction requirement. The $QI_{Density}$ measurements ranged from 0.3 to 6.8, thus exceeding the target minimum 0.00.
- Percent compaction curves indicated that 95% compaction was generally achieved within 1 to 2 break down roller passes at most locations with exceptions at few locations where up to four passes or more was required.
- Roller surface temperature measurements with pass generally indicated that pass 2 measurement was lower than pass 3 (note that the rolling pattern included forward, reverse, and forward directions of travel for passes 1, 2, and 3). The temperature sensor is located on the front drum of the roller and water sprayed on to the roller drum likely caused a reduction in the surface temperature values, when the roller travels in the reverse direction.
- Asphalt temperature cooling rate (C_r) was modeled using an exponential statistical model from surface temperature with time measurements. For cases where data up to a maximum of 35 minutes was considered, the C_r values ranged from about -0.0090 to -0.0157 with an average of about -0.0135 and standard deviation of 0.0022.
- Correlations between CCV and asphalt density or percent compaction measurements yielded relatively low R^2 values in the range of 0.1 to 0.2. However, if the measurements for each PS are viewed separately, there is generally a trend of increasing CCV with increasing percent compaction in most sections.
- Poor correlations between density and CCV are to be expected when data is combined over multiple sections, because CCV provides a measure of ground stiffness and is strongly influenced by the conditions of the layer underneath the HMA layer and not necessarily the density of the surface layer. FWD test measurements obtained from the intermediate course layer and the underlying existing base layer confirmed that variable support conditions exist at different test locations. Correlations between the E_{FWD} (on intermediate course layer and base layer) and CCV (on intermediate course layer) yielded R^2 values in the range of 0.5 to 0.9. Results presented during Phase I of this research (White et al. 2010) also corroborate with this finding. This research finding is critical to understand as it has practical consequences in terms of how roller-integrated CCV data can be used for QC or QA in future specifications.
- Correlation between T_{Roller} and T_{FILR} indicated that there was no statistically significant correlation between the two measurements; however, about 29 out of the 35 measurements were close to the 1:1 line and the measurements were on average comparable to each other.
- Based on field observations and conversations with the roller operator, it is understood that the roller operator targeted 3 to 4 roller passes using the break down roller. Roller coverage data indicated that the average number of break down roller passes on the project was about 3 with a standard deviation of about 1 to 2. Geostatistical analysis of pass count indicated that the sill values varied from about 2.4 to 3.6 and the range values varied from about 9 to 20 m. These sill values are higher than observed in Phase I on the US218 project (~1.3) and on the US20 project (~0.6) discussed later in this report. The high sill values on the US30 project compared to the US218 and US20 projects indicates that the pass coverage was more variable on the US30 project. Field observations indicated that the number of passes made by the break down roller was governed heavily by the pace of the paver ahead of the break down roller.

- Average CCV ranged from 20 to 30 on intermediate course and 22 to 33 on surface course layers. Average surface temperature at the end of break down roller pass ranged from about 215 to 225^{o}F on surface and intermediate course layers.

Summary of Key Findings from US20 Ida County Project:

- The RICM-HMA SP-090057a (with temperature and pass count information on break down roller) was successfully implemented on the US20 Ida County pilot project. Evaluation of RICM data coverage information indicated that the RICM data was collected over 98% of the project area on both intermediate and surface course layer, thus conveniently exceeding the minimum 80% requirement in the SP.
- Field core density results indicated that 101 out of 104 samples exceeded the target minimum 95% compaction requirement. The $QI_{Density}$ measurements ranged from 0.5 to 2.6, thus exceeding the target minimum 0.00.
- Percent compaction curves indicated that the number of roller passes required to achieve 95% compaction varied from 1 to 8 passes (by the full compaction train).
- Asphalt temperature cooling rate (C_r) was modeled using an exponential statistical model from surface temperature with time measurements. For cases where data up to 5 to 48 minutes was considered, the C_r values ranged from about -0.0077 to -0.0198 with an average of about -0.0139 and standard deviation of 0.0003. The average C_r = -0.0139 is close to the average C_r (-0.0135) obtained from the US30 project.
- Correlations between CCV and asphalt density or percent compaction measurements did not yield a statistically significant relationship. Only one or two measurements were available for comparison from each PS, therefore, CCV versus density measurements could not be analyzed separately for each PS. As indicated in the US30 project findings, it is likely that the primary reason for poor correlations between CCV and density/percent compaction is because of variations in support conditions.
- Correlation between T_{Roller} and T_{FILR} indicated that there was no statistically significant correlation between the two measurements; however, all the measurements were close to the 1:1 line and the measurements were on average comparable to each other.
- Roller coverage data indicated that the roller operator targeted 1 to 2 roller passes using the break down roller. Geostatistical analysis of pass count indicated that the sill values varied from about 0.4 to 0.6 and the range values varied from about 5 to 10 m (16 to 33 ft) . These sill values are lower than observed in Phase I on the US218 project (~1.3) and on the US30 project (~3.0). The comparatively lower sill values on the US20 project indicates that the pass coverage was more relatively more uniform.
- Average CCV ranged from 20 to 30 on intermediate course and 22 to 29 on surface course layers. Average surface temperature at the end of break down roller pass ranged from about 215^{o}F to 220^{o}F on surface and intermediate course layers.

Summary of Key Findings from IA9Kossuth County Project:

- The RICM-HMA SP-090058 which includes roller coverage on full compaction train (i.e., on break down, rubber tire, and finish rollers) was used on the IA9 Kossuth county pilot project. The roller coverage information could not be evaluated on this project as most of the data files obtained from the project were incomplete or did not contain any data. This problem likely occurred because of the lack of standard training protocols and inexperience of the operators in recording, saving, and exporting the data. This is an important item to address as part of the training materials to be developed in future.

- Field core density results indicated that all 77 samples collected from the project exceeded the target minimum compaction requirement. The $QI_{Density}$ measurements ranged from 0.6 to 3.7, thus exceeding the target minimum 0.00.
- Field density testing indicated that percent compaction generally continues to increase until the end of the finish roller pass, but about 90% to 95% relative compaction is achieved by the end of break down roller pass. The number of break down roller passes varied from 3 to 5, the rubber tire roller passes varied from 4 to 11, and the finish roller passes varied from 2 to 5 in the production sections tested on this project.
- Results indicated that the asphalt surface temperatures dropped from an average of about 254^{o}F to 184^{o}F within 15 minutes, to about 127^{o}F within 1 hour, and to about 117^{o}F within 2 hours. FLIR spatial temperature maps indicated that temperature segregation of about 15^{o} to 18^{o}F was observed over the width of the pavement.
- Asphalt temperature cooling rate (C_r) was modeled using an exponential statistical model from surface temperature with time measurements. For cases where data up to 30 to 60 minutes was considered, the C_r values ranged from about -0.0126 to -0.0236 with an average of about -0.0183 and standard deviation of 0.0045. The average C_r = -0.0183 is slightly higher than the Cr values observed on the US30 and US20 projects (-0.0135 on US30 and -0.0139 on US20).
- Correlation between percent compaction measurements obtained from nuclear and non-nuclear gauges indicated that the measurements are on-average similar and the results generally fall near the 1:1 line. A statistically significant correlation was not observed between the two measurements.

Cost for using RICM Special Provisions on HMA Projects:

The average RICM-HMA bid item cost (all bidders) varied from about 0.7% to 2.2% of total project cost while the actual project cost varied from about 0.9% to 1.4% of total project cost.

General Comments:

Results from the three field HMA projects indicated that the real-time temperature and pass coverage data can be valuable for HMA overlay construction projects. The stiffness related compaction data (i.e., CCV) obtained on the two projects have also provided valuable information with a strong correlation to the underlying layer support conditions, however, was not correlated well with HMA density. This poses a challenge for using the stiffness related RICM measurements for QC/QA. A recent study documented by White and Vennapusa (2008) indicated that "weak" pavement foundation (subbase and subgrade) layer conditions contribute to failure of the HMA surface layer. In light of that observation, it is recommended that the usefulness of the stiffness related information for QC/QA be evaluated on a full depth HMA project.

Recommendations for Phase III:

Following are some recommendations for the Phase III of this research program:

- Implement RICM-HMA SP that requires pass coverage, temperature, and stiffness related compaction data on a full depth HMA project. This project should include mapping of the underlying subbase layer with the RICM roller prior to paving and also obtain stiffness related point measurements for comparison. The RICM data on the HMA layers should then be carefully evaluated along with the RICM data on the underlying layer. This can provide new insights into developing methodologies to establish target values for QC/QA depending on the support conditions.
- Implement and evaluate the SP developed for HMA with coverage requirement from full compaction train (i.e., SP-090058) on a HMA project.
- Develop an education/training program for state DOT and contractor personnel based on the findings from Phases I and II of this research program. This training program should consist of web-based information and videos for easy access and technology transfer, and operator/inspector guidebook and troubleshooting manuals with input from roller manufacturers.
- Continue to investigate developing a SP for embankment cohesive soils on an earthwork construction project.

CHAPTER 1: INTRODUCTION

Roller-integrated compaction monitoring (RICM) or continuous compaction control (CCC) technologies with global position system (GPS) documentation offer 100 percent coverage information with real-time data visualization of compaction data, which is a significant improvement over traditional quality control/ assurance (QC/QA) procedures involving tests at discrete point locations. A few pilot specifications have been developed by state agencies in the U.S. (e.g., Mn/DOT 2007a, 2007b) and a few specifications exist from European countries (e.g., ZTVE-StB 1994, RVS 8S.02.6 1999, ATB Väg 2004, ISSMGE 2005). A review of these specifications (see White et al. 2008) indicated a weakness in that they are technology and material specific, and there are no widely accepted specifications in the U.S. Recent findings from three national level annual workshops organized by Iowa State University and the Iowa Department of Transportation (DOT) (see White 2008, White and Vennapusa 2009, 2010) indicated the following major obstacles for successful implementation of the RICM technologies: (a) lack of experience and proper education/training materials, (b) correlations on a wide-range of materials between RICM values and traditionally used QC/QA testing tools, (c) poor database and documentation of existing data/case histories, (d) standard protocols for data analysis/management, and (e) standardized specifications inclusive of various RICM technologies.

The *Iowa Department of Transportation Roller Integrated Compaction Monitoring (RICM) Research and Implementation* project was initiated in summer 2009 to make advancements in addressing the obstacles described above. The project is divided into three phases. Phase I of this research project involved conducting field demonstration projects with various RICM technologies on three projects with earthwork and hot-mix asphalt (HMA) construction. Phase II of this research project involved evaluation of pilot RICM specifications that require RICM values to be reported along with traditional quality control (QC) and quality assurance (QA) testing. The proposed Phase III involves revision of pilot RICM specifications and development of education and training materials for Iowa DOT.

Results from Phase I demonstration projects evaluating three different RICM technologies are summarized in the Phase I report of this project (White et al. 2010). This report presents results from Phase II of the research program which includes evaluation of following three special provisions (SPs) incorporated into the project specifications of three HMA projects:

(1) Intelligent Compaction – HMA, US30 Harrison County, NHSN-030-1(127)--2R-43 (Effective January 20, 2010) [SP-090048]
(2) Intelligent Compaction – HMA, US20 Ida County, NHSN-020-2(70) --2R-47 (Effective February 16, 2010) [SP-090057a]
(3) Intelligent Compaction – HMA Roller Pass Mapping, IA 9 Kossuth County, STPN-009-4(44) --2J-55 (Effective February 16, 2010) [SP-090058]

A fourth SP was drafted for a project involving compaction of cohesive soils as listed below but was not implemented due to lack of available equipment at the time of the project.

(4) Intelligent Compaction – Embankment, Sac County, NHSX-020-2(89)--3H-81 (Effective April 20, 2010) [SP-090063]

Sakai's RICM system was used on the US30 Harrison County and US20 Ida County projects, while Topcon's RICM system was used on the IA 9 Kossuth County project. Sakai's RICM system was used only on the Sakai SW990 smooth drum vibratory roller which was utilized as a break down roller. Topcon's RICM system was outfitted on the whole compaction train (i.e., break down roller, pneumatic rubber tire roller, and finish roller). Iowa State University (ISU) research team was present on these pilot projects to conduct in-situ density testing using Troxler's nuclear and non-nuclear density gauges, FWD testing, and asphalt surface temperature testing using FLIR thermal camera, obtain information for future training materials, provide feedback and assistance to the contractor and DOT personnel as required, and interview roller operators about the RICM technology. Density test results were used to evaluate compaction curves and correlate with the roller-integrated continuous compaction value (CCV) from the Sakai RICM system. Temperature measurements obtained from the FLIR thermal camera were used to correlate with temperature measurements obtained from the Sakai roller (from an infrared camera mounted on the roller) and develop statistical models to predict variation in HMA temperature (i.e., cooling rate) with time after placement. FWD test measurements were obtained to investigate the influence of support conditions on the density and roller-integrated CCV measurements.

This report presents an overview of the various in-situ testing methods used in the field studies, overview of the three SPs highlighting the main features and differences between the SPs, and in-situ test results and analysis results from each pilot project, an evaluation of the SPs on three pilot projects, and recommendations for Phase III RICM implementation work for Iowa. Information from this report can be utilized for developing future education and training materials.

CHAPTER 2: IN-SITU EXPERIMENTAL TESTING METHODS

In-situ Testing Methods

Five different in-situ testing methods were used in this research study to evaluate the in-situ HMA properties (Figure 1): (a) calibrated Humboldt nuclear gauge (NG); (b) dynamic cone penetrometer (DCP); (c) Zorn light weight deflectometer (LWD) setup with 300 mm plate diameter; (d) KUAB falling weight deflectometer (FWD) setup with 300 mm diameter four-segmented plate, and (e) FLIR thermal camera to measure HMA surface temperature. Brief descriptions of these test devices/methods are provided below.

Nuclear Density Gauge

A calibrated Troxler® nuclear moisture-density gauge (NG) device was used on all three projects. The device was used to obtain rapid measurements of HMA total density. During testing, silica sand was spread on the surface to fill surface voids and the measurements were obtained using back scattering method. The density values are presented as percent compaction in this report which is calculated using Eq. 1, where G_{mb} = bulk specific gravity (determined in laboratory by Iowa DOT):

$$\text{Percent Compaction (\%)} = \frac{\text{HMATotalDensity}}{G_{mb}} \quad (1)$$

Non-Nuclear Density Gauge

A non-nuclear density gauge (PaveTracker™) manufactured by Troxler was used on the Kossuth County IA 9 project. The device was used to obtain rapid measurements of HMA total density and compare with nuclear density gauge measurements.

Falling Weight Deflectometer

FWD testing was performed on the Harrison County US30 project on the base layer (prior to placement of the intermediate course layer) and then on the intermediate course layer. Tests were performed by applying one seating drop using a nominal applied contact stress of about 390 kPa followed by three test drops each at a nominal applied contact stress of about 390 kPa, 590 kPa and 800 kPa. The actual applied force was recorded using a load cell. A composite modulus value (E_{FWD}) was calculated using measured deflection at the center of the plate using Eq. 2.

$$E_{FWD} = \frac{(1-\eta^2)\sigma_0 r}{d_0} \times F \quad (2)$$

where $E_{FWD\text{-}K3}$ = elastic modulus determined using Kuab FWD setup with a 300 mm diameter plate (MPa), d_0 = measured settlement (mm), η = Poisson’s ratio, σ_0 = applied stress (MPa), r = radius of the plate (mm), F = shape factor depending on stress distribution (assumed as 2).

Figure 1. In-situ testing methods used on the project: Humboldt nuclear gauge (top left), Kuab falling weight deflectometer (top right), Pavetracker non-nuclear density gauge (bottom left), and Flir thermal imaging camera (bottom right)

Laboratory Testing Methods

Dynamic modulus testing was conducted by Iowa DOT on HMA box samples collected from the US30 Harrison County project. Results will be reported separately by the Iowa DOT (contact Dr. Scott Schram).

CHAPTER 3: OVERVIEW OF SPECIAL PROVISIONS AND BID COSTS

Special Provisions to Standard Specifications

The following four SPs have been developed as part of this research project to implement them on pilot projects as an addendum to the Iowa DOT standard specifications:

(1) Intelligent Compaction – HMA, Harrison County, NHSN-030-1(127)--2R-43 (Effective January 20, 2010) [SP-090048]
(2) Intelligent Compaction – HMA, Ida County, NHSN-020-2(70) --2R-47 (Effective February 16, 2010) [SP-090057a]
(3) Intelligent Compaction – HMA Roller Pass Mapping, Kossuth County, STPN-009-4(44) --2J-55 (Effective February 16, 2010) [SP-090058]
(4) Intelligent Compaction – Embankment, Sac County, NHSX-020-2(89)--3H-81 (Effective April 20, 2010) [SP-090063]

The SPs describe the contractor's responsibilities to furnish the RICM rollers, data acquisition, and other attributes listed in Table 1. The attributes slightly differ from each SP. For example, SP (1) requires repeatability testing of roller measurement values while SPs (2), (3), and (4) do not. The data collection, export, and onboard display attributes also differ between the special provisions as highlighted in Table 2. The Sac County Embankment project SP could not be implemented due to lack of availability of an RICM roller for the construction period. The SPs are included in Appendix A.

As part of the SPs, the contractors were required to collect the RICM data for research purposes and the data was not used for QC or QA. However, the SPs required that the RICM data (with the attributes stated in Table 2) be collected over a minimum of 80% of the project intermediate and surface course layers to request full payment.

The Iowa DOT standard specifications section 2303 describes the traditional QC/QA requirements for HMA. Class 1B compaction is specified on intermediate and surface course layers which require a minimum of 95% of laboratory density in the field for QA. According to the specification, rolling patterns are to be determined by the contractor prior to placement of the layers by constructing a test strip for the purpose of evaluating properties of the HMA mixtures and for identifying an effective rolling pattern. To the authors' knowledge, test strips were not constructed as part of these projects, but the contractors determined the optimal rolling pattern based on their experience with similar previous projects. Field cores were obtained to check the density of the asphalt mixtures for QA. Seven core samples per lot at randomly selected locations are required for QA testing in the specification. Three additional core samples were required in the SPs at locations requested by ISU research personnel, but the data was not used for QA purposes. The quality index (QI) for density of each lot was determined using Eq. 3. When the QI falls below 0.00, the lot is declared as defective.

$$QI_{Density} = \frac{(AverageG_{mb})_{Fieldlot} - (0.95 \times (AverageG_{mb})_{Lab})}{(StdDevG_{mb})_{FieldLot}} \quad (3)$$

Table 1. Overview of main attributes of the special provisions

Feature	**Specification (1)**	**(2)**	**(3)**	**(4)**
Material	HMA	HMA	HMA	Cohesive Soils
Specification Attribute				
Description	✔	✔	✔	✔
Equipment and Materials				
Rollers	✔	✔	✔	✔
Data Collection, Export, and Onboard Display	✔	✔	✔	✔
Local GPS Base Station	✔	✔	✔	✔
Training	✔	✔	✔	✔
Geotechnical Mobile Lab Parking	✔	✔	✔	✔
Test Strips				✔
Proof Area Mapping				✔
Construction				
Roller Verification/Repeatability	✔			
Roller Operations	✔	✔	✔	✔
Equipment Breakdowns	✔	✔	✔	✔
Data Submittal	✔	✔	✔	✔
Method of Measurement	✔	✔	✔	✔
Basis of Payment	✔	✔	✔	✔
Equipment/Technology Availability	Y	Y	Y	N*

Notes: Y – Yes, N – No (not available at the time of bidding)

Table 2. Differences in data collection requirements

Data Collection	**Specification (1)**	**(2)**	**(3)**	**(4)**
(1) Machine Model, Type, and Serial/Machine Number	✔	✔	✔	✔
(2) Roller Drum Dimensions	✔	✔	✔	✔
(3) Roller and Drum Weights	✔	✔	✔	✔
(4) File Name	✔	✔	✔	✔
(5) Date Stamp	✔	✔	✔	✔
(6) Time Stamp	✔	✔	✔	✔
(7) RTK Based GPS Measurements (Northing, Easting, and Elevation)	✔	✔	✔	✔
(8) Roller Travel Direction (Forward or Reverse)	✔	✔	✔	✔
(9) Roller Speed	✔	✔	✔	✔
(10) Vibration Setting (On or Off)	✔	✔		✔
(11) Vibration Amplitude	✔	✔		✔
(12) Vibration Frequency	✔	✔		✔
(13) Surface Temperature	✔	✔		
(14) Compaction Measurement Value	✔			✔
(15) Roller Pass Count	✔	✔	✔	✔

Table 3. Summary of special provisions

Spec.	Equipment	Field Size	Location Specs	QA Requirements	Speed	Freq.
SP-090048 [HMA]	Self-Propelled vibratory dual drum *break down HMA roller* (Comply with Iowa DOT Article 2001-05 Standard Specifications). Provide a computer screen in the cab for viewing results.	—*	—*	RICM data shall be collected and provided for a minimum 80% of the project surface and intermediate HMA quantity. QA for HMA is based on cores according to Section 2303 Iowa Standard Specifications.	Constant (min. of 10 impacts per linear foot and within ± 0.5 mph)	Constant (± 125 vpm)
SP-090057a [HMA]					—	—
SP-090058 [HMA]	*All compaction equipment* must comply with Iowa DOT Article 2001-05 Standard Specifications. Provide a computer screen in the cab for viewing results on all equipment.	—*	—*	RICM data shall be collected and provided for a minimum 80% of the project surface and intermediate HMA quantity. QA for HMA is based on cores according to Section 2303 Iowa Standard Specifications.	—	—
SP-090063 [Earth-work (only on materials with moisture control)]	Self-propelled padfoot roller weighing at least 10,800 kg.	Test strips to demonstrate the equipment meets the specs. 5 m wide x 75 m long compacted for 12 passes.	RICM roller shall be used for measurement at vertical intervals of 0.6 m or less in proof areas. Surface shall be relatively smooth and uniform.	RICM data in forward direction only on test strips and proof areas. RICM data shall be collected and provided for a minimum 80% of the required proof areas. QA in proof areas is based on DS-09003 earthwork specification.	Constant on test strips and proof areas	

* RICM data was not used for QC/QA except for the coverage requirement.

Cost of Using RICM for HMA Resurfacing Projects

Table 4 summarizes the contract bid total costs of each project and the cost for implementing RICM-HMA SP on each project. The average bid item cost (for all bidders) for implementing the RICM-HMA SP varied from about 0.7% to 2.2% of total project cost while the actual project cost varied from about 0.9% to 1.4% of total project cost for the winning bidders. The average bid unit cost/mile (for all bidders) varied from about $2500 to $9900 but varied significantly from about $450 to $26,000 between projects.

Table 4. Top seven bid prices for implementing RICM-HMA SP on each project

Project	Bidder	Total Bid	% Over Low Bid	Cost for implementing RICM-HMA SP	% of Total Project Cost	Unit Cost/mile
SP-090048 (RICM coverage with roller pass count, temperature, and compaction data on one breakdown roller only)						
US30 Harrison County – 8.09 mile long two lane highway HMA resurfacing (RICM on breakdown roller Only)	**1***	**$3,637,427.50**	**0.00**	**$50,000**	**1.4**	**$6,180**
	2	$3,828,672.23	5.25	$4,000	0.1	$494
	3	$3,867,951.42	6.33	$50,000	1.3	$6,180
	4	$3,951,688.43	8.63	$116,652	3.0	$14,419
	5	$4,164,111.01	14.47	$150,000	3.6	$18,541
	6	$4,242,421.16	16.63	$136,500	3.2	$16,873
	7	$4,386,013.92	20.58	$30,000	0.7	$3,708
	Average	$4,011,183.67	10.27	$76,736	1.9	$9,485
	Std. Dev.	$224,249.22	6.17	$60,997	1.5	$7,540
SP-090057a (RICM coverage with roller pass count and temperature on one breakdown roller only)						
US20 Ida County – 11.20 mile long two lane highway HMA resurfacing (RICM on breakdown roller Only)	**1**	**$3,975,334.01**	**0.00**	**$35,000**	**0.9**	**$3,125**
	2	$4,152,496.87	4.45	$5,000	0.1	$446
	3	$4,216,738.94	6.07	$20,000	0.5	$1,786
	4	$4,282,603.28	7.72	$50,000	1.2	$4,464
	5	$4,621,687.46	16.25	$30,000	0.6	$2,679
	Average	$4,249,772.11	6.90	$28,000	0.7	$2,500
	Std. Dev.	$237,312.48	5.97	$16,808	0.4	$1,501
SP-090058 (RICM coverage with roller pass count on all compaction equipment)						
IA 9 Kossuth County – 10.73 mile long two lane highway HMA resurfacing (RICM on full compaction train)	**1**	**$4,062,409.63**	**0.00**	**$40,000**	**1.0**	**$3,728**
	2	$4,179,222.66	2.87	$68,000	1.6	$6,337
	3	$4,521,721.37	11.30	$10,000	0.2	$932
	4	$4,632,077.66	14.02	$100,000	2.2	$9,320
	5	$4,679,072.51	15.17	$100,000	2.1	$9,320
	6	$4,771,151.13	17.44	$274,925	5.8	$25,622
	7	$5,259,900.22	29.47	$150,000	2.9	$13,980
	Average	$4,586,507.88	12.90	$106,132	2.2	$9,891
	Std. Dev.	$396,432.57	9.76	$87,139	1.8	$8,121

** Winning bidders indicated by #1 and highlighted in bold.*

CHAPTER 4: IN-SITU TEST RESULTS AND ANALYSIS

Evaluation of the Special Provisions

A comparison of the data collection requirements outlined in the SP's with the actual output file content is presented in Table 5. With the exception of items (1) to (3) which are related to machine information and item (11) vibration amplitude, all other items were available in the output files generated from the Sakai RICM software. Information on items (1) to (3) on the Sakai RICM roller were submitted to Iowa DOT in a RICM work plan document, while item (11) vibration amplitude setting was manually noted during field operations. Output files from the Topcon's software did not include items (1) to (3) related to machine information, (8) travel direction, (9) roller speed, and (10) roller pass count. Coverage evaluation results from US30 and US20 projects are summarized in Table 6. Coverage could not be evaluated on the IA 9 project as most of the data files were incomplete or did not contain data. This problem likely occurred because of the prototype equipment used, lack of standard training protocols, and inexperience of the operators in recording, saving, and exporting the data. This is an important item to address as part of the training materials to be developed in future.

Table 5. Comparison of the data collection requirements in the SP's with the actual output files

Data Collection	Special Provision and Project		
	US30 Project	**US20 Project**	**IA9 Project**
RICM system manufacturer	Sakai	Sakai	Topcon
(1) Machine Model, Type, and Serial/Machine Number	✔ (N)*	✔ (N)*	✔ (N)
(2) Roller Drum Dimensions	✔ (N)*	✔ (N)*	✔ (N)
(3) Roller and Drum Weights	✔ (N)*	✔ (N)*	✔ (N)
(4) File Name	✔ (Y)	✔ (Y)	✔ (Y)
(5) Date Stamp	✔ (Y)	✔ (Y)	✔ (Y)
(6) Time Stamp	✔ (Y)	✔ (Y)	✔ (Y)
(7) RTK Based GPS Measurements (Northing, Easting, and Elevation)	✔ (Y)	✔ (Y)	✔ (Y)
(8) Roller Travel Direction (Forward or Reverse)	✔ (Y)	✔ (Y)	✔ (N)
(9) Roller Speed	✔ (Y)	✔ (Y)	✔ (N)
(10) Vibration Setting (On or Off)	✔ (Y)	✔ (Y)	
(11) Vibration Amplitude	✔ (N)	✔ (N)	
(12) Vibration Frequency	✔ (Y)	✔ (Y)	
(13) Surface Temperature	✔ (Y)	✔ (Y)	
(14) Compaction Measurement Value	✔ (Y)		
(15) Roller Pass Count	✔ (Y)	✔ (Y)	✔ (N)

Y – Yes (available in the output file), N – No (not available in the output file), *this information is submitted separately by the contractor but was not included in the electronic data files.

Results from the US30 and US20 projects indicate that the coverage information recorded on both projects conveniently exceeded the minimum 80% requirement in the SPs. On the US30 project, coverage on the intermediate course layer was about 85% because of a hardware problem with the Sakai system and no coverage for about 1.5 days (Figure 2). The surface course layer on US30 project and both intermediate and surface course layers on the US20 project contained coverage information over 95% of the project area (note that there was no coverage within 150 ft of bridges on both projects (Figure 3)).

Table 6. Overview of the RICM mapping coverage on each project

Project	Layer	Total Area (ft^2)	Area with no coverage (ft^2)	Percentage net coverage (%)	Reason for no coverage
US30, Harrison Cty SP-090048 [HMA]	Intermediate	1,375,326	212,736	84.5	RICM software malfunction for 1.5 days and no coverage within 150ft of bridges.
	Surface	1,375,326	57,421	95.8	No coverage within 150ft of bridges.
US20, Ida County, SP-090057a [HMA]	Intermediate	1,655,976	24,457	98.5	No coverage within 150ft of bridges.
	Surface	1,655,976	32,952	98.0	No coverage within 150ft of bridges.
IA9, Kossuth County, SP-090058 [HMA]	Intermediate	Could not be determined due to incomplete data files.			
	Surface				

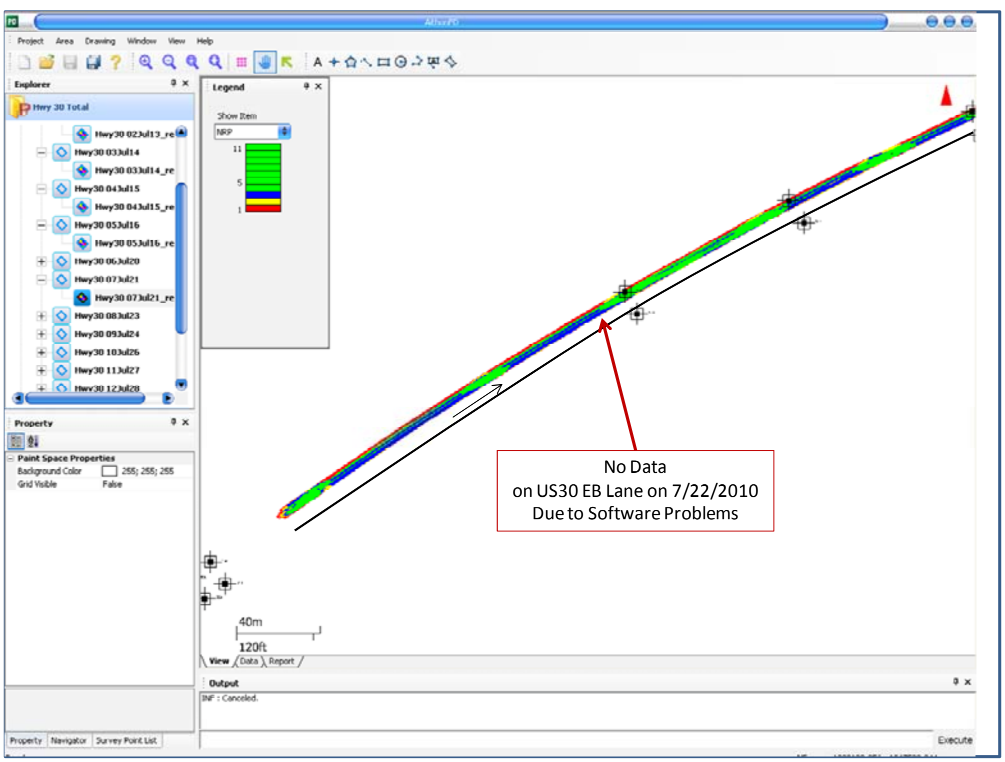

Figure 2. Roller pass coverage map with no data on 7/22/2010 due to software problems – UW30 Harrison county project

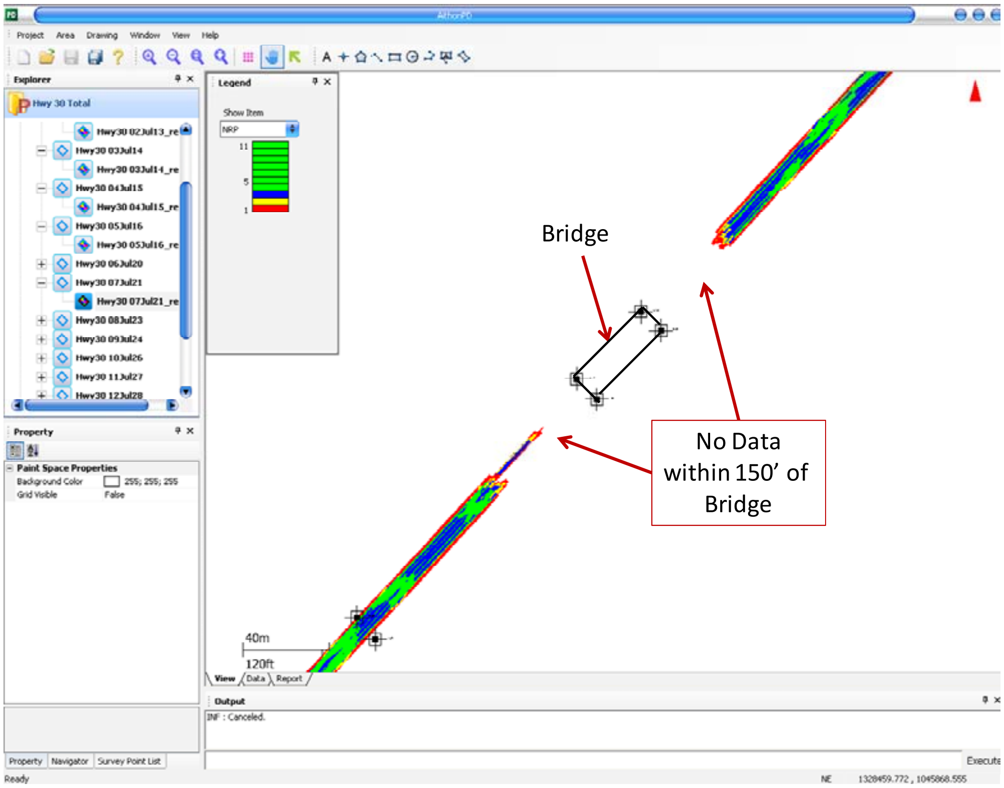

Figure 3. Roller pass coverage map with no data within 150 feet of bridge – US30 Harrison county project

Review of some output files from the Topcon software indicated that data was being collected every 25 ft which is in turn converted into a dense grid pattern for display purposes. An experimental plan was submitted to the contractor to collect data at 1, 5, 10, and 25 ft intervals to analyze the influence of data collection interval on the final coverage display. This data was reportedly collected, but unfortunately was not available for analysis. Review of Sakai roller data output files indicates that roller data is reported in a 1 ft x 1 ft grid pattern.

US30 Harrison County Project

Project Information

The US30 project is about 8.1 miles long and is located between Dunlap and Dow City, Iowa (between Sta. 24+83.50 and Sta. 432+63; between mile posts 38.38 and 46.12; Iowa DOT project number NHSN-30-1(127)--2R-43). The project location map is shown in Figure 4. It involved milling the existing pavement to about 38 mm (1.5 in.), and resurfacing with 51 mm (2 in.) of HMA intermediate course and 51 mm (2 in.) of HMA surface course layers. HMA resurfacing was performed in the mainline over a width of about 24 feet and over the shoulder extending about 4 feet on each side. According to the field core density reports, HMA 3M mix with design gyrations of 86 and ½ inch mixture size (mix design number ABD 10-3019R1 for intermediate course and ABD 10-3020R2 for surface course) was used on this project. The target binder content range was 5.2% to 5.8% for the intermediate course and 5.1% to 5.7% for the surface course layers.

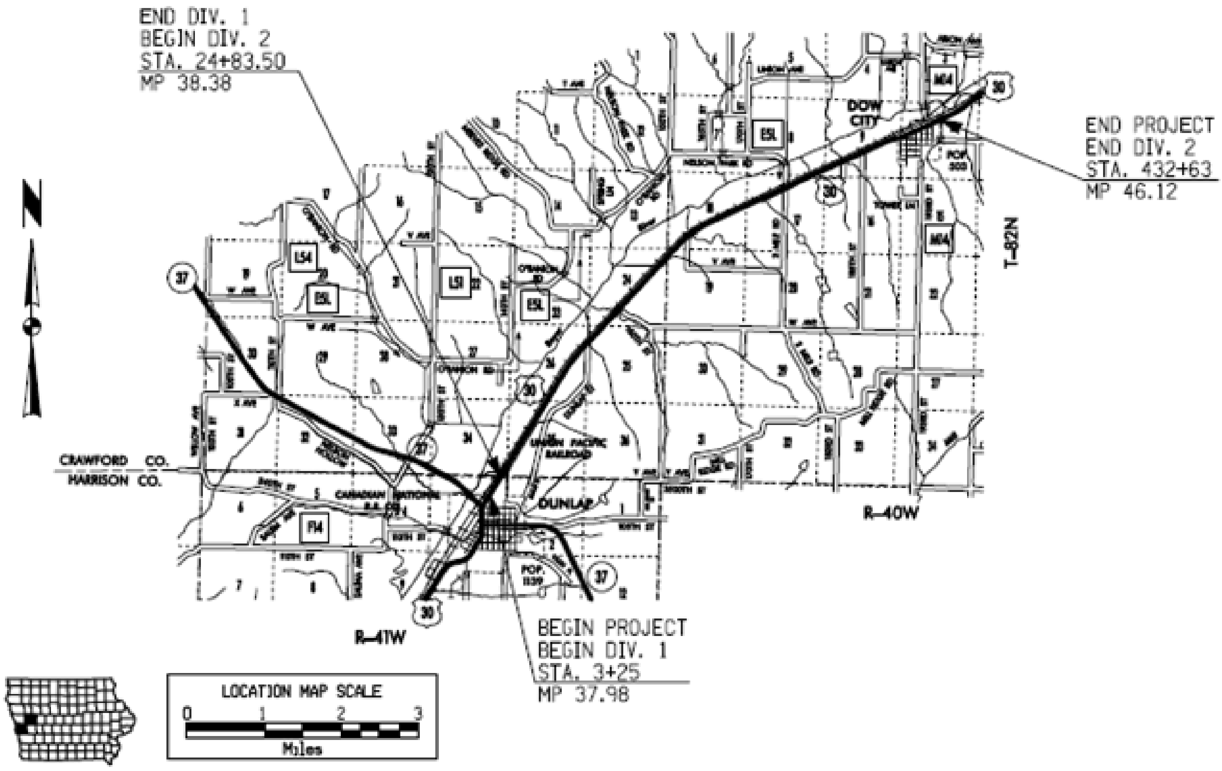

Figure 4. Project location map – US30 demonstration project

The ISU research team was present on the project site on July 12 to 15, 21, 23, and 27, 2010. Roller and RICM software operation training was conducted on July 12, 2010. Compaction of the HMA layers was achieved using a Sakai SW990 smooth drum roller in the breakdown position, followed by Hamm GRW18 pneumatic rubber tire roller, and a Caterpillar CB-6346 smooth drum roller for final passes (Figure 5). Only the Sakai SW990 smooth drum roller was equipped with the RICM system. The roller dimensions, weights, force, amplitude, and frequency information is provided in Table 7, based on the RICM work plan submitted by the contractor. The Sakai Compaction Control Value (CCV) system is explained in detail in the Phase I report of this project (White et al. 2010). Sakai's RICM system records and displays the spatial position of the roller (i.e., GPS northing, easting, and elevation), roller-integrated CCV, surface temperature, roller pass coverage, vibration mode, etc. in real time to the roller operator through an on-board display unit (Figure 5, Figure 6). Compaction using the RICM roller was achieved in vibratory mode using a low amplitude setting (0.33 mm) and a frequency setting of 50 Hz (3000 vpm). Screen shots of roller pass coverage, temperature, and CCV maps from the RICM software are shown in Figure 7, Figure 8, and Figure 9, respectively.

Figure 5. Photographs of construction equipment – US30 Harrison County project

Figure 6. Photograph showing infrared temperature sensor on the RICM roller to measure HMA surface temperature (Courtesy of Sakai)

Table 7. Summary of the Sakai RICM roller features (based on RICM work plan submitted by Mannat's Inc.)

Feature	Value
Roller Model	SW990 DEUTZ TCD-2012 L06 2V
Roller Dimensions and Weights	
Operating Weight	30800 lbs (13971 kgs)
Front Drum Weight	15235 lbs (6911 kgs)
Rear Drum Weight	15565 lbs (7060 kgs)
Drum Diameter	55 inches (139.7 cm)
Drum Width	84 inches (213.4 cm)
Overall Length	234 inches (594.4 cm)
Overall Height	128 inches (325.1 cm)
Whell Base	139 inches (353.1 cm)
Curb Clearance	29.5 inches (74.9 cm)
Side Overhang	3.1 inches (7.9 cm)
Force, Amplitude, and Frequency	
Centrifugal Force (Low Amplitude)	15285 lbs (6933 kgs)
Centrifugal Force (High Amplitude)	41590 lbs (18865 kgs)
Low Amplitude	0.013 inches (0.33 mm)
High Amplitude	0.026 inches (0.66 mm)
Minimum Frequency	2520 vpm (42 Hz)
Maximum Frequency	4000 vpm (67 Hz)
Measurement/Recording Systems	
Compaction Measurement Value	Compaction Control Value (CCV)
Temperature	Infrared Temperature Sensor
Position	GPS Radio/Reciever
Data Recording/Saving	Compaction Information System (CIS) On-Board Display
Software	Aithon MT-R Software

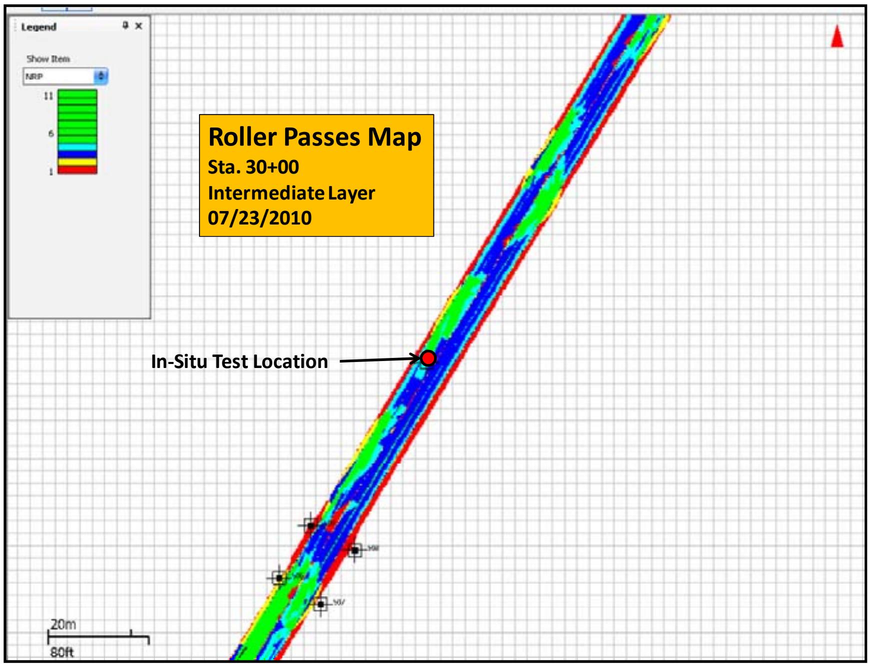

Figure 7. Roller pass coverage map at Sta. 30+00 intermediate course layer – US30 Harrison county project

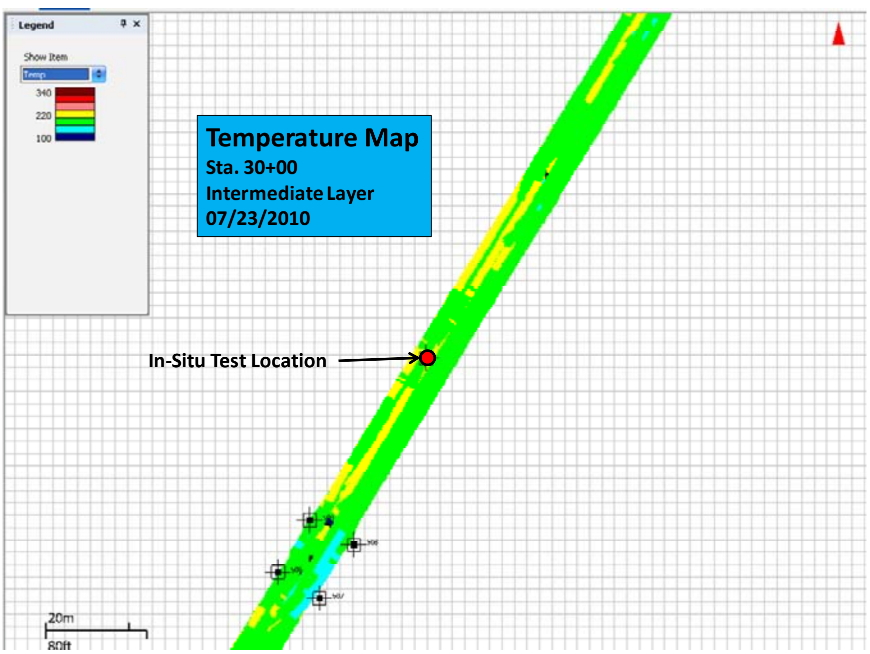

Figure 8. Surface temperature coverage map at Sta. 30+00 intermediate course layer – US30 Harrison county project

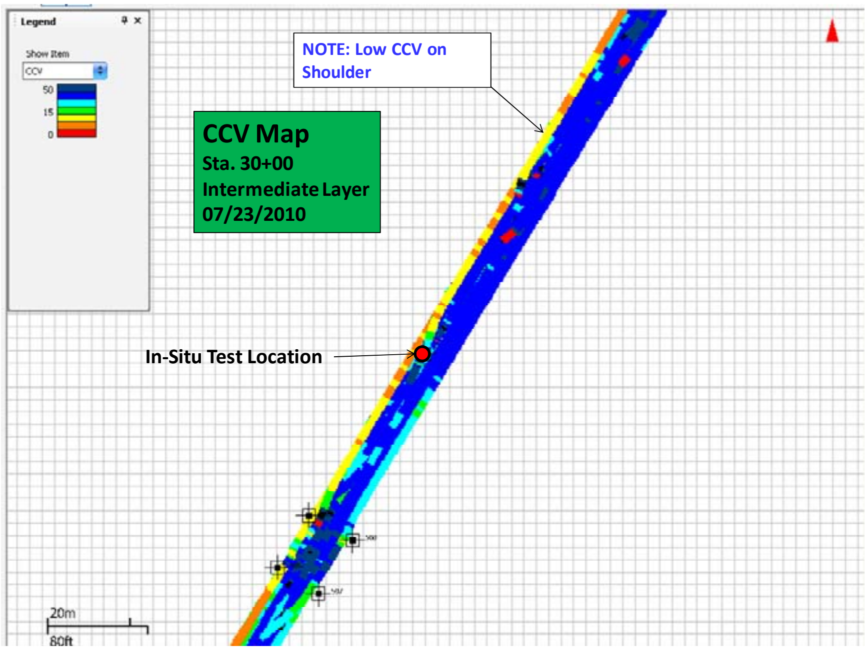

Figure 9. Roller CCV coverage map at Sta. 30+00 intermediate course layer – US30 Harrison county project

Production Information

Daily production information with the amount of HMA placed (tons/day) for intermediate and surface course layers are presented in Figure 10. The production information was obtained from DOT field core density sheets (see Appendix B). Comparison between daily gradation test results on the mixture aggregate and specifications for the intermediate and the surface course layers is provided in Figure 11. Similarly, comparison between daily measured binder contents and the specification limits are presented in Figure 12. Results indicate that both binder content and gradations of the materials were within the specified limits.

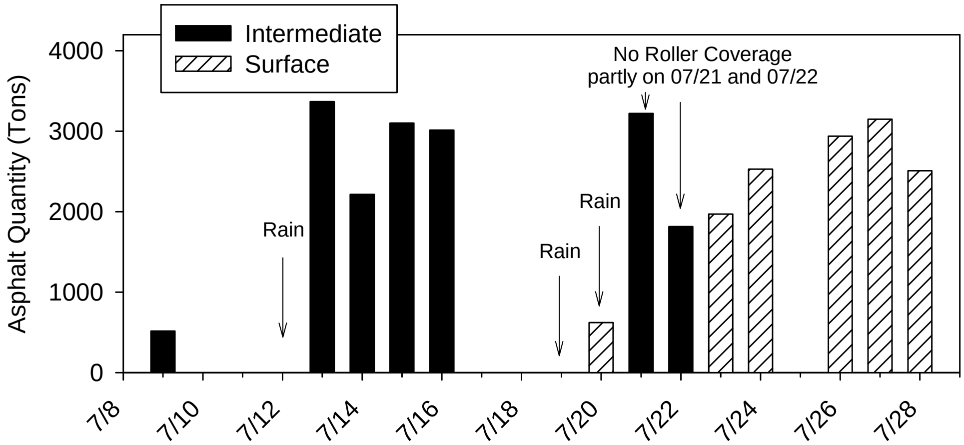

Figure 10. HMA placement (tons/day) information on intermediate and surface layers – US30 Harrison County project

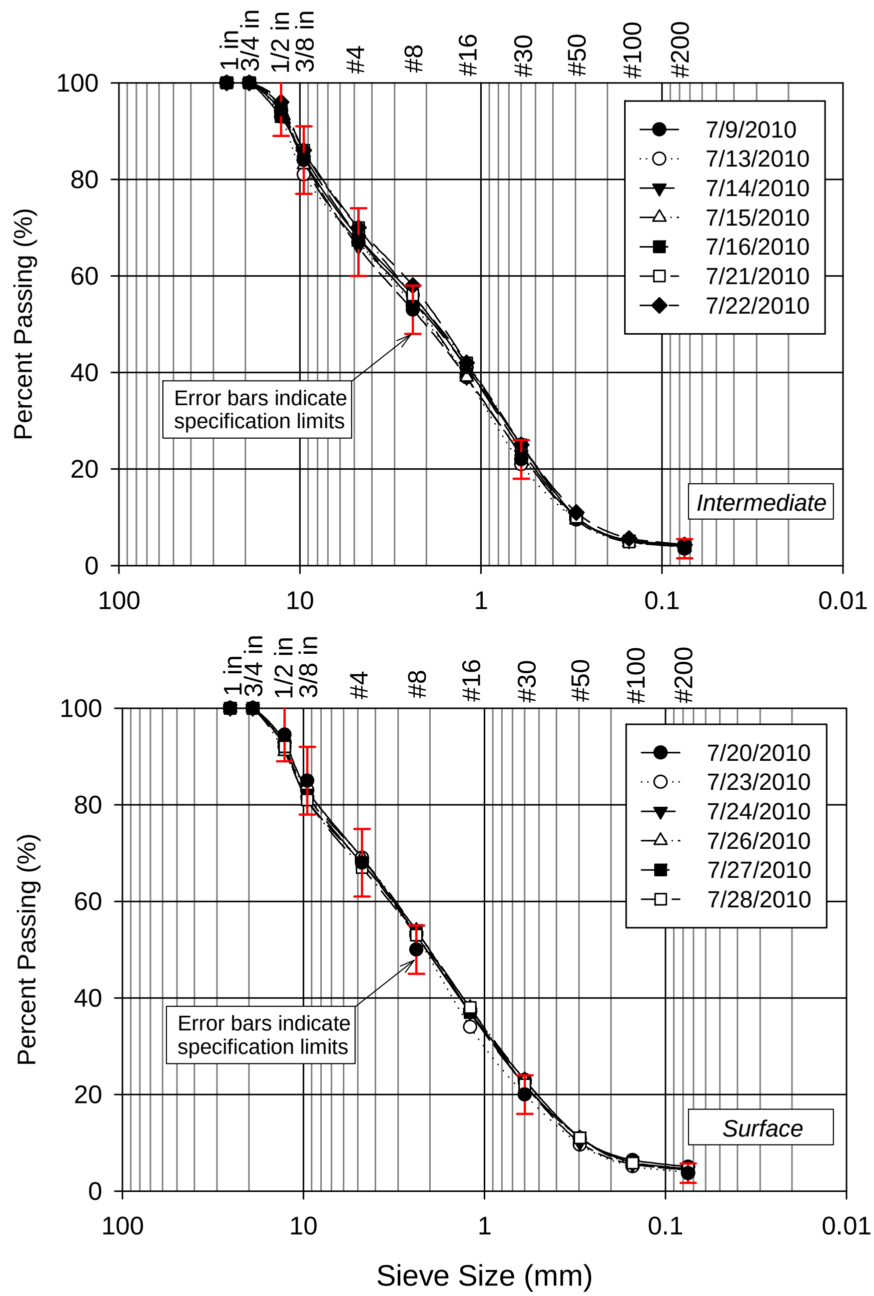

Figure 11. Grain size distribution of aggregate used in the intermediate and surface course mixtures on each paving day in comparison with specification limits – US30 Harrison County project

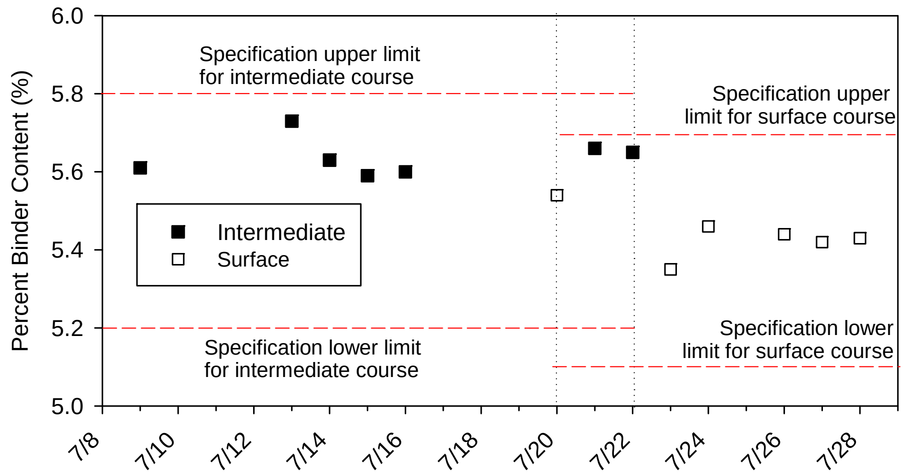

Figure 12. Binder content measurements on intermediate and surface course mixtures on each paving day in comparison with specification limits – US30 Harrison County project

In-Situ Test Results

A summary of the percent compaction measurements on the intermediate and surface course core samples is provided in Figure 13. The core density results indicate that 66 out of 67 samples from the intermediate course and 49 out of 50 samples from the surface course layer exceeded the target minimum 95% compaction requirement according to the specification. The core density results for all samples are provided in Appendix B. The $QI_{Density}$ measurements on each day are summarized in Figure 14 which indicates that all QI measurements were greater than the minimum 0.00 as required in the specification.

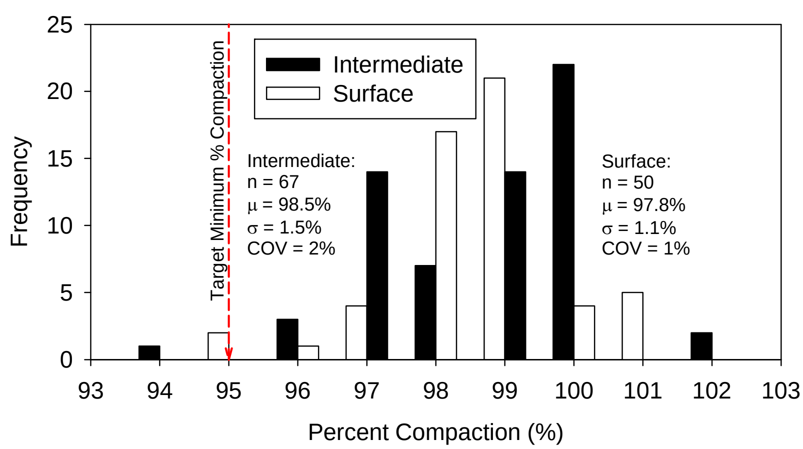

Figure 13. Summary of percent compaction measurements from field cores on intermediate and surface course layers – US30 Harrison County project

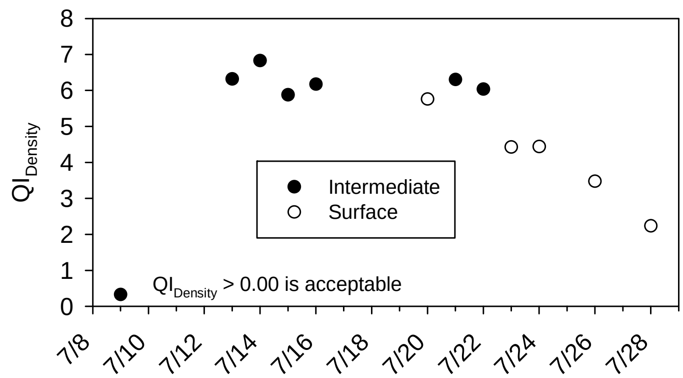

Figure 14. Summary of daily density QI measurements on intermediate and surface course layers – US30 Harrison County project

Beyond the QC/QA testing required in the project specifications, a total of fourteen production test sections (PSs) were tested between July 14 and 27, 2010. A summary of testing performed in each PS and location of each PS is presented in Table 8. A Troxler nuclear gauge was used to obtain percent compaction measurements on the HMA layers. HMA surface temperature measurements were obtained using a FLIR thermal camera (T_{FLIR}) and the infrared camera mounted on the RICM roller (T_{Roller}). Density and surface temperature measurements were obtained before and after multiple roller passes (e.g., 0, 1, 2, 3, etc) to evaluate their changes with increasing pass and time. Density measurements are correlated with roller-integrated CCV measurements and T_{FLIR} measurements are correlated with T_{Roller} measurements. In addition, FWD tests were obtained on the existing milled asphalt base layer prior to and after placement of the intermediate layer at few test locations. FWD tests were performed to evaluate the influence of support conditions on the roller-integrated CCV measurements which presumably have deeper influence depths (i.e., up to > 1 m) and also to correlate with laboratory dynamic modulus measurements obtained by Iowa DOT on the HMA samples.

Percent compaction, roller-integrated CCV, T_{FLIR}, and T_{Roller} with increasing pass, and time from each PS are presented in Figure 15 to Figure 24. Percent compaction and T_{FLIR} measurements are obtained from a point test location in each PS as noted in the figures. The exact GPS coordinates of these test locations were not obtained, however, approximate station and offset information was obtained for each location during testing. The GPS coordinates of the center line of the project alignment were obtained, which were then used to determine the approximate northing and easting of each test measurement location. These approximate northing and easting locations were used to extract the RICM data at those test locations. The RICM data was extracted from a 1 m x 1 m (3 ft x 3 ft) window area by placing the approximated location in the center of the window. Average CCV and T_{Roller} data within the 1 m x 1m (3 ft x 3 ft) window was used in the plots presented in Figure 15 to Figure 24.

Percent compaction curves indicate that 95% compaction was generally achieved within 1 to 2 break down roller passes at most locations with exceptions at few locations (e.g., PS 10, 11, and 12) where up to four passes or more was required. T_{Roller} measurements with pass generally indicated that pass 2 surface temperature measurement was lower than pass 3 (note that the rolling pattern included forward, reverse, and forward directions of travel for passes 1, 2, and 3), indicating that the measurements are travel direction dependent. The temperature sensor is located on the front drum of the roller and water sprayed on to the roller drum likely caused a reduction in the surface temperature values, when the roller travels in the reverse direction.

Figure 25 and Figure 26 present roller CCV and surface temperature data on intermediate and surface course layers at locations where field core samples were obtained. These are provided for Iowa DOT to compare with dynamic modulus measurements on intermediate and surface course materials. Figure 27 presents roller CCV and surface temperature data for only intermediate course layer at field core sample locations as CCV data on the surface course layer at those locations was not available. Figure 28 shows CCV compaction curves at several locations across the width of the pavement. Figure 29, Figure 30, and Figure 30 show these points on the roller CCV, pass count, and surface temperature maps, respectively. These curves illustrate that the CCV measurements are slightly different for each pass across the width of pavement at a given station. This is likely due to different support conditions that exist across the pavement width. This behavior is further addressed by comparing CCV measurements with FWD measurements in the Correlations Analysis section below.

Table 8. Summary of production test sections and in-situ testing (Harrison/Crawford County Project)

Layer	Date	PS	Location	In-situ Test Measurement	Comments
Intermediate Course	7/14/10	1	Near station 77+79, Offset 7ft left of CL	% compaction (Cores and Nuclear Gauge), surface temperature (thermal camera and roller infrared camera), CCV, pass count	One point, data recorded after each breakdown, rubbertire, and finish roller pass.
	7/15/10	2	Near station 111+31, Offset 6 ft left of CL		
		3	Near station 111+61, offset 6ft left of CL		
		4	Near station 112+79, offset 9 ft left of CL		
		5	Near station 146+25, offset 3ft left of CL		One point, data recorded after each breakdown roller pass.
		6	Near Sta. 149+22, offset 1.8ft right of CL	% compaction (Cores and Nuclear Gauge), surface temperature (thermal camera and roller infrared camera), CCV, pass count, E_{FWD}	
		7	Near station 158+28, offset 4.6ft right of CL		One point, data recorded after each pass of breakdown, rubbertire, and finish roller.
		8	Near station 192+78, offset 7.1ft right of CL		One point, data recorded after each breakdown roller pass.
		9	Near station 195+95, offset 8.9ft right of CL	% compaction (Cores and Nuclear Gauge), surface temperature (thermal camera and roller infrared camera), CCV, pass count, E_{FWD-K3}	One point, data recorded after each breakdown, rubbertire, and finish roller pass.
	7/21/10	10	Near station 360+00	% compaction (Cores and Nuclear Gauge), surface temperature (thermal camera and roller infrared camera), CCV, pass count	Three points spread equidistant across the pavement width. Data recorded after each breakdown, rubbertire, and finish roller pass.
Surface Course	7/23/10	11	Near station 30+00	% compaction (Cores and Nuclear Gauge), surface temperature (thermal camera and roller infrared camera), CCV, pass count	Three points spread equidistant across the pavement width. Data recorded after each breakdown, rubbertire, and finish roller pass.
		12	Near station 40+00		
	7/27/10	13	Near station 192+78, offset 7.1ft right of CL		One point, data recorded after each breakdown roller pass.
		14	Near station 195+95, offset 8.9ft right of CL		One point, data recorded after breakdown, rubbertire, and finish roller pass.

Note: PS – production test section, % compaction measurements were taken with a Troxler Nuclear Densitometer. Thermal Camera images were taken with a FLIR E45.

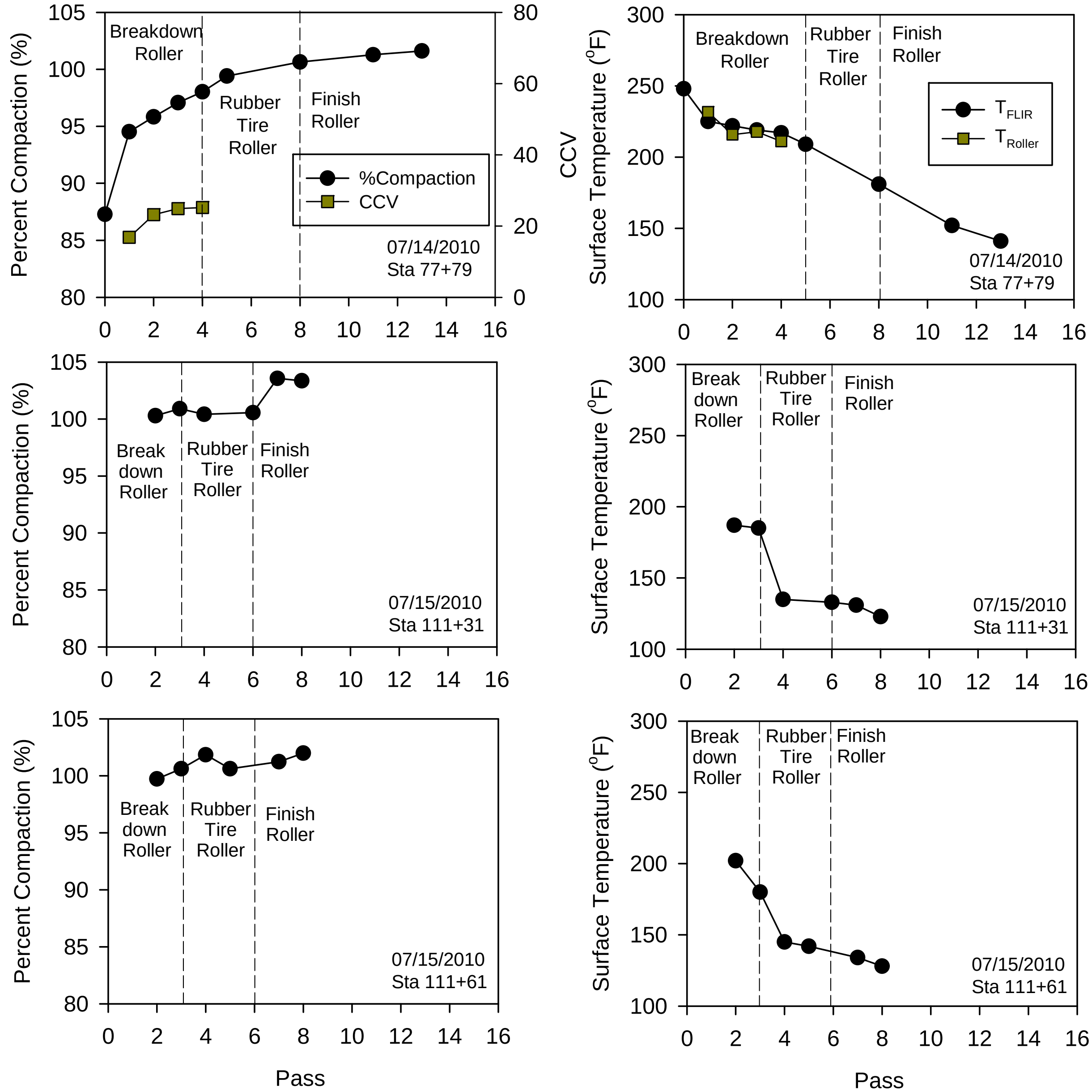

Figure 15. In-situ percent compaction, roller CCV, and surface temperature with pass measurements on intermediate course layer – US30 Harrison county project PS 1 to 3 (07/14 to 07/15/2010) [Note: G_{mb} = 2.346 (146.4 pcf)]

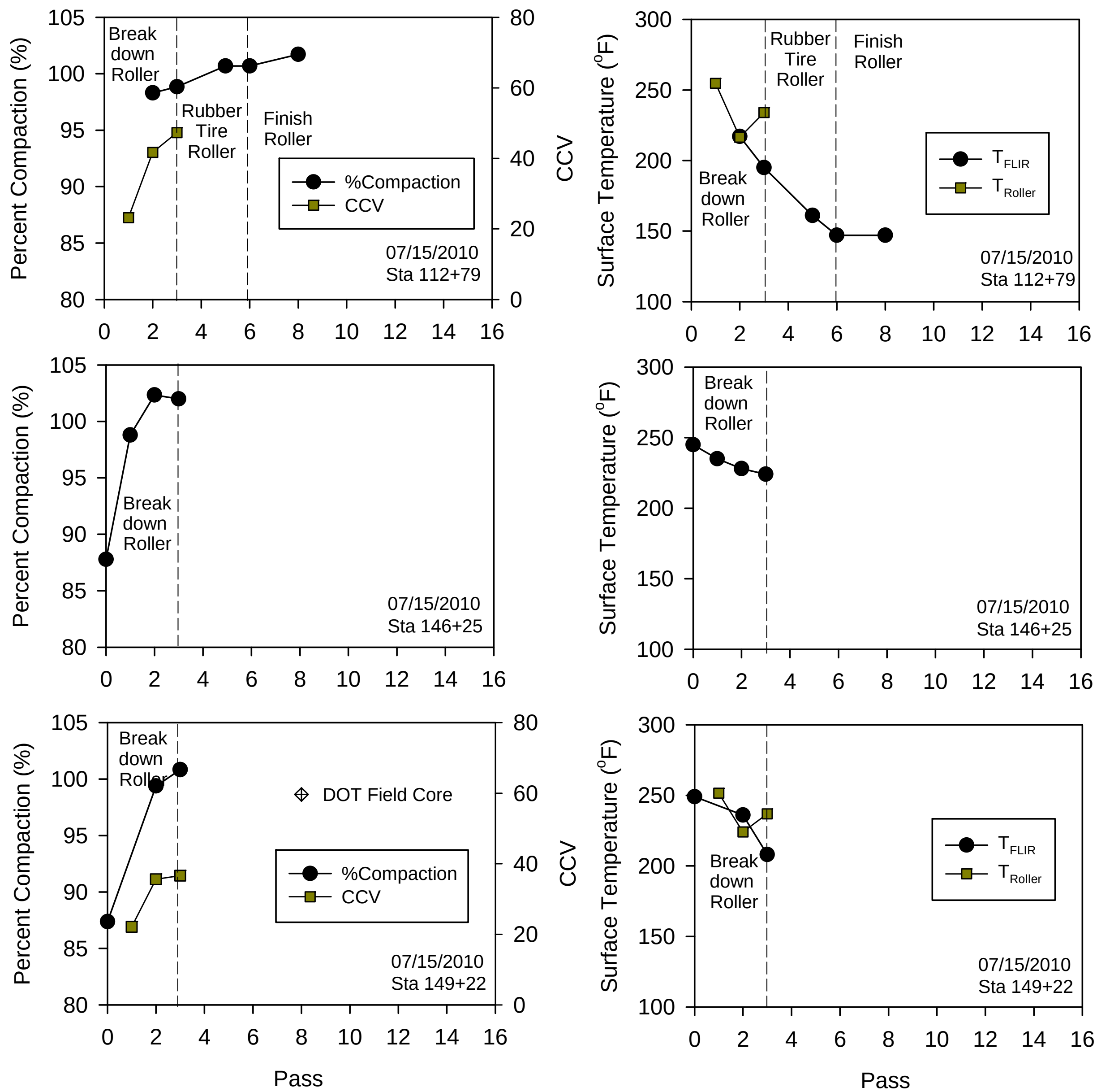

Figure 16. In-situ percent compaction, roller CCV, and surface temperature with pass measurements on intermediate course layer – US30 Harrison county project PS 4 to 6 (07/15/2010) [Note: G_{mb} = 2.346 (146.4 pcf)]

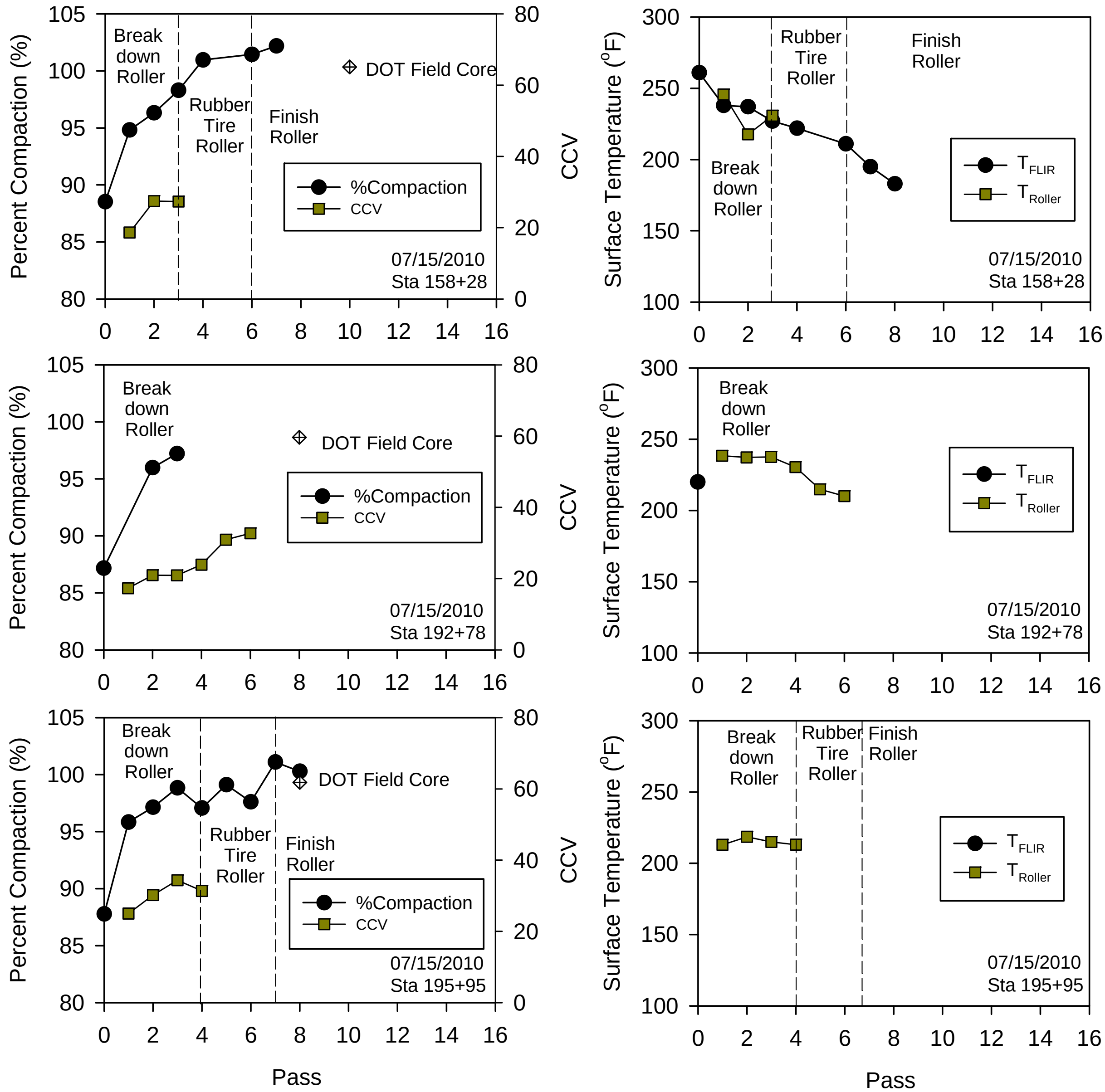

Figure 17. In-situ percent compaction, roller CCV, and surface temperature with pass measurements on intermediate course layer – US30 Harrison county project PS 7 to 9 (07/15/2010) [Note: G_{mb} = 2.346 (146.4 pcf)]

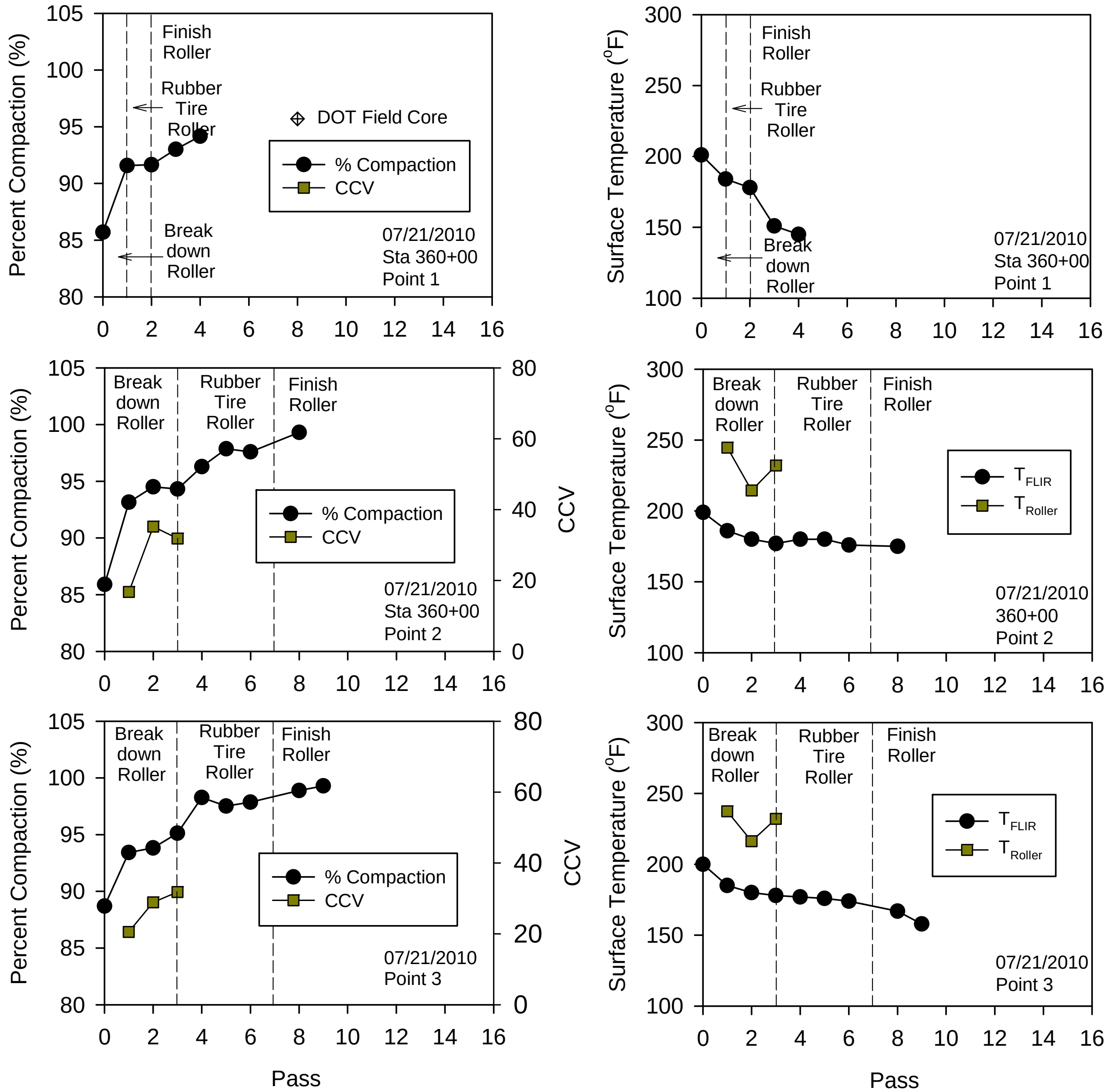

Figure 18. In-situ percent compaction, roller CCV, and surface temperature with pass measurements on intermediate course layer – US30 Harrison county project PS10 (07/21/2010) [Note: G_{mb} = 2.345 (146.3 pcf)]

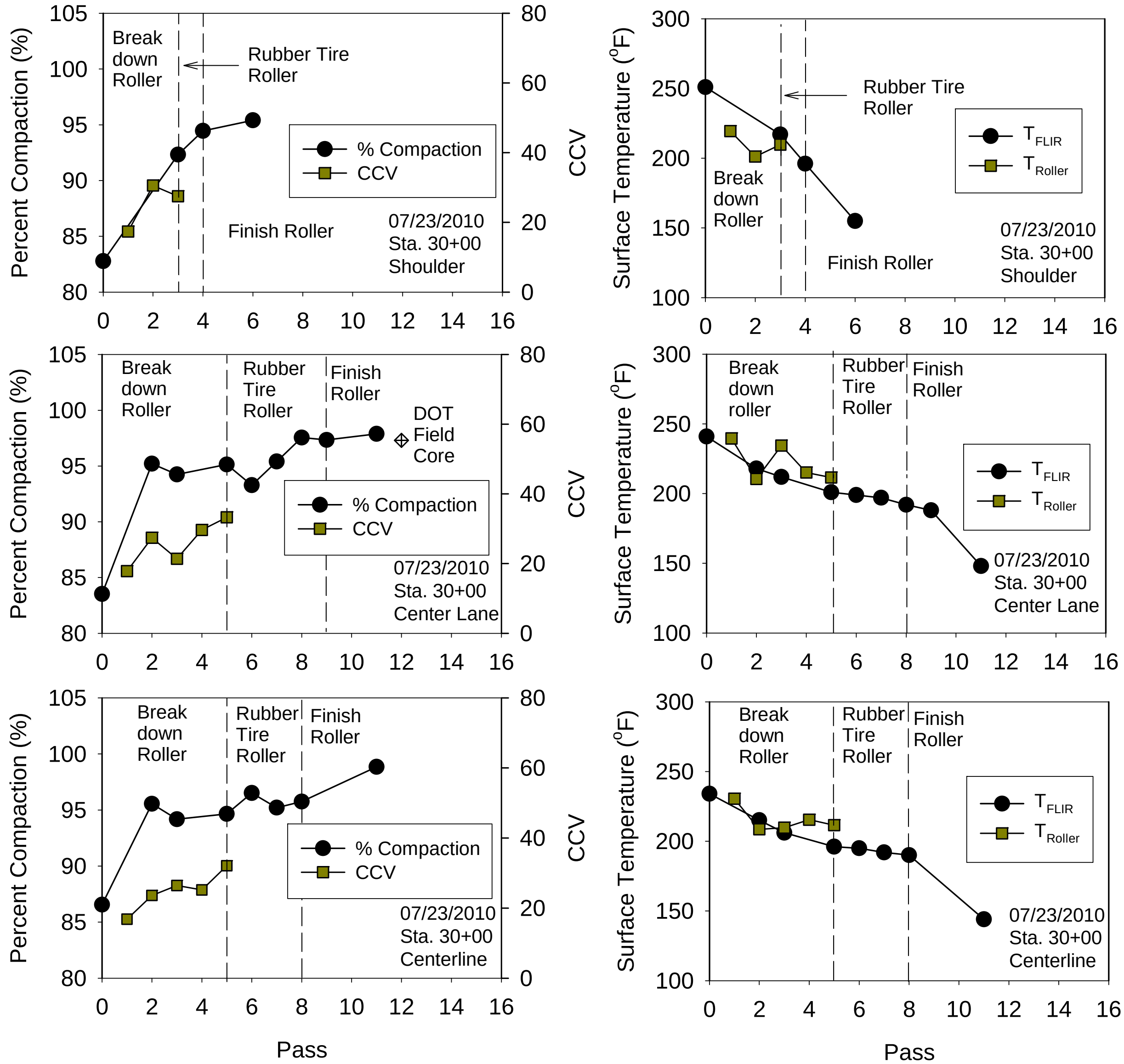

Figure 19. In-situ percent compaction, roller CCV, and surface temperature with pass measurements on surface course layer – US30 Harrison county project PS11 (07/23/2010) [Note: G_{mb} = 2.345 (145.6 pcf)]

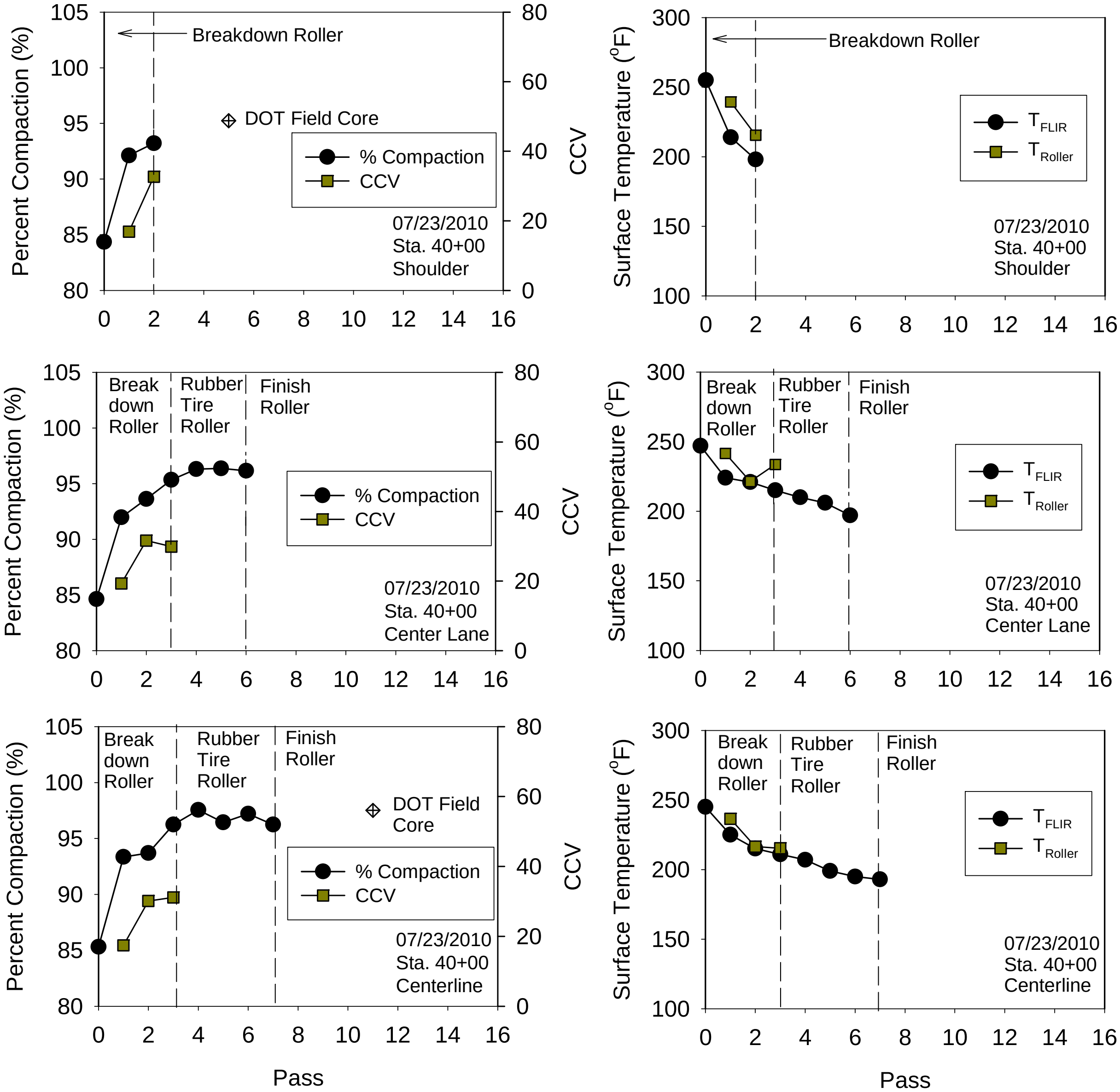

Figure 20. In-situ percent compaction, roller CCV, and surface temperature with pass measurements on surface course layer – US30 Harrison county project PS12 (07/23/2010) [Note: G_{mb} = 2.333 (145.6 pcf)]

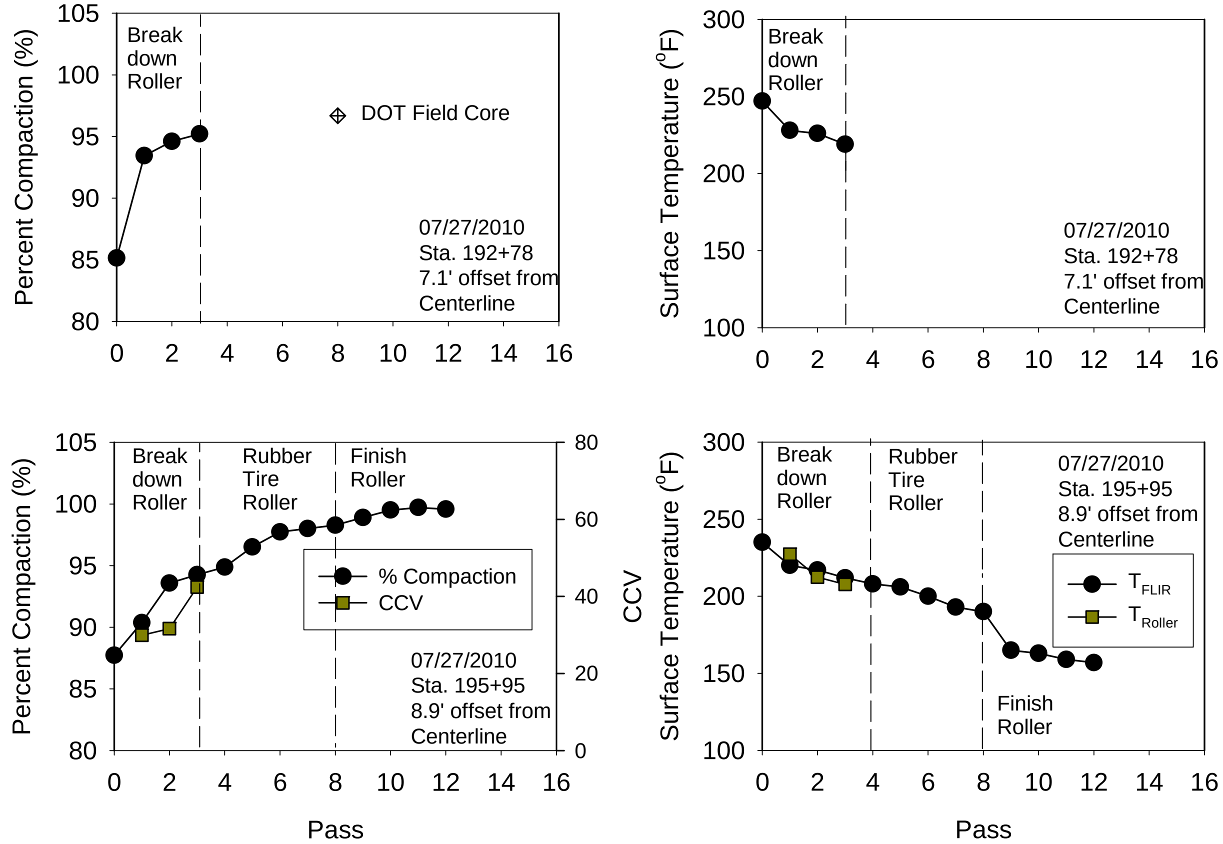

Figure 21. In-situ percent compaction, roller CCV, and surface temperature with pass measurements on surface course layer – US30 Harrison county project PS 13 and 14 (07/27/2010) [Note: G_{mb} = 2.353 (146.8 pcf)]

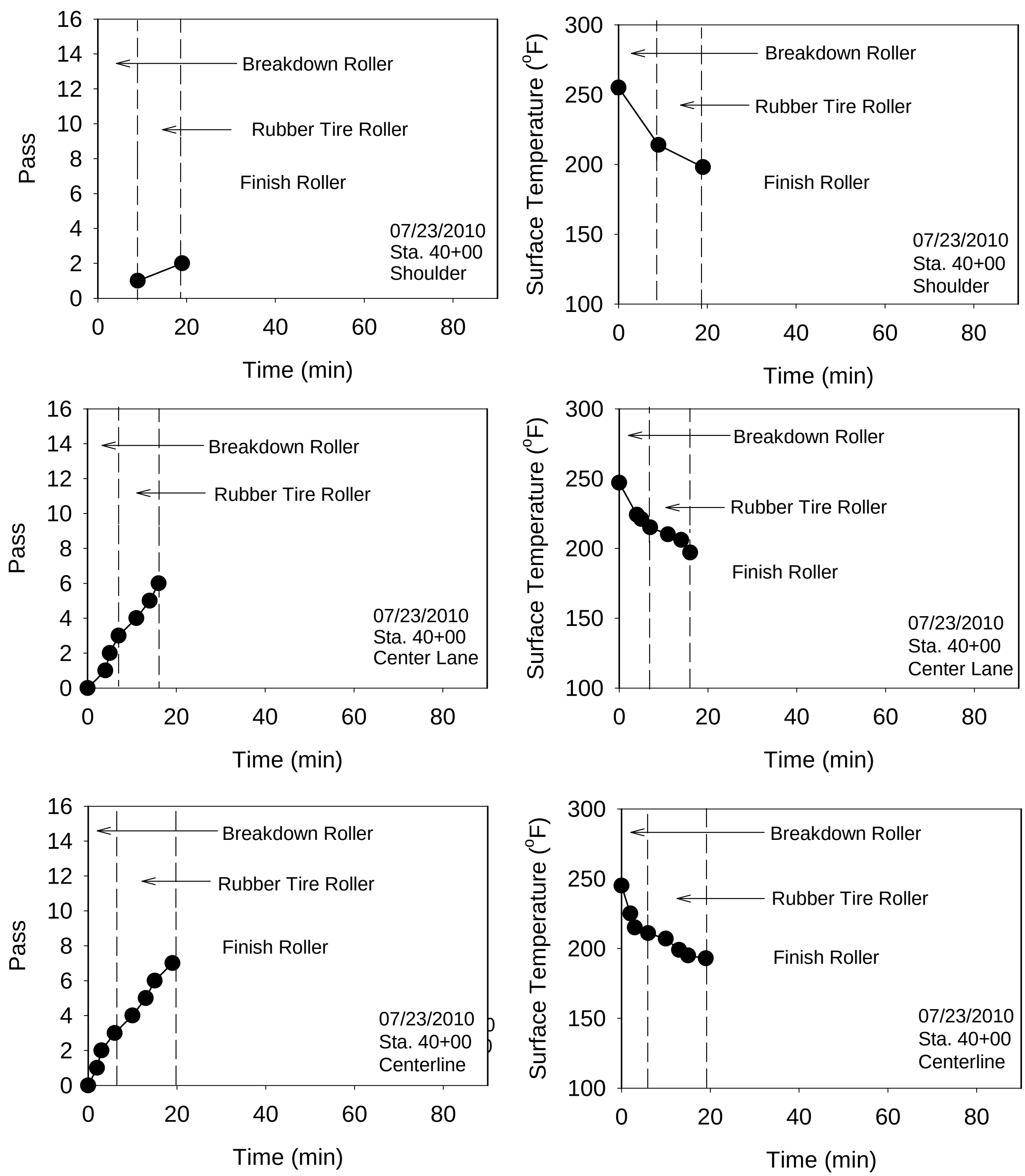

Figure 22. In-situ percent compaction, roller CCV, and surface temperature with time measurements on surface course layer – US30 Harrison county project PS11 (07/23/2010)

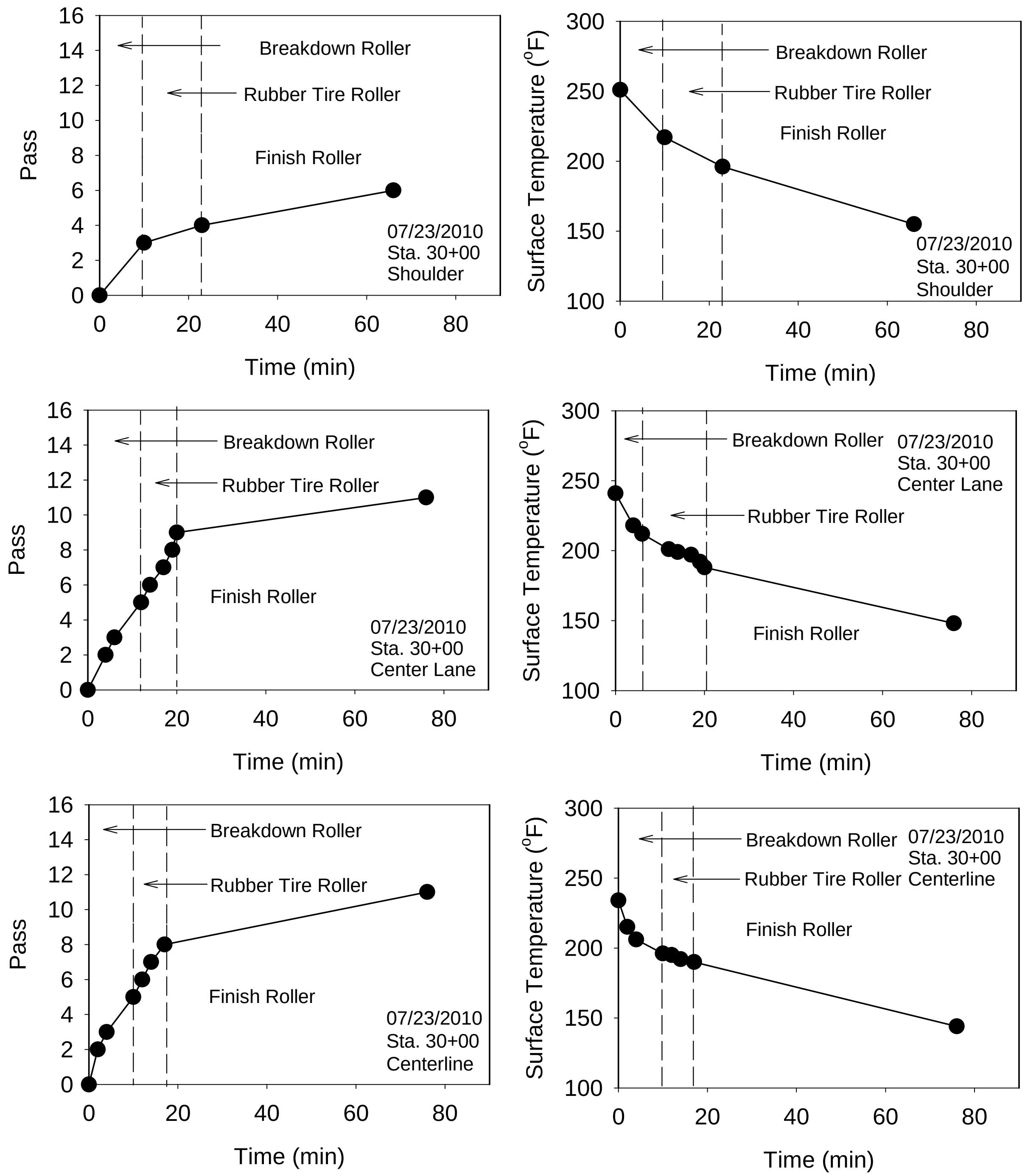

Figure 23. In-situ percent compaction, roller CCV, and surface temperature with time measurements on surface course layer – US30 Harrison county project PS12 (07/23/2010)

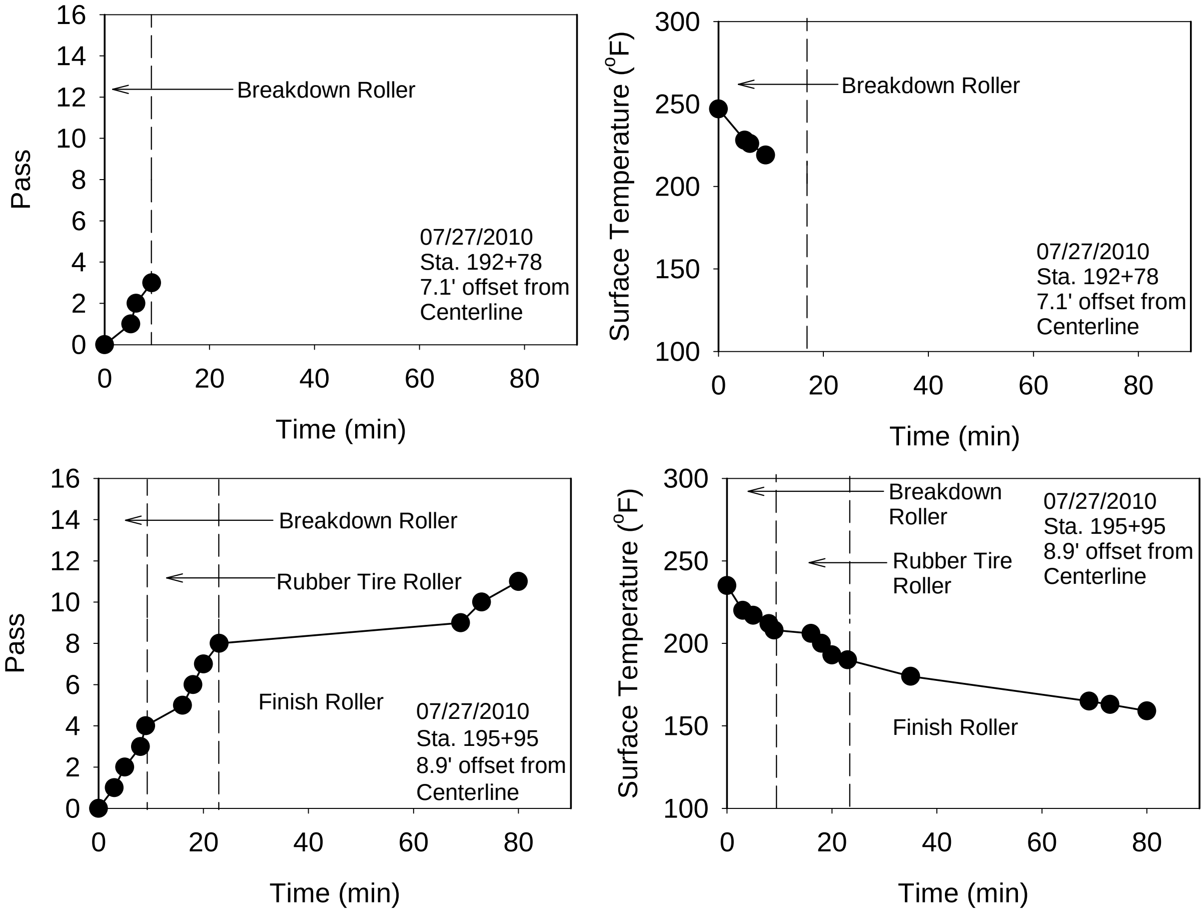

Figure 24. In-situ percent compaction, roller CCV, and surface temperature with time measurements on surface course layer – US30 Harrison county project PS 13 and 14 (07/27/2010)

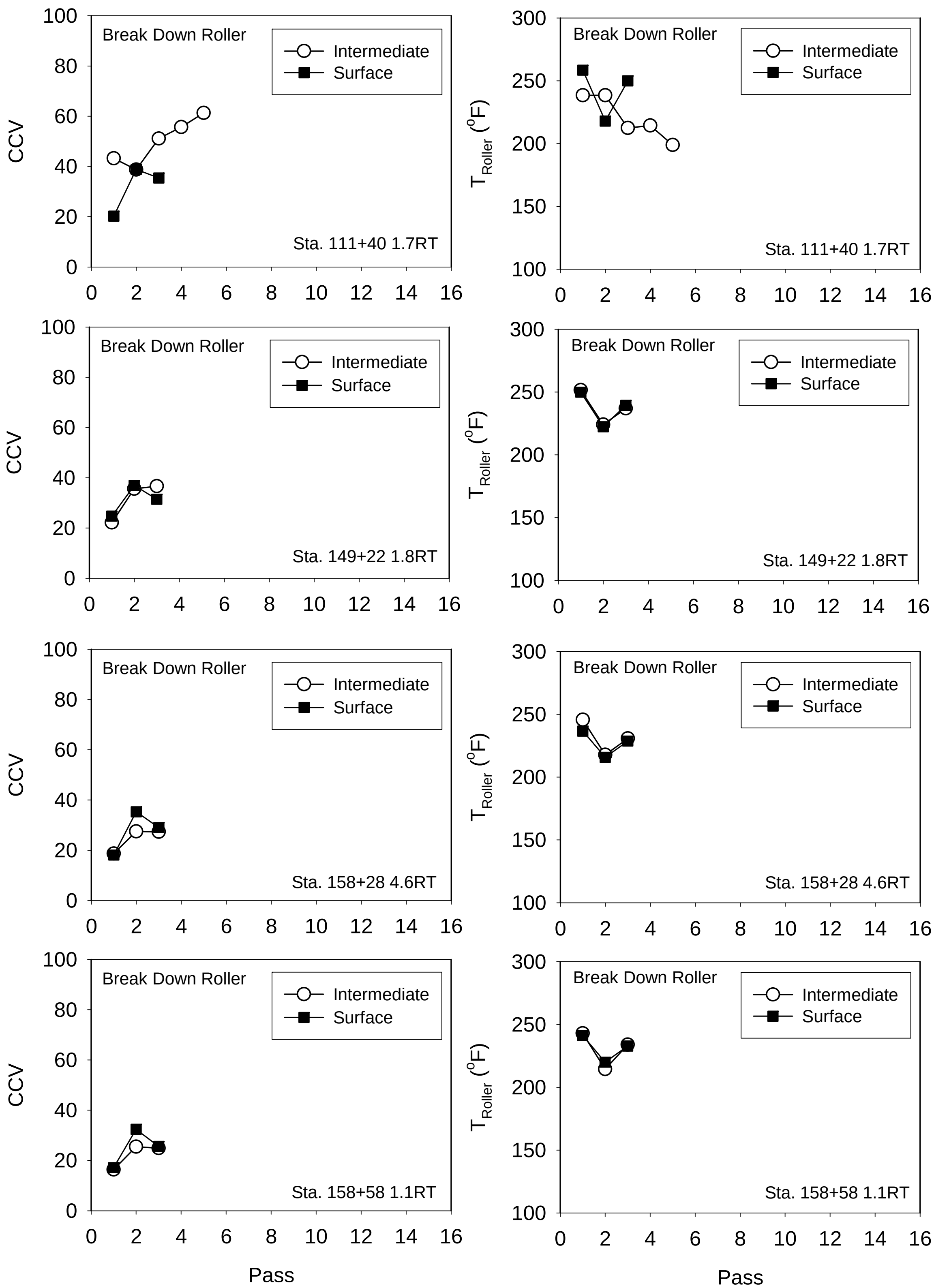

Figure 25. Roller CCV and temperature measurements with increasing pass on intermediate (on 07/15/2010) and surface course (07/26/2010) layers at four locations – US30 Harrison county project

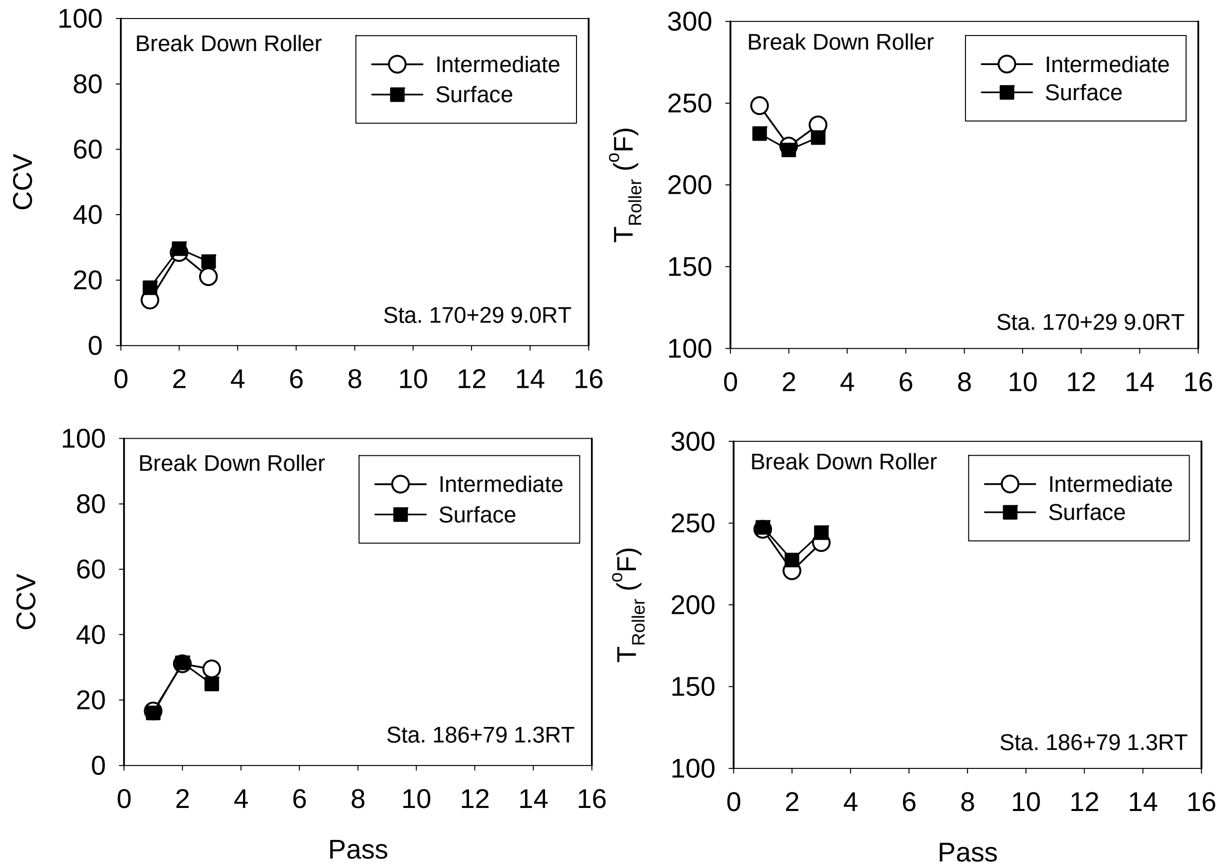

Figure 26. Roller CCV and temperature measurements with increasing pass on intermediate (on 07/15/2010) and surface course (07/26/2010) layers at two locations – US30 Harrison county project

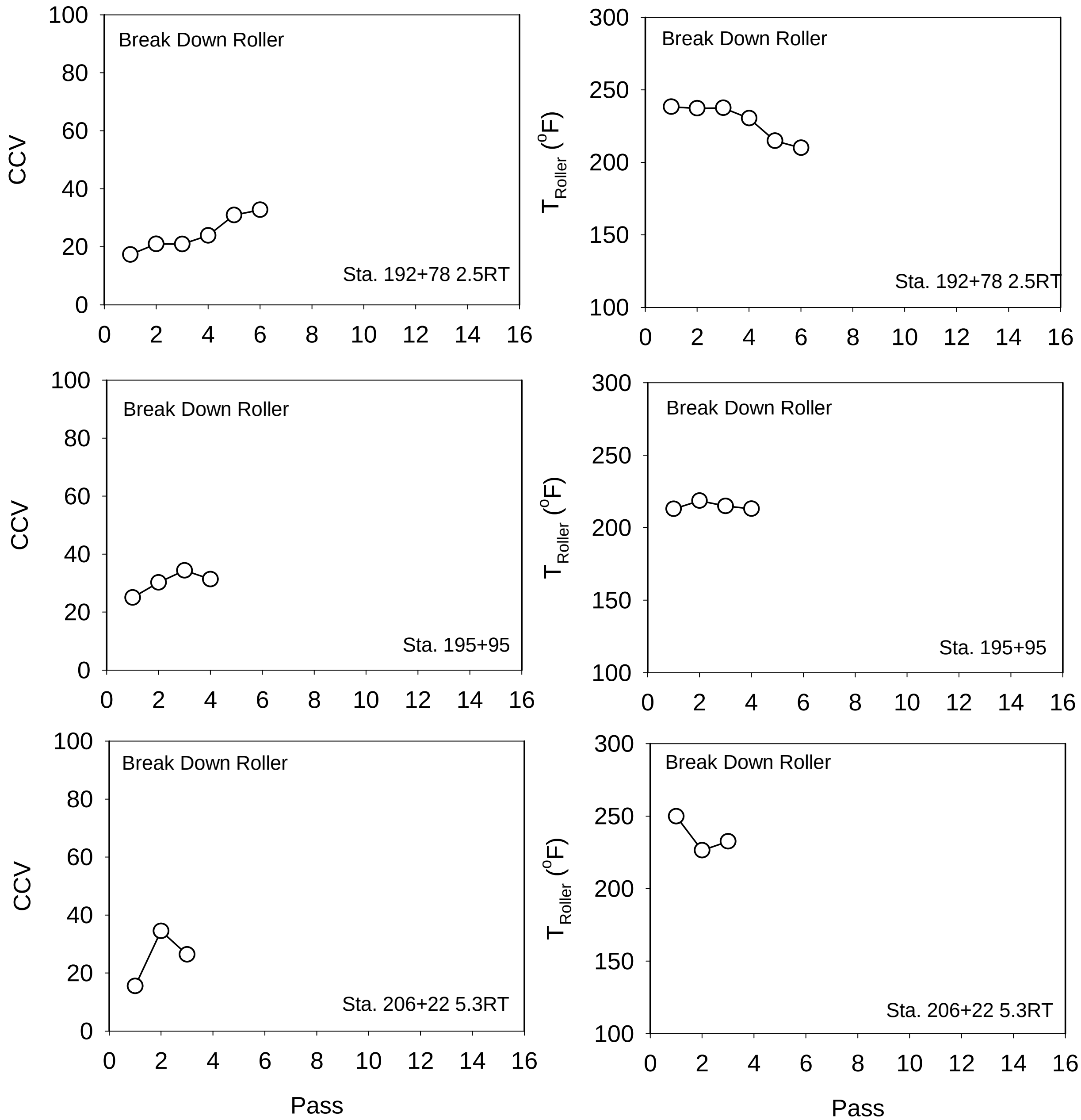

Figure 27. Roller CCV and temperature measurements with increasing pass on intermediate course layers at three locations on 7/15/2010 (Note: no roller data on surface course layers) – US30 Harrison county project

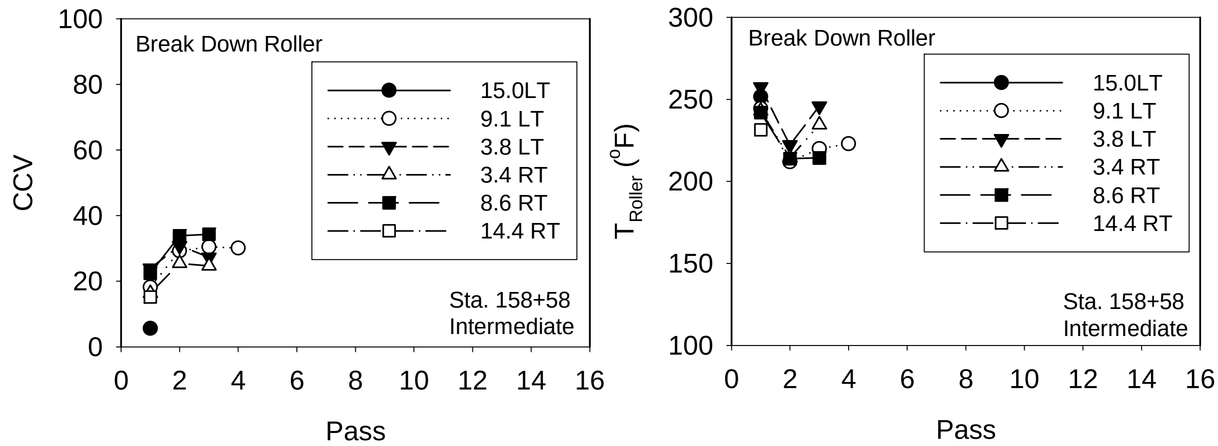

Figure 28. Roller CCV and temperature measurements with increasing pass on intermediate course (on 07/15/2010) layer at multiple locations along the width of the pavement at Sta. 158+58 – US30 Harrison county project

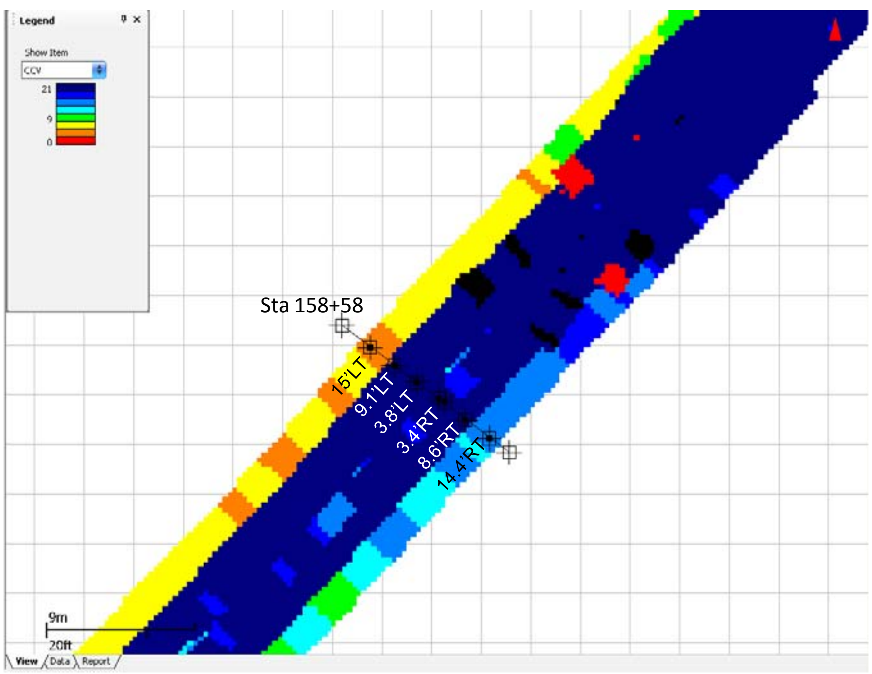

Figure 29. Roller CCV final pass map on intermediate course layer on 07/15/2010 showing test locations across the width of the pavement at Sta. 158+58 – US30 Harrison county project

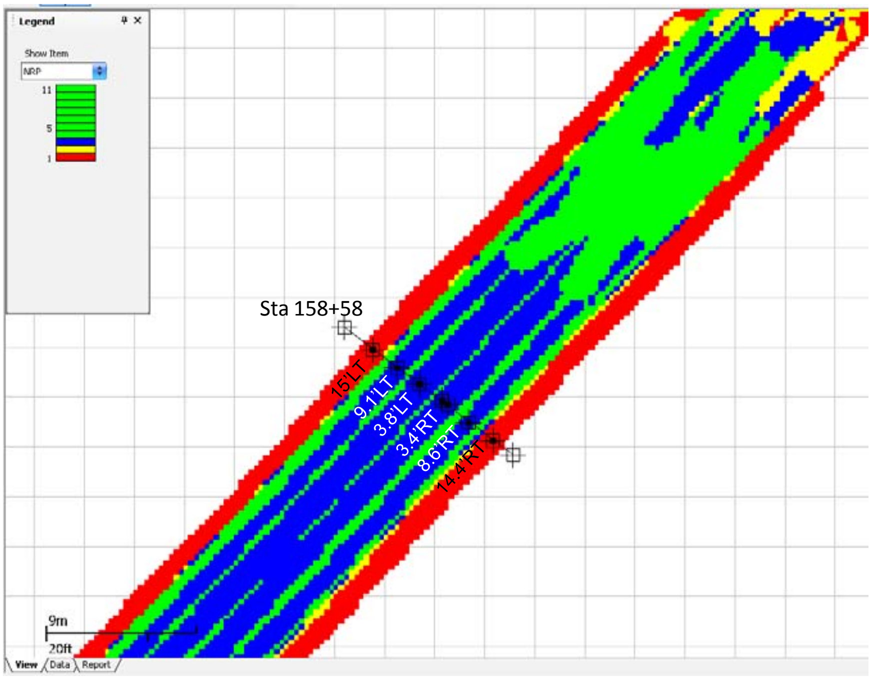

Figure 30. Roller pass count map on intermediate course layer on 07/15/2010 showing test locations across the width of the pavement at Sta. 158+58 – US30 Harrison county project

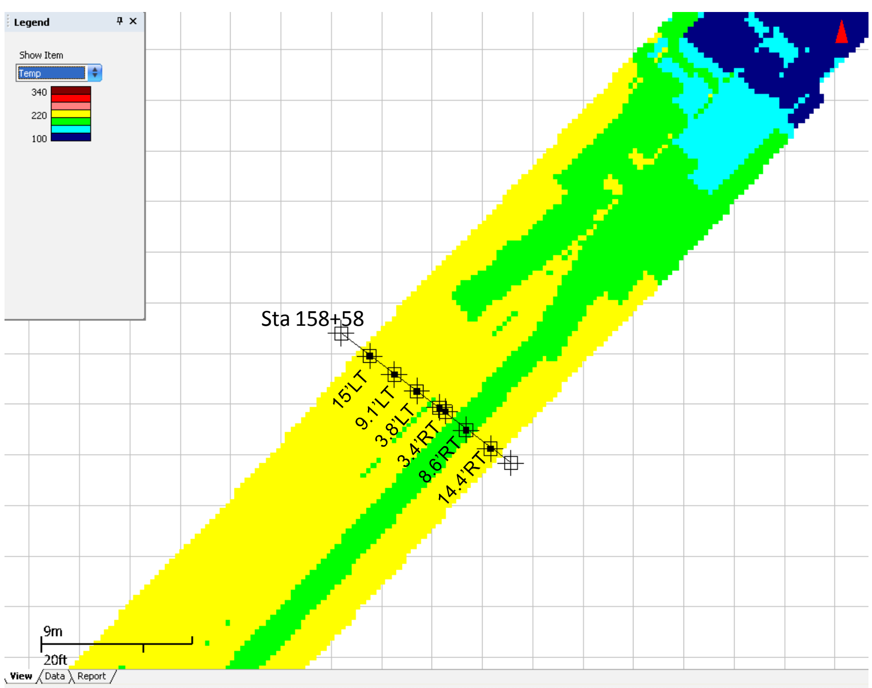

Figure 31. Surface temperature final pass map on intermediate course layer on 07/15/2010 showing test locations across the width of the pavement at Sta. 158+58 – US30 Harrison county project

Statistical Modeling of HMA Surface Temperature with Time

Mat temperature is a key component of the HMA compaction process as it has a direct effect on the viscosity of the binder and consequently compaction. As HMA temperature decreases, the asphalt binder becomes more stiff and resists deformation which results in smaller reduction in air voids for a given compaction effort. The temperature at which this occurs is commonly referred to as the cessation temperature (Roberts et al. 1996), which is a function of HMA mixture properties and weather conditions. It is critical that the compaction train complete its rolling pattern before the cessation temperature is reached. Some researchers have used 175°F as cessation temperature for dense-graded HMA mixes (Scherocman 1984).

HMA surface temperature data obtained with time from the PSs are analyzed to predict the asphalt cooling rate using an exponential formula shown in Eq. 4 (Miller et al. 2011):

$$T_{Predictetd} = T_0 \cdot e^{C_r \cdot t_i} \tag{4}$$

where, $T_{Predicted}$ = predicted surface temperature (°F); T_0 = initial temperature; C_r = cooling rate factor depending on weather and mixture conditions; t_i = time relative to the initial time (minutes). A summary of the initial temperatures, cooling rate factors (C_r), coefficient of determination (R^2) values of the predictions, and the square root of mean squared error (MSE) at different test locations are presented in Table 9. An example dataset showing the actual data with the predicted curves is presented in Figure 32. Analysis of this dataset indicated that if only data up to 32 minutes is considered, the square root of MSE value is much lower (6.4°F) compared to the square root of MSE when data up to 82 minutes (11.9°F) is considered. Prediction models and the statistics for both cases are summarized in Table 9, where data above 35 minutes was available. For cases where only data up to a maximum of 35 minutes is considered, the C_r values ranged from about -0.0090 to -0.0157 with an average of about -0.0135 and standard deviation of 0.0022. A well-populated database of these factors for different HMA mixtures and weather conditions can be beneficial to predict the time required to reach cessation temperature. Inclusion of these prediction models into the RICM software can be a significantly useful future improvement for the contractor. Some theoretical prediction software's have already been developed by researchers (e.g., Jordan and Thomas 1976) and are well documented in the literature.

Table 9. Summary of the regression parameters to predict temperature variations with time – US30 Harrison county project surface course layer

Location	Weather Conditions	T_0 (°F)	C_r	R^2	$\sqrt{MSE}$	Validity Range for Time, t
Sta. 30+00 Shoulder	84°F air temperature, sunny and very humid	251	-0.0082	0.95	11.9	66
		251	-0.0115	0.97	5.3	23
Sta. 30+00 Center lane		241	-0.0090	0.59	15.8	76
		241	-0.0132	0.93	6.5	20
Sta. 30+00 Centerline		234	-0.0085	0.89	17.4	76
		234	-0.0148	0.92	8.8	17
Sta. 40+00 Shoulder	84°F air temperature, sunny and very humid	255	-0.0147	0.94	7.6	19
Sta. 40+00 Center lane		247	-0.0151	0.92	6.3	16
Sta. 40+00 Centerline		245	-0.0157	0.85	10.6	19
Sta. 192+78 7.1'LT of center	83°F air temperature, sunny, humid, slight breeze	247	-0.0142	0.984	1.6	9
Sta. 192+78 8.9'LT of center		235	-0.0056	0.940	11.9	82
		235	-0.0090	0.940	6.4	35

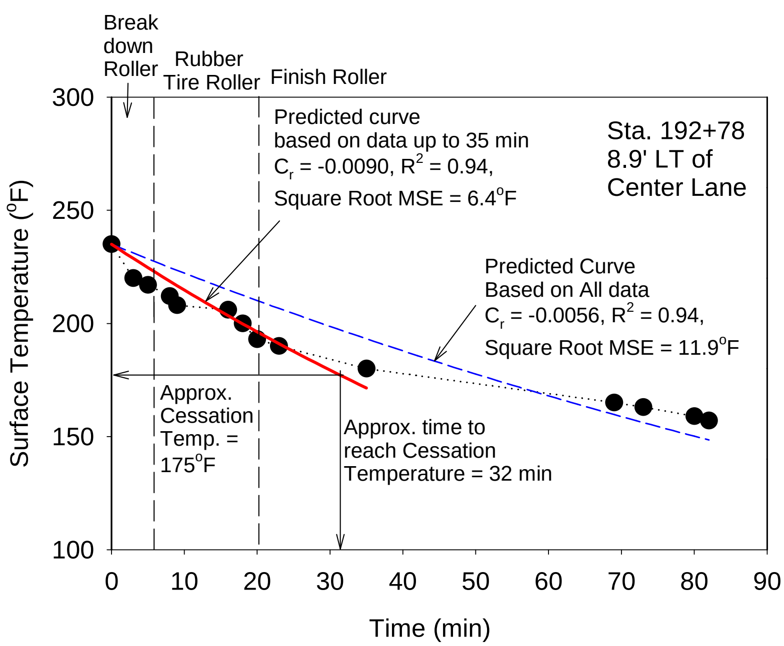

Figure 32. Surface temperature and percent compaction measurements with time at four test locations – US30 Harrison county project surface course layer

Correlation Analysis

Correlations between CCV and percent compaction, and CCV and HMA density are presented in Figure 33. The correlations are presented separately for intermediate and surface course layers, which yielded relatively low R^2 values in the range of 0.1 to 0.2. However, if the measurements for each PS are viewed separately, there is generally a trend with increasing CCV with increasing percent compaction in most sections. Poor correlations between density and CCV are to be expected when data is combined over multiple sections. This is because CCV provides a measure of ground stiffness (i.e., response to loading) and is strongly influenced by the conditions of the layer underneath the HMA layer and not necessarily the density of the surface layer. FWD test measurements (which provide a direct measure of ground stiffness) were obtained from the intermediate course layer and the underlying existing base layer at five test locations. FWD modulus (E_{FWD}) values along with roller CCV measurements 2200 m (7220 ft) long section are presented in Figure 34. The FWD measurements indicate that the support conditions varied significantly from each test location and a strong correlation exists between E_{FWD} obtained on the intermediate course and the underlying base layers (Figure 35). Further, correlations between the E_{FWD} measurements and CCV measurements on the intermediate course layer yielded R^2 values in the range of 0.5 to 0.9 (Figure 35). Results presented during Phase I of this research (White et al. 2010) also indicated that there is a stronger correlation between FWD measurements and CCV than between density and CCV. This observation is critical to point out as it has practical consequences in terms of how CCV data can be used for QC or QA in future specifications.

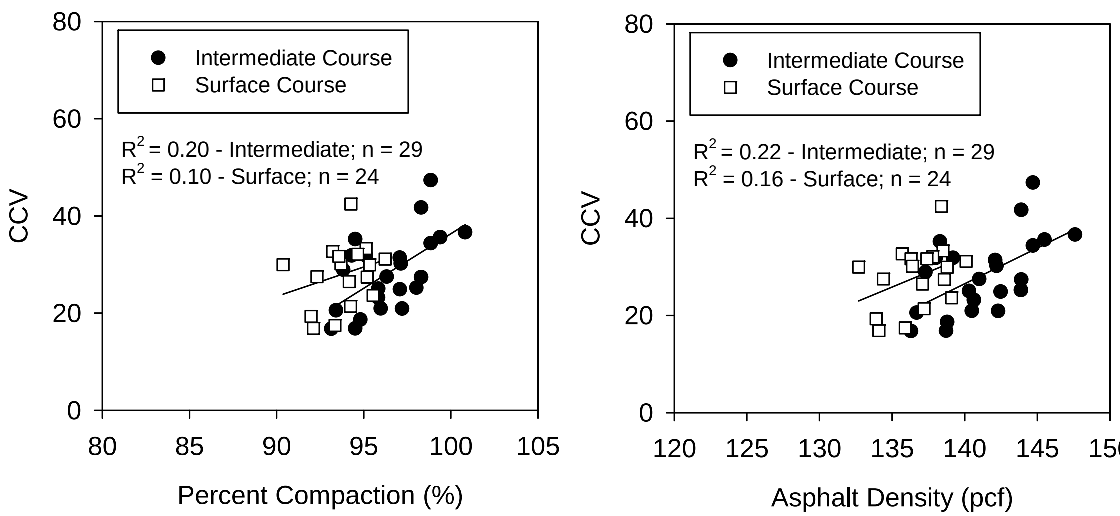

Figure 33. Correlations between in-situ HMA compaction measurements and CCV – US30 Harrison county project

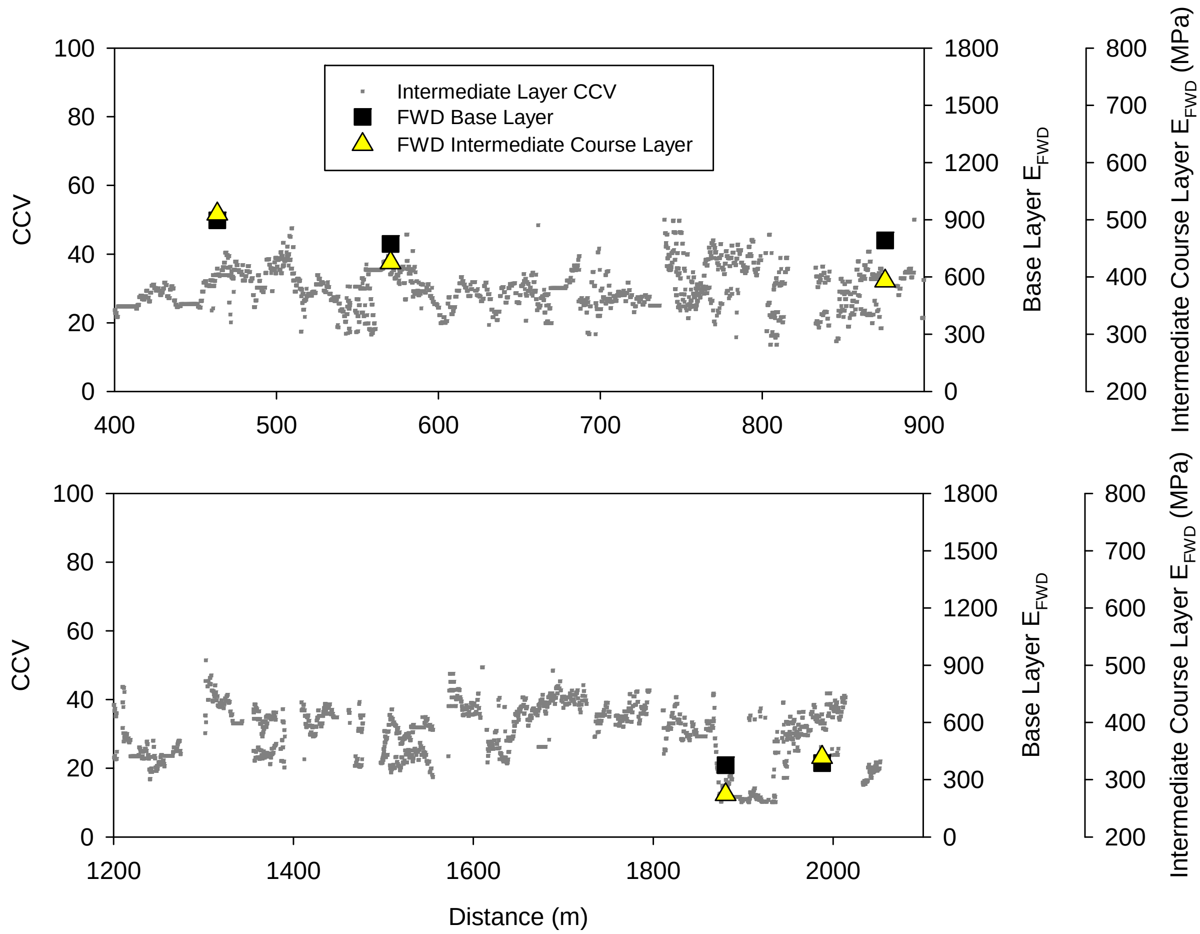

Figure 34. Comparison of CCV on intermediate course layer with FWD measurements on intermediate course and underlying base layer – US30 Harrison county project

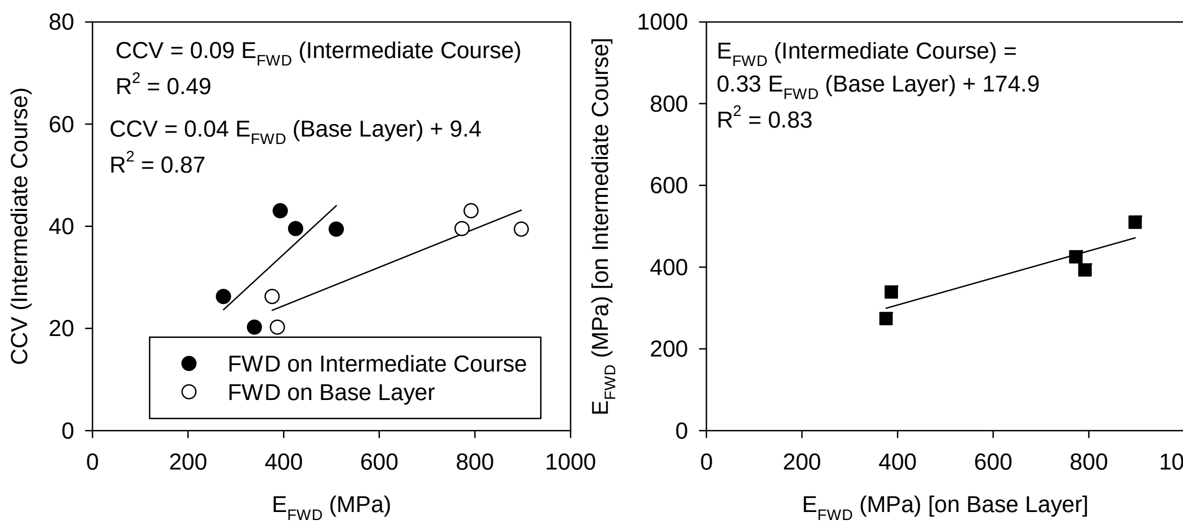

Figure 35. Correlations between CCV on intermediate course layer and E_{FWD} measurements (left) and EFWD measurements on intermediate course layer and underlying base layer – US30 Harrison county project

Correlation between T_{Roller} and T_{FLIR} are presented in Figure 36. Results indicate that on average, the T_{Roller} measurements are about 1.06 times higher than the T_{FLIR} measurements. There was no statistically significant correlation between the two measurements. However, about 29 out of the 35 measurements were close to the 1:1 line. Differences between the two measurements are attributed to: (a) spatial pairing error (recall that the spatial co-ordinates of the test location are approximated), (b) measurement error associated with different measurement devices, and (c) unquantified errors related to roller operations (e.g., due to moisture at the surface of the mat during compaction).

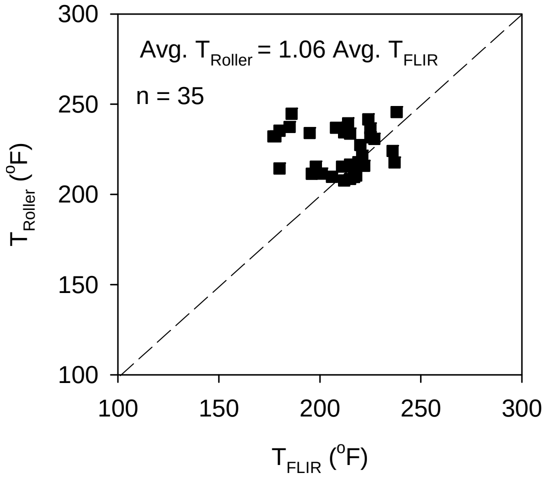

Figure 36. Correlations between surface temperature measurements from thermal camera (T_{FLIR}) and surface temperature measurements from roller – US30 Harrison county project

Analysis of RICM Data

Histograms of roller pass count data, CCV, and surface temperature data on intermediate course and surface course layers for each day are presented in Figure 37 and Figure 38, respectively. The roller pass count and CCV data showed binomial distribution. CCV ≤ 10 data on the intermediate course layer were predominantly obtained from the shoulder lane (see CCV map screen shot in Figure 9). Close review of pass count maps of the project revealed that most of the shoulder lanes received only one RICM roller pass. Average CCV ranged from about 20 to 30 on intermediate course and 22 to 33 on surface course layers. Surface temperature data showed normal distribution with an average ranging from about 215 ^{o}F to 225^{o}F on surface and intermediate course layers, at the end of break down roller passes. The temperature of the mix during placement was measured as about 270^{o}F. Box plots showing 10th, 25th, 75th, and 90th percentiles, mean, and median values of pass count, CCV, and surface temperature measurements are presented in Figure 39.

Based on field observations and conversations with the roller operator, it is understood that the roller operator targeted 3 to 4 roller passes using the break down roller. Data indicates that the average number of break down roller passes on the project was about 3 with a standard deviation of about 1 to 2. To analyze the spatial uniformity of pass coverage on each day, geostatistical semivariograms of pass count data are developed as shown in Figure 40. The software used to develop the semivariograms could handle Excel data files with < 65,000 rows of data but most of the data files contained 150,000 to 300,000 rows of data. Therefore, the semivariograms presented herein represents only for a portion of each day's data. Background details about semivariogram are presented in the Phase I report (White et al. 2010). In brief, the semivariogram is composed of three key features: range, sill, and, nugget. Range is defined as the distance at which the semivariogram reaches a plateau. Sill is the vertical distance at which the semivariogram reaches the plateau. Nugget is semivariogram value at separation distance, h = 0 (which is a measure of sampling error or very short scale variability). A semivariogram that shows low sill and longer range represent best conditions for uniformity, while the opposite represents an increasing non-uniform condition. Results presented in Figure 40 and Figure 41 indicated that the sill values varied from about 2.4 to 3.6 and the range values varied from about 9 to 20 m. These sill values are higher than observed in Phase I on US218 project (~1.3) where a controlled study was conducted by having the contractor use the on-board display to control the pass coverage. The sill values seen on this project are also much higher than the average sill value observed for pass count on the US20 project discussed later in this report. Field observations indicated that the number of passes made by the break down roller was governed heavily by the pace of the paver ahead of the break down roller.

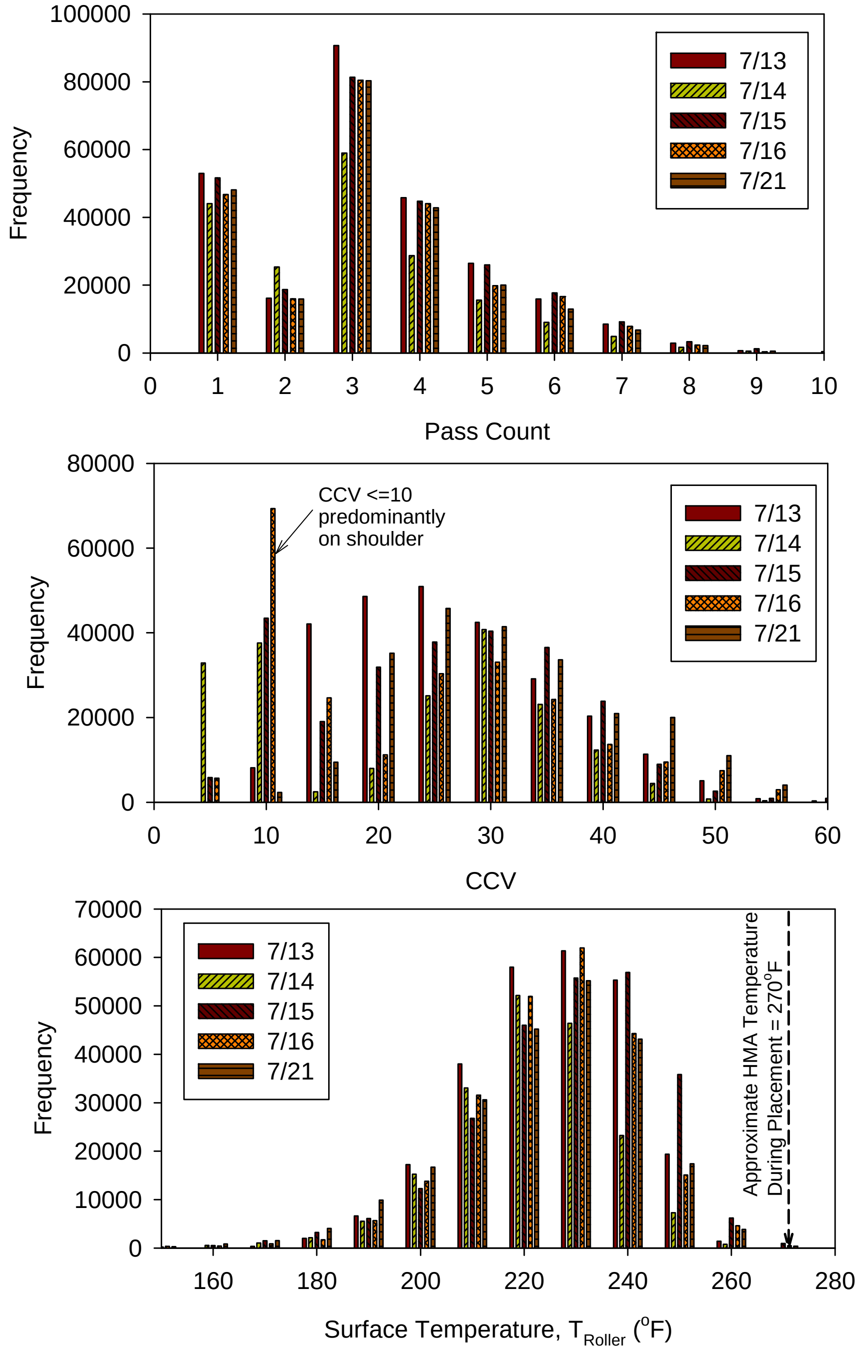

Figure 37. Histograms of pass count, CCV, and surface temperature of intermediate course layers – US30 Harrison County project

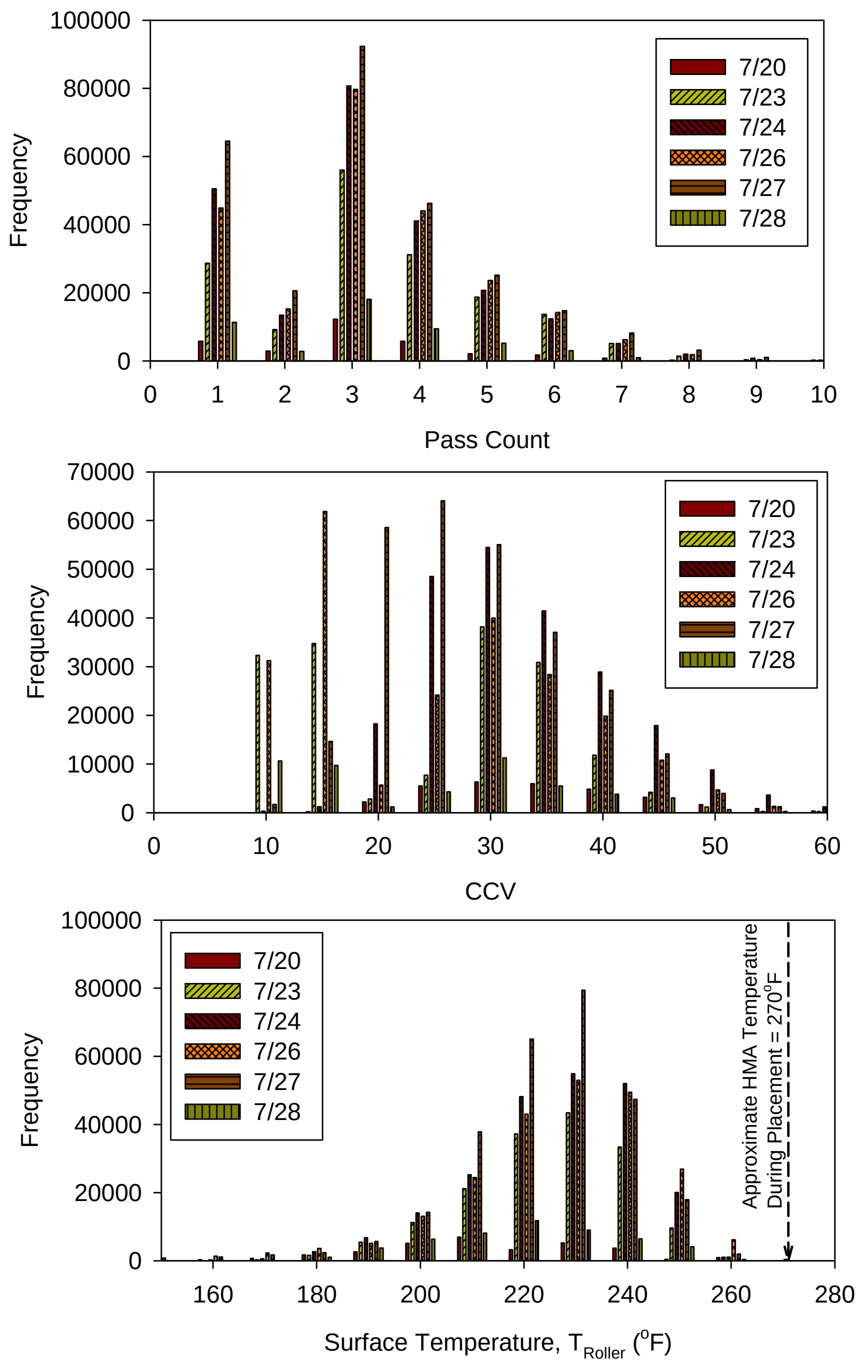

Figure 38. Histograms of pass count, CCV, and surface temperature of surface course layers – US30 Harrison County project

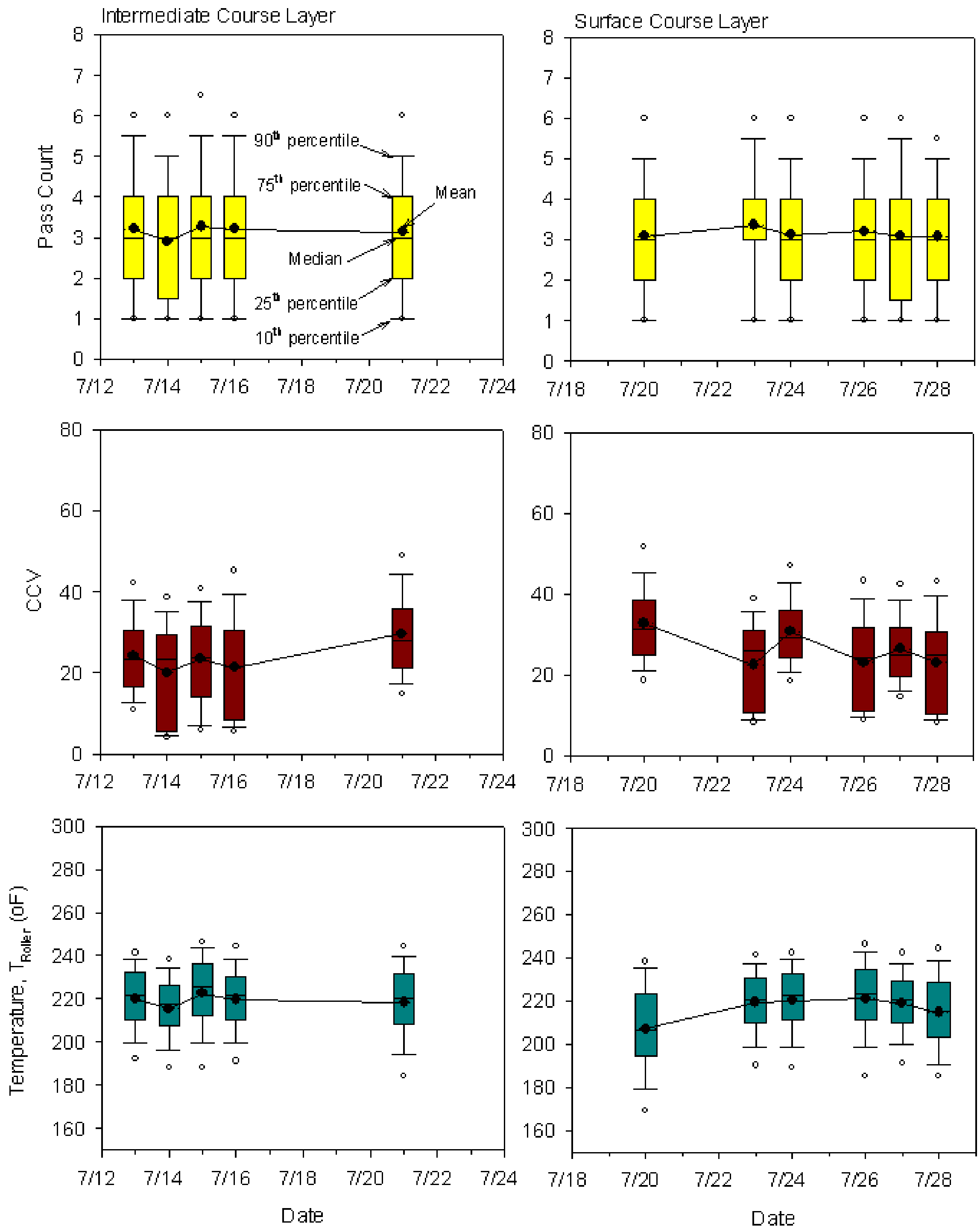

Figure 39. Box plots of pass count, CCV, and surface temperature of intermediate (left) and surface course (right) layers – US30 Harrison County project

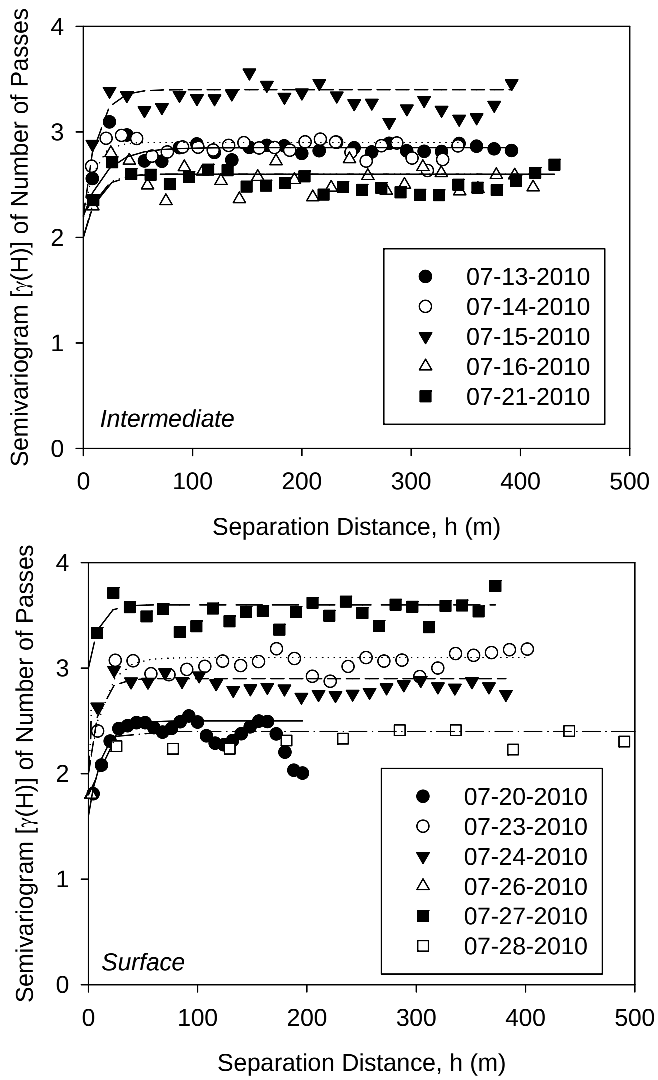

Figure 40. Semivariograms of number of roller passes on intermediate and surface course layers for each day – US30 Harrison County project

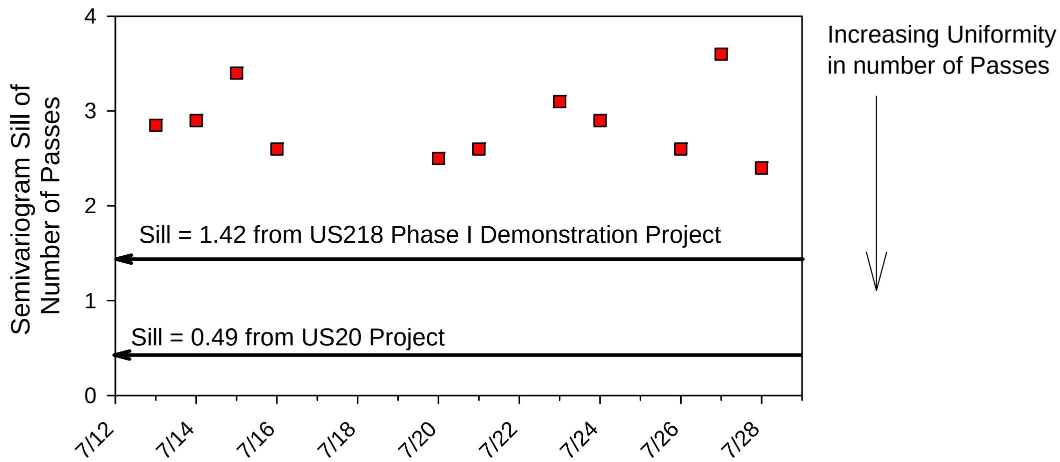

Figure 41. Variation in semivariogram sill of number of roller passes for each day – US30 Harrison County project

Summary of Key Findings

Following is a summary of key findings from the US30 project:

- The RICM-HMA SP-090048 which required RICM data coverage (with temperature, pass count, and roller-integrated CCV information on break down roller) was successfully implemented on the US30 Harrison County pilot project. Evaluation of RICM data coverage information indicated that the RICM data was collected over 85% of the project area on the intermediate course layer and over 95% of the project area on the surface course layers, thus conveniently exceeding the minimum 80% requirement in the SP.
- Field core density results indicated that 115 out of 117 samples exceeded the target minimum 95% compaction requirement. The $QI_{Density}$ measurements ranged from 0.3 to 6.8, thus exceeding the target minimum 0.00.
- Percent compaction curves indicated that 95% compaction was generally achieved within 1 to 2 break down roller passes at most locations with exceptions at few locations where up to four passes or more was required.
- Roller surface temperature measurements with pass generally indicated that pass 2 measurement was lower than pass 3 (note that the rolling pattern included forward, reverse, and forward directions of travel for passes 1, 2, and 3). The temperature sensor is located on the front drum of the roller and water sprayed on to the roller drum likely caused a reduction in the surface temperature values, when the roller travels in the reverse direction.
- Asphalt temperature cooling rate (C_r) was modeled using an exponential statistical model from surface temperature with time measurements. For cases where data up to a maximum of 35 minutes was considered, the C_r values ranged from about -0.0090 to -0.0157 with an average of about -0.0135 and standard deviation of 0.0022.
- Correlations between CCV and asphalt density or percent compaction measurements yielded relatively low R^2 values in the range of 0.1 to 0.2. However, if the measurements

for each PS are viewed separately, there is generally a trend of increasing CCV with increasing percent compaction in most sections.

- Poor correlations between density and CCV are to be expected when data is combined over multiple sections, because CCV provides a measure of ground stiffness and is strongly influenced by the conditions of the layer underneath the HMA layer and not necessarily the density of the surface layer. FWD test measurements obtained from the intermediate course layer and the underlying existing base layer confirmed that variable support conditions exist at different test locations. Correlations between the E_{FWD} (on intermediate course layer and base layer) and CCV (on intermediate course layer) yielded R^2 values in the range of 0.5 to 0.9. Results presented during Phase I of this research (White et al. 2010) also corroborate with this finding. This research finding is critical to understand as it has practical consequences in terms of how roller-integrated CCV data can be used for QC or QA in future specifications.
- Correlation between T_{Roller} and T_{FILR} indicated that there was no statistically significant correlation between the two measurements; however, about 29 out of the 35 measurements were close to the 1:1 line and the measurements were on average comparable to each other.
- Based on field observations and conversations with the roller operator, it is understood that the roller operator targeted 3 to 4 roller passes using the break down roller. Roller coverage data indicated that the average number of break down roller passes on the project was about 3 with a standard deviation of about 1 to 2. Geostatistical analysis of pass count indicated that the sill values varied from about 2.4 to 3.6 and the range values varied from about 9 to 20 m. These sill values are higher than observed in Phase I on the US218 project (~1.3) and on the US20 project (~0.6) discussed later in this report. The high sill values on the US30 project compared to the US218 and US20 projects indicates that the pass coverage was more variable on the US30 project. Field observations indicated that the number of passes made by the break down roller was governed heavily by the pace of the paver ahead of the break down roller.
- Average CCV ranged from 20 to 30 on intermediate course and 22 to 33 on surface course layers. Average surface temperature at the end of break down roller pass ranged from about 215 to 225°F on surface and intermediate course layers.

US20 Ida/Sac County Project

Project Information

The US20 project is about 11.2 miles long and is located between US59 and Iowa Hwy 110 in Ida/Sac Counties, Iowa (between Sta. 1030+70 and Sta. 1584+10; between mile posts 58.33 and 47.14; Iowa DOT project number NHSN-20-2(70)--3H-47). The project location map is shown in Figure 42. It involved milling the existing pavement and resurfacing with 38 mm (1.5 in.) of HMA intermediate course and 38 mm (1.5 in.) of HMA surface course layers. HMA resurfacing was performed in the mainline over a width of about 28 feet. According to the field core density reports, HMA 3M A60%CR mix for intermediate course and HMA 3M A75% CR mix for surface course with design gyrations of 86 and ½ inch mixture size was used on the project. The target binder content range was 5.3% to 5.9% for the intermediate course and 5.4% to 6.0% for the surface course layers.

The ISU research team was present on the project site on August 16 to 19, 2010 during construction of the intermediate course layer. The Sakai SW990 smooth drum RICM roller used on the US30 project was used on this project in the breakdown position. Compaction using the RICM roller was achieved in vibratory mode using a low amplitude setting (a = 0.33 mm) and a frequency setting of 50 Hz (3000 vpm) from 8/13/2010 to 8/23/2010, and a frequency setting of 67 Hz (4000 vpm) from 8/24/2010 to 8/28/2010. Example screen shots of roller pass coverage and surface temperature maps from the project are shown in Figure 43.

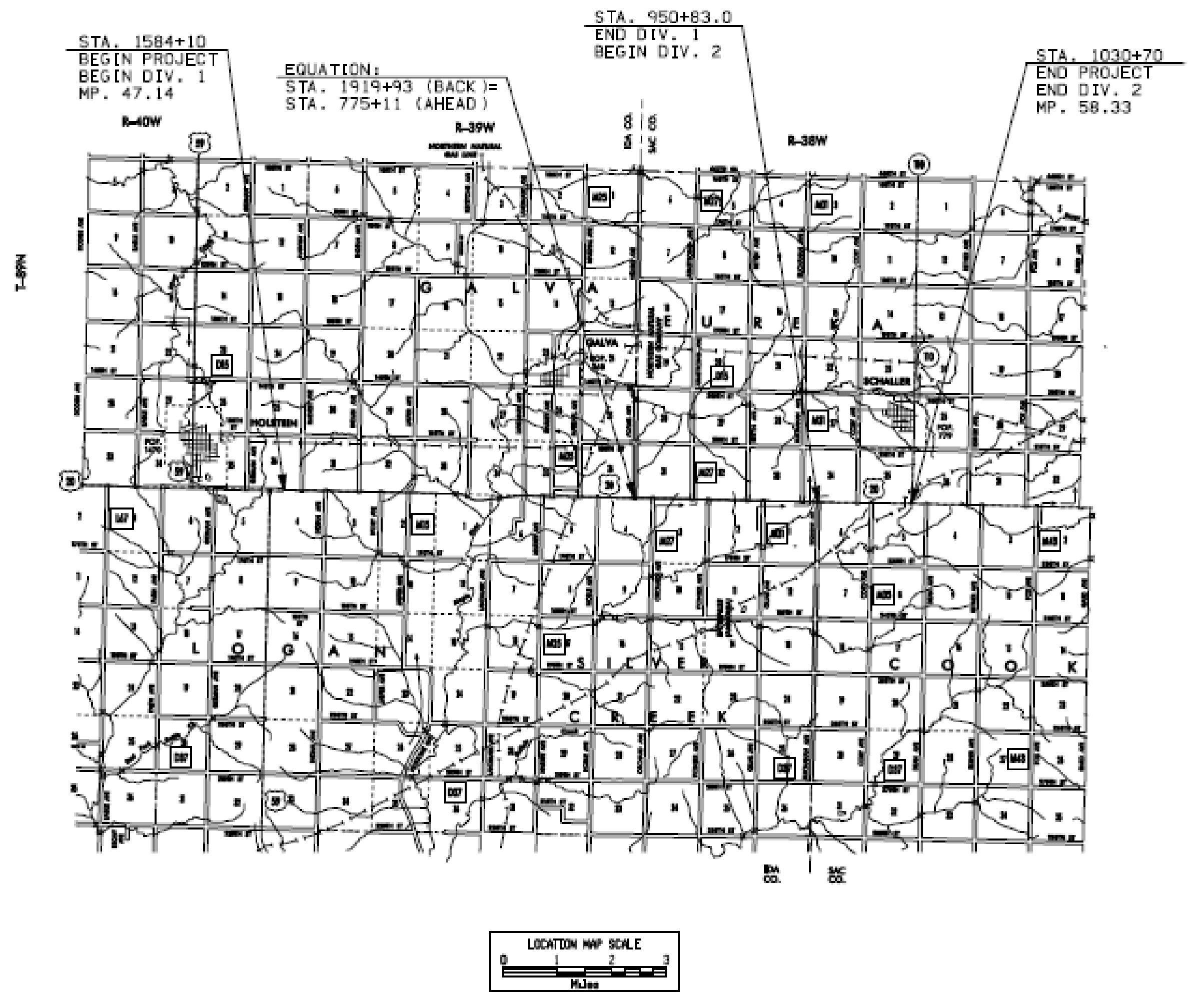

Figure 42. Project location map – US20 Ida County project

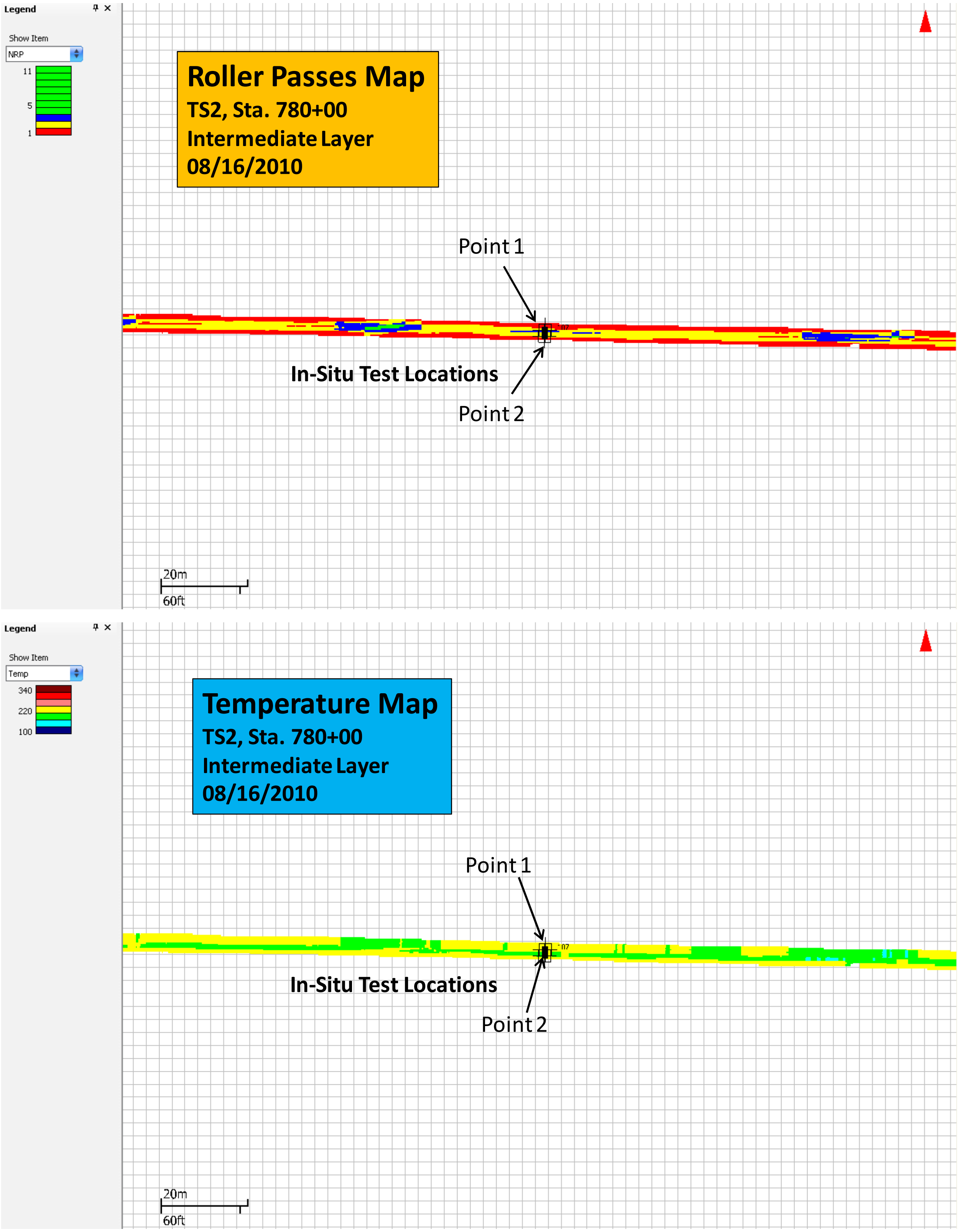

Figure 43. Roller pass coverage and surface temperature coverage maps along with in-situ test locations on PS1 – US20 Ida County project

Production Information

Daily production information with the amount of HMA placed (tons/day) for intermediate and surface course layers are presented in Figure 44. The production information was obtained from DOT field core density sheets (see Appendix C). Comparison between daily measured binder contents and the specification limits for the intermediate and surface course layers are presented in Figure 45. Similarly, comparison between daily gradation test results on the mixture aggregate and the specified limits is provided in Figure 46. Results indicate that both binder content and gradations of the materials were within the specified limits.

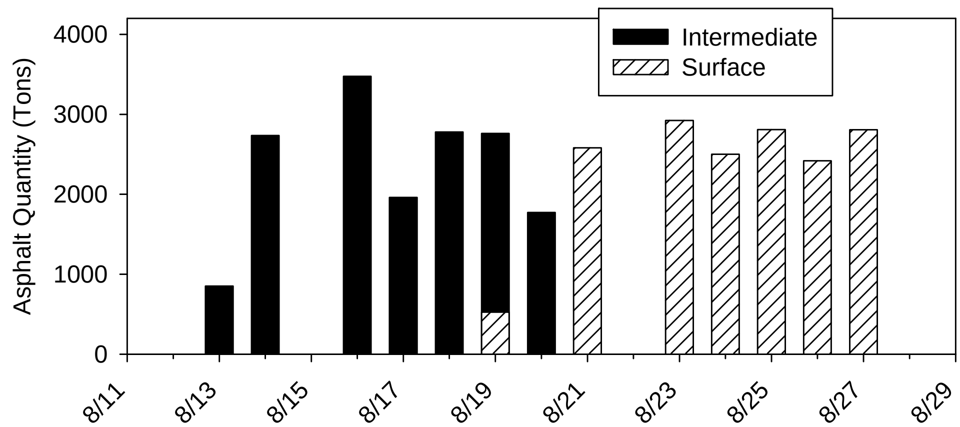

Figure 44. HMA placement (tons/day) information on intermediate and surface layers – US20 Ida County project

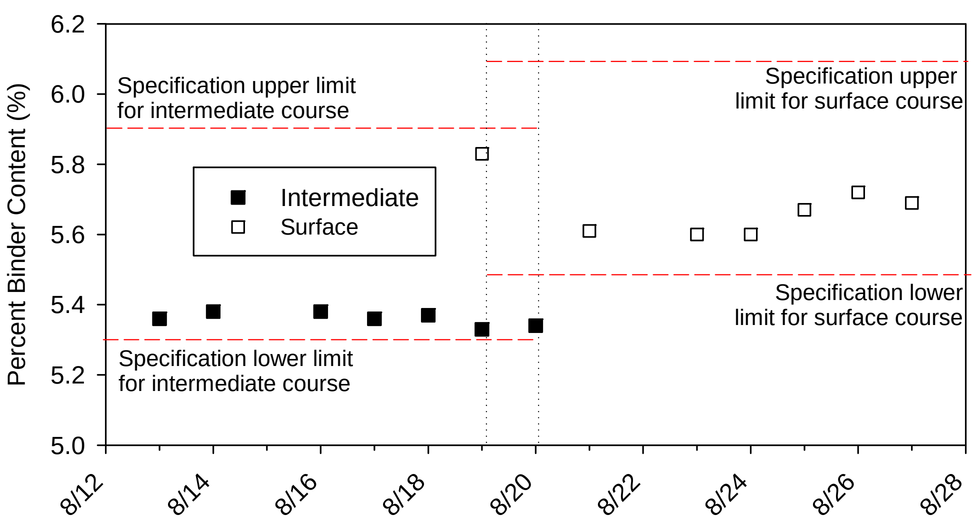

Figure 45. Binder content measurements on intermediate and surface course mixtures on each paving day in comparison with specification limits – US20 Ida County project

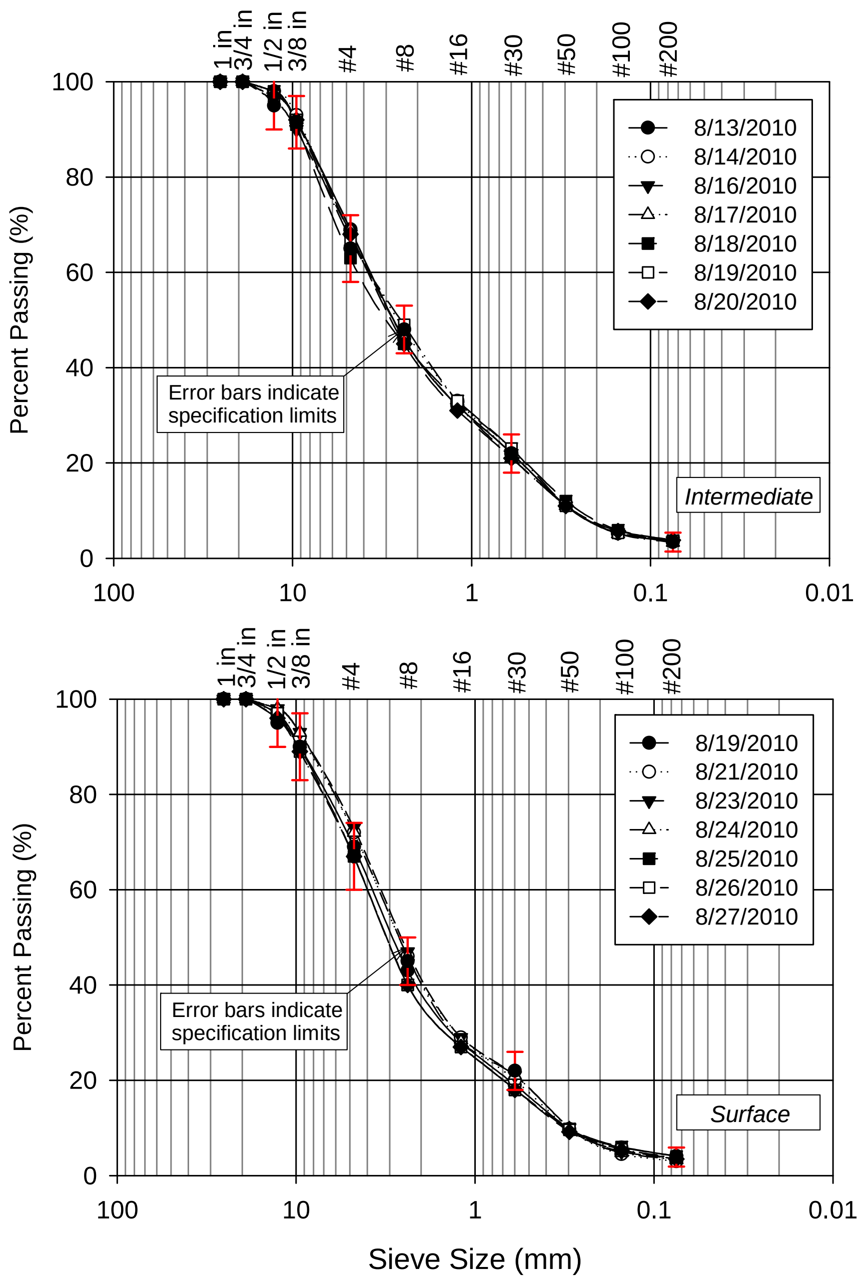

Figure 46. Grain size distribution of aggregate used in the intermediate and surface course mixtures on each paving day in comparison with specification limits – US20 Ida County project

In-Situ Test Results

A summary of the percent compaction measurements on the intermediate and surface course core samples is provided in Figure 47. The core density results indicate that 54 out of 55 samples from the intermediate course and 47 out of 49 samples from the surface course layers exceeded the target minimum 95% compaction requirement according to the specification. The core density results for all samples are provided in Appendix C. The $QI_{Density}$ measurements on each day are summarized in Figure 48 which indicates that all QI measurements were greater than the minimum 0.00 as required in the specification.

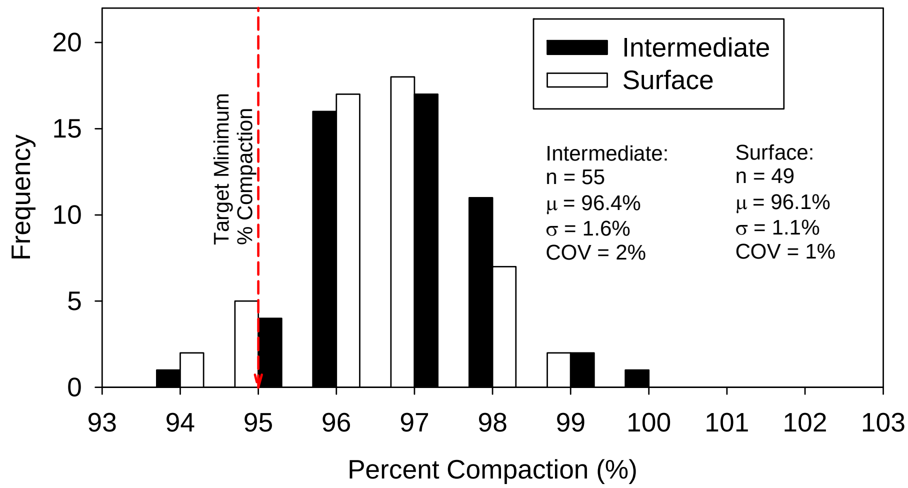

Figure 47. Summary of percent compaction measurements from field cores on intermediate and surface course layers – US20 Ida County project

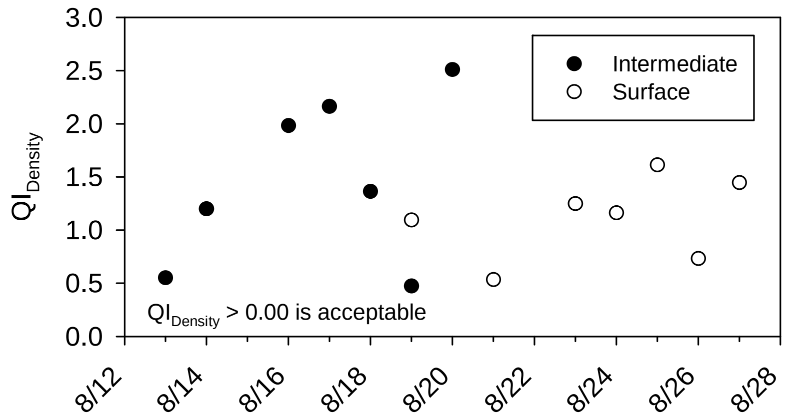

Figure 48. Summary of daily density QI measurements on intermediate and surface course layers – US20 Ida County project

Beyond the QC/QA testing required in the project specifications, a total of thirteen PSs were tested on this project. A summary of testing performed in each PS and location of each PS is presented in Table 10. A Troxler nuclear gauge was used to obtain percent compaction measurements on the HMA layers. HMA surface temperature measurements were obtained using a FLIR thermal camera (T_{FLIR}) and the infrared camera mounted on the RICM roller (T_{Roller}). Density and surface temperature measurements were obtained before and after multiple roller passes (e.g., 0, 1, 2, 3, etc) to evaluate their changes with increasing pass and time. Density measurements are correlated with roller-integrated CCV measurements and T_{FLIR} measurements are correlated with T_{Roller} measurements.

Table 10. Summary of production test sections and in-situ testing (US20 Ida County Project)

Date	PS	Location	Comments
8/16/10	1	Near station 815+00	% compaction, surface temperature (using thermal camera and roller infrared camera), roller pass count at three points spread equidistant across lane, data recorded after each pass of breakdown, rubbertire, and finish roller.
	2	Near station 780+00	% compaction, surface temperature (using thermal camera and roller infrared camera), roller pass count at two points spread equidistant across the lane, data recorded after each pass of breakdown, rubbertire, and finish roller.
8/17/10	3	Near station 775+00	
	4	Near station 1890+00	% compaction, surface temperature (using thermal camera and roller infrared camera), roller pass count at three points spread equidistant across lane, data recorded after each pass of breakdown, rubbertire, and finish roller.
8/18/10	5	Near M25/US 20 Intersection EB lane	
	6	Near Landmark Ave. EB lane	
	7	Near Maple River Bridge EB lane	
	8	Near station 1750+00	
8/19/10	9	Near M25/HWY 20 Intersection WB lane	
	10	Near Landmark Ave. WB lane	
	11	Near Maple River Bridge WB lane	
	12	20ft East of dirt road	
	13	Near house 5862	

Note: PS – production test section, % compaction measurements were taken with a Troxler Nuclear Densitometer

Percent compaction, roller-integrated CCV, T_{FLIR}, and T_{Roller} with increasing pass, and time from each PS are presented in Figure 49 to Figure 71. Percent compaction and T_{FLIR} measurements are obtained from a point test location in each PS as noted in the figures. The exact GPS co-ordinates of these test locations were not obtained, however, approximate station and offset information was obtained for each location during testing. The GPS coordinates of the center line of the project alignment were obtained, which were then used to determine the approximate northing and easting of each test measurement location. Similar to the US30 project, these approximate northing and easting locations were used to extract the RICM data at those test locations from a 1 m x 1 m (3 ft x 3 ft) window area by placing the approximated location in the center of the window. Average CCV and T_{Roller} data within the 1 m x 1m (3 ft x 3 ft) window was used in the plots presented in Figure 49 to Figure 71. Percent compaction curves indicate that the number of passes required achieving 95% compaction varied between each test section between 1 to 8 passes. Only 1 to 2 roller passes were performed by the break down roller in all the PSs.

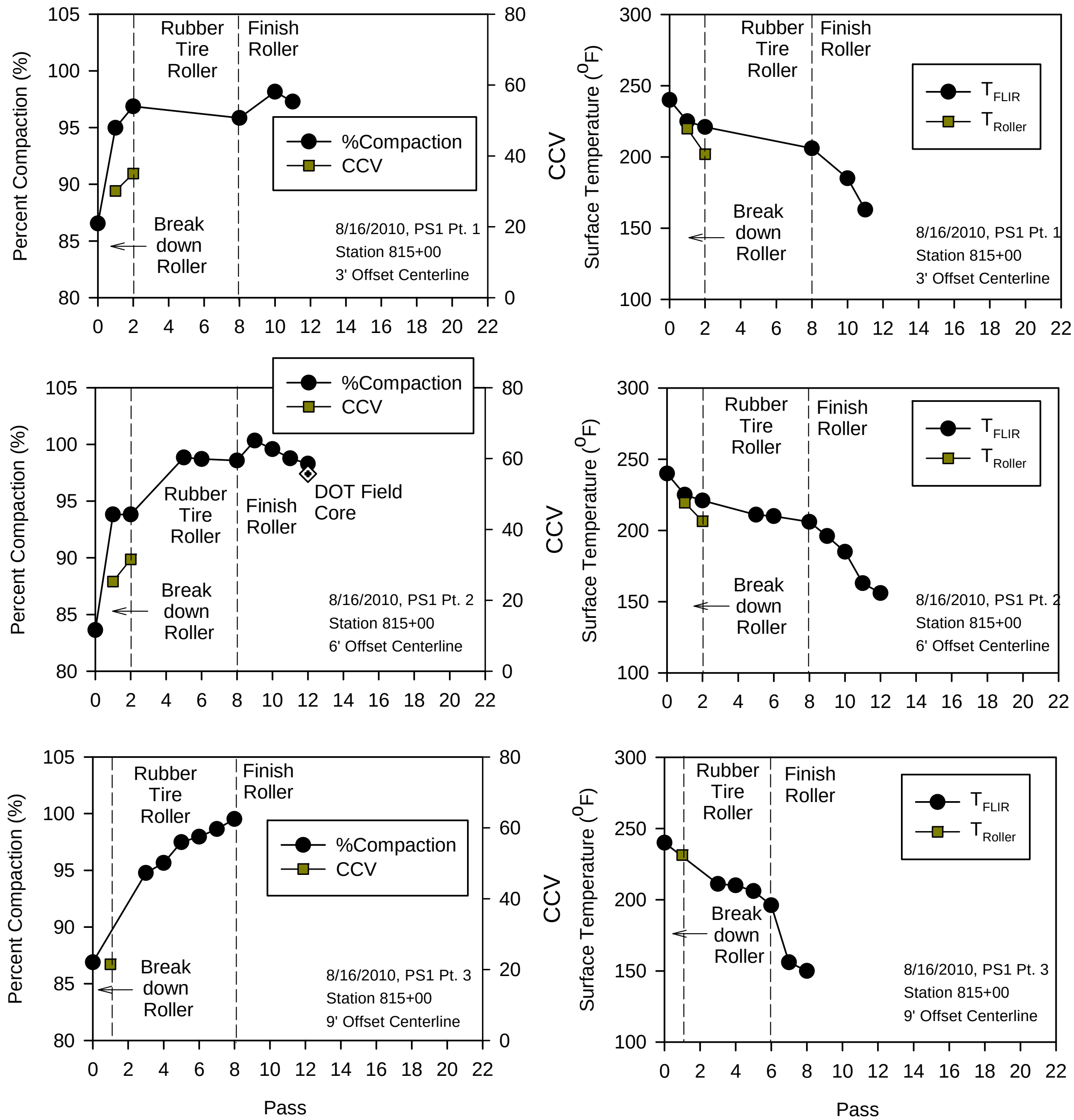

Figure 49. In-situ percent compaction, roller CCV, and surface temperature with pass count measurements on intermediate course layer at three points on PS 1 – US20 Ida county project PS1 (08/16/2010)

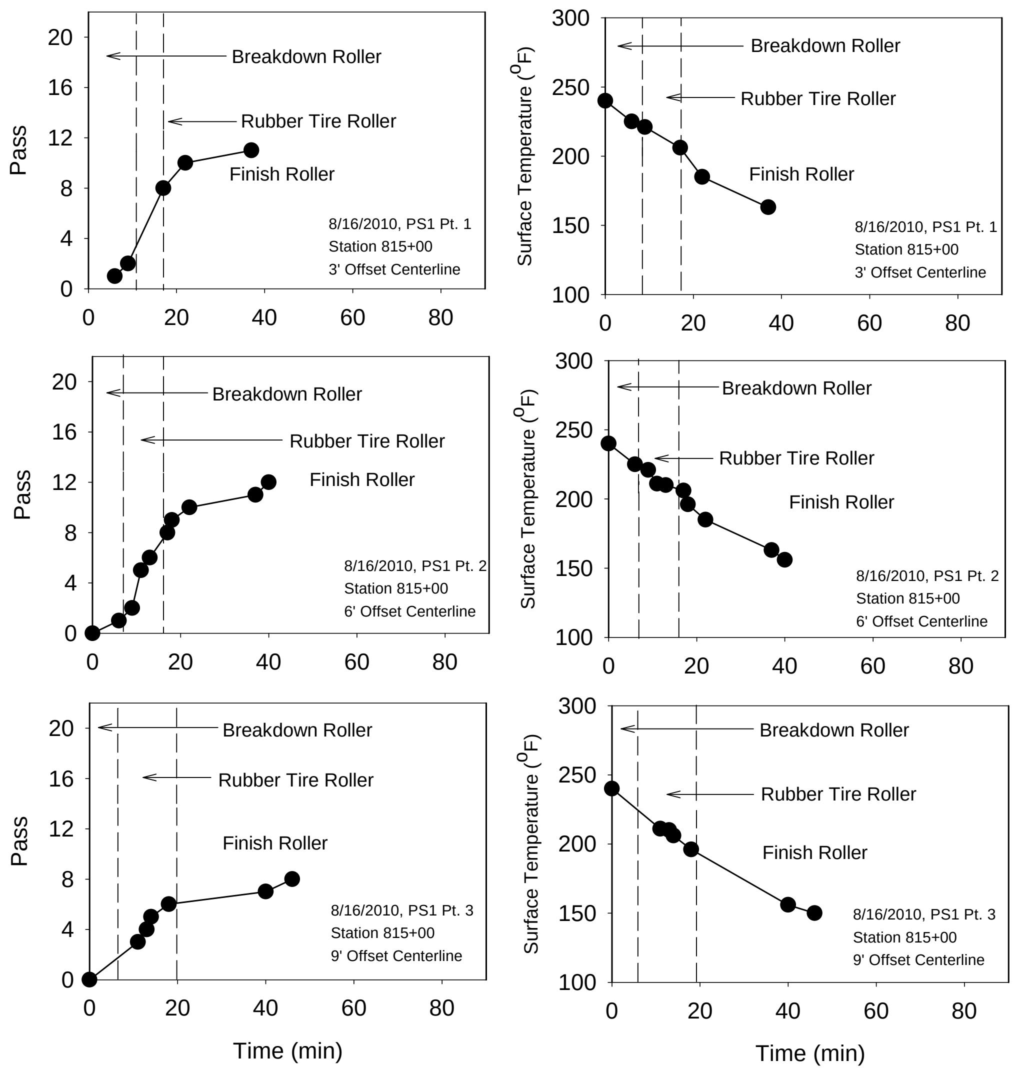

Figure 50. In-situ percent compaction and surface temperature with time measurements on intermediate course layer at three points on PS 1 – US20 Ida county project (08/16/2010)

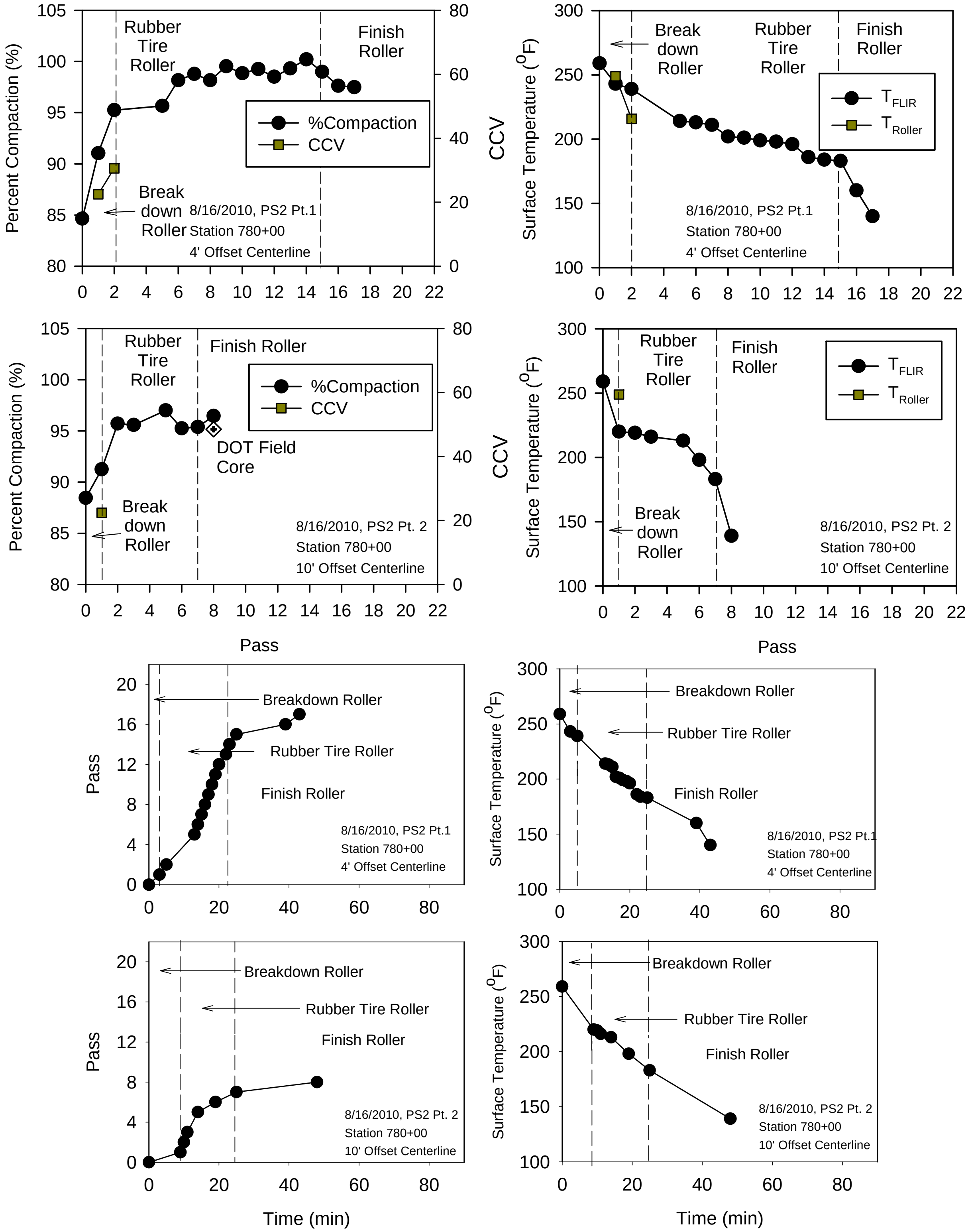

Figure 51. In-situ percent compaction, roller CCV, and surface temperature with pass count and time measurements on intermediate course layer at two points on PS 2 – US20 Ida county project (08/17/2010)

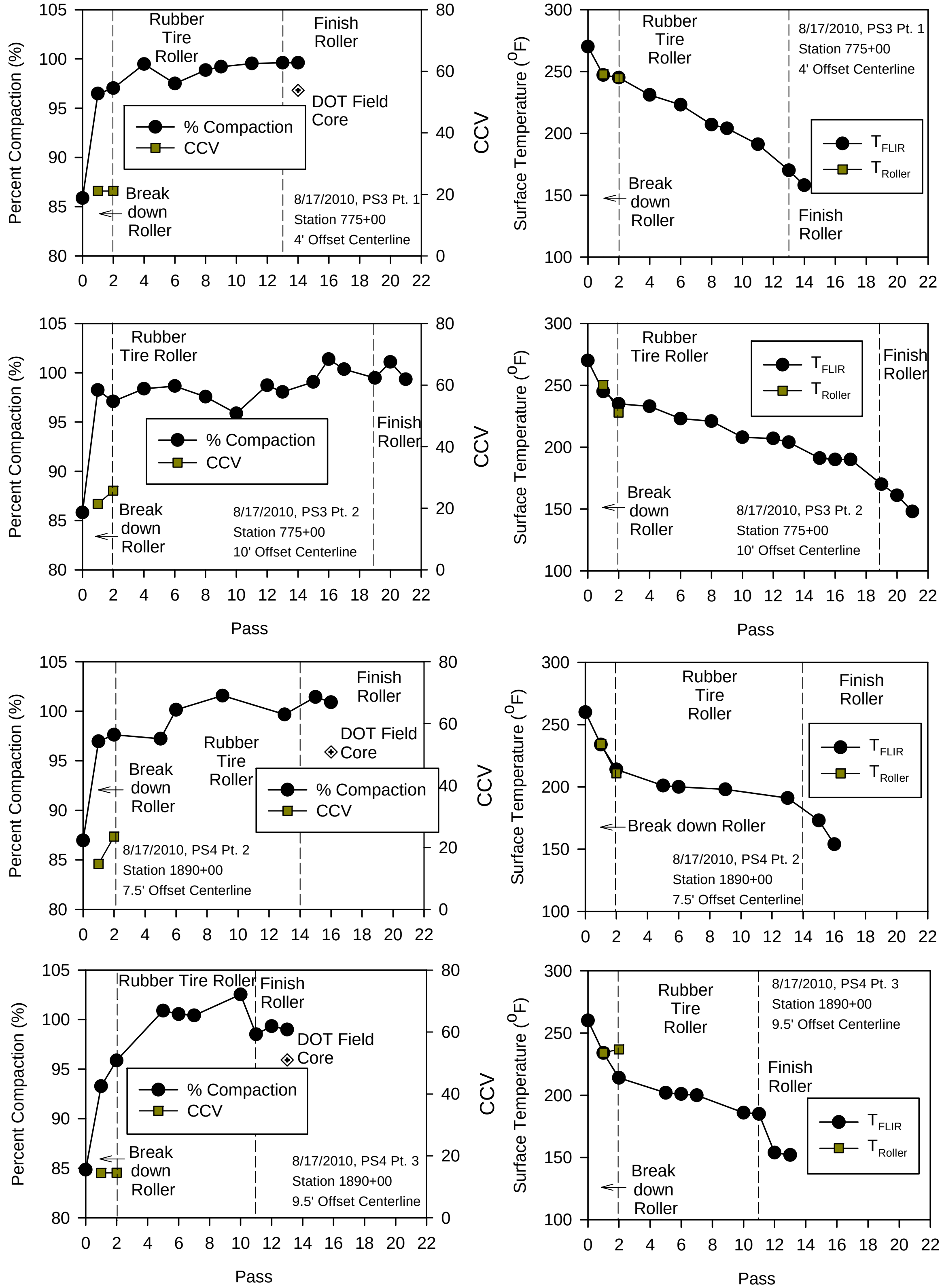

Figure 52. In-situ percent compaction, roller CCV, and surface temperature with pass count measurements on intermediate course layer at two points on PS 3/4 – US20 Ida county project (08/17/2010)

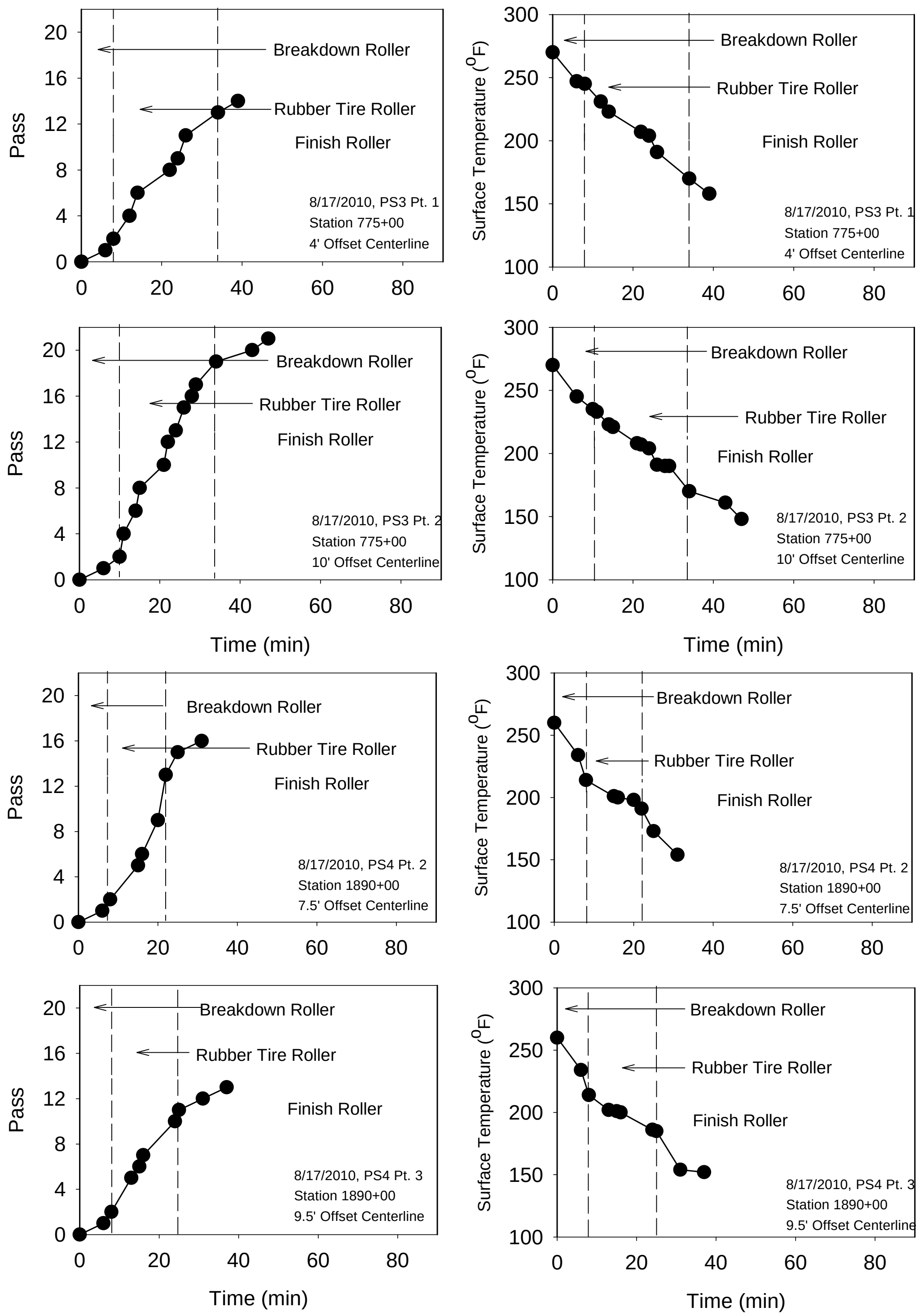

Figure 53. In-situ percent compaction and surface temperature with time measurements on intermediate course layer at two points on PS 3/4 – US20 Ida county project (08/17/2010)

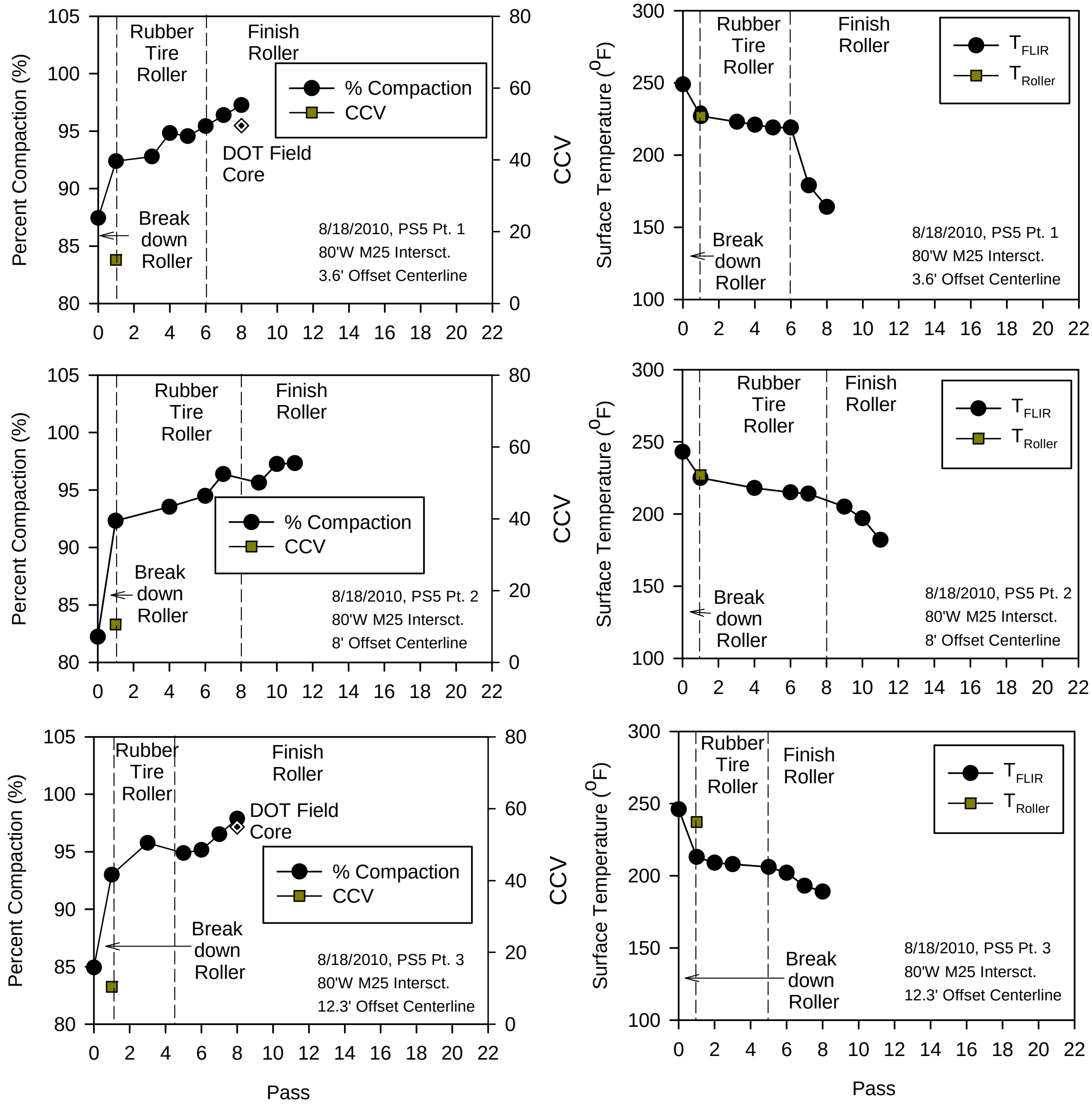

Figure 54. In-situ percent compaction, roller CCV, and surface temperature with pass count measurements on intermediate course layer at three points on PS 5 – US20 Ida county project (08/18/2010)

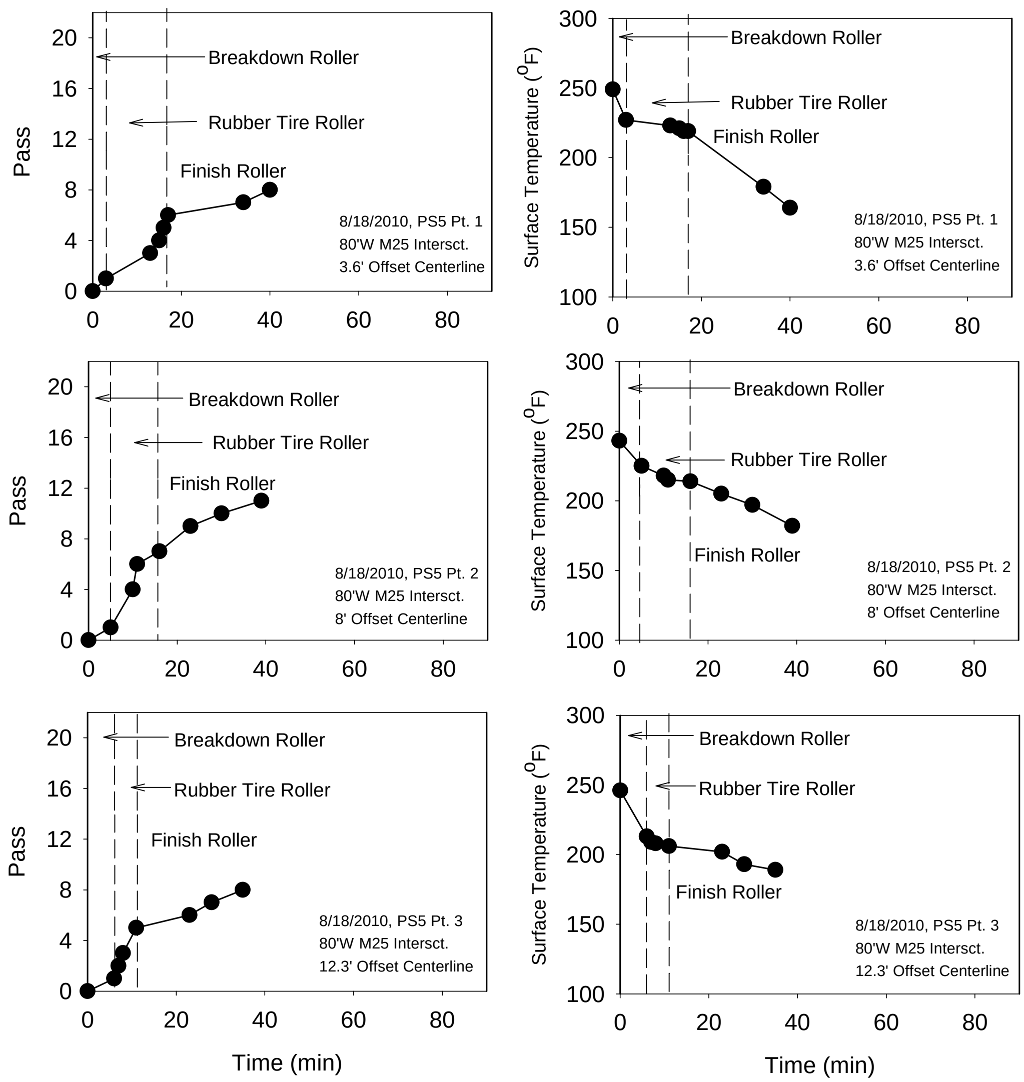

Figure 55. In-situ percent compaction and surface temperature with time measurements on intermediate course layer at three points on PS 5 – US20 Ida county project (08/18/2010)

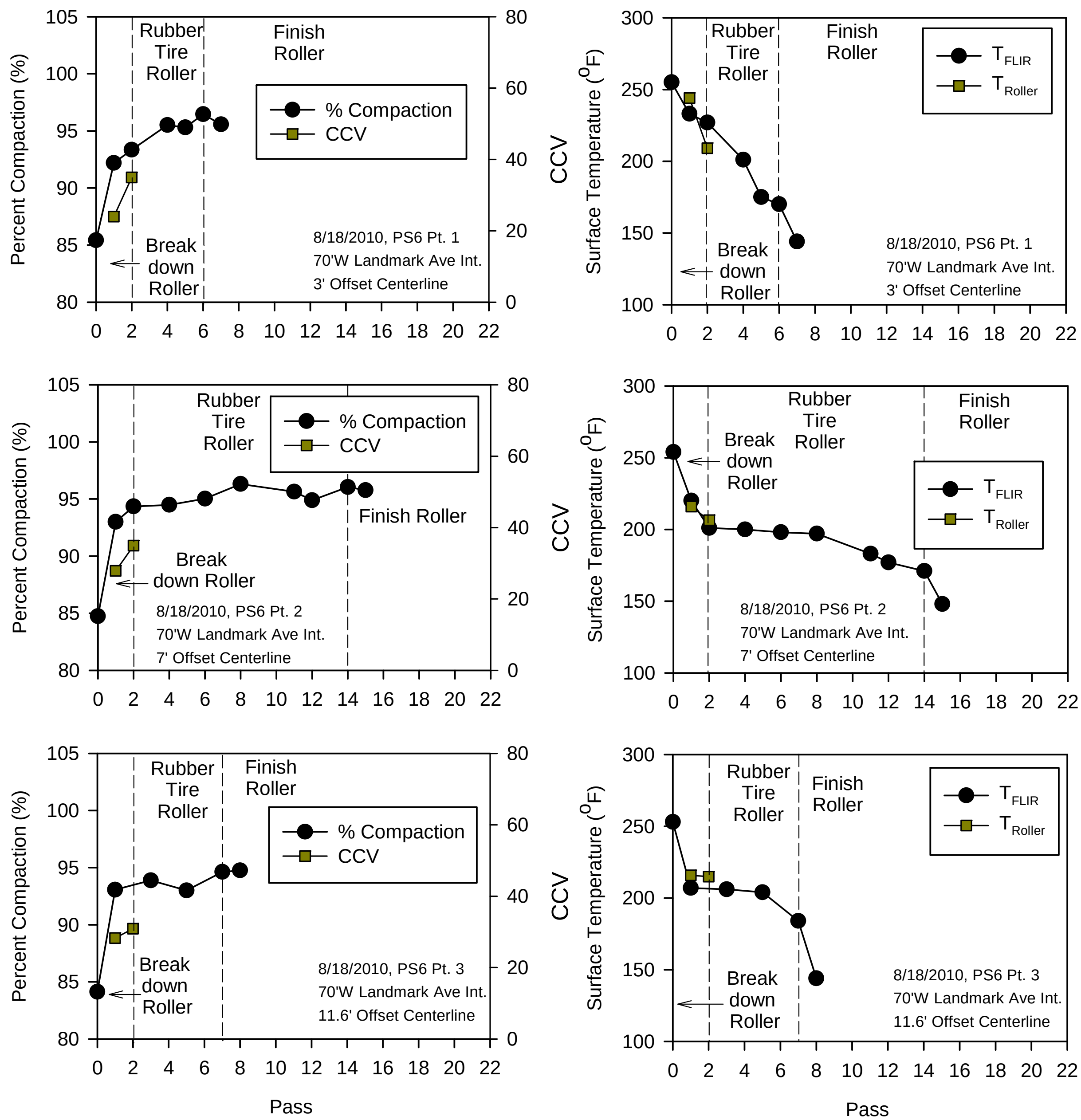

Figure 56. In-situ percent compaction, roller CCV, and surface temperature with pass count measurements on intermediate course layer at three points on PS 6 – US20 Ida county project (08/18/2010)

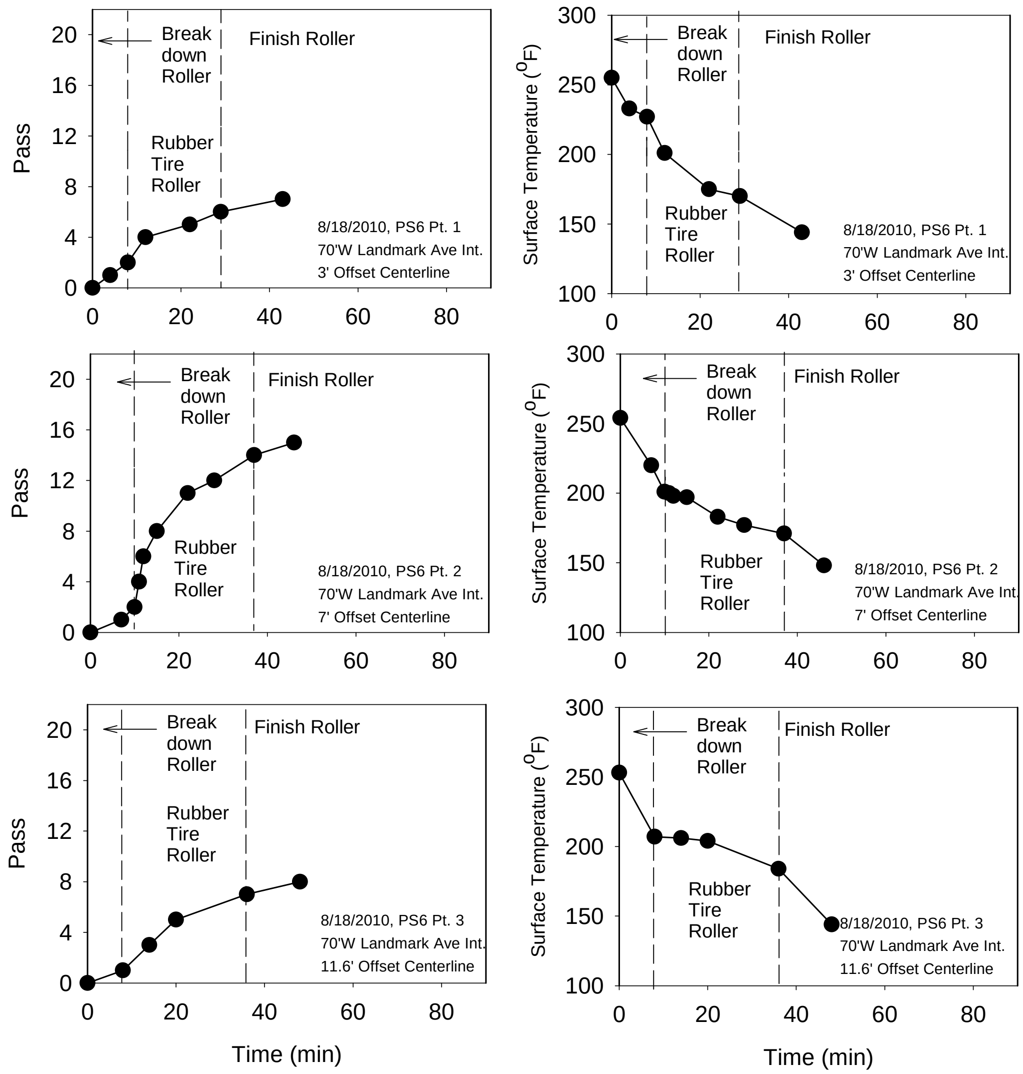

Figure 57. In-situ percent compaction and surface temperature with time measurements on intermediate course layer at three points on PS 6 – US20 Ida county project (08/18/2010)

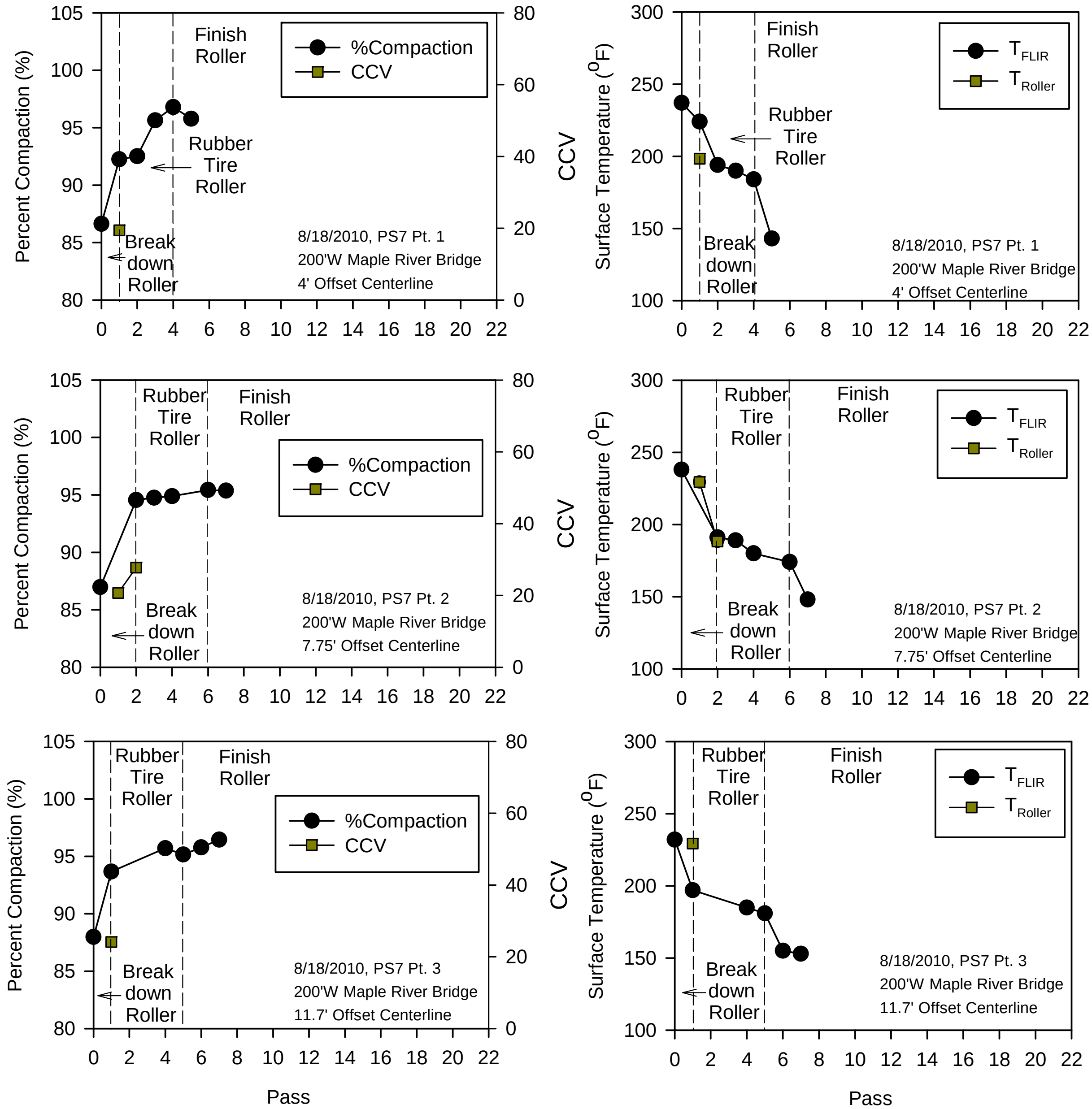

Figure 58. In-situ percent compaction, roller CCV, and surface temperature with pass count measurements on intermediate course layer at three points on PS 7 – US20 Ida county project (08/18/2010)

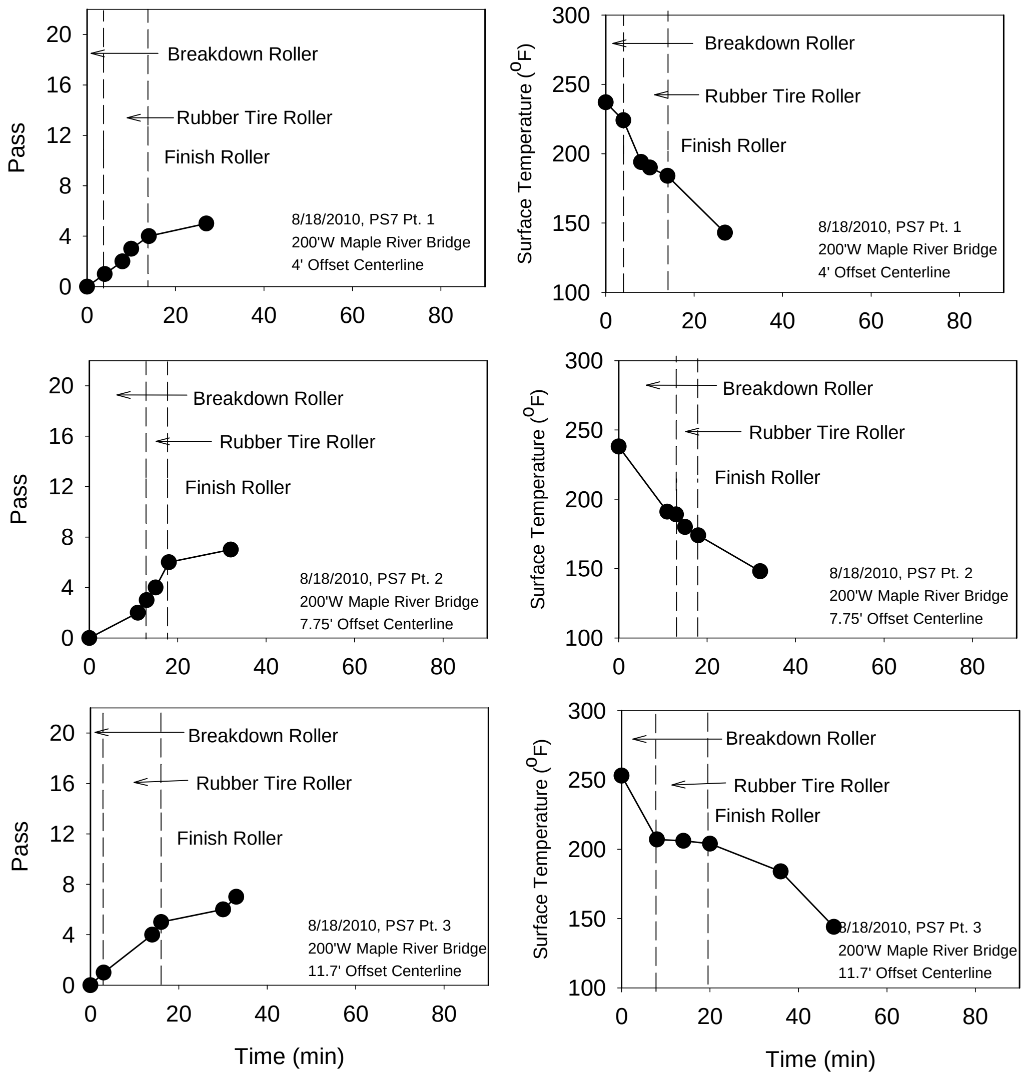

Figure 59. In-situ percent compaction and surface temperature with time measurements on intermediate course layer at three points on PS 7 – US20 Ida county project (08/18/2010)

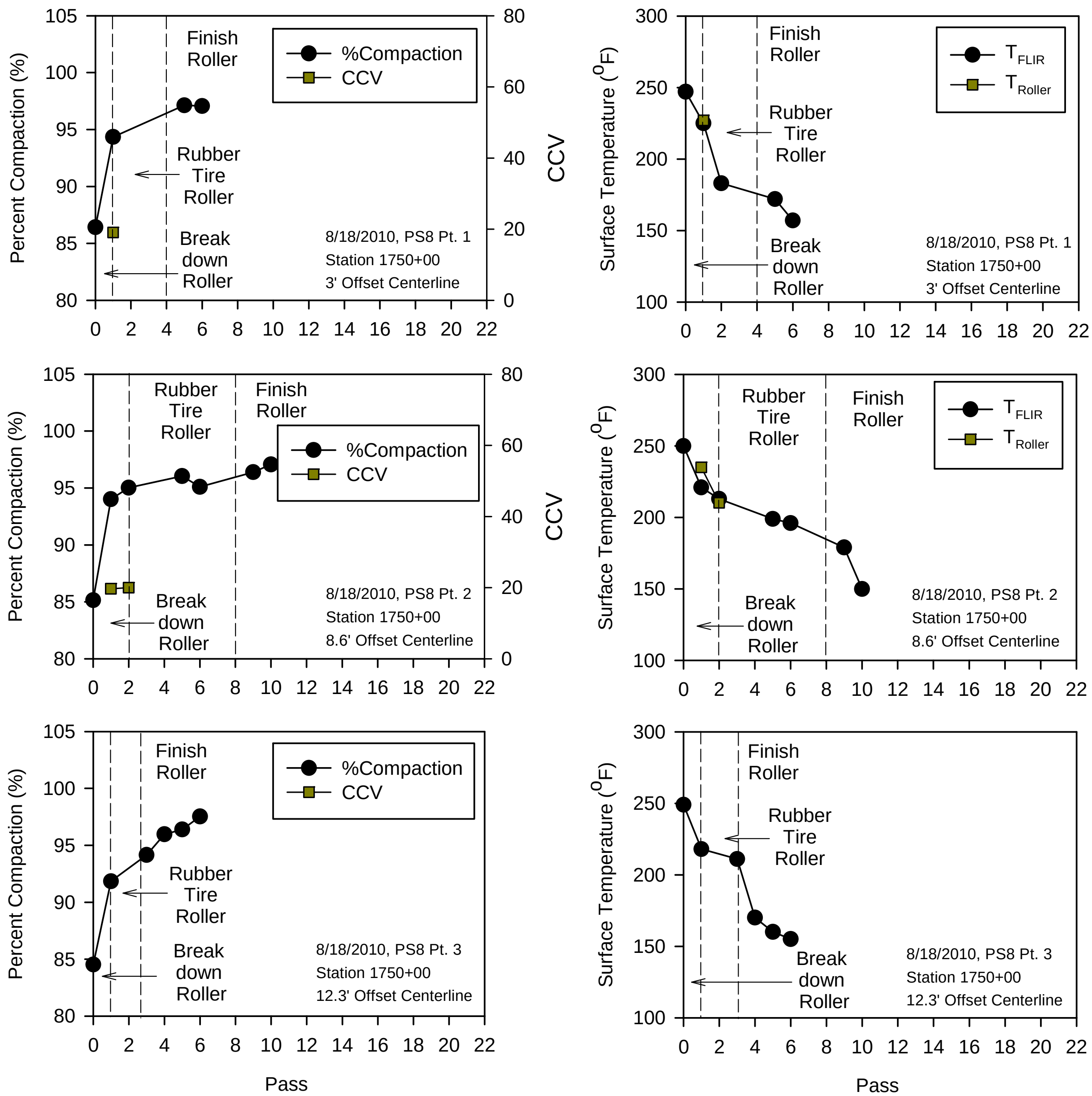

Figure 60. In-situ percent compaction, roller CCV, and surface temperature with pass count measurements on intermediate course layer at three points on PS 8 – US20 Ida county project (08/18/2010)

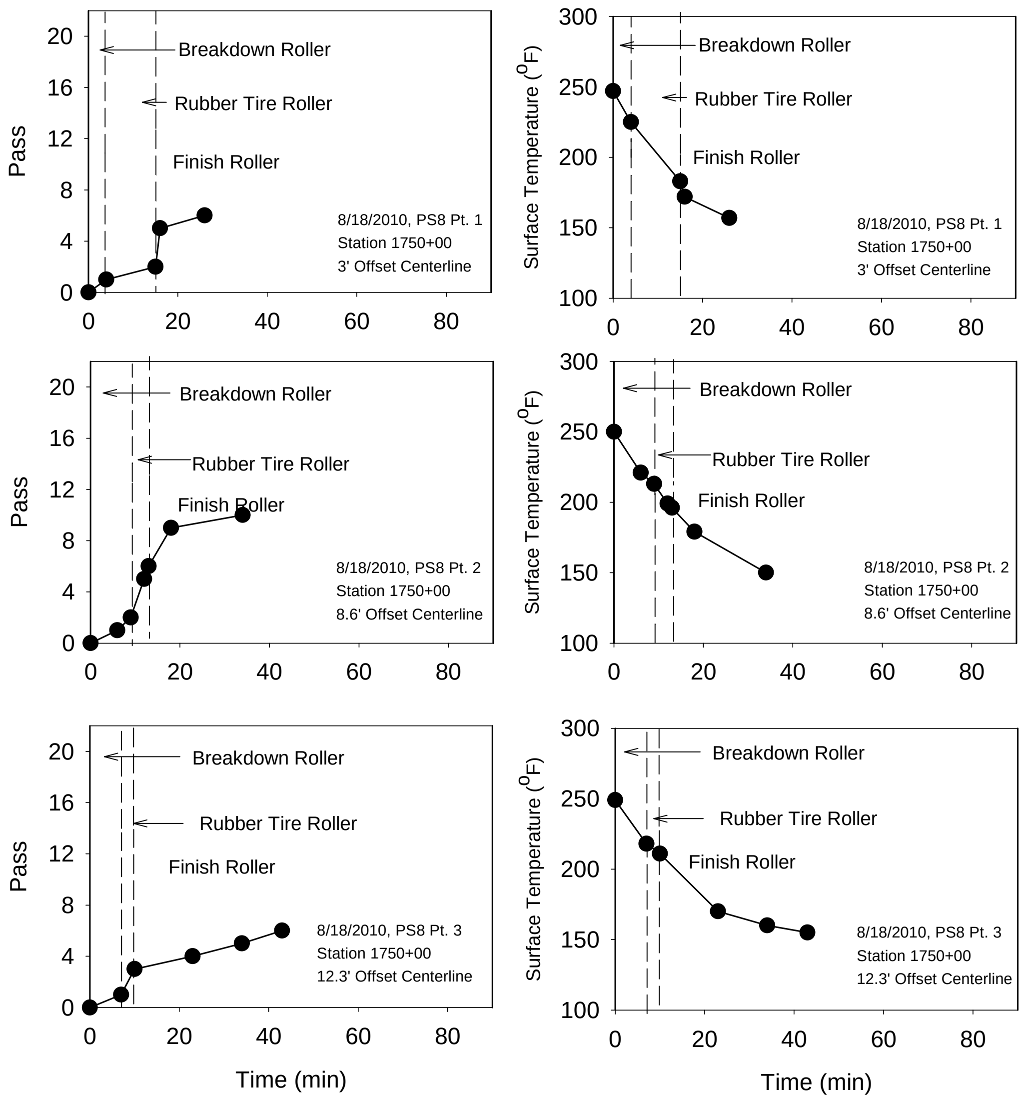

Figure 61. In-situ percent compaction and surface temperature with time measurements on intermediate course layer at three points on PS 8 – US20 Ida county project (08/18/2010)

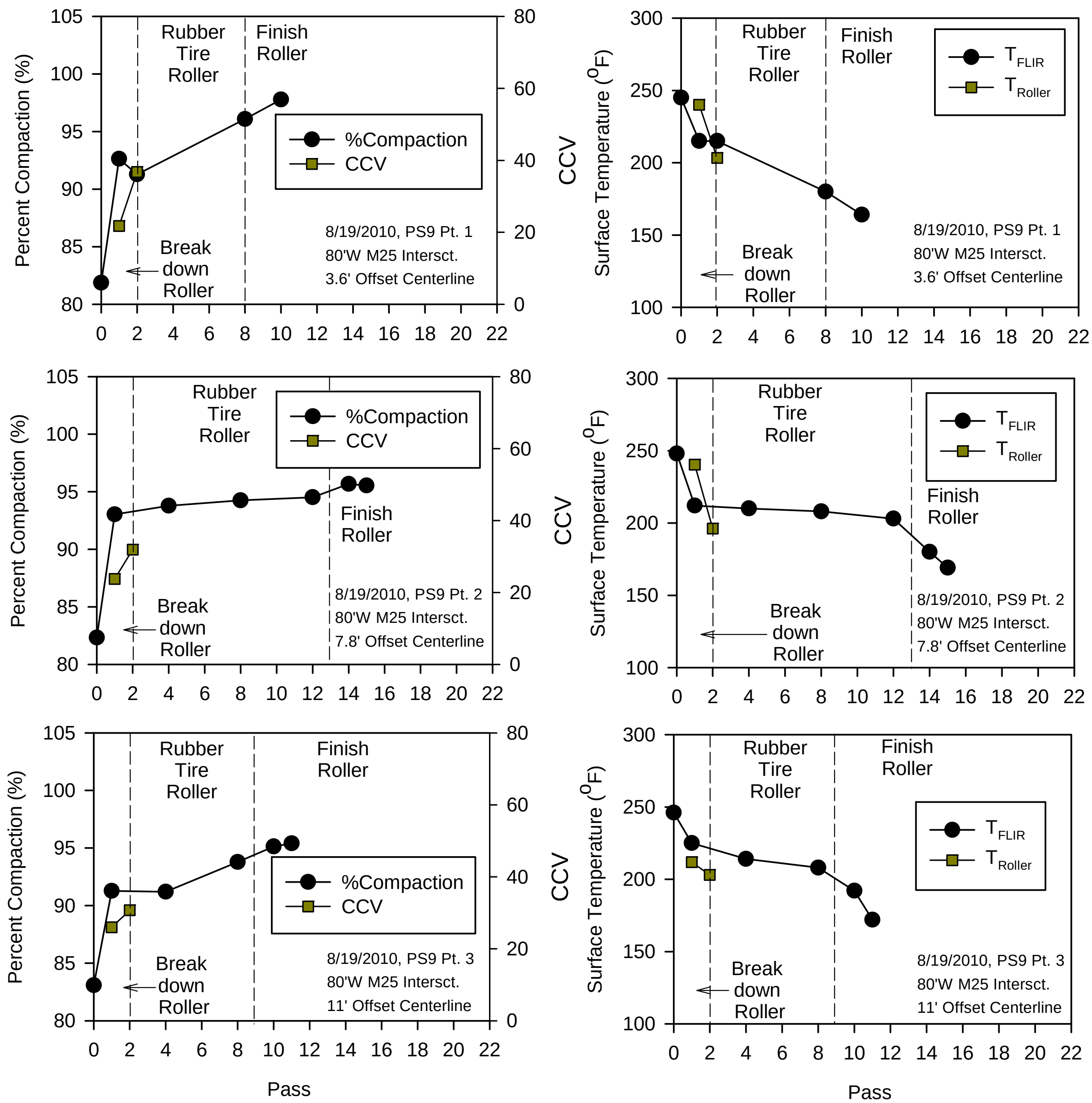

Figure 62. In-situ percent compaction, roller CCV, and surface temperature with pass count measurements on intermediate course layer at three points on PS 9 – US20 Ida county project (08/19/2010)

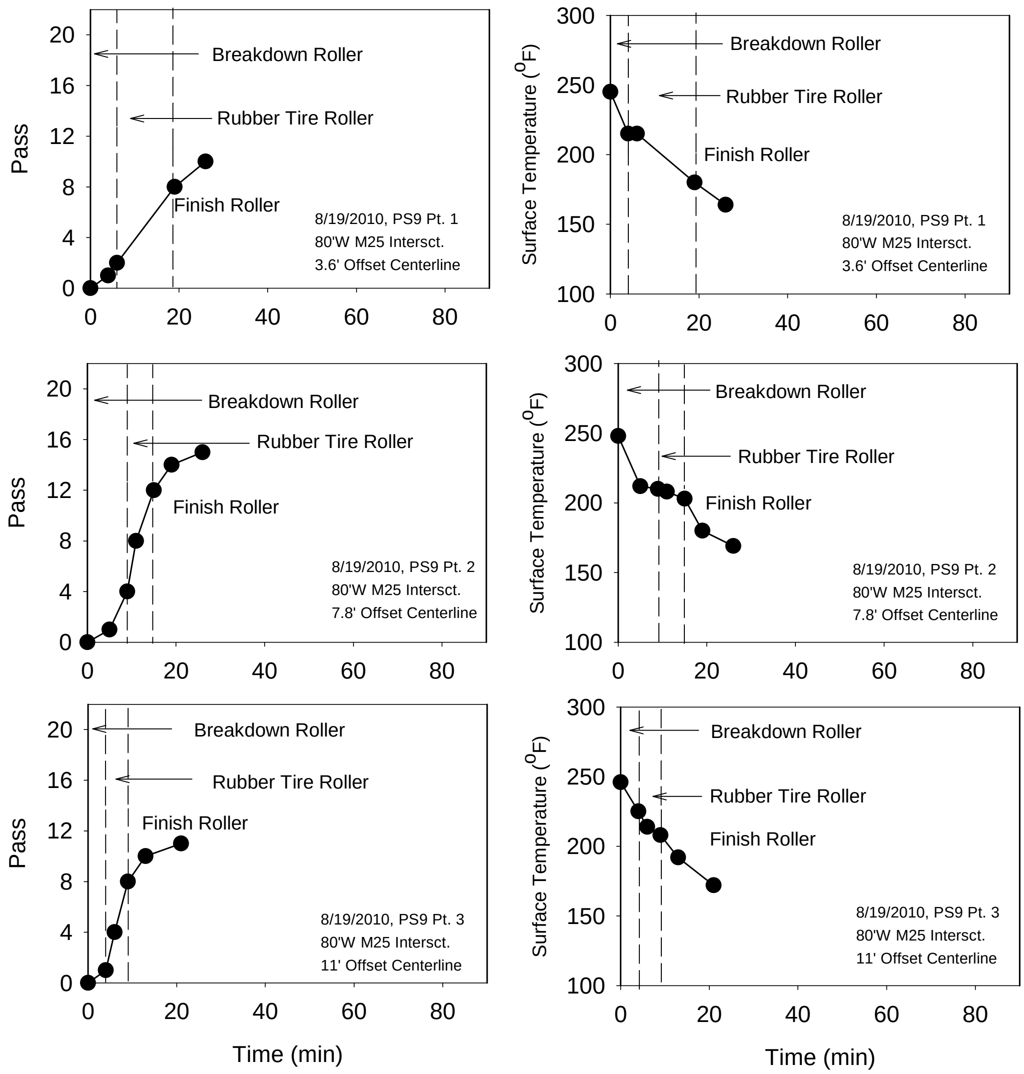

Figure 63. In-situ percent compaction and surface temperature with time measurements on intermediate course layer at three points on PS 9 – US20 Ida county project (08/19/2010)

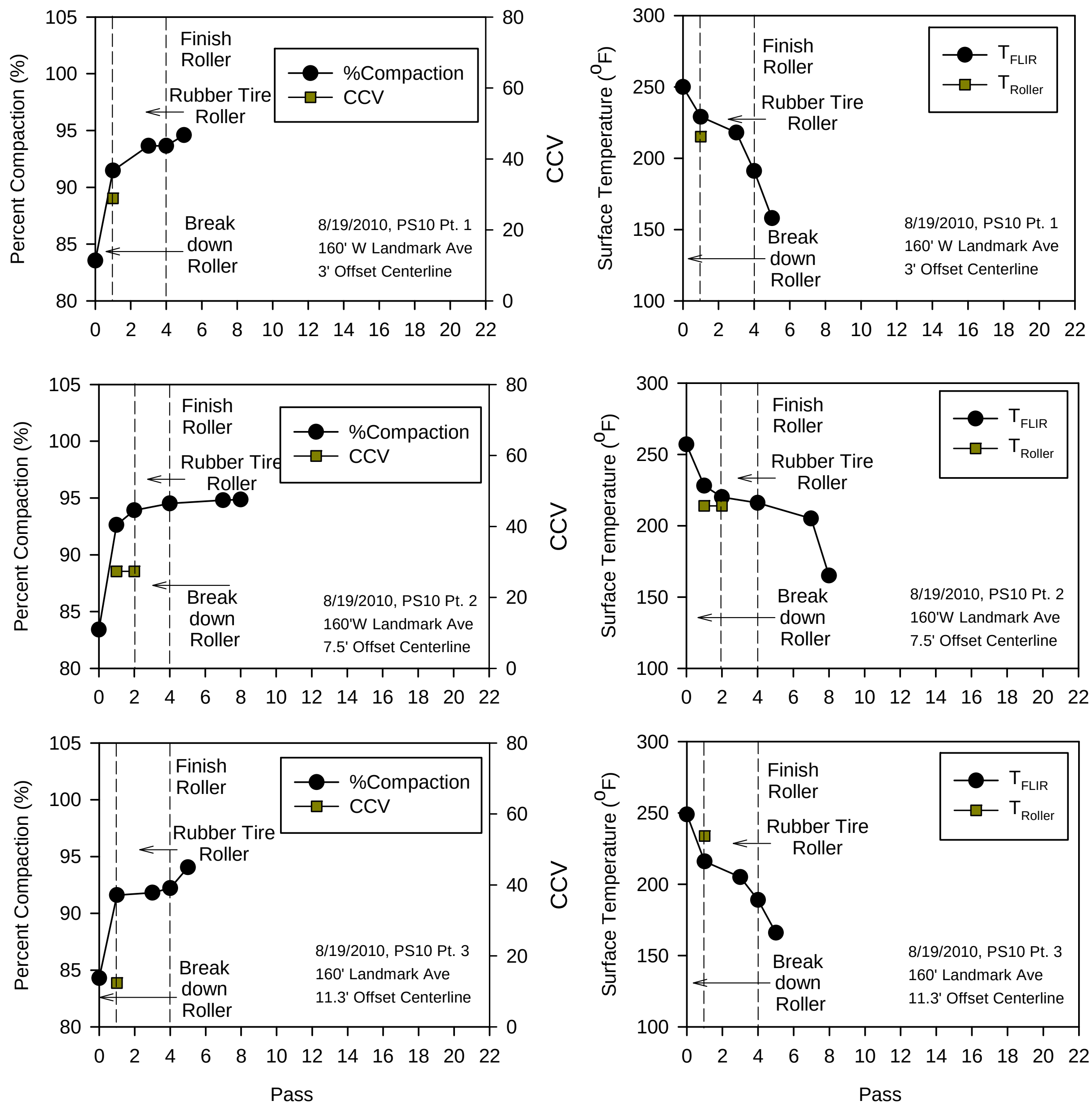

Figure 64. In-situ percent compaction, roller CCV, and surface temperature with pass count measurements on intermediate course layer at three points on PS 10 – US20 Ida county project (08/19/2010)

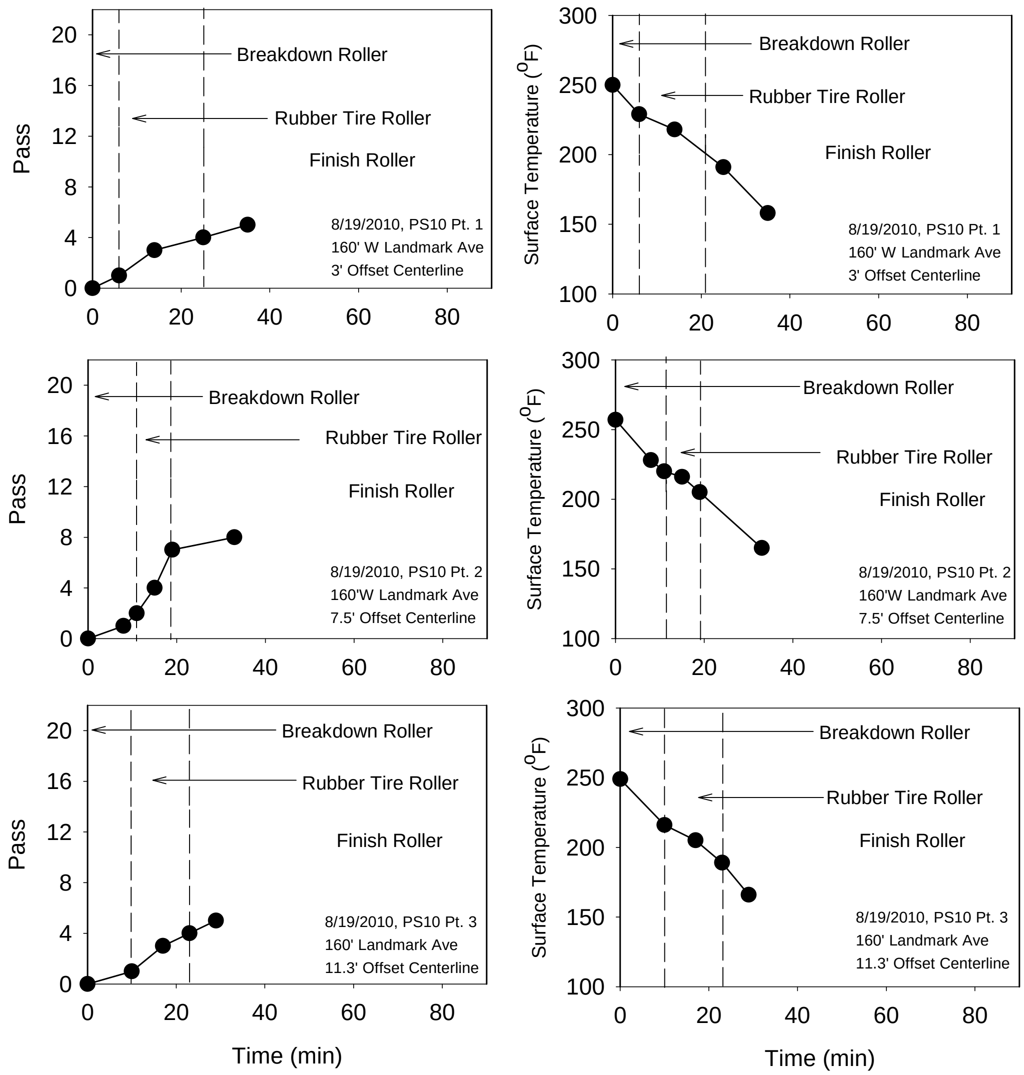

Figure 65. In-situ percent compaction and surface temperature with time measurements on intermediate course layer at three points on PS 10 – US20 Ida county project (08/19/2010)

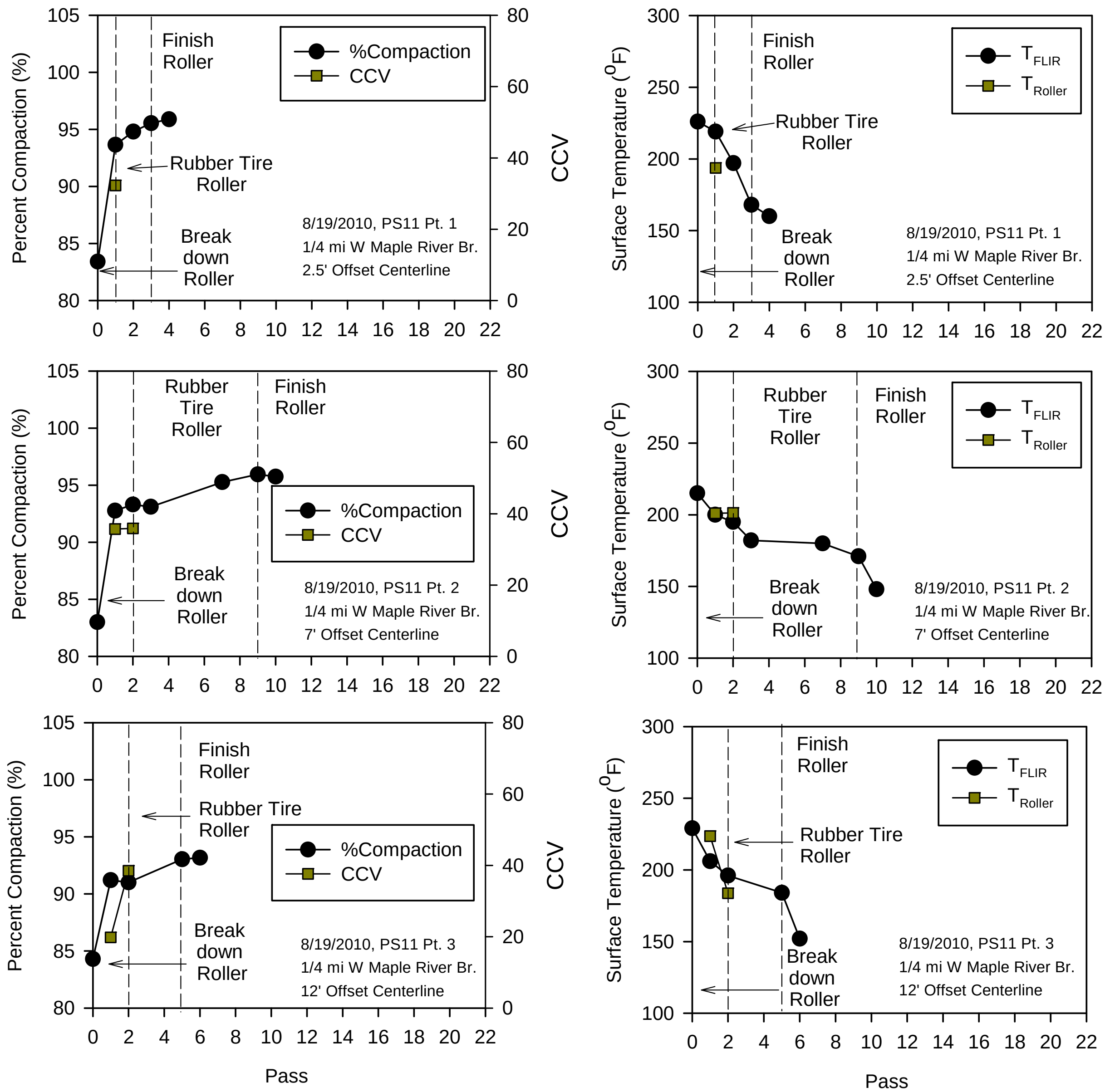

Figure 66. In-situ percent compaction, roller CCV, and surface temperature with pass count measurements on intermediate course layer at three points on PS 11 – US20 Ida county project (08/19/2010)

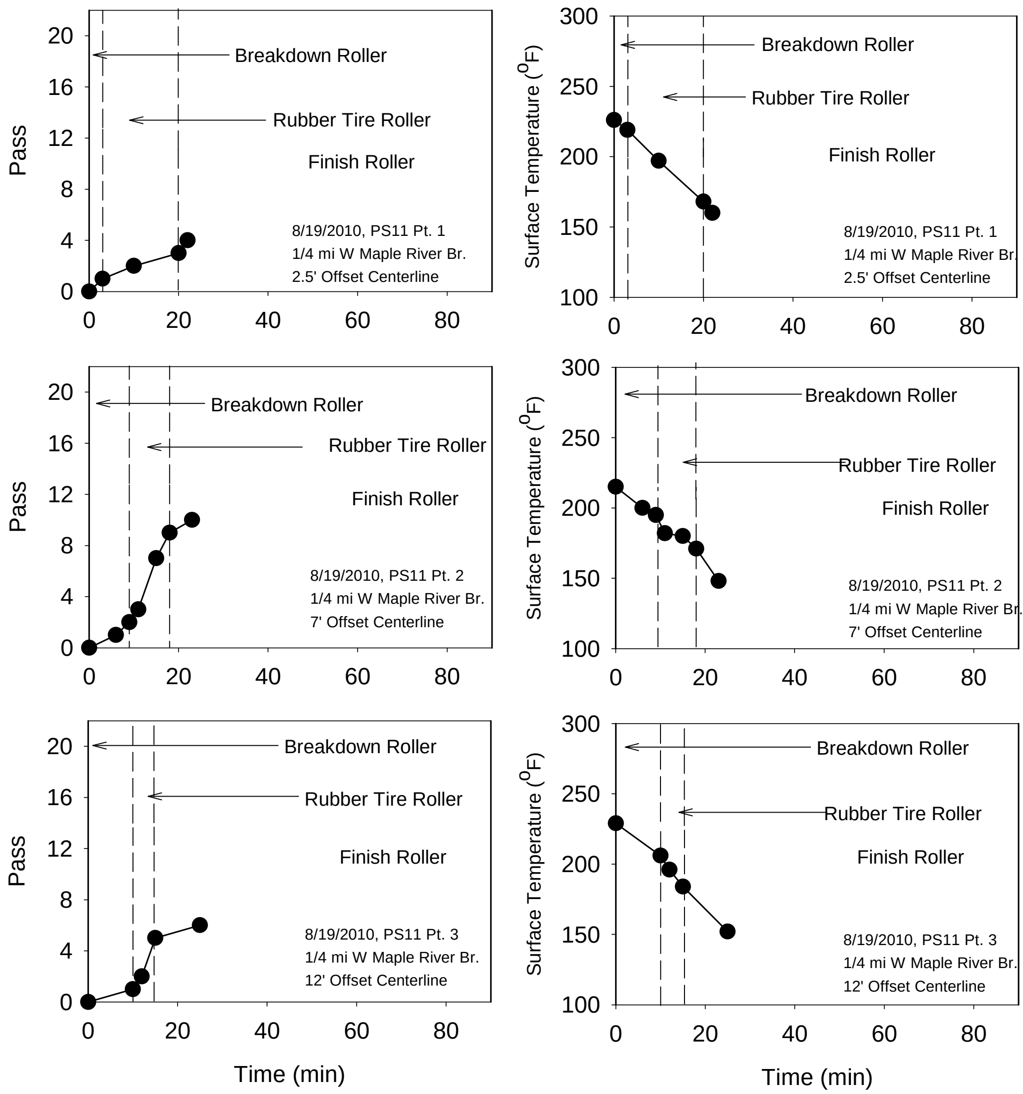

Figure 67. In-situ percent compaction and surface temperature with time measurements on intermediate course layer at three points on PS 11 – US20 Ida county project (08/19/2010)

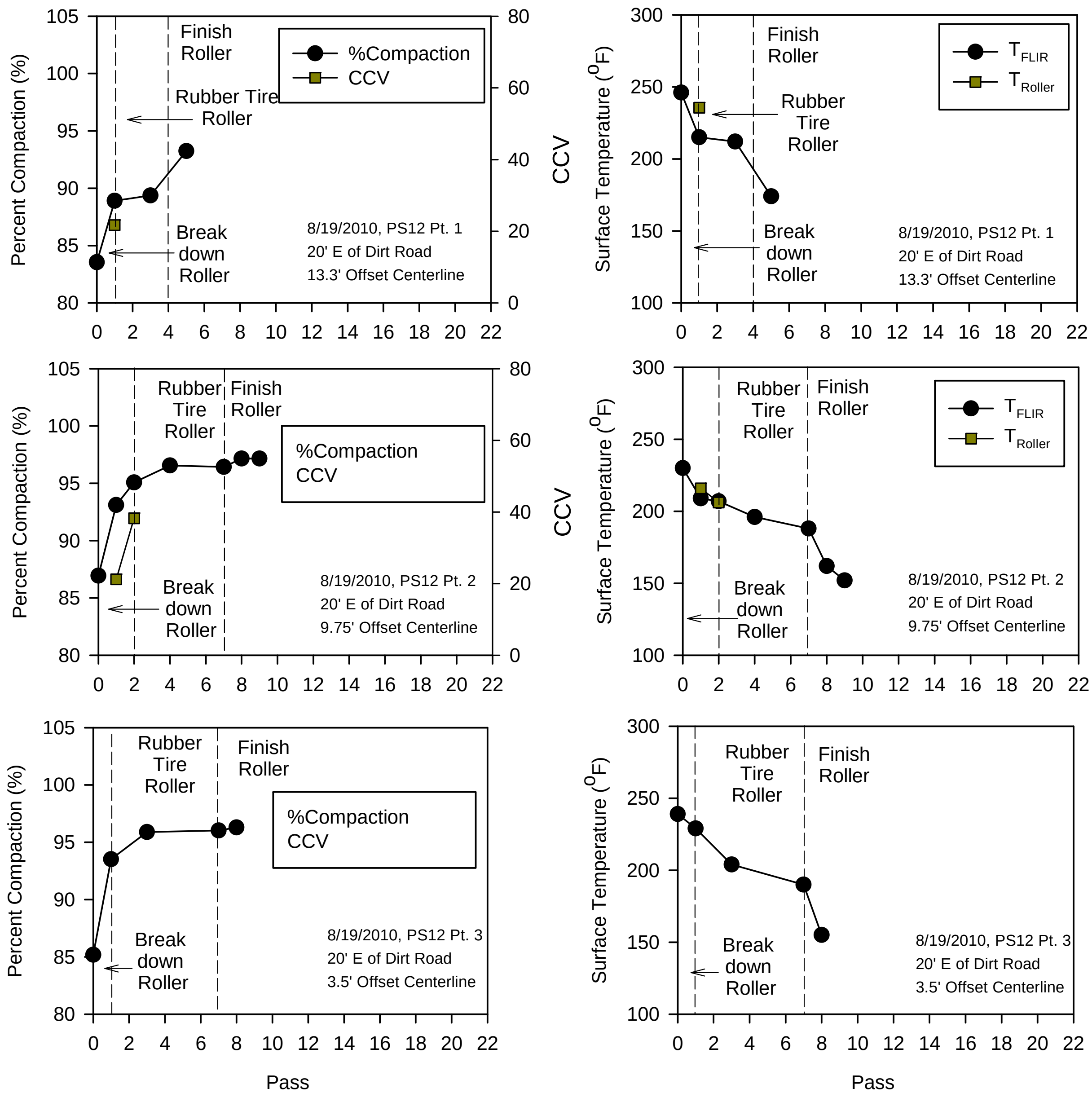

Figure 68. In-situ percent compaction, roller CCV, and surface temperature with pass count measurements on intermediate course layer at three points on PS 12 – US20 Ida county project (08/19/2010)

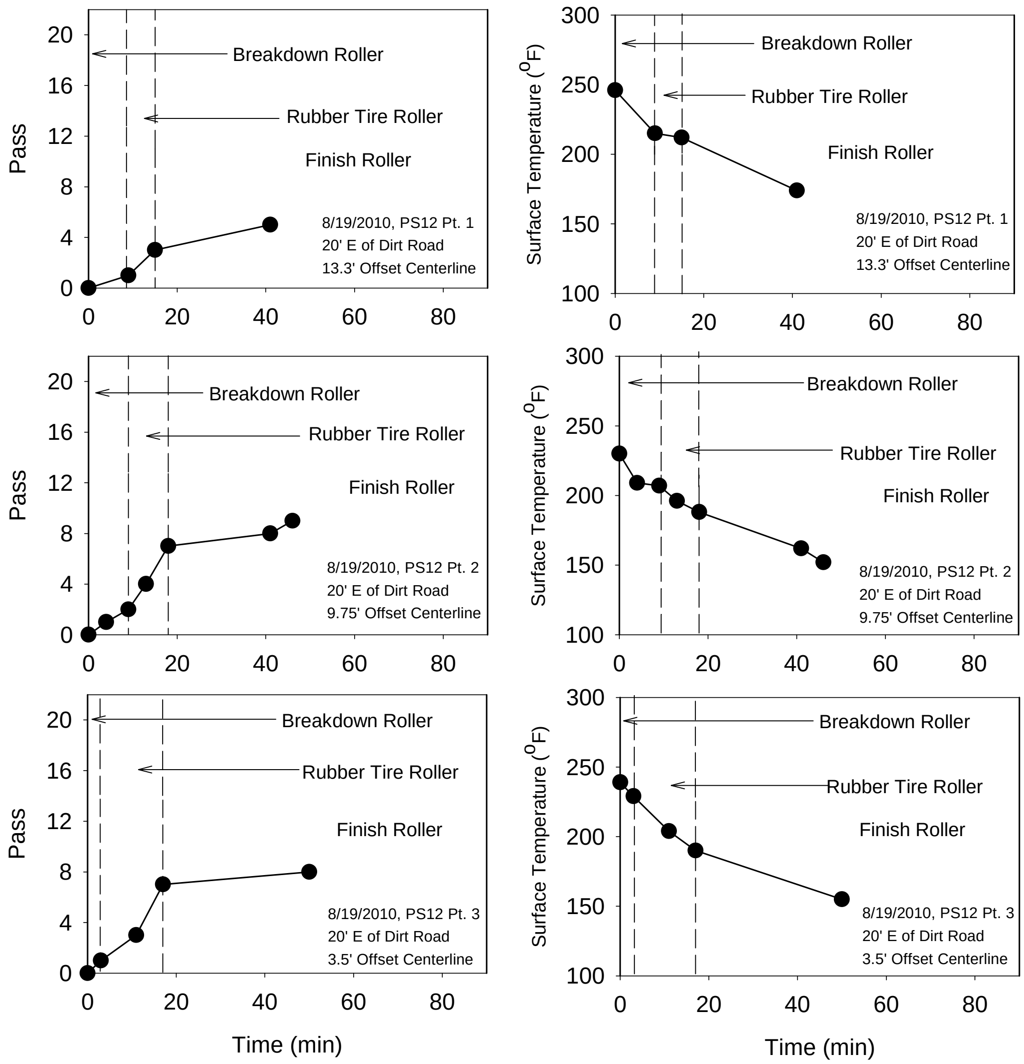

Figure 69. In-situ percent compaction and surface temperature with time measurements on intermediate course layer at three points on PS 12 – US20 Ida county project (08/19/2010)

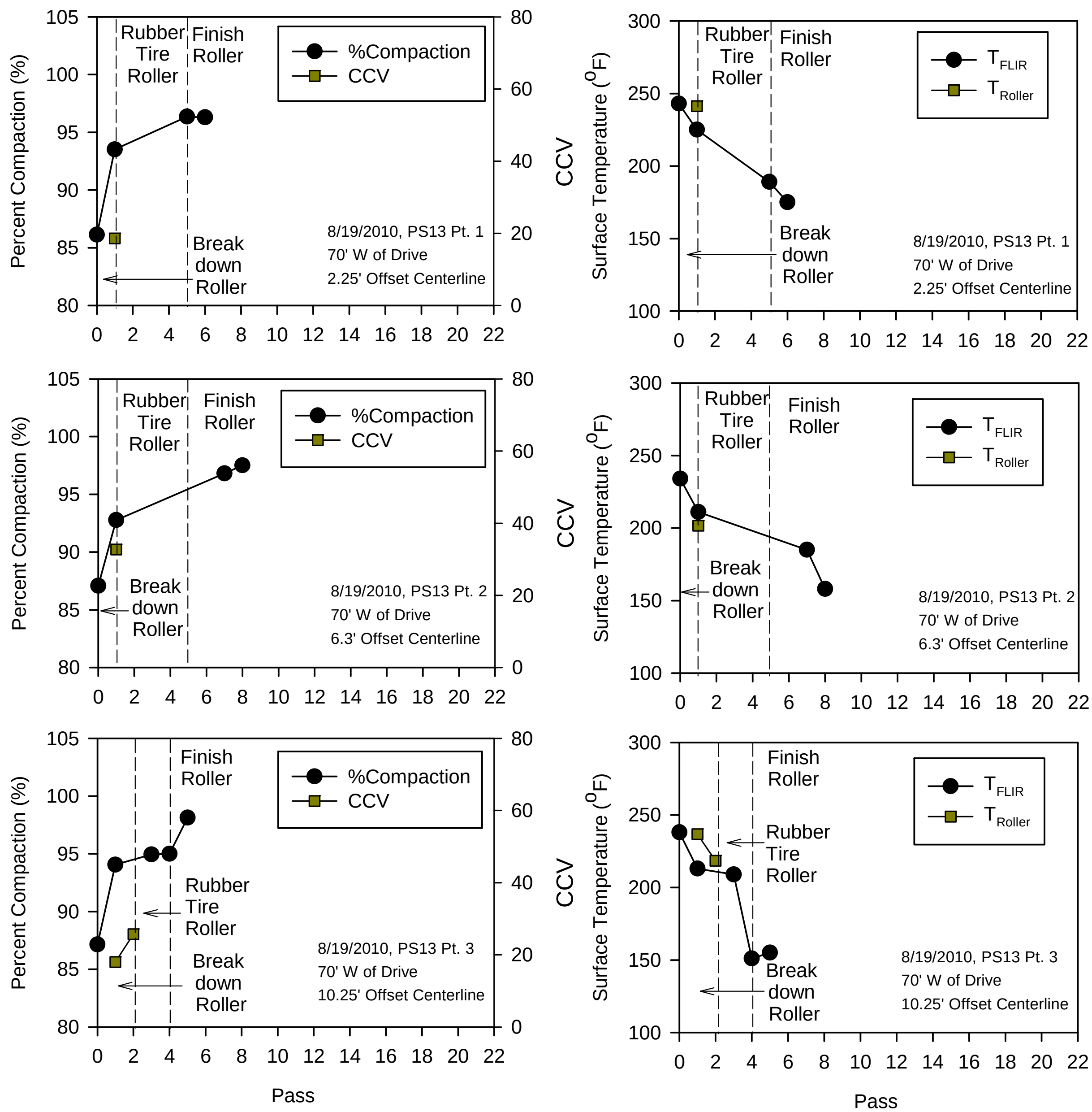

Figure 70. In-situ percent compaction, roller CCV, and surface temperature with pass count measurements on intermediate course layer at three points on PS 13 – US20 Ida county project (08/19/2010)

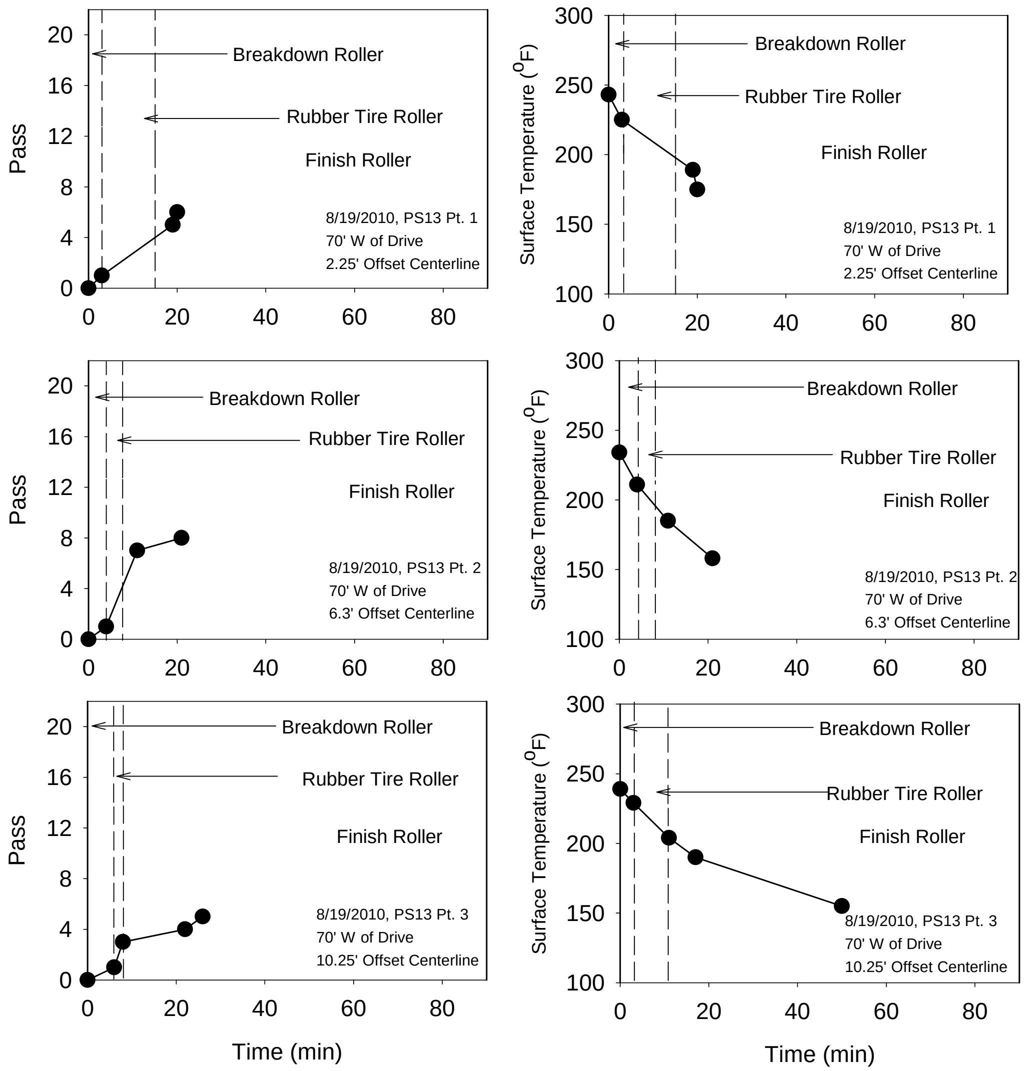

Figure 71. In-situ percent compaction and surface temperature with time measurements on intermediate course layer at three points on PS 13 – US20 Ida county project (08/19/2010)

Statistical Modeling of HMA Surface Temperature with Time

Similar to the results described above for the US30 project, the HMA surface temperature data obtained with time from the test sections are analyzed to predict the asphalt cooling rate using the exponential formula shown earlier in Eq. 4. A summary of the initial temperatures, cooling rate factors (C_r), coefficient of determination (R^2) values of the predictions, and the square root of mean squared error (MSE) at different test locations are presented in Table 11. The C_r values from this dataset ranged from about -0.0077 to -0.0198 with an average of about -0.0139 and standard deviation of 0.0003. The average C_r = -0.0139 is close to the average C_r value (-0.0135) obtained from the US30 project.

Table 11. Summary of the regression parameters to predict temperature variations with time – US20 Ida county project intermediate course layers

Location	T_0 (°F)	C_r	R^2	$\sqrt{MSE}$	Validity Range for Time, t
PS1, Pt. 1	240	-0.0105	0.985	3.6	37
PS1, Pt. 2	240	-0.0108	0.989	3.1	40
PS1, Pt. 3	240	-0.0104	0.997	1.9	46
PS2, Pt. 1	259	-0.0141	0.987	3.8	43
PS2, Pt. 2	259	-0.0140	0.989	5.2	48
PS3, Pt. 1	270	-0.0131	0.990	3.5	39
PS3, Pt. 2	270	-0.0127	0.991	3.3	47
PS4, Pt. 1	260	-0.0160	0.953	7.1	31
PS4, Pt. 2	260	-0.0157	0.955	8.1	37
PS5, Pt. 1	249	-0.0094	0.929	7.3	8
PS5, Pt. 2	243	-0.0077	0.955	5.6	11
PS6, Pt.1	255	-0.0148	0.971	8.1	7
PS6, Pt.2	254	-0.0137	0.898	14.2	15
PS6, Pt.3	253	-0.0112	0.889	13.7	8
PS7, Pt. 1	237	-0.0190	0.974	5.4	5
PS7, Pt. 2	238	-0.0168	0.975	5.7	7
PS7, Pt. 3	232	-0.0140	0.910	12.3	7
PS8, Pt. 1	247	-0.0195	0.976	6.3	6
PS8, Pt. 2	250	-0.0171	0.981	5.6	10
PS8, Pt. 3	249	-0.0132	0.947	10.2	6
PS9, Pt. 1	245	-0.0165	0.966	8.3	10
PS9, Pt. 2	248	-0.0159	0.923	8.3	15
PS9, Pt. 3	246	-0.0168	0.968	6.4	11
PS10, Pt. 1	250	-0.0119	0.974	5.7	5
PS10, Pt. 2	257	-0.0129	0.986	3.6	8
PS10, Pt. 3	249	-0.0129	0.980	4.4	5
PS11, Pt. 1	226	-0.0150	0.996	2.3	4
PS11, Pt. 2	215	-0.0138	0.954	5.0	10
PS11, Pt. 3	219	-0.0147	0.969	5.7	6
PS11, Pt. 1	246	-0.0091	0.961	7.4	5
PS11, Pt. 2	230	-0.0095	0.971	7.2	9
PS11, Pt. 3	239	-0.0099	0.951	9.3	8
PS12, Pt. 1	243	-0.0151	0.967	6.3	6
PS12, Pt. 2	234	-0.0198	0.990	4.1	8
PS12, Pt. 3	238	-0.0181	0.978	5.7	5

Correlation Analysis

Correlations between CCV and percent compaction, and CCV and HMA density are presented in Figure 72. The correlations did not yield a statistically significant relationship. Only one or two measurements were available for comparison from each PS, therefore, CCV versus density measurements could not be analyzed separately for each PS. FWD testing was not performed on this project to verify changes in underlying support conditions, however, as indicated earlier in the US30 project it is likely that the primary reason for this poor correlations between CCV and density/percent compaction is because of variations in support conditions.

Correlation between T_{Roller} and T_{FLIR} are presented in Figure 73. Results indicate that on average, the T_{Roller} measurements and T_{FLIR} measurements are comparable to most of the measurements falling close to the 1:1 line. It must be noted that the possible reasons stated earlier in US30 Harrison County project are still valid for this case as well and are likely contributors to the scatter in the relationship. Nevertheless, it is encouraging that the measurements are on average comparable to each other.

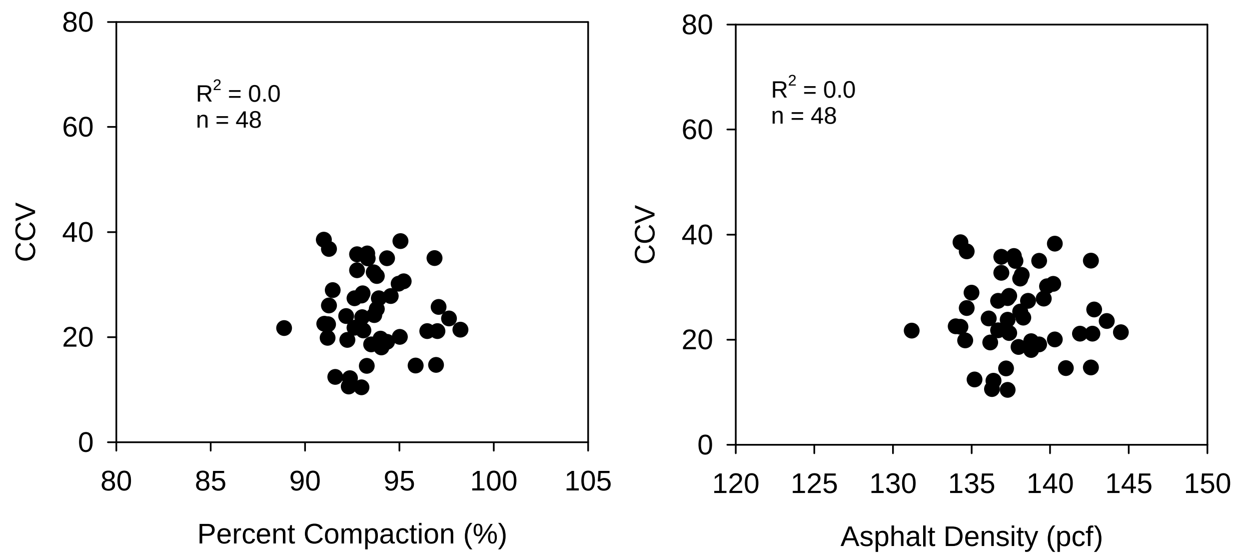

Figure 72. Correlations between in-situ HMA compaction measurements and CCV on intermediate course layer – US20 Ida county project

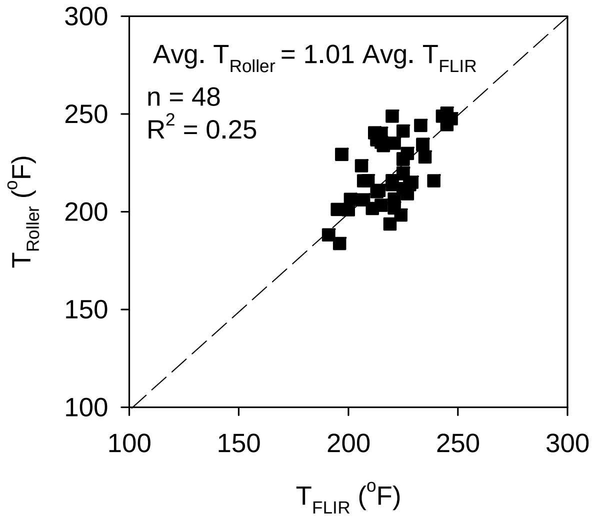

Figure 73. Correlations between surface temperature measurements from thermal camera (T_{FLIR}) and surface temperature measurements from roller – US20 Ida county project

Analysis of RICM Data

Histograms of roller pass count data, CCV, and surface temperature data on intermediate course and surface course layers for each day are presented in Figure 74 and Figure 75, respectively. Consistent with the field observations on the PSs, most of the project area show1 to 2 roller passes using the break down roller. The roller pass count histogram shows binomial distribution. CCV histogram shows normal distribution with an average ranging from about 20 to 30 on the intermediate course layer and ranging from about 22 to 29 on the surface course layer. Note that the surface course was compacted using 67 Hz (4000 vpm) frequency setting from 8/24 to 8/27 and 50 Hz (3000 Hz) frequency setting on 8/21 and 8/23, while intermediate course was compacted using 50 Hz (3000 vpm) frequency setting on all days. Although not quantified as part of this research, variations in vibration frequency influences the CCV value (Mooney et al. 2010). Surface temperature data shows normal distribution with an average of about 215^{o}F to 220^{o}F on surface and intermediate course layers. The temperature of the mix during placement was measured as about 270^{o}F. Box plots showing 10th, 25th, 75th, and 90th percentiles, mean, and median values of pass count, CCV, and surface temperature measurements are presented in Figure 76.

Field observations and pass coverage data from the RICM roller indicate that the roller operator targeted 1 to 2 roller passes using the break down roller. To analyze the spatial uniformity of pass coverage on each day, geostatistical semivariograms of pass count data are developed as shown in Figure 77. As indicated earlier in the US30 project, the semivariograms presented herein represents only for a portion of each day's data. Results presented in Figure 77 and Figure 78 indicated that the sill values varied from about 0.4 to 0.6 and the range values varied from about 5 to 10 m. These sill values are lower than observed on the Phase I US218 project (~1.3) and on the US30 project.

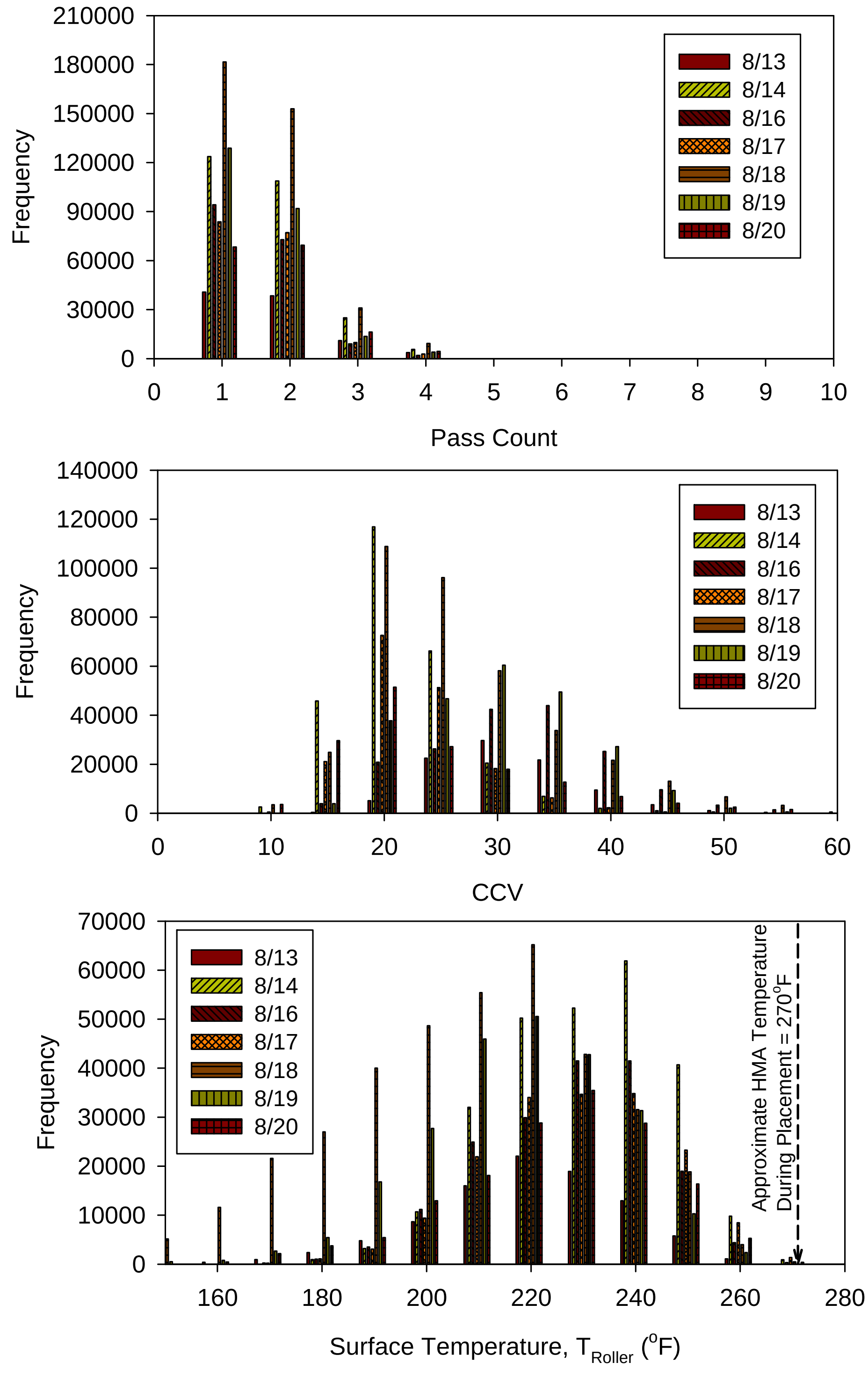

Figure 74. Histograms of pass count, CCV, and surface temperature of intermediate course layers – US20 Ida County project

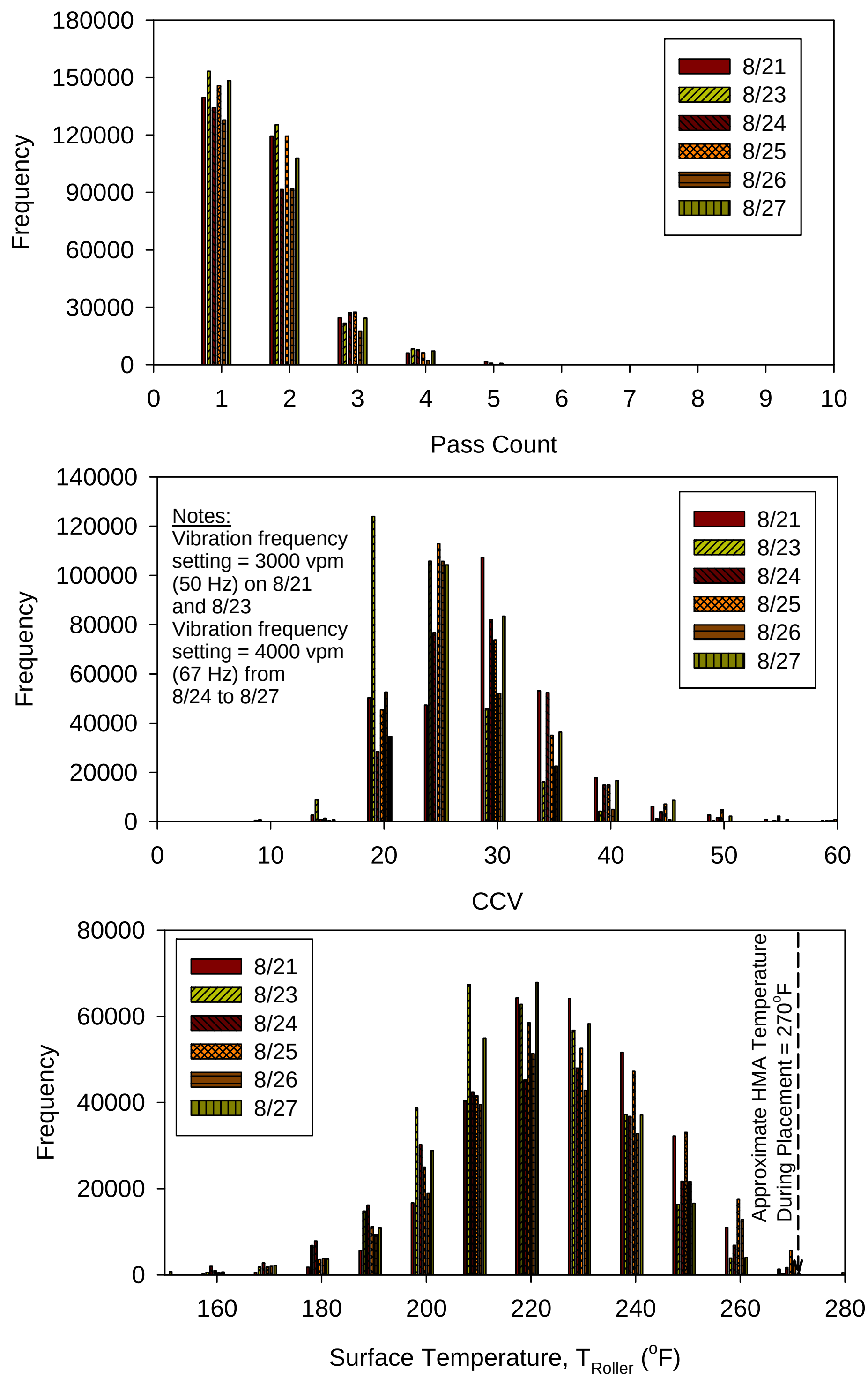

Figure 75. Histograms of pass count, CCV, and surface temperature of surface course layers – US20 Ida County project

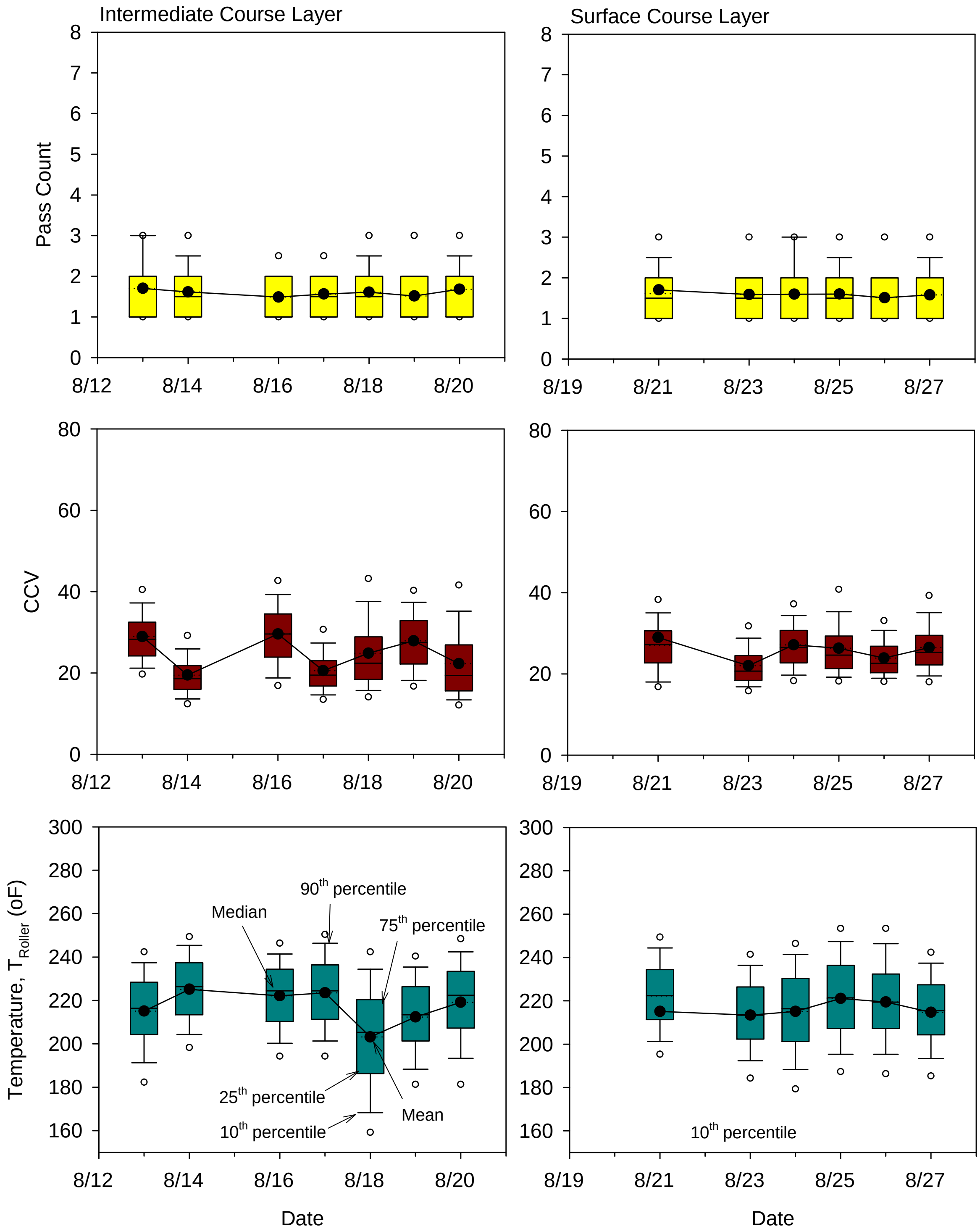

Figure 76. Box plots of pass count, CCV, and surface temperature of intermediate (left) and surface course (right) layers – US20 Harrison County project

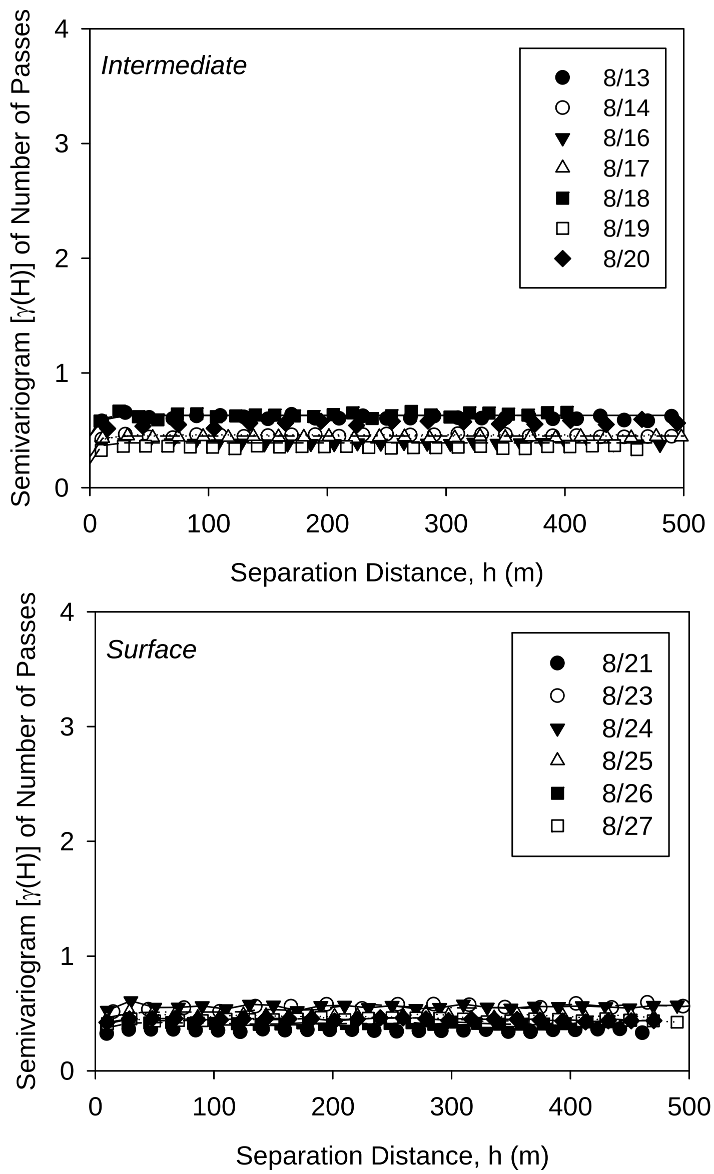

Figure 77. Semivariograms of number of roller passes on intermediate and surface course layers for each day – US20 Harrison County project

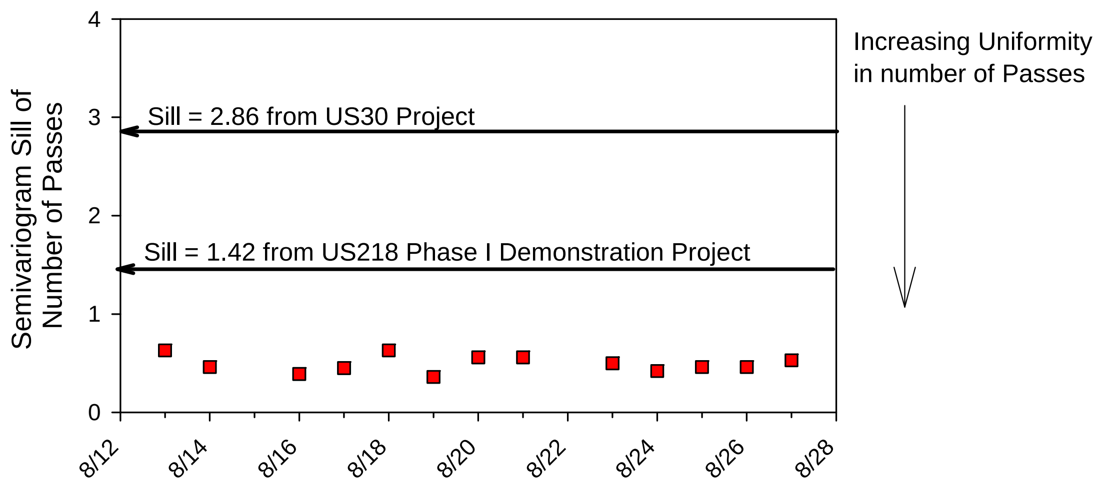

Figure 78. Variation in semivariogram sill of number of roller passes for each day – US20 Harrison County project

Summary of Key Findings

Following are a summary of key findings from the US20 project:

- The RICM-HMA SP-090057a (with temperature and pass count information on break down roller) was successfully implemented on the US20 Ida County pilot project. Evaluation of RICM data coverage information indicated that the RICM data was collected over 98% of the project area on both intermediate and surface course layer, thus conveniently exceeding the minimum 80% requirement in the SP.
- Field core density results indicated that 101 out of 104 samples exceeded the target minimum 95% compaction requirement. The $QI_{Density}$ measurements ranged from 0.5 to 2.6, thus exceeding the target minimum 0.00.
- Percent compaction curves indicated that the number of roller passes required to achieve 95% compaction varied from 1 to 8 passes (by the full compaction train).
- Asphalt temperature cooling rate (C_r) was modeled using an exponential statistical model from surface temperature with time measurements. For cases where data up to 5 to 48 minutes was considered, the C_r values ranged from about -0.0077 to -0.0198 with an average of about -0.0139 and standard deviation of 0.0003. The average C_r = -0.0139 is close to the average C_r (-0.0135) obtained from the US30 project.
- Correlations between CCV and asphalt density or percent compaction measurements did not yield a statistically significant relationship. Only one or two measurements were available for comparison from each PS, therefore, CCV versus density measurements could not be analyzed separately for each PS. As indicated in the US30 project findings, it is likely that the primary reason for poor correlations between CCV and density/percent compaction is because of variations in support conditions.
- Correlation between T_{Roller} and T_{FILR} indicated that there was no statistically significant correlation between the two measurements; however, all the measurements were close to the 1:1 line and the measurements were on average comparable to each other.
- Roller coverage data indicated that the roller operator targeted 1 to 2 roller passes using the break down roller. Geostatistical analysis of pass count indicated that the sill values

varied from about 0.4 to 0.6 and the range values varied from about 5 to 10 m (16 to 33 ft) . These sill values are lower than observed in Phase I on the US218 project (~1.3) and on the US30 project (~3.0). The comparatively lower sill values on the US20 project indicates that the pass coverage was more relatively more uniform.

- Average CCV ranged from 20 to 30 on intermediate course and 22 to 29 on surface course layers. Average surface temperature at the end of break down roller pass ranged from about 215°F to 220°F on surface and intermediate course layers.

Kossuth/Winnebago County Project

Project Details

The IA9 project is about 10.73 miles long and is located between from the east junction ofUS169 in Kossuth County to County Road R20 in Winnebago County and from County Road R50 east to the north junction of US69 in Winnebago County (Iowa DOT project number STP-009-4(44)--2C-55). The project location map is shown in Figure 79. It involved constructing a HMA overlay with about 38 to 51 mm (1.5 to 2 in.) thick intermediate and surface course layers. The existing roadway alignment was extended 4 feet on each side by constructing a base course HMA layer. The new roadway consisted of about 28 feet wide pavement. According to the field core density reports, HMA 3M mix with design gyrations of 86 and ½ inch mixture size was used for intermediate and surface course layers on the project. The field core reports indicate different target percent binder content ranges for different days ranging from 4.7-5.3 on intermediate course material and from 5.3-5.9 in surface course material.

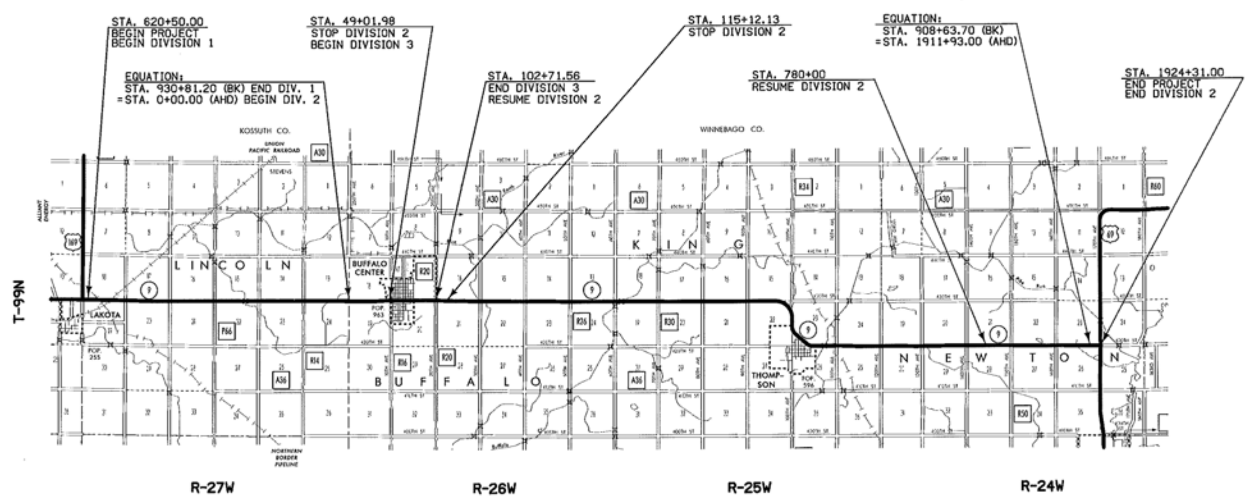

Figure 79. Project location map – Highway 9, Kossuth/Winnebago County project

Figure 80. IA9 Kossuth/Winnebago County project construction

Figure 81. Breakdown, rubbertire, and finish rollers equipped with Topcon's on-board display unit – IA9 Kossuth/Winnebago County project construction

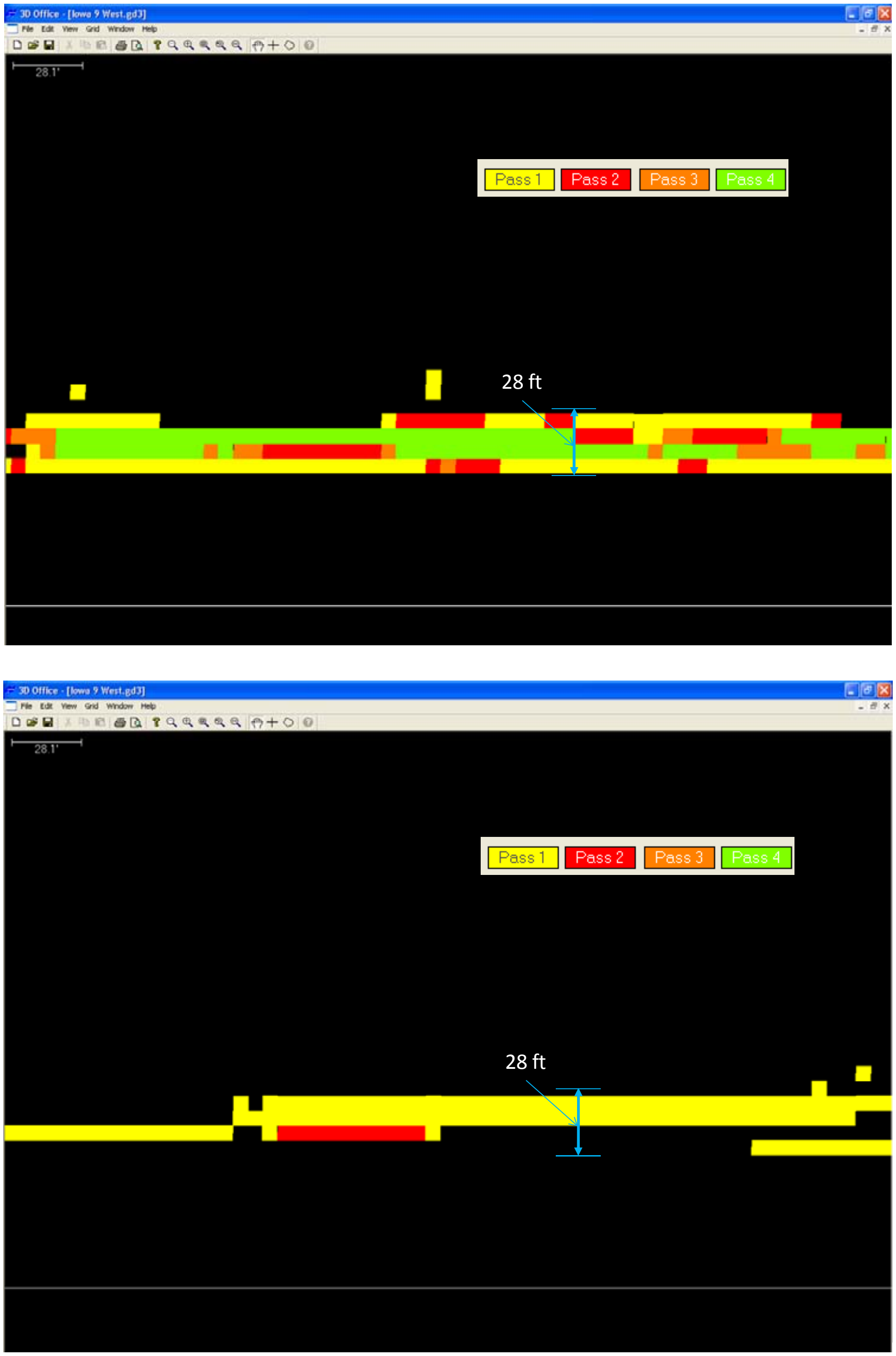

Figure 82. Screen shots of the Topcon's roller pass coverage output information – IA9 project

The ISU research team was present on the project site from May 18 to May 20, and May 24 to May 26, 2010. Roller and RICM software operation training was provided to contractor and ISU team personnel by a Topcon representative in a pre-construction meeting on April 22, 2010. Compaction of the HMA layers was achieved using a Caterpillar CB-534D smooth drum roller in the breakdown position, followed by Caterpillar PS-300B pneumatic rubber tire roller and a Hamm HD110HV smooth drum vibratory roller for final passes (Figure 81). All three rollers were equipped with the Topcon's RICM monitoring system. The Topcon's RICM system was setup to record the GPS northing, easting, and elevation information with a time and date stamp. The pass count information was displayed on the on-board display monitor, but was not recorded in the output file. Example screen shots of roller pass coverage from the Topcon's RICM office software are shown in Figure 82 which were obtained on April 27 and 28, 2010.

Production Information

Daily production information with the amount of HMA placed (tons/day) for intermediate and surface course layers are presented in Figure 83. The production information was obtained from DOT field core density sheets (see Appendix E). Comparison between daily measured binder contents and the specification limits for the intermediate and surface course layers are presented in Figure 84. Similarly, comparison between daily gradation test results on the mixture aggregate and the specified limits is provided in Figure 85. Results indicate that both binder content and gradations of the materials were within the specified limits.

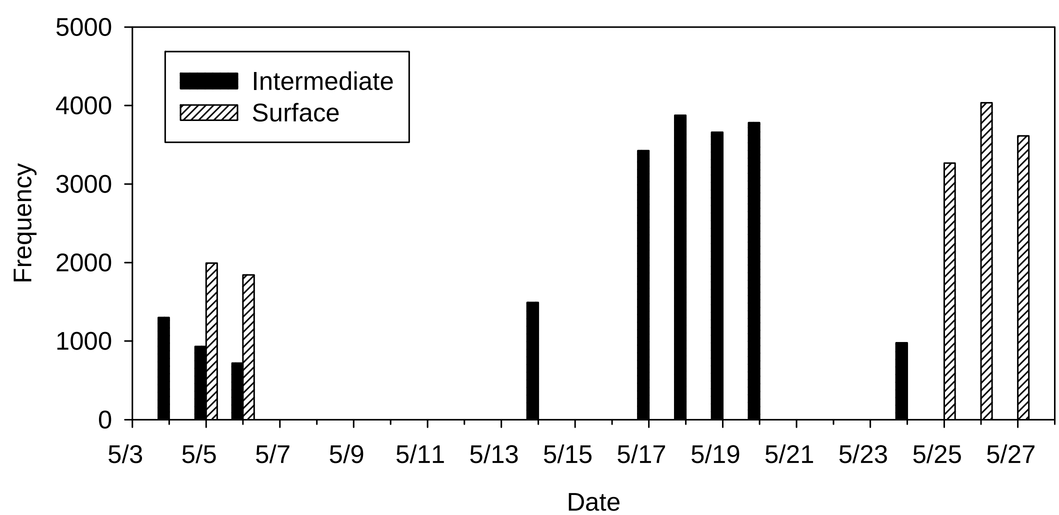

Figure 83. HMA placement (tons/day) information on intermediate and surface layers – IA9 Kossuth County project

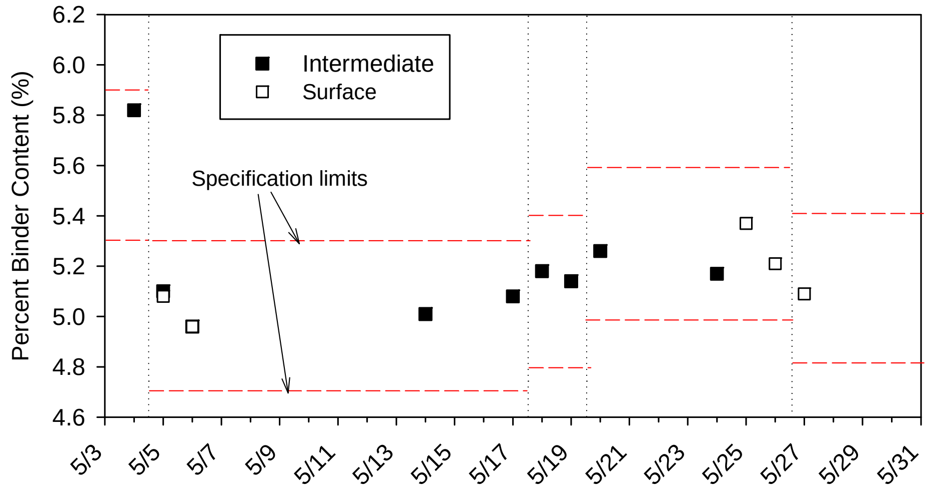

Figure 84. Binder content measurements on intermediate and surface course mixtures on each paving day in comparison with specification limits – IA9 Kossuth County project

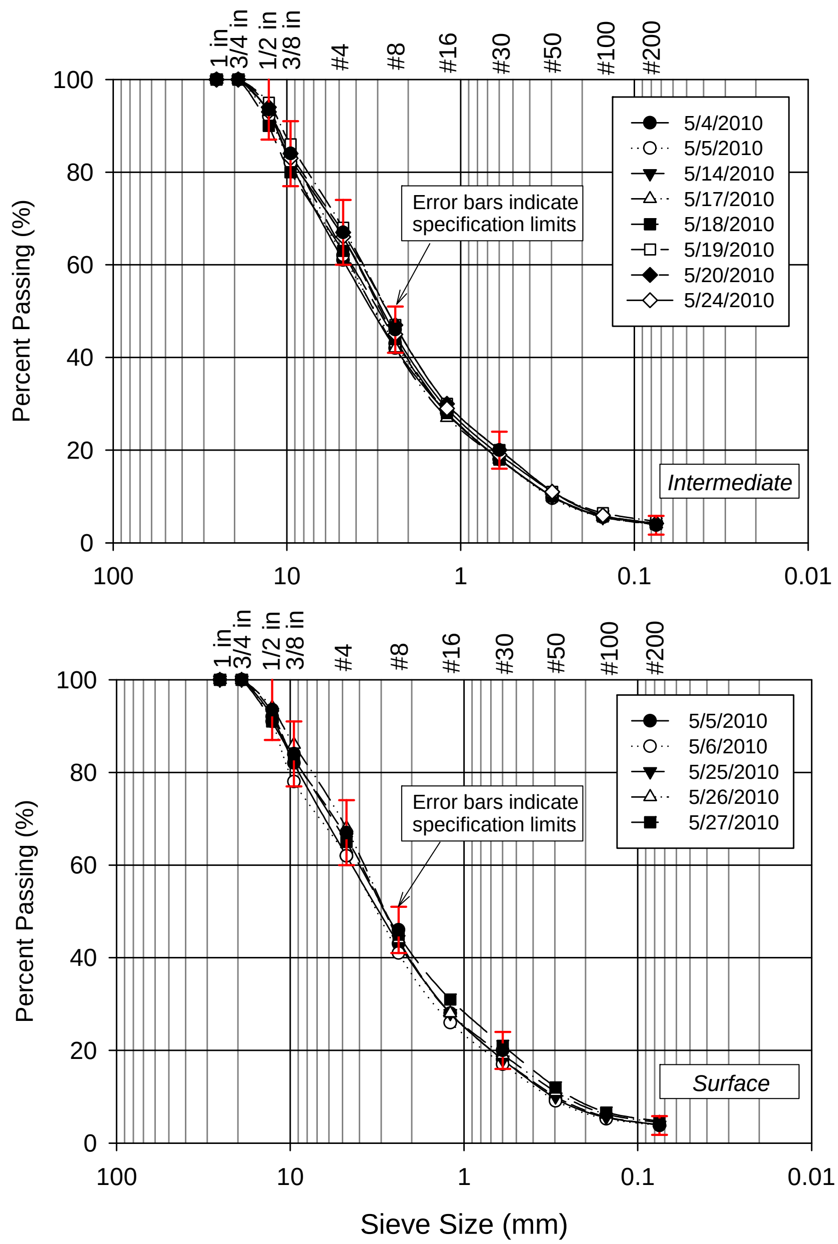

Figure 85. Grain size distribution of aggregate used in the intermediate and surface course mixtures on each paving day in comparison with specification limits – IA9 Kossuth County project

In-Situ Testing

A summary of the percent compaction measurements on the intermediate and surface course core samples is provided in Figure 86. The core density reports indicated that a 95% density was used as the target minimum compaction for all days except on 05/24/2010 intermediate course layer when 94% density was as the target minimum compaction. All the intermediate and surface course densities met the minimum specified target densities. The core density results for all samples are provided in Appendix E. The $QI_{Density}$ measurements on each day are summarized in Figure 87 which indicates that all QI measurements were greater than the minimum 0.00 as required in the specification.

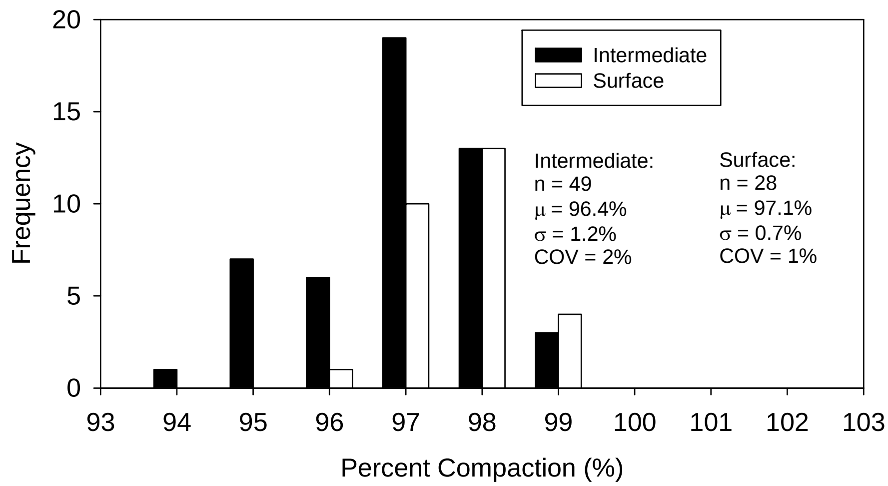

Figure 86. Summary of percent compaction measurements from field cores on intermediate and surface course layers – IA9 Kossuth County project

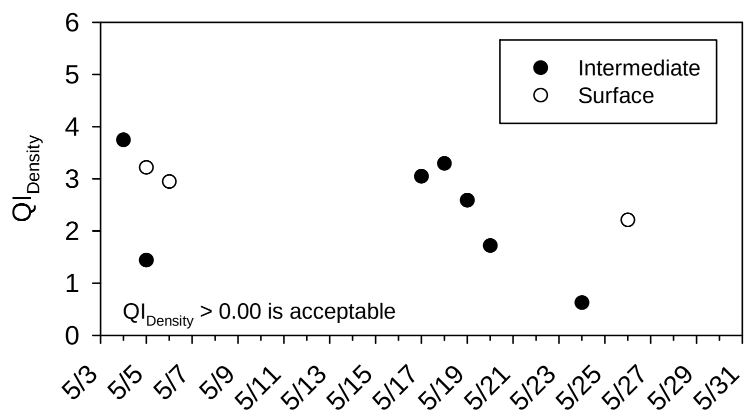

Figure 87. Summary of daily density QI measurements on intermediate and surface course layers – IA9 Kossuth County project

A total of eleven PSs were tested on this project. Testing on these PSs were beyond what was required in the project specifications. Tests were performed at multiple test locations in each PS. A summary of testing performed in each PS and location of each PS is presented in Table 12. A Troxler nuclear gauge was used to obtain percent compaction measurements on the HMA layers. HMA surface temperature measurements were obtained using a FLIR thermal camera (T_{FLIR}) and the infrared camera mounted on the RICM roller (T_{Roller}). Density and surface temperature measurements were obtained before and after multiple roller passes (e.g., 0, 1, 2, 3, etc) to evaluate their changes with increasing pass and time.

Percent compaction results with increasing pass from multiple PSs on intermediate and surface course layers are presented in Figure 88 and Figure 89, respectively. These results indicate that on average, the percent compaction increases up to the final finish roller pass (to about 90 to 95%), although about 90% of relative compaction was achieved with the break down roller. Percent compaction results with increasing pass at three different test locations from two intermediate course layer PSs are presented in Figure 90, which indicated that compaction reached about 95% at the end of break down roller passes and increased slightly with the rubber tire and finish roller passes.

Surface temperature measurements from FLIR camera after 0, 2, 5, 15, 30, 60, 120, and 1440 minutes at a same location on two PSs are presented in Figure 91. The same measurements are presented as spatial thermal images for TS5 and TS12 in Figure 92 and Figure 93, respectively. These measurements indicate that the surface temperature drop from an average of about 254°F to 184°F within 15 minutes, to about 127°F within 1 hour, and to about 117°F within 2 hours. Surface temperature measurements obtained from about 5 ft left, center, and on shoulder (about 6 feet right) on TS12 (Figure 91) indicate that the at 0 time, the temperature of the mat varied from about 252°F to 268°F and dropped to about 173°F to 191°F within 15 minutes, which indicates a temperature segregation of about 15 to 18 degrees over a spatial area. Similar to the results described above for the US30 and US20 projects, the HMA surface temperature data obtained with time from the test sections are analyzed to predict the asphalt cooling rate. A summary of the initial temperatures, cooling rate factors (C_r), coefficient of determination (R^2) values of the predictions, and the square root of mean squared error (MSE) at different test locations are presented in Table 13. If data up to 1440 minutes (24 hrs) is considered, the model yielded high square root MSE values (ranging from about 37 to 48°F). If data up to 30 to 60 minutes is considered the square root MSE values reduced to about 4 to 9°F, which are similar to what was observed in the US30 and US20 projects. The C_r values from this project ranged from about -0.0126 to -0.0236 with an average of about -0.0183 and standard deviation of 0.0045 (for models with data up to 30 minutes).

Correlation between percent compaction measurements obtained from nuclear and non-nuclear gauges are presented in Figure 94. Results indicate that the percent compaction results are on-average similar and the results generally fall near the 1:1 line. A statistically significant correlation was not observed between the two measurements.

Table 12. Summary of production test sections and in-situ testing (IA9 Field Project)

Layer	PS	Date	Location	In-situ Test Measurement	Comments
Intermediate Course Layer	1	5/18/10	Immediately east of Buffalo Center near station 80+00)	Percent compaction, surface temperature (thermal camera), roller pass count	100'long test section with 3 equidistant points every 20'. Test section on existing PCC surface
	2	5/18/10	West of Buffalo Center, near station 850+00	Percent compaction, surface temperature (thermal camera), roller pass count	
	3	5/19/10	West of Buffalo Center. Near station 794+25	Percent compaction, surface temperature (thermal camera), roller pass count	50' long test section with 3 equidistant points every 10'. Test section base divides from PCC to asphalt beginning with Test point A4
	4	5/19/10	West of Buffalo Center. Near station 764+25	Percent compaction, surface temperature (thermal camera), roller pass count	100' long test section with 3 equidistant points 45', 75', and 93' going west of sta. 764+25. Test section contained multiple cracks and pot holes
	5	5/19/10	West of Buffalo Center, near sta. 690+00	Percent compaction, surface temperature (thermal camera), roller pass count	Thermal camera shots taken at 2, 5, 15, 30, 60, and 120 min. Also a 24 hour image taken. 2" Asphalt lift on existing PCC surface. Test section contained 3 equidistant points placed near sta. 690+00
	6	5/20/10	Near Sta. 735+00	Percent compaction, roller pass count	Density reading taken after every pass of each roller at three equidistant points
	7	5/20/10	Near station 690+00	Percent compaction, roller pass count	
Surface Course Layer	8	5/24/10	Intersection of IA9 and 240th Ave	Percent compaction, roller pass count	18 comparison points between nuclear and non-nuclear density gauges
	9	5/25/10	Immediately east of Buffalo Center, near sta. 80+00	Percent compaction, roller pass count	100' long test section with 3 equidistant points placed 20', 40', and 80' west of station 80+00.
	10	5/25/10	In Buffalo Center, 200' west of 1st St	Percent compaction, roller pass count	80' long test sections with 3 equidistant points every 20'
	11	5/26/10	US IA9 EB	Percent compaction, surface temperature (thermal camera), roller pass count	

Note: PS – production test section, percent compaction determined using a Troxler Nuclear Densitometer and Troxler non-nuclear density gauge.

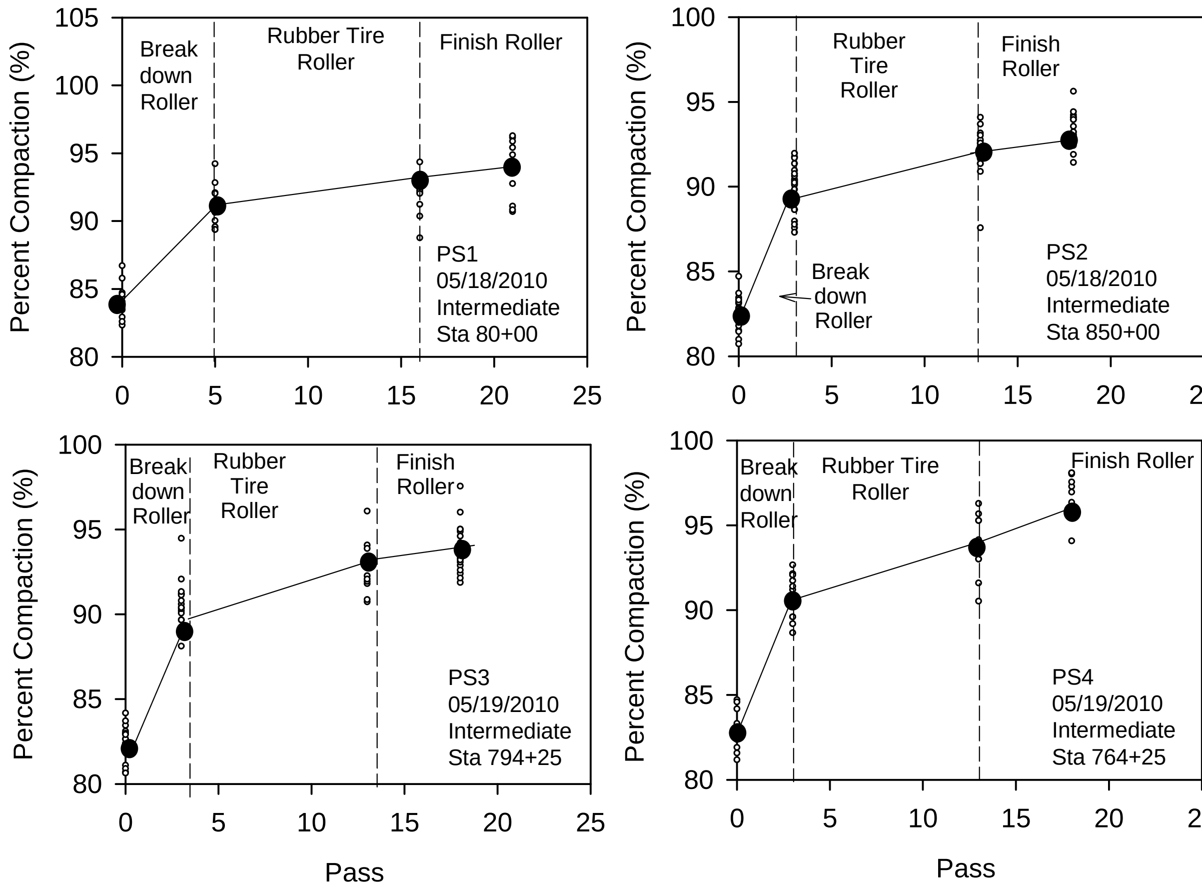

Figure 88. In-situ percent compaction with pass measurements on intermediate course layer on PS 1 to 4 – IA9 Kossuth county project (05/18 to 05/19/2010)

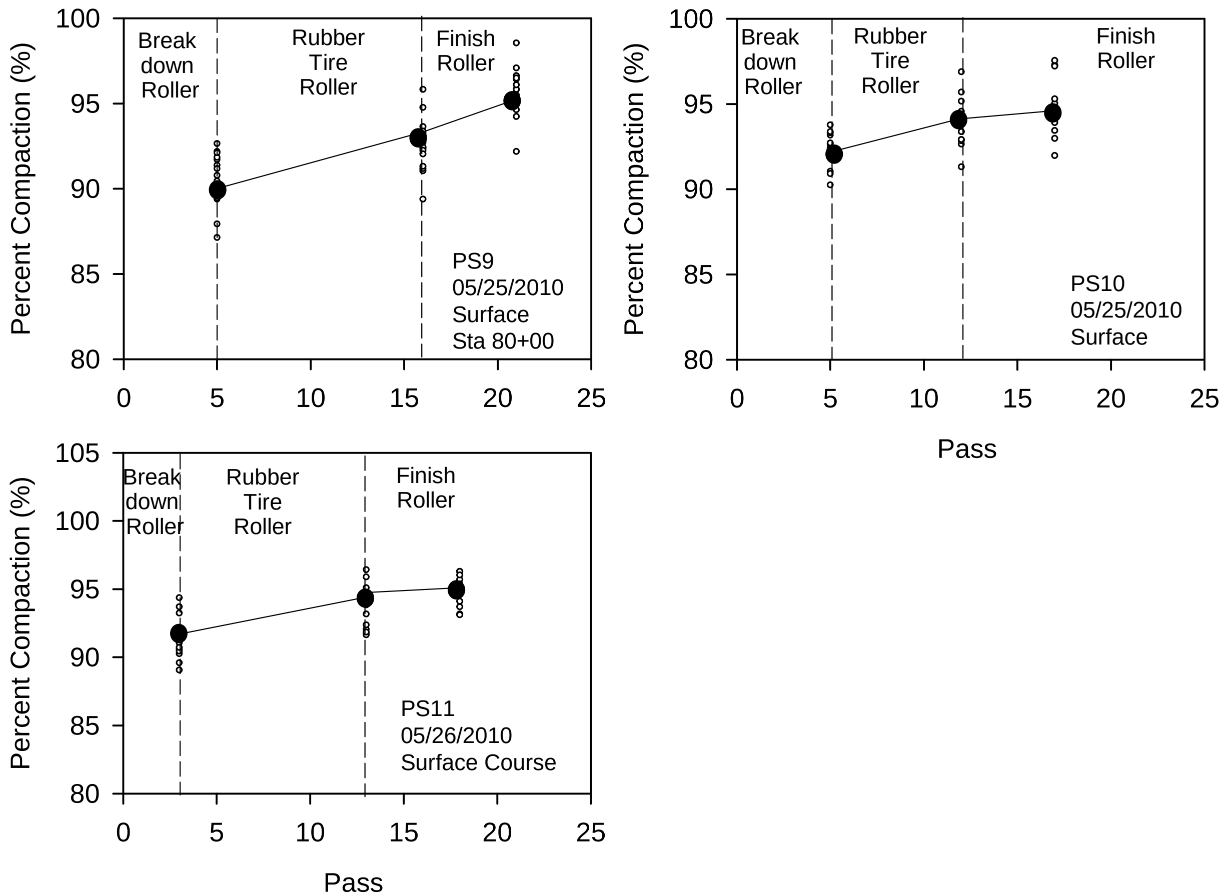

Figure 89. In-situ percent compaction with pass measurements on surface course layer on PS 9 to 11 – IA9 Kossuth county project (05/25 to 05/26/2010)

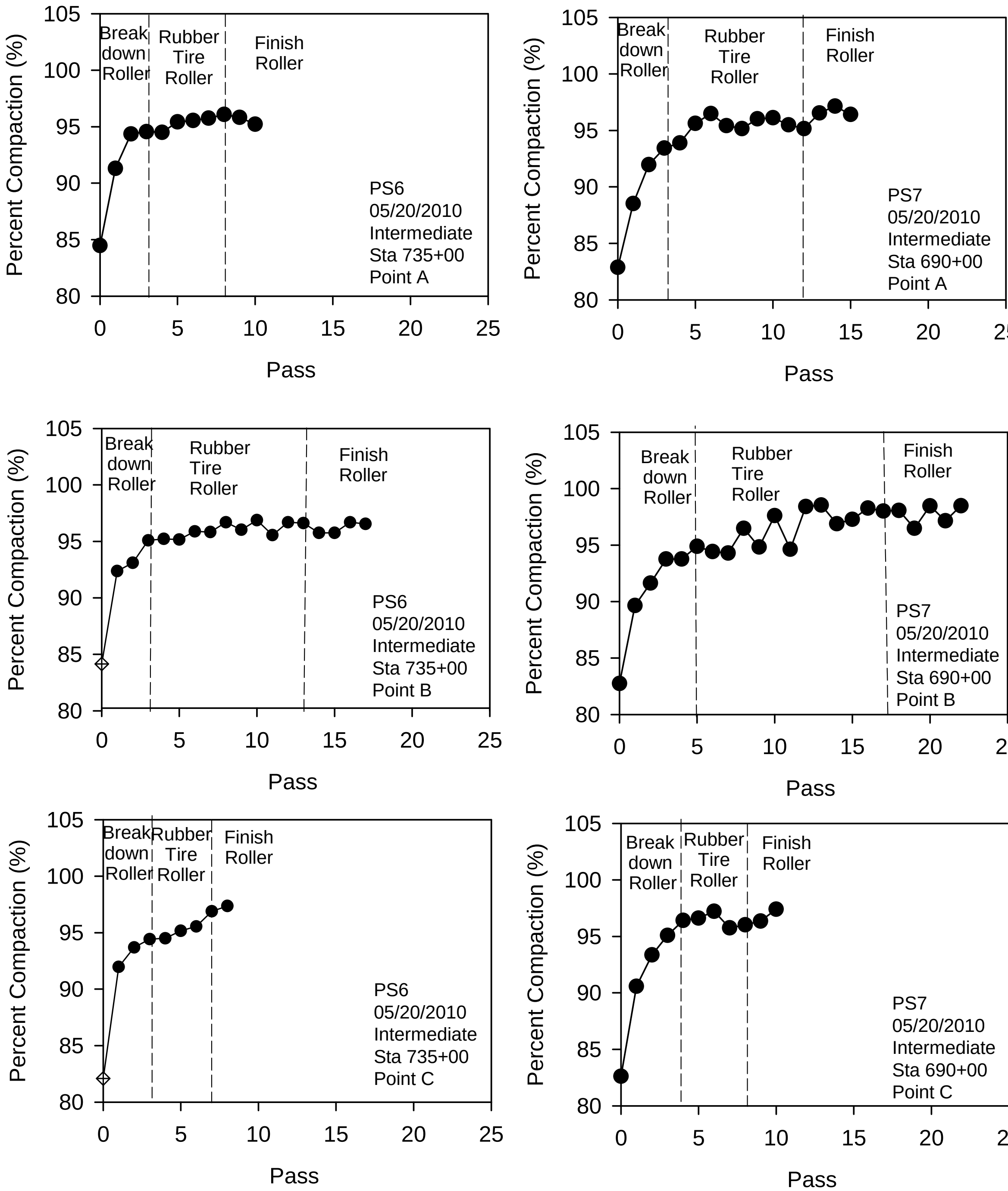

Figure 90. In-situ percent compaction with pass measurements on intermediate course layer at three test locations each on PS 6 and 7 – IA9 Kossuth county project (05/20/2010)

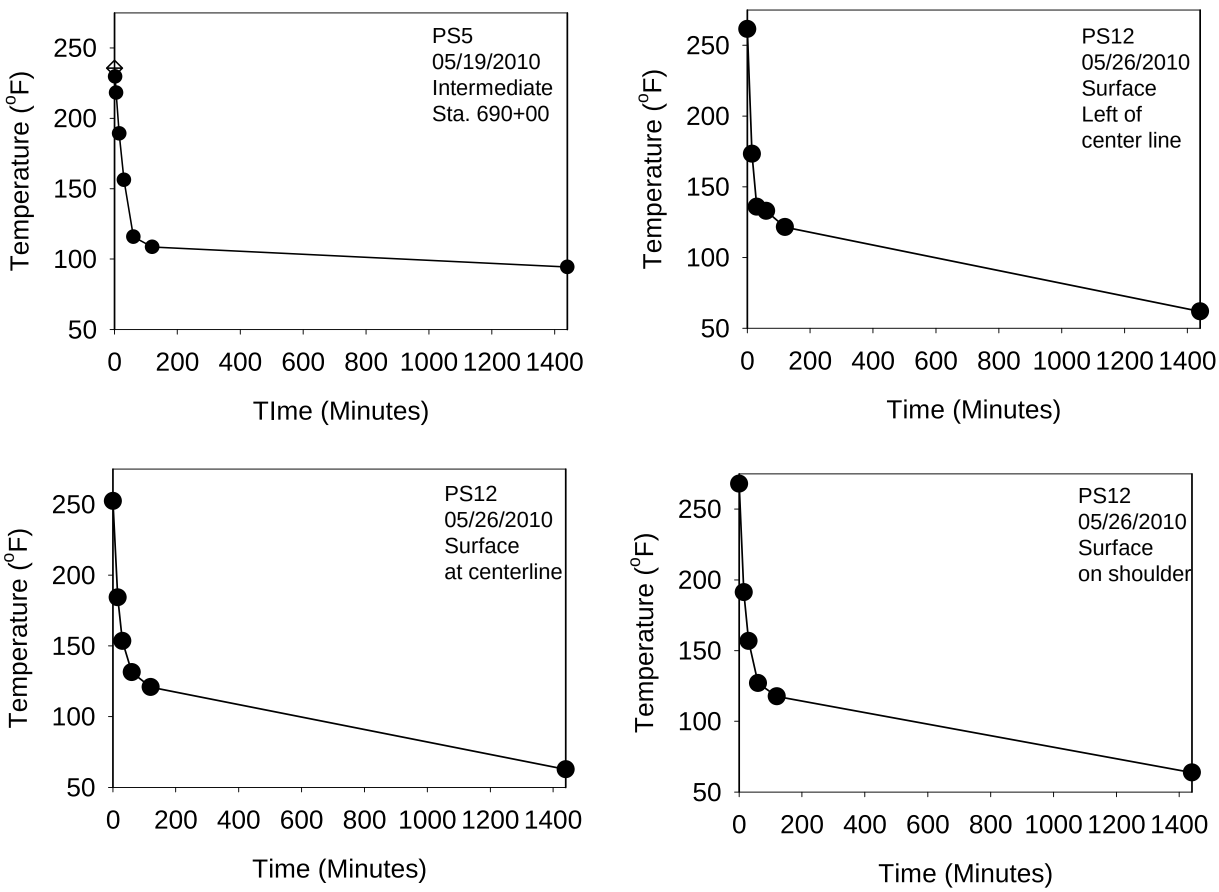

Figure 91. Asphalt mat surface temperature changes with time on intermediate course (PS5) and surface course (PS12) layers – IA9 Kossuth county project (05/19 and 05/26/2010)

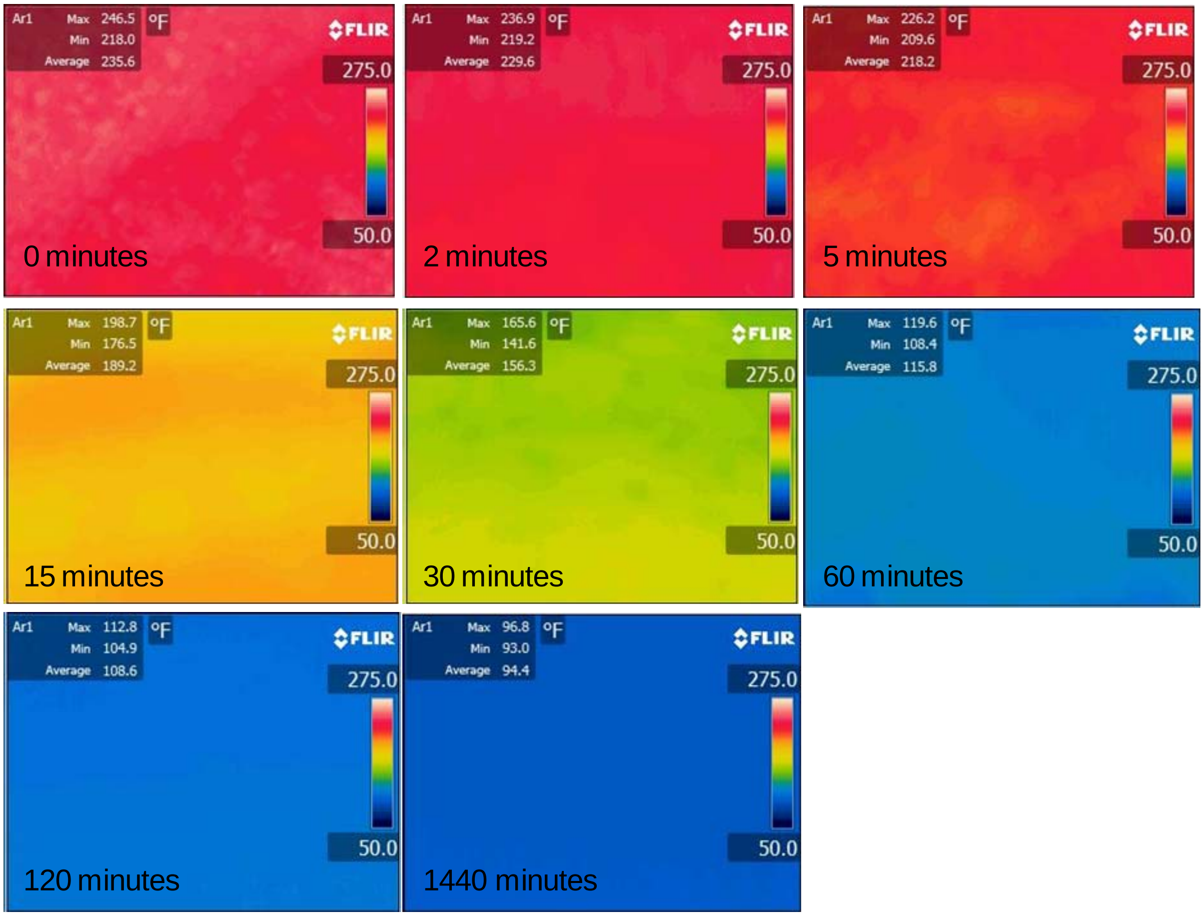

Figure 92. FLIR thermal camera images of asphalt mat surface temperature changes with time on intermediate course layer on PS5 – IA9 Kossuth county project (05/19/2010)

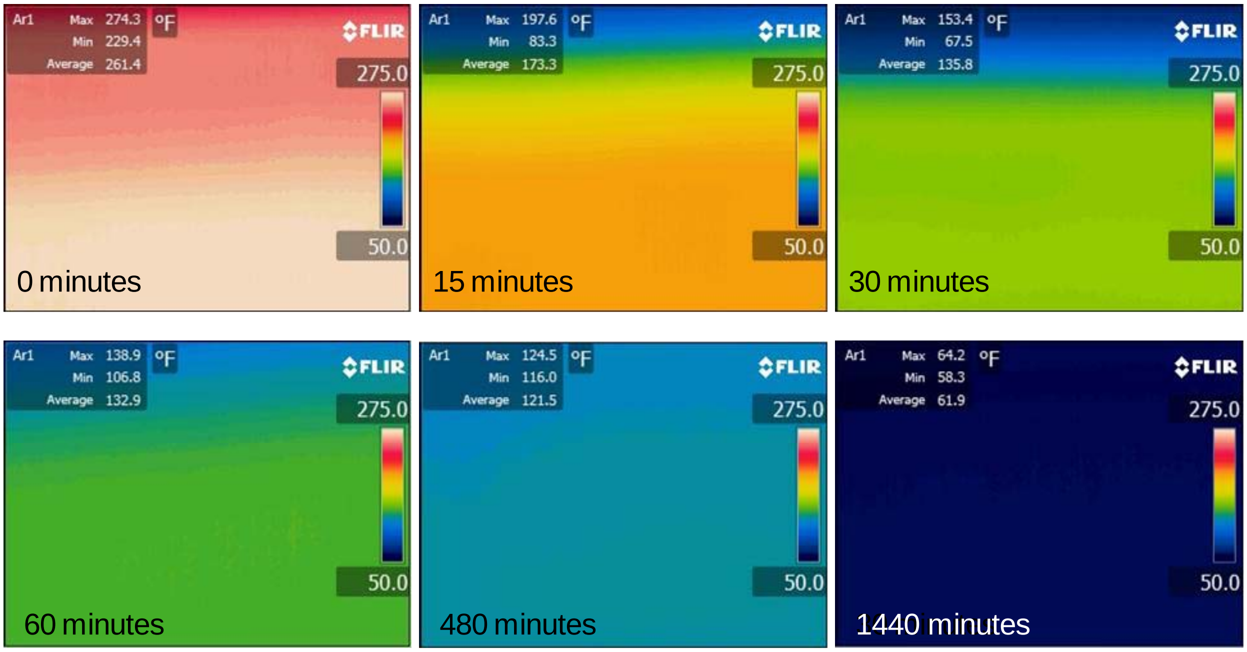

Figure 93. FLIR thermal camera images of asphalt mat surface temperature changes with time on surface course layer on PS12 – IA9 Kossuth county project (05/26/2010)

Table 13. Summary of the regression parameters to predict temperature variations with time – IA9 Kossuth County project intermediate course layers

Location	T_0 (°F)	C_r	R^2	$\sqrt{MSE}$	Validity Range for Time, t (min)
PS5	235	-0.0095	0.85	36.92	1440
	235	-0.0126	0.99	4.17	60
PS12 at centerline	252	-0.0096	0.88	40.37	1440
	252	-0.0178	0.99	7.37	30
PS12 left of centerline	261	-0.0113	0.81	48.08	1440
	261	-0.0236	0.99	8.74	30
Pas12 right of centerline	268	-0.0111	0.89	42.16	1440
	268	-0.0192	0.99	8.06	30

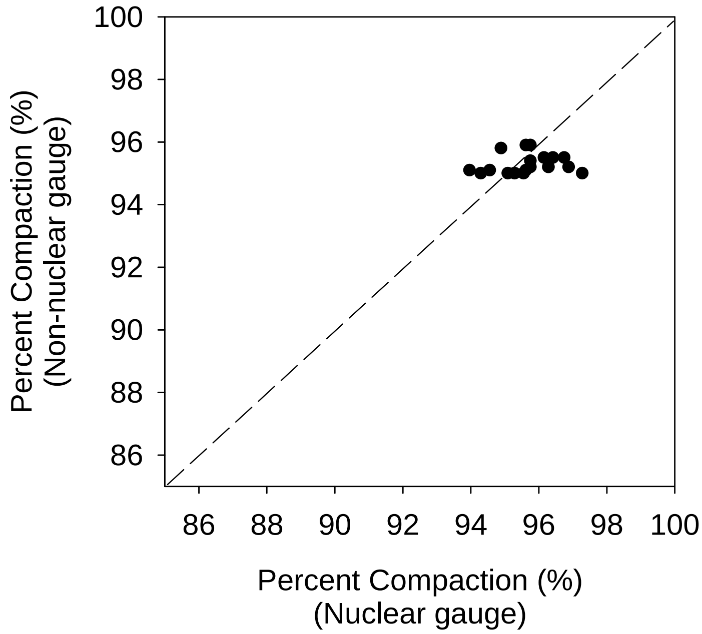

Figure 94. Comparison between percent compaction measurements using nuclear and non-nuclear gauges

Summary of Key Findings

Following are a summary of key findings from the IA9 project:

- The RICM-HMA SP-090058 which includes roller coverage on full compaction train (i.e., on break down, rubber tire, and finish rollers) was used on the IA9 Kossuth county pilot project. The roller coverage information could not be evaluated on this project as most of the data files obtained from the project were incomplete or did not contain any data. This problem likely occurred because of the lack of standard training protocols and inexperience of the operators in recording, saving, and exporting the data. This is an important item to address as part of the training materials to be developed in future.
- Field core density results indicated that all 77 samples collected from the project exceeded the target minimum compaction requirement. The $QI_{Density}$ measurements ranged from 0.6 to 3.7, thus exceeding the target minimum 0.00.
- Field density testing indicated that percent compaction generally continues to increase until the end of the finish roller pass, but about 90% to 95% relative compaction is achieved by the end of break down roller pass. The number of break down roller passes varied from 3 to 5, the rubber tire roller passes varied from 4 to 11, and the finish roller passes varied from 2 to 5 in the production sections tested on this project.
- Results indicated that the asphalt surface temperatures dropped from an average of about 254^{o}F to 184^{o}F within 15 minutes, to about 127^{o}F within 1 hour, and to about 117^{o}F within 2 hours. FLIR spatial temperature maps indicated that temperature segregation of about 15^{o} to 18^{o}F was observed over the width of the pavement.
- Asphalt temperature cooling rate (C_r) was modeled using an exponential statistical model from surface temperature with time measurements. For cases where data up to 30 to 60

minutes was considered, the C_r values ranged from about -0.0126 to -0.0236 with an average of about -0.0183 and standard deviation of 0.0045. The average C_r = -0.0183 is slightly higher than the Cr values observed on the US30 and US20 projects (-0.0135 on US30 and -0.0139 on US20).

- Correlation between percent compaction measurements obtained from nuclear and non-nuclear gauges indicated that the measurements are on-average similar and the results generally fall near the 1:1 line. A statistically significant correlation was not observed between the two measurements.

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

Summary of Key Findings and Conclusions

Summary of Special Provisions and Cost for Implementing RICM Special Provisions

The following four SPs have been developed as part of this research project to implement them on pilot projects as an addendum to the Iowa DOT standard specifications:

(1) Intelligent Compaction – HMA, Harrison County, NHSN-030-1(127)--2R-43 (Effective January 20, 2010) [SP-090048]
(2) Intelligent Compaction – HMA, Ida County, NHSN-020-2(70) --2R-47 (Effective February 16, 2010) [SP-090057a]
(3) Intelligent Compaction – HMA Roller Pass Mapping, Kossuth County, STPN-009-4(44) --2J-55 (Effective February 16, 2010) [SP-090058]
(4) Intelligent Compaction – Embankment, Sac County, NHSX-020-2(89)--3H-81 (Effective April 20, 2010) [SP-090063]

The SPs describe the contractor's responsibilities to furnish the RICM rollers, data acquisition, and many other attributes. The Sac County Embankment project SP could not be implemented due to lack of availability of an RICM roller for the construction period. A summary of key findings from implementing these SPs on each pilot project are provided below.

The average bid item cost (for all bidders) for implementing the RICM-HMA SP varied from about 0.7% to 2.2% of total project cost while the actual project cost varied from about 0.9% to 1.4% of total project cost for the winning bidders. The average bid unit cost/mile (for all bidders) varied from about $2500 to $9900, but varied significantly from about $450 to $26,000 between projects.

Summary of Key Findings from US30 Harrison County Project

- The RICM-HMA SP-090048 which required RICM coverage (with temperature, pass count, and roller-integrated CCV information on break down roller) was successfully implemented on the US30 Harrison County pilot project. Evaluation of RICM data coverage information indicated that the RICM data was collected over 85% of the project area on the intermediate course layer and over 95% of the project area on the surface course layers, thus conveniently exceeding the minimum 80% requirement in the SP.
- Field core density results indicated that 115 out of 117 samples exceeded the target minimum 95% compaction requirement. The $QI_{Density}$ measurements ranged from 0.3 to 6.8, thus exceeding the target minimum 0.00.
- Percent compaction curves indicated that 95% compaction was generally achieved within 1 to 2 break down roller passes at most locations with exceptions at few locations where up to four passes or more was required.
- Roller surface temperature measurements with pass generally indicated that pass 2 measurement was lower than pass 3 (note that the rolling pattern included forward, reverse, and forward directions of travel for passes 1, 2, and 3). The temperature sensor is

located on the front drum of the roller and water sprayed on to the roller drum likely caused a reduction in the surface temperature values, when the roller travels in the reverse direction.

- Asphalt temperature cooling rate (C_r) was modeled using an exponential statistical model from surface temperature with time measurements. For cases where data up to a maximum of 35 minutes was considered, the C_r values ranged from about -0.0090 to -0.0157 with an average of about -0.0135 and standard deviation of 0.0022.
- Correlations between CCV and asphalt density or percent compaction measurements yielded relatively low R^2 values in the range of 0.1 to 0.2. However, if the measurements for each PS are viewed separately, there is generally a trend of increasing CCV with increasing percent compaction in most sections.
- Poor correlations between density and CCV are to be expected when data is combined over multiple sections, because CCV provides a measure of ground stiffness and is strongly influenced by the conditions of the layer underneath the HMA layer and not necessarily the density of the surface layer. FWD test measurements obtained from the intermediate course layer and the underlying existing base layer confirmed that variable support conditions exist at different test locations. Correlations between the E_{FWD} (on intermediate course layer and base layer) and CCV (on intermediate course layer) yielded R^2 values in the range of 0.5 to 0.9. Results presented during Phase I of this research (White et al. 2010) also corroborate with this finding. This research finding is critical to understand as it has practical consequences in terms of how roller-integrated CCV data can be used for QC or QA in future specifications.
- Correlation between T_{Roller} and T_{FILR} indicated that there was no statistically significant correlation between the two measurements; however, about 29 out of the 35 measurements were close to the 1:1 line and the measurements were on average comparable to each other.
- Based on field observations and conversations with the roller operator, it is understood that the roller operator targeted 3 to 4 roller passes using the break down roller. Roller coverage data indicated that the average number of break down roller passes on the project was about 3 with a standard deviation of about 1 to 2. Geostatistical analysis of pass count indicated that the sill values varied from about 2.4 to 3.6 and the range values varied from about 9 to 20 m. These sill values are higher than observed in Phase I on the US218 project (~1.3) and on the US20 project (~0.6) discussed later in this report. The high sill values on the US30 project compared to the US218 and US20 projects indicates that the pass coverage was more variable on the US30 project. Field observations indicated that the number of passes made by the break down roller was governed heavily by the pace of the paver ahead of the break down roller.
- Average CCV ranged from 20 to 30 on intermediate course and 22 to 33 on surface course layers. Average surface temperature at the end of break down roller pass ranged from about 215 to 225^{o}F on surface and intermediate course layers.

Summary of Key Findings from US20 Ida County Project

- The RICM-HMA SP-090057a (with temperature and pass count information on break down roller) was successfully implemented on the US20 Ida County pilot project. Evaluation of RICM data coverage information indicated that the RICM data was collected over 98% of the project area on both intermediate and surface course layer, thus conveniently exceeding the minimum 80% requirement in the SP.

- Field core density results indicated that 101 out of 104 samples exceeded the target minimum 95% compaction requirement. The $QI_{Density}$ measurements ranged from 0.5 to 2.6, thus exceeding the target minimum 0.00.
- Percent compaction curves indicated that the number of roller passes required to achieve 95% compaction varied from 1 to 8 passes (by the full compaction train).
- Asphalt temperature cooling rate (C_r) was modeled using an exponential statistical model from surface temperature with time measurements. For cases where data up to 5 to 48 minutes was considered, the C_r values ranged from about -0.0077 to -0.0198 with an average of about -0.0139 and standard deviation of 0.0003. The average C_r = -0.0139 is close to the average C_r (-0.0135) obtained from the US30 project.
- Correlations between CCV and asphalt density or percent compaction measurements did not yield a statistically significant relationship. Only one or two measurements were available for comparison from each PS, therefore, CCV versus density measurements could not be analyzed separately for each PS. As indicated in the US30 project findings, it is likely that the primary reason for poor correlations between CCV and density/percent compaction is because of variations in support conditions.
- Correlation between T_{Roller} and T_{FILR} indicated that there was no statistically significant correlation between the two measurements; however, all the measurements were close to the 1:1 line and the measurements were on average comparable to each other.
- Roller coverage data indicated that the roller operator targeted 1 to 2 roller passes using the break down roller. Geostatistical analysis of pass count indicated that the sill values varied from about 0.4 to 0.6 and the range values varied from about 5 to 10 m (16 to 33 ft) . These sill values are lower than observed in Phase I on the US218 project (~1.3) and on the US30 project (~3.0). The comparatively lower sill values on the US20 project indicates that the pass coverage was more relatively more uniform.
- Average CCV ranged from 20 to 30 on intermediate course and 22 to 29 on surface course layers. Average surface temperature at the end of break down roller pass ranged from about 215°F to 220°F on surface and intermediate course layers.

Summary of Key Findings from IA9Kossuth County Project

- The RICM-HMA SP-090058 which includes roller coverage on full compaction train (i.e., on break down, rubber tire, and finish rollers) was used on the IA9 Kossuth county pilot project. The roller coverage information could not be evaluated on this project as most of the data files obtained from the project were incomplete or did not contain any data. This problem likely occurred because of the lack of standard training protocols and inexperience of the operators in recording, saving, and exporting the data. This is an important item to address as part of the training materials to be developed in future.
- Field core density results indicated that all 77 samples collected from the project exceeded the target minimum compaction requirement. The $QI_{Density}$ measurements ranged from 0.6 to 3.7, thus exceeding the target minimum 0.00.
- Field density testing indicated that percent compaction generally continues to increase until the end of the finish roller pass, but about 90% to 95% relative compaction is achieved by the end of break down roller pass. The number of break down roller passes

varied from 3 to 5, the rubber tire roller passes varied from 4 to 11, and the finish roller passes varied from 2 to 5 in the production sections tested on this project.

- Results indicated that the asphalt surface temperatures dropped from an average of about $254^{o}F$ to $184^{o}F$ within 15 minutes, to about $127^{o}F$ within 1 hour, and to about $117^{o}F$ within 2 hours. FLIR spatial temperature maps indicated that temperature segregation of about 15^{o} to $18^{o}F$ was observed over the width of the pavement.
- Asphalt temperature cooling rate (C_r) was modeled using an exponential statistical model from surface temperature with time measurements. For cases where data up to 30 to 60 minutes was considered, the C_r values ranged from about -0.0126 to -0.0236 with an average of about -0.0183 and standard deviation of 0.0045. The average C_r = -0.0183 is slightly higher than the Cr values observed on the US30 and US20 projects (-0.0135 on US30 and -0.0139 on US20).
- Correlation between percent compaction measurements obtained from nuclear and non-nuclear gauges indicated that the measurements are on-average similar and the results generally fall near the 1:1 line. A statistically significant correlation was not observed between the two measurements.

General Comments

Results from the three field HMA projects indicated that the real-time temperature and pass coverage data can be valuable for HMA overlay construction projects. The stiffness related compaction data (i.e., CCV) obtained on the two projects have also provided valuable information with a strong correlation to the underlying layer support conditions, however, was not correlated well with HMA density. This poses a challenge for using the stiffness related RICM measurements for QC/QA. A recent study documented by White and Vennapusa (2008) indicated that "weak" pavement foundation (subbase and subgrade) layer conditions contribute to failure of the HMA surface layer. In light of that observation, it is recommended that the usefulness of the stiffness related information for QC/QA be evaluated on a full depth HMA project.

Recommendations for Phase III

Following are some recommendations for the Phase III of this research program:

- Implement RICM-HMA SP that requires pass coverage, temperature, and stiffness related compaction data on a full depth HMA project. This project should include mapping of the underlying subbase layer with the RICM roller prior to paving and also obtain stiffness related point measurements for comparison. The RICM data on the HMA layers should then be carefully evaluated along with the RICM data on the underlying layer. This can provide new insights into developing methodologies to establish target values for QC/QA depending on the support conditions.
- Implement and evaluate the SP developed for HMA with coverage requirement from full compaction train (i.e., SP-090058) on a HMA project.
- Develop an education/training program for state DOT and contractor personnel based on the findings from Phases I and II of this research program. This training program should consist of web-based information and videos for easy access and technology transfer, and

operator/inspector guidebook and troubleshooting manuals with input from roller manufacturers.

- Implement and evaluate the SP developed for embankment cohesive soils on an earthwork construction project.

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APPENDIX A: IOWA DOT INTELLIGENT COMPACTION SPECIAL PROVISIONS FOR HMA AND EMBANKMENT CONSTRUCTION

SP-090048
(New)

Iowa Department of Transportation

SPECIAL PROVISIONS
FOR
INTELLIGENT COMPACTION-HMA

Harrison County
NHSN-030-1(127)--2R-43

Effective Date
January 20, 2010

THE STANDARD SPECIFICATIONS, SERIES 2009, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE SPECIAL PROVISIONS AND THEY PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

In addition to the requirements of Section 2303 of the Standard Specifications, the following shall apply:

090048.01 Description

This specification describes the Contractor's responsibilities for furnishing Intelligent Compaction (IC) equipped rollers, data acquisition, training, roller verification/repeatability testing, and transmitting data to the Engineer. IC for HMA is defined as the gathering of data from self-propelled vibratory roller systems involved with the measurement and recording of roller position, date/time, speed, vibration frequency, vibration amplitude, surface temperature, pass count, travel direction, and a compaction measurement value (MV). Real Time Kinematic (RTK) based Global Positions System (GPS) with base station corrections shall be used for determining the position of the roller. Results from the IC shall be displayed to the roller operator on a color coded computer screen in real-time during roller operations and the data saved for transfer and viewing by the Engineer.

Quality acceptance for IC-HMA will be based on cores according to Section 2303 of the Standard Specifications. The IC results will be used as a guide to supplement core sampling for research purposes. Secure a maximum of three additional cores per lot collected concurrently with acceptance cores based on viewing roller pass coverage, surface temperature during compaction operations, and IC compaction MVs. The Engineer will determine the location for the additional cores.

Submit to the Engineer an IC Work Plan at least two weeks prior to the Preconstruction Conference. Describe in the work plan the following:

- Compaction equipment to be used including:
    - Vendor
    - Roller model,
    - Roller dimensions and weights,
    - Description of IC measurement system,

    - GPS capabilities,
    - Documentation system,
    - Temperature measurement system, and
    - Software.
- Roller data collection methods including sampling rates and intervals and data file types.
- Transfer of data to the Engineer including method, timing, and personnel responsible. Data transfer shall occur at minimum once per day or as directed by the Engineer.
- Training plan and schedule for roller operators, Engineer's personnel, and Iowa State University's research personnel; including both classroom and field training.
- Communication protocol for informing the Iowa State University research team point of contact concerning construction progress and schedule to facilitate research field testing and data collection.

090048.02 Equipment and Materials

A. Rollers

Comply with Article 2001.05 of the Standard Specifications for self-propelled vibratory rollers. Article 2001.05 applies to all rollers used in the breakdown position. Breakdown roller is defined as the roller(s) making the initial contact with the HMA.

Ensure that IC equipment can measure roller position, date/time, speed, vibration frequency, vibration amplitude, surface temperature, pass count, travel direction, and a compaction measurement value (MV). Provide a computer screen in the roller cab for viewing measured results. Ensure that results are stored for transfer to the Engineer for viewing on a laptop computer. Provide the Engineer and Iowa State University each with a copy of the IC roller vendor software for viewing results. Ensure that results are displayed as color coded spatial maps based on GPS coordinates.

B. Data Collection, Export, and Onboard Display

Provide and export the following data in a comma, colon, or space delimited ASCII file format:

1) Machine Model, Type, and Serial/Machine Number
2) Roller Drum Dimensions (Width and Diameter)
3) Roller and Drum Weights
4) File Name
5) Date Stamp
6) Time Stamp
7) RTK based GPS measurements showing Northing, Easting, and Elevation
8) Roller Travel Direction (e.g., forward or reverse)
9) Roller Speed
10) Vibration Setting (i.e., On or Off)
11) Vibration Amplitude
12) Vibration Frequency
13) Surface Temperature
14) Compaction Measurement Value

Ensure that the roller's onboard display will furnish color-coded GPS based mapping showing number of roller passes, surface temperature, vibration frequency, vibration amplitude, and the MV on a computer screen in the roller operators cab. Provide displayed results to the Engineer for review upon request.

C. Local GPS Base Station

Provide a real time kinematic global positioning system (RTK GPS) to acquire northing, easting, and elevation data used in mapping of IC measurements. Ensure the system has the capability to collect data in an established project coordinate system. Furnish a local GPS base station used for broadcasting differential correction data to the rollers with a tolerance less than 0.1 ft in the vertical and horizontal.

D. Training

1. Preconstruction (classroom)
Make available all personnel responsible for roller operations to attend a one-day classroom training on IC. Training will be provided by Iowa State University research personnel and scheduling coordinated by the Engineer. Classroom training will involve both the Contractor's and Engineer's personnel.

2. Field (prior to and during compaction operations)
Provide two working days of field training by the IC equipment manufacturer to roller operators and Engineer's personnel.

E. Geotechnical Mobile Lab Parking
Provide the Engineer an all weather access, parking for the Iowa State University Geotechnical Mobile lab trailer (8 feet by 44 feet), and parking for 3 vehicles at the HMA plant site or agreed upon alternative location. The lab trailer will be furnished and operated by Iowa State University which will be under contract with the Contracting Authority to perform IC-HMA research.

090048.03 Construction

A. Roller Verification/Repeatability Testing
Construct periodic test strips under controlled roller operations for evaluating IC roller measurement errors. Coordinate with the Engineer and Iowa State University research personnel at least one day in advance of testing for IC roller repeatability evaluation. Test strip construction will require four to six roller passes on a 200 feet long strip of intermediate course by one roller width area under controlled roller operating conditions (i.e., constant speed, vibration amplitude, and frequency). The IC measurements obtained in the same area for several repeated passes will be used to assess the measurements errors. The results will be used for research purposes to validate the manufacturer claims for the IC measurement reliability. It is anticipated that repeatability test strips will be identified during the course of the project. The test strip areas can be designed within the production compaction areas.

B. Roller Operations
Operate the IC roller according to manufacturer's recommendations to provide reliable and repeatable measurements. Keep vibration frequency and amplitude constant during roller opertations for comparing successive passes. Changes in frequency and amplitude influence MVs. Permitted variation in vibration frequency is ± 125 vibrations per minute. Maintain rolling speed to provide a minimum of 10 impacts per linear foot and within ± 0.5 miles per hour during measurement passes. Speed fluctuations influence the MVs and are not permitted outside this range during measurement passes. Record IC-HMA roller operations forward and reverse directions. It is anticipated that MVs will be affected by rolling direction and therefore the output data fields shall indicate rolling direction. Check and recalibrate, if necessary, IC equipment at the beginning of each workday.

C. Equipment Breakdowns
In the event of IC roller breakdowns/IC system malfunctions/GPS problems, the Contactor may operate with conventional rolling operations, but IC data shall be collected and provided for a minimum 80% of the project surface and intermediate HMA quantity.

D. Data submittal
Furnish to the Engineer an electronic file in ASCII file format with information listed under Article SP-090048.02, B. As a minimum the file transfer shall occur immediately following the final compaction operations on each working day. The Engineer may request data any time during compaction operations.

090048.04 Method of Measurement
None. Lump sum item.

090048.05 Basis of Payment

A. Payment for Intelligent Compaction-HMA will be the lump sum contract price.

B. Payment is full compensation for all work associated with providing IC equipped rollers, transmission of electronic data files, two copies of IC roller manufacturer software, training, and preparing and maintaining work space for Iowa State University's IC trailer and associated parking.

C. Delays due to GPS satellite reception of signals to operate the IC equipment or IC roller breakdowns will not be considered justification for contract modifications or contract extensions.

SP-090057a
(Replaces SP-090057)

Iowa Department of Transportation

SPECIAL PROVISIONS
FOR
INTELLIGENT COMPACTION-HMA

Ida County
NHSN-020-2(70)--2R-47

Effective Date
February 16, 2010

THE STANDARD SPECIFICATIONS, SERIES 2009, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE SPECIAL PROVISIONS AND THEY PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

In addition to the requirements of Section 2303 of the Standard Specifications, the following shall apply:

090057a.01 Description

This specification describes the Contractor's responsibilities for furnishing Intelligent Compaction (IC) equipped rollers, data acquisition, training, and transmitting data to the Engineer. IC for HMA is defined as the gathering of data from self-propelled vibratory roller systems involved with the measurement and recording of roller position, date/time, speed, vibration frequency, vibration amplitude, surface temperature, pass count, and travel direction. Real Time Kinematic (RTK) based Global Positions System (GPS) with base station corrections shall be used for determining the position of the roller. Results from the IC shall be displayed to the roller operator on a color coded computer screen in real-time during roller operations and the data saved for transfer and viewing by the Engineer.

Quality acceptance for IC-HMA will be based on cores according to Section 2303 of the Standard Specifications. The IC results will be used as a guide to supplement core sampling for research purposes. Secure a maximum of three additional cores per lot collected concurrently with acceptance cores based on viewing roller pass coverage, surface temperature during compaction operations, and IC compaction MVs. The Engineer will determine the location for the additional cores.

Submit to the Engineer an IC Work Plan at least two weeks prior to the Preconstruction Conference. Describe in the work plan the following:

- Compaction equipment to be used including:
    - Vendor
    - Roller model,
    - Roller dimensions and weights,
    - Description of IC measurement system,
    - GPS capabilities,
    - Documentation system,
    - Temperature measurement system, and
    - Software.

- Roller data collection methods including sampling rates and intervals and data file types.
- Transfer of data to the Engineer including method, timing, and personnel responsible. Data transfer shall occur at minimum once per day or as directed by the Engineer.
- Training plan and schedule for roller operators, Engineer's personnel, and Iowa State University's research personnel; including both classroom and field training.
- Communication protocol for informing the Iowa State University research team point of contact concerning construction progress and schedule to facilitate research field testing and data collection.

090057a.02 Equipment and Materials

A. Rollers

Comply with Article 2001.05 of the Standard Specifications for self-propelled vibratory rollers. Article 2001.05 applies to all rollers used in the breakdown position. Breakdown roller is defined as the roller(s) making the initial contact with the HMA.

Ensure that IC equipment can measure roller position, date/time, speed, vibration frequency, vibration amplitude, surface temperature, pass count, and travel direction. Provide a computer screen in the roller cab for viewing measured results. Ensure that results are stored for transfer to the Engineer for viewing on a laptop computer. Provide the Engineer and Iowa State University each with a copy of the IC roller vendor software for viewing results. Ensure that results are displayed as color coded spatial maps based on GPS coordinates.

B. Data Collection, Export, and Onboard Display

Provide and export the following data in a comma, colon, or space delimited ASCII file format:

1) Machine Model, Type, and Serial/Machine Number
2) Roller Drum Dimensions (Width and Diameter)
3) Roller and Drum Weights
4) File Name
5) Date Stamp
6) Time Stamp
7) RTK based GPS measurements showing Northing, Easting, and Elevation
8) Roller Travel Direction (e.g., forward or reverse)
9) Roller Speed
10) Vibration Setting (i.e., On or Off)
11) Vibration Amplitude
12) Vibration Frequency
13) Surface Temperature

Ensure that the roller's onboard display will furnish color-coded GPS based mapping showing number of roller passes, surface temperature, vibration frequency, and vibration amplitude on a computer screen in the roller operators cab. Provide displayed results to the Engineer for review upon request.

C. Local GPS Base Station

Provide a real time kinematic global positioning system (RTK GPS) to acquire northing, easting, and elevation data used in mapping of IC measurements. Ensure the system has the capability to collect data in an established project coordinate system. Furnish a local GPS base station used for broadcasting differential correction data to the rollers with a tolerance less than 0.1 foot in the vertical and horizontal.

D. Training

1. Preconstruction (classroom)

Make available all personnel responsible for roller operations to attend a one-day classroom training on IC. Classroom training will involve both the Contractor's and Engineer's personnel and the Iowa State University research team. Training will shall be provided by IC equipment manufacturer and Contactor Iowa State University research personnel and scheduling coordinated by the Engineer. Classroom training will involve both the Contractor's and Engineer's personnel.

2. **Field (prior to and during compaction operations)**
Provide two working days of field training by the IC equipment manufacturer to roller operators and Engineer's personnel. Ensure the IC roller manufacturer provides onsite technical assistance the first two working days of IC roller use.

E. Geotechnical Mobile Lab Parking
Provide the Engineer an all weather access, parking for the Iowa State University Geotechnical Mobile lab trailer (8 feet by 44 feet), and parking for 3 vehicles at the HMA plant site or agreed upon alternative location. The lab trailer will be furnished and operated by Iowa State University which will be under contract with the Contracting Authority to perform IC-HMA research.

090057a.03 Construction

A. Roller Operations
Operate the IC roller according to manufacturer's recommendations to provide reliable and repeatable measurements. Keep vibration frequency and amplitude constant during roller operations Permitted variation in vibration frequency is ± 125 vibrations per minute. Maintain rolling speed to provide a minimum of 10 impacts per linear foot and within ± 0.5 miles per hour during measurement passes. Record IC-HMA roller operations forward and reverse directions. Check and recalibrate, if necessary, IC equipment at the beginning of each workday.

Record all IC-HMA roller passes including forward and reverse directions. Check, verify and recalibrate, if necessary, IC equipment at the beginning of each workday to ensure proper performance.

B. Equipment Breakdowns
In the event of IC roller breakdowns/IC system malfunctions/GPS problems, the Contactor may operate with conventional rolling operations, but it is intended that IC data shall be collected and provided for a minimum 80% of the project surface and intermediate HMA quantity.

C. Data submittal
Furnish to the Engineer an electronic file in ASCII file format with information listed under Article SP-090057a.02, B. As a minimum, the file transfer shall occur immediately following the final compaction operations on each working day. The Engineer may request data any time during compaction operations.

090057a.04 Method of Measurement
None. Lump sum item.

090057a.05 Basis of Payment

A. Payment for Intelligent Compaction-HMA will be the lump sum contract price.

B. Payment is full compensation for all work associated with providing IC equipped rollers, transmission of electronic data files, two copies of IC roller manufacturer software, training, and preparing and maintaining work space for Iowa State University's IC trailer and associated parking. Partial payments will be made as follows:

1. Upon receipt of a signed contract, 50% of the lump sum bid price.

2. The remainder 50% will be prorated based on the percent of the project HMA tonnage compacted using IC-HMA. (e.g.: to receive 100% payment for the item the Contractor will have to provide IC-HMA for at least 80% of the area of each HMA course.)

C. Delays due to GPS satellite reception of signals to operate the IC equipment or IC roller breakdowns will not be considered justification for contract modifications or contract extensions.

SP-090058
(New)

Iowa Department of Transportation

SPECIAL PROVISIONS
FOR
INTELLIGENT COMPACTION - HMA – ROLLER PASS MAPPING

Kossuth County
STPN-009-4(44)--2J-55

Effective Date
February 16, 2010

THE STANDARD SPECIFICATIONS, SERIES 2009, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE SPECIAL PROVISIONS AND THEY PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

In addition to the requirements of Section 2303 of the Standard Specifications, the following shall apply:

090058.01 Description
This specification describes the Contractor's responsibilities for furnishing Intelligent Compaction (IC) – HMA Roller Pass Mapping equipped rollers, the required data acquisition and reporting method, the training program requirement, and the data file types and process for transmitting data to the Engineer. IC-HMA Roller Pass Mapping is herein defined as the documentation of roller pass coverage data from all rollers used in the HMA compaction process. Real Time Kinematic (RTK) based Global Positions System (GPS) with base station corrections shall be used for determining the position of the rollers. Results from the IC roller pass coverage shall be displayed to the roller operator on a color coded computer screen in real-time during roller operations and the data saved for transfer and viewing by the Engineer. Data collection and reporting shall include roller position, date/time, speed, pass count, and travel direction.

Quality acceptance for IC-HMA Roller Pass Mapping will be based on cores according to Section 2303 of the Standard Specifications. The IC results will be used as a guide to supplement core sampling for research purposes. Secure a maximum of three additional cores per lot collected concurrently with acceptance cores based on viewing roller pass mapping data. The Engineer will determine the location for the additional cores.

Submit to the Engineer a work plan for IC-HMA Roller Pass Mapping at least two weeks prior to the Preconstruction Conference. Describe in the work plan the following:

- Compaction equipment to be used including:
    - Vendor
    - Roller model,
    - Roller dimensions and weights,
    - Description of IC-HMA Roller Pass Mapping measurement system,

  - GPS capabilities,
  - Documentation system, and
  - Software.

- Roller data collection methods including sampling rates and intervals and data file types.
- Transfer of data to the Engineer including method, timing, and personnel responsible. Data transfer shall occur at minimum once per day or as directed by the Engineer.
- Training plan and schedule for roller operators, Engineer's personnel, and Iowa State University's research personnel; including both classroom and field training.
- Communication protocol for informing the Iowa State University research team point of contact concerning construction progress and schedule to facilitate research field testing and data collection.

090058.02 Equipment and Materials

A. Rollers
Comply with Article 2001.05 of the Standard Specifications for rollers.
Ensure that IC equipment can measure roller position, date/time, speed, pass count, and travel direction. Provide a computer screen in the roller cab for viewing measured results. Ensure that results are stored for transfer to the Engineer for viewing on a laptop computer. Provide the Engineer and Iowa State University each with a copy of the IC equipment vendor software for viewing results. Ensure that results are displayed as color coded spatial maps based on GPS coordinates.

B. Data Collection, Export, and Onboard Display
Provide and export the following data in a comma, colon, or space delimited ASCII file format:

1) Machine Model, Type, and Serial/Machine Number
2) Roller Drum Dimensions (Width and Diameter)
3) Roller and Drum Weights
4) File Name
5) Date Stamp
6) Time Stamp
7) RTK based GPS position measurements showing Northing, Easting, and Elevation
8) Roller Travel Direction (e.g., forward or reverse)
9) Roller Speed
10) Pass count

Ensure that the roller's onboard display will furnish color-coded GPS based mapping showing number of roller passes, on a computer screen in the roller operators cab. Provide displayed results to the Engineer for review upon request.

C. Local GPS Base Station
Provide a real time kinematic global positioning system (RTK GPS) to acquire northing, easting, and elevation data used in mapping of IC measurements. Ensure the system has the capability to collect data in an established project coordinate system. Furnish a local GPS base station used for broadcasting differential correction data to the rollers with a tolerance less than 0.1 ft in the vertical and horizontal.

D. Training

1. Preconstruction (classroom)
Make available all personnel responsible for roller operations to attend a one-day classroom training on IC. Classroom training will involve both the Contractor's and Engineer's personnel and the Iowa State University research team. Training will be provided by the IC equipment manufacturer and contactor and scheduled in coordination with the Engineer.

2. Field (prior to and during compaction operations)
Provide two working days of field training by the IC equipment vendor to roller operators and Engineer's personnel.

E. Geotechnical Mobile Lab Parking
Provide the Engineer an all weather access, parking for the Iowa State University Geotechnical Mobile lab trailer (8 feet by 44 feet), and parking for 3 vehicles at the HMA plant site or agreed upon alternative location. The lab trailer will be furnished and operated by Iowa State University which will be under contract with the Contracting Authority to perform IC-HMA research.

090058.03 Construction

A. Roller Operations
Record all IC-HMA roller passes including forward and reverse directions. Check, verify and recalibrate, if necessary, IC equipment at the beginning of each workday to ensure proper performance.

B. Equipment Breakdowns
In the event of IC equipment breakdowns/IC system malfunctions/GPS problems, the Contactor may operate with conventional rolling operations, but IC-HMA Roller Pass Mapping data shall be collected and provided for a minimum 80% of the project surface and intermediate HMA quantity.

C. Data submittal
Furnish to the Engineer an electronic file in a comma, colon, or space delimited ASCII file format with information listed under Article SP-090058.02, B. As a minimum, the file transfer shall occur immediately following the final compaction operations on each working day. The Engineer may request data any time during compaction operations.

090058.04 Method of Measurement
None. Lump sum item.

090058.05 Basis of Payment

A. Payment for IC-HMA Roller Pass Mapping will be the lump sum contract price.

B. Payment is full compensation for all work associated with providing IC equipped rollers, transmission of electronic data files, two copies of IC equipment manufacturer software, training, and preparing and maintaining work space for Iowa State University's mobile lab and associated parking.

C. Delays due to GPS satellite reception of signals to operate the IC equipment or IC roller breakdowns will not be considered justification for contract modifications or contract extensions.

SP-090063
(New)

Iowa Department of Transportation

SPECIAL PROVISIONS
FOR
INTELLIGENT COMPACTION-EMBANKMENT

Sac County
NHSX-020-2(89)--3H-81

Effective Date
April 20, 2010

THE STANDARD SPECIFICATIONS, SERIES 2009, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE SPECIAL PROVISIONS AND THEY PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

090063.01 Description.
This specification describes the Contractor's responsibilities for furnishing an Intelligent Compaction–Embankment (IC-E) roller, the required data acquisition and reporting method, the training program requirement, and the data file types and process for transmitting data to the Engineer. IC-E is defined as the gathering of data from a self-propelled roller system involved with the measurement and recording of roller position, date/time, speed, pass count, travel direction, and a compaction measurement value (MV). Real Time Kinematic (RTK) based Global Positions System (GPS) with base station corrections shall be used for determining the position of the roller. Results from the IC shall be displayed to the roller operator on a color coded computer screen in real-time during roller operations and the data saved for transfer and viewing by the Engineer.

IC-E will be required only for materials subject to moisture control per DS-09003. The IC-E results will be used as a guide to supplement QA testing for research purposes. Data collection and reporting shall include roller position, date/time, speed, pass count, travel direction, and compaction measurement value.

Submit to the Engineer a work plan for IC-E at least two weeks prior to the Preconstruction Conference. Describe in the work plan the following:

- Compaction equipment to be used including:
    - Vendor
    - Roller model,
    - Roller dimensions and weights,
    - Description of IC-E measurement system and previous field verification results to show that the compaction measurement values are suitable for the project soils, which include cohesive soils as defined in Article 2102.02 of the Standard Specifications,
    - GPS capabilities,
    - Documentation system, and
    - Software.

- Roller data collection methods including sampling rates and intervals and data file types.
- Transfer of data to the Engineer including method, timing, and personnel responsible. Data transfer shall occur at minimum once per day or as directed by the Engineer.
- Training plan and schedule for roller operators, Engineer's personnel, and Iowa State University's research personnel; including both classroom and field training.
- Communication protocol for informing the Iowa State University research team point of contact concerning construction progress and schedule to facilitate research field testing and data collection.

090063.02 Equipment and Materials.

A. Rollers.
The IC-E roller shall be a self-propelled roller with a padfoot configuration weighing at least 10,800 kg with an IC system and as approved by the Engineer. Ensure that IC equipment can measure roller position, date/time, speed, pass count, travel direction, and a compaction measurement value (MV). Provide a computer screen in the roller cab for viewing measured results. Ensure that results are stored for transfer to the Engineer for viewing on a laptop computer. Provide the Engineer and Iowa State University each with a copy of the IC equipment vendor software for viewing results. Ensure results are displayed as color-coded spatial maps based on GPS coordinates.

B. Data Collection, Export, and Onboard Display.
Provide and export the following data in a comma, colon, or space delimited ASCII file format:

1) Machine Model, Type, and Serial/Machine Number
2) Roller Drum Dimensions (Width and Diameter)
3) Roller and Drum Weights
4) File Name
5) Date Stamp
6) Time Stamp
7) RTK based GPS position measurements showing Northing, Easting, and Elevation
8) Roller Travel Direction (e.g., forward or reverse)
9) Roller Speed
10) Vibration setting, amplitude, and frequency (if vibration used)
11) Pass count
12) Compaction Measurement Value

Ensure that the roller's onboard display will furnish color-coded GPS based mapping showing number of roller passes and the compaction measurement value, on a computer screen in the roller operators cab. Provide displayed results to the Engineer for review upon request.

C. Local GPS Base Station.
Provide a real time kinematic global positioning system (RTK-GPS) to acquire northing, easting, and elevation data used in mapping of the IC-E measurements. Ensure the system has the capability to collect data in an established project coordinate system. Furnish a local GPS base station used for broadcasting differential correction data to the rollers with a tolerance less than 30 mm in the vertical and horizontal.

D. Training.

1. Preconstruction (classroom).
Make available all personnel responsible for roller operations and the IC equipment manufacturer representative to attend a one-day classroom training on IC. Classroom training will involve both the Contractor's and Engineer's personnel, and the Iowa State University research team. Training shall be provided by the IC equipment manufacturer and Contractor and scheduled in coordination with the Engineer.

2. Field (prior to and during compaction operations).
Ensure the IC roller manufacturer provides onsite technical assistance the first two working days of IC roller use.

E. Geotechnical Mobile Lab Parking.
Provide the Engineer an all weather access, parking for the Iowa State University Geotechnical Mobile lab trailer (2.5 m by 13.5 m), and parking for three vehicles at the project site or agreed upon alternative location. The lab trailer will be furnished and operated by Iowa State University which will be under contract with the Contracting Authority to perform IC-E research.

F. Test Strips.
Demonstrate that the IC-E roller and system meets the requirements of this specification by compacting test strips. Test strips shall be identified within the project limits and included with project earthwork operations and be a minimum 5 m wide by 75 m long. Test strips shall be compacted with 12 roller passes. Moisture content tests will be collected within the test strip area at five locations. The moisture content test locations will be selected in consultation with the Engineer and research team members and based on the IC compaction measurement values to represent areas of low to high compaction measurement values. Three test strip areas will be selected by the Engineer to represent different materials or conditions. Results from the test strips will be used for research purposes. Quality acceptance for the earthwork in the test strip areas will be as provided in DS-09003.

G. IC-E Proof Area Mapping.
IC-E proof area mapping is to be implemented for compacted fill within the project limits where quality acceptance follows DS-09003. The IC-E roller shall be used to record the compaction measurement value at the surface of the compacted layers at vertical intervals 0.6 m or less. The IC-E compaction measurement value shall be collected for the entire area at the top of the compaction layer at the specified minimum vertical interval. The surface for IC-E measurements shall be relatively smooth and uniform and shaped to approximately line and grade for each mapping area in accordance with manufacturer guidelines to provide reliable IC-E compaction measurement values. The results will be used to identify additional moisture content tests to be performed by the research team and a means for calculating nominal lift thickness for research purposes. The time between completion of compaction and IC-E proof area mapping should be kept to a minimum. Quality acceptance for the earthwork in the proof mapping areas will be as provided in DS-09003.

090063.03 Construction.

A. Roller Operations.
Record IC-E roller passes in forward direction only for test strips and IC-E proof mapping areas. Check, verify and recalibrate, if necessary, IC equipment to ensure proper performance. Operate the IC roller according to manufacturer's recommendations to provide reliable and repeatable measurements. Keep roller speed (and vibration frequency and amplitude settings, if operated in vibratory mode) constant during test strip and IC-E proof mapping.

B. Equipment Breakdowns.
In the event of IC equipment breakdowns/IC system malfunctions/GPS problems, the Contactor may operate without IC-E rolling operations, but it is intended that IC-E data shall be collected and provided for a minimum 80% of the required proof areas.

C. Data Submittal.
Furnish to the Engineer an electronic file in a comma, colon, or space delimited ASCII file format with information listed under Article SP-090063.02, B. As a minimum, the file transfer shall occur following the final compaction operations on each working day. The Engineer may request data any time during compaction operations.

090063.04 Method of Measurement.
None. Lump sum item.

090063.05 Basis of Payment.

A. Payment for IC-E will be the lump sum contract price.

B. Payment is full compensation for all work associated with providing IC equipped rollers, transmission of electronic data files, two copies of IC equipment manufacturer software, training, and preparing and maintaining work space for Iowa State University's mobile lab and associated parking. Partial payments will be made as follows:

1. Upon receipt of a signed contract, 50% of the lump sum bid price.

2. The remainder 50% will be prorated based on the percent of the project's cubic meters of material subject to moisture control compacted using IC-E. (e.g.: to receive 100% payment for the item the Contractor will have to provide IC-E for at least 80% of the cubic meters compacted for the project.)

C. Delays due to GPS satellite reception of signals to operate the IC equipment or IC roller breakdowns will not be considered justification for contract modifications or contract extensions.

APPENDIX B: DOT FIELD CORE DENSITY REPORTS – US30 HARRISON COUNTY PROJECT

BB/2

800241 - 10/08 ver. 3.5

DAILY HMA PLANT REPORT

Project No.: NHSN-30-1(127)--2R-43
Contract ID: 43-0301-127
Mix Design No.: ABD10-3019

Contractor: Manatt's Inc
County: Harrison/Crawford
Recycle Source: ABC0-051

JMF VMA: 15.1
Size: 1/2
Mix Type: HMA 3M

Report No.: 1
Lab Voids Target: 4.0
Design Gyrations: 86

Hot Box I.D. No.:		INT0709A	INFO			Dist. Lab
Date Sampled:		07/09/10	07/09/10			Results
Gradation ID:	Specs	info				
1 in. (25mm) Sieve	100	100		100		
3/4 in. (19mm) Sieve	100	100		100		
1/2 in. (12.5mm) Sieve	89-100(96)	94		94		
3/8 in. (9.5mm) Sieve	77-91(84)	84		83		
* #4 (4.75mm) Sieve	60-74(67)	68		71		
* Moving Average						
* #8 (2.36mm) Sieve	48-58(53)	56		57		
* Moving Average						
#16 (1.18mm) Sieve		41		42		
* #30 (600um) Sieve	18-26(22)	25		25		
* Moving Average						
#50 (300um) Sieve		10		9.8		
#100 (150um) Sieve		5.2		4.8		
* #200 (75um) Sieve	1.5-5.5(3.5)	4.2		3.8		
* Moving Average						
Compliance (Y/N)		y				
Intended Added, % Binder	4.40		% Binder from RAP			
Actual Added, % Binder		4.45	20.68%			
Intended Total, % Binder	5.50		Actual % RAP			
Actual Total, % Binder	5.20-5.80	5.61	20.63%			
Gmb:		2.349	2.342			
Gmm:		2.443	2.441			
Pa:		3.8	4.1			
Moving Average	3.5-5.0					
Time		8:40 AM				This
Station		202+00				Column
Side		WBSHLD				Is For
Sample Tons		214.00				Dist. Lab
Sublot Tons		500.00	16.89			Test
Tons to Date		516.89				Results
Fines / Bitumen Ratio	0.6-1.4	0.81				

Time	7:00	9:00	11:00	1:00	3:00	5:00	7:00
Air Temp. °F	64	67					
Binder Temp. °F	300	300					
Mix Temp. °F	300	300					
Mat Temp. °F	280	285					

From Station	To Station	Lane
215+00	160+26	LT

Placement And Density Record

Date Placed: 07/09/10
Date Tested: 07/12/10
Course Placed: Intermediate
Intended Lift Thickness: 4.00
Tested By: Ed Launderville

Core No.:	1	2	3	4	5	6	7
Station	212+22	207+34	195+35	190+40	180+35	177+97	169+40
CL Reference	3'	3'	3'	2'	3'	2'	2'
W 1 Dry	4,365.5	4,184.9	4,472.3	3,977.7	3,231.4	4,174.3	3,271.4
W 2 in H20	2,441.7	2,312.4	2,465.2	2,224.5	1,763.6	2,312.9	1,805.6
W 3 Wet	4,368.4	4,190.4	4,475.1	3,979.2	3,232.3	4,176.9	3,272.9
Difference	1,926.7	1,878.0	2,009.9	1,754.7	1,468.7	1,864.0	1,467.3
Field Density	2.266	2.228	2.225	2.267	2.200	2.239	2.230
% Density	96.590	94.970	94.842	96.633	93.777	95.439	95.055
% Voids	7.2	8.8	8.9	7.2	9.9	8.3	8.7
Thickness (in.)	4.87	4.74	5.05	4.48	4	4.57	3.71

Gmb (Lot Avg.): **2.346**
Gmm (Lot Avg.): **2.442**
Pa (Lot Avg.): **4.0**
Target % RAP: **20.0**

Avg. Field Density: **2.236**
Avg. % Density: **95.329**
Avg. % Field Voids: **8.4**
Specified % Density: 94

Q.I. = (2.236 -- (0.94 x 2.346)) / 0.024 = **1.28**

Low Outlier: ______ High Outlier: ______ New Q.I. = ______

Film Thickness (FT): **10.0** (8.0-15.0) VMA: **15.7** (14.1-16.1) D.O.T. Results Used: [ ]

Gsb: 2.627 Gb: 1.0284 Effective % Binder (Pbe): 5.17
Tons of Mix for Pay: 516.89 Tons of Binder for Pay: 28.98

Remarks: using PG 58-28
intermediate test strip of 516.89 tons to be payed as base mix

This material meets all contract specifications

Mix Change Information: ______

Certified Tech: Jeff Jenkins NW086 Cert. No.
Certified Tech: Rick Loschen CI813 Cert. No.

Distribution: ____ Central Materials ____ Dist. Materials ____ Proj. Engineer ____ Contractor ____ Plant

162 1/4 PG 64-28

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DAILY HMA PLANT REPORT

Project No.: NHSN-30-1(127)--2R-43
Contract ID: 43-0301-127
Mix Design No.: ABD10-3019R1

Contractor: Manatt's Inc
County: Harrison/Crawford
Recycle Source: ABC0-051

JMF VMA: 15.1
Size: 1/2
Mix Type: HMA 3M

Report No.: 2
Lab Voids Target: 4.0
Design Gyrations: 86

Hot Box I.D. No.:		INT0713A	INT0713B	INT0713C	INT0713D	Dist. Lab
Date Sampled:		07/13/10	07/13/10	07/13/10	07/13/10	Results
Gradation ID:	Specs					
1 in. (25mm) Sieve	100	100				
3/4 in. (19mm) Sieve	100	100				
1/2 in. (12.5mm) Sieve	89-100(96)	93				
3/8 in. (9.5mm) Sieve	77-91(84)	81				
* #4 (4.75mm) Sieve	60-74(67)	67				
* Moving Average						
* #8 (2.36mm) Sieve	48-58(53)	54				
* Moving Average						
#16 (1.18mm) Sieve		39				
* #30 (600um) Sieve	18-26(22)	21				
* Moving Average						
#50 (300um) Sieve		9.5				
#100 (150um) Sieve		5				
* #200 (75um) Sieve	1.5-5.5(3.5)	3.8				
* Moving Average						
Compliance (Y/N)		Y				
Intended Added, % Binder	4.40		% Binder from RAP			
Actual Added, % Binder		4.63	19.16%			
Intended Total, % Binder	5.50		Actual % RAP			
Actual Total, % Binder	5.20-5.80	5.73	19.55%			
Gmb:		2.352	2.350	2.354	2.350	2.349
Gmm:		2.445	2.444	2.446	2.454	2.443
Pa:		3.8	3.8	3.8	4.2	3.8
Moving Average	3.5-5.0		**3.9**	**3.9**	**3.9**	
Time		8:45 AM	10:15 AM	12:20 PM	2:50 PM	This
Station		20+00	40+00	68+00	109+00	Column
Side		EBL	EBL	EBL	EBL	Is For
Sample Tons		326.00	825.00	1,472.00	2,327.00	Dist. Lab
Sublot Tons		500.00	833.33	833.33	1,200.09	Test
Tons to Date					3,366.75	Results
Fines / Bitumen Ratio	0.6-1.4	0.74				

Time	7:00	9:00	11:00	1:00	3:00	5:00	7:00
Air Temp. °F	82	82	84	87	89	87	
Binder Temp. °F	300	300	300	300	300	300	
Mix Temp. °F	300	300	300	300	300	300	
Mat Temp. °F	295	285	285	290	290	285	

From Station	To Station	Lane
3+75	155+00	RT

Placement And Density Record

Date Placed: 07/13/10
Date Tested: 07/14/10
Course Placed: Intermediate
Intended Lift Thickness: 2.00
Tested By: Ed Launderville

Core No.:	1	2	3	4	5	6	7
Station	16+17	36+80	43+81	73+44	78+65	104+20	143+88
CL Reference	4.2'	6.5'	2.1'	5.9'	10.5'	9.6'	10.1'
W 1 Dry	2,247.3	2,272.3	1,602.1	2,235.8	1,943.0	2,666.4	2,300.8
W 2 in H20	1,294.9	1,305.3	915.3	1,277.9	1,113.0	1,523.2	1,304.4
W 3 Wet	2,248.4	2,272.9	1,603.1	2,236.5	1,943.6	2,666.9	2,301.5
Difference	953.5	967.6	687.8	958.6	830.6	1,143.7	997.1
Field Density	2.357	2.348	2.329	2.332	2.339	2.331	2.307
% Density	100.213	99.830	99.022	99.150	99.447	99.107	98.087
% Voids	3.7	4.0	4.8	4.7	4.4	4.7	5.7
Thickness (in.)	2.22	2.38	1.77	2.35	2.13	2.88	2.47

Gmb (Lot Avg.): **2.352**
Gmm (Lot Avg.): **2.447**
Pa (Lot Avg.): **3.9**
Target %"RAP: **19.0**

Avg. Field Density: **2.335**
Avg. % Density: **99.265**
Avg. % Field Voids: **4.6**
Specified % Density: 95

Q.I. = (2.335 -- (0.95 x 2.352)) / 0.016 = **6.29**

Low Outlier: ______ High Outlier: ______ New Q.I. = ______

Film Thickness (FT): **10.7** (8.0-15.0) VMA: **15.6** (14.1-16.1) D.O.T. Results Used: [ ]

Gsb: 2.627 Gb: 1.0360 Effective % Binder (Pbe): 5.15
Tons of Mix for Pay: 3366.75 Tons of Binder for Pay: 192.63

Remarks: 33.76 tons placed at sta, 310+00 LT side 12 ft. fillet at Nelson Park Rd. was added to the days Run on mainline.

This material meets all contract speifications

Mix Change Information: % binder in rap over 20% took 1% of rap out and added 1%of man san

Certified Tech: Jeff Jenkins NW086 Cert. No.
Certified Tech: Rick Loschen CI813 Cert. No.

Distribution: ____ Central Materials ____ Dist. Materials ____ Proj. Engineer ____ Contractor ____ Plant

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DAILY HMA PLANT REPORT

Project No.: NHSN-30-1(127)--2R-43
Contract ID: 43-0301-127
Mix Design No.: ABD10-3019R1

Contractor: Manatt's Inc
County: Harrison/Crawford
Recycle Source: ABC0-051

JMF VMA: 15.1
Size: 1/2
Mix Type: HMA 3M

Report No.: 2
Lab Voids Target: 4.0
Design Gyrations: 86

Hot Box I.D. No.:		INT0713A	INT0713B	INT0713C	INT0713D	Dist. Lab
Date Sampled:		07/13/10	07/13/10	07/13/10	07/13/10	Results
Gradation ID:	Specs					
1 in. (25mm) Sieve	100	100				
3/4 in. (19mm) Sieve	100	100				
1/2 in. (12.5mm) Sieve	89-100(96)	93				
3/8 in. (9.5mm) Sieve	77-91(84)	81				
* #4 (4.75mm) Sieve	60-74(67)	67				
* Moving Average						
* #8 (2.36mm) Sieve	48-58(53)	54				
* Moving Average						
#16 (1.18mm) Sieve		39				
* #30 (600um) Sieve	18-26(22)	21				
* Moving Average						
#50 (300um) Sieve		9.5				
#100 (150um) Sieve		5				
* #200 (75um) Sieve	1.5-5.5(3.5)	3.8				
* Moving Average						
Compliance (Y/N)						
Intended Added, % Binder	4.40		% Binder from RAP			
Actual Added, % Binder		4.63	19.16%			
Intended Total, % Binder	5.50		Actual % RAP			
Actual Total, % Binder	5.20-5.80	5.73	19.55%			
Gmb:		2.352	2.350	2.354	2.350	
Gmm:		2.445	2.444	2.446	2.454	
Pa:		3.8	3.8	3.8	4.2	
Moving Average	3.5-5.0		3.9	3.9	3.9	
Time		8:45 AM	10:15 AM	12:20 PM	2:50 PM	This
Station		20+00	40+00	68+00	109+00	Column
Side		EBL	EBL	EBL	EBL	Is For
Sample Tons		326.00	825.00	1,472.00	2,327.00	Dist. Lab
Sublot Tons		500.00	833.33	833.33	1,200.09	Test
Tons to Date						Results
Fines / Bitumen Ratio	0.6-1.4	0.74				

Gsb: 2.627 Gb: 1.0284 Effective % Binder (Pbe): 5.13
Tons of Mix for Pay: 3366.75 Tons of Binder for Pay: 192.63

Mix Change Information: % binder in rap over 20% took 1% of rap out and added 1%of man san

Distribution: ____ Central Materials ____ Dist. Materials ____ Proj. Engineer ____ Contractor ____ Plant

Time	7:00	9:00	11:00	1:00	3:00	5:00	7:00
Air Temp. °F	82	82	84	87	89	87	
Binder Temp. °F	300	300	300	300	300	300	
Mix Temp. °F	300	300	300	300	300	300	
Mat Temp. °F							

From Station	To Station	Lane

Placement And Density Record

Date Placed: 07/13/10
Date Tested:
Course Placed: Intermediate
Intended Lift Thickness: 2.0
Tested By: Ed Launderville

Core No.:	1	2	3	4	5	6	7
Station	106+74	107+86	109+54				
CL Reference	8'	11'	1'				
W 1 Dry	2,603.4	2,466.4	2,406.2				
W 2 in H20	1,489.5	1,406.0	1,356.4				
W 3 Wet	2,604.3	2,467.0	2,407.0				
Difference	1,114.8	1,061.0	1,050.6				
Field Density	2.335	2.325	2.290				
% Density	99.277	98.852	97.364				
% Voids	4.6	5.0	6.4				
Thickness (in.)	2.72	2.57	2.53				

Gmb (Lot Avg.): **2.352**
Gmm (Lot Avg.): **2.447**
Pa (Lot Avg.): **3.9**
Target % RAP: **19.0**

Avg. Field Density:
Avg. % Density:
Avg. % Field Voids:
Specified % Density: 95

Q.I. = ____ -- (0.95 x 2.352) = ____

Low Outlier: ____ High Outlier: ____ New Q.I. = -1.76

Film Thickness (FT): **10.7** (8.0-15.0) VMA: **15.6** (14.1-16.1) D.O.T. Results Used: ☐

Remarks:

Certified Tech: Jeff Jenkins NW086 Cert. No.
Certified Tech: Rick Loschen CI813 Cert. No.

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DAILY HMA PLANT REPORT

Project No.: NHSN-30-1(127)--2R-43
Contract ID: 43-0301-127
Mix Design No.: ABD10-3019R1

Contractor: Manatt's Inc
County: Harrison/Crawford
Recycle Source: ABC0-051

JMF VMA: 15.1
Size: 1/2
Mix Type: HMA 3M

Report No.: 3
Lab Voids Target: 4.0
Design Gyrations: 86

Hot Box I.D. No.:		INT0714A	INT0714B	INT0714C	INT0714D	Dist. Lab
Date Sampled:		07/14/10	07/14/10	07/14/10	07/14/10	Results
Gradation ID:	Specs					boxA
1 in. (25mm) Sieve	100	100				
3/4 in. (19mm) Sieve	100	100				
1/2 in. (12.5mm) Sieve	89-100(96)	95				
3/8 in. (9.5mm) Sieve	77-91(84)	84				
* #4 (4.75mm) Sieve	60-74(67)	66				
* Moving Average						
* #8 (2.36mm) Sieve	48-58(53)	53				
* Moving Average						
#16 (1.18mm) Sieve		39				
* #30 (600um) Sieve	18-26(22)	23				
* Moving Average						
#50 (300um) Sieve		9.9				
#100 (150um) Sieve		5.1				
* #200 (75um) Sieve	1.5-5.5(3.5)	4.0				
* Moving Average						
Compliance (Y/N)		y				
Intended Added, % Binder	4.40		% Binder from RAP			
Actual Added, % Binder		4.54	19.34%			
Intended Total, % Binder	5.50		Actual % RAP			
Actual Total, % Binder	5.20-5.80	5.63	19.40%			
Gmb:		2.341	2.348	2.349	2.346	2.342
Gmm:		2.444	2.452	2.444	2.449	2.444
Pa:		4.2	4.2	3.9	4.2	4.2
Moving Average	3.5-5.0	4.0	4.1	4.1	4.1	
Time		7:45 AM	9:15 AM	11:30 AM	12:50 PM	This
Station		14+00	34+00	78+00	100+00	Column
Side		WBL	WBL	WBL	WBL	Is For
Sample Tons		253.00	758.00	1,588.00	2,050.00	Dist. Lab
Sublot Tons		500.00	566.67	566.67	579.31	Test
Tons to Date					5,579.40	Results
Fines / Bitumen Ratio	0.6-1.4	0.79				

Gsb: 2.627 Gb: 1.0284 Effective % Binder (Pbe): 5.09
Tons of Mix for Pay: 2212.65 Tons of Binder for Pay: 124.58

Mix Change Information:

Time	7:00	9:00	11:00	1:00	3:00	5:00	7:00
Air Temp. °F	81	84	87	89			
Binder Temp. °F	300	300	300	300			
Mix Temp. °F	300	300	300	300			
Mat Temp. °F	295	290	290	295			

From Station	To Station	Lane
3+75	106+00	LT

Placement And Density Record

Date Placed: 07/14/10
Date Tested: 07/15/10
Course Placed: Intermediate
Intended Lift Thickness: 2.0
Tested By: Ed Launderville

Core No.:	1	2	3	4	5	6	7
Station	14+25	26+54	47+72	52+72	60+43	77+79	101+71
CL Reference	8.7	8.8	10.5	3	7.9	6.9	5.5
W 1 Dry	2,925.3	2,359.0	2,145.6	2,720.7	2,805.9	2,272.8	2,414.8
W 2 in H20	1,672.3	1,332.1	1,226.5	1,550.7	1,605.1	1,294.2	1,380.2
W 3 Wet	2,926.2	2,360.1	2,146.4	2,721.8	2,806.8	2,273.6	2,415.6
Difference	1,253.9	1,028.0	919.9	1,171.1	1,201.7	979.4	1,035.4
Field Density	2.333	2.295	2.332	2.323	2.335	2.321	2.332
% Density	99.446	97.826	99.403	99.020	99.531	98.934	99.403
% Voids	4.7	6.2	4.7	5.1	4.6	5.1	4.7
Thickness (in.)	3.08	2.52	2.35	2.86	2.97	2.48	2.60

Gmb (Lot Avg.): **2.346**
Gmm (Lot Avg.): **2.447**
Pa (Lot Avg.): **4.1**
Target % RAP: **19.0**

Avg. Field Density: **2.324**
Avg. % Density: **99.080**
Avg. % Field Voids: **5.0**
Specified % Density: 95

Q.I. = 2.324 -- (0.95 x 2.346) / 0.014 = **6.81**

Low Outlier: ____ High Outlier: ____ New Q.I. = ____

Film Thickness (FT): **10.3** (8.0-15.0) VMA: **15.7** (14.1-16.1) D.O.T. Results Used: ☐

Remarks: paved shoulders will be added as waste
67.47 tons used for paved shoulders (waste)

This is to certify the material described herein meets the applicable specifications.

Certified Tech: Jeff Jenkins NW086 Cert. No.
Certified Tech: Rick Loschen CI813 Cert. No.

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DAILY HMA PLANT REPORT

Project No.: NHSN-30-1(127)--2R-43
Contract ID: 43-0301-127
Mix Design No.: ABD10-3019R1

Contractor: Manatt's Inc
County: Harrison/Crawford
Recycle Source: ABC0-051

JMF VMA: 15.1
Size: 1/2
Mix Type: HMA 3M

Report No.: 3
Lab Voids Target: 4.0
Design Gyrations: 86

Hot Box I.D. No.:		INT0714A	INT0714B	INT0714C	INT0714D	Dist. Lab
Date Sampled:		07/14/10	07/14/10	07/14/10	07/14/10	Results
Gradation ID:	Specs					
1 in. (25mm) Sieve	100	100				
3/4 in. (19mm) Sieve	100	100				
1/2 in. (12.5mm) Sieve	89-100(96)	95				
3/8 in. (9.5mm) Sieve	77-91(84)	84				
* #4 (4.75mm) Sieve	60-74(67)	66				
* Moving Average						
* #8 (2.36mm) Sieve	48-58(53)	53				
* Moving Average						
#16 (1.18mm) Sieve		39				
* #30 (600um) Sieve	18-26(22)	23				
* Moving Average						
#50 (300um) Sieve		9.9				
#100 (150um) Sieve		5.1				
* #200 (75um) Sieve	1.5-5.5(3.5)	4.0				
* Moving Average						
Compliance (Y/N)						
Intended Added, % Binder	4.40		% Binder from RAP			
Actual Added, % Binder		4.54	19.34%			
Intended Total, % Binder	5.50		Actual % RAP			
Actual Total, % Binder	5.20-5.80	5.63	19.40%			
Gmb:		2.341	2.348	2.349	2.346	
Gmm:		2.444	2.452	2.444	2.449	
Pa:		4.2	4.2	3.9	4.2	
Moving Average	3.5-5.0	4.0	4.1	4.1		
Time		7:45 AM	9:15 AM	11:30 AM	12:50 PM	This
Station		14+00	34+00	78+00	100+00	Column
Side		WBL	WBL	WBL	WBL	Is For
Sample Tons		253.00	758.00	1,588.00	2,050.00	Dist. Lab
Sublot Tons		500.00	566.67	566.67	652.78	Test
Tons to Date						Results
Fines / Bitumen Ratio	0.6-1.4	0.79				

Gsb: 2.627 Gb: 1.0284 Effective % Binder (Pbe): 5.09
Tons of Mix for Pay: 2286.12 Tons of Binder for Pay: 128.71

Mix Change Information:

Time	7:00	9:00	11:00	1:00	3:00	5:00	7:00
Air Temp. °F	81	85	89	90			
Binder Temp. °F	300	300	300	300			
Mix Temp. °F	300	300	300	300			
Mat Temp. °F							

From Station	To Station	Lane
3+75	106+00	LT

Placement And Density Record

Date Placed: 07/14/10
Date Tested: 07/15/10
Course Placed: Intermediate
Intended Lift Thickness: 2.0
Tested By: Ed Launderville

Core No.:	1	2	3	4	5	6	7
Station	103+84	104+61	105+46				
CL Reference	4.2	8.6	15				
W 1 Dry	2,475.6	2,401.9	2,084.9				
W 2 in H2O	1,415.0	1,375.8	1,165.5				
W 3 Wet	2,476.5	2,402.9	2,086.1				
Difference	1,061.5	1,027.1	920.6				
Field Density	2.332	2.339	2.265				
% Density	99.403	99.702	96.547				
% Voids	4.7	4.4	7.4				
Thickness (in.)	2.60	2.57	2.35				

Gmb (Lot Avg.): 2.346 Avg. Field Density:
Gmm (Lot Avg.): 2.447 Avg. % Density:
Pa (Lot Avg.): 4.1 Avg. % Field Voids:
Target % RAP: 19.0 Specified % Density: 95

Q.I. = – (0.95 x 2.346) =

Low Outlier: High Outlier: New Q.I. = -1.76

Film Thickness (FT): 10.3 (8.0-15.0) VMA: 15.7 (14.1-16.1) D.O.T. Results Used:

Remarks: paved shoulders will be added as waste

Certified Tech: Jeff Jenkins NW086 Cert. No.
Certified Tech: Rick Loschen CI813 Cert. No.

Distribution: ____ Central Materials ____ Dist. Materials ____ Proj. Engineer ____ Contractor ____ Plant

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DAILY HMA PLANT REPORT

Project No.: NHSN-30-1(127)--2R-43
Contract ID: 43-0301-127
Mix Design No.: ABD10-3019R1

Contractor: Manatt's Inc
County: Harrison/Crawford
Recycle Source: ABC0-051

JMF VMA: 15.1
Size: 1/2
Mix Type: HMA 3M

Report No.: 4
Lab Voids Target: 4.0
Design Gyrations: 86

Hot Box I.D. No.:		sur0715a	sur0715b	sur0715c	sur0715d	Dist. Lab
Date Sampled:		07/15/10	07/15/10	07/15/10	07/15/10	Results
Gradation ID:	Specs					
1 in. (25mm) Sieve	100	100				D
3/4 in. (19mm) Sieve	100	100				
1/2 in. (12.5mm) Sieve	89-100(96)	95				
3/8 in. (9.5mm) Sieve	77-91(84)	83				
* #4 (4.75mm) Sieve	60-74(67)	67				
* Moving Average		68				
* #8 (2.36mm) Sieve	48-58(53)	55				
* Moving Average		55				
#16 (1.18mm) Sieve		39				
* #30 (600um) Sieve	18-26(22)	23				
* Moving Average		23				
#50 (300um) Sieve		9.4				
#100 (150um) Sieve		4.8				
* #200 (75um) Sieve	1.5-5.5(3.5)	3.8				
* Moving Average		3.9				
Compliance (Y/N)		y				
Intended Added, % Binder	4.40		% Binder from RAP			
Actual Added, % Binder		4.51	19.29%			
Intended Total, % Binder	5.50		Actual % RAP			
Actual Total, % Binder	5.20-5.80	5.59	19.18%			
Gmb:		2.354	2.344	2.348	2.339	2.350
Gmm:		2.446	2.447	2.448	2.446	2.449
Pa:		3.8	4.2	4.1	4.4	4.0
Moving Average	3.5-5.0	4.0	4.0	4.0	4.1	
Time		8:00 AM	9:45 AM	1:30 PM	4:00 PM	This
Station		118+00	825+00	154+00	204+00	Column
Side		wbl	wbl	ebl	ebl	Is For
Sample Tons		236.00	825.00	1,639.00	2,431.00	Dist. Lab
Sublot Tons		500.00			2,600.21	Test
Tons to Date					8,679.61	Results
Fines / Bitumen Ratio	0.6-1.4	0.75				

Gsb: 2.627 Gb: 1.0360 Effective % Binder (Pbe): 5.10
Tons of Mix for Pay: 3100.21 Tons of Binder for Pay: 173.04

Mix Change Information:

Time	7:00	9:00	11:00	1:00	3:00	5:00	7:00
Air Temp. °F	65	73	78	81	79	77	
Binder Temp. °F	300	300	300	300	300	300	
Mix Temp. °F	300	300	300	300	300	300	
Mat Temp. °F	290	290	285	285	290	290	

From Station	To Station	Lane
106+00	161+59	WBL
155+00	161+59	EBL
165+78	184+00	WBL
165+78	236+26	EBL

Placement And Density Record

Date Placed: 07/15/10
Date Tested: 07/16/10
Course Placed: Intermediate
Intended Lift Thickness: 2.00
Tested By: Ross Wood

Core No.:	1	2	3	4	5	6	7
Station	111+40	149+22	158+28	158+58	170+29	186+79	206+22
CL Reference	1.7 RT	1.8 RT	4.6 RT	1.1 RT	9.0 RT	1.3 RT	5.3 RT
W 1 Dry	1,841.6	1,914.9	2,251.7	2,317.2	2,330.2	1,852.5	1,928.7
W 2 in H2O	1,050.9	1,091.7	1,296.4	1,325.3	1,331.2	1,054.1	1,091.6
W 3 Wet	1,842.8	1,916.3	2,252.8	2,318.4	2,331.2	1,853.8	1,930.1
Difference	791.9	824.6	956.4	993.1	1,000.0	799.7	838.5
Field Density	2.326	2.322	2.354	2.333	2.330	2.316	2.300
% Density	99.147	98.977	100.341	99.446	99.318	98.721	98.039
% Voids	4.9	5.1	3.8	4.7	4.8	5.4	6.0
Thickness (in.)	2.03	2.05	2.35	2.46	2.47	2.08	2.07

Gmb (Lot Avg.): 2.346 Avg. Field Density: 2.326
Gmm (Lot Avg.): 2.447 Avg. % Density: 99.141
Pa (Lot Avg.): 4.1 Avg. % Field Voids: 4.9
Target % RAP: 19.0 Specified % Density: 95

Q.I. = 2.326 – (0.95 x 2.346) = 5.72
0.017

Low Outlier: High Outlier: New Q.I. =

Film Thickness (FT): 10.5 (8.0-15.0) VMA: 15.7 (14.1-16.1) D.O.T. Results Used:

Remarks: This is to certify the matterial described herein meets the applicable specifications.

paved shoulders=153.69 to date=221.16

Certified Tech: Jeff Jenkins NW086 Cert. No.
Certified Tech: Rick Loschen CI813 Cert. No.

Distribution: ____ Central Materials ____ Dist. Materials ____ Proj. Engineer ____ Contractor ____ Plant

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DAILY HMA PLANT REPORT

Project No.: NHSN-30-1(127)--2R-43
Contract ID: 43-0301-127
Mix Design No.: ABD10-3019R1

Contractor: Manatt's Inc
County: Harrison/Crawford
Recycle Source: ABC0-051

JMF VMA: 15.1
Size: 1/2
Mix Type: HMA 3M

Report No.: 4
Lab Voids Target: 4.0
Design Gyrations: 86

Hot Box I.D. No.:		sur0715a	sur0715b	sur0715c	sur0715d	Dist. Lab
Date Sampled:		07/15/10	07/15/10	07/15/10	07/15/10	Results
Gradation ID:	Specs					
1 in. (25mm) Sieve	100	100				
3/4 in. (19mm) Sieve	100	100				
1/2 in. (12.5mm) Sieve	89-100(96)	95				
3/8 in. (9.5mm) Sieve	77-91(84)	83				
* #4 (4.75mm) Sieve	60-74(67)	67				
* Moving Average						
* #8 (2.36mm) Sieve	48-58(53)	55				
* Moving Average						
#16 (1.18mm) Sieve		39				
* #30 (600um) Sieve	18-26(22)	23				
* Moving Average						
#50 (300um) Sieve		9.4				
#100 (150um) Sieve		4.8				
* #200 (75um) Sieve	1.5-5.5(3.5)	3.8				
* Moving Average						
Compliance (Y/N)		y				
Intended Added, % Binder	4.40		% Binder from RAP			
Actual Added, % Binder		4.51	19.29%			
Intended Total, % Binder	5.50		Actual % RAP			
Actual Total, % Binder	5.20-5.80	5.59	19.18%			
Gmb:		2.354	2.344	2.348	2.339	
Gmm:		2.446	2.447	2.448	2.446	
Pa:		3.8	4.2	4.1	4.4	
Moving Average	3.5-5.0	**4.0**	**4.0**	**4.0**	**4.1**	
Time		8:00 AM	9:45 AM	1:30 PM	4:00 PM	This
Station		118+00	825+00	154+00	204+00	Column
Side		wbl	wbl	ebl	ebl	Is For
Sample Tons		236.00	825.00	1,639.00	2,431.00	Dist. Lab
Sublot Tons		500.00			2,770.90	Test
Tons to Date						Results
Fines / Bitumen Ratio	0.6-1.4	0.75				

Gsb: 2.627 Gb: 1.0360 Effective % Binder (Pbe): 5.10
Tons of Mix for Pay: 3270.90 Tons of Binder for Pay: 182.58

Mix Change Information:

Distribution: ____ Central Materials ____ Dist. Materials ____ Proj. Engineer ____ Contractor ____ Plant

Time	7:00	9:00	11:00	1:00	3:00	5:00	7:00
Air Temp. °F	65	73	78	81	79	77	
Binder Temp. °F	300	300	300	300	300	300	
Mix Temp. °F	300	300	300	300	300	300	
Mat Temp. °F							

From Station	To Station	Lane

Placement And Density Record

Date Placed: 07/15/10
Date Tested:
Course Placed: Intermediate
Intended Lift Thickness: 2.0
Tested By:

Core No.:	1	2	3	4	5	6	7
Station							
CL Reference	A	B	C				
W 1 Dry	1,862.4	1,965.7	1,859.7				
W 2 in H20	1,058.7	1,123.4	1,040.5				
W 3 Wet	1,863.5	1,966.9	1,860.8				
Difference	804.8	843.5	820.3				
Field Density	2.314	2.330	2.267				
% Density	98.636	99.318	96.633				
% Voids	5.4	4.8	7.4				
Thickness (in.)	2.00	2.08	2.05				

Gmb (Lot Avg.): **2.346** Avg. Field Density:
Gmm (Lot Avg.): **2.447** Avg. % Density:
Pa (Lot Avg.): **4.1** Avg. % Field Voids:
Target % RAP: **19.0** Specified % Density: 95

Q.I. = ____ -- (0.95 x 2.346) = ____

Low Outlier: ____ High Outlier: ____ New Q.I. = **-1.77**

Film Thickness (FT): **10.5** (8.0-15.0) VMA: **15.7** (14.1-16.1) D.O.T. Results Used: ☐

Remarks:

Certified Tech: Jeff Jenkins NW086 Cert. No.
Certified Tech: Rick Loschen CI813 Cert. No.

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DAILY HMA PLANT REPORT

Project No.: NHSN-30-1(127)--2R-43
Contract ID: 43-0301-127
Mix Design No.: ABD10-3019R1

Contractor: Manatt's Inc
County: Harrison/Crawford
Recycle Source: ABC0-051

JMF VMA: 15.1
Size: 1/2
Mix Type: HMA 3M

Report No.: 5
Lab Voids Target: 4.0
Design Gyrations: 86

Hot Box I.D. No.:		INT0716A	INT0716B	INT0716C	INT0716D	Dist. Lab
Date Sampled:		07/16/10	07/16/10	07/16/10	07/16/10	Results
Gradation ID:	Specs	CF0716A				
1 in. (25mm) Sieve	100	100				
3/4 in. (19mm) Sieve	100	100				
1/2 in. (12.5mm) Sieve	89-100(96)	93				
3/8 in. (9.5mm) Sieve	77-91(84)	85				
* #4 (4.75mm) Sieve	60-74(67)	68				
* Moving Average		**67**				
* #8 (2.36mm) Sieve	48-58(53)	55				
* Moving Average		**54**				
#16 (1.18mm) Sieve		41				
* #30 (600um) Sieve	18-26(22)	24				
* Moving Average		**23**				
#50 (300um) Sieve		10				
#100 (150um) Sieve		5.1				
* #200 (75um) Sieve	1.5-5.5(3.5)	4.0				
* Moving Average		**3.9**				
Compliance (Y/N)		Y				
Intended Added, % Binder	4.40		% Binder from RAP			
Actual Added, % Binder		4.51	19.48%			
Intended Total, % Binder	5.50		Actual % RAP			
Actual Total, % Binder	5.20-5.80	5.60	19.43%			
Gmb:		2.333	2.339	2.337	2.317	
Gmm:		2.442	2.447	2.450	2.433	
Pa:		4.5	4.4	4.6	4.8	
Moving Average	3.5-5.0	**4.2**	**4.3**	**4.5**	**4.6**	
Time		8:40 AM	10:15 AM	12:05 PM	2:05 PM	This
Station		200+00	233+00	256+00	290+00	Column
Side		WBL	WBL	WBL	WBL	Is For
Sample Tons		354.00	868.00	1,440.00	2,105.00	Dist. Lab
Sublot Tons		500.00	833.33	833.33	846.11	Test
Tons to Date					11,692.38	Results
Fines / Bitumen Ratio	0.6-1.4	0.77				

Gsb: 2.627 Gb: 1.0360 Effective % Binder (Pbe): 5.18
Tons of Mix for Pay: 3012.77 Tons of Binder for Pay: 168.77

Mix Change Information:

Distribution: ____ Central Materials ____ Dist. Materials ____ Proj. Engineer ____ Contractor ____ Plant

Time	7:00	9:00	11:00	1:00	3:00	5:00	7:00
Air Temp. °F	65	72	80	85	87		
Binder Temp. °F	300	300	300	300	297		
Mix Temp. °F	300	300	300	300	292		
Mat Temp. °F	290	290	285	280	285		

From Station	To Station	Lane
184+00	236+26	WBL
239+59	291+22	WBL
296+84	342+00	WBL

Placement And Density Record

Date Placed: 07/16/10
Date Tested: 07/20/10
Course Placed: Intermediate
Intended Lift Thickness: 2.0
Tested By: Ed Launderville

Core No.:	1	2	3	4	5	6	7
Station	198+15	210+33	219+79	260+07	273+57	316+85	328+60
CL Reference	1.4 LT	10.0 LT	2.7 LT	6.2 LT	10.1 LT	7.9 LT	7.4 LT
W 1 Dry	1,892.7	1,805.7	1,681.1	1,621.2	1,657.9	2,110.4	2,018.0
W 2 in H20	1,072.8	1,025.8	957.0	927.7	947.5	1,210.7	1,163.0
W 3 Wet	1,893.7	1,806.8	1,682.3	1,622.2	1,658.7	2,111.0	2,018.7
Difference	820.9	781.0	725.3	694.5	711.2	900.3	855.7
Field Density	2.306	2.312	2.318	2.334	2.331	2.344	2.358
% Density	98.885	99.142	99.400	100.086	99.957	100.515	101.115
% Voids	5.6	5.4	5.1	4.5	4.6	4.1	3.5
Thickness (in.)	1.99	1.98	1.95	1.82	1.79	2.10	2.12

Gmb (Lot Avg.): **2.332** Avg. Field Density: **2.329**
Gmm (Lot Avg.): **2.443** Avg. % Density: **99.871**
Pa (Lot Avg.): **4.6** Avg. % Field Voids: **4.7**
Target % RAP: **19.0** Specified % Density: 95

Q.I. = 2.329 -- (0.95 x 2.332) = **6.31**
0.018

Low Outlier: ____ High Outlier: ____ New Q.I. = ____

Film Thickness (FT): **10.3** (8.0-15.0) VMA: **16.2** (14.1-16.1) D.O.T. Results Used: ☐

Remarks: This is to certify material described herein meets the applicable specification:

Certified Tech: Jeff Jenkins NW086 Cert. No.
Certified Tech: Rick Loschen CI813 Cert. No.

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DAILY HMA PLANT REPORT

Project No.: NHSN-30-1(127)--2R-43
Contract ID: 43-0301-127
Mix Design No.: ABD10-3019R1

Contractor: Manatt's Inc
County: Harrison/Crawford
Recycle Source: ABC0-051

JMF VMA: 15.1
Size: 1/2
Mix Type: HMA 3M

Report No.: 5
Lab Voids Target: 4.0
Design Gyrations: 86

Hot Box I.D. No.:		INT0716A	INT0716B	INT0716C	INT0716D	Dist. Lab
Date Sampled:		07/16/10	07/16/10	07/16/10	07/16/10	Results
Gradation ID:	Specs	CF0716A				
1 in. (25mm) Sieve	100	100				
3/4 in. (19mm) Sieve	100	100				
1/2 in. (12.5mm) Sieve	89-100(96)	93				
3/8 in. (9.5mm) Sieve	77-91(84)	85				
* #4 (4.75mm) Sieve	60-74(67)	68				
* Moving Average						
* #8 (2.36mm) Sieve	48-58(53)	55				
* Moving Average						
#16 (1.18mm) Sieve		41				
* #30 (600um) Sieve	18-26(22)	24				
* Moving Average						
#50 (300um) Sieve		10				
#100 (150um) Sieve		5.1				
* #200 (75um) Sieve	1.5-5.5(3.5)	4.0				
* Moving Average						
Compliance (Y/N)						
Intended Added, % Binder	4.40		% Binder from RAP			
Actual Added, % Binder		4.51	19.48%			
Intended Total, % Binder	5.50		Actual % RAP			
Actual Total, % Binder	5.20-5.80	5.60	19.43%			
Gmb:		2.333	2.339	2.337	2.317	
Gmm:		2.442	2.447	2.450	2.433	
Pa:		4.5	4.4	4.6	4.8	
Moving Average	3.5-5.0	**4.2**	**4.3**	**4.5**		
Time		8:40 AM	10:15 AM	12:05 PM	2:05 PM	This
Station		200+00	233+00	256+00	290+00	Column
Side		WBL	WBL	WBL	WBL	Is For
Sample Tons		354.00	868.00	1,440.00	2,105.00	Dist. Lab
Sublot Tons		500.00	833.33	833.33	846.11	Test
Tons to Date						Results
Fines / Bitumen Ratio	0.6-1.4	0.77				

Time	7:00	9:00	11:00	1:00	3:00	5:00	7:00
Air Temp. °F	65	72	80	85			
Binder Temp. °F	300	300	300	300			
Mix Temp. °F	300	300	300	300			
Mat Temp. °F							

From Station	To Station	Lane

Placement And Density Record

Date Placed: 07/16/10
Date Tested:
Course Placed: Intermediate
Intended Lift Thickness: 2.0
Tested By:

Core No.:	1	2	3	4	5	6	7
Station	320+00	310+00	280+00				
CL Reference	11.0 LT	5.0 LT	9.0 LT				
W 1 Dry	2,159.2	1,613.4	1,533.7				
W 2 in H20	1,250.0	923.0	871.3				
W 3 Wet	2,159.8	1,614.2	1,534.6				
Difference	909.8	691.2	663.3				
Field Density	2.373	2.334	2.312				
% Density	101.758	100.086	99.142				
% Voids	2.9	4.5	5.4				
Thickness (in.)	2.20	1.75	1.75				

Gmb (Lot Avg.): **2.332**
Gmm (Lot Avg.): **2.443**
Pa (Lot Avg.): **4.6**
Target % RAP: **19.0**

Avg. Field Density:
Avg. % Density:
Avg. % Field Voids:
Specified % Density: 95

Q.I. = -- (0.95 x 2.332) =

Low Outlier: High Outlier: New Q.I. = **-1.73**

Film Thickness (FT): **10.3** (8.0-15.0) VMA: **16.2** (14.1-16.1) D.O.T. Results Used:

Remarks: This is to certify material described herein meets the applicable specification:

Gsb: 2.627 Gb: 1.0360 Effective % Binder (Pbe): 5.18
Tons of Mix for Pay: 3012.77 Tons of Binder for Pay: 168.77

Mix Change Information:

Certified Tech: Jeff Jenkins NW086 Cert. No.
Certified Tech: Rick Loschen CI813 Cert. No.

Distribution: ____ Central Materials ____ Dist. Materials ____ Proj. Engineer ____ Contractor ____ Plant

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DAILY HMA PLANT REPORT

Project No.: NHSN-030-1(127)--2R-43
Contract ID: 43-0301-127
Mix Design No.: ABD10-3020

Contractor: Manatt's Inc
County: Harrison
Recycle Source: ABC0-051

JMF VMA: 14.1
Size: 1/2
Mix Type: HMA 3M

Report No.: 1
Lab Voids Target: 4.0
Design Gyrations: 86

Hot Box I.D. No.:		SUR0720A	SUR0720B			Dist. Lab
Date Sampled:		07/20/10	07/20/10			Results
Gradation ID:	Specs	0720A				SUR0720B
1 in. (25mm) Sieve	100	100				
3/4 in. (19mm) Sieve	100	100				
1/2 in. (12.5mm) Sieve	89-100(96)	93				
3/8 in. (9.5mm) Sieve	78-92(85)	83				
* #4 (4.75mm) Sieve	61-75(68)	69				
* Moving Average						
* #8 (2.36mm) Sieve	45-55(50)	53				
* Moving Average						
#16 (1.18mm) Sieve		37				
* #30 (600um) Sieve	16-24(20)	23				
* Moving Average						
#50 (300um) Sieve		11				
#100 (150um) Sieve		6.4				
* #200 (75um) Sieve	1.7-5.7(3.7)	5.0				
* Moving Average						
Compliance (Y/N)		Y				
Intended Added, % Binder	4.30		% Binder from RAP			
Actual Added, % Binder		4.38	21.00%			
Intended Total, % Binder	5.40		Actual % RAP			
Actual Total, % Binder	5.10-5.70	5.54	20.71%			
Gmb:		2.366	2.362			2.374
Gmm:		2.446	2.454			2.457
Pa:		3.3	3.7			3.3
Moving Average	3.5-5.0					
Time		8:35 AM	10:00 AM			This
Station		253+00	268+00			Column
Side		EBL	EBL			Is For
Sample Tons		274.00	590.00			Dist. Lab
Sublot Tons		500.00	121.24			Test
Tons to Date			12,313.62			Results
Fines / Bitumen Ratio	.60-1.40	1.01				

Time	7:00	9:00	11:00	1:00	3:00	5:00	7:00
Air Temp. °F	69	73	RAIN				
Binder Temp. °F	300	300	OUT..				
Mix Temp. °F	300	300					
Mat Temp. °F	285	290					

From Station	To Station	Lane
239+48	268+70	EBL

Placement And Density Record

Date Placed: 07/20/10
Date Tested: 07/21/10
Course Placed: Surface
Intended Lift Thickness: 2.00
Tested By: Ed launderville

Core No.:	1	2	3	4	5	6	7
Station	242+86	244+40	265+99	253+21	256+88	261+20	263+84
CL Reference	4.3 RT	10.8 RT	9.7 RT	10.1 RT	2.4 RT	8.7 RT	9.9 RT
W 1 Dry	1,885.8	1,536.8	1,930.7	2,369.6	1,786.6	1,986.5	2,368.9
W 2 in H20	1,070.7	879.3	1,099.4	1,353.9	1,018.0	1,122.1	1,348.3
W 3 Wet	1,886.8	1,537.6	1,931.1	2,370.5	1,787.7	1,987.2	2,369.6
Difference	816.1	658.3	831.7	1,016.6	769.7	865.1	1,021.3
Field Density	2.311	2.334	2.321	2.331	2.321	2.296	2.319
% Density	97.758	98.731	98.181	98.604	98.181	97.124	98.096
% Voids	5.7	4.7	5.3	4.9	5.3	6.3	5.3
Thickness (in.)	2.10	1.68	2.10	2.53	1.95	2.25	2.62

Gmb (Lot Avg.): **2.364**
Gmm (Lot Avg.): **2.450**
Pa (Lot Avg.): **3.5**
Target %-RAP: **19.0**

Avg. Field Density: **2.319**
Avg. % Density: **98.096**
Avg. % Field Voids: **5.3**
Specified % Density: 95

Q.I. = 2.319 -- (0.95 x 2.364) = **5.63**
0.013

Low Outlier: High Outlier: New Q.I. =

Film Thickness (FT): **9.0** (8.0-15.0) VMA: **14.8** (13.1-15.1) D.O.T. Results Used:

Remarks: This is to certify material described herein meets the applicable specifications
SURFACE TEST STRIP layed in intermediate payed as surface
Core #3 was replaced by core# 8......

Gsb: 2.621 Gb: 1.0360 Effective % Binder (Pbe): 4.95
Tons of Mix for Pay: 621.24 Tons of Binder for Pay: 34.44

Mix Change Information:

Certified Tech: Jeff Jenkins NW086 Cert. No.
Certified Tech: Rick Loschen CI813 Cert. No.

Distribution: ____ Central Materials ____ Dist. Materials ____ Proj. Engineer ____ Contractor ____ Plant

800241 - 10/08 ver. 3.5

DAILY HMA PLANT REPORT

Project No.: NHSN-30-1(127)--2R-43
Contract ID: 43-0301-127
Mix Design No.: ABD10-3019R1

Contractor: Manatt's Inc
County: Harrison/Crawford
Recycle Source: ABC0-051

JMF VMA: 15.1
Size: 1/2
Mix Type: HMA 3M

Report No.: 6
Lab Voids Target: 4.0
Design Gyrations: 86

Hot Box I.D. No.:		INT0721A	INT0721B	INT0721C	INT0721D	Dist. Lab
Date Sampled:		07/21/10	07/21/10	07/21/10	07/21/10	Results
Gradation ID:	Specs					
1 in. (25mm) Sieve	100	100				
3/4 in. (19mm) Sieve	100	100				
1/2 in. (12.5mm) Sieve	89-100(96)	95				
3/8 in. (9.5mm) Sieve	77-91(84)	86				
* #4 (4.75mm) Sieve	60-74(67)	70				
* Moving Average		68				
* #8 (2.36mm) Sieve	48-58(53)	56				
* Moving Average		55				
#16 (1.18mm) Sieve		42				
* #30 (600um) Sieve	18-26(22)	25				
* Moving Average		24				
#50 (300um) Sieve		10				
#100 (150um) Sieve		4.9				
* #200 (75um) Sieve	1.5-5.5(3.5)	3.8				
* Moving Average		3.9				
Compliance (Y/N)		Y				
Intended Added, % Binder	4.40		% Binder from RAP			
Actual Added, % Binder		4.57	19.27%			
Intended Total, % Binder	5.50		Actual % RAP			
Actual Total, % Binder	5.20-5.80	5.66	19.43%			
Gmb:		2.356	2.339	2.347	2.336	
Gmm:		2.456	2.445	2.448	2.445	
Pa:		4.1	4.3	4.1	4.5	
Moving Average	3.5-5.0	4.5	4.6	4.3	4.2	
Time		8:00 AM	9:30 AM	11:30 AM	1:45 PM	This
Station		274+00	315+00	349+00	382+50	Column
Side		EBL	EBL	EBL	EBL	Is For
Sample Tons		363.00	802.00	1,513.00	2,243.00	Dist. Lab
Sublot Tons		500.00	733.33	733.33	1,255.11	Test
Tons to Date					15,535.39	Results
Fines / Bitumen Ratio	0.6-1.4	0.75				

Gsb: 2.627 Gb: 1.0360 Effective % Binder (Pbe): 5.10
Tons of Mix for Pay: 3221.77 Tons of Binder for Pay: 182.27

Mix Change Information:

Distribution: ___ Central Materials ___ Dist. Materials ___ Proj. Engineer ___ Contractor ___ Plant

Time	7:00	9:00	11:00	1:00	3:00	5:00	7:00
Air Temp. °F	70	68	75	77	81		
Binder Temp. °F	300	298	300	299	300		
Mix Temp. °F	295	300	300	297	301		
Mat Temp. °F	285	280	275	275	280	285	

From Station	To Station	Lane
268+70	291+19	RT
296+80	431+13	RT

Placement And Density Record

Date Placed: 07/21/10
Date Tested: 07/22/10
Course Placed: Intermediate
Intended Lift Thickness: 2.00
Tested By: Ed Launderville

Core No.	1	2	3	4	5	6	7
Station	271+22	280+07	319+56	341+86	364+17	383+85	406+56
CL Reference	9.5 RT	8.3 RT	3.7 RT	5.5 RT	9.8 RT	9.1 RT	6.6 RT
W 1 Dry	1,744.3	1,522.3	2,112.6	1,879.0	1,997.4	1,748.5	2,006.9
W 2 in H20	989.3	867.4	1,205.8	1,065.9	1,129.2	993.7	1,131.5
W 3 Wet	1,745.0	1,523.5	2,113.4	1,880.1	1,998.2	1,749.3	2,008.1
Difference	755.7	656.1	907.6	814.2	869.0	755.6	876.6
Field Density	2.308	2.320	2.328	2.308	2.299	2.314	2.289
% Density	98.422	98.934	99.275	98.422	98.038	98.678	97.612
% Voids	5.8	5.3	4.9	5.8	6.1	5.5	6.5
Thickness (in.)	1.93	1.7	2.28	2.05	2.19	1.97	2.2

Gmb (Lot Avg.): 2.345
Gmm (Lot Avg.): 2.449
Pa (Lot Avg.): 4.3
Target % RAP: 19.0

Avg. Field Density: 2.309
Avg. % Density: 98.483
Avg. % Field Voids: 5.7
Specified % Density: 95

Q.I. = 2.309 -- (0.95 x 2.345) = 6.25
0.013

Low Outlier: ______ High Outlier: ______ New Q.I. = ______

Film Thickness (FT): 10.1 (8.0-15.0) VMA: 15.8 (14.1-16.1) D.O.T. Results Used: [ ]

Remarks: This is to certify material described herein meets the applicable specifications

Certified Tech: Jeff Jenkins NW086 Cert. No.
Certified Tech: Rick Loschen CI813 Cert. No.

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DAILY HMA PLANT REPORT

Project No.: NHSN-30-1(127)--2R-43
Contract ID: 43-0301-127
Mix Design No.: ABD10-3019R1

Contractor: Manatt's Inc
County: Harrison/Crawford
Recycle Source: ABC0-051

JMF VMA: 15.1
Size: 1/2
Mix Type: HMA 3M

Report No.: 6
Lab Voids Target: 4.0
Design Gyrations: 86

Hot Box I.D. No.:		INT0721A	INT0721B	INT0721C	INT0721D	Dist. Lab
Date Sampled:		07/21/10	07/21/10	07/21/10	07/21/10	Results
Gradation ID:	Specs					
1 in. (25mm) Sieve	100	100				
3/4 in. (19mm) Sieve	100	100				
1/2 in. (12.5mm) Sieve	89-100(96)	95				
3/8 in. (9.5mm) Sieve	77-91(84)	86				
* #4 (4.75mm) Sieve	60-74(67)	70				
* Moving Average		68				
* #8 (2.36mm) Sieve	48-58(53)	56				
* Moving Average		55				
#16 (1.18mm) Sieve		42				
* #30 (600um) Sieve	18-26(22)	25				
* Moving Average		24				
#50 (300um) Sieve		10				
#100 (150um) Sieve		4.9				
* #200 (75um) Sieve	1.5-5.5(3.5)	3.8				
* Moving Average		3.9				
Compliance (Y/N)		Y				
Intended Added, % Binder	4.40		% Binder from RAP			
Actual Added, % Binder		4.57	19.27%			
Intended Total, % Binder	5.50		Actual % RAP			
Actual Total, % Binder	5.20-5.80	5.66	19.43%			
Gmb:		2.356	2.339	2.347	2.336	
Gmm:		2.456	2.445	2.448	2.445	
Pa:		4.1	4.3	4.1	4.5	
Moving Average	3.5-5.0	4.5	4.6	4.3	4.2	
Time		8:00 AM	9:30 AM	11:30 AM	1:45 PM	This
Station		274+00	315+00	349+00	382+50	Column
Side		EBL	EBL	EBL	EBL	Is For
Sample Tons		363.00	802.00	1,513.00	2,243.00	Dist. Lab
Sublot Tons		500.00	733.33	733.33	1,255.11	Test
Tons to Date					15,535.39	Results
Fines / Bitumen Ratio	0.6-1.4	0.75				

Gsb: 2.627 Gb: 1.0360 Effective % Binder (Pbe): 5.10
Tons of Mix for Pay: 3221.77 Tons of Binder for Pay: 182.27

Mix Change Information:

Distribution: ___ Central Materials ___ Dist. Materials ___ Proj. Engineer ___ Contractor ___ Plant

Time	7:00	9:00	11:00	1:00	3:00	5:00	7:00
Air Temp. °F	70	68	75	77	81		
Binder Temp. °F	300	298	300	299	300		
Mix Temp. °F	295	300	300	297	301		
Mat Temp. °F							

From Station	To Station	Lane

Placement And Density Record

Date Placed: 07/21/10
Date Tested: 07/22/10
Course Placed: Intermediate
Intended Lift Thickness: 2.00
Tested By: Ed Launderville

Core No.	1	2	3	4	5	6	7
Station	360+00	400+00	400+00				
CL Reference	15' RT	3' RT	9' RT				
W 1 Dry	1,718.5	1,851.8	1,758.5				
W 2 in H20	953.5	1,047.8	998.6				
W 3 Wet	1,719.3	1,853.2	1,759.7				
Difference	765.8	805.4	761.1				
Field Density	2.244	2.299	2.310				
% Density	95.693	98.038	98.507				
% Voids	8.4	6.1	5.7				
Thickness (in.)	1.92	2.0	1.94				

Gmb (Lot Avg.): 2.345
Gmm (Lot Avg.): 2.449
Pa (Lot Avg.): 4.3
Target % RAP: 19.0

Avg. Field Density: ______
Avg. % Density: ______
Avg. % Field Voids: ______
Specified % Density: 95

Q.I. = ______ -- (0.95 x 2.345) = ______

Low Outlier: ______ High Outlier: ______ New Q.I. = -1.78

Film Thickness (FT): 10.1 (8.0-15.0) VMA: 15.8 (14.1-16.1) D.O.T. Results Used: [ ]

Remarks: This is to certify material described herein meets the applicable specifications

Certified Tech: Jeff Jenkins NW086 Cert. No.
Certified Tech: Rick Loschen CI813 Cert. No.

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DAILY HMA PLANT REPORT

Project No.: NHSN-30-1(127)--2R-43
Contract ID: 43-0301-127
Mix Design No.: ABD10-3019R1

Contractor: Manatt's Inc
County: Harrison/Crawford
Recycle Source: ABC0-051

JMF VMA: 15.1
Size: 1/2
Mix Type: HMA 3M

Report No.: 7
Lab Voids Target: 4.0
Design Gyrations: 86

Hot Box I.D. No.:		INT0722A	INT0722B	INT0722C		Dist. Lab
Date Sampled:		07/22/10	07/22/10	07/22/10		Results
Gradation ID:	Specs					INT0722A
1 in. (25mm) Sieve	100	100				
3/4 in. (19mm) Sieve	100	100				
1/2 in. (12.5mm) Sieve	89-100(96)	96				
3/8 in. (9.5mm) Sieve	77-91(84)	86				
* #4 (4.75mm) Sieve	60-74(67)	70				
* Moving Average		**72**				
* #8 (2.36mm) Sieve	48-58(53)	58				
* Moving Average		**55**				
#16 (1.18mm) Sieve		42				
* #30 (600um) Sieve	18-26(22)	25				
* Moving Average		**24**				
#50 (300um) Sieve		11				
#100 (150um) Sieve		5.6				
* #200 (75um) Sieve	1.5-5.5(3.5)	4.3				
* Moving Average		**4**				
Compliance (Y/N)		Y				
Intended Added, % Binder	4.40		% Binder from RAP			
Actual Added, % Binder		4.55	19.41%			
Intended Total, % Binder	5.50		Actual % RAP			
Actual Total, % Binder	5.20-5.80	5.65	19.52%			
Gmb:		2.355	2.345	2.358		2.362
Gmm:		2.441	2.447	2.447		2.44
Pa:		3.5	4.2	3.6		3.2
Moving Average	3.5-5.0	**4.0**	**4.0**	**4.0**		
Time		12:05 PM	1:40 PM	3:30 PM		This
Station		353+00	380+00	405+00		Column
Side		WBL	WBL	WBL		Is For
Sample Tons		265.00	767.00	1,310.00		Dist. Lab
Sublot Tons		500.00	750.00	564.39		Test
Tons to Date				17,349.78		Results
Fines / Bitumen Ratio	0.6-1.4	0.83				

Time	7:00	9:00	11:00	1:00	3:00	5:00	7:00
Air Temp. °F			83	86	88	88	
Binder Temp. °F			300	300	298	300	
Mix Temp. °F			301	298	301	300	
Mat Temp. °F			290	295	290	285	

From Station	To Station	Lane
342+00	432+13	LT

Placement And Density Record

Date Placed: 07/22/10
Date Tested: 07/23/10
Course Placed: Intermediate
Intended Lift Thickness: 2.00
Tested By: Ed launderville

Core No.:	1	2	3	4	5	6	7
Station	352+49	362+49	376+66	388+40	404+69	409+03	423+89
CL Reference	8.8LT	3.6LT	3.9LT	1.3LT	3.8LT	7.2LT	7.7LT
W 1 Dry	1,616.2	1,514.9	1,620.9	1,435.3	1,667.7	1,895.6	1,619.6
W 2 in H20	920.5	863.3	916.8	811.3	947.2	1,081.6	914.9
W 3 Wet	1,617.9	1,516.1	1,622.2	1,436.2	1,668.8	1,896.8	1,620.4
Difference	697.4	652.8	705.4	624.9	721.6	815.2	705.5
Field Density	2.317	2.321	2.298	2.297	2.311	2.325	2.296
% Density	98.470	98.640	97.663	97.620	98.215	98.810	97.578
% Voids	5.2	5.1	6.0	6.1	5.5	4.9	6.1
Thickness (in.)	1.86	1.79	1.85	1.85	1.92	2.02	1.91

Gmb (Lot Avg.): **2.353**
Gmm (Lot Avg.): **2.445**
Pa (Lot Avg.): **3.8**
Target % RAP: **19.0**

Avg. Field Density: **2.309**
Avg. % Density: **98.142**
Avg. % Field Voids: **5.6**
Specified % Density: 95

Q.I. = 2.309 -- (0.95 x 2.353) = **6.14**
0.012

Low Outlier: ______ High Outlier: ______ New Q.I. = ______

Film Thickness (FT): **9.6** (8.0-15.0) VMA: **15.5** (14.1-16.1) D.O.T. Results Used: ☐

Gsb: 2.627 Gb: 1.0360 Effective % Binder (Pbe): 5.16
Tons of Mix for Pay: 1814.39 Tons of Binder for Pay: 102.44

Remarks: This is to certify material described herein meets the applicable specifications

Mix Change Information: ______

Certified Tech: Jeff Jenkins NW086 Cert. No.
Certified Tech: Rick Loschen CI813 Cert. No.

Distribution: ____ Central Materials ____ Dist. Materials ____ Proj. Engineer ____ Contractor ____ Plant

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DAILY HMA PLANT REPORT

Project No.: NHSN-30-1(127)--2R-43
Contract ID: 43-0301-127
Mix Design No.: ABD10-3019R1

Contractor: Manatt's Inc
County: Harrison/Crawford
Recycle Source: ABC0-051

JMF VMA: 15.1
Size: 1/2
Mix Type: HMA 3M

Report No.: 7
Lab Voids Target: 4.0
Design Gyrations: 86

Hot Box I.D. No.:		INT0722A	INT0722B	INT0722C		Dist. Lab
Date Sampled:		07/22/10	07/22/10	07/22/10		Results
Gradation ID:	Specs					
1 in. (25mm) Sieve	100	100				
3/4 in. (19mm) Sieve	100	100				
1/2 in. (12.5mm) Sieve	89-100(96)	96				
3/8 in. (9.5mm) Sieve	77-91(84)	86				
* #4 (4.75mm) Sieve	60-74(67)	70				
* Moving Average		**72**				
* #8 (2.36mm) Sieve	48-58(53)	58				
* Moving Average		**55**				
#16 (1.18mm) Sieve		42				
* #30 (600um) Sieve	18-26(22)	25				
* Moving Average		**24**				
#50 (300um) Sieve		11				
#100 (150um) Sieve		5.6				
* #200 (75um) Sieve	1.5-5.5(3.5)	4.3				
* Moving Average		**4**				
Compliance (Y/N)		Y				
Intended Added, % Binder	4.40		% Binder from RAP			
Actual Added, % Binder		4.55	19.41%			
Intended Total, % Binder	5.50		Actual % RAP			
Actual Total, % Binder	5.20-5.80	5.65	19.52%			
Gmb:		2.355	2.345	2.358		
Gmm:		2.441	2.447	2.447		
Pa:		3.5	4.2	3.6		
Moving Average	3.5-5.0	**4.0**	**4.0**	**4.0**		
Time		12:05 PM	1:40 PM	3:30 PM		This
Station		353+00	380+00	405+00		Column
Side		WBL	WBL	WBL		Is For
Sample Tons		265.00	767.00	1,310.00		Dist. Lab
Sublot Tons		500.00	750.00	564.39		Test
Tons to Date				17,349.78		Results
Fines / Bitumen Ratio	0.6-1.4	0.83				

Time	7:00	9:00	11:00	1:00	3:00	5:00	7:00
Air Temp. °F			83	86	88		
Binder Temp. °F			300	300	298		
Mix Temp. °F			301	298	301		
Mat Temp. °F							

From Station	To Station	Lane
342+00	432+13	LT

Placement And Density Record

Date Placed: 07/22/10
Date Tested: 07/23/10
Course Placed: Intermediate
Intended Lift Thickness: 2.00
Tested By: Ed Launderville

Core No.:	1	2	3	4	5	6	7
Station	366+57	389+60	425+99				
CL Reference	2.0LT	2.7LT	2.2LT				
W 1 Dry	1,390.7	1,602.2	1,676.5				
W 2 in H20	792.3	912.9	945.3				
W 3 Wet	1,391.8	1,603.5	1,678.0				
Difference	599.5	690.6	732.7				
Field Density	2.320	2.320	2.288				
% Density	98.598	98.598	97.238				
% Voids	5.1	5.1	6.4				
Thickness (in.)	1.60	1.75	1.96				

Gmb (Lot Avg.): **2.353**
Gmm (Lot Avg.): **2.445**
Pa (Lot Avg.): **3.8**
Target % RAP: **19.0**

Avg. Field Density: ______
Avg. % Density: ______
Avg. % Field Voids: ______
Specified % Density: 95

Q.I. = ______ -- (0.95 x 2.353) = ______

Low Outlier: ______ High Outlier: ______ New Q.I. = **-1.77**

Film Thickness (FT): **9.6** (8.0-15.0) VMA: **15.5** (14.1-16.1) D.O.T. Results Used: ☐

Gsb: 2.627 Gb: 1.0360 Effective % Binder (Pbe): 5.16
Tons of Mix for Pay: 1814.39 Tons of Binder for Pay: 102.44

Remarks: This is to certify material described herein meets the applicable specifications

Mix Change Information: ______

Certified Tech: Jeff Jenkins NW086 Cert. No.
Certified Tech: Rick Loschen CI813 Cert. No.

Distribution: ____ Central Materials ____ Dist. Materials ____ Proj. Engineer ____ Contractor ____ Plant

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DAILY HMA PLANT REPORT

Project No.: NHSN-030-1(127)--2R-43
Contract ID: 43-0301-127
Mix Design No.: ABD10-3020R1

Contractor: Manatt's Inc
County: Harrison
Recycle Source: ABC0-051

JMF VMA: 14.1
Size: 1/2
Mix Type: HMA 3M

Report No.: 2
Lab Voids Target: 4.0
Design Gyrations: 86

Hot Box I.D. No.:		SUR0723A	SUR0723B	SUR0723C	SUR0723D	Dist. Lab
Date Sampled:		07/23/10	07/23/10	07/23/10	07/23/10	Results
Gradation ID:	Specs					
1 in. (25mm) Sieve	100	100				
3/4 in. (19mm) Sieve	100	100				
1/2 in. (12.5mm) Sieve	89-100(96)	92				
3/8 in. (9.5mm) Sieve	78-92(85)	83				
* #4 (4.75mm) Sieve	61-75(68)	69				
* Moving Average						
* #8 (2.36mm) Sieve	45-55(50)	53				
* Moving Average						
#16 (1.18mm) Sieve		34				
* #30 (600um) Sieve	16-24(20)	20				
* Moving Average						
#50 (300um) Sieve		9.6				
#100 (150um) Sieve		5.1				
* #200 (75um) Sieve	1.7-5.7(3.7)	3.9				
* Moving Average						
Compliance (Y/N)		Y				
Intended Added, % Binder	4.30		% Binder from RAP 18.31%			
Actual Added, % Binder		4.37				
Intended Total, % Binder	5.40		Actual % RAP 17.42%			
Actual Total, % Binder	5.10-5.70	5.35				
Gmb:		2.336	2.326	2.338		
Gmm:		2.462	2.457	2.453		
Pa:		5.1	5.3	4.7		
Moving Average	3.5-5.0			4.7		
Time		12:30 PM	1:50 PM	4:10 PM		This
Station		11+00	33+00	70+00		Column
Side		WBL	WBL	WBL		Is For
Sample Tons		209.00	617.00	1,343.00		Dist. Lab
Sublot Tons		500.00	750.00	720.82		Test
Tons to Date				19,320.60		Results
Fines / Bitumen Ratio	.60-1.40	0.82				

Time	7:00	9:00	11:00	1:00	3:00	5:00	7:00
Air Temp. °F				84	86		
Binder Temp. °F				300	300		
Mix Temp. °F				299	301		
Mat Temp. °F			290	285	290	290	

From Station	To Station	Lane
3+25	102+50	LT

Placement And Density Record

Date Placed: 07/23/10
Date Tested: 07/24/10
Course Placed: Surface
Intended Lift Thickness: 2.00
Tested By: Kay Scott

Core No.:	1	2	3	4	5	6	7
Station	16+08	19+91	41+30	57+93	60+43	86+52	88+36
CL Reference	10.2LT	7.8LT	10.5LT	1.7LT	2.6LT	1.1LT	7.7LT
W 1 Dry	2,126.7	2,006.5	2,052.3	1,956.3	2,045.1	1,857.5	2,060.8
W 2 in H20	1,211.0	1,143.4	1,165.4	1,096.5	1,158.4	1,044.3	1,163.5
W 3 Wet	2,128.3	2,007.6	2,053.7	1,957.5	2,046.0	1,858.9	2,061.7
Difference	917.3	864.2	888.3	861.0	887.6	814.6	898.2
Field Density	2.318	2.322	2.310	2.272	2.304	2.280	2.294
% Density	99.357	99.529	99.014	97.385	98.757	97.728	98.328
% Voids	5.7	5.5	6.0	7.5	6.2	7.2	6.6
Thickness (in.)	2.15	2.20	2.25	2.00	2.20	2.00	2.00

Gmb (Lot Avg.): 2.333
Gmm (Lot Avg.): 2.457
Pa (Lot Avg.): 5.0
Target % RAP: 17.0

Avg. Field Density: 2.300
Avg. % Density: 98.585
Avg. % Field Voids: 6.4
Specified % Density: 95

Q.I. = 2.300 -- (0.95 x 2.333) = 4.40
0.019

Low Outlier: ______ High Outlier: ______ New Q.I. = ______

Film Thickness (FT): 10.0 (8.0-15.0) VMA: 15.8 (13.1-15.1) D.O.T. Results Used: ☐

Remarks: This is to certify material described herein meets the applicable specifications

Gsb: 2.621 Gb: 1.0360 Effective % Binder (Pbe): 4.74
Tons of Mix for Pay: 1970.82 Tons of Binder for Pay: 105.46

Mix Change Information: % binder from rap over 20.0 took 2% rap out added 1% manf. sand and 1% of nat. sand.

Certified Tech: Jeff Jenkins NW086 Cert. No.
Certified Tech: Rick Loschen CI813 Cert. No.

Distribution: ____ Central Materials ____ Dist. Materials ____ Proj. Engineer ____ Contractor ____ Plant

800241 - 10/08 ver. 3.5

DAILY HMA PLANT REPORT

Project No.: NHSN-030-1(127)--2R-43
Contract ID: 43-0301-127
Mix Design No.: ABD10-3020R1

Contractor: Manatt's Inc
County: Harrison
Recycle Source: ABC0-051

JMF VMA: 14.1
Size: 1/2
Mix Type: HMA 3M

Report No.: 2
Lab Voids Target: 4.0
Design Gyrations: 86

Hot Box I.D. No.:		SUR0723A	SUR0723B	SUR0723C	SUR0723D	Dist. Lab
Date Sampled:		07/23/10	07/23/10	07/23/10	07/23/10	Results
Gradation ID:	Specs					
1 in. (25mm) Sieve	100	100				
3/4 in. (19mm) Sieve	100	100				
1/2 in. (12.5mm) Sieve	89-100(96)	92				
3/8 in. (9.5mm) Sieve	78-92(85)	83				
* #4 (4.75mm) Sieve	61-75(68)	69				
* Moving Average						
* #8 (2.36mm) Sieve	45-55(50)	53				
* Moving Average						
#16 (1.18mm) Sieve		34				
* #30 (600um) Sieve	16-24(20)	20				
* Moving Average						
#50 (300um) Sieve		9.6				
#100 (150um) Sieve		5.1				
* #200 (75um) Sieve	1.7-5.7(3.7)	3.9				
* Moving Average						
Compliance (Y/N)		Y				
Intended Added, % Binder	4.30		% Binder from RAP 18.31%			
Actual Added, % Binder		4.37				
Intended Total, % Binder	5.40		Actual % RAP 17.42%			
Actual Total, % Binder	5.10-5.70	5.35				
Gmb:		2.336	2.326	2.338		
Gmm:		2.462	2.457	2.453		
Pa:		5.1	5.3	4.7		
Moving Average	3.5-5.0					
Time		12:30 PM	1:50 PM	4:10 PM		This
Station		11+00	33+00	70+00		Column
Side		WBL	WBL	WBL		Is For
Sample Tons		209.00	617.00	1,343.00		Dist. Lab
Sublot Tons		500.00	750.00	720.82		Test
Tons to Date				19,320.60		Results
Fines / Bitumen Ratio	.60-1.40	0.82				

Time	7:00	9:00	11:00	1:00	3:00	5:00	7:00
Air Temp. °F				84	86		
Binder Temp. °F				300	300		
Mix Temp. °F				299	301		
Mat Temp. °F							

From Station	To Station	Lane
3+25	102+50	LT

Placement And Density Record

Date Placed: 07/23/10
Date Tested: ______
Course Placed: Surface
Intended Lift Thickness: 2.00
Tested By: ______

Core No.:	1	2	3	4	5	6	7
Station	30+20	40+00	40+00				
CL Reference	8.6LT	4.0LT	13.5LT				
W 1 Dry	2,180.6	1,873.6	2,019.1				
W 2 in H20	1,221.3	1,051.3	1,112.6				
W 3 Wet	2,182.0	1,875.0	2,021.2				
Difference	960.7	823.7	908.6				
Field Density	2.270	2.275	2.222				
% Density	97.300	97.514	95.242				
% Voids	7.6	7.4	9.6				
Thickness (in.)	2.35	2.10	2.25				

Gmb (Lot Avg.): 2.333
Gmm (Lot Avg.): 2.457
Pa (Lot Avg.): 5.0
Target % RAP: 17.0

Avg. Field Density: ______
Avg. % Density: ______
Avg. % Field Voids: ______
Specified % Density: 95

Q.I. = ______ -- (0.95 x 2.333) = ______

Low Outlier: ______ High Outlier: ______ New Q.I. = -1.79

Film Thickness (FT): 10.0 (8.0-15.0) VMA: 15.8 (13.1-15.1) D.O.T. Results Used: ☐

Remarks: This is to certify material described herein meets the applicable specifications

Gsb: 2.621 Gb: 1.0360 Effective % Binder (Pbe): 4.74
Tons of Mix for Pay: 1970.82 Tons of Binder for Pay: 105.46

Mix Change Information: % binder from rap over 20.0 took 2% rap out added 1% manf. sand and 1% of nat. sand.

Certified Tech: Jeff Jenkins NW086 Cert. No.
Certified Tech: Rick Loschen CI813 Cert. No.

Distribution: ____ Central Materials ____ Dist. Materials ____ Proj. Engineer ____ Contractor ____ Plant

800241 - 10/08 ver. 3.5

DAILY HMA PLANT REPORT

Project No.: NHSN-030-1(127)--2R-43
Contract ID: 43-0301-127
Mix Design No.: ABD10-3020R2

Contractor: Manatt's Inc
County: Harrison
Recycle Source: ABC0-051

JMF VMA: 14.1
Size: 1/2
Mix Type: HMA 3M

Report No.: 3
Lab Voids Target: 4.0
Design Gyrations: 86

	Specs					Dist. Lab
Hot Box I.D. No.:		SUR0724A	SUR0724B	SUR0724C	SUR0724D	Dist. Lab
Date Sampled:		07/24/10	07/24/10	07/24/10	07/24/10	Results
Gradation ID:	Specs					
1 in. (25mm) Sieve	100	100				
3/4 in. (19mm) Sieve	100	100				
1/2 in. (12.5mm) Sieve	89-100(96)	92				
3/8 in. (9.5mm) Sieve	78-92(85)	81				
* #4 (4.75mm) Sieve	61-75(68)	68				
* Moving Average						
* #8 (2.36mm) Sieve	45-55(50)	53				
* Moving Average						
#16 (1.18mm) Sieve		37				
* #30 (600um) Sieve	16-24(20)	22				
* Moving Average						
#50 (300um) Sieve		10				
#100 (150um) Sieve		5.5				
* #200 (75um) Sieve	1.7-5.7(3.7)	4.3				
* Moving Average						
Compliance (Y/N)		Y				
Intended Added, % Binder	4.30		% Binder from RAP 18.75%			
Actual Added, % Binder		4.44				
Intended Total, % Binder	5.40		Actual % RAP 18.24%			
Actual Total, % Binder	5.10-5.70	5.46				
Gmb:		2.365	2.369	2.357	2.358	
Gmm:		2.453	2.456	2.453	2.453	
Pa:		3.6	3.5	3.9	3.9	
Moving Average	3.5-5.0	**4.7**	**4.3**	**3.9**	**3.7**	
Time		8:45 AM	10:15 AM	12:05 PM	2:20 PM	This
Station		15+00	37+00	70+00	104+00	Column
Side		EBL	EBL	EBL	EBL	Is For
Sample Tons		292.00	716.00	1,310.00	2,040.00	Dist. Lab
Sublot Tons		500.00	666.67	666.67	694.49	Test
Tons to Date					5,119.89	Results
Fines / Bitumen Ratio	.60-1.40	0.89				

Gsb: 2.622 Gb: 1.0360 Effective % Binder (Pbe): 4.85
Tons of Mix for Pay: 2527.83 Tons of Binder for Pay: 138.17

Mix Change Information: High VMA added 1% 5/8 dry chips took out 2% man,sand added 1% rap

Distribution: ____ Central Materials ____ Dist. Materials ____ Proj. Engineer ____ Contractor ____ Plant

Time	7:00	9:00	11:00	1:00	3:00	5:00	7:00
Air Temp. °F	74	73	72	76	76		
Binder Temp. °F	298	300	298	300	298		
Mix Temp. °F	300	300	301	300	302		
Mat Temp. °F	280	280	285	280	280		

From Station	To Station	Lane
3+25	132+50	RT

Placement And Density Record

Date Placed: 07/24/10
Date Tested: 07/26/10
Course Placed: Surface
Intended Lift Thickness: 2.00
Tested By: Dennis Altman

Core No.:	1	2	3	4	5	6	7
Station	9+89	37+31	46+83	65+31	81+84	105+73	124+95
CL Reference	8.4RT	7.6RT	3.9RT	9.2RT	9.3RT	6.6RT	4.8RT
W 1 Dry	1,942.8	1,743.3	1,764.2	1,966.6	1,970.9	2,165.4	2,114.0
W 2 in H20	1,101.5	981.5	1,008.7	1,121.0	1,115.7	1,230.5	1,204.9
W 3 Wet	1,943.7	1,744.2	1,765.9	1,967.6	1,972.1	2,166.5	2,114.5
Difference	842.2	762.7	757.2	846.6	856.4	936.0	909.6
Field Density	2.307	2.286	2.330	2.323	2.301	2.313	2.324
% Density	97.671	96.782	98.645	98.349	97.417	97.925	98.391
% Voids	6.0	6.8	5.1	5.3	6.2	5.7	5.3
Thickness (in.)	2.0	2.0	2.0	2.0	2.0	2.25	2.25

Gmb (Lot Avg.): **2.362**
Gmm (Lot Avg.): **2.454**
Pa (Lot Avg.): **3.7**
Target % RAP: **18.0**

Avg. Field Density: **2.312**
Avg. % Density: **97.883**
Avg. % Field Voids: **5.8**
Specified % Density: 95

$$Q.I. = \frac{2.312 - (0.95 \times 2.362)}{0.015} = \mathbf{4.54}$$

Low Outlier: ______ High Outlier: ______ New Q.I. = ______

Film Thickness (FT): **9.6** (8.0-15.0) VMA: **14.8** (13.1-15.1) D.O.T. Results Used: ☐

Remarks: This is to certify material described herein meets the applicable specifications

Tons to date corrected on this report.....

Certified Tech: Jeff Jenkins NW086 Cert. No.
Certified Tech: Rick Loschen CI813 Cert. No.

800241 - 10/08 ver. 3.5

DAILY HMA PLANT REPORT

Project No.: NHSN-030-1(127)--2R-43
Contract ID: 43-0301-127
Mix Design No.: ABD10-3020R2

Contractor: Manatt's Inc
County: Harrison
Recycle Source: ABC0-051

JMF VMA: 14.1
Size: 1/2
Mix Type: HMA 3M

Report No.: 3
Lab Voids Target: 4.0
Design Gyrations: 86

	Specs					Dist. Lab
Hot Box I.D. No.:		SUR0724A	SUR0724B	SUR0724C	SUR0724D	Dist. Lab
Date Sampled:		07/24/10	07/24/10	07/24/10	07/24/10	Results
Gradation ID:	Specs					
1 in. (25mm) Sieve	100	100				
3/4 in. (19mm) Sieve	100	100				
1/2 in. (12.5mm) Sieve	89-100(96)	92				
3/8 in. (9.5mm) Sieve	78-92(85)	81				
* #4 (4.75mm) Sieve	61-75(68)	68				
* Moving Average						
* #8 (2.36mm) Sieve	45-55(50)	53				
* Moving Average						
#16 (1.18mm) Sieve		37				
* #30 (600um) Sieve	16-24(20)	22				
* Moving Average						
#50 (300um) Sieve		10				
#100 (150um) Sieve		5.5				
* #200 (75um) Sieve	1.7-5.7(3.7)	4.3				
* Moving Average						
Compliance (Y/N)		Y				
Intended Added, % Binder	4.30		% Binder from RAP 18.75%			
Actual Added, % Binder		4.44				
Intended Total, % Binder	5.40		Actual % RAP 18.24%			
Actual Total, % Binder	5.10-5.70	5.46				
Gmb:		2.365	2.369	2.357	2.358	
Gmm:		2.453	2.456	2.453	2.453	
Pa:		3.6	3.5	3.9	3.9	
Moving Average	3.5-5.0	**4.7**	**4.3**	**3.9**		
Time		8:45 AM	10:15 AM	12:05 PM	2:20 PM	This
Station		15+00	37+00	70+00	104+00	Column
Side		EBL	EBL	EBL	EBL	Is For
Sample Tons		292.00	716.00	1,310.00	2,040.00	Dist. Lab
Sublot Tons		500.00	666.67	666.67	699.49	Test
Tons to Date						Results
Fines / Bitumen Ratio	.60-1.40	0.89				

Gsb: 2.622 Gb: 1.0360 Effective % Binder (Pbe): 4.85
Tons of Mix for Pay: 2532.83 Tons of Binder for Pay: 138.44

Mix Change Information: High VMA added 1% 5/8 dry chips took out 2% man,sand added 1% rap

Distribution: ____ Central Materials ____ Dist. Materials ____ Proj. Engineer ____ Contractor ____ Plant

Time	7:00	9:00	11:00	1:00	3:00	5:00	7:00
Air Temp. °F	74	73	72	76	76		
Binder Temp. °F	298	300	298	300	298		
Mix Temp. °F	300	300	301	300	302		
Mat Temp. °F							

From Station	To Station	Lane

Placement And Density Record

Date Placed: 07/24/10
Date Tested: 07/26/10
Course Placed: Surface
Intended Lift Thickness: 2.00
Tested By: Dennis Altman

Core No.:	1	2	3	4	5	6	7
Station	7+98	66+03	88+00				
CL Reference	9.7RT	1.7RT	6.7RT				
W 1 Dry	1,993.3	1,767.6	1,771.3				
W 2 in H20	1,145.5	998.9	998.6				
W 3 Wet	1,994.3	1,768.8	1,772.5				
Difference	848.8	769.9	773.9				
Field Density	2.348	2.296	2.289				
% Density	99.407	97.206	96.909				
% Voids	4.3	6.4	6.7				
Thickness (in.)	2.0	2.0	2.0				

Gmb (Lot Avg.): **2.362**
Gmm (Lot Avg.): **2.454**
Pa (Lot Avg.): **3.7**
Target % RAP: **18.0**

Avg. Field Density: ______
Avg. % Density: ______
Avg. % Field Voids: ______
Specified % Density: 95

Q.I. = ______ -- (0.95 x 2.362) = ______

Low Outlier: ______ High Outlier: ______ New Q.I. = **-1.77**

Film Thickness (FT): **9.6** (8.0-15.0) VMA: **14.8** (13.1-15.1) D.O.T. Results Used: ☐

Remarks: This is to certify material described herein meets the applicable specifications

Certified Tech: Jeff Jenkins NW086 Cert. No.
Certified Tech: Rick Loschen CI813 Cert. No.

800241 - 10/08 ver 3.5

DAILY HMA PLANT REPORT

Project No.: NHSN-030-1(127)--2R-43
Contract ID: 43-0301-127
Mix Design No.: ABD10-3020R2

Contractor: Manatt's Inc
County: Harrison
Recycle Source: ABC0-051

JMF VMA: 14.1
Size: 1/2
Mix Type: HMA 3M

Report No.: 4
Lab Voids Target: 4.0
Design Gyrations: 86

Hot Box I.D. No.:		SUR0726A	SUR0726B	SUR0726C	SUR0726D	Dist. Lab
Date Sampled:		0726/10	0726/10	0726/10	0726/10	Results
Gradation ID:	Specs					
1 in. (25mm) Sieve	100	100				
3/4 in. (19mm) Sieve	100	100				
1/2 in. (12.5mm) Sieve	89-100(96)	91				
3/8 in. (9.5mm) Sieve	78-92(85)	82				
* #4 (4.75mm) Sieve	61-75(68)	69				
* Moving Average		**69**				
* #8 (2.36mm) Sieve	45-55(50)	54				
* Moving Average		**53**				
#16 (1.18mm) Sieve		38				
* #30 (600um) Sieve	16-24(20)	23				
* Moving Average		**22**				
#50 (300um) Sieve		11				
#100 (150um) Sieve		5.6				
* #200 (75um) Sieve	1.7-5.7(3.7)	4.4				
* Moving Average		**4.4**				
Compliance (Y/N)		Y				
Intended Added, % Binder	4.30		% Binder from RAP 18.97%			
Actual Added, % Binder		4.41				
Intended Total, % Binder	5.40		Actual % RAP 18.35%			
Actual Total, % Binder	5.10-5.70	5.44				
Gmb:		2.359	2.349	2.355	2.349	
Gmm:		2.460	2.453	2.454	2.454	
Pa:		4.1	4.2	4.0	4.3	
Moving Average	3.5-5.0	**3.9**	**4.1**	**4.1**	**4.2**	
Time		8:30 AM	10:30 AM	12:56 PM	4:30 PM	This
Station		118+00	148+00	175+00	232+00	Column
Side		WBL	WBL	WBL	WBL	Is For
Sample Tons		328.00	891.00	1,412.00	2,550.00	Dist. Lab
Sublot Tons		500.00	833.33	833.33	771.52	Test
Tons to Date					8,058.07	Results
Fines / Bitumen Ratio	60-1.40	0.91				

Gsb: 2.622 Gb: 1.0360 Effective % Binder (Pbe): 4.83
Tons of Mix for Pay: 2938.18 Tons of Binder for Pay: 159.77

Mix Change Information:

Distribution: ___ Central Materials ___ Dist. Materials ___ Proj. Engineer ___ Contractor ___ Plant

Time	7:00	9:00	11:00	1:00	3:00	5:00	7:00
Air Temp. °F	76	77	77	78	79	81	
Binder Temp. °F	298	300	300	300	300	300	
Mix Temp. °F	300	300	301	300	300	301	
Mat Temp. °F	285	285	290	290	290	290	

From Station	To Station	Lane
102+150	162+30	LT
164+04	237+76	LT
237+97	260+00	LT

Placement And Density Record

Date Placed: 0726/10
Date Tested: 07/27/10
Course Placed: Surface
Intended Lift Thickness: 2.00
Tested By: Ed Launderville

Core No.:	1	2	3	4	5	6	7
Station	111+40	149+22	158+28	179+07	197+45	230+01	243+61
CL Reference	1.7	1.8	4.6	6.4	3.2	2.5	9.2
W 1 Dry	1,789.3	1,923.5	1,736.0	1,756.7	1,774.2	1,841.6	1,948.0
W 2 in H2O	1,005.6	1,079.9	987.5	986.4	996.4	1,042.7	1,097.6
W 3 Wet	1,790.6	1,924.3	1,737.0	1,757.9	1,775.1	1,842.2	1,948.6
Difference	785.0	844.4	749.5	771.5	778.7	799.5	851.0
Field Density	2.279	2.278	2.316	2.277	2.278	2.303	2.289
% Density	96.855	96.813	98.428	96.770	96.813	97.875	97.280
% Voids	7.2	7.2	5.7	7.3	7.2	6.2	6.8
Thickness (in.)	2.0	2.12	1.98	2.02	2.0	2.01	2.15

Gmb (Lot Avg.): **2.353**
Gmm (Lot Avg.): **2.455**
Pa (Lot Avg.): **4.2**
Target % RAP: **18.0**

Avg. Field Density: **2.289**
Avg. % Density: **97.262**
Avg. % Field Voids: **6.8**
Specified % Density: 95

Q.I. = 2.289 − (0.95 x 2.353) = **3.58**
0.015

Low Outlier: ______ High Outlier: ______ New Q.I. = ______

Film Thickness (FT): **9.3** (8.0-15.0) VMA: **15.1** (13.1-15.1) D.O.T. Results Used: [ ]

Remarks: This is to certify material described herein meets the applicable specifications

Paved Shoulders=51.11 to date=272.27
Surface Patch=4.00 to date=4.00

Certified Tech: Jeff Jenkins NW086 Cert. No.
Certified Tech: Rick Loschen CI813 Cert. No.

800241 - 10/08 ver 3.5

DAILY HMA PLANT REPORT

Project No.: NHSN-030-1(127)--2R-43
Contract ID: 43-0301-127
Mix Design No.: ABD10-3020R2

Contractor: Manatt's Inc
County: Harrison
Recycle Source: ABC0-051

JMF VMA: 14.1
Size: 1/2
Mix Type: HMA 3M

Report No.: 4
Lab Voids Target: 4.0
Design Gyrations: 86

Hot Box I.D. No.:		SUR0726A	SUR0726B	SUR0726C	SUR0726D	Dist. Lab
Date Sampled:		0726/10	0726/10	0726/10	0726/10	Results
Gradation ID:	Specs					
1 in. (25mm) Sieve	100	100				
3/4 in. (19mm) Sieve	100	100				
1/2 in. (12.5mm) Sieve	89-100(96)	91				
3/8 in. (9.5mm) Sieve	78-92(85)	82				
* #4 (4.75mm) Sieve	61-75(68)	69				
* Moving Average		**69**				
* #8 (2.36mm) Sieve	45-55(50)	54				
* Moving Average		**53**				
#16 (1.18mm) Sieve		38				
* #30 (600um) Sieve	16-24(20)	23				
* Moving Average		**22**				
#50 (300um) Sieve		11				
#100 (150um) Sieve		5.6				
* #200 (75um) Sieve	1.7-5.7(3.7)	4.4				
* Moving Average		**4.4**				
Compliance (Y/N)		Y				
Intended Added, % Binder	4.30		% Binder from RAP 18.97%			
Actual Added, % Binder		4.41				
Intended Total, % Binder	5.40		Actual % RAP 18.35%			
Actual Total, % Binder	5.10-5.70	5.44				
Gmb:		2.359	2.349	2.355	2.349	
Gmm:		2.460	2.453	2.454	2.454	
Pa:		4.1	4.2	4.0	4.3	
Moving Average	3.5-5.0	**3.9**	**4.1**	**4.1**	**4.2**	
Time		8:30 AM	10:30 AM	12:56 PM	4:30 PM	This
Station		118+00	148+00	175+00	232+00	Column
Side		WBL	WBL	WBL	WBL	Is For
Sample Tons		328.00	891.00	1,412.00	2,550.00	Dist. Lab
Sublot Tons		500.00	833.33	833.33	771.52	Test
Tons to Date					8,058.07	Results
Fines / Bitumen Ratio	60-1.40	0.91				

Gsb: 2.622 Gb: 1.0360 Effective % Binder (Pbe): 4.83
Tons of Mix for Pay: 2938.18 Tons of Binder for Pay: 159.77

Mix Change Information:

Distribution: ___ Central Materials ___ Dist. Materials ___ Proj. Engineer ___ Contractor ___ Plant

Time	7:00	9:00	11:00	1:00	3:00	5:00	7:00
Air Temp. °F	76	77	77	78	79	81	
Binder Temp. °F	298	300	300	300	300	300	
Mix Temp. °F	300	300	301	300	300	301	
Mat Temp. °F	285	285	290	290	290	290	

From Station	To Station	Lane
102+150	162+30	LT
164+04	237+76	LT
237+97	260+00	LT

Placement And Density Record

Date Placed: 0726/10
Date Tested: 07/27/10
Course Placed: Surface
Intended Lift Thickness: 2.00
Tested By: Ed Launderville

Core No.:	1	2	3	4	5	6	7
Station	125+67	183+70	243+12				
CL Reference	2.8	9.8	6				
W 1 Dry	1,783.9	2,029.2	1,860.3				
W 2 in H2O	1,010.5	1,150.6	1,047.4				
W 3 Wet	1,784.7	2,029.6	1,861.0				
Difference	774.2	879.0	813.6				
Field Density	2.304	2.309	2.287				
% Density	97.918	98.130	97.195				
% Voids	6.2	5.9	6.8				
Thickness (in.)	1.98	2.20	2.05				

Gmb (Lot Avg.): **2.353**
Gmm (Lot Avg.): **2.455**
Pa (Lot Avg.): **4.2**
Target % RAP: **18.0**

Avg. Field Density: ______
Avg. % Density: ______
Avg. % Field Voids: ______
Specified % Density: 95

Q.I. = ______ − (0.95 x 2.353) = ______

Low Outlier: ______ High Outlier: ______ New Q.I. = **-1.77**

Film Thickness (FT): **9.3** (8.0-15.0) VMA: **15.1** (13.1-15.1) D.O.T. Results Used: [ ]

Remarks: This is to certify material described herein meets the applicable specifications

Paved Shoulders=51.11 to date=272.27
Surface Patch=4.00 to date=4.00

Certified Tech: Jeff Jenkins NW086 Cert. No.
Certified Tech: Rick Loschen CI813 Cert. No.

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DAILY HMA PLANT REPORT

Project No.: NHSN-030-1(127)--2R-43
Contract ID: 43-0301-127
Mix Design No.: ABD10-3020R2

Contractor: Manatt's Inc
County: Harrison
Recycle Source: ABC0-051

JMF VMA: 14.1
Size: 1/2
Mix Type: HMA 3M

Report No.: 5
Lab Voids Target: 4.0
Design Gyrations: 86

Hot Box I.D. No.:		SUR0727A	SUR0727B	SUR0727C	SUR0727D	Dist. Lab
Date Sampled:		07/27/10	07/27/10	07/27/10	07/27/10	Results
Gradation ID:	Specs					
1 in. (25mm) Sieve	100	100				
3/4 in. (19mm) Sieve	100	100				
1/2 in. (12.5mm) Sieve	89-100(96)	92				
3/8 in. (9.5mm) Sieve	78-92(85)	82				
* #4 (4.75mm) Sieve	61-75(68)	68				
* Moving Average		**68**				
* #8 (2.36mm) Sieve	45-55(50)	54				
* Moving Average		**53**				
#16 (1.18mm) Sieve		37				
* #30 (600um) Sieve	16-24(20)	22				
* Moving Average		**22**				
#50 (300um) Sieve		11				
#100 (150um) Sieve		5.9				
* #200 (75um) Sieve	1.7-5.7(3.7)	4.6				
* Moving Average		**4.3**				
Compliance (Y/N)		Y				
Intended Added, % Binder	4.30		% Binder from RAP			
Actual Added, % Binder		4.38	19.12%			
Intended Total, % Binder	5.40		Actual % RAP			
Actual Total, % Binder	5.10-5.70	5.42	18.41%			
Gmb:		2.351	2.357	2.350	2.352	
Gmm:		2.456	2.455	2.458	2.445	
Pa:		4.3	4.0	4.4	3.8	
Moving Average	3.5-5.0	**4.2**	**4.2**	**4.4**	**4.2**	
Time		8:10 AM	10:45 AM	1:15 PM	4:25 PM	This
Station		146+00	183+00	227+00	263+00	Column
Side		EBL	EBL	EBL	EBL	Is For
Sample Tons		301.00	1,007.00	1,790.00	2,553.00	Dist. Lab
Sublot Tons		500.00	833.33	833.33	982.27	Test
Tons to Date						Results
Fines / Bitumen Ratio	.60-1.40	0.95				

Gsb: 2.622 Gb: 1.0360 Effective % Binder (Pbe): 4.84
Tons of Mix for Pay: 3148.93 Tons of Binder for Pay: 170.42

Mix Change Information:

Distribution: ____ Central Materials ____ Dist. Materials ____ Proj. Engineer ____ Contractor ____ Plant

Time	7:00	9:00	11:00	1:00	3:00	5:00	7:00
Air Temp. °F	75	81	83	90	91	91	
Binder Temp. °F	300	300	301	300	300	298	
Mix Temp. °F	300	301	301	305	300	305	
Mat Temp. °F							

From Station	To Station	Lane
132+50	162+30	RT
164+04	237+76	RT
237+97	291+69	RT

Placement And Density Record

Date Placed: 07/27/10
Date Tested: 07/28/10
Course Placed: Surface
Intended Lift Thickness: 2.00
Tested By: Ed Launderville

Core No.:	1	2	3	4	5	6	7
Station	192+61	195+71	268+55				
CL Reference	7.7RT	10.9RT	8.9RT				
W 1 Dry	1,967.8	1,768.9	1,866.2				
W 2 in H20	1,103.5	994.7	1,045.9				
W 3 Wet	1,968.6	1,769.6	1,867.0				
Difference	865.1	774.9	821.1				
Field Density	2.275	2.283	2.273				
% Density	96.685	97.025	96.600				
% Voids	7.3	7.0	7.4				
Thickness (in.)	2.17	2.0	2.05				

Gmb (Lot Avg.): **2.353**
Gmm (Lot Avg.): **2.454**
Pa (Lot Avg.): **4.1**
Target % RAP: **18.0**

Avg. Field Density: ____
Avg. % Density: ____
Avg. % Field Voids: ____
Specified % Density: 95

Q.I. = ____ – (0.95 x 2.353) = ____

Low Outlier: ____ High Outlier: ____ New Q.I. = **-1.79**

Film Thickness (FT): **9.1** (8.0-15.0) VMA: **15.1** (13.1-15.1) D.O.T. Results Used: ☐

Remarks: This is to certify material described herein meets the applicable specifications

Certified Tech: Jeff Jenkins NW086 Cert. No
Certified Tech: Rick Loschen CI813 Cert. No

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DAILY HMA PLANT REPORT

Project No.: NHSN-030-1(127)--2R-43
Contract ID: 43-0301-127
Mix Design No.: ABD10-3020R2

Contractor: Manatt's Inc
County: Harrison
Recycle Source: ABC0-051

JMF VMA: 14.1
Size: 1/2
Mix Type: HMA 3M

Report No.: 6
Lab Voids Target: 4.0
Design Gyrations: 86

Hot Box I.D. No.:		SUR0728A	SUR0728B	SUR0728C	SUR0728D	Dist. Lab
Date Sampled:		07/28/10	07/28/10	07/28/10	07/28/10	Results
Gradation ID:	Specs					
1 in. (25mm) Sieve	100	100				
3/4 in. (19mm) Sieve	100	100				
1/2 in. (12.5mm) Sieve	89-100(96)	92				
3/8 in. (9.5mm) Sieve	78-92(85)	81				
* #4 (4.75mm) Sieve	61-75(68)	67				
* Moving Average		**68**				
* #8 (2.36mm) Sieve	45-55(50)	53				
* Moving Average		**54**				
#16 (1.18mm) Sieve		38				
* #30 (600um) Sieve	16-24(20)	22				
* Moving Average		**22**				
#50 (300um) Sieve		11				
#100 (150um) Sieve		5.8				
* #200 (75um) Sieve	1.7-5.7(3.7)	4.6				
* Moving Average		**4.5**				
Compliance (Y/N)		Y				
Intended Added, % Binder	4.30		% Binder from RAP			
Actual Added, % Binder		4.39	19.09%			
Intended Total, % Binder	5.40		Actual % RAP			
Actual Total, % Binder	5.10-5.70	5.43	18.41%			
Gmb:		2.358	2.352	2.348	2.352	
Gmm:		2.455	2.460	2.448	2.450	
Pa:		4.0	4.4	4.1	4.0	
Moving Average	3.5-5.0	**4.0**	**4.1**	**4.1**	**4.1**	
Time		9:10 AM	12:05 PM	3:15 PM	4:56 PM	This
Station		272+00	303+00	352+00	378+00	Column
Side		WBL	WBL	WBL	WBL	Is For
Sample Tons		279.00	818.00	1,782.00	2,266.00	Dist. Lab
Sublot Tons		500.00	833.33	833.33	342.52	Test
Tons to Date					13,639.19	Results
Fines / Bitumen Ratio	.60-1.40	0.94				

Time	7:00	9:00	11:00	1:00	3:00	5:00	7:00
Air Temp. °F		75	78	79	81	82	
Binder Temp. °F		301	298	300	300	300	
Mix Temp. °F		300	305	302	300	305	
Mat Temp. °F		290	295	295	295	285	

From Station	To Station	Lane
260+00	291+69	WBL
296+30	392+25	WBL

Placement And Density Record

Date Placed: 07/28/10
Date Tested: 07/29/10
Course Placed: Surface
Intended Lift Thickness: 2.00
Tested By: Ed Launderville

Core No.:	1	2	3	4	5	6	7
Station	272+06	288+41	316+20	325+86	347+89	376+23	383+84
CL Reference	6.2 LT	10.5 LT	9.4 LT	6.9 LT	1.8 LT	2.5 LT	8.2 LT
W 1 Dry	1,849.9	2,001.5	2,189.1	1,714.1	1,974.1	1,618.5	1,884.2
W 2 in H20	1,033.1	1,136.3	1,226.9	956.3	1,116.2	905.0	1,057.7
W 3 Wet	1,850.9	2,002.6	2,190.2	1,714.8	1,974.9	1,619.4	1,884.8
Difference	817.8	866.3	963.3	758.5	858.7	714.4	827.1
Field Density	2.262	2.310	2.273	2.260	2.299	2.266	2.278
% Density	96.133	98.173	96.600	96.048	97.705	96.303	96.813
% Voids	7.8	5.8	7.3	7.9	6.3	7.6	7.1
Thickness (in.)	2.05	2.18	2.38	1.92	2.15	1.84	2.07

Gmb (Lot Avg.): **2.353**
Gmm (Lot Avg.): **2.453**
Pa (Lot Avg.): **4.1**
Target % RAP: **18.0**

Avg. Field Density: **2.278**
Avg. % Density: **96.825**
Avg. % Field Voids: **7.1**
Specified % Density: 95

Q.I. = 2.278 -- (0.95 x 2.353) / 0.019 = **2.24**

Low Outlier: ____ High Outlier: ____ New Q.I. = ____

Film Thickness (FT): **9.3** (8.0-15.0) VMA: **15.1** (13.1-15.1) D.O.T. Results Used: ☐

Gsb: 2.622 Gb: 1.0360 Effective % Binder (Pbe): 4.87
Tons of Mix for Pay: 2509.18 Tons of Binder for Pay: 136.04

Remarks: This is to certify material described herein meets the applicable specifications

Mix Change Information: ____

Certified Tech: Jeff Jenkins NW086 Cert. No.
Certified Tech: Rick Loschen CI813 Cert. No.

Distribution: ____ Central Materials ____ Dist. Materials ____ Proj. Engineer ____ Contractor ____ Plant

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DAILY HMA PLANT REPORT

Project No.: NHSN-030-1(127)--2R-43
Contract ID: 43-0301-127
Mix Design No.: ABD10-3020R2

Contractor: Manatt's Inc
County: Harrison
Recycle Source: ABC0-051

JMF VMA: 14.1
Size: 1/2
Mix Type: HMA 3M

Report No.: 6
Lab Voids Target: 4.0
Design Gyrations: 86

Hot Box I.D. No.:		SUR0728A	SUR0728B	SUR0728C	SUR0728D	Dist. Lab
Date Sampled:		07/28/10	07/28/10	07/28/10	07/28/10	Results
Gradation ID:	Specs					
1 in. (25mm) Sieve	100	100				
3/4 in. (19mm) Sieve	100	100				
1/2 in. (12.5mm) Sieve	89-100(96)	92				
3/8 in. (9.5mm) Sieve	78-92(85)	81				
* #4 (4.75mm) Sieve	61-75(68)	67				
* Moving Average		**68**				
* #8 (2.36mm) Sieve	45-55(50)	53				
* Moving Average		**54**				
#16 (1.18mm) Sieve		38				
* #30 (600um) Sieve	16-24(20)	22				
* Moving Average		**22**				
#50 (300um) Sieve		11				
#100 (150um) Sieve		5.8				
* #200 (75um) Sieve	1.7-5.7(3.7)	4.6				
* Moving Average		**4.5**				
Compliance (Y/N)		Y				
Intended Added, % Binder	4.30		% Binder from RAP			
Actual Added, % Binder		4.39	19.09%			
Intended Total, % Binder	5.40		Actual % RAP			
Actual Total, % Binder	5.10-5.70	5.43	18.41%			
Gmb:		2.358	2.352	2.348	2.352	
Gmm:		2.455	2.460	2.448	2.450	
Pa:		4.0	4.4	4.1	4.0	
Moving Average	3.5-5.0	**4.0**	**4.1**	**4.1**	**4.1**	
Time		9:10 AM	12:05 PM	3:15 PM	4:56 PM	This
Station		272+00	303+00	352+00	378+00	Column
Side		WBL	WBL	WBL	WBL	Is For
Sample Tons		279.00	818.00	1,782.00	2,266.00	Dist. Lab
Sublot Tons		500.00	833.33	833.33	342.52	Test
Tons to Date					13,639.19	Results
Fines / Bitumen Ratio	.60-1.40	0.94				

Time	7:00	9:00	11:00	1:00	3:00	5:00	7:00
Air Temp. °F	73	75	78	79	81	82	
Binder Temp. °F		301	298	300	300	300	
Mix Temp. °F		300	305	302	300	305	
Mat Temp. °F							

From Station	To Station	Lane

Placement And Density Record

Date Placed: 07/28/10
Date Tested: 07/29/10
Course Placed: Surface
Intended Lift Thickness: 2.00
Tested By: Ed Launderville

Core No.:	1	2	3	4	5	6	7
Station	263+98	308+16	370+31				
CL Reference	10.9 LT	5.2 LT	2.4 LT				
W 1 Dry	2,146.3	1,901.8	1,762.1				
W 2 in H20	1,208.3	1,078.1	989.1				
W 3 Wet	2,146.7	1,902.4	1,762.7				
Difference	938.4	824.3	773.6				
Field Density	2.287	2.307	2.278				
% Density	97.195	98.045	96.813				
% Voids	6.8	6.0	7.1				
Thickness (in.)	2.32	2.08	1.96				

Gmb (Lot Avg.): **2.353**
Gmm (Lot Avg.): **2.453**
Pa (Lot Avg.): **4.1**
Target % RAP: **18.0**

Avg. Field Density: ____
Avg. % Density: ____
Avg. % Field Voids: ____
Specified % Density: 95

Q.I. = ____ -- (0.95 x 2.353) = ____

Low Outlier: ____ High Outlier: ____ New Q.I. = **-1.78**

Film Thickness (FT): **9.3** (8.0-15.0) VMA: **15.1** (13.1-15.1) D.O.T. Results Used: ☐

Gsb: 2.622 Gb: 1.0360 Effective % Binder (Pbe): 4.87
Tons of Mix for Pay: 2509.18 Tons of Binder for Pay: 136.04

Remarks: This is to certify material described herein meets the applicable specifications

Mix Change Information: ____

Certified Tech: Jeff Jenkins NW086 Cert. No.
Certified Tech: Rick Loschen CI813 Cert. No.

Distribution: ____ Central Materials ____ Dist. Materials ____ Proj. Engineer ____ Contractor ____ Plant

APPENDIX C: DOT FIELD CORE DENSITY REPORTS – US20 IDA/SAC COUNTY PROJECT

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DAILY HMA PLANT REPORT

Project No.:	NHSX-020-2(70)--3H-47	Contractor:	Tri-State Paving	JMF VMA:	14.3
Report No.:	9	Contract ID:	47-0202-070	County:	Ida/Sac
Size:	1/2	Lab Voids Target:	4.0	Mix Design No.:	ABD10-3024
Recycle Source:	ABC10-005	Mix Type:	HMA 3M A 60% CR	Design Gyrations:	86

Hot Box I.D. No.:	Specs	81310hb1	81310hb2	81310hb3	81310hb4	
Date Sampled:		08/13/10	08/13/10	08/13/10	08/13/10	
Gradation ID:		81310cf1				
1 in. (25mm) Sieve	100	100				
3/4 in. (19mm) Sieve	100	100				
1/2 in. (12.5mm) Sieve	90-100(97)	98				
3/8 in. (9.5mm) Sieve	83-97(90)	92				
* #4 (4.75mm) Sieve	58-72(65)	69				
* Moving Average						
* #8 (2.36mm) Sieve	43-53(48)	46				
* Moving Average						
#16 (1.18mm) Sieve		32				
* #30 (600um) Sieve	21-29(25)	22				
* Moving Average						
#50 (300um) Sieve		11				
#100 (150um) Sieve		5.2				
* #200 (75um) Sieve	1.4-5.4(3.4)	3.5				
* Moving Average						
Compliance (Y/N)		Y				
Intended Added, % Binder	4.70		% Binder from RAP			
Actual Added, % Binder		4.45	17.03%			
Intended Total, % Binder	5.60		Actual % RAP			
Actual Total, % Binder	5.30-5.90	5.36	16.32%			
Gmb:		2.352	2.354			
Gmm:		2.453	2.455			
Pa:		4.1	4.1			
Moving Average	3.5-5.0					
Time		4:13 PM	6:00 PM			This
Station		1021+50	990+00			Column
Side		WB	WB			Is For
Sample Tons		120.00	553.00			Dist. Lab
Sublot Tons		500.00	350.52			Test
Tons to Date		d/t	850.52	t/t	850.52	Results
Fines / Bitumen Ratio	0.6-1.4	0.79				

Time	7:00	9:00	11:00	1:00	3:00	5:00	7:00
Air Temp. °F	n/a	n/a	n/a	n/a	88	89	
Binder Temp. °F	n/a	n/a	n/a	n/a	300	300	
Mix Temp. °F	n/a	n/a	n/a	n/a	280	280	
Mat Temp. °F	n/a	n/a	n/a	n/aa	278	276	

From Station	To Station	Lane
961+50	1031+00	EBND

Placement And Density Record

Date Placed: 08/13/10
Date Tested: 08/14/10
Course Placed: Intermediate
Intended Lift Thickness: 1.5
Tested By: Dennis Altman

Core No.:	1	2	3	4	5	6	7
Station	965+30	979+44	989+28	996+51	1005+82	1011+96	1023+83
CL Reference	1.5L	10.7L	9.7L	3.8L	4.9L	9.8L	1.2L
W 1 Dry	1,252.8	1,103.5	994.1	883.7	986.8	889.9	1,126.0
W 2 in H20	711.5	609.0	549.9	490.1	546.0	496.0	629.8
W 3 Wet	1,253.8	1,104.9	994.9	884.7	987.6	891.2	1,127.2
Difference	542.3	495.9	445.0	394.6	441.6	395.2	497.4
Field Density	2.310	2.225	2.234	2.239	2.235	2.252	2.264
% Density	98.173	94.560	94.943	95.155	94.985	95.708	96.218
% Voids	5.9	9.3	9.0	8.8	8.9	8.2	7.7
Thickness (in.)	2	1.75	1.5	1.5	1.5	1.5	1.75

Gmb (Lot Avg.):	**2.353**	Avg. Field Density:	**2.251**
Gmm (Lot Avg.):	**2.454**	Avg. % Density:	**95.677**
Pa (Lot Avg.):	**4.1**	Avg. % Field Voids:	**8.3**
Target % RAP:	**15.0**	Specified % Density:	95

Q.I. = 2.251 -- (0.95 x 2.353) = **0.54**
0.029

Low Outlier: 0.90 High Outlier: 2.03 New Q.I. = **0.48**

Film Thickness (FT): **9.4** (8.0-15) VMA: **14.1** (13.3-15.3) D.O.T. Results Used:

Remarks: Start Intermediate @ 3:15pm due to problems with the plant

Gsb: 2.593 Gb: 1.0380 Effective % Binder (Pbe): 4.42
Tons of Mix for Pay: 850.52 Tons of Binder for Pay: 45.57

Mix Change Information:

Certified Tech: Rick Weisbrod NW 473 Cert. No.
Certified Tech: Jason Pergande NW 693 Cert. No.

Distribution: ____ Central Materials ____ Dist. Materials ____ Proj. Engineer ____ Contractor ____ Plant

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DAILY HMA PLANT REPORT

Project No.:	NHSX-020-2(70)--3H-47	Contractor:	Tri-State Paving	JMF VMA:	14.3
Report No.:	10	Contract ID:	47-0202-070	County:	Ida/Sac
Size:	1/2	Lab Voids Target:	4.0	Mix Design No.:	ABD10-3024
Recycle Source:	ABC10-005	Mix Type:	HMA 3M A 60% CR	Design Gyrations:	86

Hot Box I.D. No.:	Specs	81410hb1	81410hb2	81410hb3	81410hb4	
Date Sampled:		08/14/10	08/14/10	08/14/10	08/14/10	
Gradation ID:		81410cf1				
1 in. (25mm) Sieve	100	100				
3/4 in. (19mm) Sieve	100	100				
1/2 in. (12.5mm) Sieve	90-100(97)	98				
3/8 in. (9.5mm) Sieve	83-97(90)	93				
* #4 (4.75mm) Sieve	58-72(65)	68				
* Moving Average						
* #8 (2.36mm) Sieve	43-53(48)	48				
* Moving Average						
#16 (1.18mm) Sieve		33				
* #30 (600um) Sieve	21-29(25)	22				
* Moving Average						
#50 (300um) Sieve		11				
#100 (150um) Sieve		5.3				
* #200 (75um) Sieve	1.4-5.4(3.4)	3.6				
* Moving Average						
Compliance (Y/N)		Y				
Intended Added, % Binder	4.70		% Binder from RAP			
Actual Added, % Binder		4.50	16.44%			
Intended Total, % Binder	5.60		Actual % RAP			
Actual Total, % Binder	5.30-5.90	5.38	15.83%			
Gmb:		2.359	2.357	2.361	2.358	
Gmm:		2.468	2.456	2.458	2.458	
Pa:		4.4	4.0	3.9	4.1	
Moving Average	3.5-5.0	**4.2**	**4.1**	**4.1**		
Time		9:36 AM	11:22 AM	1:40 PM	4:15 PM	This
Station		1021+20	983+00	932+50	882+40	Column
Side		EB	EB	EB	EB	Is For
Sample Tons		121.00	671.00	1,409.00	2,147.00	Dist. Lab
Sublot Tons		500.00	833.33	833.33	567.22	Test
Tons to Date		d/t	2,733.88	t/t	3,584.40	Results
Fines / Bitumen Ratio	0.6-1.4	0.84				

Time	7:00	9:00	11:00	1:00	3:00	5:00	7:00
Air Temp. °F	73	75	78	81	83	84	
Binder Temp. °F	300	300	300	300	300	300	
Mix Temp. °F	285	280	282	280	280	280	
Mat Temp. °F	279	275	275	274	274	276	

From Station	To Station	Lane
842+00	1031+16	EBND

Placement And Density Record

Date Placed: 08/14/10
Date Tested: 08/16/10
Course Placed: Intermediate
Intended Lift Thickness: 1.5
Tested By: Dennis Altman

Core No.:	1	2	3	4	5	6	7
Station	848+62	870+23	902+11	933+19	067+29	990+52	1029+37
CL Reference	2.8 RT	2.0 RT	5.8 RT	1.3 RT	6.0 RT	10.4 RT	4.4 RT
W 1 Dry	1,039.3	1,171.3	1,161.3	987.8	949.4	1,067.4	1,167.0
W 2 in H20	585.7	657.9	649.0	550.3	536.3	600.5	645.2
W 3 Wet	1,040.2	1,172.1	1,163.0	989.5	950.0	1,068.3	1,168.4
Difference	454.5	514.2	514.0	439.2	413.7	467.8	523.2
Field Density	2.287	2.278	2.259	2.249	2.295	2.282	2.231
% Density	96.948	96.566	95.761	95.337	97.287	96.736	94.574
% Voids	7.0	7.4	8.2	8.6	6.7	7.2	9.3
Thickness (in.)	1.5	1.75	1.75	1.5	2	1.37	1.85

Gmb (Lot Avg.):	**2.359**	Avg. Field Density:	**2.269**
Gmm (Lot Avg.):	**2.460**	Avg. % Density:	**96.173**
Pa (Lot Avg.):	**4.1**	Avg. % Field Voids:	**7.8**
Target % RAP:	**15.0**	Specified % Density:	95

Q.I. = 2.269 -- (0.95 x 2.359) = **1.22**
0.023

Low Outlier: High Outlier: New Q.I. =

Film Thickness (FT): **9.1** (8.0-15) VMA: **13.9** (13.3-15.3) D.O.T. Results Used:

Remarks:

Gsb: 2.593 Gb: 1.0380 Effective % Binder (Pbe): 4.31
Tons of Mix for Pay: 2733.88 Tons of Binder for Pay: 147.09

Mix Change Information:

Certified Tech: Rick Weisbrod NW 473 Cert. No.
Certified Tech: Jason Pergande NW 693 Cert. No.

Distribution: ____ Central Materials ____ Dist. Materials ____ Proj. Engineer ____ Contractor ____ Plant

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DAILY HMA PLANT REPORT

Project No.: NHSX-020-2(70)--3H-47 | Contractor: Tri-State Paving | JMF VMA: 14.3 | Report No.: 11

Contract ID: 47-0202-070 | County: Ida/Sac | Size: 1/2 | Lab Voids Target: 4.0

Mix Design No.: ABD10-3024 | Recycle Source: ABC10-005 | Mix Type: HMA 3M A 60% CR | Design Gyrations: 86

Hot Box I.D. No.:		81610hb1	81610hb2	81610hb3	81610hb4	
Date Sampled:		08/16/10	08/16/10	08/16/10	08/16/10	
Gradation ID:	Specs	81610cf1				
1 in. (25mm) Sieve	100	100				
3/4 in. (19mm) Sieve	100	100				
1/2 in. (12.5mm) Sieve	90-100(97)	96				
3/8 in. (9.5mm) Sieve	83-97(90)	90				
* #4 (4.75mm) Sieve	58-72(65)	68				
* Moving Average						
* #8 (2.36mm) Sieve	43-53(48)	46				
* Moving Average						
#16 (1.18mm) Sieve		32				
* #30 (600um) Sieve	21-29(25)	22				
* Moving Average						
#50 (300um) Sieve		11				
#100 (150um) Sieve		5.4				
* #200 (75um) Sieve	1.4-5.4(3.4)	3.7				
* Moving Average						
Compliance (Y/N)		Y				
Intended Added, % Binder	4.70		% Binder from RAP			
Actual Added, % Binder		4.48	16.72%			
Intended Total, % Binder	5.60		Actual % RAP			
Actual Total, % Binder	5.30-5.90	5.38	16.11%			
Gmb:		2.362	2.359	2.359	2.357	
Gmm:		2.458	2.462	2.464	2.461	
Pa:		3.9	4.2	4.3	4.2	
Moving Average	3.5-5.0	**4.0**	**4.0**	**4.1**	**4.2**	
Time		9:30 AM	11:15 AM	1:45 PM		This
Station		938+20	897+00	844+00		Column
Side		WB	WB	WB		Is For
Sample Tons		348.00	947.00	1,696.00		Dist. Lab
Sublot Tons		500.00	833.33	833.33	1,308.50	Test
Tons to Date		d/t	3,549.25	t/t	7,133.65	Results
Fines / Bitumen Ratio	0.6-1.4	0.86				

Time	7:00	9:00	11:00	1:00	3:00	5:00	7:00
Air Temp. °F	56	59	67	75	80	80	
Binder Temp. °F	300	300	300	300	300	300	
Mix Temp. °F	290	285	285	280	280	280	
Mat Temp. °F	287	280	275	275	275	275	

From Station	To Station	Lane
1852+00	962+50	WB

Placement And Density Record

Date Placed: 08/16/10
Date Tested: 08/17/10
Course Placed: Intermediate
Intended Lift Thickness: 1.5
Tested By: Dennis Altman

Core No.:	1	2	3	4	5	6	7
Station	1860+21	1870+25	1890+04	1917+38	777+33	856+58	948+66
CL Reference	10.5 LT	7.6 LT	1.7 LT	9.1 LT	1.5 LT	4.2 LT	3.3 LT
W 1 Dry	1,023.9	1,273.2	1,016.2	1,291.8	1,043.1	1,071.1	1,205.3
W 2 in H20	574.0	713.9	566.0	725.2	584.7	595.8	672.5
W 3 Wet	1,024.2	1,274.0	1,017.0	1,292.7	1,043.9	1,072.4	1,206.5
Difference	450.2	560.1	451.0	567.5	459.2	476.6	534.0
Field Density	2.274	2.273	2.253	2.276	2.272	2.247	2.257
% Density	96.397	96.354	95.507	96.482	96.312	95.252	95.676
% Voids	7.6	7.6	8.5	7.5	7.7	8.7	8.3
Thickness (in.)	1.5	2	1.5	2	1.75	1.75	1.75

Gmb (Lot Avg.): **2.359** | Avg. Field Density: **2.265**
Gmm (Lot Avg.): **2.461** | Avg. % Density: **95.997**
Pa (Lot Avg.): **4.2** | Avg. % Field Voids: **8.0**
Target % RAP: **15.0** | Specified % Density: 95

Q.I. = 2.265 -- (0.95 x 2.359) = **2.00**
0.012

Low Outlier: | High Outlier: | New Q.I. =

Film Thickness (FT): **9.0** (8.0-15) | VMA: **13.9** (13.3-15.3) | D.O.T. Results Used:

Remarks: 74.09 Ton went to Highway 10 Shown as waste on the Tank Stick

Gsb: 2.593 | Gb: 1.0380 | Effective % Binder (Pbe): 4.30
Tons of Mix for Pay: 3475.16 | Tons of Binder for Pay: 187.11

Mix Change Information:

Certified Tech: Rick Weisbrod | NW 473 | Cert. No.
Certified Tech: Jason Pergande | NW 693 | Cert. No.

Distribution: ____ Central Materials ____ Dist. Materials ____ Proj. Engineer ____ Contractor ____ Plant

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DAILY HMA PLANT REPORT

Project No.: NHSX-020-2(70)--3H-47 | Contractor: Tri-State Paving | JMF VMA: 14.3 | Report No.: 11

Contract ID: 47-0202-070 | County: Ida/Sac | Size: 1/2 | Lab Voids Target: 4.0

Mix Design No.: ABD10-3024 | Recycle Source: ABC10-005 | Mix Type: HMA 3M A 60% CR | Design Gyrations: 86

Hot Box I.D. No.:		81610hb1	81610hb2	81610hb3	81610hb4	
Date Sampled:		08/16/10	08/16/10	08/16/10	08/16/10	
Gradation ID:	Specs	81610cf1				
1 in. (25mm) Sieve	100	100				
3/4 in. (19mm) Sieve	100	100				
1/2 in. (12.5mm) Sieve	90-100(97)	96				
3/8 in. (9.5mm) Sieve	83-97(90)	90				
* #4 (4.75mm) Sieve	58-72(65)	68				
* Moving Average						
* #8 (2.36mm) Sieve	43-53(48)	46				
* Moving Average						
#16 (1.18mm) Sieve		32				
* #30 (600um) Sieve	21-29(25)	22				
* Moving Average						
#50 (300um) Sieve		11				
#100 (150um) Sieve		5.4				
* #200 (75um) Sieve	1.4-5.4(3.4)	3.7				
* Moving Average						
Compliance (Y/N)		Y				
Intended Added, % Binder	4.70		% Binder from RAP			
Actual Added, % Binder		4.48	16.72%			
Intended Total, % Binder	5.60		Actual % RAP			
Actual Total, % Binder	5.30-5.90	5.38	16.11%			
Gmb:		2.362	2.359	2.359	2.357	
Gmm:		2.458	2.462	2.464	2.461	
Pa:		3.9	4.2	4.3	4.2	
Moving Average	3.5-5.0	**4.0**	**4.0**	**4.1**	**4.2**	
Time		9:30 AM	11:15 AM	1:45 PM		This
Station		938+20	897+00	844+00		Column
Side		WB	WB	WB		Is For
Sample Tons		348.00	947.00	1,696.00		Dist. Lab
Sublot Tons		500.00	833.33	833.33	1,308.50	Test
Tons to Date		d/t	3,549.25	t/t	7,133.65	Results
Fines / Bitumen Ratio	0.6-1.4	0.86				

Time	7:00	9:00	11:00	1:00	3:00	5:00	7:00
Air Temp. °F	56						
Binder Temp. °F	300	300	300	300	300	300	
Mix Temp. °F	290						
Mat Temp. °F							

From Station	To Station	Lane

Placement And Density Record

Date Placed: 08/16/10
Date Tested: 08/17/10
Course Placed: Intermediate
Intended Lift Thickness: 1.5
Tested By: Dennis Altman

Core No.:	1	2	3	4	5	6	7
Station							
CL Reference							
W 1 Dry	1,238.7	1,126.0					
W 2 in H20	700.5	625.5					
W 3 Wet	1,239.5	1,127.1					
Difference	539.0	501.6					
Field Density	2.298	2.245					
% Density	97.414	95.167					
% Voids	6.6	8.8					
Thickness (in.)	1.75	1.75					

Gmb (Lot Avg.): **2.359** | Avg. Field Density:
Gmm (Lot Avg.): **2.461** | Avg. % Density:
Pa (Lot Avg.): **4.2** | Avg. % Field Voids:
Target % RAP: **15.0** | Specified % Density: 95

Q.I. = ______ -- (0.95 x 2.359) = ______

Low Outlier: | High Outlier: | New Q.I. = **-1.91**

Film Thickness (FT): 9.0 (8.0-15) | VMA: 13.9 (13.3-15.3) | D.O.T. Results Used:

Remarks: 74.09 Ton went to Highway 10 Shown as waste on the Tank Stick

Gsb: 2.593 | Gb: 1.0380 | Effective % Binder (Pbe): 4.30
Tons of Mix for Pay: 3475.16 | Tons of Binder for Pay: 187.11

Mix Change Information:

Certified Tech: Rick Weisbrod | NW 473 | Cert. No.
Certified Tech: Jason Pergande | NW 693 | Cert. No.

Distribution: ____ Central Materials ____ Dist. Materials ____ Proj. Engineer ____ Contractor ____ Plant

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DAILY HMA PLANT REPORT

Project No.: NHSX-020-2(70)--3H-47	Contractor: Tri-State Paving	JMF VMA: 14.3	Report No.: 12
Contract ID: 47-0202-070	County: Ida/Sac	Size: 1/2	Lab Voids Target: 4.0
Mix Design No.: ABD10-3024	Recycle Source: ABC10-005	Mix Type: HMA 3M A 60% CR	Design Gyrations: 86

Hot Box I.D. No.:		81710hb1	81710hb2	81710hb3	81710hb4	
Date Sampled:		08/17/10	08/17/10	08/17/10	08/17/10	
Gradation ID:	Specs	81710c1				
1 in. (25mm) Sieve	100	100				
3/4 in. (19mm) Sieve	100	100				
1/2 in. (12.5mm) Sieve	90-100(97)	98				
3/8 in. (9.5mm) Sieve	83-97(90)	92				
* #4 (4.75mm) Sieve	58-72(65)	69				
* Moving Average						
* #8 (2.36mm) Sieve	43-53(48)	46				
* Moving Average						
#16 (1.18mm) Sieve		32				
* #30 (600um) Sieve	18-26(22)	21				
* Moving Average						
#50 (300um) Sieve		11				
#100 (150um) Sieve		5.1				
* #200 (75um) Sieve	1.4-5.4(3.4)	3.3				
* Moving Average						
Compliance (Y/N)		Y				
Intended Added, % Binder	4.70		% Binder from RAP			
Actual Added, % Binder		4.49	16.03%			
Intended Total, % Binder	5.60		Actual % RAP			
Actual Total, % Binder	5.30-5.90	5.35	15.33%			
Gmb:		2.359	2.360	2.353		
Gmm:		2.461	2.464	2.460		
Pa:		4.1	4.2	4.3		
Moving Average	3.5-5.0	4.2	4.2	4.2		
Time		1:30 PM				This
Station		825+00				Column
Side		EB				Is For
Sample Tons		274.00				Dist. Lab
Sublot Tons		500.00	750.00	709.47		Test
Tons to Date		d/t	1,959.47	t/t	9,093.12	Results
Fines / Bitumen Ratio	0.6-1.4	0.77				

Time	7:00	9:00	11:00	1:00	3:00	5:00	7:00
Air Temp. °F	56	59	67	75	80	80	
Binder Temp. °F	300	300	300	300	300	300	
Mix Temp. °F	290	285	285	280	280	280	
Mat Temp. °F	287	280	275	275	275	275	

From Station	To Station	Lane
1857+50	842+00	EB

Placement And Density Record

Date Placed: 08/17/10
Date Tested: 08/18/10
Course Placed: Intermediate
Intended Lift Thickness: 1.5
Tested By: Dennis Altman

Core No.:	1	2	3	4	5	6	7
Station	1859+13	1890+34	1909+02	777+19	806+33	811+94	839+66
CL Reference	4.6 RT	3.6 RT	10.9 RT	6.7 RT	1.7 RT	3.4 RT	8.8 RT
W 1 Dry	984.9	1,044.3	1,036.4	1,236.9	1,122.4	1,096.8	1,050.2
W 2 in H20	547.3	588.8	579.4	694.1	634.4	618.2	592.9
W 3 Wet	985.8	1,045.0	1,037.2	1,237.9	1,123.1	1,097.4	1,051.1
Difference	438.5	456.2	457.8	543.8	488.7	479.2	458.2
Field Density	2.246	2.289	2.264	2.275	2.297	2.289	2.292
% Density	95.291	97.115	96.054	96.521	97.454	97.115	97.242
% Voids	8.8	7.0	8.0	7.6	6.7	7.0	6.9
Thickness (in.)	1.5	1.5	1.75	2	1.75	1.75	1.75

Gmb (Lot Avg.): **2.357** Avg. Field Density: **2.279**
Gmm (Lot Avg.): **2.462** Avg. % Density: **96.685**
Pa (Lot Avg.): **4.2** Avg. % Field Voids: **7.4**
Target % RAP: **15.0** Specified % Density: 95

Q.I. = 2.279 -- (0.95 x 2.357) = **2.21**
0.018

Low Outlier: High Outlier: New Q.I. =

Film Thickness (FT): **9.3** (8.0-15) VMA: **14** (13.3-15.3) D.O.T. Results Used:

Remarks: Late start due to rain.
448.40 Ton went to other projects
Shown as waste on the Tank Stick

Gsb: 2.593 Gb: 1.0380 Effective % Binder (Pbe): 4.27
Tons of Mix for Pay: 1959.47 Tons of Binder for Pay: 104.69

Mix Change Information:

Certified Tech: Rick Weisbrod NW 473 Cert. No.
Certified Tech: Jason Pergande NW 693 Cert. No.

Distribution: ____ Central Materials ____ Dist. Materials ____ Proj. Engineer ____ Contractor ____ Plant

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DAILY HMA PLANT REPORT

Project No.: NHSX-020-2(70)--3H-47	Contractor: Tri-State Paving	JMF VMA: 14.3	Report No.: 12
Contract ID: 47-0202-070	County: Ida/Sac	Size: 1/2	Lab Voids Target: 4.0
Mix Design No.: ABD10-3024	Recycle Source: ABC10-005	Mix Type: HMA 3M A 60% CR	Design Gyrations: 86

Hot Box I.D. No.:		81710hb1	81710hb2	81710hb3	81710hb4	
Date Sampled:		08/17/10	08/17/10	08/17/10	08/17/10	
Gradation ID:	Specs	81710c1				
1 in. (25mm) Sieve	100	100				
3/4 in. (19mm) Sieve	100	100				
1/2 in. (12.5mm) Sieve	90-100(97)	98				
3/8 in. (9.5mm) Sieve	83-97(90)	92				
* #4 (4.75mm) Sieve	58-72(65)	69				
* Moving Average						
* #8 (2.36mm) Sieve	43-53(48)	46				
* Moving Average						
#16 (1.18mm) Sieve		32				
* #30 (600um) Sieve	18-26(22)	21				
* Moving Average						
#50 (300um) Sieve		11				
#100 (150um) Sieve		5.1				
* #200 (75um) Sieve	1.4-5.4(3.4)	3.3				
* Moving Average						
Compliance (Y/N)		Y				
Intended Added, % Binder	4.70		% Binder from RAP			
Actual Added, % Binder		4.49	16.03%			
Intended Total, % Binder	5.60		Actual % RAP			
Actual Total, % Binder	5.30-5.90	5.35	15.33%			
Gmb:		2.359	2.360	2.353		
Gmm:		2.461	2.464	2.460		
Pa:		4.1	4.2	4.3		
Moving Average	3.5-5.0	4.2	4.2	4.2		
Time		1:30 PM				This
Station		825+00				Column
Side		EB				Is For
Sample Tons		274.00				Dist. Lab
Sublot Tons		500.00	750.00	709.47		Test
Tons to Date		d/t	1,959.47	t/t	9,093.12	Results
Fines / Bitumen Ratio	0.6-1.4	0.77				

Time	7:00	9:00	11:00	1:00	3:00	5:00	7:00
Air Temp. °F	56	59	67	75	80	80	
Binder Temp. °F	300	300	300	300	300	300	
Mix Temp. °F	290	285	285	280	280	280	
Mat Temp. °F	287	280	275	275	275	275	

From Station	To Station	Lane
1857+50	842+00	EB

Placement And Density Record

Date Placed: 08/17/10
Date Tested: 08/18/10
Course Placed: Intermediate
Intended Lift Thickness: 1.5
Tested By: Dennis Altman

Core No.:	1	2	3	4	5	6	7
Station							
CL Reference							
W 1 Dry	1,247.1	1,212.3	1,140.7				
W 2 in H20	701.4	677.0	637.6				
W 3 Wet	1,248.0	1,213.4	1,142.0				
Difference	546.6	536.4	504.4				
Field Density	2.282	2.260	2.261				
% Density	96.818	95.885	95.927				
% Voids	7.3	8.2	8.2				
Thickness (in.)	2	1.75	1.75				

Gmb (Lot Avg.): **2.357** Avg. Field Density:
Gmm (Lot Avg.): **2.462** Avg. % Density:
Pa (Lot Avg.): **4.2** Avg. % Field Voids:
Target % RAP: **15.0** Specified % Density: 95

Q.I. = -- (0.95 x 2.357) =

Low Outlier: High Outlier: New Q.I. = **-1.80**

Film Thickness (FT): **9.3** (8.0-15) VMA: **14** (13.3-15.3) D.O.T. Results Used:

Remarks: Late start due to rain.
448.40 Ton went to other projects
Shown as waste on the Tank Stick

Gsb: 2.593 Gb: 1.0380 Effective % Binder (Pbe): 4.27
Tons of Mix for Pay: 1959.47 Tons of Binder for Pay: 104.69

Mix Change Information:

Certified Tech: Rick Weisbrod NW 473 Cert. No.
Certified Tech: Jason Pergande NW 693 Cert. No.

Distribution: ____ Central Materials ____ Dist. Materials ____ Proj. Engineer ____ Contractor ____ Plant

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DAILY HMA PLANT REPORT

Project No.: NHSX-020-2(70)--3H-47
Contract ID: 47-0202-070
Mix Design No.: ABD10-3024

Contractor: Tri-State Paving
County: Ida/Sac
Recycle Source: ABC10-005

JMF VMA: 14.3
Size: 1/2
Mix Type: HMA 3M A 60% CR

Report No.: 13
Lab Voids Target: 4.0
Design Gyrations: 86

Hot Box I.D. No.:		81810hb1	81810hb2	81810hb3	81810hb4	
Date Sampled:		08/18/10	08/18/10	08/18/10	08/18/10	
Gradation ID:	Specs	81810c1				
1 in. (25mm) Sieve	100	100				
3/4 in. (19mm) Sieve	100	100				
1/2 in. (12.5mm) Sieve	90-100(97)	98				
3/8 in. (9.5mm) Sieve	83-97(90)	91				
* #4 (4.75mm) Sieve	58-72(65)	63				
* Moving Average						
* #8 (2.36mm) Sieve	43-53(48)	45				
* Moving Average						
#16 (1.18mm) Sieve		33				
* #30 (600um) Sieve	18-26(22)	23				
* Moving Average						
#50 (300um) Sieve		12				
#100 (150um) Sieve		5.9				
* #200 (75um) Sieve	1.4-5.4(3.4)	3.7				
* Moving Average						
Compliance (Y/N)		Y				
Intended Added, % Binder	4.70		% Binder from RAP			
Actual Added, % Binder		4.49	16.35%			
Intended Total, % Binder	5.60		Actual % RAP			
Actual Total, % Binder	5.30-5.90	5.37	15.69%			
Gmb:		2.369	2.360	2.364	2.369	
Gmm:		2.466	2.467	2.466	2.467	
Pa:		3.9	4.3	4.1	4.0	
Moving Average	3.5-5.0	**4.1**	**4.2**	**4.2**	**4.0**	
Time		8:30 AM	12:30 PM	3:30 PM	5:30 PM	This
Station		1850+00	1815+00	1778+30	1695+00	Column
Side		EB	EB	EB	EB	Is For
Sample Tons		140.00	1,062.00	1,380.00	2,350.00	Dist. Lab
Sublot Tons		500.00	833.33	833.33	612.29	Test
Tons to Date		d/t	1,959.47	t/t	9,093.12	Results
Fines / Bitumen Ratio	0.6-1.4	0.88				

Time	7:00	9:00	11:00	1:00	3:00	5:00	7:00
Air Temp. °F	58	62	70	74	76	79	
Binder Temp. °F	300	300	300	300	300	300	
Mix Temp. °F	290	290	295	288	285	292	
Mat Temp. °F	280	278	276	280	278	280	

From Station	To Station	Lane
1660+00	1857+50	rt

Placement And Density Record

Date Placed: 08/18/10
Date Tested: 08/19/10
Course Placed: Intermediate
Intended Lift Thickness: 1.5
Tested By: Dennis Altman

Core No.:	1	2	3	4	5	6	7
Station	1661+70	1673+92	1729+86	1767+69	1818+42	1836+32	1856+44
CL Reference	8 rt	3.3 rt	8.7 rt	5 rt	1.5 rt	3.6 rt	7.9 rt
W 1 Dry	1,114.4	993.8	1,115.9	1,015.9	900.8	1,109.4	1,067.5
W 2 in H20	631.9	562.0	616.2	573.4	514.0	623.8	603.2
W 3 Wet	1,115.4	994.7	1,117.2	1,016.8	901.4	1,109.8	1,068.2
Difference	483.5	432.7	501.0	443.4	387.4	486.0	465.0
Field Density	2.305	2.297	2.227	2.291	2.325	2.283	2.296
% Density	97.422	97.084	94.125	96.830	98.267	96.492	97.041
% Voids	6.6	6.9	9.7	7.1	5.8	7.5	6.9
Thickness (in.)	1.75	1.50	1.75	1.50	1.50	1.75	1.75

Gmb (Lot Avg.): **2.366**
Gmm (Lot Avg.): **2.467**
Pa (Lot Avg.): **4.1**
Target % RAP: **15.0**

Avg. Field Density: **2.289**
Avg. % Density: **96.752**
Avg. % Field Voids: **7.2**
Specified % Density: 95

Q.I. = 2.289 – (0.95 x 2.366) = **1.38**
0.03

Low Outlier: ______ High Outlier: ______ New Q.I. = ______

Film Thickness (FT): **8.5** (8.0-15) VMA: **13.7** (13.3-15.3) D.O.T. Results Used: ______

Remarks: 16 ton surface patch
559.65 ton to other projects shown as waste on the tank stick

Gsb: 2.593 Gb: 1.0380 Effective % Binder (Pbe): 4.20
Tons of Mix for Pay: 2778.95 Tons of Binder for Pay: 149.08

Mix Change Information: ______

Certified Tech: ______ Cert. No. ______
Certified Tech: Jason Pergande NW 693 Cert. No.

Distribution: ____ Central Materials ____ Dist. Materials ____ Proj. Engineer ____ Contractor ____ Plant

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DAILY HMA PLANT REPORT

Project No.: NHSX-020-2(70)--3H-47
Contract ID: 47-0202-070
Mix Design No.: ABD10-3024

Contractor: Tri-State Paving
County: Ida/Sac
Recycle Source: ABC10-005

JMF VMA: 14.3
Size: 1/2
Mix Type: HMA 3M A 60% CR

Report No.: 13
Lab Voids Target: 4.0
Design Gyrations: 86

Hot Box I.D. No.:		81810hb1	81810hb2	81810hb3	81810hb4	
Date Sampled:		08/18/10	08/18/10	08/18/10	08/18/10	
Gradation ID:	Specs	81810c1				
1 in. (25mm) Sieve	100	100				
3/4 in. (19mm) Sieve	100	100				
1/2 in. (12.5mm) Sieve	90-100(97)	98				
3/8 in. (9.5mm) Sieve	83-97(90)	91				
* #4 (4.75mm) Sieve	58-72(65)	63				
* Moving Average						
* #8 (2.36mm) Sieve	43-53(48)	45				
* Moving Average						
#16 (1.18mm) Sieve		33				
* #30 (600um) Sieve	18-26(22)	23				
* Moving Average						
#50 (300um) Sieve		12				
#100 (150um) Sieve		5.9				
* #200 (75um) Sieve	1.4-5.4(3.4)	3.7				
* Moving Average						
Compliance (Y/N)		Y				
Intended Added, % Binder	4.70		% Binder from RAP			
Actual Added, % Binder		4.49	16.35%			
Intended Total, % Binder	5.60		Actual % RAP			
Actual Total, % Binder	5.30-5.90	5.37	15.69%			
Gmb:		2.369	2.360	2.364	2.369	
Gmm:		2.466	2.467	2.466	2.467	
Pa:		3.9	4.3	4.1	4.0	
Moving Average	3.5-5.0	**4.1**	**4.2**	**4.2**	**4.0**	
Time		8:30 AM	12:30 PM	3:30 PM	5:30 PM	This
Station		1850+00	1815+00	1778+30	1695+00	Column
Side		EB	EB	EB	EB	Is For
Sample Tons		140.00	1,062.00	1,380.00	2,350.00	Dist. Lab
Sublot Tons		500.00	833.33	833.33	612.29	Test
Tons to Date		d/t	1,959.47	t/t	9,093.12	Results
Fines / Bitumen Ratio	0.6-1.4	0.88				

Time	7:00	9:00	11:00	1:00	3:00	5:00	7:00
Air Temp. °F	58	62	70	74	76	79	
Binder Temp. °F	300	300	300	300	300	300	
Mix Temp. °F	290	290	295	288	285	292	
Mat Temp. °F	280	278	276	280	278	280	

From Station	To Station	Lane

Placement And Density Record

Date Placed: 08/18/10
Date Tested: 08/19/10
Course Placed: Intermediate
Intended Lift Thickness: 1.5
Tested By: Dennis Altman

Core No.:	1	2	3	4	5	6	7
Station							
CL Reference							
W 1 Dry	1,225.1	1,251.9					
W 2 in H20	684.0	708.0					
W 3 Wet	1,226.2	1,252.5					
Difference	542.2	544.5					
Field Density	2.259	2.299					
% Density	95.478	97.168					
% Voids	8.4	6.8					
Thickness (in.)	2	2					

Gmb (Lot Avg.): **2.366**
Gmm (Lot Avg.): **2.467**
Pa (Lot Avg.): **4.1**
Target % RAP: **15.0**

Avg. Field Density: ______
Avg. % Density: ______
Avg. % Field Voids: ______
Specified % Density: 95

Q.I. = ______ – (0.95 x 2.366) = ______

Low Outlier: ______ High Outlier: ______ New Q.I. = **-1.91**

Film Thickness (FT): **8.5** (8.0-15) VMA: **13.7** (13.3-15.3) D.O.T. Results Used: ______

Remarks: 16 ton surface patch
559.65 ton to other projects shown as waste on the tank stick

Gsb: 2.593 Gb: 1.0380 Effective % Binder (Pbe): 4.20
Tons of Mix for Pay: 2778.95 Tons of Binder for Pay: 149.08

Mix Change Information: ______

Certified Tech: ______ Cert. No. ______
Certified Tech: Jason Pergande NW 693 Cert. No.

Distribution: ____ Central Materials ____ Dist. Materials ____ Proj. Engineer ____ Contractor ____ Plant

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DAILY HMA PLANT REPORT

Project No.:	NHSX-020-2(70)--3H-47	Contractor:	Tri-State Paving	JMF VMA:	14.3
Contract ID:	47-0202-070	County:	Ida/Sac	Size:	1/2
Mix Design No.:	ABD10-3024	Recycle Source:	ABC10-005	Mix Type:	HMA 3M A 60% CR

Report No.: 14 · Lab Voids Target: 4.0 · Design Gyrations: 86

Hot Box I.D. No.:		81910hb1	81910hb2	81910hb3	81910hb4	
Date Sampled:		08/19/10	08/19/10	08/19/10	08/19/10	
Gradation ID:	Specs	81910c1				
1 in. (25mm) Sieve	100	100				
3/4 in. (19mm) Sieve	100	100				
1/2 in. (12.5mm) Sieve	90-100(97)	97				
3/8 in. (9.5mm) Sieve	83-97(90)	92				
* #4 (4.75mm) Sieve	58-72(65)	67				
* Moving Average						
* #8 (2.36mm) Sieve	43-53(48)	49				
* Moving Average						
#16 (1.18mm) Sieve		33				
* #30 (600um) Sieve	18-26(22)	23				
* Moving Average						
#50 (300um) Sieve		11				
#100 (150um) Sieve		5.3				
* #200 (75um) Sieve	1.4-5.4(3.4)	3.7				
* Moving Average						
Compliance (Y/N)		Y				
Intended Added, % Binder	4.70		% Binder from RAP			
Actual Added, % Binder		4.50	15.65%			
Intended Total, % Binder	5.60		Actual % RAP			
Actual Total, % Binder	5.30-5.90	5.33	14.94%			
Gmb:		2.366	2.359	2.367	2.367	
Gmm:		2.442	2.479	2.465	2.464	
Pa:		3.1	4.8	4.0	3.9	
Moving Average	3.5-5.0	**3.9**	**4.0**	**4.0**	**4.0**	
Time		11:48 AM	2:35 AM			This
Station		1784+00	1685+70			Column
Side		WB	WB			Is For
Sample Tons		375.00	1,242.00			Dist. Lab
Sublot Tons		500.00	833.33	833.33	593.22	Test
Tons to Date		d/t	1,959.47	t/t	9,093.12	Results
Fines / Bitumen Ratio	0.6-1.4	0.87				

Time	7:00	9:00	11:00	1:00	3:00	5:00	7:00
Air Temp. °F	68	72	78	80	82	83	
Binder Temp. °F	300	300	300	300	300	300	
Mix Temp. °F	292	292	290	288	292	290	
Mat Temp. °F	275	278	279	276	280	279	

From Station	To Station	Lane
1623+00	1818+50	lt

Placement And Density Record

Date Placed: 08/19/10
Date Tested: 08/20/10
Course Placed: Intermediate
Intended Lift Thickness: 1.5
Tested By: Dennis Altman

Core No.:	1	2	3	4	5	6	7
Station	1631+75	1661+06	1699+86	1714+95	1758+73	1787+01	1804+34
CL Reference	2.8 lt	3.3 lt	7.6 lt	3.6 lt	5.7 lt	5.0 lt	8.7 lt
W 1 Dry	870.5	995.3	1,202.8	1,007.2	1,061.9	1,042.8	985.3
W 2 in H20	490.7	557.6	662.1	561.1	590.7	583.3	549.7
W 3 Wet	871.0	995.9	1,204.2	1,008.2	1,062.5	1,043.7	987.4
Difference	380.3	438.3	542.1	447.1	471.8	460.4	437.7
Field Density	2.289	2.271	2.219	2.253	2.251	2.265	2.251
% Density	96.786	96.025	93.827	95.264	95.180	95.772	95.180
% Voids	7.1	7.8	9.9	8.5	8.6	8.0	8.6
Thickness (in.)	1.25	1.50	2.00	1.50	1.75	1.50	1.50

Gmb (Lot Avg.):	**2.365**	Avg. Field Density:	**2.257**
Gmm (Lot Avg.):	**2.463**	Avg. % Density:	**95.433**
Pa (Lot Avg.):	**4.0**	Avg. % Field Voids:	**8.4**
Target % RAP:	**15.0**	Specified % Density:	95

Q.I. = 2.257 -- (0.95 x 2.365) = **0.47**
0.022

Low Outlier: 1.73 High Outlier: 1.45 New Q.I. =

Film Thickness (FT): **8.8** (8.0-15) VMA: **13.7** (13.3-15.3) D.O.T. Results Used:

Remarks: 525.64 ton was surface test strip- marked as waste on tank stick
49.05 ton for the city o Manning- marked as waste on tank stick

Gsb: 2.593 Gb: 1.0380 Effective % Binder (Pbe): 4.25
Tons of Mix for Pay: 2759.88 Tons of Binder for Pay: 147.15

Mix Change Information:

Certified Tech: Rick Weisbrod NW 473 Cert. No.
Certified Tech: Jason Pergande NW 693 Cert. No.

Distribution: ____ Central Materials ____ Dist. Materials ____ Proj. Engineer ____ Contractor ____ Plant

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DAILY HMA PLANT REPORT

Project No.:	NHSX-020-2(70)--3H-47	Contractor:	Tri-State Paving	JMF VMA:	14.8
Contract ID:	47-0202-070	County:	Ida/Sac	Size:	1/2
Mix Design No.:	ABD10-3027	Recycle Source:	ABC10-005	Mix Type:	HMA 3M A 75% CR

Report No.: Test strip · Lab Voids Target: 4.0 · Design Gyrations: 86

Hot Box I.D. No.:		81910hb1	81910hb2	81910hb3	81910hb4	
Date Sampled:		08/19/10	08/19/10	08/19/10	08/19/10	
Gradation ID:	Specs	81910c1				
1 in. (25mm) Sieve	100	100				
3/4 in. (19mm) Sieve	100	100				
1/2 in. (12.5mm) Sieve	90-100(97)	96				
3/8 in. (9.5mm) Sieve	83-97(90)	90				
* #4 (4.75mm) Sieve	60-74(67)	69				
* Moving Average						
* #8 (2.36mm) Sieve	40-50(45)	43				
* Moving Average						
#16 (1.18mm) Sieve		28				
* #30 (600um) Sieve	18-26(22)	19				
* Moving Average						
#50 (300um) Sieve		9.8				
#100 (150um) Sieve		5.9				
* #200 (75um) Sieve	1.9-5.9(3.9)	4.1				
* Moving Average						
Compliance (Y/N)		Y				
Intended Added, % Binder	5.00		% Binder from RAP			
Actual Added, % Binder		4.98	14.55%			
Intended Total, % Binder	5.80		Actual % RAP			
Actual Total, % Binder	5.50-6.10	5.83	15.27%			
Gmb:		2.379				
Gmm:		2.473				
Pa:		3.8				
Moving Average	3.5-5.0					
Time		9:30 AM				This
Station		1846+00				Column
Side		WB				Is For
Sample Tons		171.00				Dist. Lab
Sublot Tons		500.00	25.64			Test
Tons to Date		d/t	525.64	t/t	525.64	Results
Fines / Bitumen Ratio	0.6-1.4	0.89				

Time	7:00	9:00	11:00	1:00	3:00	5:00	7:00
Air Temp. °F	68	72	78	80	82	83	
Binder Temp. °F	300	300	300	300	300	300	
Mix Temp. °F	292	292	290	288	292	290	
Mat Temp. °F	275	278	279	276	280	279	

From Station	To Station	Lane
1818+50	1852+00	lt

Placement And Density Record

Date Placed: 08/19/10
Date Tested: 08/20/10
Course Placed: Surface
Intended Lift Thickness: 1.5
Tested By: Dennis Altman

Core No.:	1	2	3	4	5	6	7
Station	1819+02	1823+62	1830+11	1833+18	1838+03	1841+93	1844+21
CL Reference	2.6 lt	10.2 lt	10.8 lt	2.0 lt	6.8 lt	2.2 lt	9.4 lt
W 1 Dry	927.5	1,286.3	998.0	725.3	1,037.2	994.9	833.7
W 2 in H20	517.7	718.5	563.2	407.3	585.4	566.1	467.1
W 3 Wet	927.9	1,287.1	998.3	725.7	1,037.6	995.1	834.1
Difference	410.2	568.6	435.1	318.4	452.2	429.0	367.0
Field Density	2.261	2.262	2.294	2.278	2.294	2.319	2.272
% Density	95.040	95.082	96.427	95.755	96.427	97.478	95.502
% Voids	8.6	8.5	7.2	7.9	7.2	6.2	8.1
Thickness (in.)	1.50	2.00	1.50	1.25	1.50	1.50	834.1

Gmb (Lot Avg.):	**2.379**	Avg. Field Density:	**2.283**
Gmm (Lot Avg.):	**2.473**	Avg. % Density:	**95.959**
Pa (Lot Avg.):	**3.8**	Avg. % Field Voids:	**7.7**
Target % RAP:	**15.0**	Specified % Density:	95

Q.I. = 2.283 -- (0.95 x 2.379) = **1.09**
0.021

Low Outlier: High Outlier: New Q.I. =

Film Thickness (FT): **9.7** (8.0-15) VMA: **14.3** (13.8-15.8) D.O.T. Results Used:

Remarks:

Gsb: 2.615 Gb: 1.0380 Effective % Binder (Pbe): 4.60
Tons of Mix for Pay: 525.64 Tons of Binder for Pay: 30.66

Mix Change Information:

Certified Tech: Rick Weisbrod Nw 473 Cert. No.
Certified Tech: Jason Pergande NW 693 Cert. No.

Distribution: ____ Central Materials ____ Dist. Materials ____ Proj. Engineer ____ Contractor ____ Plant

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DAILY HMA PLANT REPORT

Project No.: NHSX-020-2(70)--3H-47
Contract ID: 47-0202-070
Mix Design No.: ABD10-3024

Contractor: Tri-State Paving
County: Ida/Sac
Recycle Source: ABC10-005

JMF VMA: 14.3
Size: 1/2
Mix Type: HMA 3M A 60% CR

Report No.: 15
Lab Voids Target: 4.0
Design Gyrations: 86

Hot Box I.D. No.:		82010hb1	82010hb2	82010hb3	82010hb4	
Date Sampled:		08/20/10	08/20/10	08/20/10	08/20/10	
Gradation ID:	Specs	82010c1				
1 in. (25mm) Sieve	100	100				
3/4 in. (19mm) Sieve	100	100				
1/2 in. (12.5mm) Sieve	90-100(97)	97				
3/8 in. (9.5mm) Sieve	83-97(90)	92				
* #4 (4.75mm) Sieve	58-72(65)	68				
* Moving Average						
* #8 (2.36mm) Sieve	43-53(48)	45				
* Moving Average						
#16 (1.18mm) Sieve		31				
* #30 (600um) Sieve	18-26(22)	21				
* Moving Average						
#50 (300um) Sieve		11				
#100 (150um) Sieve		5.7				
* #200 (75um) Sieve	1.4-5.4(3.4)	3.8				
* Moving Average						
Compliance (Y/N)		Y				
Intended Added, % Binder	4.70		% Binder from RAP			
Actual Added, % Binder		4.47	16.23%			
Intended Total, % Binder	5.60		Actual % RAP			
Actual Total, % Binder	5.30-5.90	5.34	15.48%			
Gmb:		2.362	2.365	2.372		
Gmm:		2.457	2.460	2.462		
Pa:		3.9	3.9	3.7		
Moving Average	3.5-5.0	**4.2**	**3.9**	**3.9**		
Time		10:55 AM	3:00 PM	4:47 PM		This
Station		1610+00	1640+00	1610+40		Column
Side		WB	EB	EB		Is For
Sample Tons		221.00	874.00	1,372.00		Dist. Lab
Sublot Tons		500.00	750.00	521.43		Test
Tons to Date		d/t	1,771.43	t/t	9,093.12	Results
Fines / Bitumen Ratio	0.6-1.4	0.88				

Gsb: 2.593 Gb: 1.0380 Effective % Binder (Pbe): 4.30
Tons of Mix for Pay: 1771.43 Tons of Binder for Pay: 94.46

Time	7:00	9:00	11:00	1:00	3:00	5:00	7:00
Air Temp. °F	70	74	78	83	88	88	
Binder Temp. °F	300	300	300	300	300	300	
Mix Temp. °F	292	292	290	288	292	290	
Mat Temp. °F	275	278	279	276	280	279	

From Station	To Station	Lane
1584+10	1660+00	

Placement And Density Record

Date Placed: 08/20/10
Date Tested: 08/20/10
Course Placed: Intermediate
Intended Lift Thickness: 1.5
Tested By: Dennis Altman

Core No.:	1	2	3	4	5	6	7
Station	1587+05	1598+76	1608+51	1626+10	1638+01	1643+26	1653+73
CL Reference	6.0 rt	2.5 rt	6.5 rt	6.0 rt	4.1 rt	4.0 rt	8.0 rt
W 1 Dry	964.1	1,108.8	833.5	1,043.7	945.5	1,097.8	824.6
W 2 in H20	542.9	622.4	466.9	586.5	532.4	623.5	461.7
W 3 Wet	964.6	1,109.2	834.1	1,044.4	945.9	1,098.5	824.9
Difference	421.7	486.8	367.2	457.9	413.5	475.0	363.2
Field Density	2.286	2.278	2.270	2.279	2.287	2.311	2.270
% Density	96.619	96.281	95.943	96.323	96.661	97.675	95.943
% Voids	7.1	7.4	7.7	7.4	7.0	6.1	7.7
Thickness (in.)	1.50	1.75	1.50	1.50	1.50	1.75	1.25

Gmb (Lot Avg.): **2.366** Avg. Field Density: **2.283**
Gmm (Lot Avg.): **2.460** Avg. % Density: **96.492**
Pa (Lot Avg.): **3.8** Avg. % Field Voids: **7.2**
Target % RAP: **15.0** Specified % Density: 95

Q.I. = 2.283 – (0.95 x 2.366) = **2.52**
0.014

Low Outlier: High Outlier: New Q.I. =

Film Thickness (FT): **9.0** (8.0-15) VMA: **13.6** (13.3-15.3) D.O.T. Results Used:

Remarks: 7 TON SURACE PATCH- SHOWN AS WASTE ON TANK STICK

Mix Change Information:

Certified Tech: Rick Weisbrod NW 473 Cert. No.
Certified Tech: Jason Pergande NW 693 Cert. No.

Distribution: ____ Central Materials ____ Dist. Materials ____ Proj. Engineer ____ Contractor ____ Plant

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DAILY HMA PLANT REPORT

Project No.: NHSX-020-2(70)--3H-47
Contract ID: 47-0202-070
Mix Design No.: ABD10-3027

Contractor: Tri-State Paving
County: Ida/Sac
Recycle Source: ABC10-005

JMF VMA: 14.8
Size: 1/2
Mix Type: HMA 3M A 75% CR

Report No.: 16
Lab Voids Target: 4.0
Design Gyrations: 86

Hot Box I.D. No.:		82110hb1	82110hb2	82110hb3	82110hb4	
Date Sampled:		08/21/10	08/21/10	08/21/10	08/21/10	
Gradation ID:	Specs	82110c1				
1 in. (25mm) Sieve	100	100				
3/4 in. (19mm) Sieve	100	100				
1/2 in. (12.5mm) Sieve	90-100(97)	97				
3/8 in. (9.5mm) Sieve	83-97(90)	92				
* #4 (4.75mm) Sieve	60-74(67)	72				
* Moving Average						
* #8 (2.36mm) Sieve	40-50(45)	46				
* Moving Average						
#16 (1.18mm) Sieve		29				
* #30 (600um) Sieve	18-26(22)	20				
* Moving Average						
#50 (300um) Sieve		9.6				
#100 (150um) Sieve		4.5				
* #200 (75um) Sieve	1.9-5.9(3.9)	3.0				
* Moving Average						
Compliance (Y/N)		Y				
Intended Added, % Binder	5.00		% Binder from RAP			
Actual Added, % Binder		4.77	15.04%			
Intended Total, % Binder	5.80		Actual % RAP			
Actual Total, % Binder	5.50-6.10	5.61	15.15%			
Gmb:		2.376	2.371	2.373	2.376	
Gmm:		2.471	2.474	2.476	2.475	
Pa:		3.8	4.2	4.2	4.0	
Moving Average	3.5-5.0				**4.1**	
Time		11:15 AM	1:15 PM	3:26 PM	4:16 PM	This
Station		1010+15	969+10	897+50	871+50	Column
Side		wb	wb	wb	wb	Is For
Sample Tons		273.00	796.00	1,653.00	2,168.00	Dist. Lab
Sublot Tons		500.00	833.33	833.33	414.27	Test
Tons to Date		d/t	2,580.93	t/t	3,106.57	Results
Fines / Bitumen Ratio	0.6-1.4	0.67				

Gsb: 2.615 Gb: 1.0380 Effective % Binder (Pbe): 4.49
Tons of Mix for Pay: 2580.93 Tons of Binder for Pay: 144.90

Time	7:00	9:00	11:00	1:00	3:00	5:00	7:00
Air Temp. °F	70	73	79	82	89	90	
Binder Temp. °F	300	300	300	300	300	300	
Mix Temp. °F	293	290	290	295	290	295	
Mat Temp. °F	275	275	280	280	275	280	

From Station	To Station	Lane
1031+16	827+50	lt

Placement And Density Record

Date Placed: 08/21/10
Date Tested: 08/23/10
Course Placed: Surface
Intended Lift Thickness: 1.5
Tested By: Dennis Altman

Core No.:	1	2	3	4	5	6	7
Station	850+35	877+92	888+22	937+41	961+28	987+84	1029+35
CL Reference	8.6 lt	6.7 lt	2.3 lt	10.6 lt	10.8 lt	8.1 lt	9.8 lt
W 1 Dry	1,111.7	1,113.3	1,083.4	758.2	961.5	886.1	991.3
W 2 in H20	622.7	626.9	605.2	417.3	536.4	500.4	565.5
W 3 Wet	1,112.7	1,113.9	1,084.3	759.1	962.3	886.4	991.8
Difference	490.0	487.0	479.1	341.8	425.9	386.0	426.3
Field Density	2.269	2.286	2.261	2.218	2.258	2.296	2.325
% Density	95.577	96.293	95.240	93.429	95.114	96.714	97.936
% Voids	8.3	7.6	8.6	10.3	8.7	7.2	6.0
Thickness (in.)	1.75	1.75	1.75	1.25	1.50	1.25	1.5

Gmb (Lot Avg.): **2.374** Avg. Field Density: **2.273**
Gmm (Lot Avg.): **2.474** Avg. % Density: **95.758**
Pa (Lot Avg.): **4.1** Avg. % Field Voids: **8.1**
Target % RAP: **15.0** Specified % Density: 95

Q.I. = 2.273 – (0.95 x 2.374) = **0.52**
0.034

Low Outlier: 1.62 High Outlier: 1.53 New Q.I. =

Film Thickness (FT): **10.5** (8.0-15) VMA: **14.3** (13.8-15.8) D.O.T. Results Used:

Remarks:

Mix Change Information:

Certified Tech: Rick Weisbrod Nw 473 Cert. No.
Certified Tech: Jason Pergande NW 693 Cert. No.

Distribution: ____ Central Materials ____ Dist. Materials ____ Proj. Engineer ____ Contractor _/_ Plant

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DAILY HMA PLANT REPORT

Project No.: NHSX-020-2(70)--3H-47 | Contractor: Tri-State Paving | JMF VMA: 14.8 | Report No.: 17
Contract ID: 47-0202-070 | County: Ida/Sac | Size: 1/2 | Lab Voids Target: 4.0
Mix Design No.: ABD10-3027 | Recycle Source: ABC10-005 | Mix Type: HMA 3M A 75% CR | Design Gyrations: 86

Hot Box I.D. No.:		82310hb1	82310hb2	82310hb3	82310hb4	
Date Sampled:		08/23/10	08/23/10	08/23/10	08/23/10	
Gradation ID:	Specs	82310c1				
1 in. (25mm) Sieve	100	100				
3/4 in. (19mm) Sieve	100	100				
1/2 in. (12.5mm) Sieve	90-100(97)	98				
3/8 in. (9.5mm) Sieve	83-97(90)	93				
* #4 (4.75mm) Sieve	60-74(67)	73				
* Moving Average						
* #8 (2.36mm) Sieve	40-50(45)	47				
* Moving Average						
#16 (1.18mm) Sieve		29				
* #30 (600um) Sieve	18-26(22)	21				
* Moving Average						
#50 (300um) Sieve		10				
#100 (150um) Sieve		5				
* #200 (75um) Sieve	1.9-5.9(3.9)	3.5				
* Moving Average						
Compliance (Y/N)		Y				
Intended Added, % Binder	5.00		% Binder from RAP			
Actual Added, % Binder		4.72	15.78%			
Intended Total, % Binder	5.80		Actual % RAP			
Actual Total, % Binder	5.50-6.10	5.60	15.86%			
Gmb:		2.383	2.385	2.383	2.385	
Gmm:		2.484	2.481	2.483	2.478	
Pa:		4.1	3.9	4.0	3.8	
Moving Average	3.5-5.0	4.1	4.1	4.0	4.0	
Time		10:30 AM	11:55 AM	2:10 PM	4:15 PM	This
Station		1062+00	987+60	915+00	866+20	Column
Side		EB	EB	EB	EB	Is For
Sample Tons		424.00	874.00	1,599.00	2,251.00	Dist. Lab
Sublot Tons		500.00	833.33	833.33	755.87	Test
Tons to Date		d/t	2,952.42	t/t	6,058.99	Results
Fines / Bitumen Ratio	0.6-1.4	0.80				

Time	7:00	9:00	11:00	1:00	3:00	5:00	7:00
Air Temp. °F	69	72	75	84	86	89	
Binder Temp. °F	300	300	300	300	300	300	
Mix Temp. °F	295	295	290	290	290	290	
Mat Temp. °F	278	277	278	275	275	275	

From Station	To Station	Lane
816+50	1031+16	rt

Placement And Density Record

Date Placed: 08/23/10
Date Tested: 08/24/10
Course Placed: Surface
Intended Lift Thickness: 1.5
Tested By: Dennis Altman

Core No.:	1	2	3	4	5	6	7
Station	817+74	866+69	882+85	925+03	941+29	990+21	1012+15
CL Reference	4.0 rt	5.5 rt	8.9 rt	10.2 rt	1.7 rt	7.9 rt	10.3 rt
W 1 Dry	1,081.1	983.2	1,014.4	913.4	884.9	856.6	851.6
W 2 in H20	611.3	550.4	566.2	516.4	496.9	482.0	480.8
W 3 Wet	1,081.5	983.6	1,015.1	913.9	885.2	857.2	852.0
Difference	470.2	433.2	448.9	397.5	388.3	375.2	371.2
Field Density	2.299	2.270	2.260	2.298	2.279	2.283	2.294
% Density	96.435	95.218	94.799	96.393	95.596	95.763	96.225
% Voids	7.4	8.5	8.9	7.4	8.2	8.0	7.6
Thickness (in.)	1.75	1.50	1.50	1.50	1.25	1.50	1.25

Gmb (Lot Avg.): 2.384 | Avg. Field Density: 2.283
Gmm (Lot Avg.): 2.482 | Avg. % Density: 95.776
Pa (Lot Avg.): 4.0 | Avg. % Field Voids: 8.0
Target % RAP: 15.0 | Specified % Density: 95

Q.I. = 2.283 – (0.95 x 2.384) = 1.21
0.015

Low Outlier: | High Outlier: | New Q.I. =

Film Thickness (FT): 9.6 (8.0-15) | VMA: 13.9 (13.8-15.8) | D.O.T. Results Used:

Remarks: 29.89 ton to the city of Manning- shown as waste on tank stick.

Gsb: 2.615 | Gb: 1.0380 | Effective % Binder (Pbe): 4.35
Tons of Mix for Pay: 2922.53 | Tons of Binder for Pay: 163.66

Mix Change Information:

Certified Tech: Rick Weisbrod | Nw 473 Cert. No.
Certified Tech: Jason Pergande | NW 693 Cert. No.

Distribution: Central Materials | Dist. Materials | Proj. Engineer | Contractor | Plant

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DAILY HMA PLANT REPORT

Project No.: NHSX-020-2(70)--3H-47 | Contractor: Tri-State Paving | JMF VMA: 14.8 | Report No.: 18
Contract ID: 47-0202-070 | County: Ida/Sac | Size: 1/2 | Lab Voids Target: 4.0
Mix Design No.: ABD10-3027 | Recycle Source: ABC10-005 | Mix Type: HMA 3M A 75% CR | Design Gyrations: 86

Hot Box I.D. No.:		82410hb1	82410hb2	82410hb3	82410hb4	
Date Sampled:		08/24/10	08/24/10	08/24/10	08/24/10	
Gradation ID:	Specs	82410c1				
1 in. (25mm) Sieve	100	100				
3/4 in. (19mm) Sieve	100	100				
1/2 in. (12.5mm) Sieve	90-100(97)	98				
3/8 in. (9.5mm) Sieve	83-97(90)	93				
* #4 (4.75mm) Sieve	60-74(67)	72				
* Moving Average						
* #8 (2.36mm) Sieve	40-50(45)	46				
* Moving Average						
#16 (1.18mm) Sieve		28				
* #30 (600um) Sieve	18-26(22)	21				
* Moving Average						
#50 (300um) Sieve		9.8				
#100 (150um) Sieve		4.8				
* #200 (75um) Sieve	1.9-5.9(3.9)	3.3				
* Moving Average						
Compliance (Y/N)		Y				
Intended Added, % Binder	5.00		% Binder from RAP			
Actual Added, % Binder		4.73	15.48%			
Intended Total, % Binder	5.80		Actual % RAP			
Actual Total, % Binder	5.50-6.10	5.60	15.44%			
Gmb:		2.379	2.379	2.376	2.374	
Gmm:		2.467	2.467	2.469	2.466	
Pa:		3.6	3.6	3.8	3.7	
Moving Average	3.5-5.0	3.8	3.8	3.7	3.7	
Time		10:20 AM	12:16 PM	3:40 PM	5:20 PM	This
Station		787+40	1902+10	1896+80	1810+25	Column
Side		WB	WB	WB	WB	Is For
Sample Tons		468.00	1,027.00	1,802.00	2,304.00	Dist. Lab
Sublot Tons		500.00	733.33	733.33	534.19	Test
Tons to Date		d/t	2,500.85	t/t	8,559.84	Results
Fines / Bitumen Ratio	0.6-1.4	0.72				

Time	7:00	9:00	11:00	1:00	3:00	5:00	7:00
Air Temp. °F	63	65	69	72	73	73	
Binder Temp. °F	300	300	300	300	300	300	
Mix Temp. °F	298	299	299	300	295	300	
Mat Temp. °F	280	283	285	285	280	285	

From Station	To Station	Lane
1791+52	827+50	lt

Placement And Density Record

Date Placed: 08/24/10
Date Tested: 08/25/10
Course Placed: Surface
Intended Lift Thickness: 1.5
Tested By: Dennis Altman

Core No.:	1	2	3	4	5	6	7
Station	1829+41	1850+58	1916+16	784+04	797+17	811+20	818+98
CL Reference	3.7 lt	4.9 lt	2.2 lt	1.9 lt	3.5 lt	5.9 lt	6.4 lt
W 1 Dry	887.4	1,061.5	1,037.1	861.8	982.6	756.4	982.9
W 2 in H20	494.2	598.2	583.0	491.5	550.2	434.1	560.1
W 3 Wet	887.9	1,062.0	1,037.8	862.1	983.7	756.5	983.3
Difference	393.7	463.8	454.8	370.6	433.5	322.4	423.2
Field Density	2.254	2.289	2.280	2.325	2.267	2.346	2.323
% Density	94.825	96.298	95.919	97.812	95.372	98.696	97.728
% Voids	8.6	7.2	7.6	5.8	8.1	4.9	5.8
Thickness (in.)	1.50	1.75	1.75	1.25	1.50	1.25	1.50

Gmb (Lot Avg.): 2.377 | Avg. Field Density: 2.298
Gmm (Lot Avg.): 2.467 | Avg. % Density: 96.664
Pa (Lot Avg.): 3.7 | Avg. % Field Voids: 6.9
Target % RAP: 15.0 | Specified % Density: 95

Q.I. = 2.298 – (0.95 x 2.377) = 1.17
0.034

Low Outlier: | High Outlier: | New Q.I. =

Film Thickness (FT): 10.4 (8.0-15) | VMA: 14.2 (13.8-15.8) | D.O.T. Results Used:

Remarks: 2 TON OF ROAD WASTE
44.66 TON TO THE CITY OF MANNING- BOTH SHOWN AS WASTE
ON THE TANK STICK

Gsb: 2.615 | Gb: 1.0380 | Effective % Binder (Pbe): 4.61
Tons of Mix for Pay: 2500.85 | Tons of Binder for Pay: 140.01

Mix Change Information:

Certified Tech: Rick Weisbrod | Nw 473 Cert. No.
Certified Tech: Jason Pergande | NW 693 Cert. No.

Distribution: ____ Central Materials ____ Dist. Materials ____ Proj. Engineer ____ Contractor ____ Plant

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DAILY HMA PLANT REPORT

Project No.: NHSX-020-2(70)--3H-47
Contract ID: 47-0202-070
Mix Design No.: ABD10-3027

Contractor: Tri-State Paving
County: Ida/Sac
Recycle Source: ABC10-005

JMF VMA: 14.8
Size: 1/2
Mix Type: HMA 3M A 75% CR

Report No.: 19
Lab Voids Target: 4.0
Design Gyrations: 86

Hot Box I.D. No.:		82510hb1	82510hb2	82510hb3	82510hb4	
Date Sampled:		08/25/10	08/25/10	08/25/10	08/25/10	
Gradation ID:	Specs	82510c1				
1 in. (25mm) Sieve	100	100				
3/4 in. (19mm) Sieve	100	100				
1/2 in. (12.5mm) Sieve	90-100(97)	97				
3/8 in. (9.5mm) Sieve	83-97(90)	90				
* #4 (4.75mm) Sieve	60-74(67)	67				
* Moving Average						
* #8 (2.36mm) Sieve	40-50(45)	40				
* Moving Average						
#16 (1.18mm) Sieve		27				
* #30 (600um) Sieve	18-26(22)	18				
* Moving Average						
#50 (300um) Sieve		9.8				
#100 (150um) Sieve		6				
* #200 (75um) Sieve	1.9-5.9(3.9)	4.0				
* Moving Average						
Compliance (Y/N)		Y				
Intended Added, % Binder	4.90		% Binder from RAP			
Actual Added, % Binder		4.80	15.32%			
Intended Total, % Binder	5.70		Actual % RAP			
Actual Total, % Binder	5.40-6.00	5.67	15.49%			
Gmb:		2.379	2.376	2.378	2.377	
Gmm:		2.467	2.470	2.469	2.466	
Pa:		3.6	3.8	3.7	3.6	
Moving Average	3.5-5.0	**3.7**	**3.7**	**3.7**	**3.7**	
Time		10:20 AM	1:00 PM	3:20 PM	5:30 PM	This
Station		784+20	1771+05	1819+30	1787+05	Column
Side		eb	eb	eb	eb	Is For
Sample Tons		374.00	1,426.00	1,876.00	2,250.00	Dist. Lab
Sublot Tons		500.00	733.33	733.33	842.22	Test
Tons to Date		d/t	2,808.88	t/t	11,368.72	Results
Fines / Bitumen Ratio	0.6-1.4	0.87				

Gsb: 2.615 Gb: 1.0380 Effective % Binder (Pbe): 4.61
Tons of Mix for Pay: 2808.88 Tons of Binder for Pay: 159.21

Mix Change Information:

Time	7:00	9:00	11:00	1:00	3:00	5:00	7:00
Air Temp. °F	58	63	69	71	72	74	
Binder Temp. °F	300	300	300	300	300	300	
Mix Temp. °F	300	305	298	295	298	300	
Mat Temp. °F	280	285	285	278	280	280	

From Station	To Station	Lane
1749+00	821+50	rt

Placement And Density Record

Date Placed: 08/25/10
Date Tested: 08/26/10
Course Placed: Surface
Intended Lift Thickness: 1.5
Tested By: Dennis Altman

Core No.:	1	2	3	4	5	6	7
Station	1772+25	1804+08	1831+31	1879+35	1892+88	709+95	815+42
CL Reference	7.5 rt	6.2 rt	4.7 rt	10.4 rt	4.1 rt	1.5 rt	4.8 rt
W 1 Dry	1,053.4	837.7	1,097.9	983.2	1,162.1	1,010.2	897.3
W 2 in H20	595.6	474.5	620.6	547.6	666.3	573.6	506.6
W 3 Wet	1,053.7	837.9	1,098.3	983.7	1,162.6	1,010.6	897.7
Difference	458.1	363.4	477.7	436.1	496.3	437.0	391.1
Field Density	2.299	2.305	2.298	2.255	2.342	2.312	2.294
% Density	96.678	96.930	96.636	94.828	98.486	97.225	96.468
% Voids	6.8	6.6	6.9	8.6	5.1	6.3	7.1
Thickness (in.)	1.50	1.25	1.75	1.50	1.75	1.50	1.25

Gmb (Lot Avg.): **2.378**
Gmm (Lot Avg.): **2.468**
Pa (Lot Avg.): **3.7**
Target % RAP: **15.0**

Avg. Field Density: **2.301**
Avg. % Density: **96.750**
Avg. % Field Voids: **6.8**
Specified % Density: 95

Q.I. = 2.301 – (0.95 x 2.378) = **1.61**
0.026

Low Outlier: High Outlier: New Q.I. =

Film Thickness (FT): **10.0** (8.0-15) VMA: **14.2** (13.8-15.8) D.O.T. Results Used:

Remarks:

Certified Tech: Rick Weisbrod Nw 473 Cert. No.
Certified Tech: Jason Pergande NW 693 Cert. No.

Distribution: ____ Central Materials ____ Dist. Materials ____ Proj. Engineer ____ Contractor ____ Plant

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DAILY HMA PLANT REPORT

Project No.: NHSX-020-2(70)--3H-47
Contract ID: 47-0202-070
Mix Design No.: ABD10-3027

Contractor: Tri-State Paving
County: Ida/Sac
Recycle Source: ABC10-005

JMF VMA: 14.8
Size: 1/2
Mix Type: HMA 3M A 75% CR

Report No.: 20
Lab Voids Target: 4.0
Design Gyrations: 86

Hot Box I.D. No.:		82610hb1	82610hb2	82610hb3	82610hb4	
Date Sampled:		08/26/10	08/26/10	08/26/10	08/26/10	
Gradation ID:	Specs	82610c1				
1 in. (25mm) Sieve	100	100				
3/4 in. (19mm) Sieve	100	100				
1/2 in. (12.5mm) Sieve	90-100(97)	97				
3/8 in. (9.5mm) Sieve	83-97(90)	89				
* #4 (4.75mm) Sieve	60-74(67)	67				
* Moving Average						
* #8 (2.36mm) Sieve	40-50(45)	40				
* Moving Average						
#16 (1.18mm) Sieve		27				
* #30 (600um) Sieve	18-26(22)	18				
* Moving Average						
#50 (300um) Sieve		9.6				
#100 (150um) Sieve		5.5				
* #200 (75um) Sieve	1.9-5.9(3.9)	3.7				
* Moving Average						
Compliance (Y/N)		Y				
Intended Added, % Binder	4.90		% Binder from RAP			
Actual Added, % Binder		4.87	14.87%			
Intended Total, % Binder	5.70		Actual % RAP			
Actual Total, % Binder	5.40-6.00	5.72	15.17%			
Gmb:		2.377	2.379	2.378	2.376	
Gmm:		2.467	2.469	2.469	2.467	
Pa:		3.6	3.6	3.7	3.7	
Moving Average	3.5-5.0	**3.7**	**3.6**	**3.6**	**3.6**	
Time		9:35 AM	1:30 PM	3:15 PM	4:40 PM	This
Station		1837+10	1693+00	1644+70	1606+10	Column
Side		EB	EB	EB	EB	Is For
Sample Tons		226.00	1,060.00	1,642.00	2,147.00	Dist. Lab
Sublot Tons		500.00	733.33	733.33	451.34	Test
Tons to Date		d/t	2,418.00	t/t	13,786.72	Results
Fines / Bitumen Ratio	0.6-1.4	0.80				

Gsb: 2.615 Gb: 1.0380 Effective % Binder (Pbe): 4.64
Tons of Mix for Pay: 2418.00 Tons of Binder for Pay: 138.19

Mix Change Information:

Time	7:00	9:00	11:00	1:00	3:00	5:00	7:00
Air Temp. °F	55	60	64	75	79	81	
Binder Temp. °F	300	300	300	300	300	300	
Mix Temp. °F	305	300	295	295	295	295	
Mat Temp. °F	285	280	280	280	280	285	

From Station	To Station	Lane
1584+10	1744+71	rt

Placement And Density Record

Date Placed: 08/26/10
Date Tested: 08/27/10
Course Placed: Surface
Intended Lift Thickness: 1.5
Tested By: Dennis Altman

Core No.:	1	2	3	4	5	6	7
Station	1585+03	1608+07	1632+22	1665+59	1679+68	1705+00	1740+11
CL Reference	4.4 rt	9.8 rt	2.6 rt	4.5 rt	8.3 rt	10 rt	6.3 rt
W 1 Dry	1,211.7	951.4	1,011.0	1,056.1	818.9	800.8	1,021.4
W 2 in H20	681.4	526.3	568.8	599.1	462.4	455.2	568.0
W 3 Wet	1,212.4	952.4	1,011.4	1,056.5	819.4	801.2	1,021.9
Difference	531.0	426.1	442.6	457.4	357.0	346.0	453.9
Field Density	2.282	2.233	2.284	2.309	2.294	2.314	2.250
% Density	95.963	93.902	96.047	97.098	96.468	97.309	94.617
% Voids	7.5	9.5	7.5	6.4	7.1	6.2	8.8
Thickness (in.)	1.75	1.50	1.50	1.50	1.25	1.25	1.50

Gmb (Lot Avg.): **2.378**
Gmm (Lot Avg.): **2.468**
Pa (Lot Avg.): **3.7**
Target % RAP: **15.0**

Avg. Field Density: **2.281**
Avg. % Density: **95.915**
Avg. % Field Voids: **7.6**
Specified % Density: 95

Q.I. = 2.281 – (0.95 x 2.378) = **0.73**
0.03

Low Outlier: High Outlier: New Q.I. =

Film Thickness (FT): **10.4** (8.0-15) VMA: **14.3** (13.8-15.8) D.O.T. Results Used:

Remarks: Ther was 25.52 ton of plant waste and 8 ton road waste shown on tank stick

Certified Tech: Rick Weisbrod Nw 473 Cert. No.
Certified Tech: Jason Pergande NW 693 Cert. No.

Distribution: ____ Central Materials ____ Dist. Materials ____ Proj. Engineer ____ Contractor ____ Plant

800241 - 10/08 ver. 3.5

DAILY HMA PLANT REPORT

Project No.: NHSX-020-2(70)--3H-47
Contract ID: 47-0202-070
Mix Design No.: ABD10-3027

Contractor: Tri-State Paving
County: Ida/Sac
Recycle Source: ABC10-005

JMF VMA: 14.8
Size: 1/2
Mix Type: HMA 3M A 75% CR

Report No.: 21
Lab Voids Target: 4.0
Design Gyrations: 86

Hot Box I.D. No.:		82710hb1	82710hb2	82710hb3	82710hb4	
Date Sampled:		08/27/10	08/27/10	08/27/10	08/27/10	
Gradation ID:	Specs	82710c1				
1 in. (25mm) Sieve	100	100				
3/4 in. (19mm) Sieve	100	100				
1/2 in. (12.5mm) Sieve	90-100(97)	96				
3/8 in. (9.5mm) Sieve	83-97(90)	89				
* #4 (4.75mm) Sieve	60-74(67)	67				
* Moving Average						
* #8 (2.36mm) Sieve	40-50(45)	40				
* Moving Average						
#16 (1.18mm) Sieve		27				
* #30 (600um) Sieve	18-26(22)	18				
* Moving Average						
#50 (300um) Sieve		9.2				
#100 (150um) Sieve		5.3				
* #200 (75um) Sieve	1.9-5.9(3.9)	3.5				
* Moving Average						
Compliance (Y/N)		Y				
Intended Added, % Binder	4.90		% Binder from RAP			
Actual Added, % Binder		4.81	15.44%			
Intended Total, % Binder	5.70		Actual % RAP			
Actual Total, % Binder	5.40-6.00	5.69	15.66%			
Gmb:		2.380	2.379	2.378	2.381	
Gmm:		2.467	2.466	2.469	2.467	
Pa:		3.5	3.5	3.7	3.5	
Moving Average	3.5-5.0	**3.7**	**3.6**	**3.6**	**3.6**	
Time						This
Station						Column
Side						Is For
Sample Tons						Dist. Lab
Sublot Tons		500.00	666.67	666.67	973.30	Test
Tons to Date		d/t	2,806.64	t/t	16,593.36	Results
Fines / Bitumen Ratio	0.6-1.4	0.75				

Gsb: 2.615 Gb: 1.0380 Effective % Binder (Pbe): 4.64
Tons of Mix for Pay: 2806.64 Tons of Binder for Pay: 159.53

Mix Change Information: ____________

Time	7:00	9:00	11:00	1:00	3:00	5:00	7:00
Air Temp. °F	59	64	70	77	80	82	
Binder Temp. °F	300	300	300	300	300	300	
Mix Temp. °F	300	300	305	300	300	300	
Mat Temp. °F	285	285	285	280	280	285	

From Station	To Station	Lane
1584+10	1788+62	Left

Placement And Density Record

Date Placed: 08/27/10
Date Tested: 08/30/10
Course Placed: Surface
Intended Lift Thickness: 1.5
Tested By: Dennis Altman

Core No.:	1	2	3	4	5	6	7
Station	1589+52	1615+05	1652+66	1679+22	1704+56	1746+22	1785+83
CL Reference	4.8 lt	4.6 lt	10.5 lt	10.9 lt	10.5 lt	4.2 lt	1.7 lt
W 1 Dry	1,199.7	1,050.7	1,098.2	994.3	1,121.2	1,006.5	1,072.7
W 2 In H20	677.3	589.9	616.7	560.5	635.8	562.5	601.5
W 3 Wet	1,200.6	1,051.3	1,099.1	995.2	1,121.9	1,007.5	1,073.5
Difference	523.3	461.4	482.4	434.7	486.1	445.0	472.0
Field Density	2.293	2.277	2.277	2.287	2.307	2.262	2.273
% Density	96.345	95.672	95.672	96.092	96.933	95.042	95.504
% Voids	7.1	7.7	7.7	7.3	6.5	8.3	7.9
Thickness (in.)	1.75	1.5	1.75	1.5	1.5	1.5	1.5

Gmb (Lot Avg.): **2.380** Avg. Field Density: **2.282**
Gmm (Lot Avg.): **2.467** Avg. % Density: **95.894**
Pa (Lot Avg.): **3.6** Avg. % Field Voids: **7.5**
Target % RAP: **15.0** Specified % Density: 95

$$Q.I. = \frac{2.282 - (0.95 \times 2.380)}{0.015} = \mathbf{1.40}$$

Low Outlier: ______ High Outlier: ______ New Q.I. = ______

Film Thickness (FT): **10.7** (8.0-15) VMA: **14.2** (13.8-15.8) D.O.T. Results Used: ☐

Remarks: there was 6 ton of road waste

Certified Tech: Rick Weisbrod Nw 473 Cert. No.
Certified Tech: Jason Pergande NW 693 Cert. No.

Distribution: ____ Central Materials ____ Dist. Materials ____ Proj. Engineer ____ Contractor ____ Plant

APPENDIX D: DOT FIELD CORE DENSITY REPORTS – IA9 KOSSUTH/WINNEBAGO COUNTY PROJECT

800241 - 10/08 ver. 3.5

DAILY HMA PLANT REPORT

Project No.:	STP-009-4(44)--2C-55	Contractor:	MATHY CONSTUCTION	JMF VMA:	16.2
Report No.:	INT #1-1				
Contract ID:	55-0094-044	County:	KOSSUTH	Size:	l/2" TYPE A
Lab Voids Target:	4.0				
Mix Design No.:	ABD0-2008	Recycle Source:		Mix Type:	HMA 3M
Design Gyrations:	86				

Hot Box I.D. No.:		INT504-1	INT504-2	INT504-3	INT504-4	INT504-2
Date Sampled:		05/04/10	05/04/10	05/04/10	05/04/10	I DOT
Gradation ID:	Specs	INT504-1				
1 in. (25mm) Sieve	100	100				
3/4 in. (19mm) Sieve	100	100				
1/2 in. (12.5mm) Sieve	87-100(94)	93				
3/8 in. (9.5mm) Sieve	76-90(83)	82				
* #4 (4.75mm) Sieve	57-71(64)	61				
* Moving Average						
* #8 (2.36mm) Sieve	40-50(45)	42				
* Moving Average						
#16 (1.18mm) Sieve		28				
* #30 (600um) Sieve	16-24(20)	18				
* Moving Average						
#50 (300um) Sieve		10				
#100 (150um) Sieve		5.7				
* #200 (75um) Sieve	1.9-5.9(3.9)	4.1				
* Moving Average						
Compliance (Y/N)		Y				
Intended Added, % Binder	5.60		% Binder from RAP			
Actual Added, % Binder		5.82				
Intended Total, % Binder	5.60		Actual % RAP			
Actual Total, % Binder	5.30-5.90	5.82				
Gmb:		2.434	2.433	2.422	2.422	2.452
Gmm:		2.481	2.483	2.487	2.504	2.486
Pa:		1.9	2.0	2.6	3.3	1.4
Moving Average	3.5-5.0				**2.5**	
Time		9:31 AM	12:00 PM	3:40 PM	5:20 PM	This
Station		900+00	853+00	915+82	880+55	Column
Side		RT	RT	LT	LT	Is For
Sample Tons		430.00	1,285.61			Dist. Lab
Sublot Tons		500.00	750.00	50.00		Test
Tons to Date		TODAY	1,300.00	TO DATE	1,300.00	Results
Fines / Bitumen Ratio	.06-1.4	0.79				

Time	7:00	9:00	11:00	1:00	3:00	5:00	7:00
Air Temp. °F	50	66	74	78	82		
Binder Temp. °F	308	310	311	310	308		
Mix Temp. °F	299	295	299	298	301		
Mat Temp. °F		250	260	265	260	265	

Placement And Density Record

From Station	To Station	Lane
1922+63	1911+93	RT
908+63	813+35	RT
1922+63	1911+93	LT
908+63	870+00	LT

Date Placed: 05/04/10
Date Tested: 05/05/10
Course Placed: Intermediate
Intended Lift Thickness: 2"
Tested By: Tim Molacek NE761

Core No.:	1	2	3	4	5	6	7
Station	1914+76	906+18	849+48	823+43	1912+56	897+83	886+79
CL Reference	2.7' LT	6.7' LT	4.5'LT	11.9'LT	7.3' LT	6.0' LT	7.0' LT
W 1 Dry	1,256.6	1,280.3	968.1	659.7	1,386.2	945.5	983.7
W 2 in H20	720.3	743.5	557.6	380.6	802.1	548.5	566.5
W 3 Wet	1,257.4	1,280.6	968.6	660.0	1,386.9	945.9	984.1
Difference	537.1	537.1	411.0	279.4	584.8	397.4	417.6
Field Density	2.340	2.384	2.355	2.361	2.370	2.379	2.356
% Density	96.376	98.188	96.993	97.241	97.611	97.982	97.035
% Voids	6.0	4.2	5.4	5.1	4.8	4.4	5.3
Thickness (in.)	2.625"	2.625"	2.000"	1.375"	2.875"	2.000"	2.000"

Gmb (Lot Avg.):	**2.428**	Avg. Field Density:	**2.364**
Gmm (Lot Avg.):	**2.489**	Avg. % Density:	**97.347**
Pa (Lot Avg.):	**2.5**	Avg. % Field Voids:	**5.0**
Target % RAP:		Specified % Density:	95

Q.I. = 2.364 -- (0.95 x 2.428) = **3.83**
0.015

Low Outlier: High Outlier: New Q.I. =

Film Thickness (FT): **11.3** (8.0-15.0) VMA: **14.6** (15.2-17.2) D.O.T. Results Used:

Gsb: 2.679 Gb: 1.0370 Effective % Binder (Pbe): 5.21
Tons of Mix for Pay: 1300.00 Tons of Binder for Pay: 75.63

Remarks: 1300 Ton @ 5.6% AC
1300 Ton for pay on project STP-009-4(44)--2C-55 Intermediate

Mix Change Information: 5.9% AC to 5.6% AC Start of day.

Certified Tech: JAMES YOUNG NE227 Cert. No.
Certified Tech: AL STRUB EC192 Cert. No.

Distribution: _____ Central Materials _____ Dist. Materials _____ Proj. Engineer _____ Contractor _____ Plant

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DAILY HMA PLANT REPORT

Project No.:	STP-009-4(44)--2C-55	Contractor:	MATHY CONSTUCTION	JMF VMA:	16.2
Report No.:	INT #2				
Contract ID:	55-0094-044	County:	KOSSUTH	Size:	l/2" TYPE A
Lab Voids Target:	4.0				
Mix Design No.:	ABD0-2008R1	Recycle Source:		Mix Type:	HMA 3M
Design Gyrations:	86				

Hot Box I.D. No.:		INT505-1	INT505-2			
Date Sampled:		05/05/10	05/05/10			
Gradation ID:	Specs	CF505-1				
1 in. (25mm) Sieve	100	100				
3/4 in. (19mm) Sieve	100	100				
1/2 in. (12.5mm) Sieve	87-100(94)	92				
3/8 in. (9.5mm) Sieve	77-91(84)	82				
* #4 (4.75mm) Sieve	60-74(67)	62				
* Moving Average						
* #8 (2.36mm) Sieve	42-52(47)	43				
* Moving Average						
#16 (1.18mm) Sieve		28				
* #30 (600um) Sieve	17-25(21)	18				
* Moving Average						
#50 (300um) Sieve		9.6				
#100 (150um) Sieve		5.5				
* #200 (75um) Sieve	1.8-5.8(3.8)	3.9				
* Moving Average						
Compliance (Y/N)		Y				
Intended Added, % Binder	5.00		% Binder from RAP			
Actual Added, % Binder		5.10				
Intended Total, % Binder	5.00		Actual % RAP			
Actual Total, % Binder	4.70-5.30	5.10				
Gmb:		2.416	2.413			
Gmm:		2.509	2.509			
Pa:		3.7	3.8			
Moving Average	3.5-5.0	**2.9**	**3.4**			
Time		8:30 AM	8:50 AM			This
Station		849+25	839+40			Column
Side		RT	RT			Is For
Sample Tons		400.92	538.93			Dist. Lab
Sublot Tons		500.00	430.72			Test
Tons to Date		TODAY	930.72	TO DATE	3,835.95	Results
Fines / Bitumen Ratio	.06-1.4	0.85				

Time	7:00	9:00	11:00	1:00	3:00	5:00	7:00
Air Temp. °F	47	52	55	59	57		
Binder Temp. °F	311	306	304	302	305		
Mix Temp. °F	298	293	297	301	295		
Mat Temp. °F		285	280	275	295	290	

Placement And Density Record

From Station	To Station	Lane
870+00	814+35	LT
814+35	813+35	LT

Date Placed: 05/05/10
Date Tested: 05/06/10
Course Placed: Intermediate
Intended Lift Thickness: 2"
Tested By: Tim Molacek NE761

Core No.:	1	2	3	4	5	6	7
Station	802+18	854+64	854+04	841+08	835+75	822+56	821+32
CL Reference	3.1' LT	1.4' LT	1.7' LT	9.5' LT	4.0' LT	10.9' LT	1.2'LT
W 1 Dry	1,018.3	1,083.2	1,037.2	543.2	905.8	745.1	920.4
W 2 in H20	583.0	621.1	591.0	306.3	516.8	423.6	523.4
W 3 Wet	1,019.8	1,083.7	1,039.3	543.6	907.1	745.6	921.0
Difference	436.8	462.6	448.3	237.3	390.3	322.0	397.6
Field Density	2.331	2.342	2.314	2.289	2.321	2.314	2.315
% Density	96.522	96.977	95.818	94.783	96.108	95.818	95.859
% Voids	7.1	6.7	7.8	8.8	7.5	7.8	7.7
Thickness (in.)	2.125"	2.250"	2.125"	1.125"	2."	1.625"	2"

Gmb (Lot Avg.):	**2.415**	Avg. Field Density:	**2.318**
Gmm (Lot Avg.):	**2.509**	Avg. % Density:	**95.984**
Pa (Lot Avg.):	**3.8**	Avg. % Field Voids:	**7.6**
Target % RAP:		Specified % Density:	95

Q.I. = 2.318 -- (0.95 x 2.415) = **1.40**
0.017

Low Outlier: High Outlier: New Q.I. =

Film Thickness (FT): **10.1** (8.0-15.0) VMA: **14.5** (15.2-17.2) D.O.T. Results Used:

Gsb: 2.679 Gb: 1.0370 Effective % Binder (Pbe): 4.60
Tons of Mix for Pay: 930.72 Tons of Binder for Pay: 47.50

Remarks: 930.72 Ton mix for pay on project STP-009-4(44)--2C-55 Intermediate
0 TONS WASTE

Mix Change Information: @ Start-up dropped AC% 0.2th

Certified Tech: JAMES YOUNG NE227 Cert. No.
Certified Tech: AL STRUB EC192 Cert. No.

Distribution: _____ Central Materials _____ Dist. Materials _____ Proj. Engineer _____ Contractor _____ Plant

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DAILY HMA PLANT REPORT

Project No.:	STP-009-4(44)--2C-55	Contractor:	MATHY CONSTUCTION	JMF VMA:	16.2
Contract ID:	55-0094-044	County:	KOSSUTH	Size:	1/2" TYPE A
Mix Design No.:	ABD0-2008R2	Recycle Source:		Mix Type:	HMA 3M

Report No.:	INT #3
Lab Voids Target:	4.0
Design Gyrations:	86

Hot Box I.D. No.:						
Date Sampled:		05/06/10				
Gradation ID:	Specs					
1 in. (25mm) Sieve	100					
3/4 in. (19mm) Sieve	100					
1/2 in. (12.5mm) Sieve	87-100(94)					
3/8 in. (9.5mm) Sieve	77-91(84)					
* #4 (4.75mm) Sieve	60-74(67)					
* Moving Average						
* #8 (2.36mm) Sieve	41-51(46)					
* Moving Average						
#16 (1.18mm) Sieve						
* #30 (600um) Sieve	16-24(20)					
* Moving Average						
#50 (300um) Sieve						
#100 (150um) Sieve						
* #200 (75um) Sieve	1.8-5.8(3.8)					
* Moving Average						
Compliance (Y/N)						
Intended Added, % Binder	5.00		% Binder from RAP			
Actual Added, % Binder		4.96				
Intended Total, % Binder	5.00		Actual % RAP			
Actual Total, % Binder	4.70-5.30	4.96				
Gmb:						
Gmm:						
Pa:						
Moving Average	3.5-5.0					
Time						This
Station						Column
Side						Is For
Sample Tons		323.60	1,025.00	1,672.27	2,082.79	Dist. Lab
Sublot Tons		500.00	219.92			Test
Tons to Date		TODAY	719.92	TO DATE	4,555.87	Results
Fines / Bitumen Ratio	.06-1.4					

Time	7:00	9:00	11:00	1:00	3:00	5:00	7:00
Air Temp. °F	40	46	58	60	62		
Binder Temp. °F	286	285	290	295	298		
Mix Temp. °F	305	302	298	296	303		
Mat Temp. °F		295	280	285	275	280	

From Station	To Station	Lane
860+00	874+00	Both
925+00	930+80	Both
0+00	8+00	Both

Placement And Density Record

Date Placed: 05/06/10
Date Tested:
Course Placed: Intermediate / Levelers
Intended Lift Thickness: 2"
Tested By: Tim Molacek NE761

Core No.:	1	2	3	4	5	6	7
Station							
CL Reference							
W 1 Dry							
W 2 in H20							
W 3 Wet							
Difference							
Field Density							
% Density							
% Voids							
Thickness (in.)							

Gmb (Lot Avg.):		Avg. Field Density:	
Gmm (Lot Avg.):		Avg. % Density:	
Pa (Lot Avg.):		Avg. % Field Voids:	
Target % RAP:		Specified % Density:	95

Q.I. = -- (0.95 x) =

Low Outlier: High Outlier: New Q.I. =

Film Thickness (FT): **#DIV/0!** (8.0-15.0) VMA: (15.2-17.2) D.O.T. Results Used:

Remarks: 719.92 Tons mix made for pay as Intermediate on STP-009-4(44)--2C-55

SEE REPORT SUR #2 FOR TEST RESULTS

Gsb: 2.676 Gb: 1.0370 Effective % Binder (Pbe): #DIV/0!

Tons of Mix for Pay: 719.92 Tons of Binder for Pay: 35.77

Mix Change Information:

Certified Tech: JAMES YOUNG NE227 Cert. No.
Certified Tech: AL STRUB EC192 Cert. No.

Distribution: ____ Central Materials ____ Dist. Materials ____ Proj. Engineer ____ Contractor ____ Plant

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DAILY HMA PLANT REPORT

Project No.:	STP-009-4(44)--2C-55	Contractor:	MATHY CONSTUCTION	JMF VMA:	16.2
Contract ID:	55-0094-044	County:	KOSSUTH	Size:	1/2" TYPE A
Mix Design No.:	ABD0-2008R2	Recycle Source:		Mix Type:	HMA 3M

Report No.:	INT #4
Lab Voids Target:	4.0
Design Gyrations:	86

Hot Box I.D. No.:		INT514-1	INT514-2			
Date Sampled:		05/14/10	05/14/10			I DOT
Gradation ID:	Specs	CF514-1				
1 in. (25mm) Sieve	100	100				
3/4 in. (19mm) Sieve	100	100				
1/2 in. (12.5mm) Sieve	87-100(94)	93				
3/8 in. (9.5mm) Sieve	77-91(84)	83				
* #4 (4.75mm) Sieve	60-74(67)	66				
* Moving Average		**63**				
* #8 (2.36mm) Sieve	41-51(46)	44				
* Moving Average		**43**				
#16 (1.18mm) Sieve		28				
* #30 (600um) Sieve	16-24(20)	18				
* Moving Average		**18**				
#50 (300um) Sieve		9.9				
#100 (150um) Sieve		5.5				
* #200 (75um) Sieve	1.8-5.8(3.8)	3.9				
* Moving Average		**3.6**				
Compliance (Y/N)		Y				
Intended Added, % Binder	5.00		% Binder from RAP			
Actual Added, % Binder		5.01				
Intended Total, % Binder	5.00		Actual % RAP			
Actual Total, % Binder	4.70-5.30	5.01				
Gmb:		2.414	2.422			
Gmm:		2.523	2.520			
Pa:		4.3	3.9			
Moving Average	3.5-5.0	**4.4**	**4.3**			
Time		9:00 AM	1:00 PM			This
Station		891+00	752+43			Column
Side		LT	RT			Is For
Sample Tons		265.68	1,196.96			Dist. Lab
Sublot Tons		500.00	750.00	242.56		Test
Tons to Date		TODAY	1,492.56	TO DATE	6,048.43	Results
Fines / Bitumen Ratio	.06-1.4	0.90				

Time	7:00	9:00	11:00	1:00	3:00	5:00	7:00
Air Temp. °F	42	50	58	61			
Binder Temp. °F	285	292	301	300			
Mix Temp. °F	302	288	285	295			
Mat Temp. °F		275	275	290	290		

From Station	To Station	Lane
869+79	732+05	Both

Placement And Density Record

Date Placed: 05/14/10
Date Tested:
Course Placed: Intermediate
Intended Lift Thickness: 4"
Tested By: Tim Molacek NE761

Core No.:	1	2	3	4	5	6	7
Station							
CL Reference							
W 1 Dry	NO CORES						
W 2 in H20							
W 3 Wet							
Difference							
Field Density							
% Density							
% Voids							
Thickness (in.)							

Gmb (Lot Avg.):	**2.418**	Avg. Field Density:	
Gmm (Lot Avg.):	**2.522**	Avg. % Density:	
Pa (Lot Avg.):	**4.1**	Avg. % Field Voids:	
Target % RAP:		Specified % Density:	94

Q.I. = -- (0.94 x 2.418) =

Low Outlier: High Outlier: New Q.I. =

Film Thickness (FT): **9.4** (8.0-15.0) VMA: **14.2** (15.2-17.2) D.O.T. Results Used:

Remarks: 1492.56 Tons mix made

1492.56 Tons mix for pay as Intermediate on project STP-009-4(44)--2C-55

NO WASTE

Gsb: 2.676 Gb: 1.0370 Effective % Binder (Pbe): 4.31

Tons of Mix for Pay: 1492.56 Tons of Binder for Pay: 74.78

Mix Change Information:

Certified Tech: JAMES YOUNG NE227 Cert. No.
Certified Tech: AL STRUB EC192 Cert. No.

Distribution: ____ Central Materials ____ Dist. Materials ____ Proj. Engineer ____ Contractor ____ Plant

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DAILY HMA PLANT REPORT

Project No.: STP-009-4(44)--2C-55	Contractor: MATHY CONSTUCTION	JMF VMA: 16.2	Report No.: INT#5
Contract ID: 55-0094-044	County: KOSSUTH	Size: 1/2" TYPE A	Lab Voids Target: 4.0
Mix Design No.: ABD0-2008R2	Recycle Source:	Mix Type: HMA 3M	Design Gyrations: 86

Hot Box I.D. No.:		INT517-1	INT517-2	INT517-3	INT517-4	INT517-3
Date Sampled:		05/17/10	05/17/10	05/17/10	05/17/10	IDOT
Gradation ID:	Specs	CF517-1				
1 in. (25mm) Sieve	100	100				
3/4 in. (19mm) Sieve	100	100				
1/2 in. (12.5mm) Sieve	87-100(94)	93				
3/8 in. (9.5mm) Sieve	77-91(84)	84				
* #4 (4.75mm) Sieve	60-74(67)	63				
* Moving Average		**64**				
* #8 (2.36mm) Sieve	41-51(46)	42				
* Moving Average		**43**				
#16 (1.18mm) Sieve		27				
* #30 (600um) Sieve	16-24(20)	18				
* Moving Average		**18**				
#50 (300um) Sieve		9.9				
#100 (150um) Sieve		5.6				
* #200 (75um) Sieve	1.8-5.8(3.8)	4.0				
* Moving Average		**3.9**				
Compliance (Y/N)		Y				
Intended Added, % Binder	5.00		% Binder from RAP			
Actual Added, % Binder		5.08				
Intended Total, % Binder	5.00		Actual % RAP			
Actual Total, % Binder	4.70-5.30	5.08				
Gmb:		2.421	2.414	2.422	2.407	2.422
Gmm:		2.517	2.527	2.532	2.519	2.53
Pa:		3.8	4.5	4.3	4.4	4.3
Moving Average	3.5-5.0	**4.1**	**4.1**	**4.1**	**4.3**	
Time		8:45 AM	11:15 AM	1:30 PM	3:50 PM	This
Station		95+75	47+50	1+50	891+50	Column
Side		RT	RT	RT	RT	Is For
Sample Tons		399.35	1,011.13	1,804.59	2,581.63	Dist. Lab
Sublot Tons		500.00	1,000.00	1,000.00	925.79	Test
Tons to Date		TODAY	3,425.79	TO DATE	9,474.22	Results
Fines / Bitumen Ratio	.06-1.4	0.93				

Time	7:00	9:00	11:00	1:00	3:00	5:00	7:00
Air Temp. °F	56	59	64	71	74	75	
Binder Temp. °F	275	285	289	300	300	300	
Mix Temp. °F	294	293	291	295	297	294	
Mat Temp. °F		285	285	280	290	275	

From Station	To Station	Lane	**Placement And Density Record**	
115+12	0+00	RT	Date Placed:	05/17/10
930+81	844+90	RT	Date Tested:	05/18/10
			Course Placed:	Intermediate
			Intended Lift Thickness:	2"
			Tested By:	Tim Molacek NE761

Core No.:	1	2	3	4	5	6	7
Station	108+83	82+05	26+32	17+81	926+72	901+45	867+51
CL Reference	9.2' RT	3.1' RT	4.6' RT	4.1' RT	6.0' RT	9.4' RT	6.2' RT
W 1 Dry	1,181.8	1,116.4	914.2	857.0	978.5	1,042.2	963.4
W 2 in H20	685.9	644.4	520.5	493.2	561.1	599.0	553.8
W 3 Wet	1,182.8	1,116.6	914.5	857.2	979.2	1,042.7	963.8
Difference	496.9	472.2	394.0	364.0	418.1	443.7	410.0
Field Density	2.378	2.364	2.320	2.354	2.340	2.349	2.350
% Density	98.427	97.848	96.026	97.434	96.854	97.227	97.268
% Voids	5.8	6.3	8.1	6.7	7.3	6.9	6.9
Thickness (in.)	2.500"	2.375"	2.000"	1.750"	2.000"	2.125"	2.000"

Gmb (Lot Avg.):	**2.416**	Avg. Field Density:	**2.351**
Gmm (Lot Avg.):	**2.524**	Avg. % Density:	**97.298**
Pa (Lot Avg.):	**4.3**	Avg. % Field Voids:	**6.9**
Target % RAP:		Specified % Density:	95

Q.I. = 2.351 -- (0.95 x 2.416) = **3.10**

0.018

Low Outlier: High Outlier: New Q.I. =

Film Thickness (FT): **9.4** (8.0-15.0) VMA: **14.3** (15.2-17.2) D.O.T. Results Used:

Remarks: 3425.79 Tons mix made
3425.79 Tons for pay as Intermediate on Project STP-009-4(44)--2C-55
0 TONS WASTE

Gsb: 2.676 Gb: 1.0370 Effective % Binder (Pbe): 4.30

Tons of Mix for Pay: 3425.79 Tons of Binder for Pay: 173.92

Mix Change Information:

Certified Tech: JAMES YOUNG NE227 Cert. No.

Certified Tech: AL STRUB EC192 Cert. No.

Distribution: ____ Central Materials ____ Dist. Materials ____ Proj. Engineer ____ Contractor ____ Plant

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DAILY HMA PLANT REPORT

Project No.: STP-009-4(44)--2C-55	Contractor: MATHY CONSTUCTION	JMF VMA: 16.2	Report No.: INT#6
Contract ID: 55-0094-044	County: KOSSUTH	Size: 1/2" TYPE A	Lab Voids Target: 4.0
Mix Design No.: ABD0-2008R2	Recycle Source:	Mix Type: HMA 3M	Design Gyrations: 86

Hot Box I.D. No.:		INT518-1	INT518-2	INT518-3	INT518-4	
Date Sampled:		05/18/10	05/18/10	05/18/10	05/18/10	
Gradation ID:	Specs	CF518-1				
1 in. (25mm) Sieve	100	100				
3/4 in. (19mm) Sieve	100	100				
1/2 in. (12.5mm) Sieve	87-100(94)	90				
3/8 in. (9.5mm) Sieve	77-91(84)	80				
* #4 (4.75mm) Sieve	60-74(67)	63				
* Moving Average		**64**				
* #8 (2.36mm) Sieve	41-51(46)	44				
* Moving Average		**43**				
#16 (1.18mm) Sieve		28				
* #30 (600um) Sieve	16-24(20)	18				
* Moving Average		**18**				
#50 (300um) Sieve		10				
#100 (150um) Sieve		5.7				
* #200 (75um) Sieve	1.8-5.8(3.8)	4.1				
* Moving Average		**4**				
Compliance (Y/N)		Y				
Intended Added, % Binder	5.10		% Binder from RAP			
Actual Added, % Binder		5.18				
Intended Total, % Binder	5.10		Actual % RAP			
Actual Total, % Binder	4.80-5.40	5.18				
Gmb:		2.417	2.408	2.419	2.404	
Gmm:		2.513	2.512	2.513	2.510	
Pa:		3.8	4.1	3.7	4.2	
Moving Average	3.5-5.0	**4.3**	**4.2**	**4.0**	**4.0**	
Time		8:30 AM	11:15 AM	1:30 PM	4:00 PM	This
Station		95+50	28+75	920+30	868+00	Column
Side		LT	LT	LT	LT	Is For
Sample Tons		375.96	1,251.31	1,952.65	2,876.59	Dist. Lab
Sublot Tons		500.00	1,166.67	1,166.67	1,043.39	Test
Tons to Date		TODAY	3,876.73	TO DATE	13,350.95	Results
Fines / Bitumen Ratio	.06-1.4	0.90				

Time	7:00	9:00	11:00	1:00	3:00	5:00	7:00
Air Temp. °F	46	64	72	75	76	75	
Binder Temp. °F	305	300	301	298	300	300	
Mix Temp. °F	296	300	297	295	305	294	
Mat Temp. °F		290	295	285	295	285	

From Station	To Station	Lane	**Placement And Density Record**	
115+12	0+00	LT	Date Placed:	05/18/10
930.81	813+70	LT	Date Tested:	05/19/10
			Course Placed:	Intermediate
			Intended Lift Thickness:	2"
			Tested By:	Tim Molacek NE761

Core No.:	1	2	3	4	5	6	7
Station	98+83	81+26	47+72	1+03	914+50	860+08	852+61
CL Reference	7.1' LT	10.5' LT	2.8' LT	9.9' LT	10.6' LT	3.9' LT	11.5' LT
W 1 Dry	1,139.2	724.4	919.4	892.8	979.9	1,010.1	877.3
W 2 in H20	651.1	412.6	527.3	508.2	557.4	579.8	502.6
W 3 Wet	1,139.8	724.9	919.5	893.2	980.2	1,010.5	877.7
Difference	488.7	312.3	392.2	385.0	422.8	430.7	375.1
Field Density	2.331	2.320	2.344	2.319	2.318	2.345	2.339
% Density	96.642	96.186	97.181	96.144	96.103	97.222	96.973
% Voids	7.2	7.6	6.7	7.7	7.7	6.6	6.9
Thickness (in.)	2.375"	1.500"	1.875"	1.875"	2.000"	2.000"	1.875"

Gmb (Lot Avg.):	**2.412**	Avg. Field Density:	**2.331**
Gmm (Lot Avg.):	**2.512**	Avg. % Density:	**96.636**
Pa (Lot Avg.):	**4.0**	Avg. % Field Voids:	**7.2**
Target % RAP:		Specified % Density:	95

Q.I. = 2.331 -- (0.95 x 2.412) = **3.30**

0.012

Low Outlier: High Outlier: New Q.I. =

Film Thickness (FT): **9.7** (8.0-15.0) VMA: **14.5** (15.2-17.2) D.O.T. Results Used:

Remarks:
3876.73 Tons mix made
3876.73 Tons for pay as Intermediate on project STP-009-4(44)--2C-55
0 Tons WASTE

Gsb: 2.676 Gb: 1.0370 Effective % Binder (Pbe): 4.54

Tons of Mix for Pay: 3876.73 Tons of Binder for Pay: 200.82

Mix Change Information: Raised the AC % to 5.1 from 5.0, high voids yesterday

Certified Tech: JAMES YOUNG NE227 Cert. No.

Certified Tech: AL STRUB EC192 Cert. No.

Distribution: ____ Central Materials ____ Dist. Materials ____ Proj. Engineer ____ Contractor ____ Plant

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DAILY HMA PLANT REPORT

Project No.:	STP-009-4(44)--2C-55	Contractor:	MATHY CONSTUCTION	JMF VMA:	16.2
Contract ID:	55-0094-044	County:	KOSSUTH	Size:	1/2" TYPE A
Mix Design No.:	ABD0-2008R2	Recycle Source:		Mix Type:	HMA 3M

Report No.:	INT#7
Lab Voids Target:	4.0
Design Gyrations:	86

Hot Box I.D. No.:		INT519-1	INT519-2	INT519-3	INT519-4	INT519-2
Date Sampled:		05/19/10	05/19/10	05/19/10	05/19/10	I DOT
Gradation ID:	Specs	CF519-1				
1 in. (25mm) Sieve	100	100				
3/4 in. (19mm) Sieve	100	100				
1/2 in. (12.5mm) Sieve	87-100(94)	95				
3/8 in. (9.5mm) Sieve	77-91(84)	86				
* #4 (4.75mm) Sieve	60-74(67)	68				
* Moving Average		**65**				
* #8 (2.36mm) Sieve	41-51(46)	47				
* Moving Average		**44**				
#16 (1.18mm) Sieve		30				
* #30 (600um) Sieve	16-24(20)	20				
* Moving Average		**19**				
#50 (300um) Sieve		11				
#100 (150um) Sieve		6.4				
* #200 (75um) Sieve	1.8-5.8(3.8)	4.6				
* Moving Average		**4.2**				
Compliance (Y/N)		Y				
Intended Added, % Binder	5.10		% Binder from RAP			
Actual Added, % Binder		5.14				
Intended Total, % Binder	5.10		Actual % RAP			
Actual Total, % Binder	4.80-5.40	5.14				
Gmb:		2.412	2.382	2.392	2.400	2.396
Gmm:		2.525	2.518	2.511	2.503	2.521
Pa:		4.5	5.4	4.7	4.1	5
Moving Average	3.5-5.0	**4.1**	**4.5**	**4.7**	**4.7**	
Time		8:15 AM	11:15 AM	2:30 PM	5:00 PM	This
Station		823+00	765+00	715+87	672+76	Column
Side		RT	RT	RT	RT	Is For
Sample Tons		333.99	1,411.16	2,273.08	3,173.85	Dist. Lab
Sublot Tons		500.00	1,166.67	1,166.67	828.36	Test
Tons to Date		TODAY	3,661.70	TO DATE	17,012.65	Results
Fines / Bitumen Ratio	.06-1.4	1.02				

Time	7:00	9:00	11:00	1:00	3:00	5:00	7:00
Air Temp. °F	54	62	73	76	78	80	
Binder Temp. °F	305	302	300	302	304	300	
Mix Temp. °F	289	293	294	299	301	298	
Mat Temp. °F		280	290	280	270	280	

From Station	To Station	Lane
844+90	643+70	RT

Placement And Density Record

Date Placed: 05/19/10
Date Tested: 05/20/10
Course Placed: Intermediate
Intended Lift Thickness: 2"
Tested By: Tim Molacek NE761

Core No.:	1	2	3	4	5	6	7
Station	825+90	812+47	778+80	744+55	728+90	674+12	666+30
CL Reference	4.8' RT	7.0' RT	10.2' RT	8.0' RT	8.6' RT	11.6' RT	10.9' RT
W 1 Dry	910.1	605.0	828.2	959.3	865.4	1,001.8	765.8
W 2 in H20	522.5	343.4	471.7	548.3	489.6	571.0	441.0
W 3 Wet	910.2	605.3	828.5	959.5	865.9	1,002.4	766.5
Difference	387.7	261.9	356.8	411.2	376.3	431.4	325.5
Field Density	2.347	2.310	2.321	2.333	2.300	2.322	2.353
% Density	97.914	96.370	96.829	97.330	95.953	96.871	98.164
% Voids	6.6	8.1	7.7	7.2	8.5	7.6	6.4
Thickness (in.)	1.875"	1.400"	1.750"	2.000"	1.875"	2.000"	1.625"

Gmb (Lot Avg.):	**2.397**	Avg. Field Density:	**2.327**
Gmm (Lot Avg.):	**2.514**	Avg. % Density:	**97.062**
Pa (Lot Avg.):	**4.7**	Avg. % Field Voids:	**7.4**
Target % RAP:		Specified % Density:	95

Q.I. = 2.327 -- (0.95 x 2.397) = **2.62**

0.019

Low Outlier: High Outlier: New Q.I. =

Film Thickness (FT): **8.8** (8.0-15.0) VMA: **15** (15.2-17.2) D.O.T. Results Used:

Remarks: 3701.7 Tons mix made
3661.7 Tons mix for pay as Intermediate on STP-009-4(44)--2C-55
40.0 Tons mix for pay as SQ YDS

Gsb: 2.676 Gb: 1.0370 Effective % Binder (Pbe): 4.49
Tons of Mix for Pay: 3661.70 Tons of Binder for Pay: 188.09

Mix Change Information:

Certified Tech: JAMES YOUNG NE227 Cert. No.
Certified Tech: AL STRUB EC192 Cert. No.

Distribution: _____ Central Materials _____ Dist. Materials _____ Proj. Engineer _____ Contractor _____ Plant

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DAILY HMA PLANT REPORT

Project No.:	STP-009-4(44)--2C-55	Contractor:	MATHY CONSTUCTION	JMF VMA:	16.2
Contract ID:	55-0094-044	County:	KOSSUTH	Size:	1/2" TYPE A
Mix Design No.:	ABD0-2008R2	Recycle Source:		Mix Type:	HMA 3M

Report No.:	INT#8
Lab Voids Target:	4.0
Design Gyrations:	86

Hot Box I.D. No.:		INT520-1	INT520-2	INT520-3	INT520-4	
Date Sampled:		05/20/10	05/20/10	05/20/10	05/20/10	
Gradation ID:	Specs	CF520-1				
1 in. (25mm) Sieve	100	100				
3/4 in. (19mm) Sieve	100	100				
1/2 in. (12.5mm) Sieve	87-100(94)	94				
3/8 in. (9.5mm) Sieve	77-91(84)	84				
* #4 (4.75mm) Sieve	60-74(67)	67				
* Moving Average		**65**				
* #8 (2.36mm) Sieve	41-51(46)	47				
* Moving Average		**45**				
#16 (1.18mm) Sieve		30				
* #30 (600um) Sieve	16-24(20)	20				
* Moving Average		**19**				
#50 (300um) Sieve		11				
#100 (150um) Sieve		5.9				
* #200 (75um) Sieve	1.8-5.8(3.8)	4.2				
* Moving Average		**4.2**				
Compliance (Y/N)		Y				
Intended Added, % Binder	5.30		% Binder from RAP			
Actual Added, % Binder		5.26				
Intended Total, % Binder	5.30		Actual % RAP			
Actual Total, % Binder	5.00-5.60	5.26				
Gmb:		2.430	2.420	2.414	2.396	
Gmm:		2.518	2.515	2.512	2.501	
Pa:		3.5	3.8	3.9	4.2	
Moving Average	3.5-5.0	**4.4**	**4.0**	**3.8**	**3.9**	
Time		8:15 AM	10:30 AM	1:30 PM	4:00 PM	This
Station		799+99	741+66	700+00	631+20	Column
Side		LT	LT	LT	LT	Is For
Sample Tons		279.56	1,288.91	2,142.85	3,267.37	Dist. Lab
Sublot Tons		500.00	1,166.67	1,166.67	947.65	Test
Tons to Date		TODAY	3,780.99	TO DATE	20,793.64	Results
Fines / Bitumen Ratio	.06-1.4	0.92				

Time	7:00	9:00	11:00	1:00	3:00	5:00	7:00
Air Temp. °F	52	65	73	75	78	77	
Binder Temp. °F	302	303	305	300	300	300	
Mix Temp. °F	300	297	301	295	293	294	
Mat Temp. °F		290	280	250	280	275	

From Station	To Station	Lane
813+70	621+20	LT
643+70	621+20	RT

Placement And Density Record

Date Placed: 05/20/10
Date Tested: 05/21/10
Course Placed: Intermediate
Intended Lift Thickness: 2"
Tested By: Tim Molacek NE761

Core No.:	1	2	3	4	5	6	7
Station	775+24	751+26	700+70	672+73	649+15	633+64	628+61
CL Reference	3.2' LT	6.3' LT	11.3' LT	9.9' LT	7.0' LT	9.8' RT	11.7' RT
W 1 Dry	1,075.5	893.7	891.9	1,013.8	879.1	874.8	1,025.0
W 2 in H20	616.6	509.6	503.5	575.7	503.4	497.8	586.1
W 3 Wet	1,075.7	893.9	892.4	1,014.1	879.4	875.1	1,025.2
Difference	459.1	384.3	388.9	438.4	376.0	377.3	439.1
Field Density	2.343	2.326	2.293	2.313	2.338	2.319	2.334
% Density	97.019	96.315	94.948	95.776	96.812	96.025	96.646
% Voids	6.7	7.4	8.7	7.9	6.9	7.7	7.1
Thickness (in.)	2.250"	1.875"	1.875"	2.125"	1.875"	1.875"	2.125"

Gmb (Lot Avg.):	**2.415**	Avg. Field Density:	**2.324**
Gmm (Lot Avg.):	**2.512**	Avg. % Density:	**96.220**
Pa (Lot Avg.):	**3.9**	Avg. % Field Voids:	**7.5**
Target % RAP:		Specified % Density:	95

Q.I. = 2.324 -- (0.95 x 2.415) = **1.75**

0.017

Low Outlier: High Outlier: New Q.I. =

Film Thickness (FT): **9.3** (8.0-15.0) VMA: **14.5** (15.2-17.2) D.O.T. Results Used:

Remarks: 3815.99 Tons mix made
3780.99 Tons for pay as Intermediate on project STP-009-4(44)--2C-55
35.0 Tons for pay as Square Yards as WIDENING

Gsb: 2.676 Gb: 1.0370 Effective % Binder (Pbe): 4.58
Tons of Mix for Pay: 3780.99 Tons of Binder for Pay: 198.82

Mix Change Information: @ 2:00pm drop AC to 5.2% from 5.3% low voids

Certified Tech: JAMES YOUNG NE227 Cert. No.
Certified Tech: AL STRUB EC192 Cert. No.

Distribution: _____ Central Materials _____ Dist. Materials _____ Proj. Engineer _____ Contractor _____ Plant

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DAILY HMA PLANT REPORT

Project No.:	STP-009-4(44)--2C-55	Contractor:	MATHY CONSTUCTION	JMF VMA:	16.2	Report No.:	INT#9
Contract ID:	55-0094-044	County:	KOSSUTH	Size:	1/2" TYPE A	Lab Voids Target:	4.0
Mix Design No.:	ABD0-2008R2	Recycle Source:		Mix Type:	HMA 3M	Design Gyrations:	86

Hot Box I.D. No.:		INT524-1	INT524-2			INT524-2
Date Sampled:		05/24/10	05/24/10			I DOT
Gradation ID:	Specs	CF524-1				
1 in. (25mm) Sieve	100	100				
3/4 in. (19mm) Sieve	100	100				
1/2 in. (12.5mm) Sieve	87-100(94)	93				
3/8 in. (9.5mm) Sieve	77-91(84)	83				
* #4 (4.75mm) Sieve	60-74(67)	66				
* Moving Average		66				
* #8 (2.36mm) Sieve	41-51(46)	45				
* Moving Average		46				
#16 (1.18mm) Sieve		29				
* #30 (600um) Sieve	16-24(20)	19				
* Moving Average		19				
#50 (300um) Sieve		11				
#100 (150um) Sieve		5.9				
* #200 (75um) Sieve	1.8-5.8(3.8)	4.2				
* Moving Average		4.3				
Compliance (Y/N)		Y				
Intended Added, % Binder	5.20		% Binder from RAP			
Actual Added, % Binder		5.17				
Intended Total, % Binder	5.20		Actual % RAP			
Actual Total, % Binder	4.90-5.50	5.17				
Gmb:		2.417	2.413			2.423
Gmm:		2.529	2.523			2.427
Pa:		4.4	4.4			4.1
Moving Average	3.5-5.0	4.1	4.2			
Time		9:59 AM	4:00 PM			This
Station		878+24	103+75			Column
Side		R14 Intersed	Medium			Is For
Sample Tons		192.00	780.00			Dist. Lab
Sublot Tons		500.00	478.72			Test
Tons to Date		TODAY	978.72	TO DATE	21,772.36	Results
Fines / Bitumen Ratio	.06-1.4	0.98				

Time	7:00	9:00	11:00	1:00	3:00	5:00	7:00
Air Temp. °F	71	78	85	86	90		
Binder Temp. °F	281	283	288	290	292		
Mix Temp. °F	297	295	299	296	301		
Mat Temp. °F		280	290	280	285	285	

From Station	To Station	Lane
106+00	772+65	RT & LT

Placement And Density Record

Date Placed: 05/24/10
Date Tested: 05/25/10
Course Placed: Intermediate
Intended Lift Thickness: 2"
Tested By: Tim Molacek NE761

Core No.:	1	2	3	4	5	6	7
Station	879+22	100+34	101+15	104+59	103+98	880+30	879+42
CL Reference	5.5' RT	6.5' RT	4.5' RT	6.0' LT	5.0' LT	5.2' LT	6.2' LT
W 1 Dry	935.4	972.4	850.4	1,012.9	977.4	779.1	865.6
W 2 in H20	528.7	542.4	477.9	570.1	550.7	440.3	487.7
W 3 Wet	936.7	975.0	851.6	1,013.8	979.3	779.3	866.9
Difference	408.0	432.6	373.7	443.7	428.6	339.0	379.2
Field Density	2.293	2.248	2.276	2.283	2.280	2.298	2.283
% Density	94.948	93.085	94.244	94.534	94.410	95.155	94.534
% Voids	9.2	11.0	9.9	9.6	9.7	9.0	9.6
Thickness (in.)	2.000"	2.125"	1.875"	2.125"	2.000"	1.625"	1.875"

Gmb (Lot Avg.): **2.415** Avg. Field Density: **2.280**
Gmm (Lot Avg.): **2.526** Avg. % Density: **94.416**
Pa (Lot Avg.): **4.4** Avg. % Field Voids: **9.7**
Target % RAP: Specified % Density: 94

Q.I. = 2.280 -- (0.94 x 2.415) = **0.62**
0.016

Low Outlier: 2.00 High Outlier: 1.13 New Q.I. = **1.99**

Film Thickness (FT): **8.8** (8.0-15.0) VMA: **14.4** (15.2-17.2) D.O.T. Results Used:

Remarks: 1002.08 Tons mix made
978.72 Tons mix for pay as Intermediate on STP-009-4(44)--2C-55
23.36 Tons WASTE
Paved intersections & Gore areas & Turning lanes

Gsb: 2.676 Gb: 1.0370 Effective % Binder (Pbe): 4.30
Tons of Mix for Pay: 978.72 Tons of Binder for Pay: 50.62

Mix Change Information:

Certified Tech: JAMES YOUNG NE227 Cert. No.
Certified Tech: AL STRUB EC192 Cert. No.

Distribution: ____ Central Materials ____ Dist. Materials ____ Proj. Engineer ____ Contractor ____ Plant

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DAILY HMA PLANT REPORT

Project No.:	STP-009-4(44)--2C-55	Contractor:	MATHY CONSTUCTION	JMF VMA:	16.2	Report No.:	SUR #1
Contract ID:	55-0094-044	County:	KOSSUTH	Size:	1/2" Type A	Lab Voids Target:	4.0
Mix Design No.:	ABD0-2008R1	Recycle Source:		Mix Type:	HMA 3M	Design Gyrations:	86

Hot Box I.D. No.:		SUR505-1	SUR505-2	SUR505-3		
Date Sampled:		05/05/10	05/05/10	05/05/10		
Gradation ID:	Specs	CF505-1				
1 in. (25mm) Sieve	100	100				
3/4 in. (19mm) Sieve	100	100				
1/2 in. (12.5mm) Sieve	87-100(94)	92				
3/8 in. (9.5mm) Sieve	77-91(84)	82				
* #4 (4.75mm) Sieve	60-74(67)	62				
* Moving Average						
* #8 (2.36mm) Sieve	42-52(47)	43				
* Moving Average						
#16 (1.18mm) Sieve		28				
* #30 (600um) Sieve	17-25(21)	18				
* Moving Average						
#50 (300um) Sieve		9.6				
#100 (150um) Sieve		5.5				
* #200 (75um) Sieve	1.8-5.8(3.8)	3.9				
* Moving Average						
Compliance (Y/N)		Y				
Intended Added, % Binder	5.00		% Binder from RAP			
Actual Added, % Binder		5.08				
Intended Total, % Binder	5.00		Actual % RAP			
Actual Total, % Binder	4.70-5.30	5.08				
Gmb:		2.416	2.405	2.395		
Gmm:		2.517	2.509	2.490		
Pa:		4.0	4.1	3.8		
Moving Average	3.5-5.0	3.7	3.9	3.9		
Time		12:00 PM	1:45 PM	3:30 PM		This
Station		902+25	870+00	836+57		Column
Side		LT	LT	LT		Is For
Sample Tons		324.70	925.28	1,494.81		Dist. Lab
Sublot Tons		500.00	750.00	741.61		Test
Tons to Date		TODAY	1,991.61	TO DATE	1,991.61	Results
Fines / Bitumen Ratio	.06-1.4	0.86				

Time	7:00	9:00	11:00	1:00	3:00	5:00	7:00
Air Temp. °F	47	52	55	59	57		
Binder Temp. °F	311	306	304	302	305		
Mix Temp. °F	298	293	297	301	295		
Mat Temp. °F		285	280	275	295	290	

From Station	To Station	Lane
1923+28	1911+93	RT
908+63	812+35	RT

Placement And Density Record

Date Placed: 05/05/10
Date Tested: 05/06/10
Course Placed: SURFACE L4
Intended Lift Thickness: 2"
Tested By: Tim Molacek NE761

Core No.:	1	2	3	4	5	6	7
Station	1916+74	895+74	877+84	867+78	845+87	842+88	816+55
CL Reference	9.2' RT	4.8' RT	6.3' RT	2.7' RT	6.0' RT	5.2' RT	2.3' RT
W 1 Dry	1,009.2	998.7	982.9	975.3	950.6	919.4	978.9
W 2 in H20	576.7	573.4	565.3	559.4	541.2	522.0	559.4
W 3 Wet	1,009.7	999.0	983.3	976.1	951.3	919.9	979.8
Difference	433.0	425.6	418.0	416.7	410.1	397.9	420.4
Field Density	2.331	2.347	2.351	2.341	2.318	2.311	2.328
% Density	96.923	97.588	97.755	97.339	96.383	96.091	96.798
% Voids	6.9	6.3	6.1	6.5	7.5	7.7	7.1
Thickness (in.)	2.125"	2.125"	2.125"	2.125"	2"	2"	2"

Gmb (Lot Avg.): **2.405** Avg. Field Density: **2.332**
Gmm (Lot Avg.): **2.505** Avg. % Density: **96.982**
Pa (Lot Avg.): **4.0** Avg. % Field Voids: **6.9**
Target % RAP: Specified % Density: 95

Q.I. = 2.332 -- (0.95 x 2.405) = **3.15**
0.015

Low Outlier: High Outlier: New Q.I. =

Film Thickness (FT): **10.0** (8.0-15.0) VMA: **14.5** (15.2-17.2) D.O.T. Results Used:

Remarks: 1991.61 Tons mix for pay on project STP-009-4(44)--2C-55 SURFACE
0 Tons Waste

Grading the same on REPORTS SUR #1 & INT #2

Gsb: 2.669 Gb: 1.0370 Effective % Binder (Pbe): 4.52
Tons of Mix for Pay: 1991.61 Tons of Binder for Pay: 101.08

Mix Change Information: add 2% Man Sand, 2% off 5/8" Screened @1:45

Certified Tech: JAMES YOUNG NE227 Cert. No.
Certified Tech: AL STRUB EC192 Cert. No.

Distribution: ____ Central Materials ____ Dist. Materials ____ Proj. Engineer ____ Contractor ____ Plant

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DAILY HMA PLANT REPORT

Project No.:	STP-009-4(44)--2C-55	Contractor:	MATHY CONSTUCTION	JMF VMA:	16.2	Report No.:	SUR #2
Contract ID:	55-0094-044	County:	KOSSUTH	Size:	1/2" TYPE A	Lab Voids Target:	4.0
Mix Design No.:	ABD0-2008R2	Recycle Source:		Mix Type:	HMA 3M	Design Gyrations:	86

Hot Box I.D. No.:		SUR506-1	SUR506-2	SUR506-3	SUR506-4	SUR506-1
Date Sampled:		05/06/10	05/06/10	05/06/10	05/06/10	I DOT
Gradation ID:	Specs	CF506-1				.
1 in. (25mm) Sieve	100	100				
3/4 in. (19mm) Sieve	100	100				
1/2 in. (12.5mm) Sieve	87-100(94)	91				
3/8 in. (9.5mm) Sieve	77-91(84)	78				
* #4 (4.75mm) Sieve	60-74(67)	62				
* Moving Average						
* #8 (2.36mm) Sieve	41-51(46)	41				
* Moving Average						
#16 (1.18mm) Sieve		26				
* #30 (600um) Sieve	16-24(20)	17				
* Moving Average						
#50 (300um) Sieve		9.1				
#100 (150um) Sieve		5.2				
* #200 (75um) Sieve	1.8-5.8(3.8)	3.8				
* Moving Average						
Compliance (Y/N)		Y				
Intended Added, % Binder	5.00		% Binder from RAP			
Actual Added, % Binder		4.96				
Intended Total, % Binder	5.00		Actual % RAP			
Actual Total, % Binder	4.70-5.30	4.96				
Gmb:		2.415	2.400	2.407	2.406	2.424
Gmm:		2.510	2.510	2.523	2.518	2.523
Pa:		3.8	4.4	4.6	4.4	3.9
Moving Average	3.5-5.0	**3.9**	**4.0**	**4.2**	**4.3**	
Time		8"20	10"30	12:15 PM	4:15 PM	This
Station		900+90	860+00	820+00	870+23	Column
Side		RT	RT	RT	LT	Is For
Sample Tons		323.60	1,025.00	1,672.27	2,082.79	Dist. Lab
Sublot Tons		500.00	750.00	591.71		Test
Tons to Date		TODAY	1,841.71	TO DATE	3,833.32	Results
Fines / Bitumen Ratio	.06-1.4	0.86				

Time	7:00	9:00	11:00	1:00	3:00	5:00	7:00
Air Temp. °F	40	46	58	60	62		
Binder Temp. °F	286	285	290	295	298		
Mix Temp. °F	305	302	298	296	303		
Mat Temp. °F		295	280	285	275	280	

From Station	To Station	Lane
1923+28	1911+93	LT
908+63	812+35	LT

Placement And Density Record

Date Placed: 05/06/10
Date Tested: 05/07/10
Course Placed: SURFACE L4
Intended Lift Thickness: 2"
Tested By: Tim Molacek NE761

Core No.:	1	2	3	4	5	6	7
Station	1919+33	1916+49	899+26	888+45	861+84	850+35	813+09
CL Reference	6.0' LT	3.7' LT	7.8' LT	4.6' LT	11.8' LT	4.7' LT	8.5' LT
W 1 Dry	845.3	987.4	883.0	1,044.9	958.4	1,014.0	942.1
W 2 in H20	486.1	564.6	507.2	604.2	544.0	581.1	539.7
W 3 Wet	846.1	988.1	883.6	1,045.7	959.3	1,015.0	942.7
Difference	360.0	423.5	376.4	441.5	415.3	433.9	403.0
Field Density	2.348	2.332	2.346	2.367	2.308	2.337	2.338
% Density	97.549	96.884	97.466	98.338	95.887	97.092	97.133
% Voids	6.6	7.3	6.7	5.9	8.2	7.1	7.0
Thickness (in.)	1.750"	2.000"	1.875"	2.125"	2.000"	2.125"	2.000"

Gmb (Lot Avg.):	**2.407**	Avg. Field Density:	**2.339**
Gmm (Lot Avg.):	**2.515**	Avg. % Density:	**97.193**
Pa (Lot Avg.):	**4.3**	Avg. % Field Voids:	**7.0**
Target % RAP:		Specified % Density:	95

Q.I. = 2.339 -- (0.95 x 2.407) = **2.91**
0.018

Low Outlier: High Outlier: New Q.I. =

Film Thickness (FT): **10.1** (8.0-15.0) VMA: **14.5** (15.2-17.2) D.O.T. Results Used:

Remarks: 1841.71 Tons mix for pay on project STP-009-4(44)--2C-55 SURFACE

Gsb: 2.676 Gb: 1.0370 Effective % Binder (Pbe): 4.41
Tons of Mix for Pay: 1841.71 Tons of Binder for Pay: 91.41

Mix Change Information:

Certified Tech: JAMES YOUNG NE227 Cert. No.
Certified Tech: AL STRUB EC192 Cert. No.

Distribution: ____ Central Materials ____ Dist. Materials ____ Proj. Engineer ____ Contractor ____ Plant

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DAILY HMA PLANT REPORT

Project No.:	STP-009-4(44)--2C-55	Contractor:	MATHY CONSTUCTION	JMF VMA:	16.2	Report No.:	SUR#3
Contract ID:	55-0094-044	County:	KOSSUTH	Size:	1/2" TYPE A	Lab Voids Target:	4.0
Mix Design No.:	ABD0-2008R2	Recycle Source:		Mix Type:	HMA 3M	Design Gyrations:	86

Hot Box I.D. No.:		SUR525-1	SUR525-2	SUR525-3	SUR525-4	SUR425-3
Date Sampled:		05/25/10	05/25/10	05/25/10	05/25/10	I DOT
Gradation ID:	Specs	CF525-1				
1 in. (25mm) Sieve	100	100				
3/4 in. (19mm) Sieve	100	100				
1/2 in. (12.5mm) Sieve	87-100(94)	93				
3/8 in. (9.5mm) Sieve	77-91(84)	83				
* #4 (4.75mm) Sieve	60-74(67)	66				
* Moving Average		**67**				
* #8 (2.36mm) Sieve	41-51(46)	44				
* Moving Average		**46**				
#16 (1.18mm) Sieve		28				
* #30 (600um) Sieve	16-24(20)	18				
* Moving Average		**19**				
#50 (300um) Sieve		10				
#100 (150um) Sieve		5.6				
* #200 (75um) Sieve	1.8-5.8(3.8)	3.9				
* Moving Average		**4.2**				
Compliance (Y/N)		Y				
Intended Added, % Binder	5.30		% Binder from RAP			
Actual Added, % Binder		5.37				
Intended Total, % Binder	5.30		Actual % RAP			
Actual Total, % Binder	5.00-5.60	5.37				
Gmb:		2.413	2.406	2.420	2.418	2.443
Gmm:		2.516	2.510	2.514	2.505	2.516
Pa:		4.1	4.1	3.7	3.5	2.9
Moving Average	3.5-5.0	**4.3**	**4.3**	**4.1**	**3.9**	
Time		8:30 AM	12:35 PM	1:45 PM	4:45 PM	This
Station		97+00	39+11	920+00	865+00	Column
Side		RT	RT	RT	RT	Is For
Sample Tons		323.53	1,235.25	2,075.65	3,082.43	Dist. Lab
Sublot Tons		500.00	1,166.67	1,166.67	433.41	Test
Tons to Date		TODAY	3,266.75	TO DATE	7,100.07	Results
Fines / Bitumen Ratio	.06-1.4	0.84				

Time	7:00	9:00	11:00	1:00	3:00	5:00	7:00
Air Temp. °F	71	80	82	88	90		
Binder Temp. °F	298	300	301	280	300		
Mix Temp. °F	295	298	300	295	305		
Mat Temp. °F		290	305	280	290	280	

From Station	To Station	Lane
115+12	0+00	RT
930+81	854+42	RT

Placement And Density Record

Date Placed: 05/25/10
Date Tested: 05/26/10
Course Placed: SURFACE L4
Intended Lift Thickness: 2"
Tested By: Tim Molacek NE761

Core No.:	1	2	3	4	5	6	7
Station	82+37	31+68	7+08	927+59	892+73	886+13	863+82
CL Reference	10.9' RT	8.6' RT	6.8' RT	2.3' RT	9.8' RT	11.5' RT	4.0' RT
W 1 Dry	899.6	1,021.8	1,019.5	899.6	974.4	967.2	1,016.3
W 2 in H20	520.2	586.3	588.2	515.6	562.8	554.5	584.1
W 3 Wet	899.8	1,021.9	1,019.7	899.8	974.6	967.5	1,016.5
Difference	379.6	435.6	431.5	384.2	411.8	413.0	432.4
Field Density	2.370	2.346	2.363	2.341	2.366	2.342	2.350
% Density	98.177	97.183	97.887	96.976	98.012	97.017	97.349
% Voids	5.6	6.6	5.9	6.8	5.8	6.7	6.4
Thickness (in.)	1.875"	2.125"	2.125"	1.875"	2.000"	2.000"	2.125"

Gmb (Lot Avg.):	**2.414**	Avg. Field Density:	**2.354**
Gmm (Lot Avg.):	**2.511**	Avg. % Density:	**97.514**
Pa (Lot Avg.):	**3.9**	Avg. % Field Voids:	**6.3**
Target % RAP:		Specified % Density:	95

Q.I. = 2.354 -- (0.95 x 2.414) = **5.06**
0.012

Low Outlier: High Outlier: New Q.I. =

Film Thickness (FT): **10.1** (8.0-15.0) VMA: **14.6** (15.2-17.2) D.O.T. Results Used:

Remarks: 3400.39 Tons mix made
3266.75 Tons mix for pay as SURFACE project STP-009-4(44)--2C-55
133.64 Tons WASTED RAIN ON ROAD

Gsb: 2.676 Gb: 1.0370 Effective % Binder (Pbe): 4.63
Tons of Mix for Pay: 3266.75 Tons of Binder for Pay: 175.53

Mix Change Information: Raised AC% from 5.2 to 5.3

Certified Tech: JAMES YOUNG NE227 Cert. No.
Certified Tech: AL STRUB EC192 Cert. No.

Distribution: ____ Central Materials ____ Dist. Materials ____ Proj. Engineer ____ Contractor ____ Plant

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DAILY HMA PLANT REPORT

Project No.:	STP-009-4(44)--2C-55	Contractor:	MATHY CONSTUCTION	JMF VMA: 16.2	Report No.: SUR#4
Contract ID:	55-0094-044	County:	KOSSUTH	Size: 1/2" TYPE A	Lab Voids Target: 4.0
Mix Design No.:	ABD0-2008R2	Recycle Source:		Mix Type: HMA 3M	Design Gyrations: 86

Hot Box I.D. No.:		SUR526-1	SUR526-2	SUR526-3	SUR526-4	
Date Sampled:		05/26/10	05/26/10	05/26/10	05/26/10	
Gradation ID:	Specs	CF526-1				
1 in. (25mm) Sieve	100	100				
3/4 in. (19mm) Sieve	100	100				
1/2 in. (12.5mm) Sieve	87-100(94)	94				
3/8 in. (9.5mm) Sieve	77-91(84)	86				
* #4 (4.75mm) Sieve	60-74(67)	68				
* Moving Average		**67**				
* #8 (2.36mm) Sieve	41-51(46)	44				
* Moving Average		**45**				
#16 (1.18mm) Sieve		28				
* #30 (600um) Sieve	16-24(20)	19				
* Moving Average		**19**				
#50 (300um) Sieve		11				
#100 (150um) Sieve		6.2				
* #200 (75um) Sieve	1.8-5.8(3.8)	4.4				
* Moving Average		**4.2**				
Compliance (Y/N)		Y				
Intended Added, % Binder	5.30		% Binder from RAP			
Actual Added, % Binder		5.21				
Intended Total, % Binder	5.30		Actual % RAP			
Actual Total, % Binder	5.00-5.60	5.21				
Gmb:		2.424	2.417	2.406	2.414	
Gmm:		2.509	2.521	2.520	2.520	
Pa:		3.4	4.1	4.5	4.2	
Moving Average	3.5-5.0	**3.7**	**3.7**	**3.9**	**4.1**	
Time		8:45 AM	11:00 AM	1:45 PM	4:30 PM	This
Station		91+40	26+55	910+50	851+94	Column
Side		LT	LT	LT	LT	Is For
Sample Tons		424.80	1,414.40	2,275.93	3,223.78	Dist. Lab
Sublot Tons		500.00	1,166.67	1,166.67	1,200.23	Test
Tons to Date		TODAY	4,033.57	TO DATE	11,133.64	Results
Fines / Bitumen Ratio	.06-1.4	0.99				

Time	7:00	9:00	11:00	1:00	3:00	5:00	7:00
Air Temp. °F	54	68	75	78	82	84	
Binder Temp. °F	301	300	296	295	303	300	
Mix Temp. °F	299	304	293	291	282	296	
Mat Temp. °F		300	290	280	285	290	

From Station	To Station	Lane
115+12	0+00	LT
0+00	805+20	LT

Placement And Density Record

Date Placed: 05/26/10
Date Tested: 05/27/10
Course Placed: SURFACE L4
Intended Lift Thickness: 2"
Tested By: Tim Molacek NE761

Core No.:	1	2	3	4	5	6	7
Station	110+24	5+95	928+82	903+81	863+9+5	834+00	815+22
CL Reference	3.2' LT	6.0' LT	7.1' LT	4.5' LT	6.9' LT	11.2' LT	6.5' LT
W 1 Dry	1,004.0	1,027.8	1,019.1	930.7	958.1	1,042.5	956.8
W 2 in H20	581.1	587.0	587.3	529.6	545.6	597.5	546.3
W 3 Wet	1,004.3	1,028.8	1,019.6	930.8	958.4	1,042.5	957.2
Difference	423.2	441.8	432.3	401.2	412.8	445.0	410.9
Field Density	2.372	2.326	2.357	2.320	2.321	2.343	2.329
% Density	98.219	96.315	97.598	96.066	96.108	97.019	96.439
% Voids	5.8	7.6	6.4	7.9	7.8	6.9	7.5
Thickness (in.)	2.000"	2.125"	2.125"	2.000"	2.000"	2.250"	2.000"

Gmb (Lot Avg.):	**2.415**	Avg. Field Density:	**2.338**
Gmm (Lot Avg.):	**2.518**	Avg. % Density:	**96.823**
Pa (Lot Avg.):	**4.1**	Avg. % Field Voids:	**7.1**
Target % RAP:		Specified % Density:	95

Q.I. = 2.338 -- (0.95 x 2.415) = **2.19**
0.02

Low Outlier: High Outlier: New Q.I. =

Film Thickness (FT): **9.0** (8.0-15.0) VMA: **14.5** (15.2-17.2) D.O.T. Results Used:

Remarks: 4033.57 Tons mix made
4033.57 Tons mix for pay as SURFACE on STP-009-4(44)--2C-55
0 tons WASTE

Gsb: 2.676 Gb: 1.0370 Effective % Binder (Pbe): 4.46
Tons of Mix for Pay: 4033.57 Tons of Binder for Pay: 210.20

Mix Change Information: Dropped the AC% from 5.3% to 5.1% LOW VOIDS

Certified Tech: JAMES YOUNG NE227 Cert. No.
Certified Tech: AL STRUB EC192 Cert. No.

800241 - 10/08 ver. 3.5

DAILY HMA PLANT REPORT

Project No.:	STP-009-4(44)--2C-55	Contractor:	MATHY CONSTUCTION	JMF VMA: 16.2	Report No.: SUR#5
Contract ID:	55-0094-044	County:	KOSSUTH	Size: 1/2" TYPE A	Lab Voids Target: 4.0
Mix Design No.:	ABD0-2008R2	Recycle Source:		Mix Type: HMA 3M	Design Gyrations: 86

Hot Box I.D. No.:		SUR527-1	SUR527-2	SUR527-3	SUR527-4	
Date Sampled:		05/27/10	05/27/10	05/27/10	05/27/10	
Gradation ID:	Specs	CF527-1				
1 in. (25mm) Sieve	100	100				
3/4 in. (19mm) Sieve	100	100				
1/2 in. (12.5mm) Sieve	87-100(94)	91				
3/8 in. (9.5mm) Sieve	77-91(84)	83				
* #4 (4.75mm) Sieve	60-74(67)	65				
* Moving Average		**66**				
* #8 (2.36mm) Sieve	41-51(46)	45				
* Moving Average		**45**				
#16 (1.18mm) Sieve		31				
* #30 (600um) Sieve	16-24(20)	21				
* Moving Average		**19**				
#50 (300um) Sieve		12				
#100 (150um) Sieve		6.6				
* #200 (75um) Sieve	1.8-5.8(3.8)	4.7				
* Moving Average		**4.3**				
Compliance (Y/N)		Y				
Intended Added, % Binder	5.10		% Binder from RAP			
Actual Added, % Binder		5.09				
Intended Total, % Binder	5.10		Actual % RAP			
Actual Total, % Binder	4.80-5.40	5.09				
Gmb:		2.419	2.416	2.417	2.407	
Gmm:		2.514	2.530	2.525	2.526	
Pa:		3.8	4.5	4.3	4.7	
Moving Average	3.5-5.0	**4.2**	**4.3**	**4.2**		
Time		8:15 AM	10:30 AM	2:00 PM		This
Station		784+66	735+82	815+21		Column
Side		LT	LT	RT	RT	Is For
Sample Tons		372.20	1,269.47	2,160.95		Dist. Lab
Sublot Tons		500.00	1,050.00	1,050.00	1,011.86	Test
Tons to Date		TODAY		TO DATE		Results
Fines / Bitumen Ratio	.06-1.4	1.09				

Time	7:00	9:00	11:00	1:00	3:00	5:00	7:00
Air Temp. °F	64	66	70	77	83	86	
Binder Temp. °F	303	304	303	301	300	300	
Mix Temp. °F	301	289	279	282	278	282	
Mat Temp. °F							

From Station	To Station	Lane

Placement And Density Record

Date Placed: 05/27/10
Date Tested:
Course Placed: SURFACE L4
Intended Lift Thickness: 2"
Tested By: Tim Molacek NE761

Core No.:	1	2	3	4	5	6	7
Station							
CL Reference							
W 1 Dry							
W 2 in H20							
W 3 Wet							
Difference							
Field Density							
% Density							
% Voids							
Thickness (in.)							

Gmb (Lot Avg.):	**2.415**	Avg. Field Density:	
Gmm (Lot Avg.):	**2.524**	Avg. % Density:	
Pa (Lot Avg.):	**4.3**	Avg. % Field Voids:	
Target % RAP:		Specified % Density:	95

Q.I. = -- (0.95 x 2.415) =

Low Outlier: High Outlier: New Q.I. =

Film Thickness (FT): **8.2** (8.0-15.0) VMA: **14.3** (15.2-17.2) D.O.T. Results Used:

Remarks:

Gsb: 2.676 Gb: 1.0370 Effective % Binder (Pbe): 4.31
Tons of Mix for Pay: 3611.86 Tons of Binder for Pay: 184.01

Mix Change Information:

Certified Tech: JAMES YOUNG NE227 Cert. No.
Certified Tech: AL STRUB EC192 Cert. No.

Distribution: ____ Central Materials ____ Dist. Materials ____ Proj. Engineer ____ Contractor ____ Plant

APPENDIX E: ON-SITE INTERVIEWS WITH ROLLER OPERATORS

Project: IA9, Kossuth County Project

Interview #1, Date: 5/25/2010

Interviewers: Justin Harland and Steve Quist
Crew Member: Paul Tulley; Breakdown Roller operator

Quist: How did you use the IC roller pass count information on this project?
Tulley: I really didn't use the pass count map.

Quist: What impact do you think IC roller pass count mapping will have on future construction operations and QC and QA testing?
Tulley: For the roller operator I really don't see any benefits. For the lab I suppose they could have verification that we did hit a point certain number of times.

Quist: What improvements would you like to see made to the IC/GPS mapping capabilities?
Tulley: I would like a little more training for the operator use.

Quist: Do you have any general comments on IC rolling or the project?
Tulley: I just wish we would have had a little more knowledge and training on how to use it.

Interview # 2, Date: 5/25/2010

Interviewer: Justin Harland, Steve Quist
Crew Member: Eric Leisenger, Rubber Tire Roller Operator

Quist: How did you use the IC roller pass count information on this project?
Leisenger: I didn't use any of the information. It's for the office personnel to look at and decipher.

Quist: What impact do you think IC roller pass count mapping will have on future construction operations and QC and QA testing?
Leisenger: Not sure about any of that except that its really kind of complicated for the operator to keep his mind on the road and what he is doing as opposed to looking at the computer screen.

Quist: What improvements would you like to see made to the IC/GPS mapping capabilities?
Leisenger: Uh tear it all down and start over.

Quist: Do you have any general comments on IC rolling or the project?
Leisenger: Its good if it produces the information that helps the engineers, but it doesn't do anything for the operator.

Interview # 3, Date: 5/25/2010

Interviewer: Justin Harland, Steve Quist
Crew Member: Sandy Streibech, Finish Roller Operator

Quist: Do you have any comments about the IC system in general?
Streibech: I don't see the purpose of putting them on the machines.

Interview #4, Date: 5/25/2010

Interviewer: Justin Harland, Steve Quist
Crew Member: Frank Webster, Foreman

Quist: How did you use the IC roller pass count information on this project?
Webster: I really didn't use the information on it. I just went by what our density guy told me our densities were.

Quist: What impact do you think IC roller pass count mapping will have on future construction operations and QC and QA testing?
Webster: Well I think if you got it running right it would show you how your uh rollers are doing and if they are missing any spots. I think it's a good thing, especially if you get new people.

Quist: What improvements would you like to see made to the IC/GPS mapping capabilities?
Webster: I would like to see that if the pass count legend could be adjusted to say eleven passes so we could see on every pass what it is doing for us.

Quist: Do you have any general comments on IC rolling or the project?
Webster: I'd like to have flexibility to adjust the pass count legend on the map. I'd like the capability to overlay data from one roller to the next and have an overall pass count map so we can see what each roller is doing to the densities.

Interview #5, Date: 5/25/2010

Interviewer: Justin Harland, Steve Quist
Crew Member: Cody Webster, Roller Operator

Harland: What impact do you think IC roller pass count mapping will have on future construction operations and QC and QA testing?
Cody: Not much. I don't know really.
Harland: What improvements would you like to see made to the IC/GPS roller mapping capabilities?
Cody: It would be better if it is easier to install on the equipment.
Harland: Any general comments you would like to make?
Cody: No.