

Asphalt Paving Inspection Workbook

Certified Inspector
Training Program



TABLE OF CONTENTS

- Introduction
- Plant
- Paving
- Surface Treatments
- Paving Alternatives

Asphalt Paving Inspection

Part 1 – Introduction

Mitchel Johnson – CE Hays Construction

Cale Brown – EA Hays Construction



1

What's this about...

Goals

- General knowledge of asphalt paving
- Where to locate related specifications

Topics in this course

- Plans and specification navigation
- HMA
 - Plant and Paving Operations
- Surface treatments
- Recycling options
- Tips & Tricks – Helpful Information



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Specification Resources

- Standard Specifications & Special Provisions
 - Division 100 – General Clauses & Covenants
 - Division 150 – Equipment
 - Division 600 – Flexible Pavement
- Construction Manual Part V (Materials)
 - KT Methods, Testing Procedures, Sampling, etc...



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Hierarchy of Information

- Information received pre-bid
 - Addendums, Bid Express
- Project Special Provisions (PS) & Modified Requirements (MR)
 - Applicable list included in proposal/contract
 - Accessible through ksdot.org
- Special Provisions/Errata
- Plans
- Standard Specifications/Construction Manual



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Example Project

Pre-Bid Information

- Addendums
 - Issued by KDOT
 - Correcting errors or omissions
- Bid Express
 - Online question submission
 - Issued as part of the contract

Proposal: 521062383 **Project NM:** KA 2372-03
Question: 1 **Subject:** RAP Sample
Where is the RAP sample?
Answer:
A RAP sample was not obtained for this project. If a bidder wishes to perform exploratory work on the pavement, they should coordinate with the Phillipsburg Area Office.
Proposal: 521062383 **Project NM:** KA 2372-03
Question: 2 **Subject:** Removals
Is the excavation quantity that is required to complete the removal of the RCBs included in the common excavation plan quantity?
Answer:
The excavation required for RCB removal and construction is not included in the common excavation quantities and will not be measured for payment per 204.4b.(2).

(Project) Special Provisions

- Project Special Provisions
 - Apply *specifically* to an individual project.
- Special Provisions/Errata
 - Overall provisions to the Standard Specifications
 - Errata are revisions usually for printing or writing



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Example Project Cont. – Special Provisions

KANSAS DEPARTMENT OF TRANSPORTATION
SPECIAL PROVISION LIST
STATE PROJECT NO. K38-074 KA 2372-03
FEDERAL PROJ. NO. ACSTP-A2372(03)
PRIMARY DISTRICT: 3
PRIMARY COUNTY: PHILLIPS
DESCRIPTION: GRADING AND SURFACING, K-38 FR N EWS OF BR #01 (PRAIRIE DOG CRK)
THENCE NE TO JCT K-38/US-163, N/PL CO. 10TH S S 18M
NOTE: THE FOLLOWING LIST OF SPECIAL PROVISIONS ARE FOR THIS PROJECT.
OMISSION OF ALL OR PART OF A SPECIAL PROVISION IN THE ATTACHED PROPOSAL CONTRACT DOES NOT RELIEVE THE CONTRACTOR OF THE RESPONSIBILITY FOR OBTAINING THE COMPLETE PROVISIONS LISTED.

PROVISION NO.	DESCRIPTION
15-0001	REMOVAL OF EXISTING STRUCTURES
15-0002	STRUCTURAL CONCRETE
15-0003-R01	GENERAL CONCRETE
15-0003-R02	ASPHALT PAVEMENT SMOOTHNESS
15-0007-R01	NOT MIX ASPHALT CONSTRUCTION QUOTA
15-0010	NOT MIX ASPHALT OVER/UNDER/UNDER GRADE
15-0011-R01	CONCRETE STRUCTURE CONSTRUCTION
15-0014-R01	PAVED PAVEMENT EDGE
15-0015-R01	PERMANENT SIGNAGE
15-0016	CONTRACTOR CONSTRUCTION SIGNAGE
15-0018	MAINTENANCE AND RESTORATION OF PAUL ROADS
15-0019-R01	WORK ZONE TRAFFIC CONTROL & SAFETY
15-0020-R01	DURABLE PAVEMENT MARKING
15-0023	FIELD OFFICE AND LABORATORY
15-0023-R02	STORMWATER POLLUTION MANAGEMENT
15-0025	RELOCATING
15-0024-R01	TEMPORARY EROSION AND SEDIMENT CONTROL/SEEDING
15-1100-R01	STONE FOR RIPRAP, SLOPE LINING AND OTHER MISCELLANEOUS USES
15-1100-R02	AGGREGATE FOR ASPHALT
15-1100-R03	AGGREGATE FOR CONCRETE NOT PLACED ON GRADE
15-1100-R04	AGGREGATES FOR SURFACE MODIFICATION OR RECONSTRUCTION
15-1100-R05	AGGREGATES FOR BACKFILL
15-1200	GENERAL REQUIREMENTS FOR CONCRETE
15-1202	PERFORMANCE GRADED ASPHALT BINDER
15-1400-R01	ASPHALT/CONCRETE JOINTS FOR CONCRETE
15-1402	SHEET MATERIALS FOR CURING CONCRETE
15-1403	LIQUID MEMBRANE FORMING COMPOUNDS
15-1601-R01	STRUCTURAL STEEL TUBING
15-1602-R01	STEEL SIGN POSTS
15-1603-R01	STEEL WIRE ROPE BARS FOR CONCRETE REINFORCEMENT
15-1608-R01	STEEL PLATE GUARDRAILS AND PROPER DAILY END TERMINALS
15-1700-R01	RELEASE COMPING FOR ASPHALT MIXES
15-1707-R01	GEOPHRENETICS
15-1800-R01	POLYETHYLENE PIPE
15-1800-R02	POLYETHYLENE GLYCOL (PEG) PIPE

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PROVISION NO.	DESCRIPTION
15-1800-R03	USES OF PIPE
15-1808-R01	CARP AND END SECTIONS
15-2001-R01	PORTLAND CEMENT AND BLENDED HYDRAULIC CEMENT
15-2002	INTERLOCKED LIME
15-2004	FLASH FOR USE IN CONCRETE
15-2101	SEEDS
15-2201-R01	TRIMMINGS
15-2203-R02	MULTI-COMPONENT LIQUID PAVEMENT MARKING MATERIAL
15-2205-R03	MASS SYSTEMS
15-2206-R01	RETROREFLECTIVE SHEETING
15-2208-R01	PREFORMED THERMOPLASTIC PAVEMENT MARKING MATERIAL
15-2211	ROLL-UP SIGNS
15-2214	WOOD DRAINAGE
15-2301-R02	WOOD POSTS
15-2303	FIELD HANDLING AND PRESERVATIVE TREATMENT OF WOOD PRODUCTS
15-2401-R01	PART V
15-2402-R01	CONSTRUCTION MANUAL - PART V
15-2403-R01	MATERIALS CERTIFICATIONS
15-MR0440-R1	MODIFIED REQUIREMENTS - ASPHALT MIXTURES
15-WO0161	WORK SCHEDULE

15-26001-R08
15-MR0440-R1
15-WS0167

MATERIALS CERTIFICATIONS
MODIFIED REQUIREMENTS – ASPHALT MIXTURES
WORK SCHEDULE

END OF SPECIAL PROVISION LIST



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Example Project Cont. – Modified Req. (1)

Modified Requirements

- Included in the contract
- Required and included on all HMA projects under Section 602
 - Individual project mix design requirements
- Specific Mix Requirements
 - Air Voids, Compaction, RAP, Binder
- Multi-action projects

15-MR0440-R1
Sheet 1 of 7

KANSAS DEPARTMENT OF TRANSPORTATION SPECIAL PROVISION TO THE STANDARD SPECIFICATIONS, EDITION 2015

SECTION 602

MODIFIED REQUIREMENTS – ASPHALT MIXTURES

Project Number: 383-74 KA-2372-03

Page 600-7, TABLE 602-1, delete note 4 and replace with the following:

4. The target air voids (V_v) for any mix designation shall be 3.0% at N_{max} gyrations.

Page 600-7, TABLE 602-1, delete note 6 and replace with the following:

6. The level of compaction of the mix when compacted to N_{max} gyrations shall be less than the percent of the G_{min} shown in the Contract Special Provision, and when compacted to N_{max} gyrations shall be a maximum of 98.5% of the G_{min} .



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Example Project Cont. – Modified Req. (2)

TABLE 1: PROJECT MIX REQUIREMENTS

MIX CRITERIA	SR-12.5A (PG70-28) ⁽²⁾ SR-19A (PG70-28) ⁽²⁾	SR-19A (PG64-22) ⁽⁴⁾	SR-12.5A (PG58-28)sh ⁽⁵⁾ SR-19A (PG64-22)sh ⁽⁶⁾
AGGREGATE:			
Coarse Angularity (min.%)	75	50	50
Uncompacted Voids-Fine (min. %)	42 for SR-12.5A 45 for SR-19A	42	40
Sand Equivalent (min. %)	40	40	40
Reclaimed Asphalt Pavement (RAP) (max. %)	25	25	30 for SR-12.5A 40 for SR-19A
COMPACTION REVOLUTIONS:			
N_{ini} (level of compaction)	7 (≤ 91.5)	7 (≤ 91.5)	(A) ⁽¹⁾ (B) ⁽¹⁾
N_{des}	75	75	50 75
N_{max}	115	115	75 115
MIX:			
VFA	65 - 82	65 - 82	66 - 82 65 - 82

⁽¹⁾ At the Contractor's option, Column (A) or (B) may be used

⁽²⁾ Between 0 and 25% RAP may be used. The required binder and name shown below are based on the percent RAP used in the contract. The mix will be paid for at the bid price of SR-12.5A (PG70-28).

Percent RAP	Name
0	SM-12.5A (PG70-28)
1 - 15	SR-12.5A (PG70-28)
16 - 25	SR-12.5A (PG64-34)



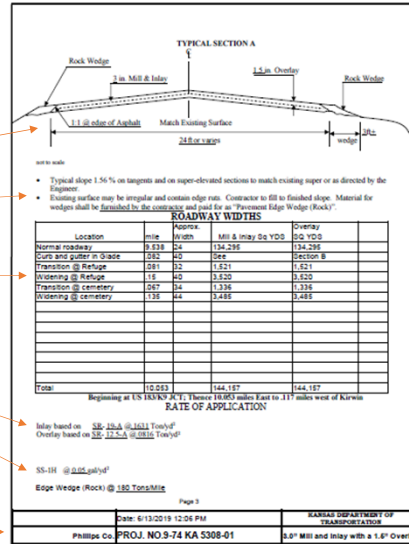
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Example Project Cont. – Plans (402)

HMA Overlays

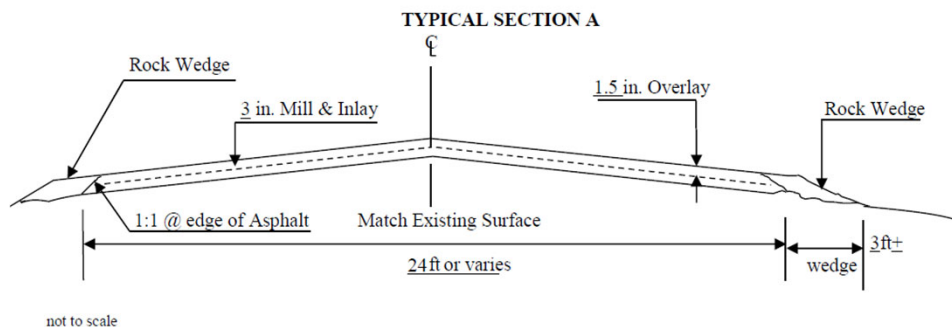
• 402

- Typical Section
- Notes
- Section locations, lengths, widths, bid quantities, etc...
- Rate of application
- Project Information



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Example Project Cont. – Typical Section



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Example Project Cont. – Descriptions

ROADWAY WIDTHS

Location	mile	Approx. Width	Mill & Inlay Sq YDS	Overlay SQ YDS	
Normal roadway	9.538	24	134,295	134,295	
Curb and gutter in Glade	.082	40	See	Section B	
Transition @ Refuge	.081	32	1,521	1,521	
Widening @ Refuge	.15	40	3,520	3,520	
Transition @ cemetery	.067	34	1,336	1,336	
Widening @ cemetery	.135	44	3,485	3,485	
Total	10.053		144,157	144,157	

Beginning at US 183/K9 JCT; Thence 10.053 miles East to .117 miles west of Kirwin



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Example Project Cont. – Rates

Inlay based on SR- 19-A @.1631 Ton/yd²

Overlay based on SR- 12.5-A @.0816 Ton/yd²

SS-1H @ 0.05 gal/yd²

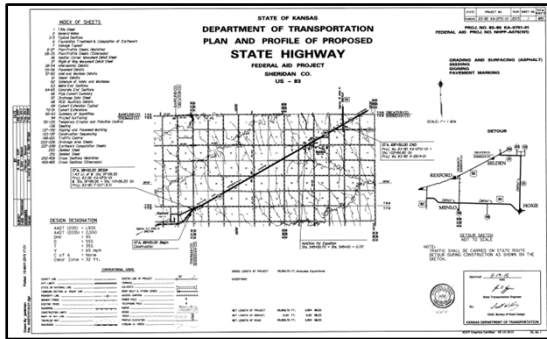
Edge Wedge (Rock) @ 180 Tons/Mile



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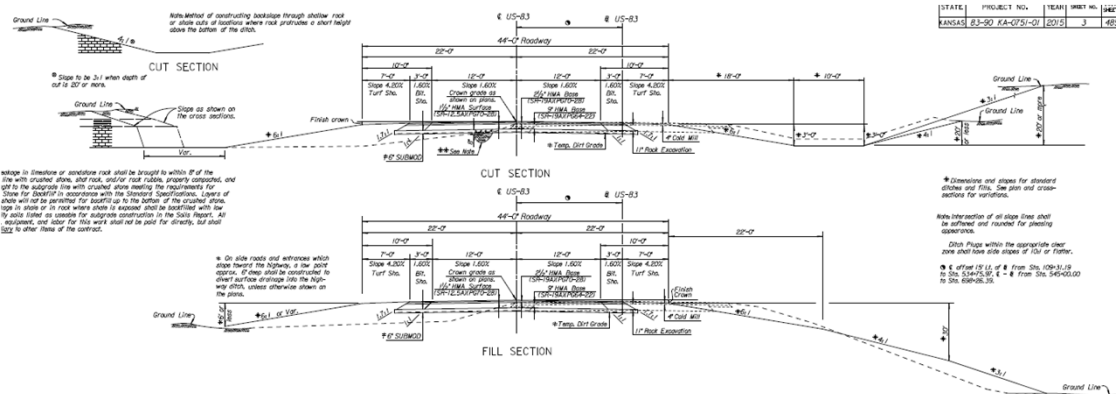
Example Project Cont. – Plan Sheets

- Typical Sections
 - Description/Scope of Work
- Plan & Profile
 - Horizontal/Vertical Alignment, Plan Notes
- Summary of Quantities
 - Application Rates



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Example Project Cont. – Typical Sections



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Example Project Cont. – Rates

SUMMARY OF QUANTITIES								
	ITEM	MAINLINE	SIDEROADS	ENTR'S	HO. ENT.	BUS. ENT.	TOTAL	UNIT
	ASPHALT SURFACE COURSE							
	+ HMA Surface (SR-12.5A) (PG70-28)	18,033.9	3,759.9		180.1	506.4	18,033.9	Tons
	+ HMA Comm Gr. (CS95-A)						3,796.4	Tons
Δ	ASPHALT BASE COURSE							
Δ	+ HMA Base (SR-9A) (PG67-28)	34,526.9					34,526.9	Tons
	+ HMA Base (SR-9A) (PG64-22)	111,480.9					111,480.9	Tons
	AGGREGATE SURFACE COURSE							
	⑤ Surface Gr. Material (AS-3)		858.8		6.5	81.2	956.5	Tons
	SUBGRADE MODIFICATION							
	Aggregate For Subgrade Modification (Millings)	40,598.5					40,598.5	Cu. Yds.
	+ Asst.	8,833.6					8,833.6	Tons
	Manipulation for Aggregate Subgrade Modification (Millings)(X by Ash)	245,991.0					245,991.0	Sq. Yds.
Δ	Millng	45,189	369				45,558	Tons
	Emulsified Asphalt (SS-1HP)	187.7					187.7	Tons

Specifications & Construction Manual

- Requirements & Procedures
- Materials & Prequalifications
 - Basis of Acceptance
 - Last subsection of the **materials** division of specifications (1100-2600)
- Part V
 - Sampling and Test methods

Specifications

Construction – 602 Example

- 602.2 QC Requirements
- 602.3 Materials
 - Directs you to Materials Spec applicable
- 602.4 Construction Requirements
- 602.5 Process Control
- Compaction, Weather, etc...

Materials – 1201 Example

- 1201.4 Prequalification
 - What a producer needs to submit to KDOT in order to be pre-approved for use on a project
- 1201.5 Basis of Acceptance
 - Prequalification requirements
 - Certifications
 - Material Testing



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Part V

- Test Procedures
 - HOW to test materials
- Testing Frequencies
 - How OFTEN to test materials

SAMPLING AND TESTING FREQUENCY CHART CONTRACTOR QUALITY CONTROL TESTING						
CONSTRUCTION OR MATERIAL TYPE (2015 Std. Spec. (SS 2015))	TESTS REQUIRED (RECORDED TO)	TEST METHOD	CODE	QUALITY CONTROL BY CONTRACTOR	CODE	VERIFICATION BY KDOT
DIVISION 600						
HMA (Plant Mix) Sec. 602, 603, 611 & 1103						
Individual Aggregates	Sieve Analysis of Aggregate (1%, 0.1% for No. 200 [75 µm] sieve, of mass)	KT-02	a	1 per 1000 TONS (1000 Mg) for each individual aggregate.		1 during the first 5000 TONS (5000 Mg) of HMA produced for each individual aggregate.
	Clay Lumps and Friable Particles in Aggregate (0.1 g or 0.01% of mass)	KT-07	e h			As required.

5.9.02 SIEVE ANALYSIS OF AGGREGATES (Kansas Test Method KT-02)

1. SCOPE

This method of test covers procedures for the determination of the particle size distribution of aggregates using standard sieves. **KT-02** reflects testing procedures found in **AASHTO T 27**.

6.1. Nest the sieves in order of decreasing size of opening from top to bottom and place the sample, or portion of the sample, if it is to be sieved in more than one increment, on the top sieve. Agitate the sieves by hand or by mechanical apparatus for a sufficient period, established by trial or checked by measurement on the actual test sample, to meet the criterion for adequacy of sieving described in **Section 6.3**, of this test method.

6.2. Limit the quantity of material on a given sieve so that all particles have opportunity to reach sieve openings a number of times during the sieving operation. For sieves with openings smaller than No. 4 (4.75 mm) the mass retained on any sieve at the completion of the sieving operation shall not exceed 4 g/m² (7 kg/m²) of sieving surface. For sieves with openings No. 4 (4.75 mm) and larger, the mass in kg/m² of sieving surface shall not exceed the product of 2.5 times the sieve opening in mm. In no case shall the mass be so great as to cause permanent deformation of the sieve cloth.

7. CALCULATIONS

7.1 Calculate the total percent of material retained on each sieve as follows:

$$\text{Percent Retained} = \frac{100 (\text{Mass Retained})}{\text{Total Original Dry Mass of Sample}}$$

Percent Passing No. 200 (75 µm) =

$$\frac{100 (\text{Sum of material Passing No. 200 (75 µm) by Sieve and Wash})}{\text{Total Original Dry Mass of Sample}}$$

7.2. Instructions for using split sample procedure (**KDOT Form #645**):

7.2.1. Record the total dry mass of sample before separation as A.

7.2.2. Record the total dry mass of material retained on No. 4 (4.75 mm) sieve following separation as B.

7.2.3. Record the total dry mass of material passing the No. 4 (4.75 mm) sieve following separation as C.



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Exam Advice

- Know where to look in the spec and how to navigate it
 - It's not realistic to memorize specifications
 - TIP: Utilize search function for electronic spec
- Make sure you read the spec and surrounding information
- Not trying to trick you...
 - Testing you on specification, materials, procedures, etc...
 - Cannot teach you every scenario in the field
- MOST exam questions can be answered within these presentations
 - When in doubt, use your specifications!



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END

- Have a good evening!



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API

Asphalt Paving Inspection Part 2 – HMA Plant



1

Stockpiles (1)



2

Stockpiles (2)

1103.2d

d. Stockpiling. Stockpile and handle aggregates in such a manner to prevent detrimental degradation and segregation, the incorporation of appreciable amounts of foreign material, and the intermingling of stockpiled materials.



- Main goal is to prevent segregation and comingling
 - Heavier/coarser material will settle to the bottom and sides
 - Material gradations!
- Short piles
 - Prevents coarse aggregate from falling
 - Made of multiple small piles dumped from truck
- Double or Triple stack
 - Build in layers



3

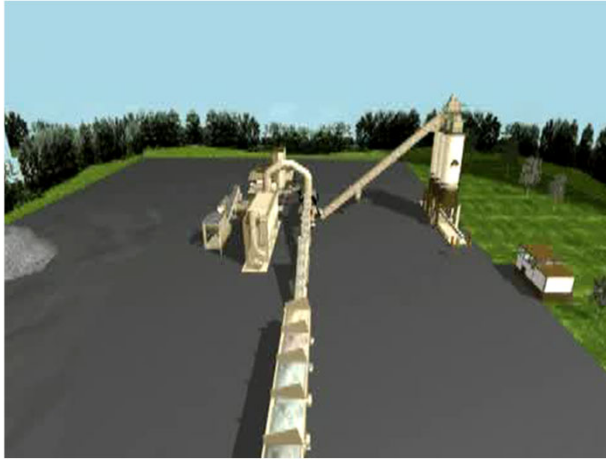
Plant Specifications

- 109.1e – Measurement by Weight
- 152.2 Weighing Equipment
- 155.3 Storage or Surge Bins
- 1103 Aggregates for HMA
- Division 602 (15-06007-R01) – HMA Construction (QC/QA)
 - 602.4a – Plant Operation
 - Asphalt Binder, Additives
 - Aggregates
 - HMA
 - End of Day Quantities



4

Plant Setup (1)



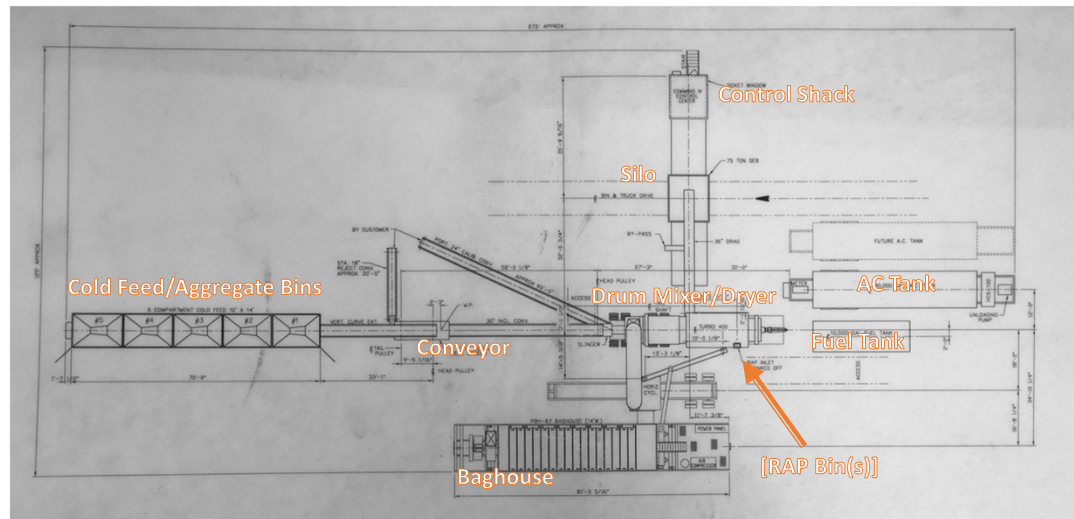
5

Plant Setup (2)



6

Plant Layout (1)



7

Plant Layout (2)



8

Plant Layout (3)



9

Cold Feed/Aggregate Bins



10

Avoid 'Comingling' Aggregates



11

Conveyor & Shaker



12

Aggregate Bins & Conveyor



13

Shaker



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Agg/RAP Bins

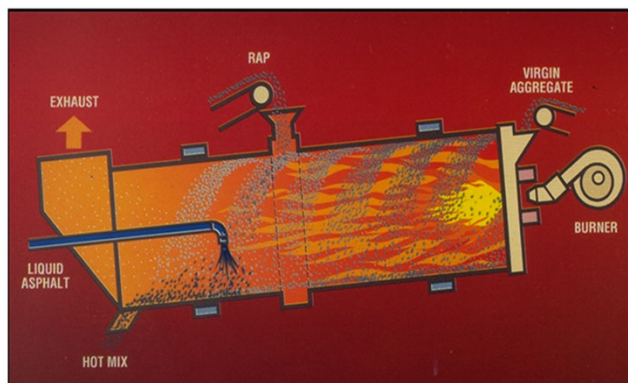


- Material quantity based on mix design
 - Submitted min. 10 working days prior to production
- Agg. Bins to be separated
 - Screens/Grizzlies also used (2 ¼ inch)
- Max %RAP shown in Contract/MR
 - Deduct for excess RAP; based on 4-point moving average
- Totalizer readings used for RAP quantities (602.5d)
- Checked min. twice daily
- Included in End of Day quantities
- FRAP (1103.2a(4))
- RAS (1103.2a(5))



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Drum Mixer/Dryer



Inputs

- Virgin Aggregate
- RAP
- AC (Liquid Asphalt)
- Heat, lots of heat

Outputs

- HMA
- Exhaust
 - Filtered through baghouse



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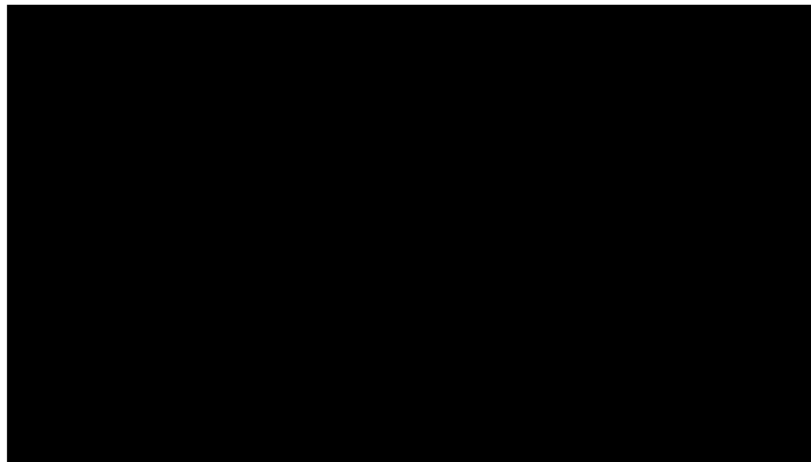
Baghouse/Dust Collector



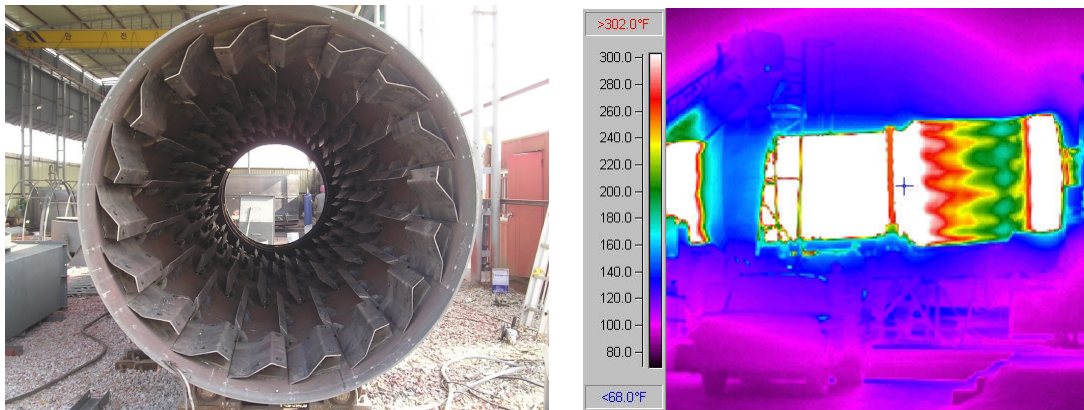
- Fabric filters to collect fines
- Controlling air emissions



Drum Mixer/Dryer (1)



Drum Mixer/Dryer (2)



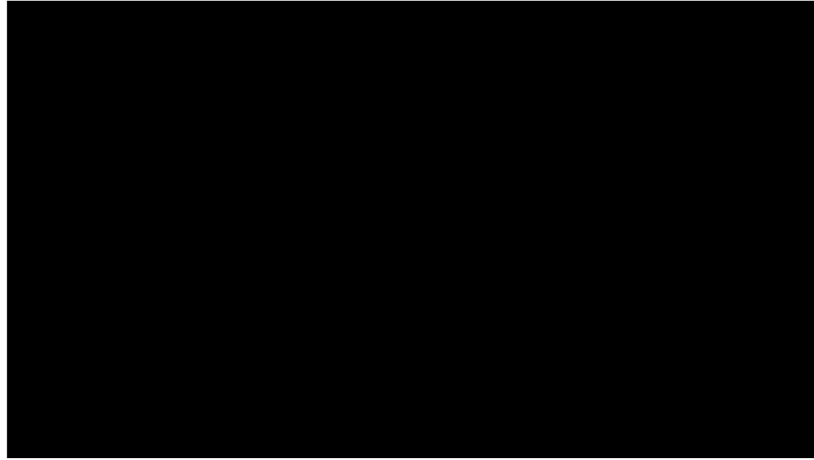
19

Drum to Silo – HMA



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Plant Setup



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Storage/Surge Bin with Gob Hopper (1)

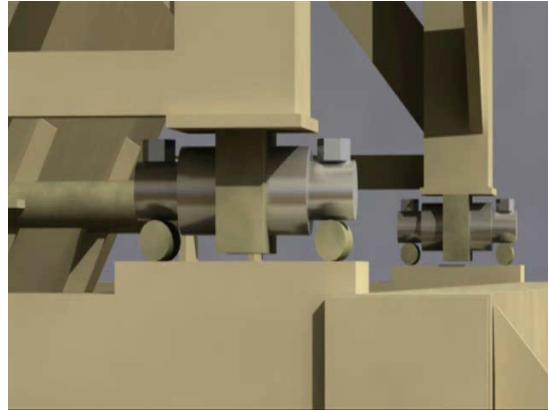
155.3

- Designed to prevent segregation
- Protected from heat loss
- Use a gob hopper or other device to load silo
- Loading sensors
- HMA should not be stored longer than 3 hours



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Storage/Surge Bin with Gob Hopper (2)



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Weighing Requirements

- Accurate within 0.5% throughout use (ERR)
- Equipment must be tested and certified
 - before and after setup, prior to production
 - 6-month intervals
 - When receiving repairs
 - Other times deemed necessary
- Scales shall be checked at random intervals
- Check scales a **minimum** 2 times per week
 - Use 2 different scales (co-op)
- Scale Operators remain the same unless change is approved



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HMA Loading

Surge Bins

- Asphalt weighed in the silo
- Tickets generated from control shack/plant operator



Platform Scale

- Trucks loaded from silo then sent to scales
- Tickets generated from scale operator



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Scales

Silo Scale/Surge Bin

- Net Weight
 - No need for tare/gross weight
 - Only material weights
- Load Cells
 - Weigh the material as loaded into the silo and then deposited into truck

Platform Scales

- Tare Weight – Gross Weight = Net Weight
 - Tare Weights twice a day
- Scale must be large enough to accommodate the longest truck/trailer in a single operation
 - No Split weighing (152.2)



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Scale Tickets

Tickets must include:

- Date
- KDOT Project Number
- Material
- Truck Information
- Weights (Gross, Tare, Net)
- Pay Quantity
- Scale Operator and Road Inspector Initials

apac APAC-Kansas, Inc. - Shears Div
820 Canterbury Rd
Hays, KS 67601
Ticket: 20121488

04/30/2012 9:00:33AM 04201 - Hwy Portable Asphalt
Customer: 208 Company: 309-APAC-Kansas
Order: 698292.50.401075 - KDOT Sheridan 24.90 Base
Job: 698292 P.O.: 50.40105.7
Product: 211100 SR-10A ML Base UOM: Ton

Deliver To: Tax Status: TX Zone: TX

Vehicle: MCNUAAS378 Legal Gross: 85,500

Received:

Weights		Tons	
Gross	0	0.00	
Tare	0	0.00	
Net	53,380	26.14	
Ordered	0.00		
Received	34,850.73		
Remaining	-34,850.73		
Today	434.30	0.00	17
Today	0.00		
Weightman:	Jason Overford		

Venture Corporation
South Hwy 281
Great Bend, Kansas
67530

1154

** MANUAL WEIGHT **

Ticket Number: 11154
DATE: 7/10/2010 TIME: 11:20 AM

SOLD TO: Kdot

CUSTOMER NO.: 001
JOB ORDER NUMBER: U036-74KA1734-1

DELIVERED TO:

TRUCK INFORMATION				MATERIAL LOADED				PLANT NO.	
NUMBER	LOADS TODAY	MATERIAL TODAY	SOLD TO SPEC	CODE	PRODUCT NAME	MATERIAL SOLD TODAY	PLT2 OPERATOR		
T1	6	132.31	0	SR-12	SR-12.5A	703.84			
WEIGHT IN: Tons				COMMENTS/DIRECTIONS:				CASH SALE	
GROSS				TARE				NET	
35.620				**12.260*				23.360	
0.000				TRUCK MAXIMUMS				0.000	
CONTRACT #				JOB INFORMATION					
LOAD NO.	MATERIAL TODAY	TOTAL MATERIAL TO DATE	MATERIAL REQD.	LOCATION of JOB NAME					
33	703.84	23,519.28	23,251	Phillips County					
Driver: Gilbert				Road By:				Insp:	
TOTAL									



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Hauling Equipment (152.1b)

- End dump or belly dump
- Smooth metal beds to prevent loss of material
 - Bed liners or release agent often used
 - PQL 27 – Release Compound for Asphalt Mixes
 - DO NOT use petroleum products ie diesel
- Equipped to protect from heat loss
 - Covers/tarps to cover the entire load of HMA
- 602.4d
 - Minimize hauling over surface/final course
 - Deliver to paver at sufficient temperature for placement and compaction



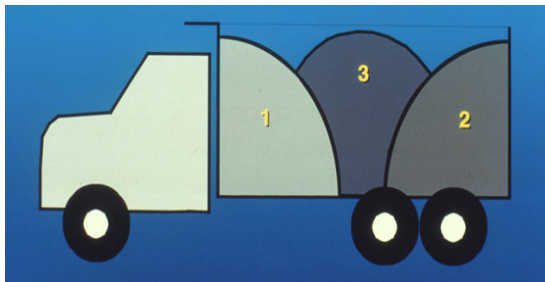
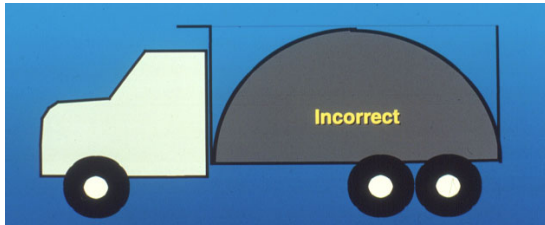
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Typical Trucks



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Loading Trucks



- Avoiding truck segregation
- Avoid single stacking/cones
- Separate piles
 - Ideally front, back, middle

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Plant Inspection

Information for Plant Inspection

Typically, this part of the Superpave Lab Inspector's job



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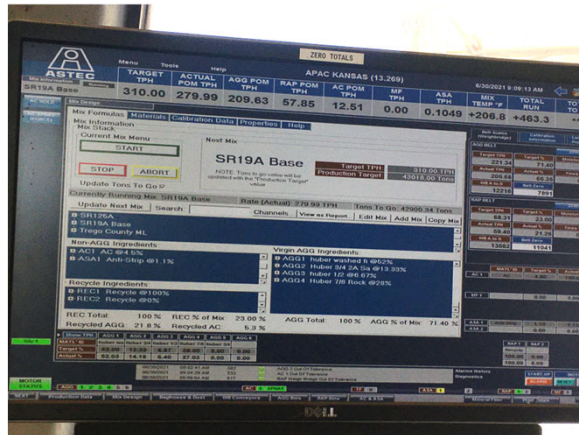
Control Shack (1)



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Control Shack (2)

During Production



Daily Totals



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Control Shack (3)



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Print-out Information

Plant Checks

We are looking for...

- Totalizer Information
- % Moistures
- Production Rate (Tons per Hour)
- Metered AC and Additives
- Temperatures
 - Mix and AC
 - Manufacturer's Recommendations
 - **Mixing** & Compaction Temperatures

The logo for the Kansas Department of Transportation is located in the bottom right corner. It features the word "Kansas" in a large, blue, serif font. Above the letters "kan" is a yellow sunburst graphic with the words "KANSAS HIGHWAY" written in a small, yellow, sans-serif font. Below the word "Kansas" is the text "Department of Transportation" in a smaller, blue, sans-serif font.

- ## We are looking for...
- Totalizer Information
 - % Moistures
 - Production Rate (Tons per Hour)
 - Metered AC and Additives
 - Temperatures
 - Mix and AC
 - Manufacturer's Recommendations
 - **Mixing** & Compaction Temperatures

Daily Quantities

- Excel Sheets of daily totals
 - KDOT or online generated
 - Confirm quantity totals
- Write waste on tickets
 - Plant waste provided by plant, Road waste written on ticket
 - Plant waste could be beginning or end of day
 - Road waste could be from ordering too much or complications while paving



37

END

- Main thing when in an asphalt lab is to get in a good rhythm



38

Asphalt Paving Inspection

Part 3 – Paving

We'll discuss...

Tack Coat, Pavers & MTV's, Grade Control, Compaction, Segregation,
Densities, Joints, Smoothness, Miscellaneous items and HMA
Commercial Grade



1

Asphalt is loaded and weighed... Now what

- Material Transfer Device/Vehicle (MTD/MTV)
- Paving
- Compaction with Rollers
- Density testing with Nuclear Gauge
- But first... Tack Coat (Emulsified Asphalt)



2

Distributor and Tack Coat

155.2 – Asphalt Distributor

- We need them to...
 - Show gallons used
 - Show temperature
 - Cover the required width *consistently*
- Calibration (prior to use on project)
 - Accurate within 0.01 gallon per square yard
 - Certified by District Materials Engineer and on file with KDOT

602.4b – Road Surface Preparation

- Earth Subgrade
 - Prepare by sprinkling, lightly scarifying, blading and rolling until proper crown is obtained
 - Lightly spray with water to obtain moistened condition
 - Do not place when frozen, muddy or when raining or snowing
- Existing Asphalt, Concrete or Brick Pavement
 - Clean of all foreign materials
- Tack Coat
 - Weather may warrant a request to change asphalt



3

Surface Preparation



4

Tack Truck



5

Distributor 1



6

Distributor 2



7

Construction Requirements 1

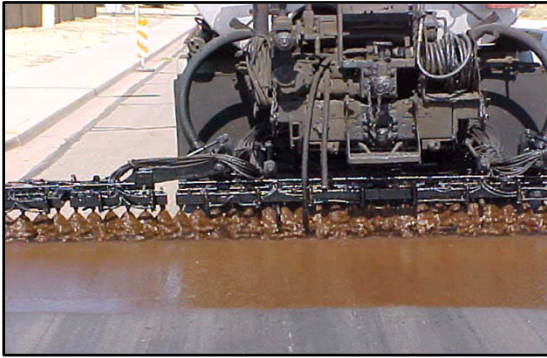
602.4.b.(4) Page 15-06007-10

- Tack Coat
 - Prior to placing the HMA, apply a tack coat to the existing surface as shown in the contract documents.
 - Application rate is shown on the Typical Section in the Contract
 - Emulsified Asphalt SS-1H most common



8

Construction Requirements 2



602.4.b.(4) Page 15-06007-10

- “Tack” coat is often a diluted mixture of emulsified asphalt and water
- The brown color will fade as water evaporates and oil sets
- Pavement should not be placed until tack coat has “broken” i.e. no more brown color/water



9

Construction Requirements 3

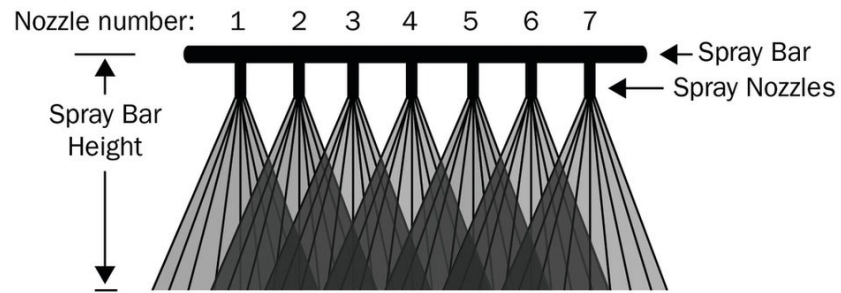
602.4.b.(4) Page 15-06007-10 – Tack Coat



10

Construction Requirements 4 602.4.b.(4)– Tack Coat

Good Coverage - triple lap



11

Tack Coat



12

Temperature Correction Example 1

Refer to Construction Manual Section 5.10.3

Given:

- Stab = 10,000 gallons of emulsified asphalt
- Asphalt Temp = 190°F

Find **tons** of asphalt in the tanker

1. Convert to 60 °F

- Construction Manual (Part V) 5.10.3 (Table 3)



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CM – 5.10.3 (Table 3)

TABLE 3											
Temperature-Volume Corrections for Emulsified Asphalts											
Legend:											
°C = Observed temperature in Celsius											
°F = Observed temperature in Fahrenheit											
M = Multiplier for correcting volumes to the basis of 15.6° C (60° F)											
°C	°F	M	°C	°F	M	°C	°F	M	°C	°F	M
10.0	50	1.00250	32.2	90	0.99250	54.4	130	0.98250	76.7	170	0.97250
10.6	51	1.00225	32.8	91	0.99225	55.0	131	0.98225	77.2	171	0.97225
11.1	52	1.00200	33.3	92	0.99200	55.6	132	0.98200	77.8	172	0.97200
11.7	53	1.00175	33.9	93	0.99175	56.1	133	0.98175	78.3	173	0.97175
12.2	54	1.00150	34.4	94	0.99150	56.7	134	0.98150	78.9	174	0.97150
12.8	55	1.00125	35.0	95	0.99125	57.2	135	0.98125	79.4	175	0.97125
13.3	56	1.00100	35.6	96	0.99100	57.8	136	0.98100	80.0	176	0.97100
13.9	57	1.00075	36.1	97	0.99075	58.3	137	0.98075	80.6	177	0.97075
14.4	58	1.00050	36.7	98	0.99050	58.9	138	0.98050	81.1	178	0.97050
15.0	59	1.00025	37.2	99	0.99025	59.4	139	0.98025	81.7	179	0.97025

87.8	190	0.96750
88.3	191	0.96725
88.9	192	0.96700
89.4	193	0.96675
90.0	194	0.96650



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Temperature Correction Example 5

Convert Gallons to Tons:

$$9,675 \text{ gal} \times 8.420 \text{ lbs/gal} = 81,463.5 \text{ lbs}$$

$$81,463.5 \text{ lbs} \div 2000 \text{ lbs/ton} = 40.73 \text{ tons}$$



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Temperature Correction Example RECAP

- STAB = 10,000 gallons
- Asphalt Temp = 190°F
 - Correction factor from chart = 0.96750
 - Load ticket shows 8.420 lbs/gallon
- $10,000 \times 0.96750 = 9,675$ gallons at 60°F
 - Use 8.420 lbs/gallons to get 81,463.5 lbs
 - Use 2000 lbs/ton to get 40.73 tons



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Temperature Correction

- If Temperature of oil is greater than 60°F, then corrected gallons will be less than measured gallons.
- If Temperature of oil is less than 60°F, then corrected gallons will be more than measured gallons.

• 601 – Asphalt Application Temperatures

All asphalt binders and cutback asphalts reheated to temperatures 50°F more than the maximum in **TABLE 601-1** will be considered overheated and may be rejected pending re-sampling and re-testing of the material at the discretion of the Engineer.
All emulsified asphalts reheated to temperatures above the maximum shown above will be considered overheated and may be rejected pending re-sampling and re-testing of the material at the discretion of the Engineer.

- Typical with HMA is SS-1H or CSS-1H (Max 150°F)
- Another example provided in Surfacing Section
 - We will cover dilution then, as well



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Tack Coat – Emulsified Asphalt Typically Used

SECTION 601 ASPHALT APPLICATION TEMPERATURES

Page 600-1, subsection 601.1, delete TABLE 601-1 and replace with the following:

TYPE AND GRADE	TEMPERATURE RANGE (°F)			
	Spraying		Plant Mixing	
	Min.	Max.	Min.	Max.
Asphalt Binder	275	340	*	*
Cutback Asphalt, MC 30	88	125	88	125
Cutback Asphalt, MC & RC 70 & 250	125	200	125	200
Cutback Asphalt, MC & RC 800 & 3000	150	250	150	250
Asphalt Rejuvenating Agent, ARA	70	150	70	150
Emulsified Asphalt, CRS-1H, RS-1H, SS-1HP, CMS-1, MS-1, HFMS-1, RS-1HP, CRS-1HP	100	180	100	180
Emulsified Asphalt, SS-1H, CSS-1H	None	150	None	150
Emulsified Asphalt, CSS-1HM, CSS-Special	None	120	None	120
EBL	120	180	NA	NA

* Use the Producer's recommended mixing temperature range.

- Brief Discussion on Liquid Asphalt Materials
 - Section 601 – Asphalt Application Temperatures
 - Errata Sheet 15-ER-1-R20



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Material Transfer Device

155.5

- Mobile conveyors, shut buggies, material transfer vehicles, material transfer paver and pick-up devices are all considered MTDs
- Must be...
 - Self-propelled
 - Move independent OR attached
 - Able to mix and deposit material at uniform temperature and consistency
- Preventing segregation!

602.4e

- Remix hauled material prior to placement (with a few mix design exceptions)
- Do not dump wings of the paver hopper



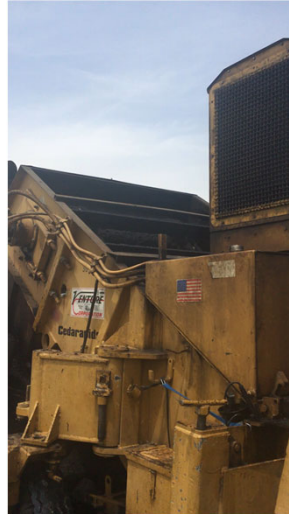
21

Shuttle Buggy



22

MTV



23

Pick-Up Device



- Used with belly-dump style haul trucks

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Asphalt Paver 1

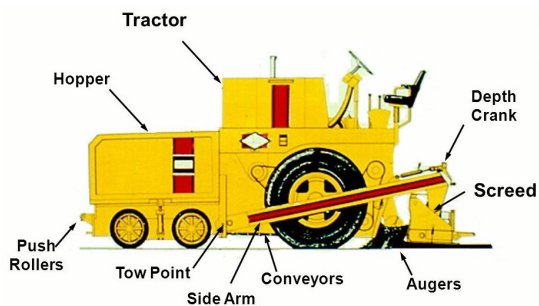
155.4

- Self-contained and power-propelled
- Equipped with automatically controlled activated screed and heated if necessary
- Capable of paving width and thicknesses required
- Automatic grade control (sensor operated)
- Screed produces an even, finished surface



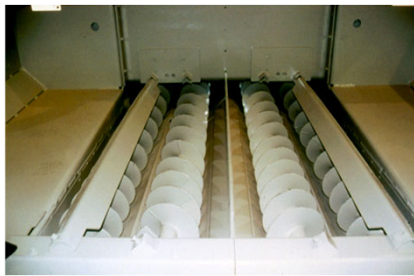
25

Asphalt Paver 2

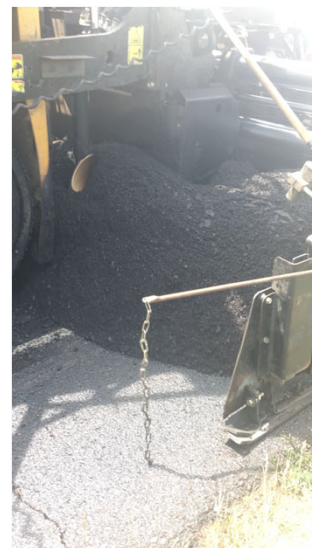
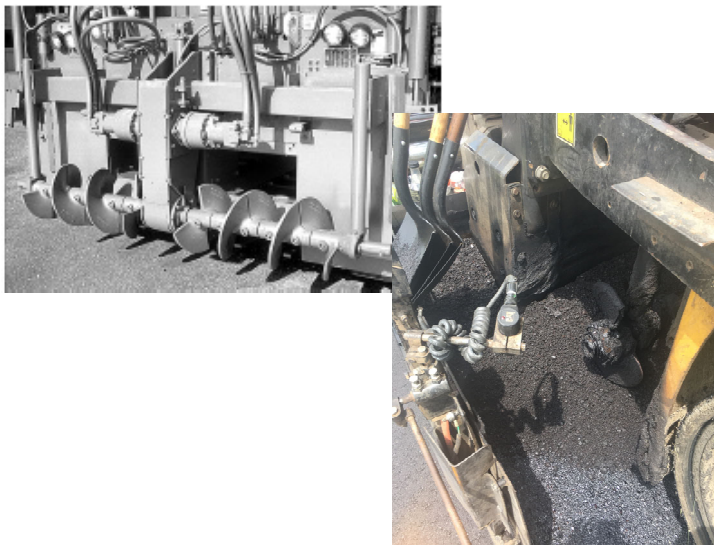


26

Asphalt Paver – Hopper



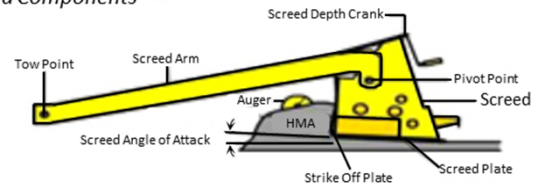
Asphalt Paver – Spreading Augers



Asphalt Paver – Screed



Screed Components



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Paving Operations 1

602.4e

- Spread and finish material to reasonably true crown and grade by an automatically controlled paver without tearing surface.
- Uniform in density and texture and free from surface irregularities.
- Except when other methods are approved, the paver shall be operated at a speed which will provide a uniform rate of placement without undue interruption.
- If the automatic grade control devices breaks down, the Engineer may permit the paver to operate to the close of the working day provided the surface is satisfactory, but it shall not operate on a lift that was laid without automatic controls.



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Paving Operations 2

602.4e(3)

- Grade Control – Surface Tolerances – Lift Thickness
 - Except for leveling courses, nominal compacted thickness for the bituminous mixture shall not exceed 2 inches for surface courses and 4 inches for other courses unless shown otherwise in the Contract Documents or specified by the Engineer. (Table 602-9)

TABLE 602-9: NOMINAL COMPACTED THICKNESS	
Lift	Maximum Nominal Compacted Thickness
Surface	2 inches
Base	4 inches

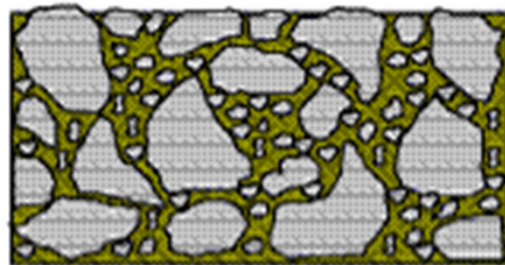


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Paving Operations 3

602.4.e.(3) Page 15-06007-11

- Grade Control – Surface Tolerances – Lift Thickness
 - The minimum lift thickness for any HMA mixture is 3 times the nominal maximum aggregate size, unless otherwise designated in the contract documents or approved by the Engineer.



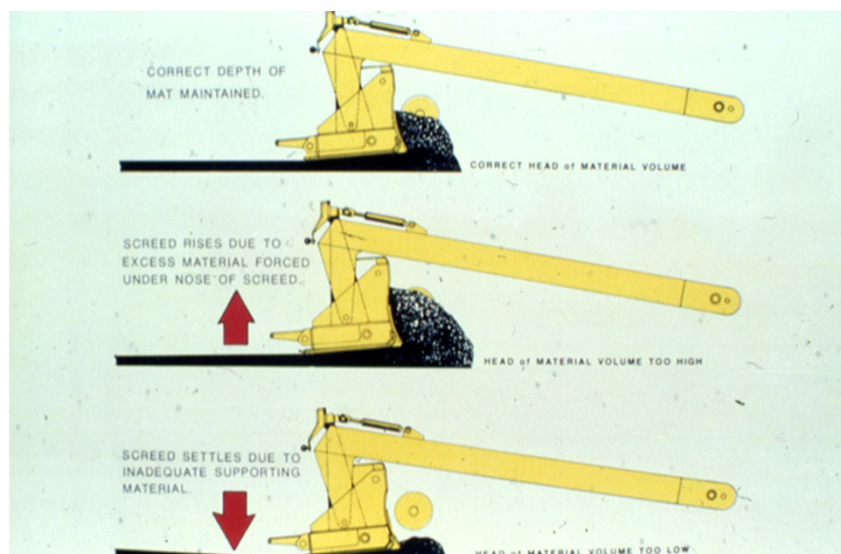
32

Surface Quality 1

- Speed and continuity of paver operation
- Amount and flow of material in hopper, full & consistent flow is optimal
 - Avoid overfilling or letting it get too empty
- Head of material in augers
- Type of mix being paved
- Condition of existing surface
- Weather conditions

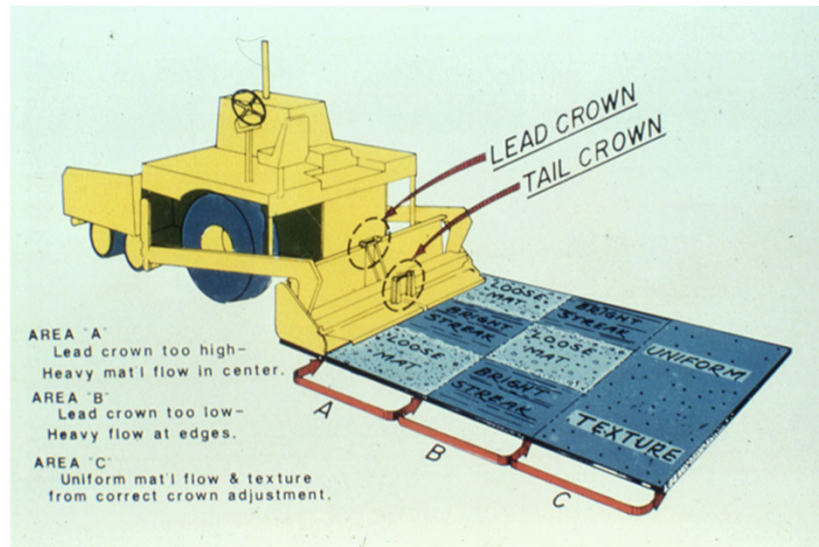
33

Surface Quality 2 – Screed



34

Surface Quality 3 – Screed



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Surface Quality 4



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Paving Operations

602.4.e.(4) Page 15-06007-11

- **Grade Control – Surface Tolerances – Lift Thickness**
 - Grade control shall be achieved by use of one or more of the following grade reference devices. Approval based on performance.
 - Traveling Stringline
 - Reference Shoe
 - Erect Stringline
 - Stringless Paving
- **Grade Control – Traveling Stringline**
 - Attach a traveling stringline or ski type attachment, a minimum length of 30 feet, to the paver and operate parallel with its line of travel.



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Traveling Stringline



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Reference Shoe

602.4.e.(4)(b) Page 15-06007-11

- Grade Control – Reference Shoe
 - A short reference shoe or joint matching device shall be attached to the paver for control in matching surface grades along longitudinal joints.
 - Good for matching curb & gutter or any surface you want to match grade exactly.



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Erected Stringline

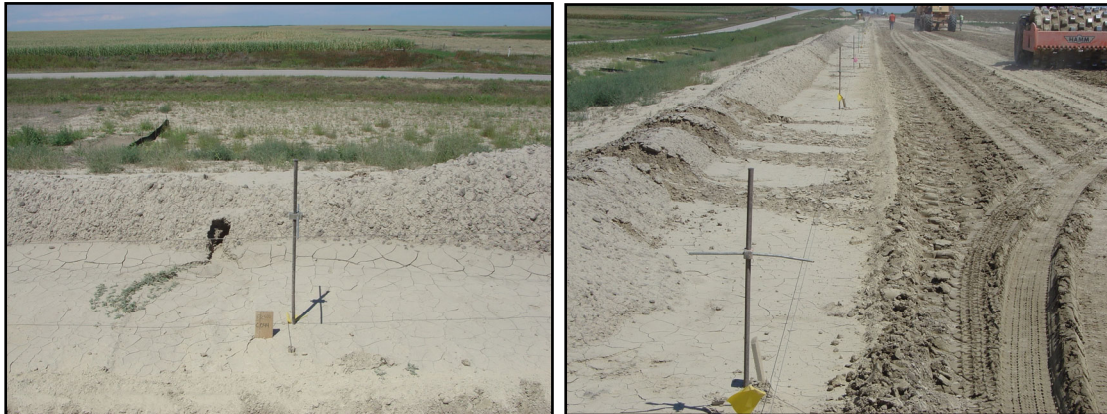
602.4.e.(4)(c) Page 15-06007-11

- Grade Control – Erected Stringline
 - An erected string line consisting of a tightly stretched wire or string offset from and parallel to the pavement edge on one or both sides
 - Erected parallel to the established pavement surface grade
 - Supported at such intervals as necessary to maintain the established grade and alignment. (Typically 50' to 100')



40

Erected Stringline

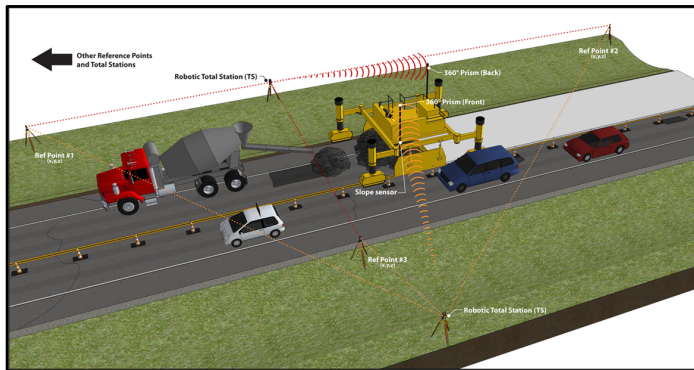


Stringless Paving

602.4.e.(4)(d)

- Grade Control – Stringless Paving
 - Horizontal control guided via GPS
 - Vertical control guided via Total Stations, GPS is not allowed for vertical control.
 - When paving on fresh subgrade it must be trimmed by automatically controlled machine via erected stringline or using approved stringless method above.

Stringless/GPS



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Asphalt Compaction

Equipment

- Self-Propelled Smooth Faced Steel Rollers – 151.4c
- Self Propelled Vibratory Rollers – 151.5
- Pneumatic Tired Rollers – 151.3



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Asphalt Compaction Equipment - 151

- 151.1
 - “If a numerical density is specified, the Engineer may waive the roller weight requirement if the roller compacts the material to the specified density. If a numerical density is not specified, the Engineer may waive the roller weight requirement if the roller performed satisfactorily on a previous KDOT project.”



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Which Rollers Are Used Where???

Construction Operation	Required Number & Type of Rollers	
	Pneumatic-Tired Roller	Smooth Faced Steel Roller
HMA/WMA Construction	*	*
Ultrathin Bonded Asphalt Surfacing (UBAS)	-	**
Surface Recycle (HIR) Construction	-	2
Cold Recycle (CIR) Construction	1	1
Chip Seal Construction	3	-

* Minimum of 2 rollers required when plant is producing less than 275 tons per hour, 3 rollers required when plant is producing more than 275 tons per hour. Final rolling pass shall be completed with smooth steel roller in static mode. 602.4e.(5) 15-06007 Pages 12-13

** 613.43.(2) – Roll UBAS with minimum of 1 pass, maximum of 3 passes with 2 axle tandem steel rollers (min. 10 Ton)



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Self-Propelled Smooth Faced Steel Rollers

151.4c Page 150-1 – 150-2

- Requirements per 151.4c
 - Smooth faces on all steel rollers
 - Require water tanks, sprinkling devices and scrapers to prevent material build up on drum
 - Two-Axle rollers must weigh 8-12 Tons



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Self-Propelled Vibratory Rollers 1

- Requirements per 151.5 – Page 150-2 – 150-3
 - Operate vibratory roller at frequency and amplitude necessary for desired compaction without damaging material
 - Shall be amplitude adjustable, operate at low amplitude unless otherwise directed
 - Minimum frequency = 1,800 vibrations/minute
 - Minimum static force on drum = 135 lbs per inch of roller width



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Self-Propelled Vibratory Roller 2

- Requirements per 151.5
 - Operate vibratory roller at frequency (min 1,800 vibrations/minute) and speed to achieve 10 impacts per linear foot
 - Above bold line 151.5 Table 151-2



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Self-Propelled Vibratory Rollers 3

TABLE 151-2: HOT MIX ASPHALT PAVING
Impacts per Linear Foot

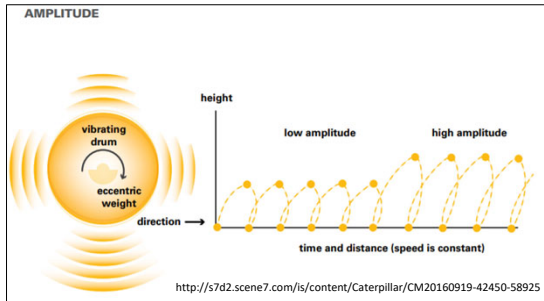
Roller Speed MPH (ft./Min)	Vibrations Per Minute											
	1800	2000	2200	2400	2600	2800	3000	3200	3400	3600	3800	4000
1.0(88)	20.5	22.7	25.0	27.3	29.5	31.8	34.1	36.4	38.6	40.9	43.2	45.5
1.5(132)	13.6	15.2	16.7	18.2	19.7	21.2	22.7	24.2	25.8	27.3	28.8	30.3
2.0(176)	10.2	11.4	12.5	13.6	14.8	15.9	17.0	18.2	19.3	20.5	21.6	22.7
2.5(220)	8.2	9.1	10.0	10.9	11.8	12.7	13.6	14.5	15.5	16.4	17.3	18.2
3.0(264)	6.8	7.6	8.3	9.1	9.8	10.6	11.4	12.1	12.9	13.6	14.4	15.2
3.5(308)	5.8	6.5	7.1	7.8	8.4	9.1	9.7	10.4	11.0	11.7	12.3	13.0
4.0(352)	5.1	5.7	6.2	6.8	7.4	8.0	8.5	9.1	9.7	10.2	10.8	11.4
4.5(396)	4.5	5.1	5.6	6.1	6.6	7.1	7.6	8.1	8.6	9.1	9.6	10.1
5.0(440)	4.1	4.5	5.0	5.5	5.9	6.4	6.8	7.3	7.7	8.2	8.6	9.1

- Operate at speed/frequency combination above bold line (min. 10 impacts per foot)

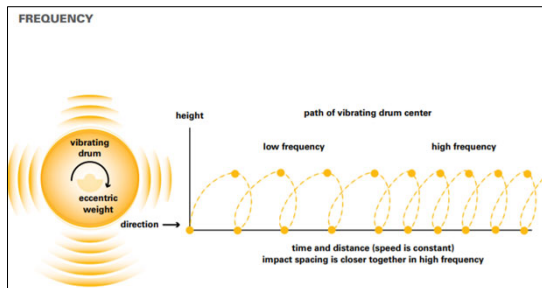


50

Self-Propelled Vibratory Rollers 4



Amplitude is the distance that the drum moves *into* the mat (the impact force).



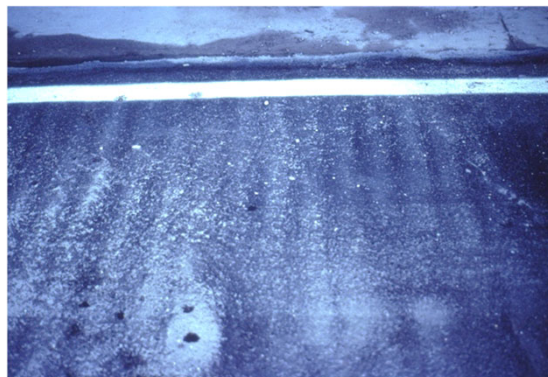
Frequency is the number of times the drum hits the mat, vibrations per minute.



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Self-Propelled Vibratory Rollers 5

- The drum is moving into the mat so the impacts need to be properly spaced
- Need the right balance of amplitude and frequency to achieve density and a smooth finish



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Self-Propelled Vibratory Rollers 6



53

Roller Compaction



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Oscillation

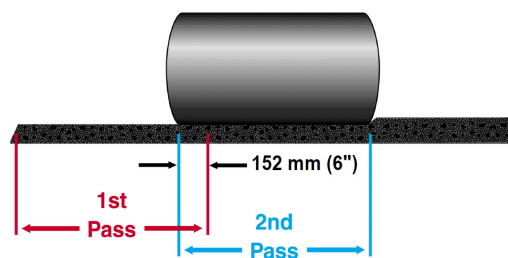
- Spec allows oscillating roller as a finish to remove marks (602.4e(6)(c))
- Oscillation is a non-vertical force
- Removes the up/down motion and moves horizontally, only.

Self-Propelled Vibratory Rollers - 7



- Spray nozzles not working properly

Compaction Requirements & Testing 1



Compaction Requirements & Testing 2

- Compaction of HMA Mixtures - 602.4e.(5)
 - Compact as soon as possible after spreading and strike-off as possible without shoving or tearing
 - Minimum of 2 rollers required for HMA
 - Dependent on plant production
 - Achieve maximum density before mat temperature falls below 175°F (165° for WMA) (602.4e.(6)(c))
 - Final rolling of surface shall be done with a steel roller in static mode unless otherwise specified

Compaction Testing 1

(602.4e(6))

- HMA placed less than 1.5" thick
 - Rolling procedure using nuclear density gauge
- HMA placed 1.5" thick or greater*
 - Compaction Testing – Asphalt Density Pay Adjustment
 - Performed by certified personnel – Contractor (QC/ACC) & KDOT (QA/VER)
 - Cores OR
 - Nuclear Density Testing

*Exception for all HMA (Commercial Grade), HIR – use rolling procedure



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Compaction Testing 2– Rolling Procedure

- Used on HMA lifts placed less than 1.5" thick
- Use nuclear density gauge to determine optimum rolling procedure
 - Take one 1 min. reading directly behind paver
 - Take one 1 min. reading after each roller pass
 - Check temperature behind paver and before & after each roller pass
 - Record & plot (DOT Form 608 – next 2 slides)
 - Determine maximum density "break-over point"
 - Periodically check density & procedure as required



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Compaction Testing 3 – Rolling Procedure

KANSAS DEPARTMENT OF TRANSPORTATION
APPROVED ROLLING PROCEDURE

Project _____ County _____ Lab No. _____
 Contractor _____ Field Engineer _____
 Gauge Type Troder Number _____ 3440 Standard Count _____
 Operator _____ Date _____ Min Design No. _____
 Mix Type EM-1T Thickness 40 mm Base _____ OR Surface X
 Weather _____

Description	Pass	0	1	2	3	4	5	6	7	8	9	10
Roller #1			V	V								
Roller #2					S	S	S	S				
Roller #3												
Temp		124.7	130.1	135.4	137.8	142	140.5	138.4				
P.C.F.												
Time												

Type of Roller S - Static Steel, P - Pneumatic, V - Vibratory

V-Roller No. _____ No. _____
 Frequency (VPM) _____
 Speed (PPM) _____

Note 1 pass - 1 Time Over A Given Spot

Recommended Rolling Procedure VIB, VIB, STATIC, STATIC

District Materials Engineer _____ Date _____
D.O.T. 608

Kansas
Department of Transportation

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Compaction Testing 4 – Density Testing

- Used on HMA lifts placed 1.5" thick or greater
- Asphalt Density Pay Adjustment
- Cores or Nuke Gauge (more common)
- Performed by certified personnel – Contractor (QC/ACC) & KDOT (QA/VER)
- Density Lot – 1 day of production
- Sublot Size – Based on daily production (typically 5 sublots)
 - Contractor – 2 locations per sublot
 - KDOT – 1 location per sublot

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Compaction Testing 5 – Cores

- Contractor required to cut all cores
- Density determined using KT-15



Compaction Testing 6 – Nuke Gauge



Compaction Testing 7– Nuke Gauge

- Nuke gauges must be calibrated
 - For every mix
 - For every lift location
 - For any thickness changes
- Density determined using KT-15
- Contractor and KDOT

KT-32									
CALCULATION FOR CALIBRATION OF NUCLEAR METER ON ASPHALT PAVEMENT									
LAB NO.	ENGLISH		X		METRIC				
PROJECT NO:	35-92 KA 1438-01		COUNTY:		Phillips				
CONTRACTOR:	Venture		MIX TYPE:		SR 12.5 A				
GAUGE TYPE:	3440		NUMBER:		1972		STD COUNT: 835 2141		
DATE GAUGE CALIB:			BACKSCATTER		X		DIRECT TRANS.		
COMPUTED BY:	Cody Ward		DATE:		8/15/2010				
CHECKED BY:	Mike Rogers		DATE:		8/16/2010				
OPERATOR:	Jerry Ming		CORRECTION FACTOR =db=		1.5				
Sample No.	P.C.F. Roadway Core Avg	P.C.F. Nuclear Avg	d1	d1-db	(d1-db)²	d1	d1-db	(d1-db)²	
1	138.0	138.8	1.2	-0.3	0.07	1.2	-0.3	0.07	
2	137.3	139.1	2.2	0.7	0.55	2.2	0.7	0.55	
3	138.8	137.9	0.9	-0.6	0.31	0.9	-0.6	0.31	
4	141.0	138.8	2.2	0.7	0.55	2.2	0.7	0.55	
5	138.7	137.9	0.8	-0.7	0.44	0.8	-0.7	0.44	
			Σ d1	7.3	Σ (d1-db)²	1.91			
			n	5					
E.S.D. = $\sqrt{\frac{(db - db)^2}{n-1}}$ = 0.69									
Tmax = Larger of T _b & T ₁ = 1.07									
T = 1.07									
NOTE: This calibration passed the T-sensitivity test									



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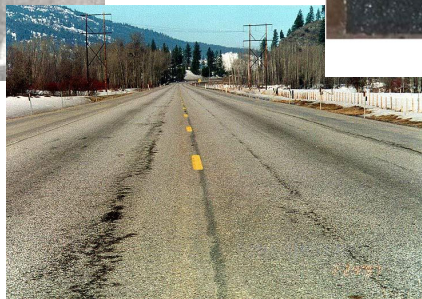
Segregation

- Segregation – separation of large & small aggregates in bituminous mixture into streaks or patches of coarse and/or fine areas
 - Coarse Segregation – low AC content, low density, high air voids, rough surface texture, accelerated rutting and fatigue failure
 - Fine Segregation – high AC content, low density, smooth surface texture, accelerated rutting
- Common causes in the field
 - Temperature differences
 - Hopper, augers, etc...
 - “Piles” during haul and delivery



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Segregation Examples 1



(a)

(b)

Segregation Examples 2

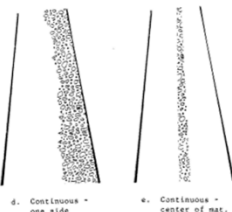
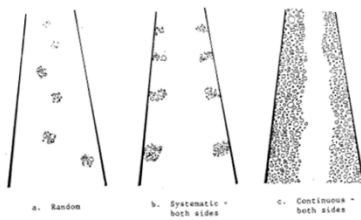


Figure 6.3. Typical segregation patterns



Causes of Segregation

- Segregation “Check Points”
 - Aggregate stockpiling / handling
 - Plant operation
 - Truck loading
 - Truck dumping
 - Material Transfer Device/Vehicle (MTD/MTV)
 - Paver / Laydown machine



69

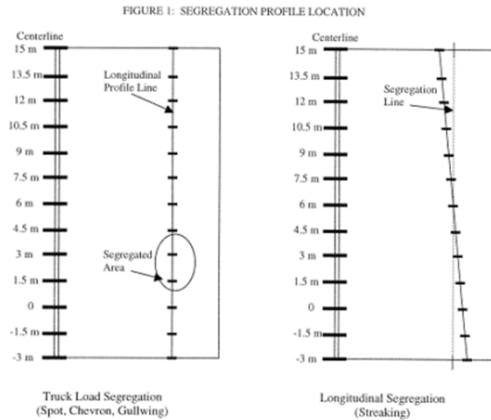
Segregation Profile 1 (CM 5.8.3)

- Series of density tests with nuclear density gauge
 - Minimum of 10 locations, three 1-minute shots per location
 - Comparison of average density values to determine whether segregation has occurred
- Straight Line Profile
 - Segregation caused by plant operation, truck loading, transfer device
- Transverse Profile
 - Segregation caused by paver operation (longitudinal streaking)



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Segregation Profile 2 (CM 5.8.3 & KT-32)



71

Segregation Profile 3 – CM 5.8.3

- Allow paving unit to progress 1,000 ft before performing a segregation check
- Initially perform 4 segregation checks for each mix
 - AM/PM
- Perform check in visibly segregated area, or use a stopping location of the paver for a zero point
- If the paver does not periodically stop and no visible segregation, randomly select location
- Screed = 0 point, start 10 ft behind screed and take at least 10 shots every 5 ft

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Segregation Profile 4 (15-06007 & CM 5.8.3)

- Evaluate segregation per 602.4e.(1) Table 602-7 Page 15-06007-10
 - Maximum Range = highest – lowest
 - Maximum Drop = average - lowest

TABLE 602-7: SEGREGATION AND UNIFORMITY OF DENSITY CHECK

Mix Designation	Maximum Density Range (highest minus lowest)	Maximum Density Drop (average minus lowest)
All	4.4 lbs./cu. ft.	2.2 lbs./cu. ft.



73

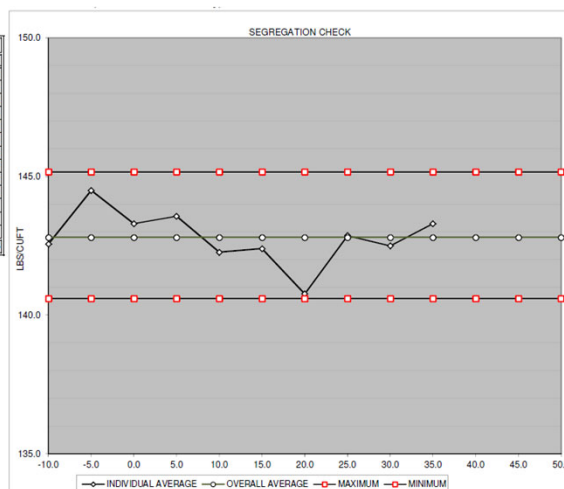
Segregation Profile 5 (AP-14)

LOCATION	READINGS lb / ft ³			
	#1	#2	#3	AVG
-10.0	142.5	142.4	142.8	142.6
-5.0	143.3	144.7	145.5	144.5
0.0	142.6	143.6	143.7	143.3
5.0	143.6	144.2	142.9	143.6
10.0	142.8	142.4	141.6	142.3
15.0	141.6	142.8	142.8	142.4
20.0	140.8	140.6	140.9	140.8
25.0	143.0	142.5	143.1	142.9
30.0	143.3	142.0	142.2	142.5
35.0	143.2	143.3	143.4	143.3
40.0	0.0	0.0	0.0	0.0
45.0	0.0	0.0	0.0	0.0
50.0	0.0	0.0	0.0	0.0
				142.8

HIGH POINT	144.5
LOW POINT	140.8
DIFFERENCE	3.7
PASS / FAIL	PASS

OVERALL AVG	142.8
LOW POINT	140.8
DIFFERENCE	2.0
PASS / FAIL	PASS

(Minimum = Overall Avg - 2.2 lb/cuft)
(Maximum = Lowpoint + 4.4 lb/cuft)



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Segregation Profile 6 (CM 5.8.3)

- One Failing Segregation Profile
 - Notify contractor, contractor must make adjustments to mitigate segregation
- Two Consecutive Failing Segregation Profiles
 - Suspend production, contractor must make adjustments, proceed per 5.8.3(6)
- Four Consecutive Passing Segregation Profiles
 - District Materials Engineer (DME) may reduce frequency



75

Construction Joints 1

- Transverse Joints (602.4e.(9)(a))
 - Contractor shall use a method of making transverse construction joints which:
 - Provide thorough and continuous bond
 - Provide an acceptable surface texture
 - Meet density requirements
 - Surface elevation doesn't vary more than 3/16" in 10 ft longitudinally across joint
- Longitudinal Joints (602.4e.(9)(b))
 - Longitudinal construction joints shall be:
 - Well bonded and sealed to obtain maximum compaction
 - Offset 6 to 12 inches in successive courses
 - Comply with traffic lane edges for width of the surface of top course placement, i.e.
 - Centerline joint must be on centerline on surface course

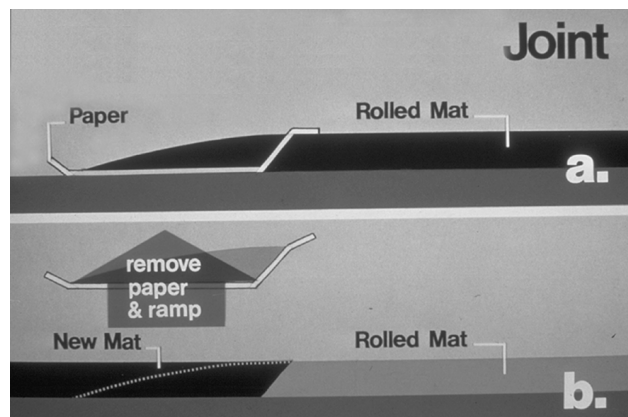


76

Construction Joints 2



Construction Joints 3

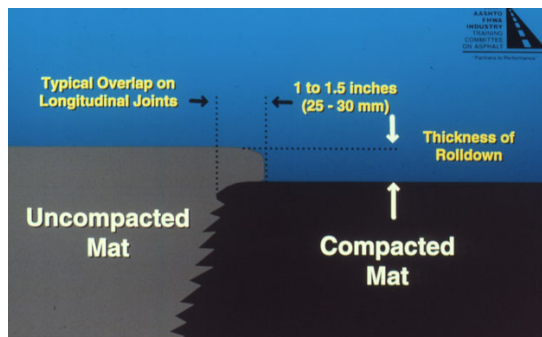
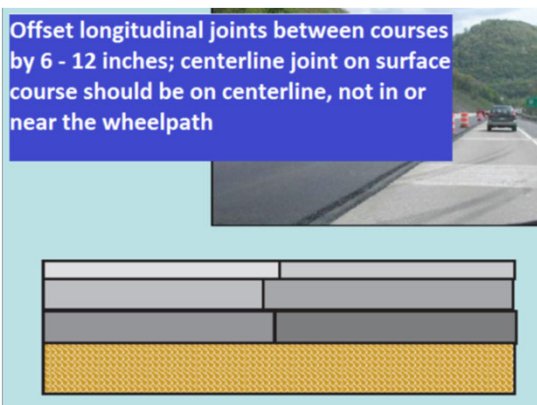


Construction Joints 4



Longitudinal Construction Joints 1

Offset longitudinal joints between courses by 6 - 12 inches; centerline joint on surface course should be on centerline, not in or near the wheelpath



Longitudinal Construction Joints 2



81

Joint Density Requirements

- Evaluate longitudinal joint density per CM 5.8.4
 - Evaluate one longitudinal location per subplot
 - Use KT-32 (nuke meter) to determine joint density
 - Compare to interior joint density OR % G_{mm} (15-06007-R01 Table 602-8)
 - If 2 consecutive joint density evaluations fail, suspend paving operations, proceed per 5.8.4 (similar to failing segregation check procedure)

TABLE 602-8: JOINT DENSITY REQUIREMENTS	
Nuclear Gauge Readings	Requirement
Interior Density minus Joint Density	≤ 3.0 lbs./cu. ft.
OR	
Joint Density	$\geq 90.00\%$ of G_{mm}

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- Locations are randomly generated
- Locations need to be able to be replicated so...
 - Measure out your density locations with wheel/tape and mark out nuke with lumber crayon
 - If there is a dispute, this will help us replicate the shots after some time has passed



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TABLE 805-4: HEIGHT DIFFERENTIAL TREATMENT		
Condition	Height Differential ("D")	Treatment
Nominal height differential between driving lanes open to traffic	1 inch < D ≤ 2 inches	Use the Uneven Lanes signs (W8-11) as part of the Traffic Control Plan.
	2 inches < D ≤ 4 inches	Use the Uneven Lanes signs (W8-11) as part of the Traffic Control Plan. Construct a 3:1 or flatter slope wedge against the pavement edge.
	D > 4 inches	This condition is not permitted unless otherwise indicated by the contract documents.
Nominal height differential between driving lane and shoulder or adjacent pavement that is closed to traffic	D ≤ 2 inches	Use the Shoulder Drop-Off sign (W8-17 and W8-17P) as part of the Traffic Control Plan.
	2 inches < D ≤ 4 inches	Use Shoulder Drop-Off signs (W8-17 and W8-17P) signs as part of the Traffic Control Plan. Construct a 1:1 or flatter slope wedge against the pavement edge. Channelizing devices may be used instead of a wedge if approved by the Engineer and when placed so the maximum device spacing, measured in feet, is equal to the posted speed limit prior to construction. height differential is expected to last longer than 2 weeks, the use of a 3:1 or flatter slope wedge against the pavement edge is required and the use of channelizing devices instead of a wedge is not permitted unless otherwise indicated in the Contract Documents.
	D > 4 inches	To the extent feasible, provide an obstruction free recovery area between the channelizing devices and height differential. Use Shoulder Drop-Off signs (W8-17 and W8-17P) as part of the Traffic Control Plan. Construct a 3:1 or flatter slope wedge against the pavement edge. Channelizing devices may be used instead of a wedge as approved by the Engineer when the channelizers are placed so the maximum device spacing, measured in feet, is equal to the posted speed limit prior to construction and no height differentials greater than 4 inches are left overnight without a wedge, unless otherwise indicated in the Contract Documents.



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Factors Affecting Asphalt Pavement Smoothness

- Base / Subgrade / Existing Roadway
- Milling
- Paver Operation
- Roller Operation
- Mix Properties



85

Asphalt Pavement Smoothness

(15-06007-R01 & 15-06006-R01)

- Surface Tolerances - Bumps / Dips / Defects
 - Stringline or Straightedge
- Smoothness – Profilograph Roughness Index (PRI)
 - Profilograph Testing
- Asphalt Pavement Smoothness Bid Item
 - Monetary contract adjustment based on Profilograph Testing & PRI
 - New Construction vs Rehabilitation Construction



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Surface Tolerances

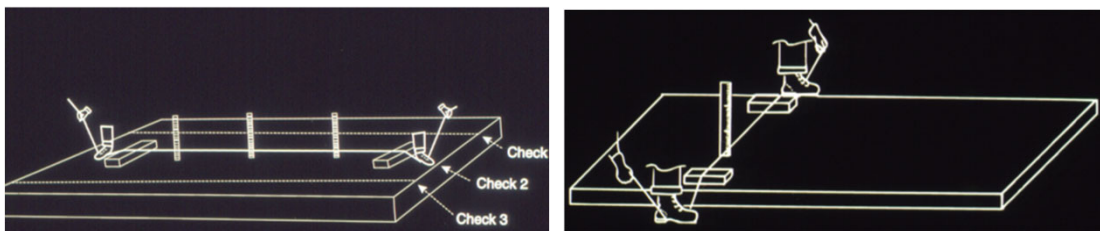
- Identify defects using a straightedge or stringline
- 602.4h Page 15-06007-14 – Table 602-11
- Defects require correction

TABLE 602-11: MAXIMUM VARIATION OF THE SURFACE	
Length (feet)	Maximum Variation of the Surface (inches)
10	3/16
25	5/16



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Stringline Checks



88

Aluminum Straightedge



Smoothness - PRI

Profilograph Roughness Index (PRI)

- 603.3a details which items to be profilographed and which of these are eligible for pay adjustments
- Certified Profilograph Equipment (603.3b & 603.3c)
 - California Type ("Push")
 - Speed Profilograph
 - PQL - 44 & CIT Certified Operator
- Pavement Section (603.3c)
 - 0.10 mile long (528 ft)
 - 1 lane wide (12 ft nominal)

California "Push"



91

High Speed Profilograph



92

PRI Results 1

Run 1							
Track 1				Track 2			
Seg	Station (ft)	Rough (in)	PRI (in/mi)	Seg	Station (ft)	Rough (in)	PRI (in/mi)
1	93+30.0	1.930	19.300	1	93+30.0	2.260	22.600
2	88+02.0	1.770	17.700	2	88+02.0	2.350	23.500
3	82+74.0	1.330	13.300	3	82+74.0	0.940	9.400
4	77+46.0	1.520	15.200	4	77+46.0	0.960	9.600
5	72+18.0	1.310	13.100	5	72+18.0	1.670	16.700
6	66+90.0	1.710	17.100	6	66+90.0	1.570	15.700
7	61+62.0	1.140	11.400	7	61+62.0	2.260	22.600
8	56+34.0	2.890	28.900	8	56+34.0	2.330	23.300
	51+06.0				51+06.0		

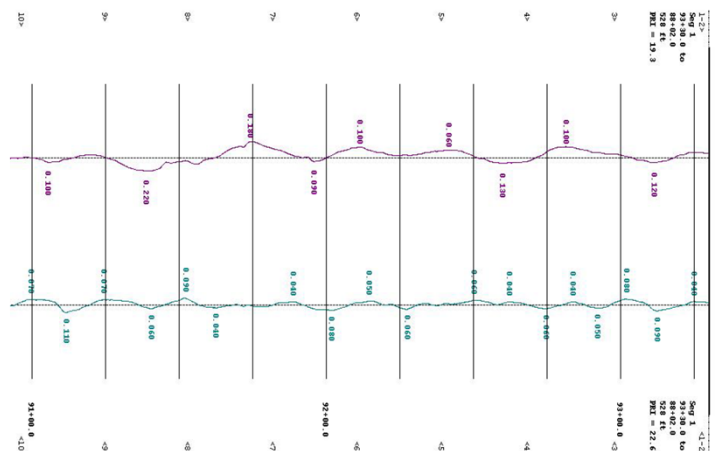
Defect Locations:

Defect	Type	Track	Segment	Start	End	Length (ft)
1	Dip	1	8	51+79.1	51+76.7	2.4
2	Bump	1	10	43+42.4	43+32.8	9.6
3	Bump	2	10	42+34.4	42+30.8	3.6
4	Dip	2	10	42+26.8	42+19.6	7.3
5	Bump	2	10	42+15.6	42+09.4	6.2



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PRI Results 2



94

Asphalt Pavement Smoothness Bid Item

- Applies if HMA depth $\geq 4"$ AND Asphalt Pavement Smoothness Bid Item in contract (603.3a)
- Requires Profilograph Testing
- Monetary Contract Adjustment based on PRI
 - DOT Form 242
 - Tables 603-4 & 603-5
 - Based on type of construction



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Bump Grinding/PRI Correction

- Correct all bumps & dips
- If profilograph testing is required, grinding based on PRI according to Tables 603-1, 603-2, 603-3
- Dispose of slurry & residue per 603.3f
- Correct all areas within each section having high or low points (bumps or dips) with deviations in excess of 0.4 inches in a length of 25 feet or less regardless of the PRI value.



96

Types of Grinding

• Diamond Grind vs Profile (Mill) Grind (603.3e)

e. Corrections. Make the required corrections for pavement smoothness before making the pavement thickness determinations. Use these methods for corrections:

- diamond grinding when the layer is the final riding surface
- when the layer will be covered with a chip seal or microsurfacing
 - micro-milling or fine-lace milling (minimum of 60 teeth per foot) may be done in a continuous 100-foot segment provided there is at least 400 feet of the surface adjacent to the segment that is not milled or diamond ground
 - diamond grind when more than 100 feet within a 400-foot segment requires correction. The Engineer may permit micro-milling if in the opinion of the Engineer the resulting surface is not detrimental to the functionality of the chip seal or the microsurfacing
- milling if the layer will be covered by UBAS or a layer of HMA.
- remove and replace the entire pavement thickness
- remove the surface by milling, and replace the specified surface course
- overlay (not patch) with the specified surface course
- other methods that are approved by the Engineer

Apply the corrective measure to the full-lane width of the pavement. The corrected areas shall have uniform texture and appearance. The beginning and ending of the corrected areas shall be squared normal to centerline of the paved surface.

When grinding is performed, use vacuum equipment or other continuous methods to remove grinding slurry and residue. Remove from the project and properly dispose of the material. Do not allow the grinding slurry to flow across lanes being used by traffic, onto shoulder slopes, into streams, lakes, ponds or other bodies of water, or gutters or other drainage facilities. Do not place grinding slurry on foreslopes.



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Diamond Grinding



98

Weather Limitations 1

(602.7)

- Do not place HMA on any wet or frozen surface or when weather conditions prevent the proper handling and finishing of the mixture
- Only place HMA when either the minimum ambient air temperature **OR** the road surface temperature shown in Table 602-13 is met
- **Regardless of temperature**, suspend paving operations when specified density can **NOT** be achieved before temperature of HMA falls below 175°F (165°F for WMA)

TABLE 602-13: MINIMUM HMA PLACEMENT TEMPERATURES							
Paving Course	Thickness (inches)	Air Temperature (°F)			Surface Temperature (°F)		
		HMA	WMA Foam	WMA Chem	HMA	WMA Foam	WMA Chem
Surface	All	50	45	40	55	50	45
Subsurface	<1.5	50	45	40	55	50	45
Subsurface	≥1.5 and < 3	40	35	30	45	40	35
Subsurface	≥ 3	30	30	30	35	32	32



99

Weather Limitations 2 (602.7)

- Example: A contractor needs to pave a 1.5" Surface lift using WMA – Chem. Additive. The air temperature is 37°F & the surface temperature is 48°F. By specification, is this allowable?



100

Weather Limitations 3 (602.7)

- Example: A contractor needs to pave a 1.5" Surface lift using WMA – Chem. Additive. The air temperature is 37°F & the surface temperature is 48°F. By specification, is this allowable?

TABLE 602-13: MINIMUM HMA PLACEMENT TEMPERATURES

Paving Course	Thickness (inches)	Air Temperature (°F)			Surface Temperature (°F)		
		HMA	WMA Foam	WMA Chem	HMA	WMA Foam	WMA Chem
→ Surface	All	50	45	40	55	50	45
Subsurface	<1.5	50	45	40	55	50	45
Subsurface	≥1.5 and < 3	40	35	30	45	40	35
Subsurface	≥ 3	30	30	30	35	32	32

37 < 40

48 > 45



101

Weather Limitations 4 (602.7)

By specification, **this operation is allowable** because one of the two above criteria is satisfied. As long specified density is reached before mat cools below 165°F (WMA).

			Foam	Chem		Foam	Chem
→ Surface	All	50	45	40	55	50	45
Subsurface	<1.5	50	45	40	55	50	45
Subsurface	≥1.5 and < 3	40	35	30	45	40	35
Subsurface	≥ 3	30	30	30	35	32	32

37 < 40

48 > 45



102

Measurement & Payment 1

- At the end of a production run, waste any material in the silo/storage bin
 - Plant Waste
- Material delivered to the road that is not paved
 - Road Waste
- Either type of wasted material is not paid for.
- Outside Sales



103

Measurement & Payment 2

Venture Corporation South HWY 281 Great Bend, Kansas 67530				1154			
				** MANUAL WEIGHT **			
				Ticket Number 11154			
				DATE: 7/10/2010 TIME: 11:20 AM			
SOLD TO:		CUSTOMER NO.		DELIVERED TO:			
Kdot		001					
		JOB ORDER NUMBER					
		U036-74KA1734-1					
TRUCK INFORMATION				MATERIAL LOADED		PLANT NO.	
NUMBER	LOADS TODAY	MATERIAL TODAY	SILLO OF SPEC	CODE	PRODUCT NAME	MATERIAL SOLD TODAY	PLT2 OPERATOR
T1	6	132.31	0	SR-12.5A	SR-12.5A	703.84	
WEIGHT IN: Tons				COMMENTS/DIRECTIONS:		CASH SALE	
GROSS	TARE	NET			PRICE PER UNIT		\$
35.620	**12.260*	23.360			MATERIAL COST		\$
0.000 ← TRUCK MAXIMUMS → 0.000				CONTRACT #		HAUL COST	
JOB INFORMATION						SALES TAX	
LOAD NO.	MATERIAL TODAY	TOTAL MATERIAL TO DATE	MATERIAL REQD.	LOCATION or JOB NAME		TOTAL	
33	703.84	3,519.28	23.251	Phillips County			
Driver: Gilbert				Rcvd By:		Insp:	



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Measurement & Payment 3

CONTRACT NO. <u>599116413</u>		WORK TYPE <u>SM-12.5A (PG 64-28)</u>							
PROJECT NO. <u>36-106 K 7800-01</u>		COUNTY <u>PHILLIPS</u>							
DATE <u>08-08-2003</u>		TONS PRODUCED <u>1,454.51 T</u>							
WASTE TK NO. <u>8767</u>		WASTE TONS <u>5 T</u>							
REASON <u>Non pay patch</u>		PAY TONS <u>1,449.51 T</u>							
LIFT	<u>Surface</u>	LANE	<u>EB</u>	STA.	<u>0+00</u>	TO STA.	<u>0+450</u>	TONS	<u>372.54 T</u>
LIFT	<u>Surface</u>	LANE	<u>EB</u>	STA.	<u>0+450</u>	TO STA.	<u>0+550</u>	TONS	<u>112.63 T</u>
LIFT	<u>Surface</u>	LANE	<u>EB</u>	STA.	<u>0+550</u>	TO STA.	<u>0+880</u>	TONS	<u>338.24 T</u>
LIFT	<u>Surface</u>	LANE	<u>EB</u>	STA.	<u>0+880</u>	TO STA.	<u>1+035</u>	TONS	<u>137.82 T</u>
LIFT	<u>Surface</u>	LANE	<u>EB</u>	STA.	<u>1+035</u>	TO STA.	<u>2+470</u>	TONS	<u>493.18 T</u>
REMARKS								PAY TONS	<u>1,449.51 T</u>
<u>Line #12 1,454.51 T</u>								PREVIOUS PAY TONS	<u>11,752.12 T</u>
								LINE 12 & 24 PAY TONS TO DATE	<u>13,206.63 T</u>
								INSPECTOR	<u>David Fry</u>
								CHECKED BY	<u>PES</u>



105

HMA Commercial Grade 1

(15-06010)

- Applies if the bid item HMA – Commercial Grade is in the contract
- Typically used for small quantities or temporary pavement
 - Temporary crossover
 - Temporary pavement widening
 - Shoo-Fly
- SR 12.5A or SM 12.5A required unless otherwise approved by engineer
- Class A or B, mixture requirements per Table 611-1
- Construction requirements similar to section 602



106

HMA Commercial Grade 2

- Mixture Acceptance – Contractor may select one of the two options below:
 - Aggregate Price Adjustment – Virgin Cold Feed Gradations
 - Compare field gradations to single point design values
 - Tolerances based on sieve size, Table 611-3
 - Contract adjustment, deduct only per lot, based on pay factors Table 611-5
 - Form 292 – HMA Aggregate Price Adjustment
 - Air Void Price Adjustment
 - Air void testing per section 602, deduct only per lot



107

Break time!



108

Asphalt Paving Inspection

Part 4 – Surface Treatments

In Division 600...

Microsurfacing, Chip Seals, Asphalt Prime Coat, Single & Double Asphalt Surface Treatment, UBAS



1

Microsurfacing 1 (Modified Slurry Seal)

What is it?

- Seal on existing asphalt comprised of water, asphalt emulsion, crushed aggregate and chemical additives
 - Differs from Slurry Seal because it relies on chemical additives to 'break' as opposed to sun or heat for evaporation

Applicable Specs

- 155.11
- 606



2

Microsurfacing 2 - Equipment (155.11)

- **Mixing Equipment**

- Self-propelled mixing machine
- Capable of delivering and proportioning materials to revolving multi-blade dual mixer and discharging:
 - Aggregate, mineral filler, water, additives and emulsified
 - Thoroughly mixed product
- Operate continuously to eliminate joints
- Individual volume/weight controls for proportioning

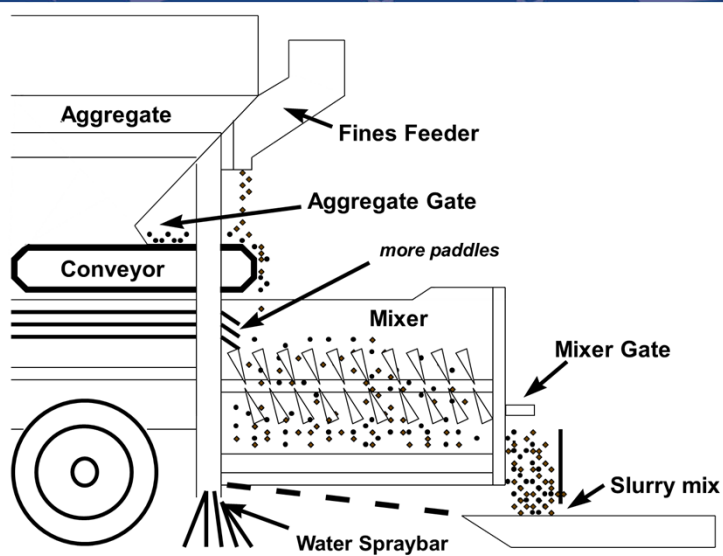
- **Spreading Equipment**

- Spread uniformly by means of a mechanical laydown box attached to mixer and equipped with paddles to agitate
- Paddles prevent buildup, lumps or 'setting up'
- Lateral movement controls
- Prevent loss of paving mixture and kept clean of buildup



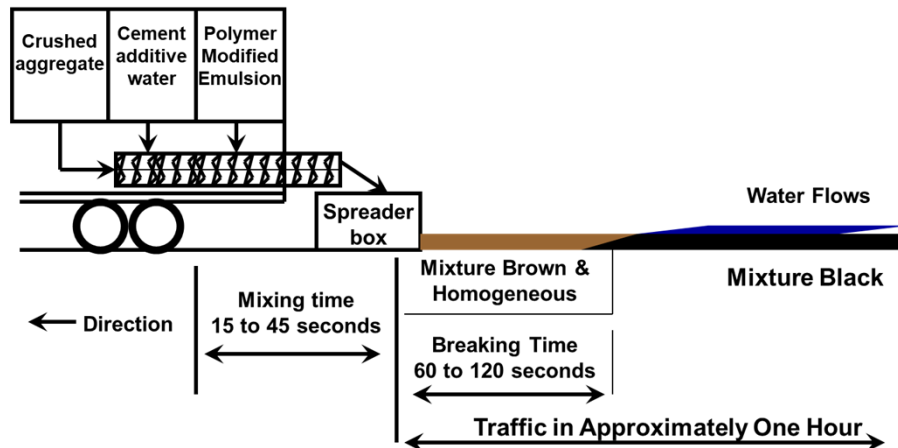
3

Microsurfacing 3



4

Microsurfacing 4



5

Microsurfacing 5 (606)

• Proportioning (Table 606-2)

Material	Units	Value
Mineral Aggregate	lbs/SY dry weight	15, minimum
Modified Emulsion	Percent residue by weight	8.0, minimum
Mineral Filler	Percent by weight of dry aggregate	0.5 to 2.0 *
Additive	Percent by weight of dry aggregate	As required

* Unless otherwise approved by the Engineer.

- Mix design must be approved prior to microsurfacing
- Aggregate must be screened and weighed, emulsified must be weighed

KOCH
Pavement Solutions
...Longer Lasting Roads

Customer: Ballou Construction Company
P.O. Box 2100
Salina, Kansas 67402

cc: P. Peltier
W. Cross

Project No.: #98-1877
Location: City of Dallas, TX

Aggregate: Grade II - Texas Special Specification
Source: Vulcan Materials
Tulsa, Texas

Emulsion: CES-1P
Supplier: Koch Materials Company
Waco, TX

Microsurface Mix Recommendation (BDWA):

Hydrated Lime:	0.5% +/- 0.25%
Emulsion (@ 65% Res.):	12.0% +/- 0.6%
Residue:	7.8 % +/- 0.4%
Exposited Additive Usage:	1.1 kg. per metric ton (35 oz. per ton)
Water:	As required

Slight modifications to the recommendation may be required due to weather and / or existing conditions. All proposed modifications to the design shall be discussed with a Koch Materials representative before implementation.

The required residual asphalt content is established using ISSA mix design methods. This aggregate will require approximately 9 - 13 percent total moisture including additive to produce proper consistency of the mix:

Test data reported herein have been secured by reliable testing procedures. As we have no knowledge of, or control over, the conditions that may affect the use of the materials from which the samples were taken, we assume no responsibility in furnishing these data other than to warrant they represent reliable measurement of the properties of the sample tested.

Recommendation by: Susan Stauff
Date: September 20, 1999

MS/99/127X

Kansas
Department of Transportation

6

Microsurfacing 6 (606)

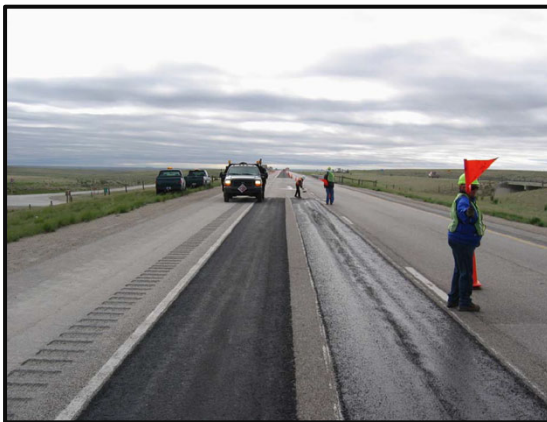
- 606.3c Ruts

- Fill ruts/cuts/depressions prior to final surface placement
- Fill ruts less than ½ inch in depth with a full width scratch coat.
- Ruts greater than ½ inch in depth will be filled with a rut box 5 to 6 feet in width.
- Ruts greater than 1 ½ inches require multiple rut box passes.
- When multiple rut passes are required, carry traffic overnight on each rut-filling pass before a subsequent filling pass is made.



7

Microsurfacing 7



8

Microsurfacing 8



9

Microsurfacing 9 (606)

- Seasonal Limitations
 - May 1 to October 15
 - Do not place when ambient air is less than 50°F, or if it is foggy or raining
 - Do not place if forecast is expected to go below 32°F within 24 hours of placement
- Observation Period
 - If constructed within seasonal limitations, it will be inspected 30 days after completion
 - If seasonal limitations are modified, it will be inspected jointly between May 1 and April 1 of the following year
 - Repairs required for bare areas:
 - In 5% of wheel paths
 - Individual areas ≥ 10 SQYD
 - Where total SQYD of bare areas is greater than 5% of total microsurfacing



10

Microsurfacing 10



11

Microsurfacing 11



12

Microsurfacing 12



13

Chip Seal 1

What is it?

- Application of special protective wearing surface to existing pavement
 - Asphalt with rock covering
 - Emulsified or Polymer Modified

Applicable Specs

- 155.7
- 608

Emulsified Asphalt:

Suspension of asphalt in water assisted by mild soap solution (water-based asphalt)

Polymer Modified:

Added polymers to improve performance of asphalt

Cutback Asphalt:

Asphalt cement and petroleum solvent. Used because they reduce viscosity for lower temperature uses



14

Chip Seal 2 - Equipment (155.7)

- Self-Propelled Aggregate Spreader
 - Supported by minimum 4 wheels with pneumatic tires
 - Equip with means of applying the larger cover coat materials to the surface *ahead*
 - Material is deposited uniformly over the full width of asphalt material
- Pneumatic Rollers
 - Covered in 608



15

Chip Seal 3 (608)

- Surface Prep
 - Clean of all foreign material – broom surface to remove dust
- Protect adjacent structures & restore any damaged or splattered appurtenances at own expense
- Apply asphalt material according to Table 601-1 (or shown on BOL)
- Use distributor to uniformly apply asphalt at rate shown in plans
- Immediately following the application of asphalt, spread cover material with self-propelled aggregate spreader in quantities designated in plans
- Tires of trucks or spreaders shall not come in contact with fresh asphalt at any time
- Immediately following covering, embed with pneumatic rolling



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Chip Seal 4 (608)

• Aggregates (Table 608-1)

The application rate shown in **TABLE 608-1** may be changed with written approval from the Engineer.

Type	Composition	Aggregate Cu. Yd./Mile 24 foot width*	Asphalt Material Gal/Sq. Yd. Residue*	Asphalt Type**
CM-A	Sand-Gravel	105	0.20	CRS-1H
CM-B	Sand-Gravel	135	0.23	CRS-1H
CM-D	Crushed Sandstone	145	0.27	CRS-1H or RS-1H
CM-K	Limestone	140	0.24	RS-1H
CM-L-1	Lightweight	85	0.17	CRS-1H
CM-L-2	Lightweight	115	0.26	CRS-1H
CM-L-3	Lightweight	150	0.30	CRS-1H

*Rates shown are estimated and will be adjusted to comply with actual field conditions.

** Asphalt type may be changed with approval of the DME.

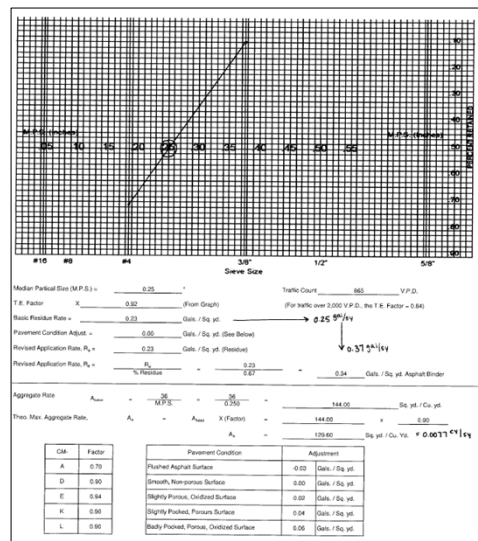
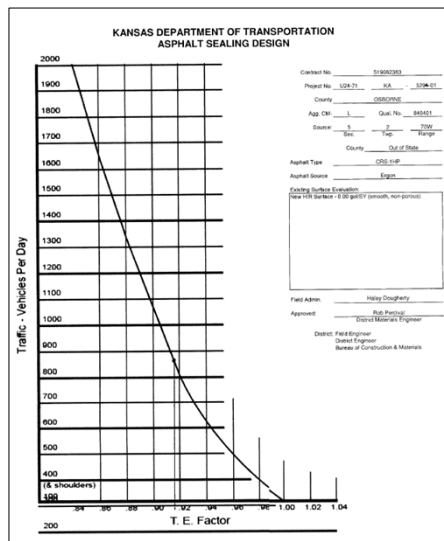
• The above rates are standard application rates. Actual field rates determined by Asphalt Sealing Design, based on:

- Roadway surface condition
- Aggregate gradation - median particle size (M.P.S.)
- Traffic volume – vehicles per day (V.P.D.)
- Asphalt – residue rate



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Chip Seal 5 - Design



Distributor Log at the end...



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Chip Seal 6 (608)

Things to look for...

- Joints
 - Start the application on strip of building paper. 3 feet wide and extending at least 1 foot past spray bar length
- Do not spread more asphalt material that can be immediately covered
- Do not allow distributor to “blow”
- Check and adjust angle of spray nozzles and height of spray bar
 - Looking for uniform distribution
- Balance between full coverage and bleeding asphalt
 - Do not want to pull cover material up
- Traffic speeds specified
 - 30 MPH on bare pavement, 20 MPH on fresh seal



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Chip Seal 7 (608)

- Manipulation
 - Minimum 3 self-propelled pneumatic rollers
 - Uniform pressure on all tires, checked every morning
 - Initial rolling within 5 minutes of cover material application (unless temp below 70°F, then 2 minutes)
 - Minimum 3 complete passes, full width covered in one pass by all rollers together
 - Cure time depends on asphalt used
 - Emulsified (4 hours), Polymer Modified (1.5 hours)
 - Can increase based on traffic's effect on seal
 - Broom loose material after sufficient curing (minimum 1 light brooming before opening to traffic)



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Chip Seal 8 (608)

- Seasonal Limitations

- May 1 through October 15 if using cutback asphalt and ambient air is 60°F and rising
- June 1 through September 15 if using emulsified, ambient is 60°F and rising and pavement is minimum 70°F
- June 1 through September 1 if using asphalt cement, ambient is 70°F and rising and pavement is minimum 80°F
- Do not seal on wet pavement or when it is foggy or rainy

- Observation Period

- If in accordance with seasonal limitations, 30 day observation period
- If seasonal limitations are modified, it will be inspected jointly between May 1 and April 1 of the following year
 - Repairs required for bare areas:
 - In 5% of wheel paths
 - Individual areas ≥ 10 SQYD
 - Where total SQYD of bare areas is greater than 5% of total seal



21

Asphalt Prime Coat (607)

- What is it?
 - Application of an asphalt material to subgrade or base course
- Broom off all loose materials and clean until free of dust
- When required, apply water (approx. 0.1 gal per sqyd) prior to asphalt material
- Protect adjacent surfaces
- Apply prime coat with distributor ASAP and immediately after final rolling, prior to any traffic
- Maintain and protect until surface course
- Construct between May 1 and October 15, ambient is 60°F and rising and weather is not rainy or foggy



22

Single Asphalt Surface Treatment (609)

- What is it?
 - Asphalt prime coat followed by an application of asphalt seal
- Same specs as Asphalt Prime Coat PLUS Chip Seal
 - Minimum 7 times rolled with pneumatic rollers
- Seasonal Limitations follow Chip Seal Specification (608)



23

Double Asphalt Surface Treatment (610)

- What is it?
 - Asphalt prime coat followed by TWO applications of asphalt seal
 - Follow Specs for Asphalt Prime coat and Chip seal
- Second Seal Coat
 - If asphalt material consists of cutback asphalt, do not apply the second seal coat until 60 days after application of first seal
 - Minimum 7 times rolled with pneumatic rollers



24

UBAS (Ultrathin Bonded Asphalt Surface) 1

What is it?

- Similar to a chip seal mixed with HMA
 - Uses seal surface (polymer-rich modified emulsion) covered by gap-graded hot mix asphalt
 - Designed so the surface course can drain moisture while sealing and protecting underlying pavement

Applicable Specs

- 613



25

UBAS (Ultrathin Bonded Asphalt Surface) 2

- Quality Control Testing (613.2)
 - Similar to HMA testing requirements
- RAP/RAS is **not** allowed in UBAS
- Paving Operations
 - Use a transfer device (shuttle buggy, MTV, conveyor, etc...)
 - Use a self-priming spray paver
 - Conform to Section 155.4 PLUS...
 - Equipped with receiving hopper, feed conveyor, asphalt emulsion storage tank, ability to measure EBL volume applied, spray bar and a heated, variable width, vibratory screed
 - Capable of spraying EBL uniformly at specified rate, applying and leveling surface course in one pass
 - Capable of paving at controlled speed 30-100 fpm
 - Equipped so no wheel/other part in contact with EBL prior to HMA application
 - Screed has the ability to crown pavement and extensions can be adjusted vertically



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UBAS (Ultrathin Bonded Asphalt Surface) 3

- Application
 - EBL application according to Table 601-1 or as recommended by supplier
 - Apply UBAS at 290-330°F over full width of EBL with heated vibratory screed
- Compaction
 - Roll within 1-3 passes with tandem steel rollers, minimum 10 tons weight, before material reaches 195°F
 - Rollers may not remain stationary
 - At least until mat reaches 160°F. Traffic may be allowed then
- Weather Limitations
 - Do not place on wet/frozen surface
 - Only place when min. 50°F ambient or min. 55°F road surface



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Distributor Log Handout 1

	Example (Chip Seal)	
Date		
Type	CRS-1HP	CRS-1HP
Lane	I70 EB DL	I70 EB DL
Start Gallons	2,640	3,800
End Gallons	1,000	900
Hot Gallons	1,640	
Temp (F°)	160	160
Corr. Factor	0.97500	0.97500
Corr. Gallons	1,599.0	
Dilution (%Asph/%Water)	100/0	100/0
Gallons Asphalt	1,599.0	
Lbs/Gallon	8,420	8,420
Tons	6.73	
Accum. Tons	6.73	
Start STA	100+00	100+00
End STA	129+80	129+80
Length (Inft)	2980	2980
Bar Width (ft)	12	12
Spray Area (SQYD)	3,973	3,973
Asphalt Rate (gal/sqyd)	0.402	
% Residue	67%	67%
Residue Rate (gal/sqyd)	0.270	
Insp.	HDD	

- Hot Gallons (Used Gallons) = Start – End
- Temperature (Off of the distributor)
 - Correction Factor found Part V - Table 3, 5.10.3
- Corrected Gallons = Hot Gallons x Correction Factor
- Dilution: Contractor may elect to dilute asphalt with water, you will need to ask them. On a chip seal, no dilution therefore 100% asphalt
 - Gallons of asphalt = % asphalt (100 in this scenario) x Corrected Gallons
- Lbs/Gallon: This information comes from Ticket/BOL
- Tons = [(Lbs/Gallon)*Gallons of asphalt)]/2000
 - Keep track of accumulated tons
 - If these are short rates, keeping a running total



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Distributor Log Handout 2

Example (Chip Seal)		
Date		
Type	CRS-1HP	CRS-1HP
Lane	170 EB DL	170 EB DL
Start Gallons	2,640	3,800
End Gallons	1,000	900
Hot Gallons	1,640	
Temp (F°)	160	160
Corr. Factor	0.97500	0.97500
Corr. Gallons	1,599.0	
Dilution (%Asph/%Water)	100/0	100/0
Gallons Asphalt	1,599.0	
Lbs/Gallon	8.420	8.420
Tons	6.73	
Accum. Tons	6.73	
Start STA	100+00	100+00
End STA	129+80	129+80
Length (Inft)	2980	2980
Bar Width (ft)	12	12
Spray Area (SQYD)	3,973	3,973
Asphalt Rate (gal/sqyd)	0.402	
% Residue	67%	67%
Residue Rate (gal/sqyd)	0.270	
Insp.	HDD	

- Asphalt rate given in Gallons per Square Yard

- Square yard is area applied (length x width)
- Length = Difference in Stations
 - Reminder: 1 Station = 100 Feet
 - 129+80 – 100+00 = 29+80 or 2980 feet

- [Length (2980 feet) x Width (Spray bar @ 12 feet)]/9

- % Residue comes from ticket/BOL

- Emulsified asphalt is made of asphalt cement, water and an emulsifying agent
- Residual accounts for the percentage of remaining asphalt



Asphalt Paving Inspection

Part 5 – Paving Alternatives

In Division 600...

Cold Recycled Asphalt (CIR), Surface Recycled Asphalt (HIR), Milling



1

Milling 1 (aka Cold Milling)

What is it?

- Tearing up existing pavement
- Generating RAP for use in...
 - HMA
 - Cold/Hot Recycle
 - Maintenance Stockpiling
 - Mixed in aggregate shoulders



2

Milling 2 (612)

- Automatic grade and slope control
 - Shall operate from traveling stringline not less than 30 feet long
 - Attached and parallel
- If the operating weight exceeds 80,000 pounds, it cannot be tracked across a span bridge
 - Typically, 12' or greater width mills will need to be hauled across
- Must be thoroughly cleaned prior to opening traffic or paving
 - Or within city limits
 - No chunks or debris
- Milled surface may be open to traffic upon approval
 - Typically a note found in the plans



3

Milling 3



4

Milling 4



5

Milling 5



6

Milling 6



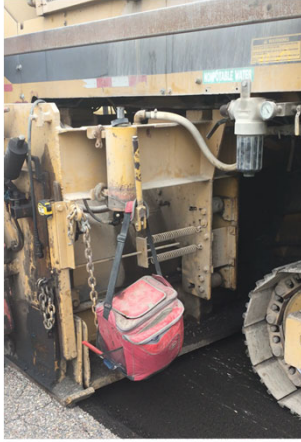
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Milling 7



8

Milling 8



Milling 9



Milling 10



11

Milling 11



12

Cold Recycle Asphalt (CIR) 1

What is it?

- Mill up existing asphalt
- Add hydrated lime slurry based upon mix design or as directed
- Add emulsified asphalt based on supplier
- Spread and compact the mixture as specified

Applicable Specs

- 155.9
- 604



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Cold Recycle Asphalt (CIR) 2

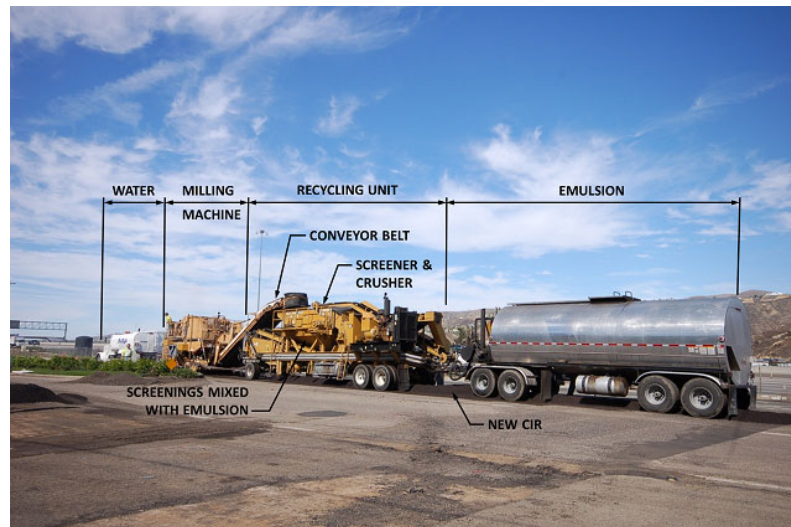
• Milling Operation

- The pavement shall be milled to the required depth and width in accordance with the requirements shown in the contract/plans
 - Process RAP to required gradation and thoroughly mix with specified amount of binder
 - Water may be added to facilitate mixing
 - Hydrated lime slurry added during milling
 - Deposit recycled material into a windrow, pick up with MTV and place with paver to avoid segregation
- Sieving done on site prior to mixing and paving



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Cold Recycle (CIR) 3 - Train



15

Cold Recycle (CIR) 4 - Train



16

Cold Recycle (CIR) 5 - Train



17

Cold Recycle (CIR) 6 - Construction

- Table 604-1
 - 0% RAP retained on the 1 ¼" Sieve
- Sizing is obtained by an onboard crusher incorporated with the train



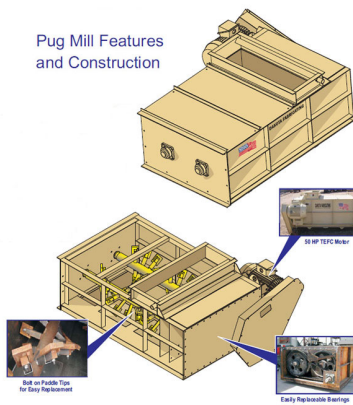
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Cold Recycle (CIR) 7 - Construction

- Mixing Operations
 - Totalizer for RAP weigh belt
 - Totalizer for Emulsion Pump
 - Emulsion % based on RAP weigh belt
 - Emulsion incorporated through a pugmill
 - Multiple mix designs may be necessary

CIR 8 - Mixing Operations

Pug Mill Features
and Construction



Cold Recycle (CIR) 9 - Construction

- Paving Operations
 - Mix to the paver immediately after mixing Emulsion in
 - Paver remain within 150 feet of the mixing unit
 - Suspend production if these requirements are not met
- Compaction and Density
 - Start rolling within 30 minutes of paving
 - Finish rolling within 1 hour of milling
 - Compact to minimum 97% target density
 - Minimum temp of 50°F
 - Significant changes may require a new test strip or roller sequence
 - i.e. mix proportions, weather conditions, etc...



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Cold Recycle (CIR) 10 - Construction

- Test Strips and Roller Sequences to determine target density
 - Minimum 2 Rollers per project
 - Minimum 1 double drum steel roller and 1 pneumatic roller
 - Determine optimal passes of rollers
 - Lift depth shall be representative of the requirements within Contract Documents
 - Test strip shall remain in place
- Weather Requirements
 - Ambient air = 50°F and rising
 - No moisture (rain, drizzle, fog, etc...)
 - No freezing within 48 hours of placement unless otherwise approved



22

Cold Recycle (CIR) 11 - Construction



23

Surface Recycled Asphalt (HIR) 1

What is it?

- Paving train with multiple heaters and mills
- Slowly heat up pavement and mill into windrow
- Add Asphalt Rejuvenating Agent (ARA) to existing material
- Repave immediately

Applicable Specs

- 155.8
- 605



24

Surface Recycled Asphalt Construction (HIR) 2

- Hot In-Place Recycle (HIR)
 - Preheaters, tunnel heaters
 - Infrared heaters, radiant heaters
 - Open flame heaters
 - 190°F to 300 °F prior to paving
 - Minimum 190 °F behind the paver
 - Uniform temperatures across the mat
 - 30 °F within 2 feet, 50 °F within 10 feet
 - One hour to comply with temperature requirements



25

Surface Recycled Asphalt Construction (HIR) 3

- HIR
 - Flaming pavement or windrow
 - Intermittent/occasional
 - Self extinguish within 10 seconds
- Scarify/Hot Mill Pavement
 - Depth from Contract Documents
 - Depths greater than 1"
 - Maximum removal per pass = $\frac{3}{4}$ "
 - Existing pavement removed at uniform depth across the lane
 - Windrow scarified/hot milled material for subsequent heating passes



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Surface Recycled Asphalt Construction (HIR) 4 (605)



27

Surface Recycled Asphalt Construction (HIR) 5 (605)



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Surface Recycled Asphalt Construction (HIR) 6 (605)



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Surface Recycled Asphalt Construction (HIR) 7 (605)



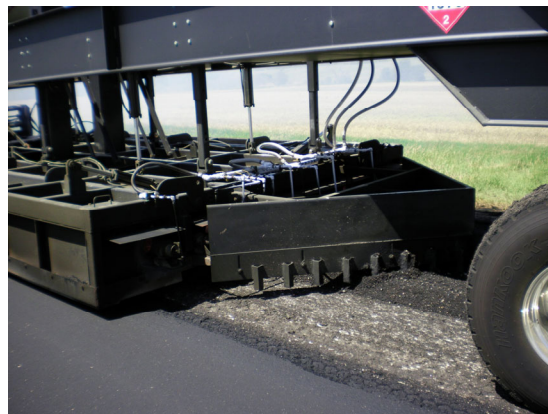
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Surface Recycled Asphalt Construction (HIR) 8 (605)



31

Surface Recycled Asphalt Construction (HIR) 9 (605)



32

HIR Train 10



33

HIR 11 - ARA (Asphalt Rejuvenating Agent)

- Added uniformly to the heated material
- Added ONCE, just before the paver



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Surface Recycled Asphalt Construction (HIR) 12

- Process Control
 - Depth Checks (KT-47)
 - Elevation differences checked using a level or transit
 - Use a calibrated stab stick
 - 3-Point moving average
 - Adjustments made per specification for failing 3 Points in comparison with plan depth
 - Example to follow



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Surface Recycled Asphalt Construction (HIR) (605) 13



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Surface Recycled Asphalt Construction (HIR)

14

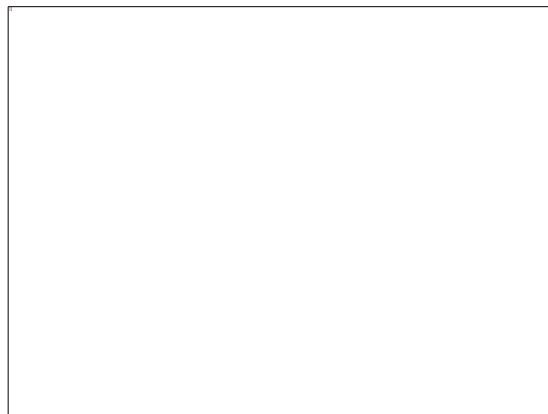
- Paving and Compaction
 - Standard paving practices
 - Density determined from approved rolling procedure
- Typically followed by seal coat
 - Chip seal, asphalt seal, microsurfacing, UBAS...
 - HIR must cure minimum 1 week prior to surfacing



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Surface Recycled Asphalt Construction (HIR) (605)

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Surface Recycled Asphalt Construction (HIR) (605) 16



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Surface Recycled Asphalt Construction (HIR) 17

- Weather and Seasonal Limitations
 - No fog or rain
 - May 1 to September 30
 - Meet minimum temperature requirements as shown in table 605-2
One requirement must be met

TABLE 605-2: MINIMUM HIR TEMPERATURE REQUIREMENTS		
Existing Surface Type	Ambient Air Temperature (°F)	Road Surface Temperature (°F)
On HMA Surface	50	55
On Asphalt Seal Surface	55	60

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END

- Questions?
- Know where things are at in the spec!

