HMA Paving Field Inspection

Technical Training & Certification Program

IOWA | DOT

CONSTRUCTION & MATERIALS BUREAU

Table of Contents

INTRODUCTION

HMA Paving Field Inspection

2026

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HMA Paving Field Inspection

- Introductory Course
- Two-day Course
- F.C. 130 (Technical Training) - DOT
- Starting & Ending Times
- Lunch & Breaks

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Course Schedule – Day 1

- Introduction
  - Course Goals & Objectives
  - Course Manual & References
  - Terminology
- Properties of HMA
- Equipment

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Course Schedule – Day 1

- Role of the Inspector
- Preparation of Grade & Base
- Delivery of HMA
- Placement of HMA
- Compaction of HMA

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Course Schedule – Day 2

- Limitations & Misc. Operations
- Project Plans
  - Phases of Work, Sequence of Operations
  - Tabs, Typicals, Notes
- Calculations
  - Quantities
  - Yield
  - Random Core Locations

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Course Schedule – Day 2

- Documentation
- Problems & Solutions
- Questions & Answers

- This class will use IMN-035-7(083)193—0E-17

I-35 HMA Resurfacing with milling in Cerro Gordo County Project for examples

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Introduction

- Instructor
  - **Brian Johnson**
    Bituminous Field Engineer
    Construction & Materials Bureau
- Class Members
  - **Experience with Asphalt Paving?**

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Course Goals & Objectives

- Provide working knowledge of HMA Paving Grade Inspection, and its role and effect on construction quality.
- Recommend good practices and methods to set the project up right and minimize problems during construction.

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Course Goals & Objectives

- Provide information and references to allow participants to identify potential problems and possible solutions.
- Standardize and encourage uniformity throughout the state.

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Reference Materials

- Course Instructional Manual
  - Standard Specifications (listed at beginning of each section)
  - Materials I.M.'s
  - Standard Road Plans
  - Construction Manual
- Photos & Videos
- Project Plans

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Other Reference Materials

- HMA Construction (MS-22)
- Hot-Mix Asphalt Paving HANDBOOK
- Other Publications
  - National Asphalt Paving Association
  - AASHTO

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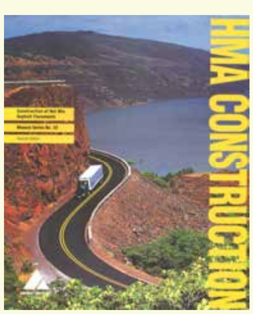
HMA Construction (MS-22)



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HMA Paving HANDBOOK

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QC/QA Program Changes

- This course is based on current DOT specifications.
- QC/QA Specifications
  - Percent Within Limits (PWL)
  - Statistically-based system with I/D

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QC/QA Program Changes

- **<u>Appendices:</u>**
  - Appendix A – Plan Review
  - Appendix B – Yield Calculation
  - Appendix C – Coring and Random Samples
  - Appendix D – Daily Field Report
  - Appendix E – Reference Information
    - Terminology
    - Background/History
    - Inspection Checklist

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What is hot mix asphalt?

- Asphalt binder, aggregate, and air blended together in precise proportions to produce a mix with desired qualities.
- Different types of asphalt binder and aggregates, so it is possible to combine them in ways to produce a variety of HMA pavements.

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Why use hot mix asphalt?

- Existing pavements upgraded quickly, with least inconvenience to public.
- Maintenance repairs and surface corrections made quicker and cheaper (overall) than PCC.
- “Flexible” pavements less likely to suffer damage related settlements and movements.

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Why use hot mix asphalt?

- Increased Smoothness
- Decreased Noise
- Higher Contrast with Pavement Markings

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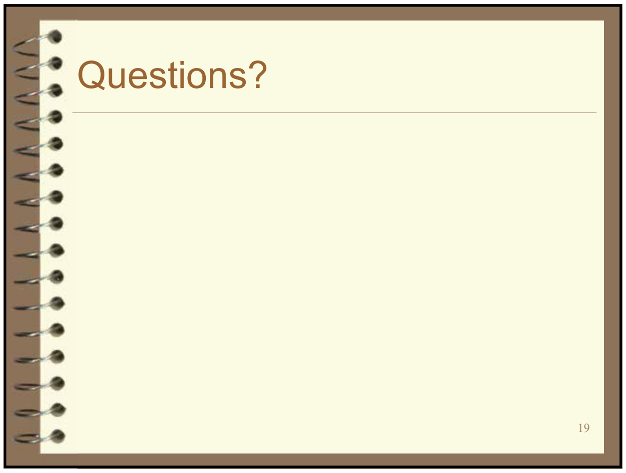

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MIX PROPERTIES

Properties of Hot Mix Asphalt

1

Stability

- Ability of pavement to maintain its shape and smoothness (resist shoving and rutting) under repeated loading.
- Factors
  - Internal friction (aggregate texture & shape)
  - Cohesion (bonding ability of asphalt binder)
  - Critical asphalt binder content

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Density

- Unit weight (weight of specific volume)
  - 145 to 147 lbs. per cu. ft. (compacted HMA)
  - higher unit weights for heavy aggregates (slag)
- Laboratory density (Gmm)
  - maximum for given mixture
- Field density
  - expressed as % of lab (max.) density
  - specification requirements vary

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Workability

- Ease of placing and compacting mixes
- “Harsh” mixes
  - high percentage of coarse aggregate
  - may segregate or be difficult to compact

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Workability

- "Tender" mixes
  - Too easily worked (push & shove under rollers)
  - may be too unstable to properly compaction
  - May be caused by
    - Shortage of mineral filler
    - Too much moisture in the mix
    - Too high of mix temperature

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Flexibility

- Ability of pavement to adjust to gradual movements in base without cracking.
- <u>High</u> binder content → <u>more</u> flexible
- <u>Low</u> binder content → <u>less</u> flexible
- Balancing act with stability

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Durability

- Ability of pavement to resist:
  - aging or oxidation of pavement (binder)
  - disintegration of aggregate
  - stripping of asphalt film from aggregate
  - "raveling"
- Key to long-lasting pavements

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Impermeability

- Prevents passage of water and air into or through pavement.
- Directly related to void content
- Character of the voids is more inmortant than number of voids:
  - Void size
  - Are voids interconnected
  - Are voids accessible to the surface

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Fatigue Resistance

- Ability of pavement to resist cracking due to repeated bending under wheel loads.
- Factors
  - aging of the binder (hardened binder = less resistance to fatigue cracking)
  - pavement thickness
  - subgrade strength

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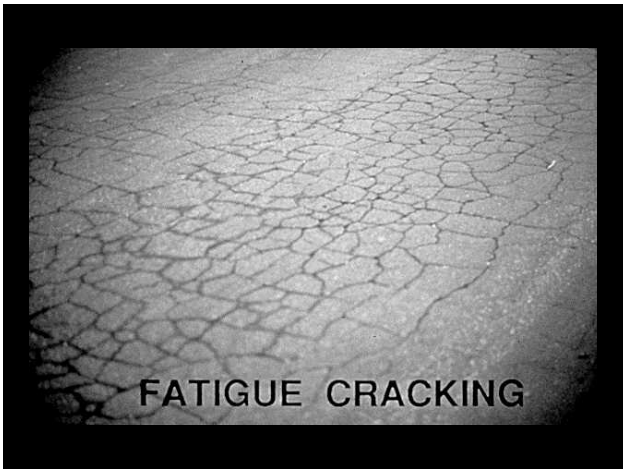

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Skid Resistance

- Ability of pavement surface to minimize skidding or slipping of vehicle tires.
- Factors
  - aggregate shape & texture
  - Aggregate type (polishing etc.)
  - gradation
  - asphalt binder content (too much binder can lead to flushing or bleeding)

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Smoothness

- “Ride” is most important to traveling public.
- Less wear & tear on vehicles.
- Improved safety & pavement life.
- Factors
  - paving operation (placement & compaction)
  - aggregate gradations
- Contractor’s vested interests
  - incentive payments & price reductions

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Asphalt Binder Content

- Percent by weight of asphalt binder in mix.
- “Optimum” - amount that effectively forms a bonding film on aggregate particles.
- Aggregate absorption
- Aggregate gradation
  - finer mixes have larger surface area
  - coarser mixes have less surface area

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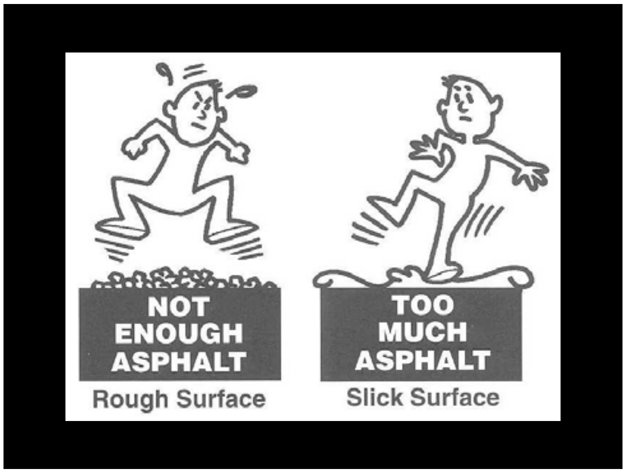

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Air Voids

- Small pockets of air between the coated aggregate in the compacted mix.
- Air voids and density inversely related.
- Air voids too <u>high</u>
  - water & air passageways into the mat
- Air voids too <u>low</u>
  - flushing of asphalt
  - rutting of pavement

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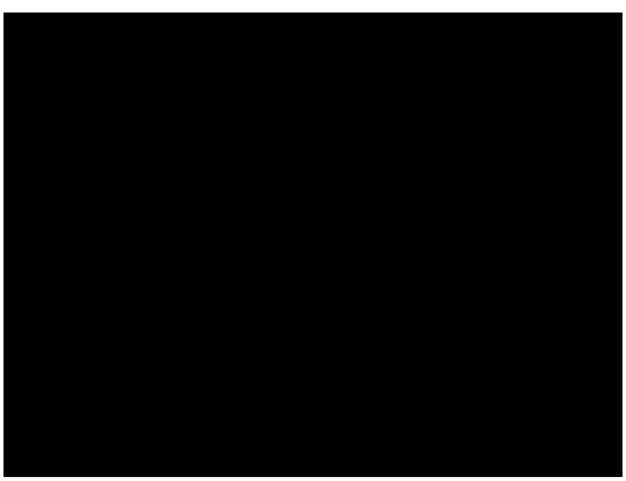

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EQUIPMENT

Equipment

1

Brooms

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Brooms

(Specification 2001.14)

- Cleaning and prep of base pavement
- Increased bond between existing pavement and new HMA.
- Rotary type
- Driven by auxiliary motor or PTO

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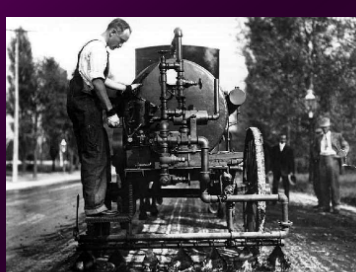
Tack Distributor

(Specification 2001.11 & 2001.12)



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Tack Distributor

- Apply tack coat between asphalt layers
- Truck or trailer-mounted
- Burners - adequately sized
- Circulation of material
- Temperature gauge
- Spray bar - width adjustable
- Uniform coating at specified rate

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Haul Trucks

(Specifications 2001.01 & 2001.03)

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Haul Trucks

- Deliver hot mix to job site
- Metal or metal-lined bodies
- Types
  - End dump
  - Bottom (belly) dump
  - Horizontal discharge (Flo-Boy)

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Haul Trucks

- Insulation
  - when required by Engineer
  - early Spring or late Fall, long hauls
- Canvas cover (tarp)
- Release agents
  - Materials IM 491.15
  - drain for 5 hours if solvents used (diesel)

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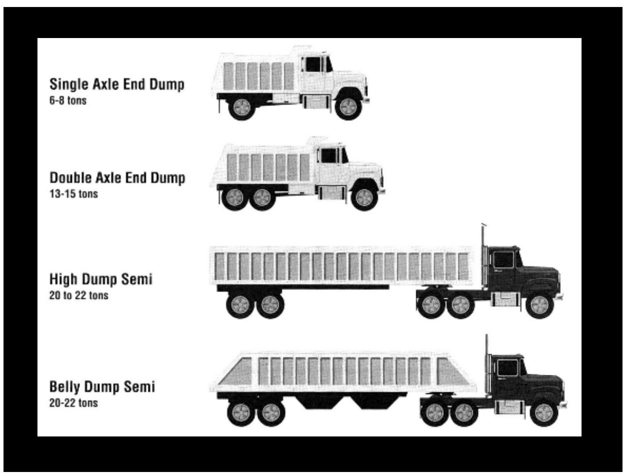

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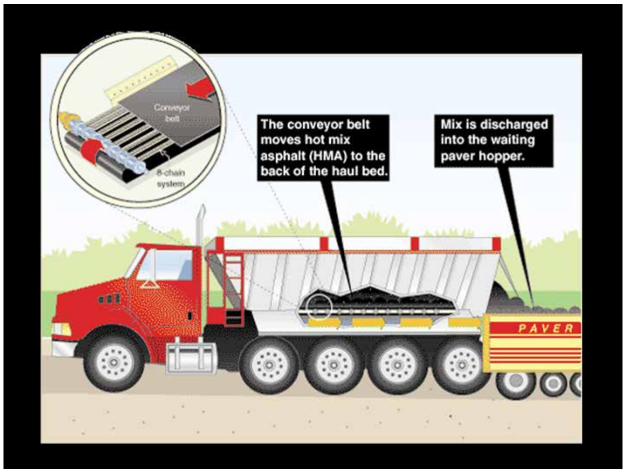
Conveyor belt
8-chain system
The conveyor belt moves hot mix asphalt (HMA) to the back of the haul bed.
Mix is discharged into the waiting paver hopper.
PAVER

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AMERICAN
Vögele America

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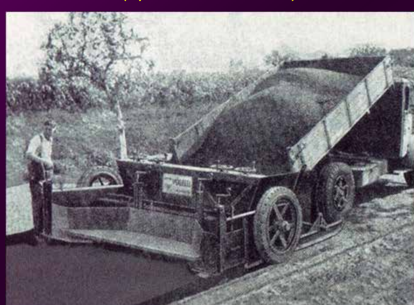
Pavers

(Specification 2001.19)



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Pavers

- Place and initially compact HMA mixture to a specified depth and slope.
- Self-propelled for 8’ or greater width.
- Operate on crawler treads or rubber tires.
- Major parts:
  - Tractor unit
  - Screed unit

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Pavers

- Tractor Unit
  - – provides moving power to wheels or tracks
  - – provides power to all components of paver
- Screed Unit
  - – strikes off the mix
  - – provides initial compaction
  - – vibrators
  - – heater (diesel burner or electric)

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Pavers

- Screed Extension
- Augers
- Automatic Screed Controls
  - – mat thickness & crown shape
  - – grade & slope controls
- Grade Referencing System
  - – ski or traveling stringline
  - – sonic sensors (non-contact)

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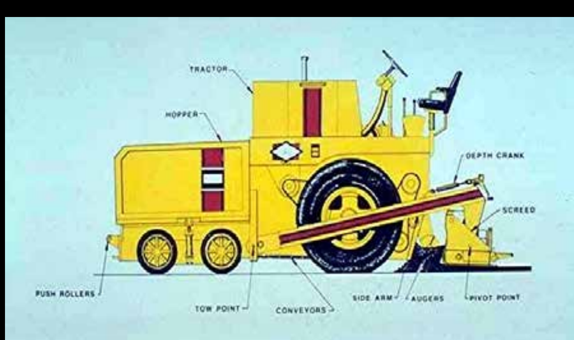

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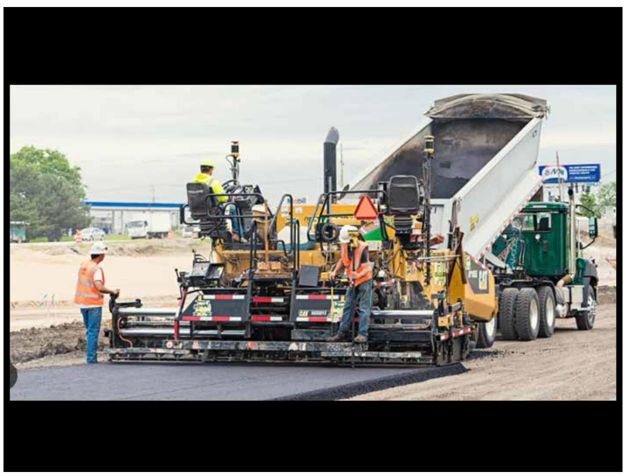

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Rollers
(Specification 2001.05)

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Roller Types

- Vibratory steel-wheeled
- Pneumatic (rubber) tired
- Static steel-wheeled

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Roller Types

- Vibratory steel-wheeled
- Pneumatic (rubber) tired
- Static steel-wheeled

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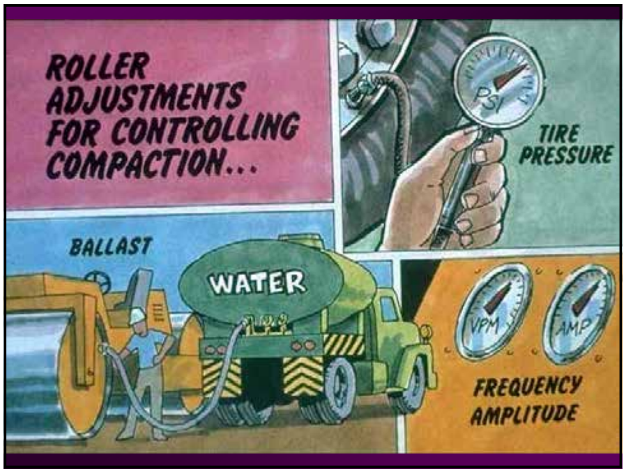
ROLLER ADJUSTMENTS FOR CONTROLLING COMPACTION...
TIRE PRESSURE
PSI
BALLAST
WATER
VPM
AMP
FREQUENCY
AMPLITUDE

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CAT
CB-634C
CAT

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BOMAG
BW205
BOMAG

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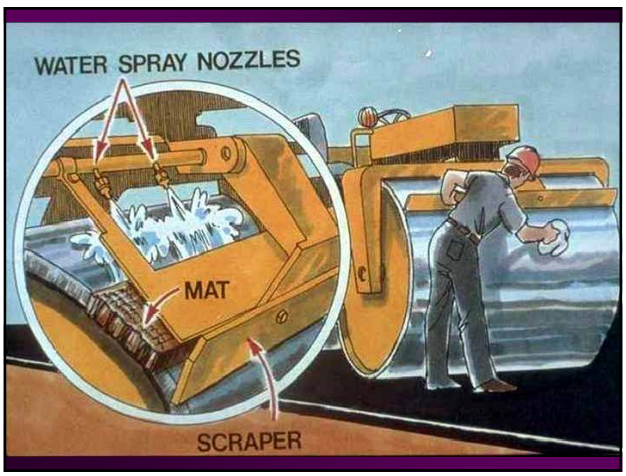

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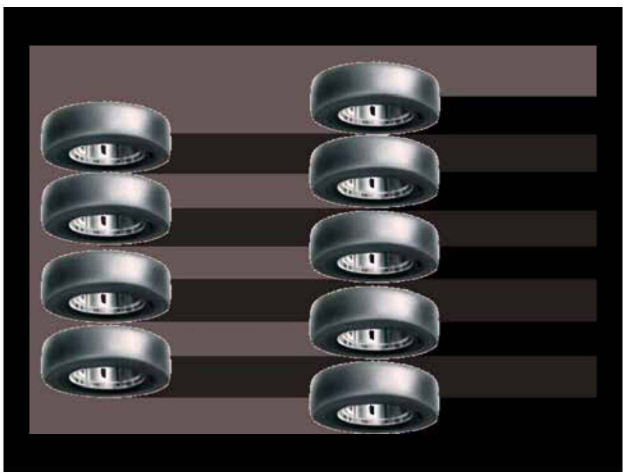

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Windrow Pick-up Elevator

(Construction Manual section 8.80)

- Windrow placed by bottom dump trailer.
- Picks up & deposits mix in paver hopper.
- Advantages:
  - uniform speed of operation
  - eliminates trucks bumping into paver
- Concerns:
  - balancing delivery and placement
  - windrow length

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Material Transfer Vehicles

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Material Transfer Vehicles

- Mobile surge bin
- Remixes the mix
- Surge capacity for continuous feed of mix
- Operates in front or alongside paver
- Must be approved to cross bridges
- Makes / models:
  - **RoadTec SB-2500 “Shuttle Buggy”**
  - **Weiler E2850 “Remixing Transfer Vehicle”**
  - Others (Terex / Cedarapids, Blaw Knox)

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Material Transfer Vehicles

Advantages:

- Pavement Quality
  - increased smoothness (paver doesn't have to stop and start and eliminating truck bumping)
  - consistent density
  - reduce / eliminate segregation

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Material Transfer Vehicles

Advantages:

- Contractor Efficiency
  - continuous operation
  - consistent speed of paver
  - higher productivity
  - fewer haul trucks

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Material Transfer Vehicles

Disadvantages:

- Expensive equipment
- Requires additional operator
- Weight
  - up to 125,000 lbs. (62.5 tons) loaded
  - up to 76,000 lbs. (38 tons) empty
  - all bridges to be crossed must be analyzed

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Material Transfer Vehicles

- Full Depth Paving
  - – not used to place base course
  - – look for distortion or rutting of base course
- Overlays
  - – existing pavement 8” minimum
  - – look for distress in existing pavement (cracking in wheelpaths, movement at joints, distortion / rutting)

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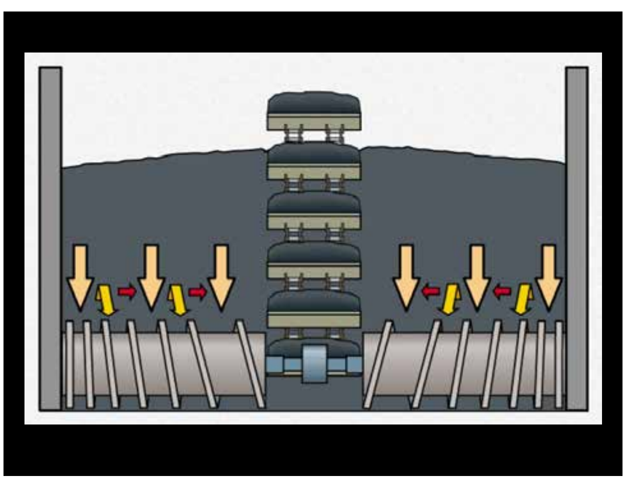

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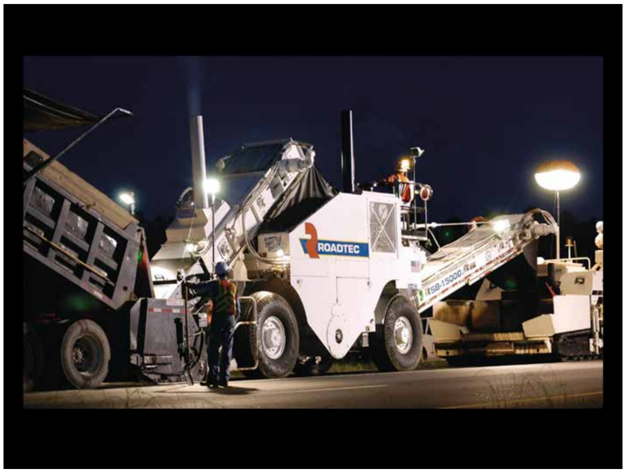

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Mat Smoothness Machine

- Material Transfer Device (MTD)
  - requires no operator (pushed by paver)
  - weight restrictions not a concern
- Many of same advantages of MTV
  - allows for more continuous paving
  - smooth truck exchanges (no bumping paver)

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How to pave a
Super Speedway…

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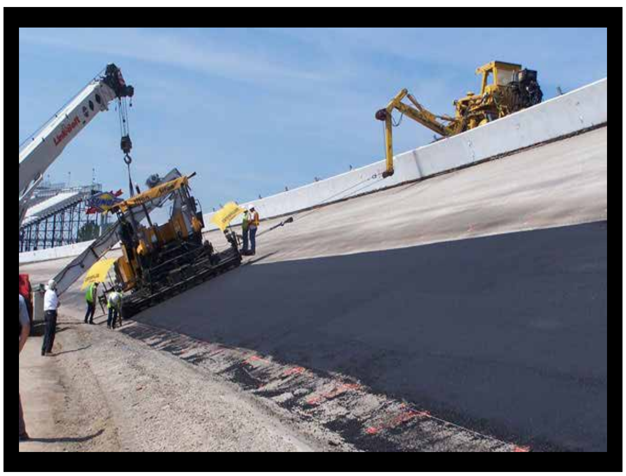

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ROLE OF THE INSPECTOR

Role of the Inspector

1

Inspection Process

- One of the most important processes in a highway project.
- Quality of finished project generally reflects the quality of the inspection.
- Collaboration (partnership) with contractor, with common goals & objectives.
  - Quality work, meeting plans & spec's.
  - Completed on time & within budget

2

Good Inspector Traits

- Respectful, honest and fair.
- Perform duties with both firmness & good nature.
- Work cooperatively with fellow employees, supervisors and contractors.
- Organized and efficient in doing their job.
- Safety conscious.

3

Communication

- Critical for project success.
- Establish lines of communication early.
- Timely notifications by all parties.
  - Work schedule / changes.
  - Potential problems.
  - Specification violations / failing test results.
  - Limit placement of defective material.
  - Minimize rework required.

4

Responsibilities

- Plan Familiarity
  - Project plans, specifications & requirements that apply to work being inspected.
- Work Done Without Inspection
  - Anticipate when situations may arise.
  - Working arrangement with contractor that allows for being in right place at right time.

5

Responsibilities

- Contract Compliance
  - Ensure materials furnished & work performed are in compliance with contract requirements.
  - Appropriate tests & measurements made to determine the progress and quality of work.
- Unacceptable Work
  - Recognized and reported to contractor before it becomes expensive & time-consuming fix.

6

Responsibilities

- Testing
  - Ensure proper sampling & testing procedures.
  - Notify contractor of failures or rejection of materials before being incorporated into work.
- Daily Diary / Daily Field Report (DFR)
  - Accurate record of the day’s happenings, including contractor’s activities, etc.
  - Legal importance (help recreate events).

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Responsibilities

- Daily Diary / Daily Field Report (DFR)
  - Controlling operation (on critical path)
  - Weather conditions
  - Prime, subcontractors on-site
  - Description of work taking place
  - Material sampling & testing / certifications
  - Safety Issues (TC, equipment, operations)
  - Non-compliances
  - Photos or videos

8

Authority

- Reject material or suspend work if quality is in dispute
  - Inform contractor & supervisor promptly.
  - Final decision from project engineer.
- Inspector’s authority does <u>not</u> extend to:
  - Modification of contract documents.
  - Approval or acceptance of work.
  - Supervising contractor’s operation.

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Contract Documents

- Proposal Form
- Contract
- Addendum
- Project Plans
- Standard Plans
- Specifications
- Special Provisions
- Materials Instructional Memorandums (IMs)

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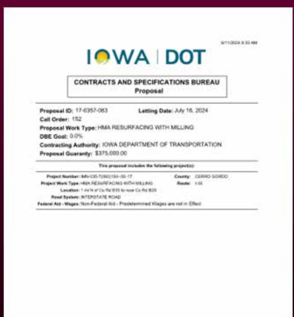
Proposal Form



CONTRACTS AND SPECIFICATIONS BUREAU
Proposal

Proposal ID: 17-0357-083 Letting Date: July 16, 2024
Call Order: 152
Proposal Work Type: HMA RESURFACING WITH MILLING
DBE Goal: 0.0%
Contracting Authority: IOWA DEPARTMENT OF TRANSPORTATION
Proposal Guaranty: $375,000.00

Contracts and Specifications Bureau
Proposal Schedule of Items

SECTION: 0001
ROADWAY ITEMS

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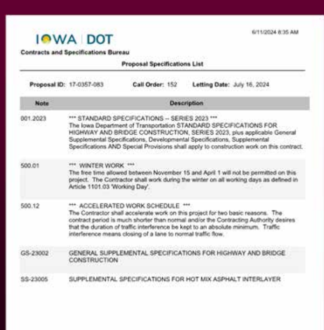
Proposal – Specifications List



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Contracts and Specifications Bureau
Proposal Specifications List

Proposal ID: 17-0357-083 Call Order: 152 Letting Date: July 16, 2024

Note	Description
001.2023	*** STANDARD SPECIFICATIONS – SERIES 2023 *** The Iowa Department of Transportation STANDARD SPECIFICATIONS FOR HIGHWAY AND BRIDGE CONSTRUCTION, SERIES 2023, plus applicable General Supplemental Specifications, Developmental Specifications, Supplemental Specifications AND Special Provisions shall apply to construction work on this contract.
500.01	*** WINTER WORK *** The free time allowed between November 15 and April 1 will not be permitted on this project. The Contractor shall work during the winter on all working days as defined in Article 1101.03 'Working Day'.
500.12	*** ACCELERATED WORK SCHEDULE *** The Contractor shall accelerate work on this project for two basic reasons. The contract period is much shorter than normal and/or the Contracting Authority desires that the duration of traffic interference be kept to an absolute minimum. Traffic interference means closing of a lane to normal traffic flow.
GS-23002	GENERAL SUPPLEMENTAL SPECIFICATIONS FOR HIGHWAY AND BRIDGE CONSTRUCTION
SS-23005	SUPPLEMENTAL SPECIFICATIONS FOR HOT MIX ASPHALT INTERLAYER

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Contract

CONTRACT

7/24/2024 2:49 PM

Letting Date: July 16, 2024 **Contract ID:** 17-0357-083 **Call Order:** 152

County: CERRO GORDO **Project Engineer:** MASON CITY RESIDENT CONST OFFICE

Cost Center: 601000 **Object Code:** 890 **DBE Commitment:** $0.00

Contract Work Type: HMA RESURFACING WITH MILLING

This agreement made and entered by and between the Contracting Authority,

IOWA DEPARTMENT OF TRANSPORTATION

and Contractor,

HENNINGSEN CONSTRUCTION, INC. (HE400)

City: ATLANTIC State: IA

It is agreed that the notice and instructions to bidders, the proposal filed by the Contractor, the specifications, the plan, if any, for project(s) listed herein, together with Contractor's performance bond, are made a part hereof and together with this instrument constitute the contract. This contract contains all of the terms and conditions agreed upon by the parties hereto.

Contractor, for and in considerations of $ 3,834,976.07 payable as set forth in the specifications constituting a part of this contract, agrees to construct various items of work and/or provide various materials or supplies in accordance with the plans and specifications therefore, and in the locations designated in the Notice to Bidders.

Contractor certifies by signature on this contract, under pain of penalties for false certification, that the Contractor has complied with Iowa Code Section 452A.17(8) as amended, if applicable, and Iowa Code Section 91C.5 (Public Registration Number), if applicable.

In consideration of the foregoing, Contracting Authority hereby agrees to pay the Contractor promptly and according to the requirements of the specifications the amounts set fourth, subject to the conditions as set forth in the specifications.

It is further understood and agreed that the above work shall also be commenced or completed in accordance with Contract Time of this Contract and assigned Notes.

To accomplish the purpose herein expressed, the Contracting Authority and Contractor have signed this instrument.

For Federal-Aid Contracts the Contractor certifies that each subcontract is evidenced in writing and that it contains all pertinent provisions and requirements of the contract.

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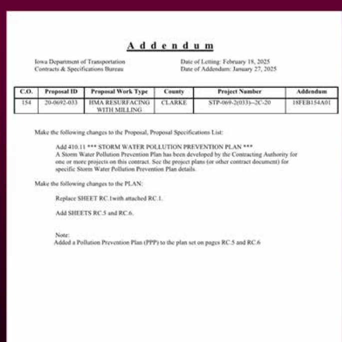
Addendum



Addendum

Iowa Department of Transportation
Contracts & Specifications Bureau

Date of Letting: February 18, 2025
Date of Addendum: January 27, 2025

C.O.	Proposal ID	Proposal Work Type	County	Project Number	Addendum
154	20-0692-033	HMA RESURFACING WITH MILLING	CLARKE	STP-069-2(033)--2C-20	18FEB154A01

Make the following changes to the Proposal, Proposal Specifications List:

Add 410.11 *** STORM WATER POLLUTION PREVENTION PLAN ***
A Storm Water Pollution Prevention Plan has been developed by the Contracting Authority for one or more projects on this contract. See the project plans (or other contract document) for specific Storm Water Pollution Prevention Plan details.

Make the following changes to the PLAN:

Replace SHEET RC.1with attached RC.1.

Add SHEETS RC.5 and RC.6.

Note:
Added a Pollution Prevention Plan (PPP) to the plan set on pages RC.5 and RC.6

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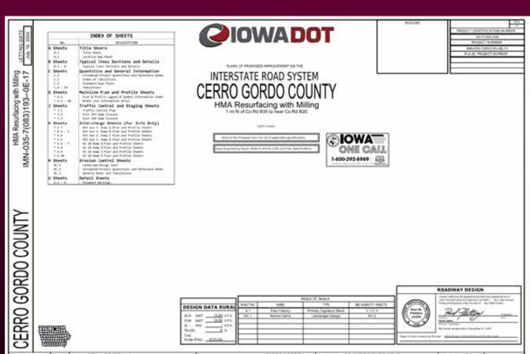
Project Plans



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Standard Specifications

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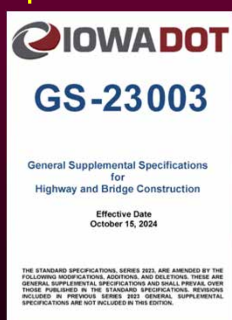
General Supplemental Specifications



IOWADOT

GS-23003

General Supplemental Specifications
for
Highway and Bridge Construction

Effective Date
October 15, 2024

THE STANDARD SPECIFICATIONS, SERIES 2023, ARE AMENDED BY THE FOLLOWING MODIFICATIONS, ADDITIONS, AND DELETIONS. THESE ARE GENERAL SUPPLEMENTAL SPECIFICATIONS AND SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS. REVISIONS INCLUDED IN PREVIOUS SERIES 2023 GENERAL SUPPLEMENTAL SPECIFICATIONS ARE NOT INCLUDED IN THIS EDITION.

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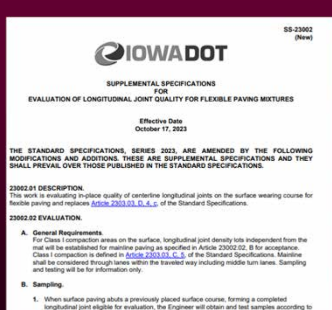
Supplemental Specifications



SS-23002
(New)

IOWADOT

SUPPLEMENTAL SPECIFICATIONS
FOR
EVALUATION OF LONGITUDINAL JOINT QUALITY FOR FLEXIBLE PAVING MIXTURES

Effective Date
October 17, 2023

THE STANDARD SPECIFICATIONS, SERIES 2023, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE SUPPLEMENTAL SPECIFICATIONS AND THEY SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

23002.01 DESCRIPTION.
This work is evaluating in-place quality of centerline longitudinal joints on the surface wearing course for flexible paving and replaces Article 2303.03, D, 4, c, of the Standard Specifications.

23002.02 EVALUATION.

A. **General Requirements.**
For Class I compaction areas on the surface, longitudinal joint density lots independent from the mat will be established for mainline paving as specified in Article 23002.02, B for acceptance. Class I compaction is defined in Article 2303.03, C, 5, of the Standard Specifications. Mainline shall be considered through lanes within the traveled way including middle turn lanes. Sampling and testing will be for information only.

B. **Sampling.**

1. When surface paving abuts a previously placed surface course, forming a completed longitudinal joint eligible for evaluation, the Engineer will obtain and test samples according to Materials I.M. 320 and 321. Using random core locations determined for daily field voids lot

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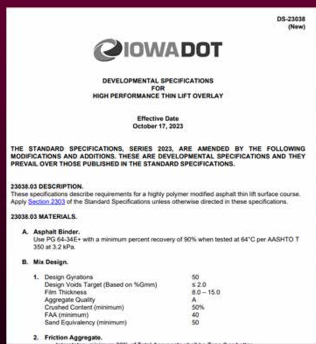
Developmental Specifications



DS-23038
(New)

IOWADOT

DEVELOPMENTAL SPECIFICATIONS
FOR
HIGH PERFORMANCE THIN LIFT OVERLAY

Effective Date
October 17, 2023

THE STANDARD SPECIFICATIONS, SERIES 2023, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE DEVELOPMENTAL SPECIFICATIONS AND THEY PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

23038.03 DESCRIPTION.
These specifications describe requirements for a highly polymer modified asphalt thin lift surface course. Apply Section 2303 of the Standard Specifications unless otherwise directed in these specifications.

23038.03 MATERIALS.

A. **Asphalt Binder.**
Use PG 64-34E+ with a minimum percent recovery of 90% when tested at 64°C per AASHTO T 350 at 3.2 kPa.

B. **Mix Design.**

1. | | |
|---|---|
| Design Gyrations | 50 |
| Design Voids Target (Based on %Gmm) | ≤ 2.0 |
| Film Thickness | 8.0 – 15.0 |
| Aggregate Quality | A |
| Crushed Content (minimum) | 50% |
| FAA (minimum) | 40 |
| Sand Equivalency (minimum) | 50 |

2. **Friction Aggregate.**

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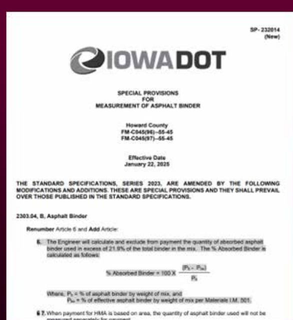
Special Provisions



SP- 232014
(New)

IOWADOT

SPECIAL PROVISIONS
FOR
MEASUREMENT OF ASPHALT BINDER

Howard County
FM-C045(96)--55-45
FM-C045(97)--55-45

Effective Date
January 22, 2025

THE STANDARD SPECIFICATIONS, SERIES 2023, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE SPECIAL PROVISIONS AND THEY SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

2303.04, B, Asphalt Binder

Renumber Article 6 and **Add** Article:

6. The Engineer will calculate and exclude from payment the quantity of absorbed asphalt binder used in excess of 21.9% of the total binder in the mix. The % Absorbed Binder is calculated as follows:

$$\% \text{ Absorbed Binder} = 100 \text{ X } \frac{(P_b - P_{be})}{P_b}$$

Where, P_b = % of asphalt binder by weight of mix, and
P_{be} = % of effective asphalt binder by weight of mix per Materials I.M. 501.

~~6~~ 7. When payment for HMA is based on area, the quantity of asphalt binder used will not be measured separately for payment.

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Materials IM's

METHOD OF DESIGN OF ASPHALT MIXTURES

SCOPE
The design of asphalt mixtures involves determining an economical blend of aggregates that provides a combined gradation within the limits of the specifications and a determination of the percent of asphalt binder to mix with the aggregate blend, which provides a mix, which meets volumetric specifications. Trial mixes prepared with different binder contents are tested for mix properties and the results are analyzed to select the binder content that is judged to be most satisfactory for the intended use of the mix.

This IM will cover the sample preparation procedure, aggregate blend selection, binder content selection and the evaluation of the test results. Individual test method IMs are referenced for measuring the properties of individual mixes.

> **NOTE**: The aggregate variable and asphalt binder variable blends are important tools needed by the production control technician for field adjustment of the Job Mix Formula (JMF).

Appendix A of this IM contains the criteria for Gyratory mix design.

REFERENCED DOCUMENTS:

Standard Specification 4127 Aggregate for Flexible Paving Mixtures
AASHTO R-35 Practice for Superpave Volumetric Design for Hot Mix Asphalt (HMA)
ASTM D7313 Standard Test Method for Determining Fracture Energy of Asphalt Aggregate Mixtures Using the Disk Shaped Compact Tension Geometry
IM 302 Sieve Analysis of Aggregates
IM 306 Determining the Amount of Material Finer than the #200 (75 µm) Sieve in Aggregate
IM 336 Methods of Reducing Aggregate Field Samples to Test Samples
IM 321 Method of Test for Compacted Density of Asphalt Mixtures (Displacement)
IM 319 Moisture Sensitivity Testing of Asphalt Mixtures
IM 325G Method of Test for Determining the Density of Asphalt Using the Superpave Gyratory Compactor (SGC)
IM 350 Determining Maximum Specific Gravity of Asphalt Mixtures
IM 357 Preparation of Asphalt Mix Samples for Test Specimens
IM 369 Determining Specific Gravity of Asphalt Binder
IM 380 Vacuum Saturated Specific Gravity & Absorption of Combined or Individual Aggregate Sources
IM 501 Equations & Example Calculations

APPARATUS

- Thermometers: Armored glass, dial type or digital thermometer with metal stems is recommended. A range of 50° to 400°F (10° to 200°C) with graduations of 5°F (2°C) is required.
- Balances: 20,000-gram capacity; 0.1 gram resolution for mix design and production testing.
- Forced Draft Oven, 350°F (177°C) minimum with controls sensitive to ± 5°F (3°C); minimum size, 7 cu. ft. for production testing or mix design.

> **NOTE**: Experience has shown that a 15 cu. ft. or larger oven may be desirable.

- Mixer: Hobart 19 liters with Dough Hook, Model A-200, or equivalent for Mix Design.

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Conformity with and Coordination of the Contract Documents

- Specification Article 1105.04
- Provides the order to follow in case of discrepancy between the contents of the contract documents.

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So…What's What

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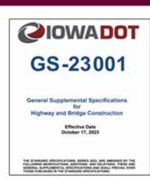
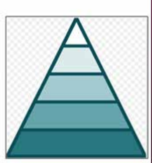
Hierarchy of Contract Documents
In case of a discrepancy between contents of the contract documents, the following items listed by descending order shall prevail:

1. Addendum
2. Proposal Form
3. Special Provision
4. Digital Contract Files. Shall apply only when digital files are available, and the Contractor uses automated machine control guidance.
5. Plans
6. Standard Bridge Plans, Standard Culvert Plans, and Standard Road Plans
7. Developmental Specifications
8. Supplemental Specifications
9. General Supplemental Specifications
10. Standard Specifications
11. Materials I.M.
12. Notice to Bidders

This list is also found in General specifications 1105.04.A.





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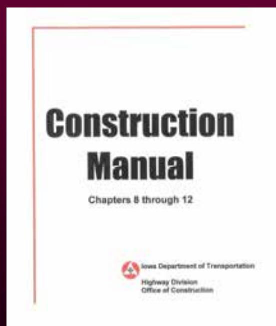
Construction Manual



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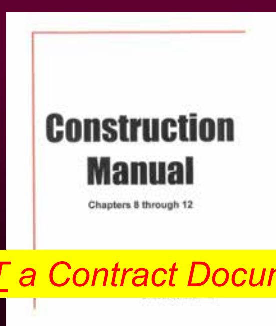
Construction Manual



NOT a Contract Document

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Construction Manual

- Purpose
  - Establish uniform policy & procedure for contract administration and inspection.
  - Provide interpretation & clarification of spec's.
- Chapters of interest (HMA inspection)
  - 2. Contract administration.
  - 3. General inspection.
  - 8. HMA pavement, bases & subbases.

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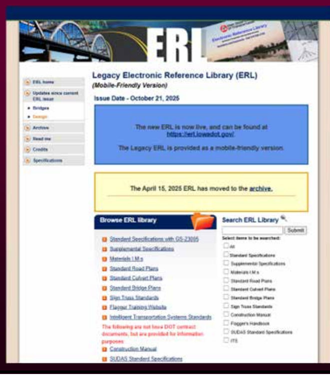
ERL (Online) – iowadot.gov



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Inspection Duties

(Construction Manual Chapter 3, Material IM's 204 & 511)

- Checking
- Observing
- Documentation and Reporting
- Collection of Tickets
- Direct & Witness Contractor Sampling
- Testing

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Inspection Duties

Checking

- Measurement Checks
- Temperature Checks
- Review Plans (know what to check for)
- Acquire knowledge of specifications that apply to the project
- Check Quantities/Yields
- Check Mix Uniformity (Segregation/clumps)

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Inspection Duties

Observing

- Done continuously to insure compliance with specifications

Some Typical items to observe:

- Roadway Prep
- Handling of Mix
- Equipment type and features
- Traffic Control
- Safety

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Inspection Duties

Documentation and Reporting

- Daily Field Reports
- Good records of each item for payment to contractor
- Never have too much information
- Record and inform other inspectors or supervisors of discrepancies or irregularities

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Inspection Duties

Collection of Material Truck Tickets

(including Electronic Tickets)

Things to look for on truck tickets:

- Type of material (is the material delivered the correct material)
- Date
- Project Number
- Contractor Name
- Truck status times
- Weights (gross, tare, net)
- Mix design number

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Inspection Duties

Direct and witness Contractor Sampling

- Most project sampling is performed by the contractor as directed and witnessed by the inspector
- Hot Boxes and Gmb (bulk specific gravity)
- Coring
- Aggregate (cold-feed)
- Refer to IM 204 for timing and frequency of sampling

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Inspection Duties

Testing

- Testing of materials may be performed by the contractor, District Materials Office personnel, or by the plant monitor
- Refer to IM 204 for testing responsibilities and requirements.

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Temperature Checks

- Ambient (air)
- Existing pavement surface
- Mix at delivery (truck / windrow / hopper)
- Mix placed (loose mix behind paver)
  - First few loads
  - Every two hours, if steady

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Measurement Checks

- Lift depth (loose mix behind paver)
- Cross slopes
- Pavement width (before & after rolling)
- Compacted thickness (from cores)
- Placed mat length

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Hot Box (Loose) Samples

- Number and timing of samples based on estimated / intended mix quantity for day.
- Random location (within mix qty. "window").
- Direct & witness contractor sampling.
- Document sampling locations
  - Sta./MP & offset or use of Locator App.
- ID & secure sample if transport by others.

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Securing Samples (IM 205)

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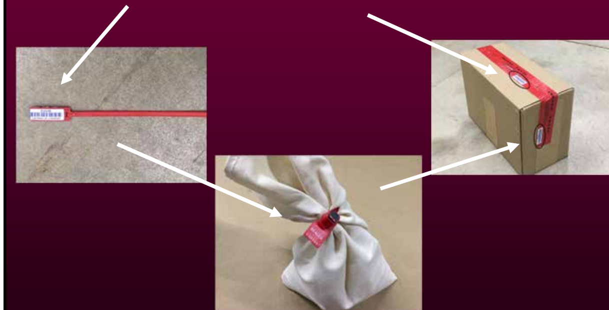
Sample ID: Barcodes



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Barcode Use with Form 193

- Complete Sample ID (Form 193).
- Scan barcode (QR code) or use the tag number to link the sample to Form 193.

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Core (Compacted) Samples

- Compute random core locations.
- Layout and mark core locations.
- Direct & witness contractor sampling.
- Inspect cores for damage, length, etc.
- Document sampling locations
  - Sta./MP & offset or use of Locator App.
- ID & secure samples if transport by others.
- Test (weigh) cores at lab.

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PREPARATION OF

GRADE & BASE

Preparation of Grade and Base

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Cleaning & Preparation of Base
(Specification 2212)

- Remove loose, spalled & scaled material
- Remove old patch & joint material
- Clean cracks & joints
- Removals by:
  - hand tools
  - brooming
  - compressed air
- Removed materials property of contractor

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Base Repair
(Specification 2212)

- Surface Patches
  - spalled concrete or patching material removed to depth > 1” but < total thickness
  - cleaned, tacked & filled with HMA
  - compaction with weighted pneumatic tire, mechanical tamper or small roller
  - level to 1/4” above surrounding surface

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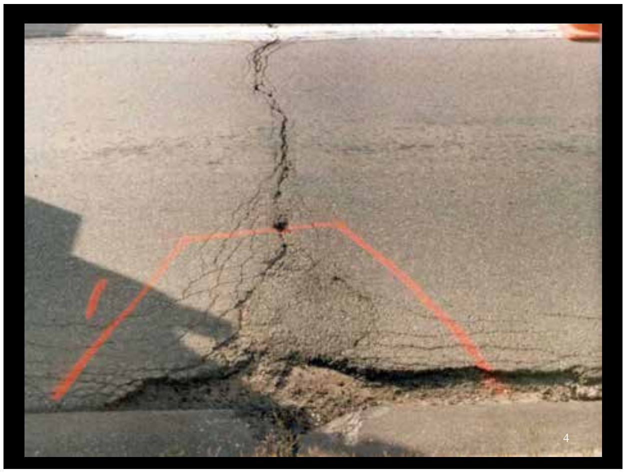

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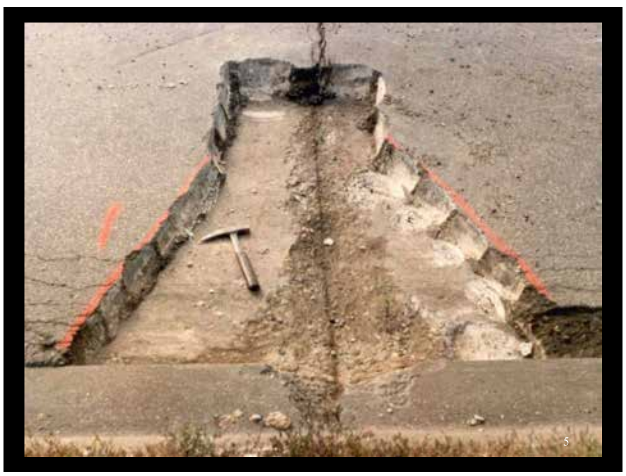

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Base Repair

- <u>Partial Depth</u> Patches
  - pavement section removed to a specified depth
  - milling
  - replace with specified patching material (HMA or PCC)

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Base Repair

- Full Depth Patches
  - entire pavement section removed
  - subbase or subgrade restored, if necessary
  - place specified patching material (HMA or PCC)

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Base Repair

- Patching information tabulated on plans
  - location
  - type of patch
  - dimensions
  - quantities
  - joint requirements

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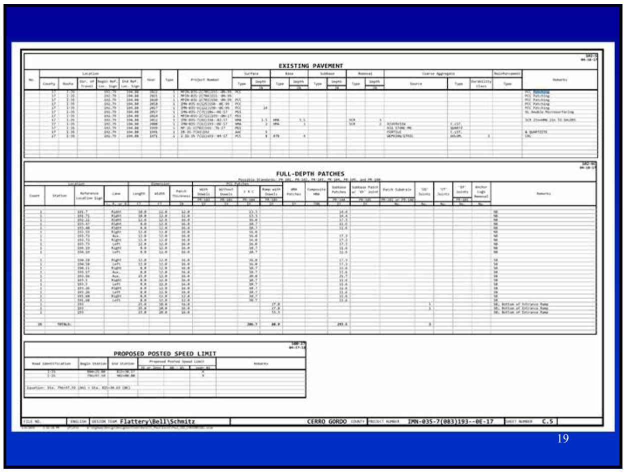

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Base Widening

(Specification 2213)

- Existing pavement width < design width
- Work may involve:
  - excavating shoulder material
  - removal of existing curb or flumes
  - constructing widened base pavement
- Plans will indicate:
  - HMA, PCC, or contractor's option
  - width and thickness dimensions

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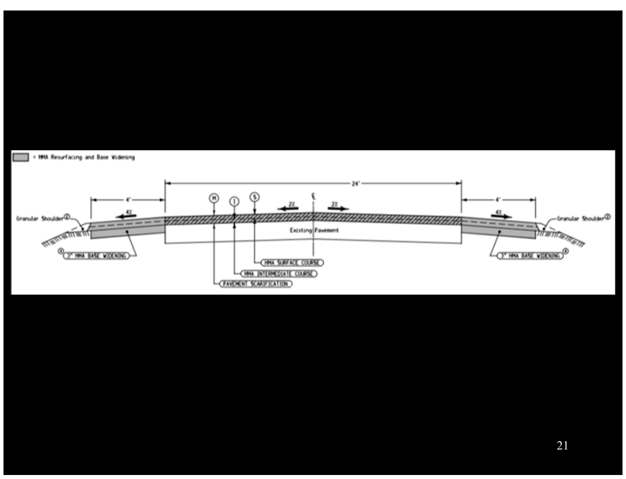

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Scarification

(Specification 2214)

- Removal of pavement surface by cold milling in preparation for resurfacing
- Improve surface profile & cross section
- Texture enhances bond
- Location & depth tabulated on plans
- Debris removed from surface immediately
- Overlay begins within 10 days of scarification commencing (per spec.)

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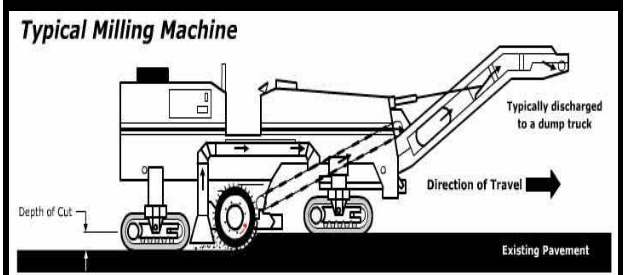

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Cold In-place Recycling (CIR)

(Specification 2318; Materials IM's 204 and 504)

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CIR Steps

- Milling
- Crushing / Resizing
- Remixing with Stabilizing Agent
- Placing
- Compacting
- Curing / Drying period *(Variable)*
- HMA Overlay / Surface Treatment

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CIR Stabilizing Agents

- Foamed Asphalt
- Emulsion

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CIR with Foamed Asphalt

- Basics of Using Foamed Asphalt
  - Foaming / Expansion of Asphalt Binder
    - Hot asphalt binder
    - Water injection
  - Increased Surface Area
  - Decreased Viscosity
  - Efficient Coating of Millings

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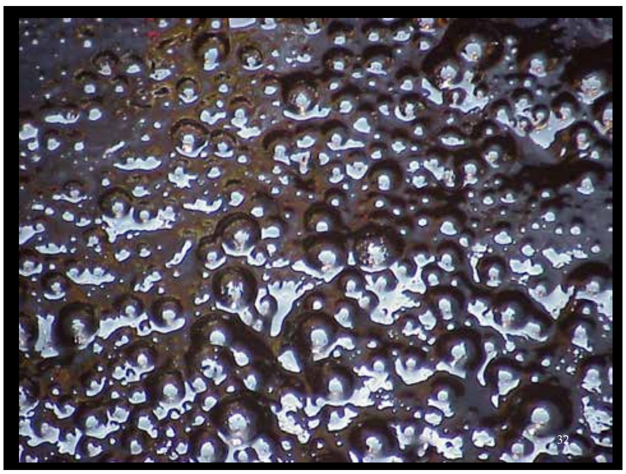

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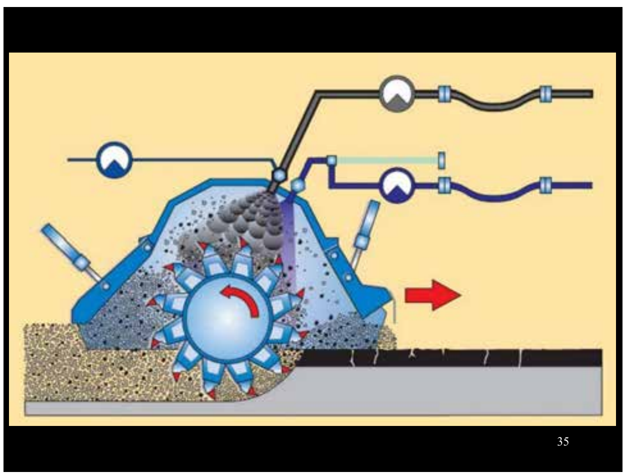

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CIR with Foamed Asphalt

- Projects with Improper Foaming
  - Inconsistent coating of millings
  - Balling / clumping of asphalt binder & fines
    - Excess binder - “fat” spots
    - Rutting / Distortion
    - Lack of binder elsewhere
  - Uncoated / dry millings
    - Raveling
    - Pot holes

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CIR with Foamed Asphalt

- Inspect Foaming Characteristics
  - Asphalt Binder Temperature
    - Minimum Temperature ~ 320 deg. F
  - Visual Confirmation of Foaming (Bucket Test)
    - Expansion Ratio ~ 8:1 (by volume).
    - “Half-Life” of Expansion ~ 6 sec.
    - Contractor partially fills bucket (<1/8 full) with foamed asphalt from test nozzle.
    - Watch for expansion, followed by collapse of foam
  - Halt operations if foaming is not adequate

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Curing of CIR

- **Article 2318.03, H.**
  Placement of Surface Course.
  Subsequent HMA overlay or surface treatment will not be allowed until one of the following requirements has been met:

  1. Average moisture content of the CIR layer is no more than 0.3% above the residual moisture content (according to Materials I.M. 504) or <u>3.5</u>%, whichever is greater.

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Curing of CIR

2. The moisture content of the CIR layer has reached a plateau of less than 5.0% and has remained constant (within +/- 0.3%) for a minimum of 3 calendar days.

3. The CIR layer has been completed for 21 calendar days.

The Engineer may adjust this drying period depending on field conditions. The completed CIR layer shall be retested until one of the requirements listed above has been met.

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Heater Scarification (HIR)

(Specification 2309, Special Provision (project specific)

STEPS

- Pavement is evenly heated and scarified (minimum depth ¾" highest point such as between wheel paths. ½" at lowest point)
- Equipment capable of producing 10 million BTU's and process 1500 SY per hour
- Heated material in range 220-260 degrees F
- Level Scarified Material
- Overlay with surface course

(Other methods may be acceptable through SP's)

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Slab Fracturing Processes

(Specifications 2216 & 2217)

- Crack and Seat
- Break and Seat
- Rubblization

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Crack and Seat

- Minimize / eliminate reflective cracking in HMA overlay by reducing effective slab length of PCC pavement.
- **Cracking** produces tight cracks that permit load transfer with minimal loss of structural value.
- **Seating** re-establishes support between subbase and fractured slab.

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Break and Seat

- Same objective as Crack and Seat.
- Increased effort needed to reduce slab size due to reinforcing in PCC:
  – steel reinforcing bars
  – wire mesh
- To be effective, one of these must occur:
  – slab reinforcement must be broken
  – concrete to steel bond destroyed

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Rubblization

- Eliminate reflective cracking in overlay by total destruction of existing PCC slab action.
- “Full” Rubblization
  - Rubblize slab into maximum 4” fragments.
- “Modified” Rubblization
  - Site conditions may warrant up to 12” size.
  - By contract documents or Engineer’s decision.

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Rubblization

- Reinforcing steel, if present, is fully debonded from the concrete.
- Seating (compaction) by vibratory roller.
- Interlayer
  - Rock or RAP layer between rubblized PCC and HMA overlay
  - Absorbs stress to eliminate reflective cracking.
  - Specified in contract documents.

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Slab Fracturing Guidelines

- Existing HMA overlays totally removed
- Test sections (impact energy & spacing)
- Crack pattern (based on equipment)
- Crack spacing (equipment & exist. PCC)
- Locate soft spots by proof rolling (& replace)
- No traffic on seated layers (1 lift of HMA)
- Avoid exposure to rains (HMA within 24 hrs.)

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Full Depth Reclamation (FDR)
(Specification 2116)

Process:

This is the process of reclaiming existing asphalt and mixing with a soil/sub-base for new base material. Requires new pavement on top.

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Full Depth Reclamation (FDR)

Steps:

- Reclaim existing asphalt
- During reclaiming existing asphalt mix mineral stabilizing agent and foamed asphalt to required depth as indicated on plans
- Compact and shape

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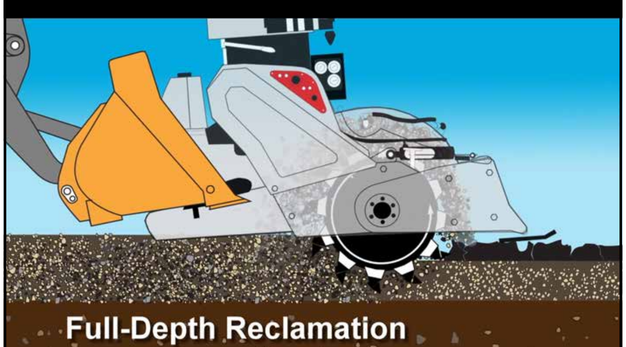

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Tack Coat Application

- Ensure bond between existing pavement and new hot mix asphalt overlay
  - increase overall strength
  - prevent intrusion of water
- Asphalt emulsion
  - heated
  - sprayed from nozzles
- Pavement surface clean & free of moisture

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Tack Coat Application

- Application rate
  - too little results in little bond between layers
  - too much results in sliding/slippage of layers and bleeding to surface
  - milling requires more tack
- Uniform coating
- Overlay after tack “breaks”
  - water evaporates from emulsion
  - changes from brown to black

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Special Backfill

(Specification 4132)

- Material used as a subbase that consist of
  - Crushed Stone
  - Crushed PCC, crushed composite pavement or reclaimed HMA
  - Mixtures of gravel, sand and soil
  - OR uniformly blended combinations of the above
- Permeability of the layer varies with materials
- Must meet certain gradation
- Less predictable behavior because materials vary

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Special Backfill

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Modified Subbase

(Specification 2115)

- Material used as a subbase that consist of
  - Crushed Stone
  - Gravels
  - Recycled Pavements
  - Uniformly blended materials above with a maximum of 50% RAP
- More permeable than special backfill
- Mostly replaced special backfill for HMA subbase because provides adequate stability and drainage characteristics.

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Modified Subbase

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Unstable Subgrades and Subbase

(Specification 2109.03 and Construction Manual section 8.41)

- Do not place HMA over any distorted subgrade or subbase
- Proof roll with loaded truck to identify soft or wet spots. When excessive distortion is observed the areas must be dried and reworked, or stabilized as necessary
- Deep instability may require additional treatments
  - Coring out unstable materials and replace with suitable
  - Add subdrains
  - Over depth paving

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MIX DELIVERY

PLACEMENT & COMPACTION

Delivery of HMA

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Delivery of HMA

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Delivery (Load) Tickets

- Paper Tickets
  - Documentation of delivered quantity
  - Must accompany each load
  - Inspector picks up from haul truck drivers or
  - Contractor collects & keeps for Inspector
  - Dangerous (walking around backing trucks)
  - Lost or damaged tickets

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Delivery (Load) Tickets

- Electronic Tickets (E-Ticketing)
  - Load weight, time, etc. uploaded at plant.
  - Some haul trucks equipped with transponder for truck (load) location to be tracked by GPS.
  - Inspector uses App for iPad or smart phone (provides load info., locations & summaries).
  - Review E-Ticket load info. on arrival at site.

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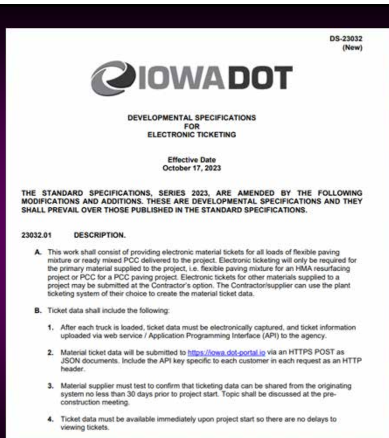

DS-23032
(New)

IOWA DOT

DEVELOPMENTAL SPECIFICATIONS
FOR
ELECTRONIC TICKETING

Effective Date
October 17, 2023

THE STANDARD SPECIFICATIONS, SERIES 2023, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE DEVELOPMENTAL SPECIFICATIONS AND THEY SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

23032.01 DESCRIPTION.

A. This work shall consist of providing electronic material tickets for all loads of flexible paving mixture or ready mixed PCC delivered to the project. Electronic ticketing will only be required for the primary material supplied to the project, i.e. flexible paving mixture for an HMA resurfacing project or PCC for a PCC paving project. Electronic tickets for other materials supplied to a project may be submitted at the Contractor's option. The Contractor/supplier can use the plant ticketing system of their choice to create the material ticket data.

B. Ticket data shall include the following:

1. After each truck is loaded, ticket data must be electronically captured, and ticket information uploaded via web service / Application Programming Interface (API) to the agency.
2. Material ticket data will be submitted to https://iowa.dot-portal.io via an HTTPS POST as JSON documents. Include the API key specific to each customer in each request as an HTTP header.
3. Material supplier must test to confirm that ticketing data can be shared from the originating system no less than 30 days prior to project start. Topic shall be discussed at the pre-construction meeting.
4. Ticket data must be available immediately upon project start so there are no delays to viewing tickets.

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What to look for

- Proper truck size
- Mix Segregation
- Blue smoke (overheated mix)
- No distillates as release agent (diesel fuel)
- Windrow proper size and length (not more than 2 truckloads ahead of paver) but depends on speed of paver, mix temp, and weather.

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What to look for (cont.)

- Trucks bumping into paver
- Excessive spillage on grade in path of paver. Spillage must be cleaned up.
- Mix remaining in corners of truck beds after unloading
- Leaking truck fluids
- Mass movement (we would like one big drop instead of dribble to help minimize segregation of larger aggregate)

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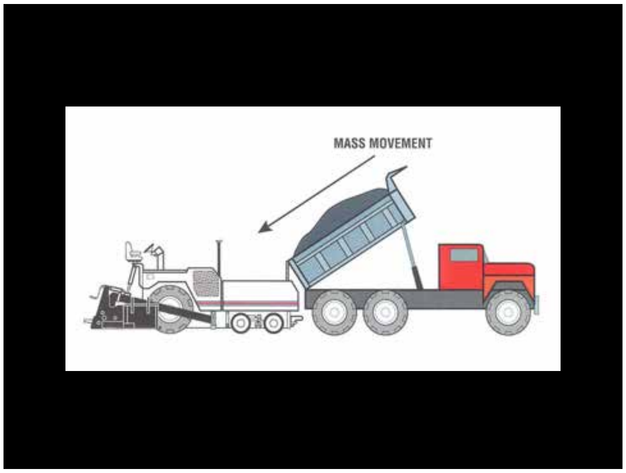

16

17

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24

Trucks operation you might see on the grade

25

26

27

28

29

30

31

32

33

Placement of HMA

34

Placement of HMA

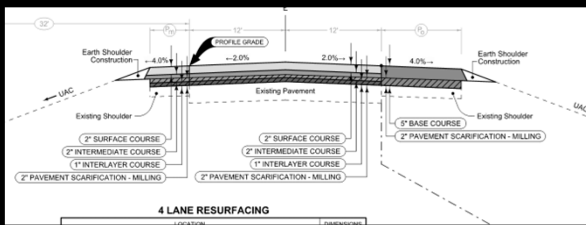
35

Dimensions

(Construction Manual sections 8.52 & 8.53)

- Typical sections in plans show design dimensions of finished pavement.
- Plans show total thickness of each course
  - base, intermediate & surface
  - contractor must divulge each intended lift thickness to inspector.
- Adjust spread width for “broadening” effect during rolling.

36



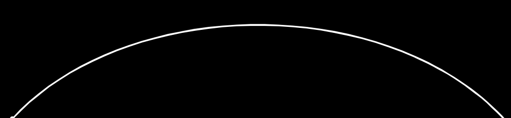
37

Stringlines

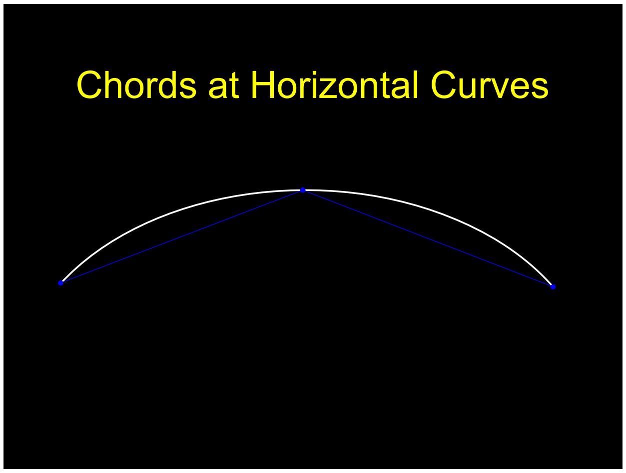
- Wire or string used to guide paver & maintain alignment.
- Establish centerline early in project.
- Follow guideline (alignment) exactly.
  - adjust back on line immediately
  - incorrect lap results from gradual correction
- Intermediate nails to eliminate "chords" (short tangent sections) at curves.

38

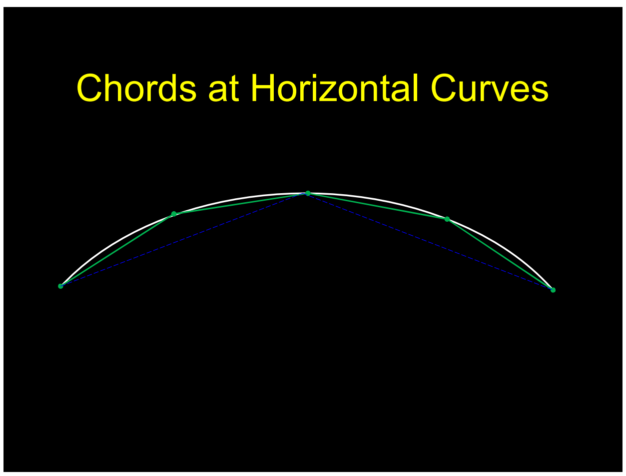
Chords at Horizontal Curves



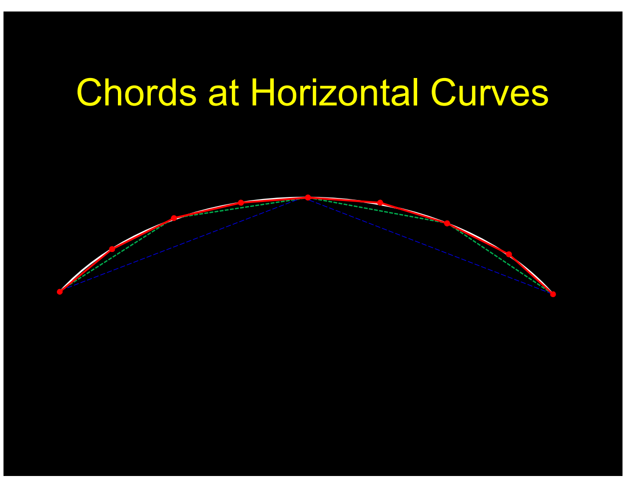
39


Chords at Horizontal Curves

40


Chords at Horizontal Curves

41


Chords at Horizontal Curves

42

43

"Stringless" paving

- Eliminates using traditional stringlines.
- Establish centerline and mark with paint then manually followed by operator for edgeline.
- Sonic skis are used for depth and slope control
- Not true stringless paving with CAD 3D model.

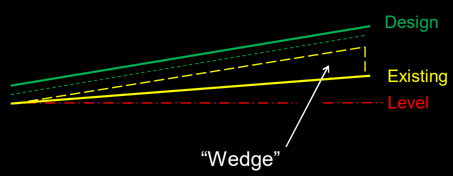
44

Wedge Courses

- Correct or increase curve superelevation.
- Plans show location, rate of superelevation, and transition length.
- Wedge placed full width of pavement.
- C.M. section 8.51 gives procedures for placing successive passes of wedges.
- Check with 4' level & ruler; adjust slope and thickness of next pass, if necessary.

45

Wedge Courses

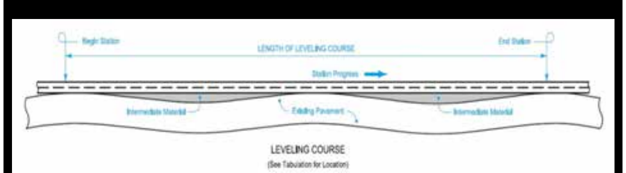


46

Leveling Courses

- Correct existing pavement surface low areas or depressions more than 1” deep.
- “Scratch” (thin leveling) courses
  - screed scratches on aggregate
  - lift thickness at or just above largest aggregate
- Plans show locations & thickness.
- Multiple lifts if thickness exceeds 3”.
- Compaction with pneumatic roller.

47

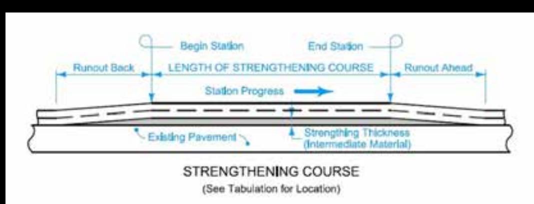


48

Strengthening Courses

- Placed over weak areas in the existing pavement.
- Usually uniform in thickness.
- Plans show location and thickness.
- Multiple lifts if thickness exceeds 3”.

49

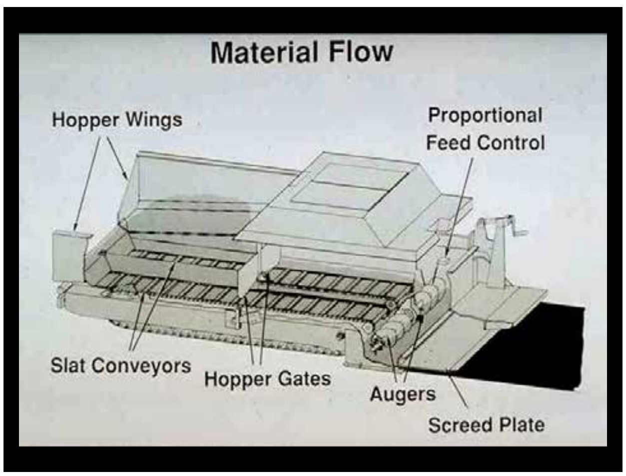


50

51

Paver Operation

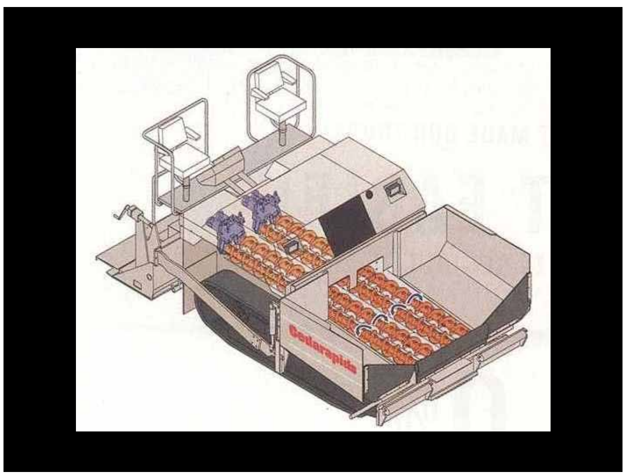
52



53

54

55

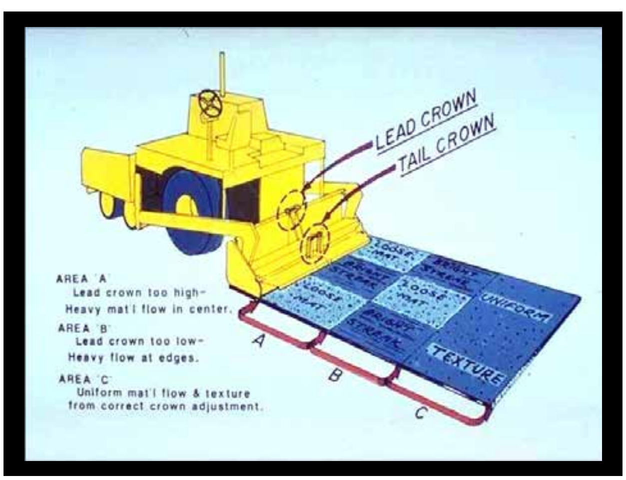


56

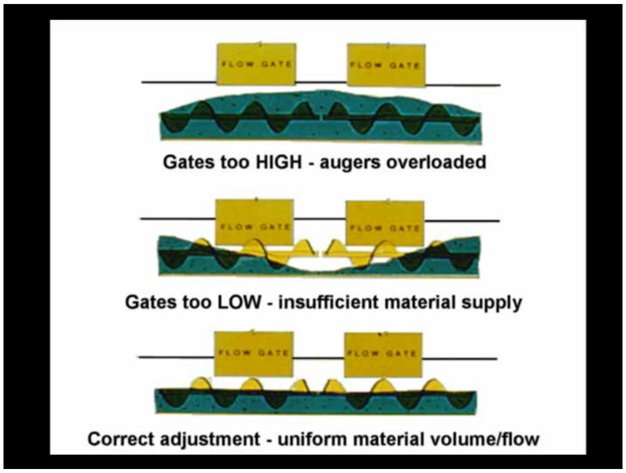
57

58

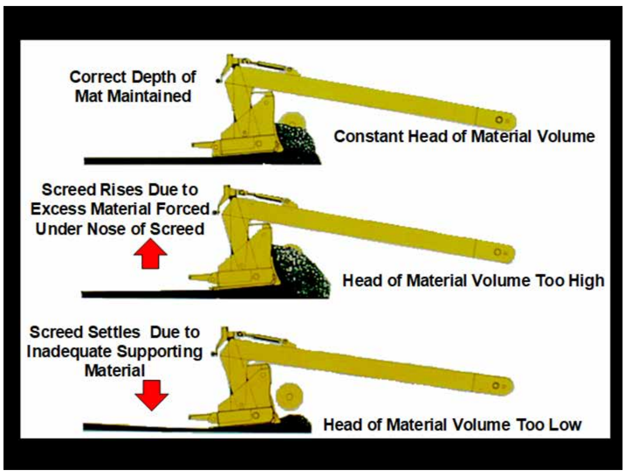
59


LEAD CROWN
TAIL CROWN
LOOSE MAT
BRIGHT STREAK
LOOSE MAT
BRIGHT STREAK
LOOSE MAT
BRIGHT STREAK
UNIFORM
TEXTURE
A
B
C
AREA 'A'
Lead crown too high-
Heavy mat'l flow in center.
AREA 'B'
Lead crown too low-
Heavy flow at edges.
AREA 'C'
Uniform mat'l flow & texture
from correct crown adjustment.

60


FLOW GATE
FLOW GATE
Gates too HIGH - augers overloaded
Gates too LOW - insufficient material supply
Correct adjustment - uniform material volume/flow

61


Correct Depth of Mat Maintained
Constant Head of Material Volume
Screed Rises Due to Excess Material Forced Under Nose of Screed
Head of Material Volume Too High
Screed Settles Due to Inadequate Supporting Material
Head of Material Volume Too Low

62

63

64

65

Full Width Paving

- Single paver with screed extensions.
- Multiple pavers (echelon).
- Eliminates cold joint between lanes.
- Requires well-coordinated operations.
- Used mostly on local / county roads.
- Rarely able to close multiple lanes on primary or interstate highways.

66

67

68

69

70

71

Temporary Runouts
(Standard Road Plans (PR-201, PR-202, PV-202)

- End of day's paving – lane to be opened.
- Raise paver screed before all mix run out.
- Move paver & remove excess material (square off mat at full lift thickness).
- Place paper (to prevent bond) under temporary runout material.
- Taper down to existing pavement (10' length per inch of lift thickness).

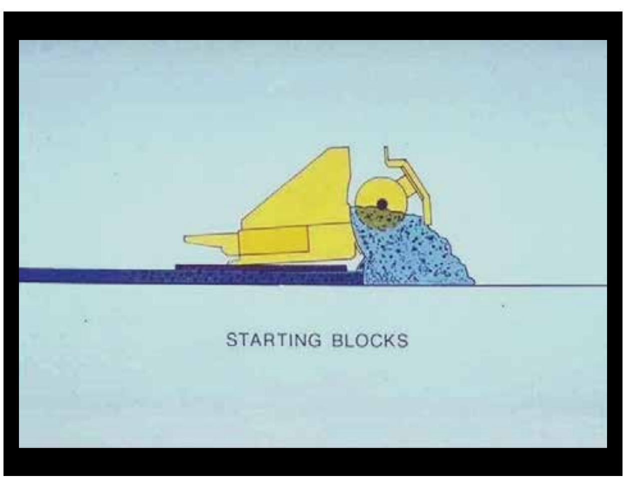
72

73

Taking off from a Cold Joint

- Saw joint at right angles, full lift thickness.
- Remove temporary runout material.
- Shim the screed to “loose” lift thickness
  - 20-25% of compacted lift thickness
- Hot screed, not placed directly on cold mat.
- Place 30-50 feet, stop & check joint
  - continue paving if OK
  - back up & repave if necessary

74



75

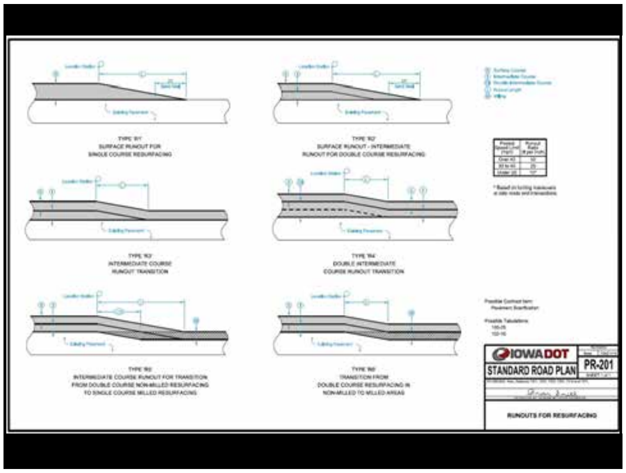
76

77

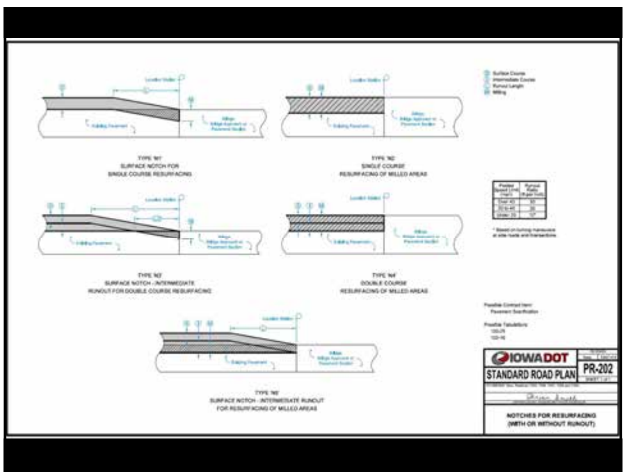
Permanent Runouts
(Standard Road Plans (PR-201, PR-202, PV-202)

- Wedge shaped fillets (some are notched).
- Provide transition from resurfacing course to existing pavement surface.
- Length based on thickness of resurfacing and posted speed limit (Runout Ratio).
- Layout using runout information on plans.
- Check fit with actual field conditions.
- Surface runout is sand sealed.

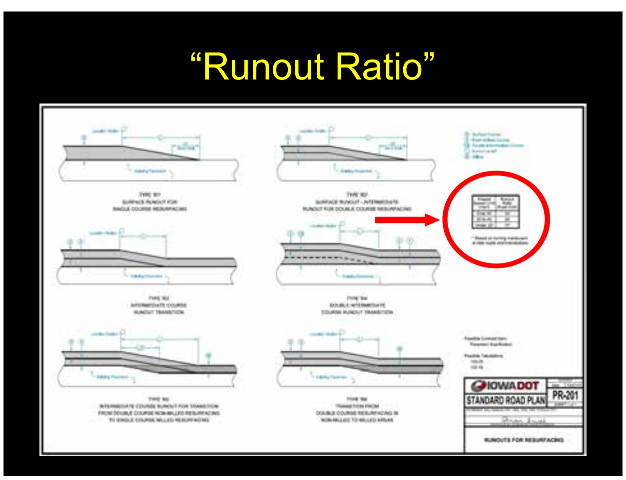
78


IOWADOT
STANDARD ROAD PLAN
PR-201
RUNOUTS FOR RESURFACING

79


IOWADOT
STANDARD ROAD PLAN
PR-202
NOTCHES FOR RESURFACING
(WITH OR WITHOUT RUNOUT)

80


"Runout Ratio"
IOWADOT
STANDARD ROAD PLAN
PR-201
RUNOUTS FOR RESURFACING

81

Hand Spreading

- Required for small, irregular areas
- Tools designed for use with hot mix
- Place and spread material evenly to avoid segregating the mix
- Minimize hand spreading
- Some mixes are very hard or impossible to hand spread (Hi-Pro)

82

83

84

85

Compaction of HMA

(Specification 2303.03, C, 5)

86

We've known for a long time …..

"The importance of COMPACTION in highway construction has long been recognized. Recent laboratory and field investigation have repeatedly emphasized the value of thorough consolidation in both the base and surfacing courses. Thorough compaction is known to produce the following desirable results:

1. It increases interlocking of the aggregate particles, which is the primary factor in developing a high degree of stability.
2. It retards the entrance of moisture, thus preventing excessive loss of stability under adverse service conditions.
3. It reduces the flow of air and water through bituminous mixtures and is therefore an effective means of lessening damage from weathering and film stripping."

Reference: ***Public Roads*, May 1939**, ← **83+ yrs.**
(authors J.T. Pauls and J.F. Goode)

87

Compaction

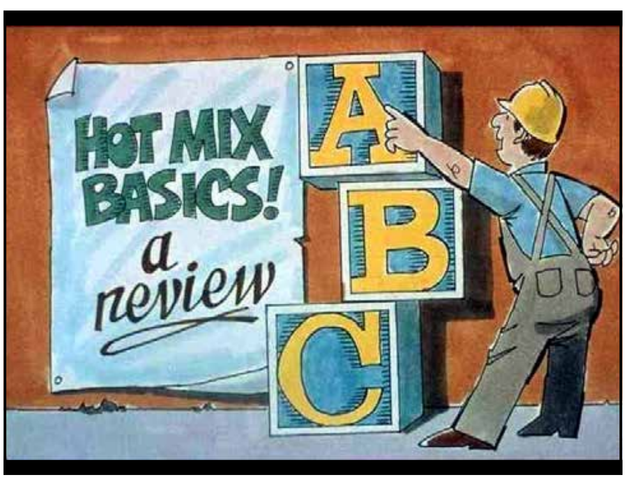
- Compaction is the single most important factor that affects performance of asphalt
- Three main forces at work
  1. Compressive force of rollers
  2. Resistive forces of mixture
  3. Supportive forces of surface beneath

88

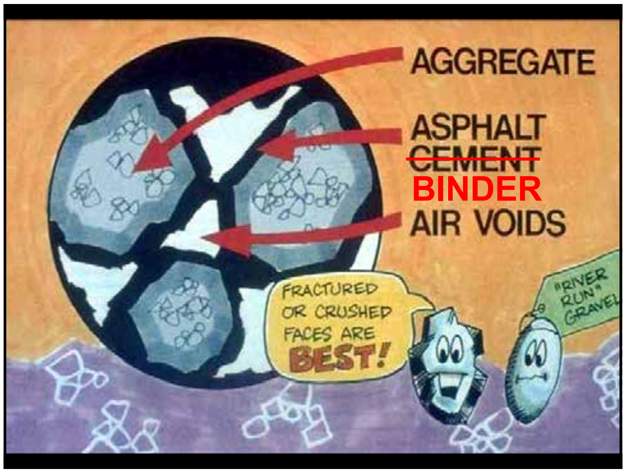
Compaction

- Compaction is the single most important factor that affects performance of asphalt
- Three main forces at work
  1. Compressive force of rollers
  2. Resistive forces of mixture
  3. Supportive forces of surface beneath

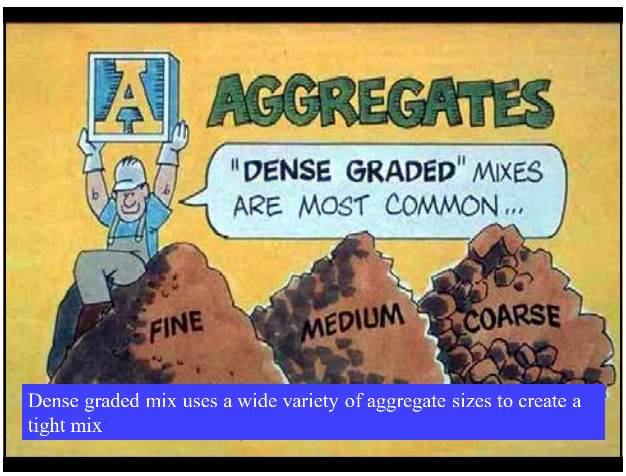
89



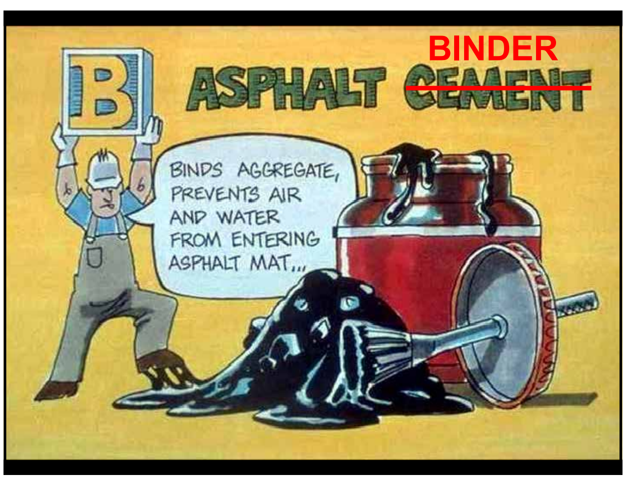
90


AGGREGATE
ASPHALT
~~CEMENT~~
BINDER
AIR VOIDS
FRACTURED OR CRUSHED FACES ARE BEST!
"RIVER RUN" GRAVEL

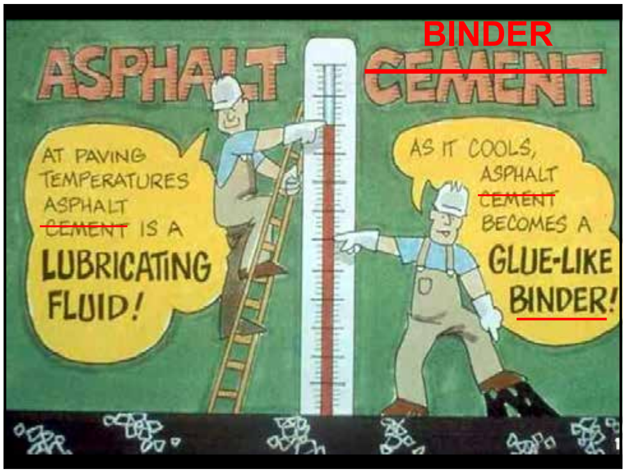
91


A
AGGREGATES
"DENSE GRADED" MIXES ARE MOST COMMON...
FINE
MEDIUM
COARSE
Dense graded mix uses a wide variety of aggregate sizes to create a tight mix

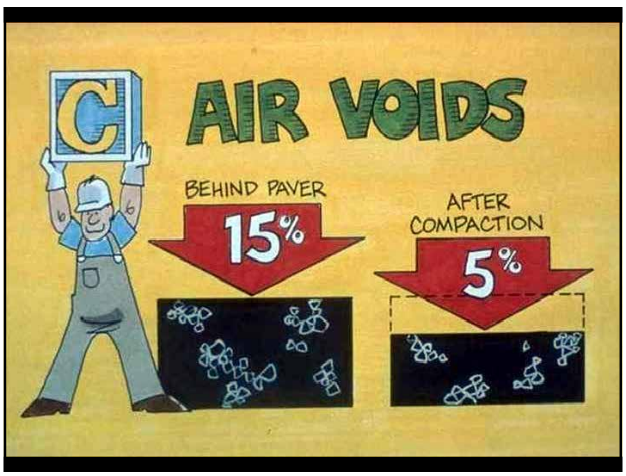
92


BINDER
B
ASPHALT ~~CEMENT~~
BINDS AGGREGATE, PREVENTS AIR AND WATER FROM ENTERING ASPHALT MAT...

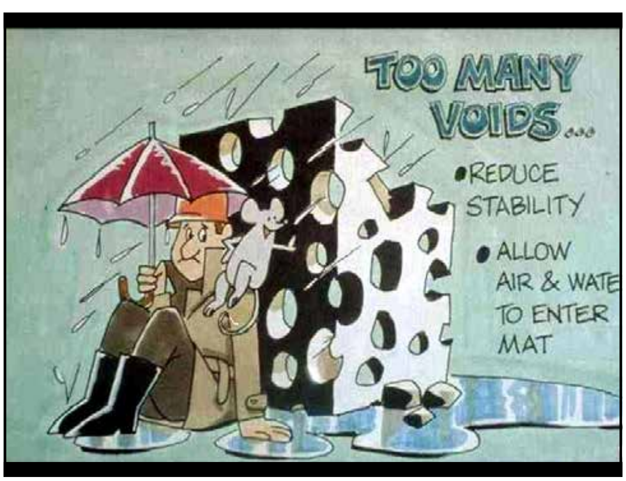
93


BINDER
ASPHALT ~~CEMENT~~
AT PAVING TEMPERATURES ASPHALT ~~CEMENT~~ IS A LUBRICATING FLUID!
AS IT COOLS, ASPHALT ~~CEMENT~~ BECOMES A GLUE-LIKE BINDER!

94


C
AIR VOIDS
BEHIND PAVER
15%
AFTER COMPACTION
5%

95


TOO MANY VOIDS...
•REDUCE STABILITY
•ALLOW AIR & WATE
TO ENTER MAT

96


1. increases stability
2. reduces air voids
3. provides smooth surface
COMPACTION

97


needed for
COMPACTION..
• mix confinement
• correct mix temperature
HOT MIX

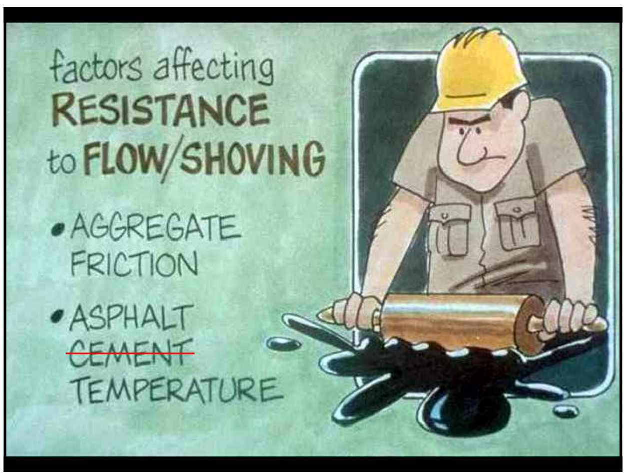
98


Confinement during mix design

99


ROLLER
TIRES
MAT
BASE
Confinement during mix placement

100


factors affecting
RESISTANCE
to FLOW/SHOVING
• AGGREGATE
FRICTION
• ASPHALT
~~CEMENT~~
TEMPERATURE

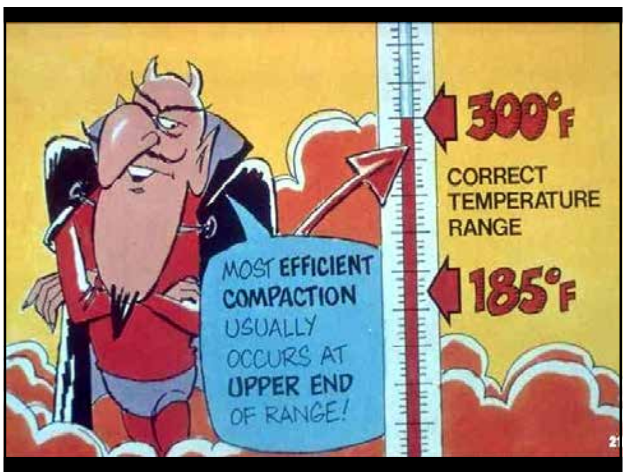
101


MIX TOO HOT!
ROLLER
DRUM

102


MIX TOO COLD!
ROLLER DRUM
AGGREGATE PARTICLES PREVENTED FROM COMPACTING

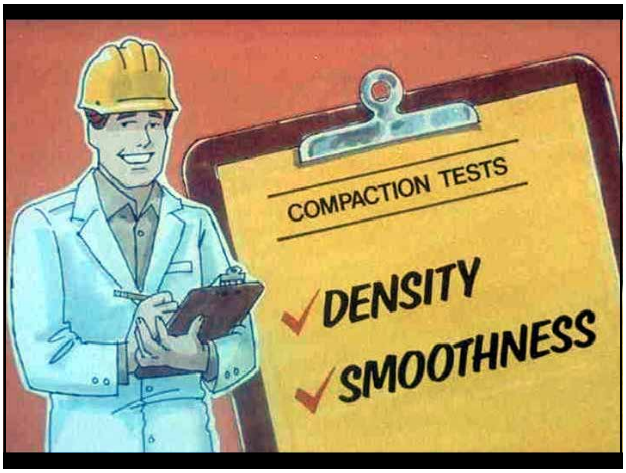
103


300°F
CORRECT TEMPERATURE RANGE
185°F
MOST EFFICIENT COMPACTION USUALLY OCCURS AT UPPER END OF RANGE!

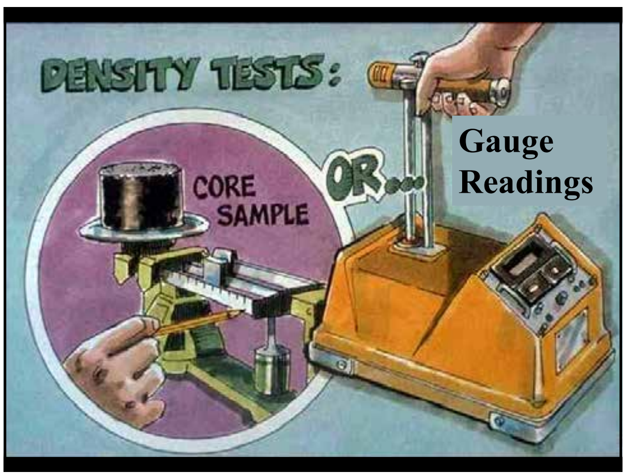
104


COMPACTION SUMMARY:
1. pack aggregate
2. reduce air voids
3. achieve smooth surface

105


COMPACTION TESTS
DENSITY
SMOOTHNESS

106


DENSITY TESTS:
CORE SAMPLE
OR...
Gauge Readings

107


Mean Roughness Index (MRI)

108

Classes of Compaction

- Class I Compaction
- Class II Compaction

109

Classes of Compaction

- Class I Compaction
  - **Base**, **Intermediate** & **Surface** courses for traffic lanes, ramps & loops on roadways.
  - Cores taken to determine density (air voids).
  - Payment determined by PWL for the daily lot, based on 8.5% upper specification limit and 0% lower spec. limit for field air voids.

110

Classes of Compaction

- Class I Compaction
  - Test Strips used to verify compaction effort (establish rolling pattern).
  - **Test Strip** required for **Surface** mixture on Interstate highways, Primary highways, and ramps connecting Interstate & Primary highways.
  - **Test Strip** required for **Intermediate** mixture on Interstate highways and Interstate-to-Interstate ramps.

111

Classes of Compaction

- Class II Compaction
  - Paved Shoulders, Temporary Crossovers, Onsite Detours, Base Widening in non-travel lane & wherever else Class I not specified.
  - Establish rolling pattern to achieve compaction.
  - Verification cores or gauge readings taken on first day of placement.
    - If average of field voids $\leq$ 8.0%, OK to go.
    - If > 8.0%, modify rolling pattern.
  - Periodically monitor rolling pattern.

112

Roller Operations

Breakdown roller

- First interaction between roller and the mat.
- Most contractors use a vibratory smooth drum roller to break down the mix, increase density and establish smoothness.
- Majority of density is obtained.
- Usually followed as close to the paver as possible

113

Roller Operations

Intermediate Roller

- May or may not be required on project.
- Most contractors use a pneumatic (rubber-tired) roller
- Used if adequate compaction cannot be achieved with break down roller or kneeding action of tires is needed.
- Operates at higher speeds than break down roller for more passes.

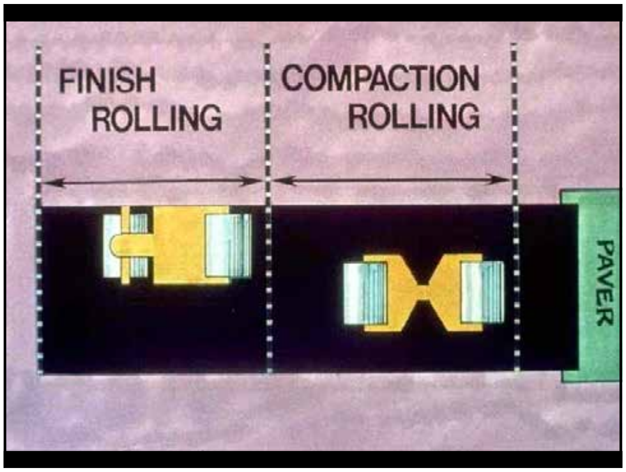
114

Roller Operations

Finish Roller

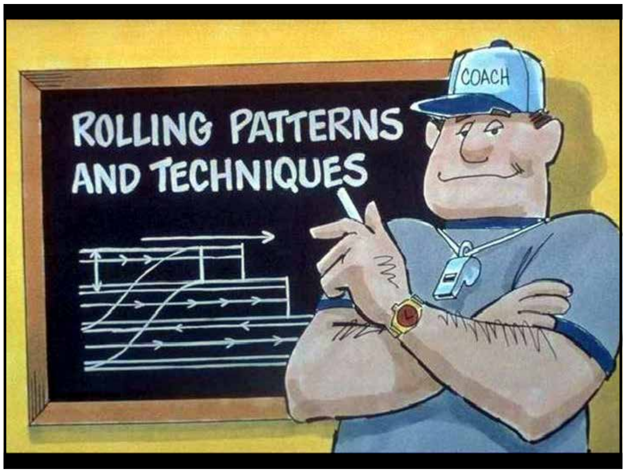
- Last step in the operation.
- Used to “iron” out roller marks left by previous rollers.
- Very little additional compaction by the finish roller
- Contractor uses static steel roller or vibratory roller in static mode.

115

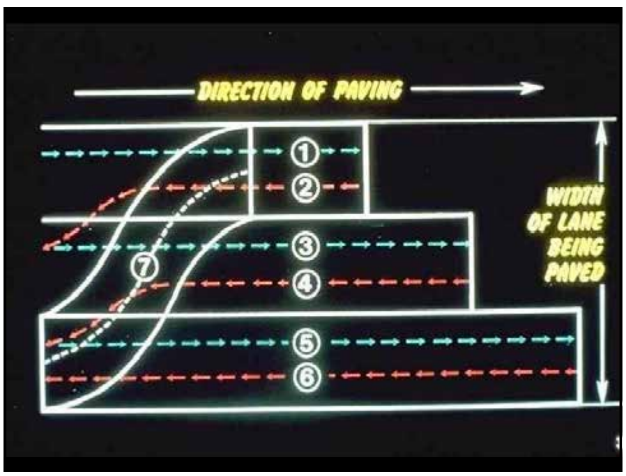


116

117


ROLLING PATTERNS
AND TECHNIQUES
COACH

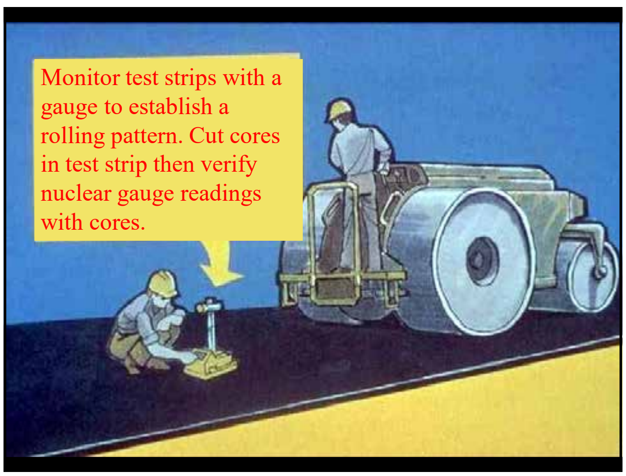
118


DIRECTION OF PAVING
1
2
3
4
5
6
7
WIDTH
OF LANE
BEING
PAVED

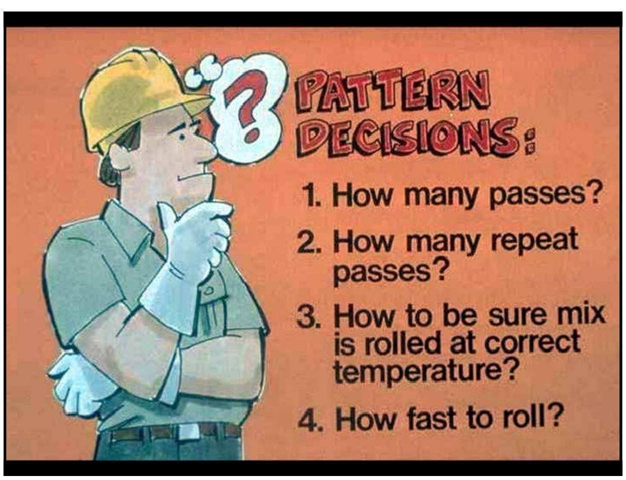
119

120

121


Monitor test strips with a gauge to establish a rolling pattern. Cut cores in test strip then verify nuclear gauge readings with cores.

122


PATTERN DECISIONS:
1. How many passes?
2. How many repeat passes?
3. How to be sure mix is rolled at correct temperature?
4. How fast to roll?

123

How to determine number of passes needed?

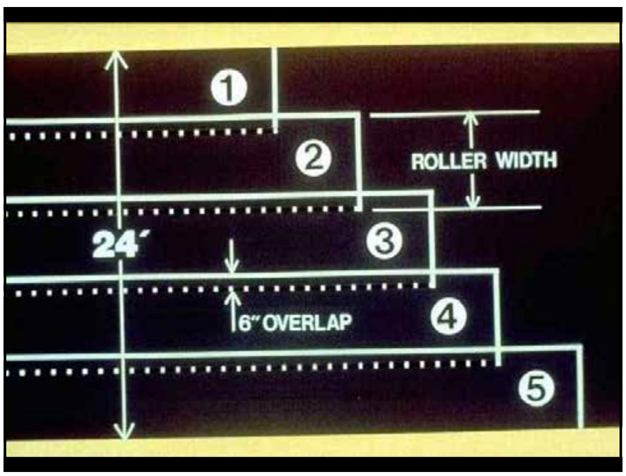
Class I Compaction

- When test strip required - determine number of passes with gauge and verify with cores.
- When no test strip is not required - contractor will determine number of passes. Usually based on contractor's previous experience - PWL applies

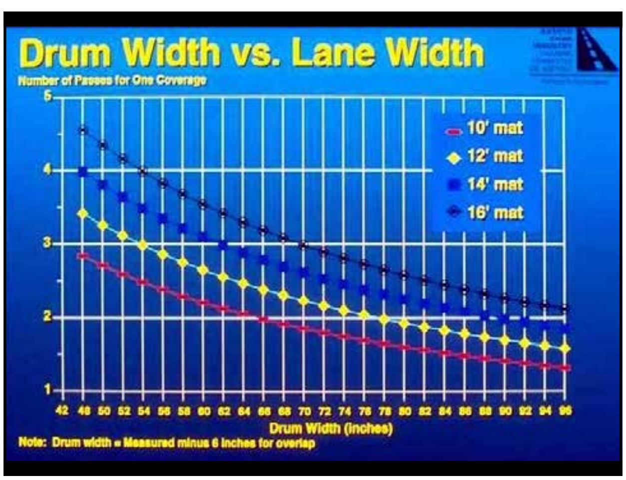
Class II Compaction

- Determined by process used to establish rolling pattern (gauge readings or cores) – PWL does not apply

124



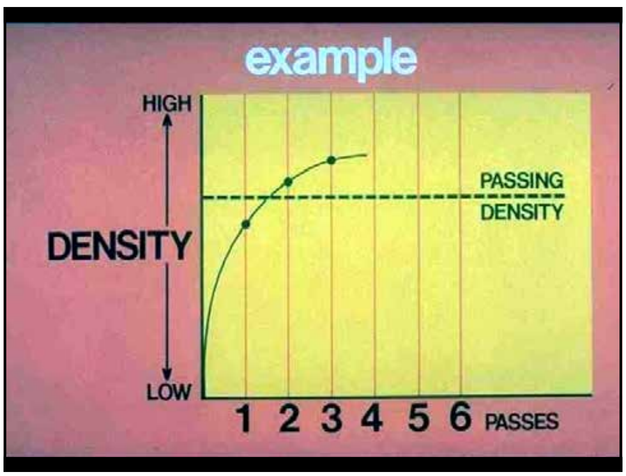
125



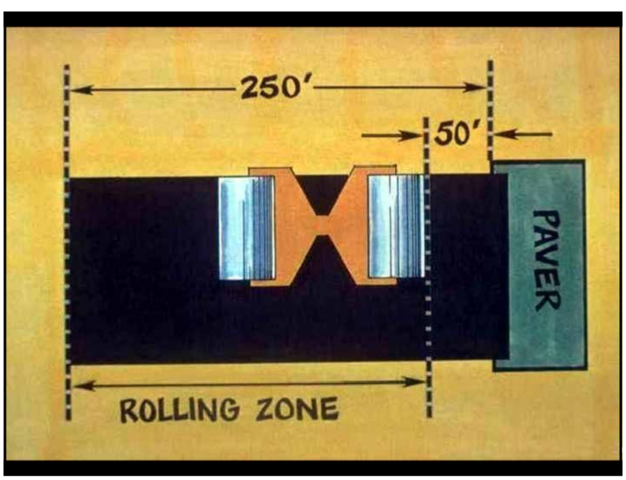
126


2...3...4...?
HOW MANY
REPEAT PASSES?

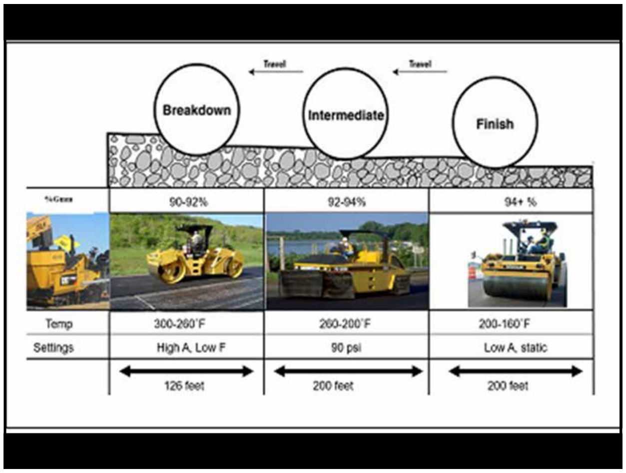
127


example
HIGH
DENSITY
LOW
PASSING
DENSITY
1 2 3 4 5 6 PASSES

128


250′
50′
PAVER
ROLLING ZONE

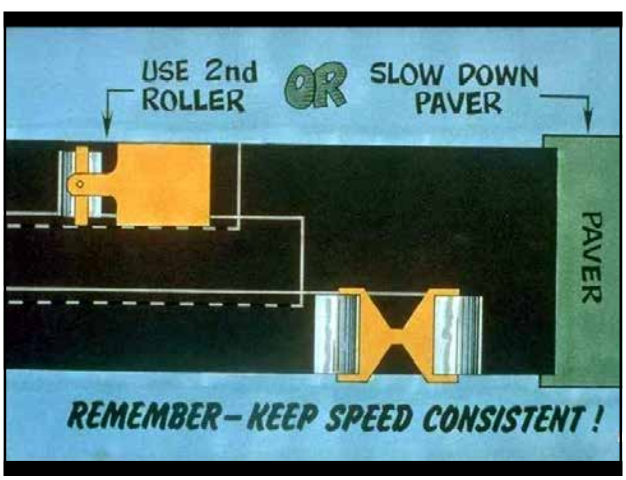
129



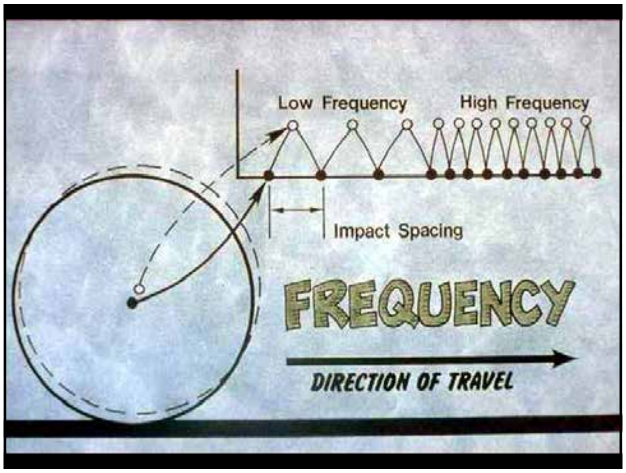
130

MAJOR FACTORS AFFECTING ROLLING TIME	allows MORE time	allows LESS time
MAT THICKNESS	THICK	THIN
MIX TEMPERATURE	HIGH	LOW
BASE TEMPERATURE	HIGH	LOW

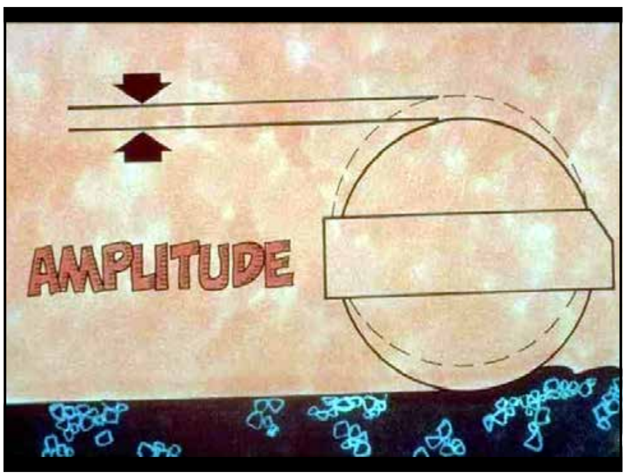
131



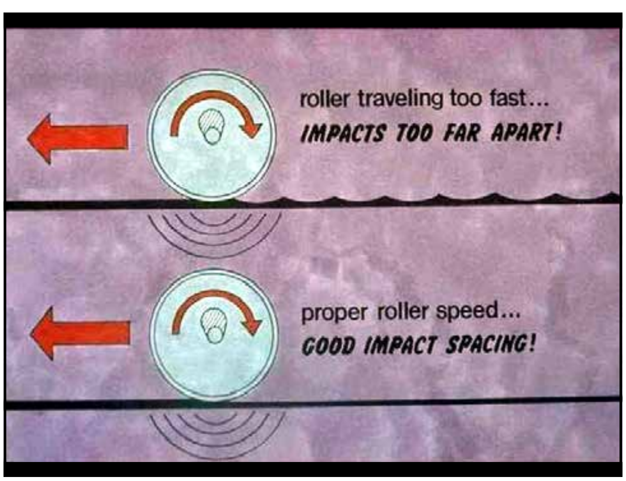
132


Low Frequency
High Frequency
Impact Spacing
FREQUENCY
DIRECTION OF TRAVEL

133

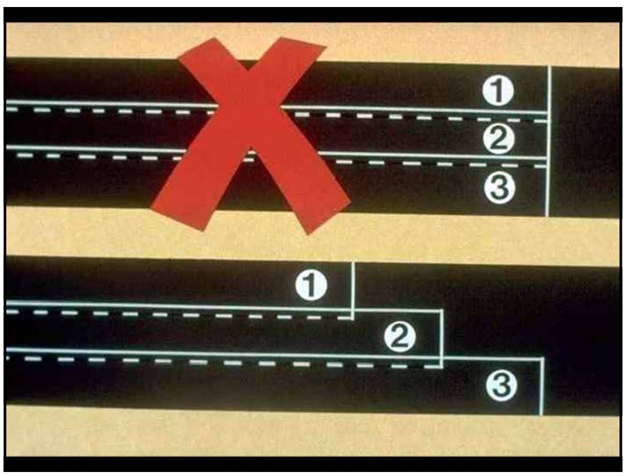

AMPLITUDE

134

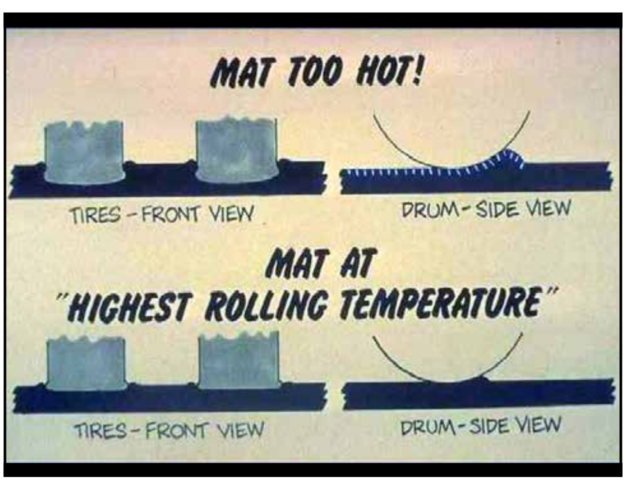

roller traveling too fast...
IMPACTS TOO FAR APART!
proper roller speed...
GOOD IMPACT SPACING!

135

136


1
2
3
1
2
3

137


MAT TOO HOT!
TIRES - FRONT VIEW
DRUM - SIDE VIEW
MAT AT
"HIGHEST ROLLING TEMPERATURE"
TIRES - FRONT VIEW
DRUM - SIDE VIEW

138

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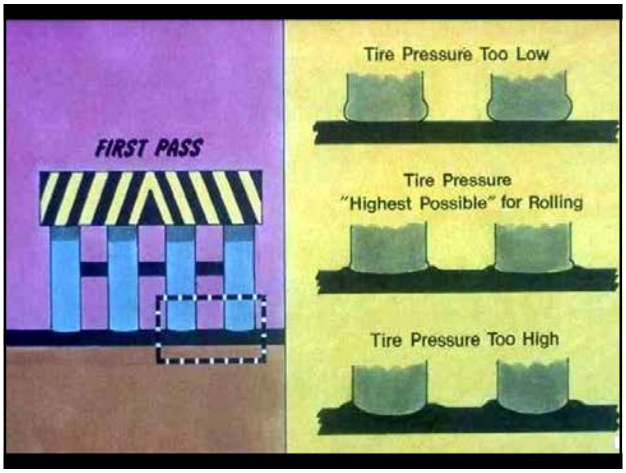
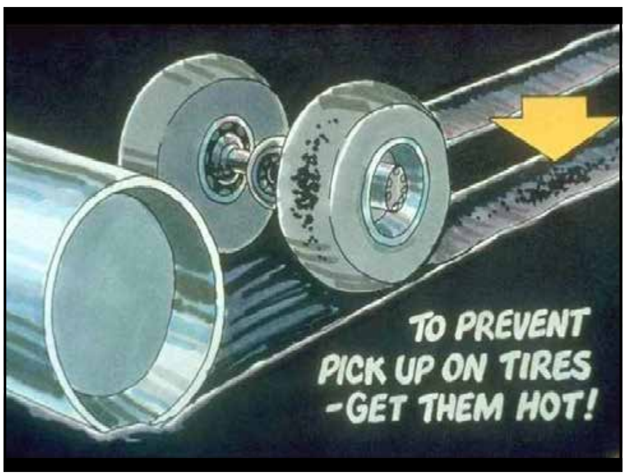
140

141


FIRST PASS
Tire Pressure Too Low
Tire Pressure
"Highest Possible" for Rolling
Tire Pressure Too High

142


TO PREVENT
PICK UP ON TIRES
-GET THEM HOT!

143

144

145

Longitudinal Joint Compaction

- Compact from hot side (not cold side)
  - compact while mat is hottest.
  - adjacent lane rarely available.
  - potential damage to cold mat.
- First pass 6” away from joint (optional).
  - confines mix near joint. (pinching the joint)
- Next pass overlaps 6” onto cold side.

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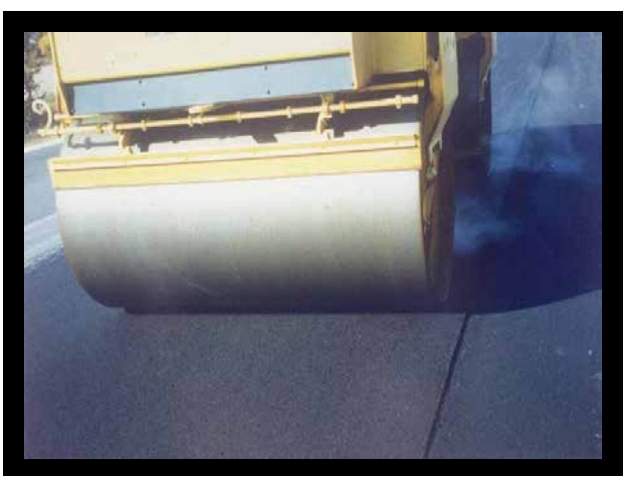
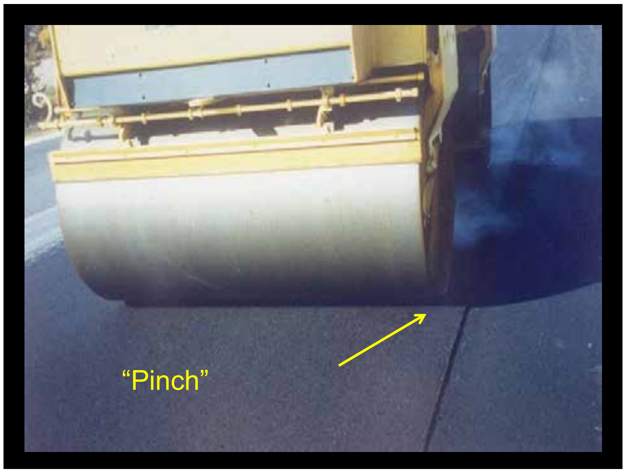
148

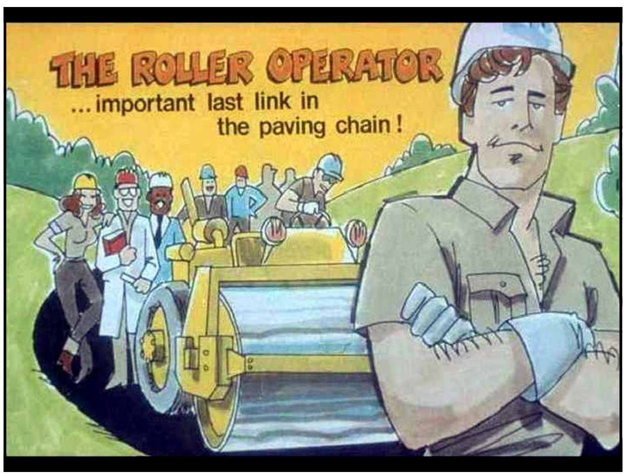
149



150


"Pinch"

151


THE ROLLER OPERATOR
...important last link in
the paving chain!

152

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LIMITATIONS &
MISC. OPERATIONS

Limitations & Miscellaneous Operations

1

Miscellaneous Operations

- High Performance Thin Lift Overlay
- HMA Interlayer
- Warm Mix Asphalt
- Recycled Asphalt Shingles
- Safety Edge
- Milled Rumble Strips
- Granular Shoulders

2

High Performance Thin Lift Overlay

- Asphalt mixes engineered specifically for pavement preservation. (not so much anymore)
- Benefits
  - Seals the surface
  - Provides a smoother ride
  - Extends pavement service life (5 to 10 years)
- Designed with aggregate gradations allowing placement as thin as 1".

3

High Performance Thin Lift Overlay

- **DS-23078** (Oct. 2023 - latest version)
- Binder and gradation selected to optimize mix flexibility, durability and rut resistance.
- Binder: PG 64-34E+
  - Highly polymerized (“E+”)
  - Flexible (min. 90% Recovery)
  - Very durable / rut resistant surface course
  - Sticky (efficient operations to keep temp’s. up)

4

High Performance Thin Lift Overlay

- Aggregate
  - 3/8” nominal max. aggregate size
  - Type A quality
  - 50% min. crushed content
  - Friction: Interstates – 30% Type 2 or better
    Non-Interstates – 50% Type 4 or better
- Dense Mix
  - High binder content (estimated ~ 8.0%)
  - Lab Voids target: </= 2.0% (shoot for ~ 1.0%)

5

High Performance Thin Lift Overlay

- Construction
  - Crown corrections by milling or intermediate
  - Normal tack coat application
  - Conventional placement
  - Compaction with static steel roller
  - No traffic until mat below 150 deg. F
- QC / QA
  - Lab Voids – sample from windrow or hopper
  - Field Voids –Visual Acceptance

6

7

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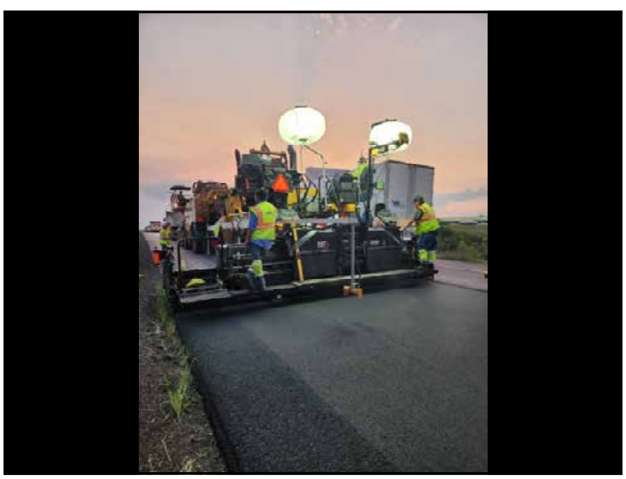


9

10

HMA Interlayer

- **SS-23005** (Oct. 2023 - latest version)
- Binder and gradation selected to optimize mix flexibility and stop / slow reflective cracking to surface course.
- Binder: PG 58-34E
  - Highly polymerized ("E")
  - Flexible (min. 80% Recovery)
  - Sticky (efficient operations to keep temp's. up)

11

HMA Interlayer

- Construction
  - Crown corrections by milling or scratch course
  - Conventional tack coat & mix placement
  - Compaction with static steel roller
  - No traffic until mat below 150 deg. F
  - Surface course required following Interlayer
- QC / QA
  - Lab Voids – sample from windrow or hopper
  - Field Voids – Visual Acceptance

12

Warm Mix Asphalt (WMA)

13

Warm Mix Asphalt (WMA)

- What is Warm Mix Asphalt?
  - group of technologies that allow production of asphalt mixtures at temperatures 50° F or more below conventional HMA.
  - lowers mix viscosity (resistance to flow).
  - allows aggregate to be fully coated and improve mix workability for compaction at lower temperature.

14

Warm Mix Asphalt (WMA)

- WMA Technologies
  - Chemical additives (Most Common in Iowa)
    - Dispersant / Emulsion
    - Reduce Surface Tension or Internal Friction
  - Organic (Wax) additives
    - Melt - decrease mix viscosity
  - Foaming of asphalt binder
    - Direct Water Injection
    - Zeolites – release held water (steam)

15

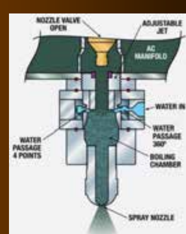
Warm Mix Asphalt (WMA)

- Organic / Wax (Sasobit)

16

Warm Mix Asphalt (WMA)

- Foaming – Water Injection (DB Green)



17

Warm Mix Asphalt (WMA)

- Zeolite (Aspha-min)

18

Warm Mix Asphalt (WMA)

- Advantages
  - Lower Mix Temperature
  - Reduced Burner Fuel Consumption
  - Reduced Plant Emissions
  - Improved Worker Conditions
  - Compaction Aid (stiff mixes / cool weather)
  - Less Binder Oxidation (pav't. more durable)
  - Increased Time Available (haul & compact)

19

Warm Mix Asphalt (WMA)

- Challenges
  - Moisture Control
    - Slower moisture removal at lower temperatures (longer aggregate drying times).
    - Requires better stockpile mgt. (aggregate & RAP) - stockpile drainage; covering stockpiles?
  - Potential Instability / Rutting
    - Tenderness
    - Delay opening to traffic ("cure")

20

Warm Mix Asphalt (WMA)

- Conditions on WMA Use
  - WMA use (vs. HMA) is contractor option.
  - Lower min. existing surface temp.
  - Lower production & placement temp's.

21

Recycled Asphalt Shingles (RAS)

22

Recycled Asphalt Shingles (RAS)

We Don't Use Much Anymore!

23

Recycled Asphalt Shingles (RAS)

- <u>Advantages</u>
  - Reduced landfilling
  - Replaces raw materials in mix
  - Cost savings
  - Desirable materials properties
    - High Binder Content (20-30% by weight)
    - Fibers (promote mix flexibility)

24

Recycled Asphalt Shingles (RAS)

- Challenges
  - Harder Asphalt Binder in RAS
    - “Bumping” virgin binder grades required?
  - “Black Rock” effect
    - Some of asphalt binder remains solid.
    - Chunks / clumping vs. fine (loose) grindings
  - Limited supply / suppliers for full scale use
    - Cost increases as demand exceeds supply.

25

Recycled Asphalt Shingles (RAS)

- Conditions on RAS Use
  - Processed from pre-consumer (factory scraps) or post-consumer (tear-off) shingles.
  - Certification from approved supplier.
  - Up to 5% RAS - by total weight of aggregate.
  - Two-thirds (67%) credit for asphalt binder in RAS.

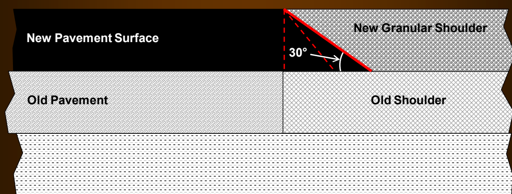
26

Recycled Asphalt Shingles (RAS)

- Conditions on RAS Use
  - RAS used in combination with RAP
    - RAS replaces equal % of allowable RAP.
  - RAS used in combination with WMA
    - WMA (softer) can offset required binder grade “bumping” due to RAS (stiffer).

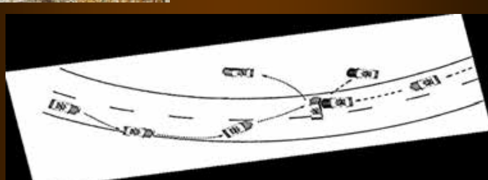
27

Safety Edge



28

Safety Edge



29

Safety Edge

30

Safety Edge

- Advant-Edger

31

Safety Edge

- <u>Benefits</u>
  - Reduced run-off-the-road accidents.
  - Safer re-entry (recovery) of errant vehicles.
  - Less critical timeframe for filling edge ruts.
  - Eliminates need for temporary granular safety fillet prior to opening lane to traffic.
    - Contractor efficiency / cost savings
    - Keeps trucks & equipment off fresh HMA mat

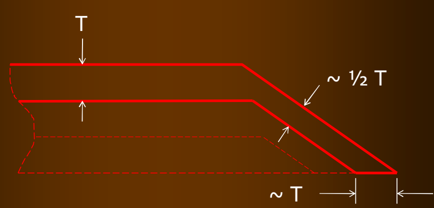
32

Safety Edge

- Criteria for Safety Edge use
  - Required for unwidened pavement sections or sections with paved shoulders < 4’ wide.
  - <u>Not</u> required for pavement sections with paved shoulders 4’ or greater in width, or for interchange ramps & loops.
- Contract Documents
  - Standard Specification Section 2305
  - Standard Road Plan PV-3

33

Safety Edge



34

Safety Edge

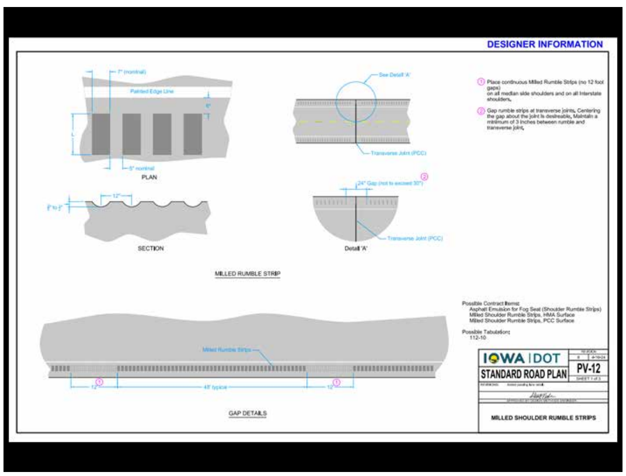
35

Milled Shoulder Rumble Strips

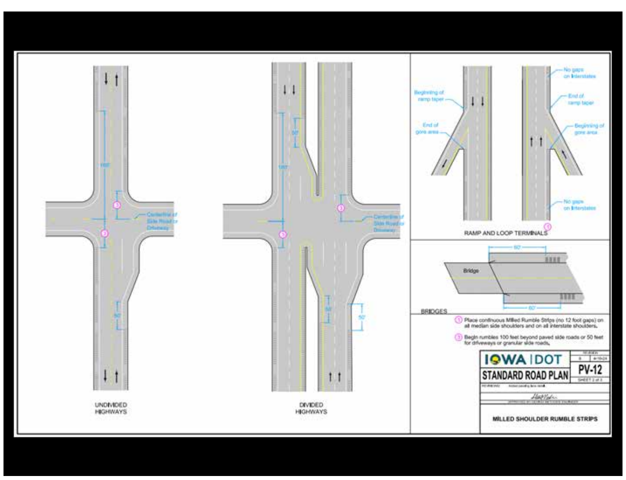
- Alert drivers leaving the mainline lane.
- Prevention of run-off-the-road accidents.
- Milled into adjacent paved shoulder.
- Milled thru traffic markings
  - outside lane line
  - narrow pavements
  - creates “rumble stripe” effect

36

37


DESIGNER INFORMATION
7" (nominal)
Painted Edge Line
5" nominal
PLAN
See Detail 'A'
Transverse Joint (PCC)
SECTION
24" Gap (not to exceed 30")
Transverse Joint (PCC)
Detail 'A'
MILLED RUMBLE STRIP
1 Place continuous Milled Rumble Strips (no 12 foot gaps) on all median side shoulders and on all Interstate shoulders.
2 Gap rumble strips at transverse joints. Centering the gap about the joint is desireable. Maintain a minimum of 3 inches between rumble and transverse joint.
Possible Contract Items:
Asphalt Emulsion for Fog Seal (Shoulder Rumble Strips)
Milled Shoulder Rumble Strips, HMA Surface
Milled Shoulder Rumble Strips, PCC Surface
Possible Tabulation:
112-10
Milled Rumble Strips
12'
48' typical
12'
GAP DETAILS
IOWA DOT
STANDARD ROAD PLAN
PV-12
MILLED SHOULDER RUMBLE STRIPS

38


UNDIVIDED HIGHWAYS
DIVIDED HIGHWAYS
Beginning of ramp taper
End of gore area
No gaps on Interstates
End of ramp taper
Beginning of gore area
No gaps on Interstates
RAMP AND LOOP TERMINALS
Bridge
60'
60'
BRIDGES
1 Place continuous Milled Rumble Strips (no 12 foot gaps) on all median side shoulders and on all interstate shoulders.
3 Begin rumbles 100 feet beyond paved side roads or 50 feet for driveways or granular side roads.
IOWA DOT
STANDARD ROAD PLAN
PV-12
MILLED SHOULDER RUMBLE STRIPS

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41

42

43

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46

47

Milled Centerline Rumble Strips

- Prevention of cross-road accidents.
- Unique gapped milling pattern
  - skip every third cut
  - audible difference from shoulders
- Traffic markings thru milled areas
  - creates “rumble stripe” effect
  - Need to be fog sealed but not all doing
  - Clear sealants are an option but further testing being conducted

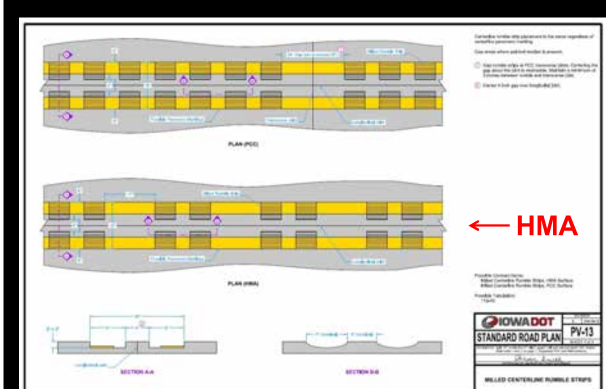
48

Milled Centerline Rumble Strips

- Original design milled thru CL joint
  - Opens up (exposes) the joint
  - No sealing compounds the problem
  - Water ponding at joint
  - Freeze / thaw action
  - Raveling (progressive damage)
- Investigated milled RS to “gap” the joint.
- Revised Standard Road Plan PV-13.

49

50

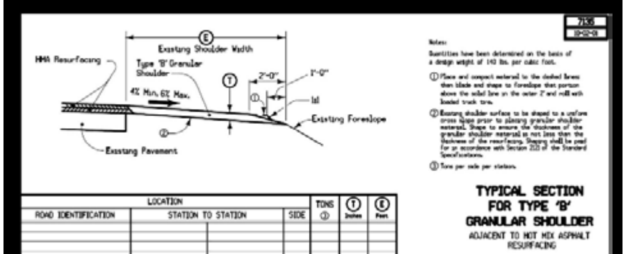


51

Granular Shoulders

- Bring up to design cross section
- Eliminate drop off
- Rock dumped on shoulder - <u>not</u> pavement
- Compaction (Type “B”)
  - 4 roller coverages (min.) – pneumatic or steel
  - 1 finish coverage - steel
  - additional moistening if required

52



53

54

Limitation of Operations

- Public safety and convenience
- Mat surface conditions
- Mix temperature
- Calendar dates
- Winter shutdown

55

Public Safety and Convenience

- On the road / Off the road times
- Haul road conditions

56

On / Off the Road Times

- Normal working hours
  - start 30 minutes after sunrise
  - end 30 minutes before sunset
- Sunrise & Sunset times?
- Sources of information
  - Smartphone Apps
  - Websites

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Haul Roads

- Designated route to haul material to job site
- Agreement with local jurisdiction
- Watch for unauthorized routes
  - shortcuts
  - potential damages
- Monitor haul road conditions
  - maintenance
  - dust control

58

Mat Surface Conditions

- Wet or damp conditions
  - paving not allowed by spec's. (2303.03,C)
  - sliding or slippage of mat
  - room for judgement

59

60

Wet or Damp Conditions

- Weather forecasts & radar
- Rain stops, trucks waiting - what to do?
  - weather window of opportunity?
  - dry pavement artificially?
  - mix temperature?
  - tack coat condition?

61

Mat Surface Conditions

- Surface Temperature
  - tables in spec's. (2303.03,C) show minimum surface temp's.
  - based on lift thickness
  - based on lift location (base, intermediate, or surface course)
  - based on HMA or WMA use

62

Mat Surface Conditions

"The Engineer may further limit placement if, in the Engineer's judgment, other conditions are detrimental to quality work."

63

Mat Surface Conditions

- Other limiting factors
  - air temperature
  - wind speed
  - sky conditions
- Time available for compaction
  - charts & tables
  - PaveCool software

64

Mix Temperatures - HMA

- Production Temperatures
  - maximum temperature = 330 deg. F *
  - minimum temperature = 225 deg. F
  - no discharge into paver, if HMA less than:
    245 deg. F for layer 1.5” thick or less
    225 deg. F for layer > 1.5” thick

  * 335 deg. F allowed for HP Thin Lift Overlay

65

Mix Temperatures - WMA

- Production Temperatures
  - maximum temperature = 280 deg. F
    (maximum temperature = 330 deg. F before May 1st and after Oct. 1st)
  - minimum temperature = 215 deg. F
  - do not produce WMA more than 10 deg. F below target temperature designated in JMF (unless approved by Engineer).

66

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Calendar Dates

- HMA mixtures shall not be placed after November 15th, except with approval of the Engineer.

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Cold Weather Paving

- Running out of time and good weather (temperature) in late Fall
- Want / need to get to a certain completion point before winter shutdown
  - Mainline lanes open
  - Eliminate traffic shifts and drop-offs
  - Meet production goals
- Standard way of handling situation and assignment of risk

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Cold Weather Paving

- New specification
  - Based on WI DOT specification
- **GS-15011** (effective Oct. 2020)
- Language included in **Section 2303**
  - **2303.03, F.** Construction
  - **2303.04, H.** Method of Measurement
  - **2303.05, H.** Basis of Payment

70

Cold Weather Paving

- "Cold Weather Paving"
  - Paving when road surface temperature is below requirements shown in **Tables 2303.03-1** and **2303.03-2**, or air temperature is less than 40°F.
- **Cold Weather Paving Plan**
  - Written plan submitted (timely) by Contractor.
  - Reviewed & accepted by Engineer (RCE).
  - Acceptance of Cold Weather Paving Plan does not relieve Contractor of quality requirements*.

71

Cold Weather Paving Plan

- Approved Mix Design with Warm Mix Additive
  - Identify warm mix additive and dosage rate
  - Foaming by water injection is not an option
- Why use Warm Mix?
  - Compaction aid – mix stays flexible longer
  - Allows placing & compaction at lower temp's.
  - Increases time available for compaction

72

Cold Weather Paving Plan

- Material, operational & equipment changes to be used for Cold Weather Paving
  - Identify modifications to compaction process and when they apply
    - Add second breakdown roller
    - Shorten rolling patterns (rollers closer to paver)
  - Other “Best Practices” for the situation
    - Increase mix temperature at plant (within limit)
    - Dump mix directly into paver (or MTV) hopper
    - Insulate haul trucks & trailers

73

Cold Weather Paving

- Limitations
  - No placement over frozen subgrade or base, or where roadbed is unstable.
  - Engineer may further limit placement if existing conditions are deemed detrimental to quality work.
    - Precipitation
    - Extreme temperatures
    - High Winds

74

Cold Weather Paving

- Add’l. payment for Cold Weather Paving
  - Cold weather paving is permitted by Engineer.
  - $3.00 per ton of mix (with WMA additive).
- <u>No</u> payment for WMA additive when:
  - Pay Factor for Field Voids < 1.0 **(Class I)**
  - Compaction is <u>not</u> thorough/effective. **(Class II)**
  - Liquidated damages are being assessed

75

Cold Weather Paving

- ***Article 2303.05, H, 3**

"If because of an excusable compensable delay, **the Engineer directs Contractor to pave when temperatures meet cold weather definition**, the Contracting Authority will relieve Contractor of responsibility for damage and defects the Engineer attributes to cold weather paving."

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Winter Shutdown

- Granular shoulders
  - full width
  - at design slope
- Scarification
  - cover with one full lift of HMA
- Headers
  - located across from each other

77

Winter Shutdown

- Temporary runouts
  - 25' per inch
  - removal required (incidental)
- Cold in-place recycling
  - cover with one full lift of HMA
- Pavement markings
  - place edge lines, symbols, etc. (as per spec.)
  - add'l. markings at contract unit price

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PROBLEMS & SOLUTIONS

Problems & Solutions

1

Mat Problems

- Segregation
- Tack Coat Application
- Flushing / Bleeding
- Tender Mix
- Mix Pickup
- Roller Marks
- Wavy Surface

2

Mix Segregation

(Construction Manual sections 2.53 & Appendix 2-34)

- Non-uniform distribution of various aggregate sizes.
- “Coarse” or “Open” areas.
- Inconsistent surface texture, smoothness or mat density.
- Increased maintenance due to raveling and premature cracking.

3

Mix Segregation Types

- Random
- Truckload Interval
- Longitudinal

4

Random Segregation

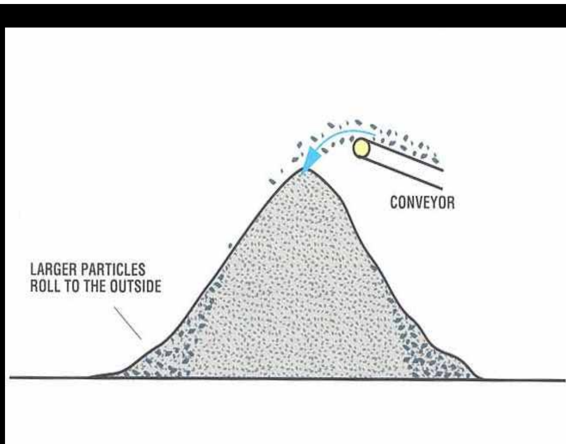
- Coarse aggregate “rock pockets”.
- Random locations.
- Causes:
  – Improper handling of aggregates at plant
    - stockpiles
    - cold feed bins
  – Drum mix (continuous) plants.

5

6

Aggregate Handling & Stockpiling

7



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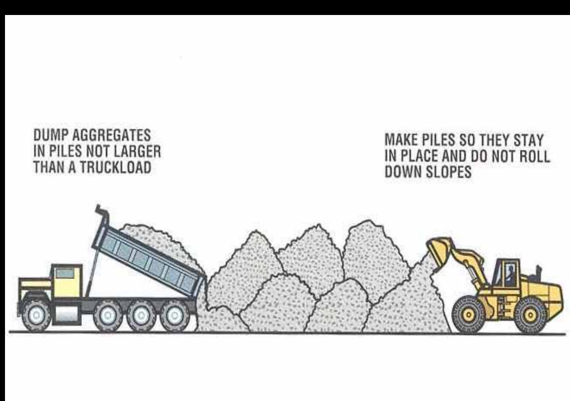

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10

Truckload Interval Segregation

- Crescent or chevron shaped spots.
- Occur at end / beginning of loads.
- Causes:
  - – Delivery operations
    - Haul truck loading (if placed in one drop vs 2 or 3)
    - Haul truck unloading (we want one mass movement to flood the hopper so larger aggregate doesn't segregate)
  - – Paver operations
    - Paver hopper level fluctuations
    - Dumping paver hopper wings

11

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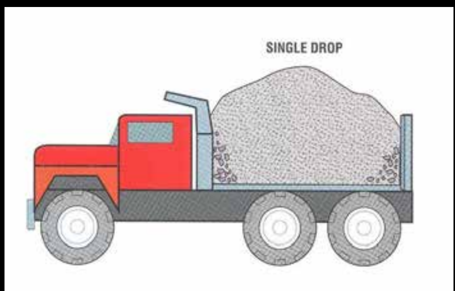
Truck Loading

14



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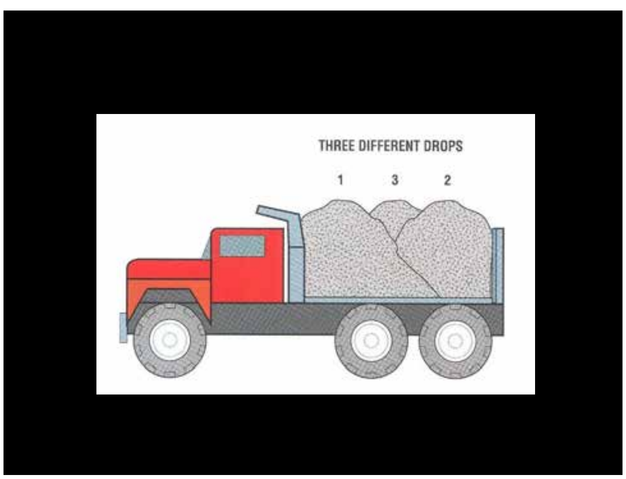
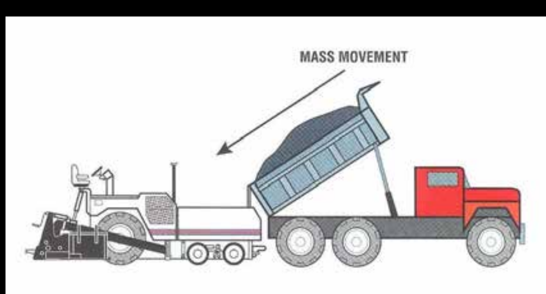


18

19

Truck Unloading

20



21

22

Longitudinal Segregation

- Continuous strip(s) of coarse aggregate.
- Disruption of uniform material flow.
- “Roll down” of coarse aggregate.
- Causes:
  - Paver’s material handling system
    - center auger gear box
    - auger (bearing) supports
    - outer edges of slat conveyors

23

24

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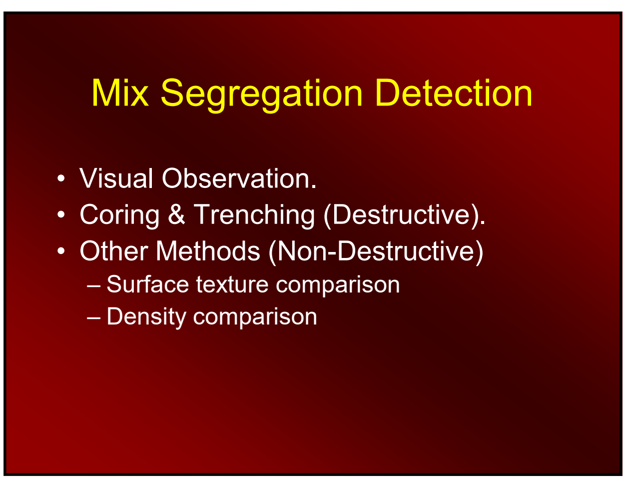
26


Mix Segregation Detection
• Visual Observation.
• Coring & Trenching (Destructive).
• Other Methods (Non-Destructive)
– Surface texture comparison
– Density comparison

27

Identifying Mix Segregation

- Visual observation of the mat
  - behind paver and rollers
  - sun low in sky
  - wet / damp pavement
- Non-uniform coarse appearance.
- Notify contractor and supervisor.
- C.M. Section 2.53 & Appendix 2-34(K)
  - price adjustment guidance & examples

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"Thermal" Segregation

- Mat temperature differentials (cool areas).
- Causes:
  - delays at plant or in delivery operations
  - inconsistent paving operations
- Results:
  - waves / inconsistent ride quality
  - lack of density
  - premature deterioration

29

30

Thermal Imaging Camera

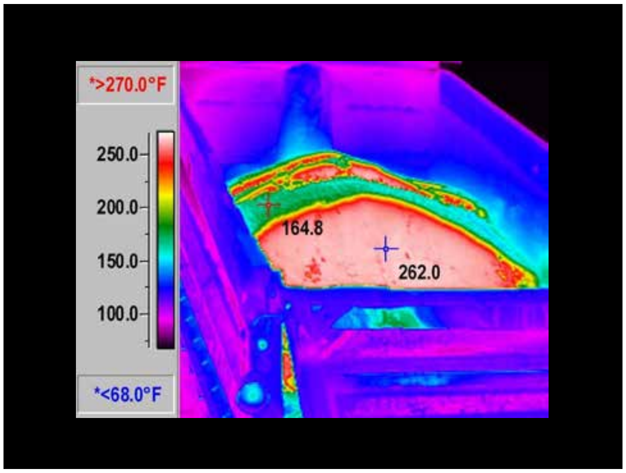
31

Pave IR - Bar

32

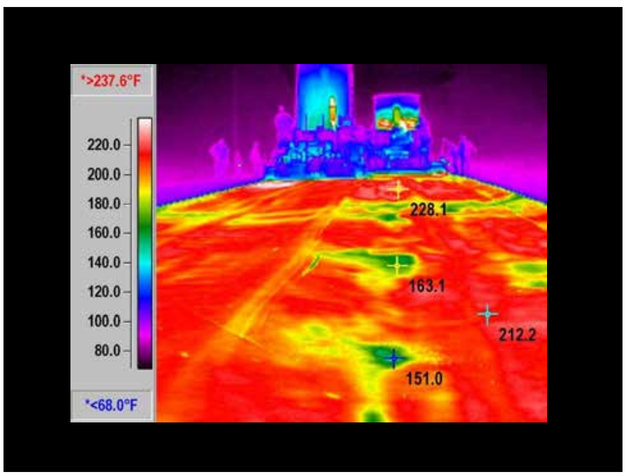
Pave IR - Scan

33



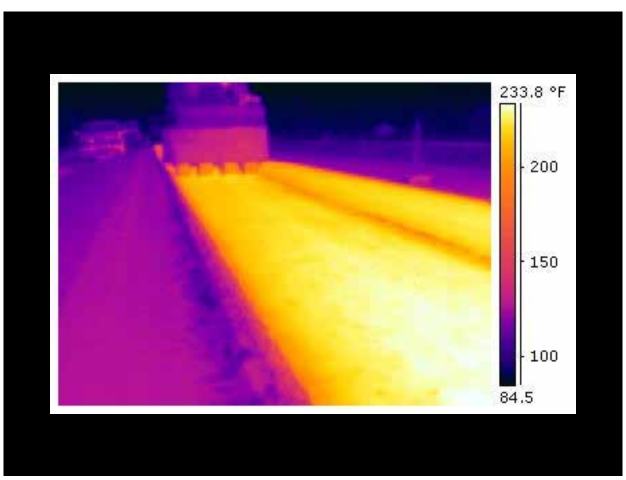
*>270.0°F
250.0
200.0
150.0
100.0
164.8
262.0
*<68.0°F

34



*>237.6°F
220.0
200.0
180.0
160.0
140.0
120.0
100.0
80.0
228.1
163.1
212.2
151.0
*<68.0°F

35



233.8 °F
200
150
100
84.5

36

Segregation Cure?

37

38

39

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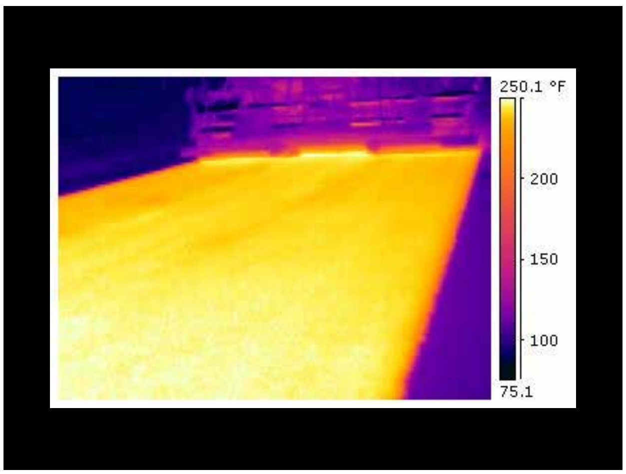

41

Identifying Thermal Segregation

- Non-uniform temperature distribution
  - longitudinal
  - transverse
- Temperature monitoring
  - at plant
  - behind paver
- Thermal imaging
  - infrared cameras

42

Levels of Segregation
(Slight Segregation)


43

Levels of Segregation
(Moderate Segregation)


44

Levels of Segregation
(Severe Segregation)


45

Tack Coat Application

- Application rate
  - too little results in little bond between layers.
  - too much results in sliding/slippage of layers and bleeding to surface.
- Uniform application.
- Overlay after tack "breaks"
  - Water evaporates from emulsion.
  - Changes from brown to black.

46

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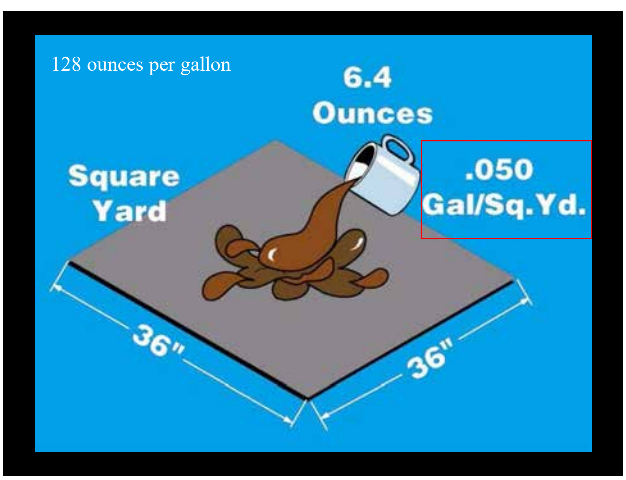
Tack Coat Application Rate

- Application Rate – lane to be covered
  - undiluted rate based on situation / conditions:

New HMA Surface: **0.03** to **0.05** gal. / SY
PCC / Exist. HMA Surface: **0.04** to **0.06** gal. / SY
Milled HMA / CIR Surface: **0.05** to **0.07** gal. / SY

  - emulsion may be diluted with water (up to 1:1) to improve application, with corresponding increase in application rate.

53



54

Tack Coat Application Rate

- Vertical face of longitudinal joint
  - undiluted rate: **0.10** to **0.15** gal. / sq. yd.
  - tacked as a separate operation.
- Yield
  - tack quantity from contractor (daily).
  - calculate yield based on area covered.
  - evaluate undiluted rate based on conditions.

55

Uniform Tack Coat Application

56

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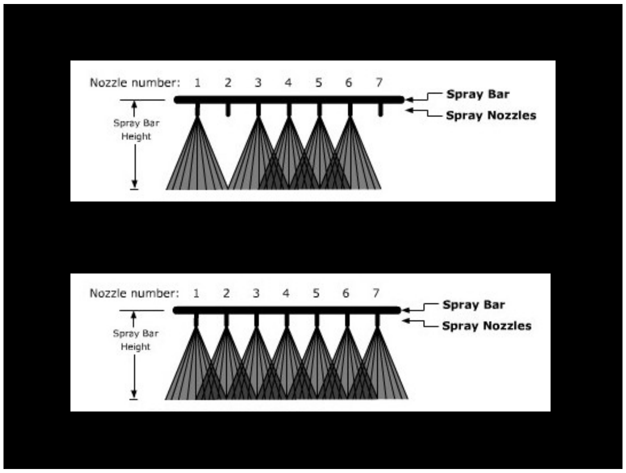

Nozzle number: 1 2 3 4 5 6 7
Spray Bar
Spray Nozzles
Spray Bar Height
Nozzle number: 1 2 3 4 5 6 7
Spray Bar
Spray Nozzles
Spray Bar Height

61

3257

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63

64

Flushing or Bleeding

- Upward movement of asphalt binder in mix that forms a film on surface.
- Safety concerns.
- Excess asphalt binder in mix
  - plant mix too rich
  - tack coat too heavy
  - solvent in mix

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66

67


DIESEL FUEL
CANNOT BE USED AS A
RELEASE AGENT.
IF YOU HAVE ANY QUESTIONS
TALK TO THE PLANT FOREMAN

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Mix Tenderness

- High Temperature Tenderness
- Mid-Range Tenderness

73

High Temperature Tenderness

- Mix pushes and shoves under initial breakdown rollers.
- Low viscosity at high temperatures
  - excess sand
  - excess binder / wrong binder
- Solutions
  - delay breakdown rolling
  - mix changes (aggregate, binder)

74

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Mid-Range Tenderness

- Mix pushes and shoves under rollers within certain temperature range.
  – tearing of mat
  – decompaction
- "Tender Zone"
  – varies with mix
  – 200 to 240 degrees F
- Possible cause - trapped moisture in rock.

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Tender Zone - Solutions

- Pneumatic roller in tender zone (?)
  – mix pick-up and tire marks can be an issue in tender zone.
- Breakdown roller above tender zone.
  – keep vibratory roller(s) close to paver
  – may require additional rollers
- Finish rolling below tender zone.

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Mix Pickup

- Mix Pickup
  - fines stick to roller - pulled from surface
  - “segregation” effect
  - patties, rough texture
  - polymer modified binders are worse
- Solutions
  - keep roller tires hot
  - drums, tires clean
  - release agents

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Roller Marks

- Mix tenderness
- High tire pressures
- Rolling techniques
  - roller speed
  - abrupt turns
  - no drum turn when reversing
  - rolling pattern variations
  - stopping on hot mat

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Wavy Surface

- Thickness and temperature fluctuations.
- Non-uniform compaction.
- Poor ride quality.
- Delivery
  - inconsistent plant operation / breakdown
  - lack of trucks
  - bunching of trucks
  - inconsistent windrow length

94

Wavy Surface

- Paver
  - inconsistent paver speed
  - hopper level
  - head of material
  - grade controls
  - feeder screws

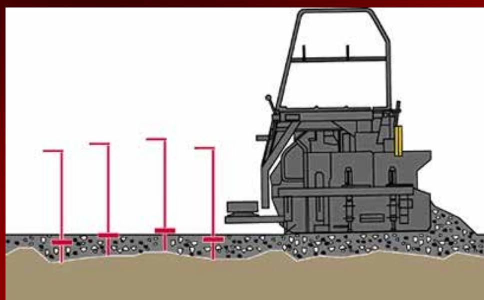
95

Wavy Surface

- Vibratory roller
  - excessive speed
  - frequency too low
  - inconsistent roller speed
  - varying rolling pattern

96

Multiple depth checks



97

Mat Problems (cont.)

- Reflective Cracks & Bumps
- Cracking
- Rutting
- Crushing Aggregate
- Matching Centerline Joints
- Screed Marks / Mat Texture
- Other Problems

98

Reflective Cracks & Bumps

- First lift of resurfacing over filled joints.
  - lack of smoothness
  - cracking & deterioration
- Preventive measures
  - keep Maintenance “in the loop” (no crack / joint sealing prior to overlay)
  - remove all loose or excess joint material
  - tack application rate

99

Reflective Bumps

- Possible solutions
  - tight blading prior to subsequent lifts.
  - breakdown with pneumatic / static roller.
  - lower mix temperature.
  - Warm Mix Asphalt (long-term solution?)

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Cracking Types

- Checking
- Longitudinal Cracking
- Low Temperature Cracking
- Fatigue Cracking
- Reflection Cracking

105

Checking

- Short transverse cracks, approximately 1/2 in. deep.
- Possible causes:
  - mix properties or overheated mix.
  - roller too heavy or over-rolling.
- Reduced by:
  - changes at plant.
  - changing rollers or rolling zone.

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Longitudinal Cracking

- Continuous band of coarse segregation.
- Paver related problem
  - disruption in flow of material
  - coarse aggregate roll-down
- Best practices to eliminate problem:
  - keep hopper (consistently) near full
  - watch for obstructions to uniform flow
  - adjustments to paver (baffles, deflectors, etc.)

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114

Low Temperature Cracking

- Transverse cracks in full depth pavement.
- Environmental distress
  - stresses & strains due to temp. change
  - not traffic or aggregate related
- Asphalt binder plays key role
  - use softer asphalt binder for low temp's.
  - use asphalt binder less prone to aging

115

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Fatigue Cracking

- Distress in wheelpaths.
- Progressive damage
  - longitudinal cracking
  - alligator cracking
  - potholes
- Failure modes
  - pavement structure (materials, thickness)
  - subgrade failure

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Reflection Cracking

- Overlay of cracked or jointed pavement.
- Crack pattern same as underlying pav't.
- Reflect thru overlay at approx. 1" per year.
- Possible Treatments
  - fabrics, membranes (delay – not worth cost)
  - HMA Interlayer (effective – increased cost)
  - Crack & Seat / Rubblization (last resort)

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HMA Interlayer

- Heavily polymerized pavement layer.
- Typically 1” to 1-1/2” thick lift.
- Placed prior to intermediate & surface lifts.
- Very flexible (absorbs stresses).
- Prevents cracks from reflecting through into new overlay.
- Results so far → greatly reduced cracking

124

Rutting

- Permanent deformation in wheel paths.
- High temperatures with heavy axle loads.
- Failure of underlying base.
- Rutting of HMA pavement.
- Pavement design
  - aggregate selection & gradation
  - asphalt binder grade selection

125

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Asphalt Binder Specification

130

Asphalt Binder Specification

- Grading system based on climate
- Temperature range to resist failure modes

131

Asphalt Binder Specification

Example: PG 58-28

132

Asphalt Binder Specification

Example: PG 58-28

PG = Performance Grade

133

Asphalt Binder Specification

Example: PG 58-28

PG = Performance Grade

58 = 58 deg. C (max. pav't. design temp.)
>high temp. grade protects against rutting

134

Asphalt Binder Specification

Example: PG 58-28

PG = Performance Grade

58 = 58 deg. C (max. pav't. design temp.)
>high temp. grade protects against rutting

-28 = -28 deg. C (min. pav't. design temp.)
>low temp. grade resists thermal cracking

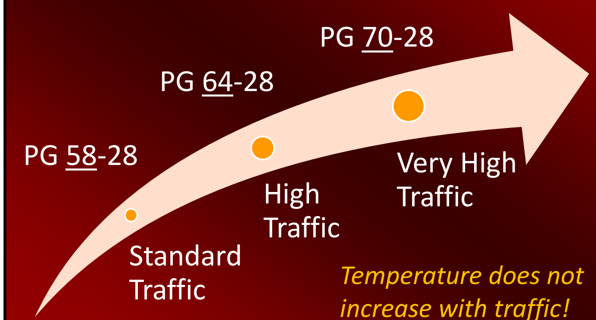
135

Asphalt Binder Designations Changes (2017)

- Designations to match actual climate (temperatures) in Iowa.
- Avoid over-specifying binders.
- Standardize with other Midwest states.

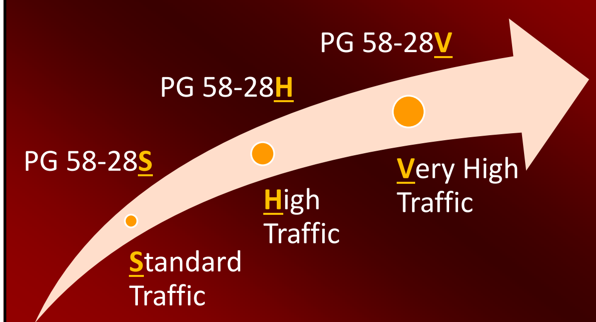
136

Old PG Binder Designations



137

New PG Binder Designations



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New Asphalt Mix Designations

- ST = Standard Traffic
- HT = High Traffic
- VT = Very High Traffic

- "E" designation = Extremely High Traffic
- Based on Traffic Level (ESAL's)

139

Asphalt Reference Guide Update

- **2023 - DOT**
  Version

  (Front)

140

Asphalt Reference Guide Update

- **2023 - DOT**
  Version

  (Back)

141

Crushing Aggregate

- White spots on surface after rolling.
- Rolling cold mat.
- Mat lift thickness - early Superpave mixes.
- Design (choose) lift thickness 3 to 4 times nominal maximum aggregate size.
- Vibratory roller
  - LOW amplitude & HIGH frequency
  - “massage” the mix

142

143

Aggregate Size vs. Depth

144

Longitudinal Joint Construction

- Get the first lane placed correctly.
  - straight, stay on-line
  - sufficient mix at end of screed
  - end gate to confine mix; uniform edge
- Stringline
  - centerline nails
  - extra nails in curves to reduce chords
  - paint to mark string

145

146

Longitudinal Joint Construction

- Second lane placement
  - 1” overlap (+/- ½”).
  - enough mix flowing to outer portion of screed to prevent segregation / dips.
  - minimize use of hand tools.
- Insufficient mix / overlap
  - joint appears smooth but lacks density.

147

Longitudinal Joint Construction

- Excess mix / overlap
  - wide scab of material.
  - white streak of crushed aggregate.
- Loose thickness to account for roll-down.
  - 20 to 25% typical
  - automatic grade controls
  - no bumps or dips at joint

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Bumping Joint

149

Bumping Joint

150

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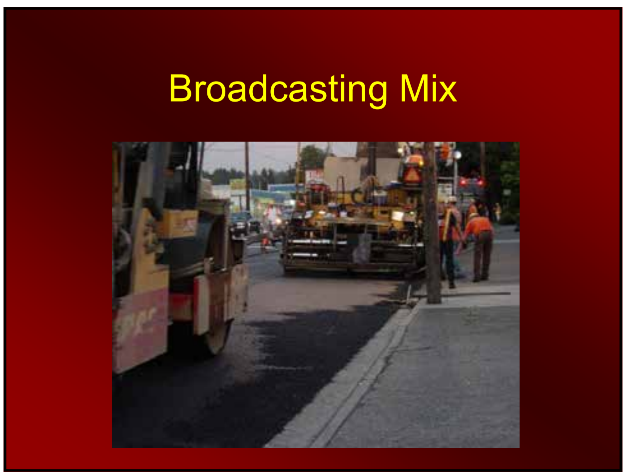

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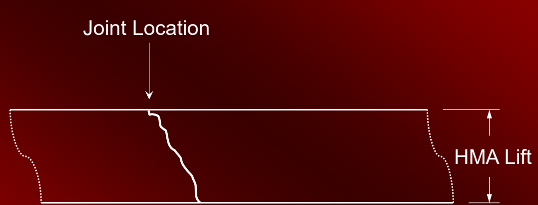
Notched Wedge Longitudinal Joint

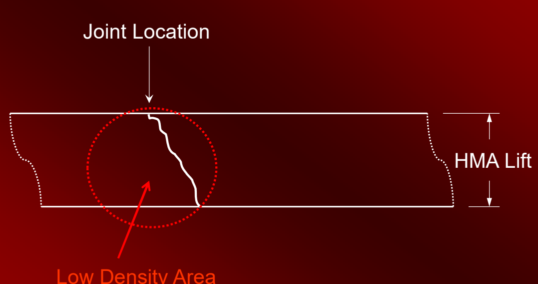
157

Conventional (Butt) Joint



158

Conventional (Butt) Joint



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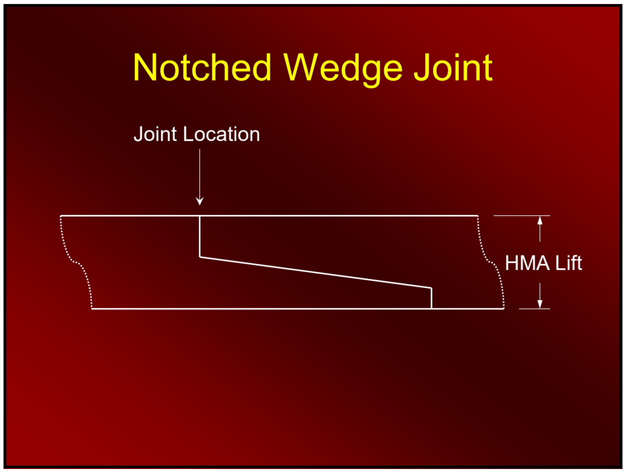
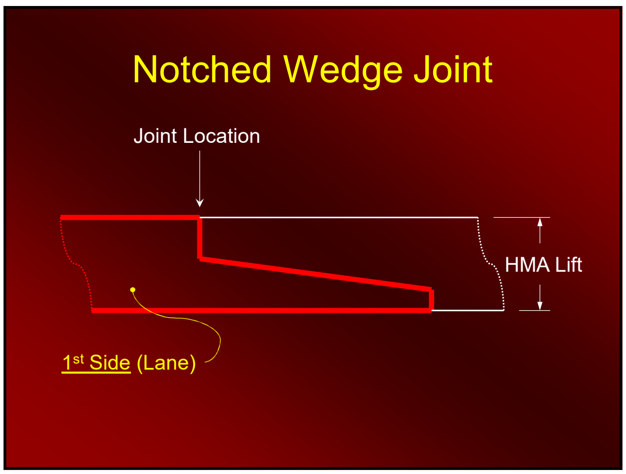


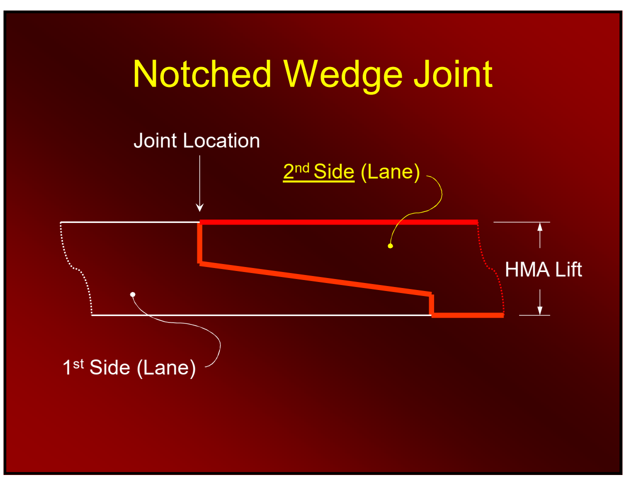
Notched Wedge Joint
Joint Location
HMA Lift

160



Notched Wedge Joint
Joint Location
HMA Lift
1st Side (Lane)

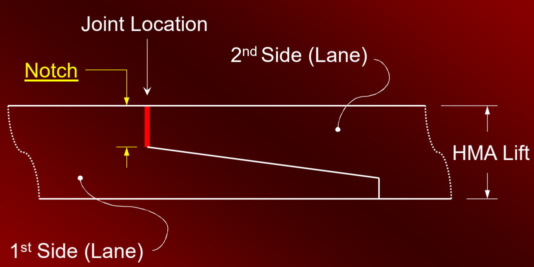
161



Notched Wedge Joint
Joint Location
2nd Side (Lane)
HMA Lift
1st Side (Lane)

162

Notched Wedge Joint



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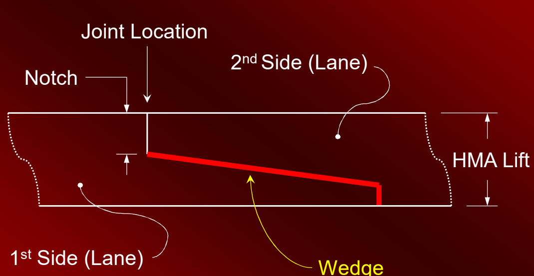
Notched Wedge Joint

- **Vertical Notch**
  - Area for mix confinement, aiding compaction.
  - Defined edge for uniform alignment / overlap.
- **Notch Depth**
  - Based on mix size & lift thickness.
  - Compacted
    - Min. = nom. max. agg. size
    - Max. = ½ X lift thickness
  - Loose ← **IMPORTANT!**
    - Compacted depth + rolldown (20-25%) of mix

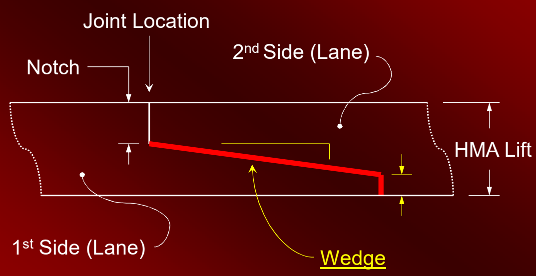
164

Notched Wedge Joint



165

Notched Wedge Joint



166

Notched Wedge Joint

- **Rate of Slope of Wedge**
  - May vary with equipment and lift thickness.
  - Typically 1" fall in 12" width (12:1 slope).
- **Width of Wedge**
  - Varies with equipment and lift thickness.
  - 9" to 12" width typical.

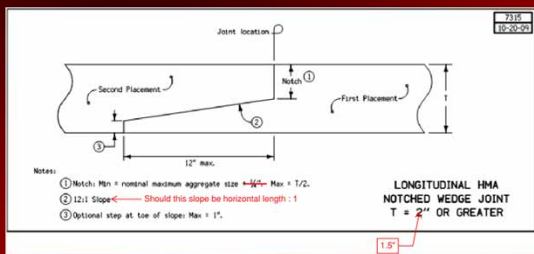
167

Notched Wedge Joint

- **Vertical Step at Toe of Wedge**
  - Optional (depends on situation).
  - Step is recommended in most cases.
    - Limit width of wedge for thicker lifts
    - Variation in width of wedge (ragged edge)
  - Nominal max. aggregate (mix) size, whenever possible.

168

Notched Wedge Joint - Detail



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Notched Wedge Joint

Construction – Side 1

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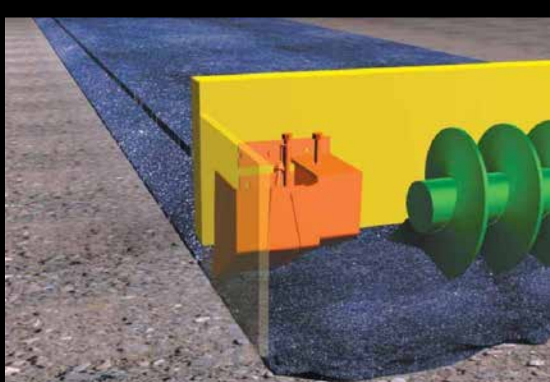

171

Notched Wedge Joint

- **Notched Wedge Joint Former**
  - Screed attachment
  - Adjustable
  - TransTech, others
  - Provides mix strike-off and “pre-compaction” of wedge

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Notched Wedge Joint

- **Pre-compaction of Wedge**
  - Joint forming equipment provides some.
  - Additional pre-compaction of wedge increases final joint density.
  - Small trailing roller
    - Attached to paver
    - Same width as wedge
    - Additional weight / ballast

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Notched Wedge Joint

- **Compaction of First Side Placed**
  - Steel vibratory roller.
  - First pass roller overhangs notch approx. 4”.
  - Use vibration unless notch is distorted.
  - Up & back to “set” notch & pavement edge.
  - Normal rolling pattern for balance of mat.

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183

Notched Wedge Joint

Construction – Side 2

184

Notched Wedge Joint

- **Placement of Second Side of Joint**
  - Tack coat entire notch & wedge.
  - Use proper loose thickness for roll-down.
  - No “bridging” of joint.
  - Approx. 1” paver overlap at joint.

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187

Notched Wedge Joint

- **Compaction of Second Side of Joint**
  - Similar to conventional joint.
  - Overlap 4-6” onto cold side of joint.
  - Use vibration with steel rollers.
  - Additional density may be obtained by:
    - Use of “oscillatory” rollers
    - Extra roller pass over joint *

* Avoid over-rolling (may crack top wedge if “thin”)

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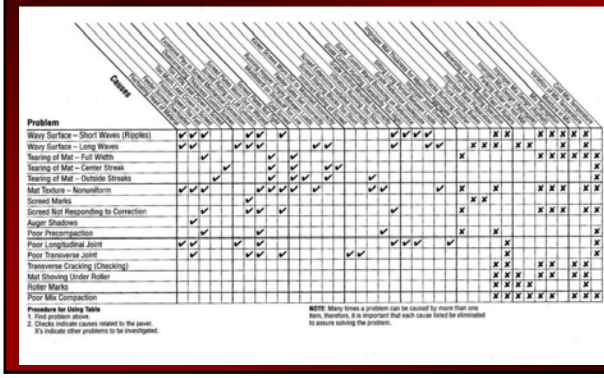
Mat Problem Trouble-Shooting



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Other Problems

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Appendix A

I-35– Cerro Gordo Co.
Project Plans

LETTING DATE
July 16, 2024

HMA Resurfacing with Milling
IMN-035-7(083)193--0E-17

CERRO GORDO COUNTY

INDEX OF SHEETS

No.	DESCRIPTION
A Sheets	**Title Sheets**
A.1	Title Sheet
A.2	Location Map Sheet
B Sheets	**Typical Cross Sections and Details**
B.1 - 4	Typical Cross Sections and Details
C Sheets	**Quantities and General Information**
C.1	Estimated Project Quantities and Reference Notes
C.2	Index of Tabulations
C.3	Standard Road Plans
C.4 - 16	Tabulations
D Sheets	**Mainline Plan and Profile Sheets**
* D.1	Plan & Profile Legend & Symbol Information Sheet
* D.2 - 10	ML035 (For Information Only)
J Sheets	**Traffic Control and Staging Sheets**
* J.1	Traffic Control Plan
* J.2	Exit 193 Ramp Closure
* J.3	Exit 194 Ramp Closure
K Sheets	**Interchange Sheets (For Info Only)**
* K.1	4th Ave S. Ramp A Plan and Profile Sheets
* K.2 - 3	4th Ave S. Ramp B Plan and Profile Sheets
* K.4	4th Ave S. Ramp C Plan and Profile Sheets
* K.5	4th Ave S. Ramp D Plan and Profile Sheets
* K.6 - 7	US 18 Ramp A Plan and Profile Sheets
* K.8	US 18 Ramp B Plan and Profile Sheets
* K.9	US 18 Ramp C Plan and Profile Sheets
* K.10	US 18 Ramp D Plan and Profile Sheets
R Sheets	**Erosion Control Sheets**
RC.1	Landscape Design Seal
RC.2	Estimated Project Quantities and Reference Notes
RC.3	General Notes and Tabulations
U Sheets	**Detail Sheets**
U.1 - 9	Pavement Markings

IOWA DOT

PLANS OF PROPOSED IMPROVEMENT ON THE

INTERSTATE ROAD SYSTEM
CERRO GORDO COUNTY
HMA Resurfacing with Milling
1 mi N of Co Rd B35 to near Co Rd B20

SCALES: As Noted

Refer to the Proposal Form for list of applicable specifications.

Value Engineering Saves. Refer to Article 1105.14 of the Specifications.

IOWA ONE CALL
1-800-292-8989
www.iowaonecall.com
811

REVISIONS

	TOTAL 57
PROJECT IDENTIFICATION NUMBER	
20-17-035-040	
PROJECT NUMBER	
IMN-035-7(083)193--0E-17	
R.O.W. PROJECT NUMBER	

DESIGN DATA RURAL

2024	AADT	23,200	V.P.D.
2044	AADT	29,300	V.P.D.
20 --	DHV	--	V.P.H.
TRUCKS		32	%
Total Design ESALs		35,572,600	

INDEX OF SEALS

SHEET NO.	NAME	TYPE	BID QUANTITY SHEETS
A.1	Paul Flattery	Primary Signature Block	C.1-C.3
RC.1	Rachel Harris	Landscape Design	RC.2

ROADWAY DESIGN

LICENSED PROFESSIONAL ENGINEER
Paul W. Flattery
15282
IOWA

I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Iowa.

Paul Flattery 07/16/2024
Signature Date
Paul W. Flattery
Printed or Typed Name

My license renewal date is December 31, 2025

Pages or sheets covered by this seal: A.1-2, B.1-4, C.1-16, D.1-10, J.1-3, K.1-10, U.1-9

FILE NO.	ENGLISH	DESIGN TEAM Flattery\Bell\Schmitz	CERRO GORDO COUNTY	PROJECT NUMBER IMN-035-7(083)193--0E-17	SHEET NUMBER A.1

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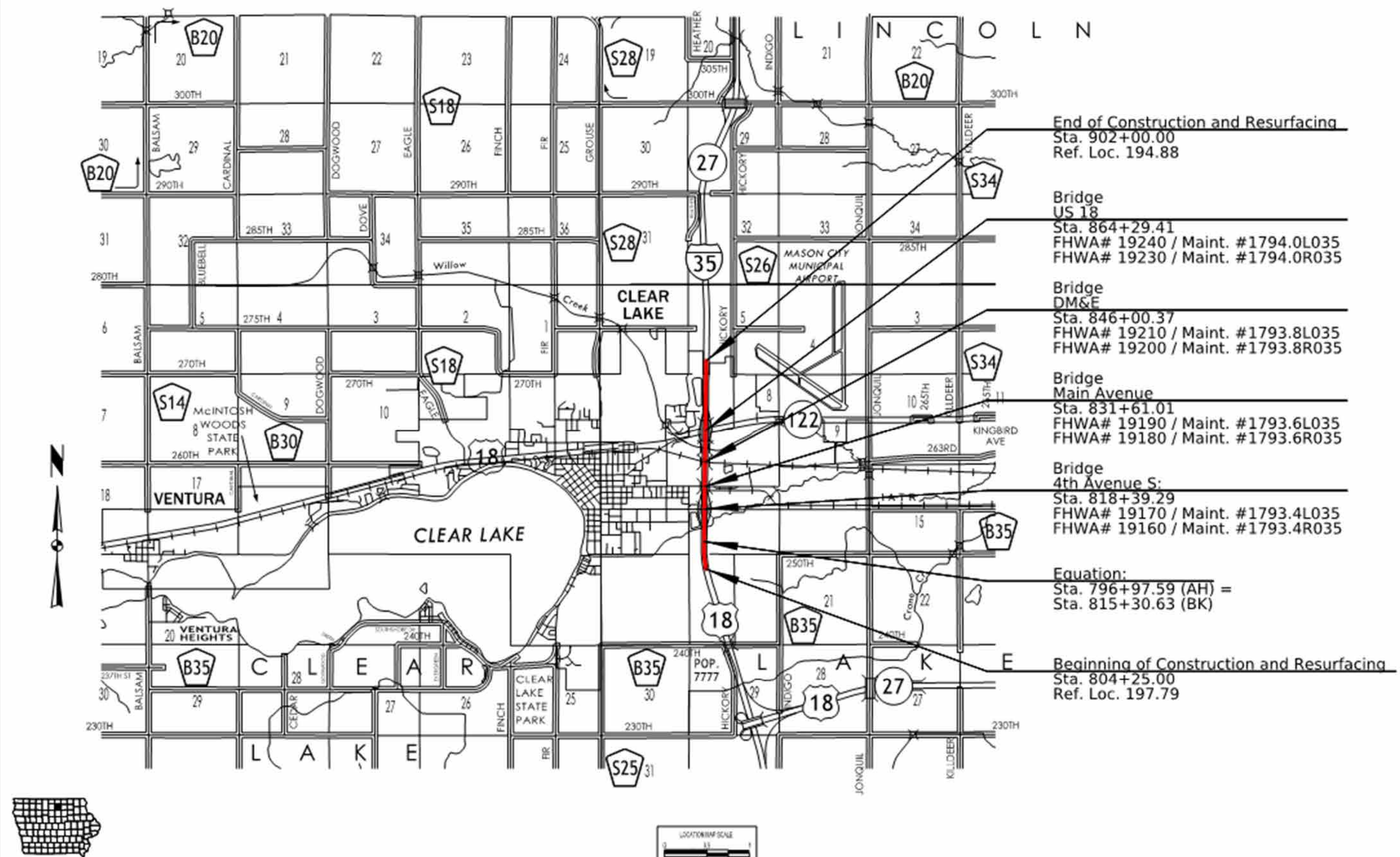

FILE NO. | ENGLISH | DESIGN TEAM **Flattery\Bell\Schmitz** | **CERRO GORDO** COUNTY | PROJECT NUMBER **IMN-035-7(083)193--0E-17** | SHEET NUMBER **A.2**

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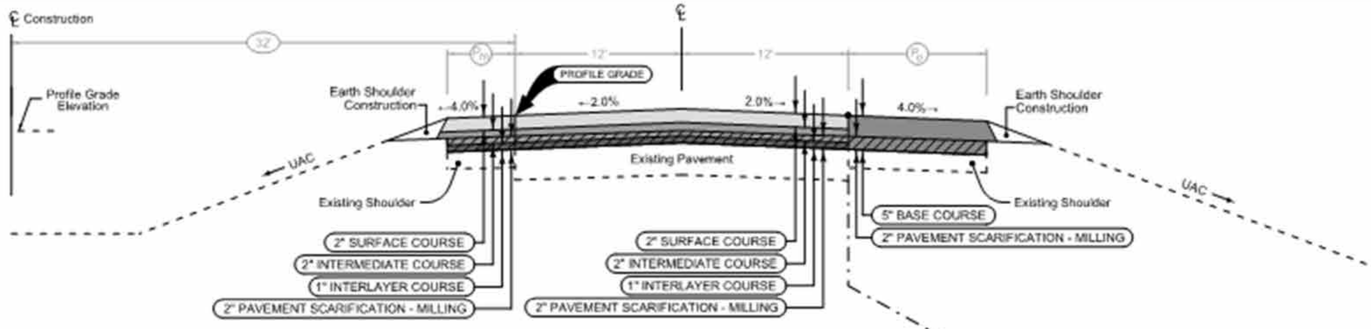
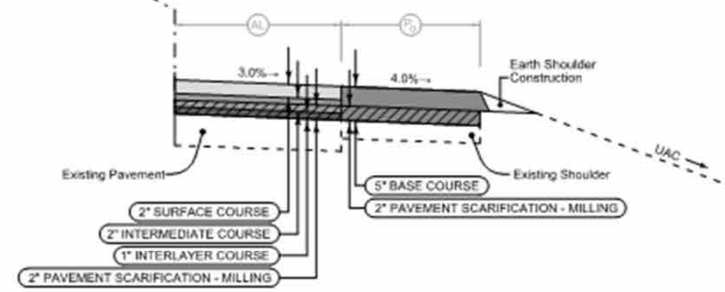


4 LANE RESURFACING

LOCATION			DIMENSIONS	
ROAD IDENTIFICATION	STATION TO STATION		P_N Feet	P_S Feet
NORTHBOUND				
I-35	804+25.00	815+30.63	6	10
I-35	Eq: Sta. 796+97.59 (AH) = Sta. 815+30.63 (BK)			
I-35	796+97.59	816+64.46	6	10
I-35	Gap for Bridge and Approaches			
I-35	820+14.10	829+78.42	6	10
I-35	Gap for Bridge and Approaches			
I-35	833+15.25	844+39.89	6	10
I-35	Gap for Bridge and Approaches			
I-35	847+40.11	862+42.22	6	10
I-35	Gap for Bridge and Approaches			
I-35	866+37.50	902+00.00	6	10
SOUTHBOUND				
I-35	804+25.00	815+30.63	6	10
I-35	Eq: Sta. 796+97.59 (AH) = Sta. 815+30.63 (BK)			
I-35	796+97.59	816+64.46	6	10
I-35	Gap for Bridge and Approaches			
I-35	820+14.10	829+77.42	6	10
I-35	Gap for Bridge and Approaches			
I-35	833+14.25	844+57.15	6	10
I-35	Gap for Bridge and Approaches			
I-35	847+57.61	862+21.32	6	10
I-35	Gap for Bridge and Approaches			
I-35	866+16.60	902+00.00	6	10



Auxiliary Lane Resurfacing

LOCATION			AL Feet	P_S Feet
ROAD IDENTIFICATION	STATION TO STATION			
NORTHBOUND				
I-35	833+15.25	836+20.00	19.6-12	10
I-35	836+20.00	844+39.89	12	10
I-35	Gap for Bridge and Approaches			
I-35	847+40.11	849+90.00	12	10
SOUTHBOUND				
I-35	833+14.25	844+57.15	12	10

Normal section shown may be modified appropriately in areas of superelevated curves or other locations specifically designated by the Engineer.

Section view is in the direction of traffic.

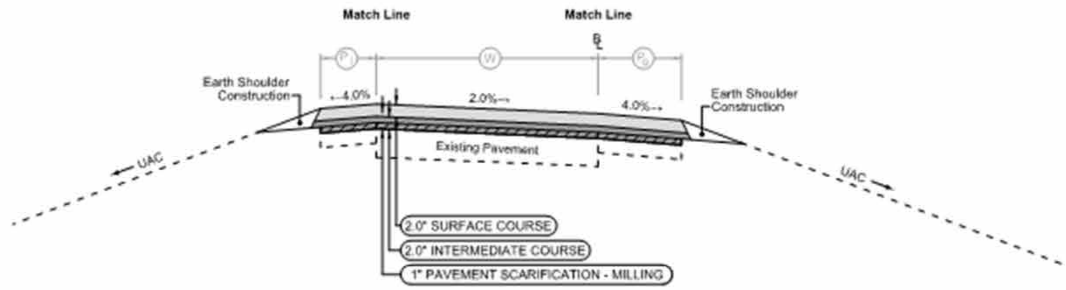
Shows how much if any scarification and what mix and lift thickness

See Tab 100-25 for pavement quantities.
See Tab 112-9 for shoulder quantities.

I-35 Resurfacing
Northbound & Southbound

FILE NO.	ENGLISH	DESIGN TEAM Flattery\Bell\Schmitz	CERRO GORDO COUNTY	PROJECT NUMBER IMN-035-7(083)193--0E-17	SHEET NUMBER B.1

7:50:04 AM 4/26/2024 rschmi2 pw:\\NTPwint1.dot.int.lan:PWMain\Documents\Projects\1703504020\Design\CADD_Files\Sheet_Files\B01_17035083202.dgn



TYPICAL CROSS SECTION
HMA RESURFACING RAMP

INTERCHANGE	RAMP IDENT.	STATION TO STATION		(W) Feet	(P_I) Feet	(P_O) Feet
I-35 / 4th Ave. S.	A	1517+19.90	1526+69.59	16	4	6
I-35 / 4th Ave. S.	B	2517+00.41	2526+47.01	16	4	6
I-35 / 4th Ave. S.	C	3507+60.04	3517+32.38	16	4	6
I-35 / 4th Ave. S.	D	4507+36.71	4517+62.32	16	4	6
I-35 / US 18	A	1545+17.48	1550+15.00	16	4	6
I-35 / US 18	A	1550+15.00	1550+75.00	16	4-10	6
I-35 / US 18	A	1550+75.00	1552+00.00	16	10	6
I-35 / US 18	A	1552+00.00	1553+20.00	16-24	10	6
I-35 / US 18	A	1553+20.00	1555+02.17	24	10	6
I-35 / US 18	B	2546+96.53	2552+20.00	16	4	6
I-35 / US 18	B	2552+20.00	2553+40.00	16-26	4	6
I-35 / US 18	B	2553+40.00	2557+07.80	26	4	6
I-35 / US 18	C	3536+74.97	3547+85.94	16	4	6
I-35 / US 18	D	4537+31.88	4547+40.02	16	4	6

Section view is in the direction of traffic.

Refer to other drawings for details of shoulder design and construction.

See Tab 100-25 for pavement quantities.

See Tab 112-9 for shoulder quantities.

I-35 Ramp Resurfacing

FILE NO.	ENGLISH	DESIGN TEAM Flattery\Bell\Schmitz	CERRO GORDO COUNTY	PROJECT NUMBER IMN-035-7(083)193--0E-17	SHEET NUMBER B.2

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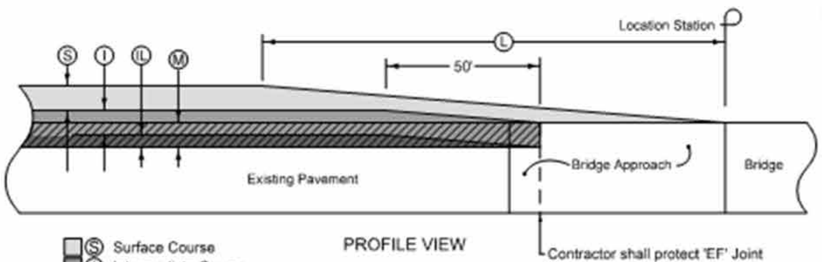
Runout-1



PROFILE VIEW

- S Surface Course
- I Intermediate Course
- IL Interlayer Course
- M Milling

ROAD IDENTIFICATION	LOCATION STATION	S Inches	I Inches	IL Inches	M Inches	L Feet
NORTHBOUND						
I-35	817+24.46	2.0	2.0	1.0	2.0	150
I-35	819+54.10	2.0	2.0	1.0	2.0	150
I-35	830+38.42	2.0	2.0	1.0	2.0	150
I-35	832+52.25	2.0	2.0	1.0	2.0	150
I-35	844+99.89	2.0	2.0	1.0	2.0	150
I-35	846+80.11	2.0	2.0	1.0	2.0	150
I-35	863+02.22	2.0	2.0	1.0	2.0	150
I-35	865+77.50	2.0	2.0	1.0	2.0	150
SOUTHBOUND						
I-35	817+24.46	2.0	2.0	1.0	2.0	150
I-35	819+54.10	2.0	2.0	1.0	2.0	150
I-35	830+37.42	2.0	2.0	1.0	2.0	150
I-35	832+51.25	2.0	2.0	1.0	2.0	150
I-35	845+97.15	2.0	2.0	1.0	2.0	150
I-35	846+97.61	2.0	2.0	1.0	2.0	150
I-35	862+81.32	2.0	2.0	1.0	2.0	150
I-35	865+56.60	2.0	2.0	1.0	2.0	150

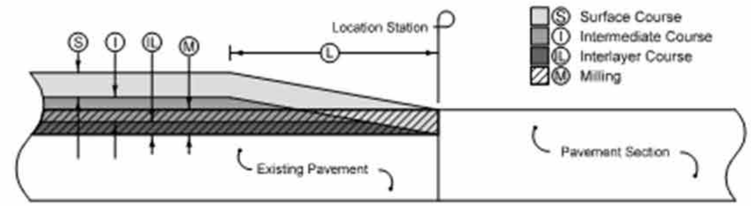
Posted Speed Limit (mph)	Runout Ratio (ft per inch)
Over 40	50
20 to 40	25
Under 20	10*

* Based on turning maneuvers at side roads and intersections.

See Tab 100-25 for pavement quantities.
See Tab 112-9 for shoulder quantities.

RUNOUT FOR RESURFACING OF MILLED AREAS

Runout-2



- S Surface Course
- I Intermediate Course
- IL Interlayer Course
- M Milling

PROFILE VIEW

ROAD IDENTIFICATION	LOCATION STATION	S Inches	I Inches	IL Inches	M Inches	L Feet
NB & SB						
I-35	804+25.00	2.0	2.0	1.0	2.0	150
I-35	902+00.00	2.0	2.0	1.0	2.0	150

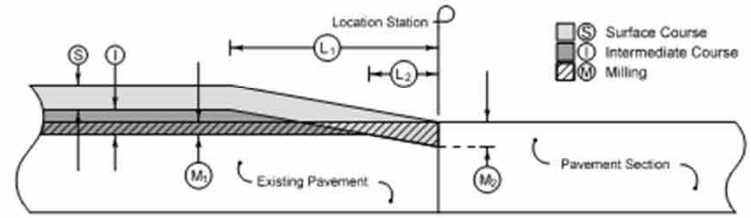
Posted Speed Limit (mph)	Runout Ratio (ft per inch)
Over 40	50
20 to 40	25
Under 20	10*

* Based on turning maneuvers at side roads and intersections.

See Tab 100-25 for pavement quantities.
See Tab 112-9 for shoulder quantities.

RUNOUT FOR RESURFACING OF MILLED AREAS

Runout-3



- S Surface Course
- I Intermediate Course
- M Milling

PROFILE VIEW

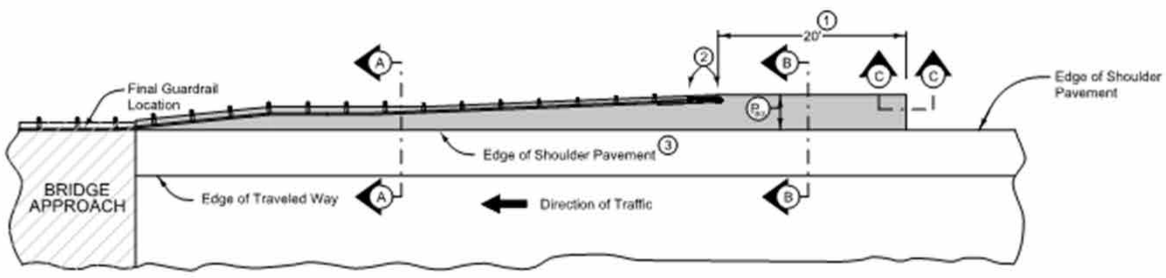
ROAD IDENTIFICATION	LOCATION STATION	S Inches	I Inches	M_1 Inches	M_2 Inches	L_1 Feet	L_2 Feet
4th Ave. S.							
Ramp A	1526+69.59	2.0	2.0	1.0	2.0	150	50
Ramp B	2526+47.01	2.0	2.0	1.0	2.0	150	50
Ramp C	3507+60.04	2.0	2.0	1.0	2.0	150	50
Ramp D	4507+36.71	2.0	2.0	1.0	2.0	150	50
US 18							
Ramp A	1555+02.17	2.0	2.0	1.0	2.0	150	50
Ramp B	2557+07.80	2.0	2.0	1.0	2.0	150	50
Ramp C	3536+74.97	2.0	2.0	1.0	2.0	150	50
Ramp D	4537+31.88	2.0	2.0	1.0	2.0	150	50

Posted Speed Limit (mph)	Runout Ratio (ft per inch)
Over 40	50
20 to 40	25
Under 20	10*

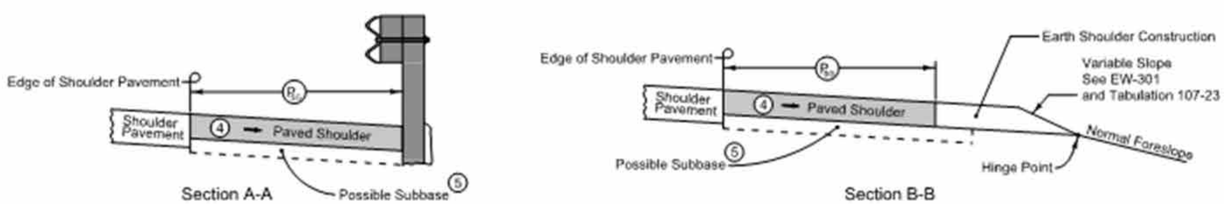
* Based on turning maneuvers at side roads and intersections.

See Tab 100-25 for pavement quantities.
See Tab 112-9 for shoulder quantities.

RUNOUT FOR RESURFACING OF MILLED AREAS



PLAN VIEW



EXISTING SHOULDER

71588
MODIFIED

9" HMA Detour Pavement - Paved Shoulder at guardrail:

Compaction of HMA is required to face of guardrail post. Hand compaction will be allowed under guardrail. Removal and reinstallation of guardrail will be allowed with no additional payment.

Refer to Tabulation 112-9 for shoulder quantities.

① Continue paved shoulder 20 feet beyond the center of the first post.

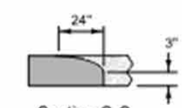
② Shoulder may be notched for first 2 posts or post sleeves may be installed through pavement. Do not drive posts through pavement.

③ 'B' (per PV-101) joint for HMA shoulder.

④ Match shoulder slope.

⑤ Refer to other details in the plan.

⑥ The Contractor has the option to pave the paved shoulder at guardrail and the partial width paved shoulder as one operation.



Section C-C
Roll down at granular shoulder or earth.

PAVED SHOULDER AT GUARDRAIL
(ADJACENT TO FULL WIDTH PAVED SHOULDER)

ESTIMATED PROJECT QUANTITIES AND REFERENCE NOTES

Item no.	Item Code	Item	Unit	Quantities Estimated Roadway Items	Estimate Reference Notes
1	2102-2625000	EMBANKMENT-IN-PLACE	CY	900	See Tab. 107-23 in the C Sheets for locations and details. No payment will be allowed for overhaul.
2	2102-2713070	EXCAVATION, CLASS 13, ROADWAY AND BORROW	CY	268.8	See Tab. 112-9M in the C Sheets for locations and details. No payment will be allowed for overhaul.
3	2123-7450000	SHOULDER CONSTRUCTION, EARTH	STA	444.1	See B Sheets and Tab. 112-9M in the C Sheets for location and details.
4	2212-0475095	CLEANING AND PREPARATION OF BASE	MILE	5.9	This bid item includes: _1.5___ miles of ramps _2.2___ miles of NB four lane roadway _2.2___ miles of SB four lane roadway _5.9___ miles total
5	2212-5070310	PATCHES, FULL-DEPTH REPAIR	SY	375.6	See Tab. 102-6C in the C Sheets for locations and details.
6	2212-5070330	PATCHES BY COUNT (REPAIR)	EACH	25	See Tab. 102-6C in the C Sheets for locations and details.
7	2214-5145150	PAVEMENT SCARIFICATION	SY	133,781.2	See Tab. 100-25M in the C Sheets for locations and details.
8	2303-0002380	HOT MIX ASPHALT MIXTURE INTERLAYER BASE COURSE, 3/8 IN. MIX	TON	5,068.6	See B Sheets and Tab. 100-25M in the C Sheets for locations and details. Additional 5% added to bid quantity for irregularities.
9	2303-1031500	HOT MIX ASPHALT STANDARD TRAFFIC, BASE COURSE, 1/2 IN. MIX	TON	6,289.3	See B Sheets and Tab. 112-9M in the C Sheets for locations and details. Additional 5% added to bid quantity for irregularities.
10	2303-1052500	HOT MIX ASPHALT VERY HIGH TRAFFIC, INTERMEDIATE COURSE 1/2 IN. MIX	TON	12,722.3	See B Sheets and Tab. 100-25M in the C Sheets for locations and details. Additional 5% added to bid quantity for irregularities.
11	2303-1053502	HOT MIX ASPHALT VERY HIGH TRAFFIC, SURFACE COURSE, 1/2 IN. MIX, FRICTION L-2	TON	12,722.3	See B Sheets and Tab. 100-25M in the C Sheets for locations and details. Additional 5% added to bid quantity for irregularities.

What bid items on project and their estimated quantities

Item no.	Item Code	Item	Unit	Quantities Estimated Roadway Items	Estimate Reference Notes
12	2303-1258283	ASPHALT BINDER, PG 58-28S, STANDARD TRAFFIC	TON	377.4	Base Course Binder. See B Sheets and Tab. 112-9M in the C Sheets for locations and details. Additional 5% added to bid quantity for irregularities.
13	2303-1258285	ASPHALT BINDER, PG 58-28V, VERY HIGH TRAFFIC	TON	1,526.7	Surface and Intermediate Course Binder. See B Sheets and Tab. 100-25M in the C Sheets for locations and details. Additional 5% added to bid quantity for irregularities.
14	2303-1258346	ASPHALT BINDER, PG 58-34E, EXTREMELY HIGH TRAFFIC	TON	304.1	Interlayer Course Binder. See B Sheets and Tab. 100-25M in the C Sheets for locations and details. Additional 5% added to bid quantity for irregularities.
15	2303-6911000	HOT MIX ASPHALT PAVEMENT SAMPLES	LS	1	
16	2303-7000610	PAYMENT ADJUSTMENT INCENTIVE/DISINCENTIVE FOR HMA MIXTURE LABORATORY VOIDS (FORMULA - BY PAY FACTOR)	EACH	15,866.95	
17	2303-7000620	PAYMENT ADJUSTMENT INCENTIVE/DISINCENTIVE FOR HMA MIXTURE FIELD VOIDS (FORMULA - BY PAY FACTOR)	EACH	15,866.95	
18	2304-0100000	DETOUR PAVEMENT	SY	1,075.119	See B Sheets and Tab. 112-9M in the C Sheets for locations and details.
19	2317-7000120	PAYMENT ADJUSTMENT INCENTIVE/DISINCENTIVE FOR HMA PAVEMENT SMOOTHNESS (BY SCHEDULE)	EACH	2,907.96	
20	2505-4008120	REMOVAL OF STEEL BEAM GUARDRAIL	LF	4,910	See Tab. 110-7A in the C Sheets for locations and details.
21	2505-4008300	STEEL BEAM GUARDRAIL	LF	3,475	See Tab. 108-8A and Tab. 108-8C in the C Sheets for locations and details.
22	2505-4008410	STEEL BEAM GUARDRAIL BARRIER TRANSITION SECTION, BA-201	EACH	16	See Tab. 108-8A in the C Sheets for locations and details.
23	2505-4021010	STEEL BEAM GUARDRAIL END ANCHOR, BOLTED	EACH	16	
24	2505-4021020	STEEL BEAM GUARDRAIL END ANCHOR, W-BEAM	EACH	2	See Tab. 108-8C in the C Sheets for locations and details.
25	2505-4021720	STEEL BEAM GUARDRAIL TANGENT END TERMINAL, BA-205	EACH	18	See Tabs. 108-8A and 108-8C in the C Sheets for locations and details.
26	2520-3350015	FIELD OFFICE	EACH	1	
27	2527-9263137	PAINTED SYMBOLS AND LEGENDS, WATERBORNE OR SOLVENT-BASED	EACH	4	See Tab. 108-29 in the C Sheets for locations and details.
28	2527-9263209	PAINTED PAVEMENT MARKINGS, WATERBORNE OR SOLVENT-BASED	STA	2,183.77	See Tab. 108-22 in the C Sheets for locations and details.

Item no.	Item Code	Item	Unit	Quantities Estimated Roadway Items	Estimate Reference Notes
29	2528-2518000	SAFETY CLOSURE	EACH	8	See Tab. 108-13A in the C sheets for locations and details.
30	2528-8445110	TRAFFIC CONTROL	LS	1	
31	2528-9290050	PORTABLE DYNAMIC MESSAGE SIGN (PDMS)	CDAY	0	See Proposal.
32	2529-2242304	CD JOINT ASSEMBLY	EACH	2	See Tab. 102-6C in the C Sheets for locations and details.
33	2529-8174010	SUBBASE (PATCHES)	SY	293.5	
34	2533-4980005	MOBILIZATION	LS	1	- -
35	2548-0000100	MILLED SHOULDER RUMBLE STRIPS, HMA SURFACE	STA	391	See Tab. 112-10 in the C Sheets for locations and details.
36	2548-0000115	ENGINEERED EMULSION FOR FOG SEAL (SHOULDER RUMBLE STRIPS)	GAL	423.6	

STANDARD ROAD PLANS

105-4
10-18-11

The following Standard Road Plans apply to construction work on this project.

Number	Date	Title
BA-200	04-20-21	Steel Beam Guardrail Components
BA-201	10-18-22	Steel Beam Guardrail Barrier Transition Section (MASH TL-3)
BA-202	10-20-15	Steel Beam Guardrail Bolted End Anchor
BA-203	10-15-19	Steel Beam Guardrail W-Beam End Anchor
BA-205	10-17-23	Steel Beam Guardrail Tangent End Terminal (MASH TL-3)
BA-250	04-20-21	Steel Beam Guardrail Installation at Concrete Barrier or Bridge End Post (MASH TL-3)
BA-252	04-20-21	Steel Beam Guardrail Installation at Side Object (One-Way Protection)
EW-301	04-20-21	Guardrail Grading
PM-110	04-21-20	Line Types
PM-111	04-21-20	Symbols and Legends
PM-120	10-21-14	Stop Lines and Islands
PM-310	10-18-22	Entrance and Exit Ramps
PR-104	10-21-14	Full Depth Patch continuous Reinforced PCC Pavement
PR-105	10-17-23	Full Depth Ramp PCC Patch with Dowels
PR-140	04-21-15	Subbase Patches
PV-12	10-20-20	Milled Shoulder Rumble Strips
PV-101	04-19-22	Joints
PV-202	04-21-20	Hot Mix Asphalt Resurfacing
SI-173	04-19-16	Object Markers
SI-211	10-18-22	Object Marker and Delineator Placement with Guardrail
SI-881	04-16-19	Special Signs for Workzones
TC-1	10-15-19	Work Not Affecting Traffic (Two-Lane or Multi-Lane)
TC-402	04-18-23	Work Within 15 ft of Traveled Way
TC-417	04-21-20	Ramp Closure
TC-418	04-18-23	Lane Closure on Divided Highway
TC-432	10-17-17	Shoulder Rumble Strip Operations
TC-433	10-17-17	Pavement Marking Operations
TC-482	04-19-22	Uneven Lanes

INDEX OF TABULATIONS

111-25
10-18-11

Tabulation	Tabulation Title	Sheet No.
C Sheets		
100-25M	HMA PAVEMENT	C.6 - C.9
100-27	PROPOSED POSTED SPEED LIMIT	C.5
102-5	EXISTING PAVEMENT	C.5
102-6C	FULL-DEPTH PATCHES	C.5
105-4	STANDARD ROAD PLANS	C.4
107-23	GRADING FOR GUARDRAIL INSTALLATIONS	C.13
108-8A	STEEL BEAM GUARDRAIL AT CONCRETE BARRIER OR BRIDGE RAIL END SECTION	C.13
108-8C	STEEL BEAM GUARDRAIL FOR SIDE OBSTACLE (ONE-WAY PROTECTION)	C.14
108-13A	SAFETY CLOSURES	C.12
108-22	PAVEMENT MARKING LINE TYPES	C.15 - C.16
108-29	PAVEMENT MARKING SYMBOLS AND LEGENDS	C.16
110-7A	REMOVAL OF STEEL BEAM GUARDRAIL	C.13
111-25	INDEX OF TABULATIONS	C.4
112-9M	SHOULDERS	C.10 - C.12
112-10	MILLED RUMBLE STRIPS	C.12

MEDIAN CROSSOVER

253-1
10-18-11

The Contractor is prohibited from using any established or other type median crossover on this project unless specifically designated for the Contractor's use by this plan.

INCIDENT MANAGEMENT

254-1
10-02-01

An incident management plan, provided by the District Office, will be discussed at the pre-construction conference.

102-5
04-18-17

EXISTING PAVEMENT

No.	Location: County	Route	Dir. of Travel	Begin Ref. Loc. Sign	End Ref. Loc. Sign	Year	Type	Project Number	Surface: Type	Depth (IN)	Base: Type	Depth (IN)	Subbase: Type	Depth (IN)	Removal: Type	Depth (IN)	Coarse Aggregate: Source	Type	Durability Class	Reinforcement: Type	Remarks
	17	I-35		192.79	194.88	2022	1	MPIN-035-2(705)155--0N-99	PCC												PCC Patching
	17	I-35		192.79	194.88	2021	1	MPIN-035-2(704)155--0N-99													PCC Patching
	17	I-35		192.79	194.88	2020	1	MPIN-035-2(703)150--0N-99	PCC												PCC Patching
	17	I-35		192.79	194.88	2018	1	IMN-035-6(125)150--0E-99	PCC												PCC Patching
	17	I-35		192.79	194.88	2017	1	IMN-035-6(122)150--0E-99	PCC	14											PCC Patching
	17	I-35		192.79	194.88	2017	1	IMN-035-7(71)186--0E-17	MSS												VL Double Microsurfacing
	17	I-35		192.79	194.88	2014	1	MPIN-035-2(722)193--0N-17	MSS												
	17	I-35		192.79	194.88	2012	1	IMX-035-7(69)194--02-17	HMA	1.5	HMA	1.5			SCR	3					SCR 2in+HMA 2in TO SHLDRS
	17	I-35		192.79	194.88	2008	1	IMN-035-7(63)193--0E-17	HMA	2	HMA	3			SCR	2	RIVERVIEW	C.LST.			
	17	I-35		192.79	194.88	1999	1	MP-35-2(703)193--76-17	MSS								BIG STONE-MN	QUARTZ			
	17	I-35		192.79	194.88	1991	1	IR-35-7(43)192	AAC	5							FERTILE	C.LST.			& QUARTZITE
	17	I-35		192.79	194.88	1971	1	I-IG-35-7(11)193--04-17	PCC	8	ATB	4					WEPKING/STRIC	DOLOM.	3		CRC

102-6C
04-18-17

FULL-DEPTH PATCHES

Possible Standards: PR-101, PR-102, PR-103, PR-104, PR-105, and PR-140.

Count	Station	Reference Location Sign	Lane (L, R, or B)	Length (FT)	Width (FT)	Patch Thickness (IN)	PCC Patches: With Dowels PR-103 (SY)	Without Dowels PR-102 (SY)	C R C PR-104 (SY)	Ramp with Dowels PR-105 (SY)	HMA Patches (SY)	Composite HMA (TON)	Subbase Patches PR-140 (SY)	Subbase Patch w/ 'EF' Joint PR-101 (SY)	Patch Subdrain PR-101 or PR-140 (No.)	'CD' Joints (No.)	'CT' Joints (No.)	'EF' Joints PR-101 (No.)	Anchor Lugs Removal (No.)	Remarks
1		191.7	Right	10.0	12.0	12.0			13.3				14.4							NB
1		191.71	Right	10.0	12.0	12.0			13.3				14.4							NB
1		192.22	Right	12.0	12.0	16.0			16.0				17.3							NB
1		193.47	Right	8.0	12.0	16.0			10.7				11.6							NB
1		193.48	Right	8.0	12.0	16.0			10.7				11.6							NB
1		193.59	Right	12.0	12.0	16.0			16.0											NB
1		193.73	Aux.	12.0	12.0	16.0			16.0				17.3							NB
1		193.73	Right	12.0	12.0	16.0			16.0				17.3							NB
1		193.73	Left	12.0	12.0	16.0			16.0				17.3							NB
1		194.19	Right	8.0	12.0	16.0			10.7				11.6							NB
1		194.19	Left	8.0	12.0	16.0			10.7				11.6							NB
1		194.18	Right	12.0	12.0	16.0			16.0				17.3							SB
1		194.18	Left	12.0	12.0	16.0			16.0				17.3							SB
1		194.11	Right	8.0	12.0	16.0			10.7				11.6							SB
1		193.57	Aux.	8.0	12.0	16.0			10.7				11.6							SB
1		193.56	Aux.	15.0	12.0	16.0			20.0				21.7							SB
1		193.5	Right	8.0	12.0	16.0			10.7				11.6							SB
1		193.5	Left	8.0	12.0	16.0			10.7				11.6							SB
1		193.26	Right	8.0	12.0	16.0			10.7				11.6							SB
1		193.26	Left	8.0	12.0	16.0			10.7				11.6							SB
1		191.68	Right	8.0	12.0	12.0			10.7				11.6							SB
1		191.68	Left	8.0	12.0	12.0			10.7				11.6							SB
1		193		25.0	10.0	16.0				27.8						1				SB; Bottom of Entrance Ramp
1		193		25.0	10.0	16.0				27.8						1				SB; Bottom of Entrance Ramp
1		193		15.0	20.0	16.0				33.3										SB; Bottom of Entrance Ramp
25	TOTALS:								286.7	88.9			293.5			2				

100-27
04-17-18

PROPOSED POSTED SPEED LIMIT

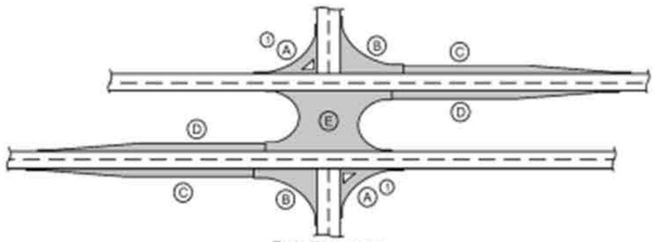
Road Identification	Begin Station	End Station	Proposed Posted Speed Limit: 35 or less	40 - 45	over 45	Remarks
I-35	804+25.00	815+30.57			X	
I-35	796+97.59	902+00.00			X	

Equation: Sta. 796+97.59 (AH) = Sta. 815+30.63 (BK)

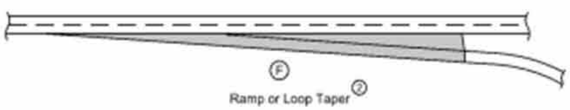
100-25M
Modified

HMA PAVEMENT

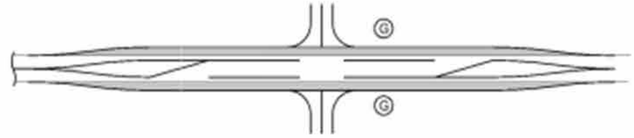
What mix quantities, measurements, location and corresponding stationing



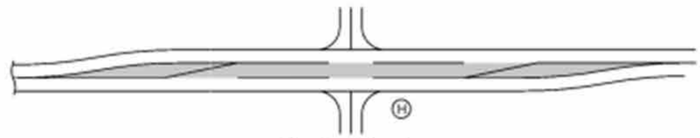
Typical Intersection



Ramp or Loop Taper 2



Channelized Intersection
Widen Existing Roadway



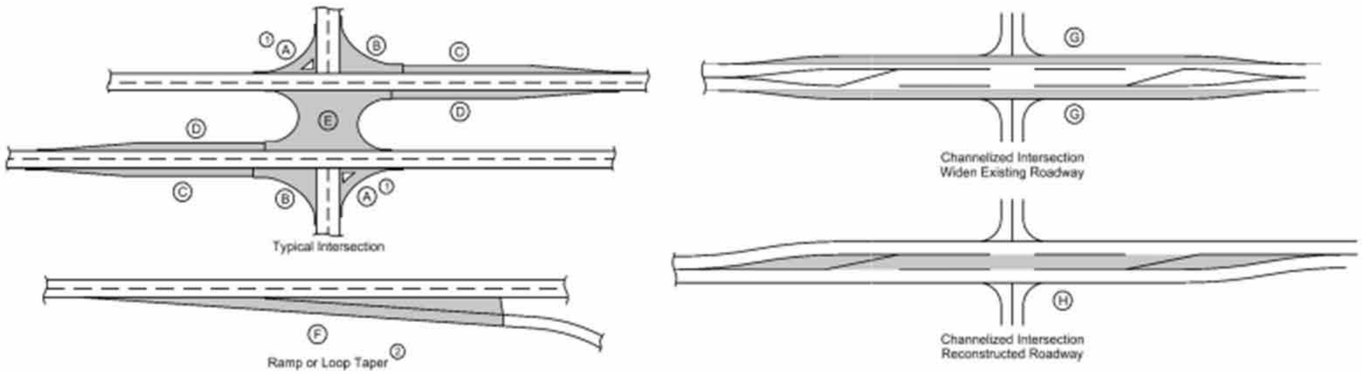
Channelized Intersection
Reconstructed Roadway

1. Does not include raised island area or curb. Refer to tabulation 112-4 for quantities.
2. Refer to PV-410, PV-411, PV-412, and PV-414.
3. Quantity includes Pavement Header.

Calculations assume a surface course unit weight (lbs/cf) of 147, an intermediate course unit weight (lbs/cf) of 147, an interlayer course unit weight (lbs/cf) of 150, and a special backfill unit weight (lbs/cf) of 140.

Location				Mainline			Area			Bid Items: Hot Mix Asphalt Pavement						Binder (6%)							
Road Identification	Direction of Travel	Station to Station		Width	Length	Area	A 1	B	F 3	Surface Very High 1/2" L-2 Mix		Intermediate Very High 1/2" Mix		Interlayer 3/8" Mix		Surface PG 58-28V	Intermediate PG 58-28V	Interlayer PG 58-34E	Special Backfill	Modified Subbase	Granular Subbase	Pavement Scarification	Remarks
				FT	FT	SY	SY	SY	SY	TONS	SY	TONS	SY	TONS	SY	TONS	TONS	TONS	TONS	CY	SY	SY	
MAINLINE																							
I-35	NB	805+75.00	815+30.63	24.0	955.6	2548.3				280.955	2548.3	280.955	2548.3	143.345	2548.3	16.857	16.857	8.601				2548.3	
I-35	NB	796+97.59	815+74.46	24.0	1876.9	5005.0			1404.9	706.690	6409.9	706.690	6409.9	360.556	6409.9	42.401	42.401	21.633				6409.9	
I-35	NB	Bridge and approaches																					
I-35	NB	821+04.10	828+88.42	24.0	784.3	2091.5			111.8	242.916	2203.3	242.916	2203.3	123.937	2203.3	14.575	14.575	7.436				2203.3	
I-35	NB	Bridge and approaches																					
I-35	NB	834+02.25	836+20.00	24.0	217.8	666.5			350.0	112.069	1016.5	112.069	1016.5	57.178	1016.5	6.724	6.724	3.431				1016.5	
I-35	NB	836+20.00	843+49.89	36.0	729.9	2919.6				321.881	2919.6	321.881	2919.6	164.225	2919.6	19.313	19.313	9.854				2919.6	
I-35	NB	Bridge and approaches																					
I-35	NB	848+30.11	849+90.00	36.0	159.9	639.6				70.511	639.6	70.511	639.6	35.975	639.6	4.231	4.231	2.159				639.6	
I-35	NB	849+90.00	861+52.22	24.0	1162.2	3099.3			1143.6	467.775	4242.9	467.775	4242.9	238.661	4242.9	28.066	28.066	14.320				4242.9	
I-35	NB	Bridge and approaches																					
I-35	NB	867+27.50	900+50.00	24.0	3322.5	8860.0			2195.0	1218.814	11055.0	1218.814	11055.0	621.844	11055.0	73.129	73.129	37.311				11055.0	
I-35	SB	805+75.00	815+30.63	24.0	955.6	2548.3			16.3	282.752	2564.6	282.752	2564.6	144.261	2564.6	16.965	16.965	8.656				2564.6	
I-35	SB	796+97.59	815+74.46	24.0	1876.9	5005.0			2156.2	789.521	7161.2	789.521	7161.2	402.817	7161.2	47.371	47.371	24.169				7161.2	
I-35	SB	Bridge and approaches																					
I-35	SB	821+04.10	828+87.42	24.0	783.3	2088.9			467.4	281.827	2556.3	281.827	2556.3	143.789	2556.3	16.910	16.910	8.627				2556.3	
I-35	SB	Bridge and approaches																					
I-35	SB	834+01.25	844+47.15	36.0	1045.9	4183.6				461.242	4183.6	461.242	4183.6	235.327	4183.6	27.675	27.675	14.120				4183.6	
I-35	SB	Bridge and approaches																					
I-35	SB	848+47.61	861+31.32	24.0	1283.7	3423.2			1170.3	506.436	4593.5	506.436	4593.5	258.386	4593.5	30.386	30.386	15.503				4593.5	
I-35	SB	Bridge and approaches																					
I-35	SB	867+06.60	900+50.00	24.0	3343.4	8915.7			1405.0	1137.861	10320.7	1137.861	10320.7	580.541	10320.7	68.272	68.272	34.832				10320.7	
INSIDE SHOULDER																							
I-35	NB	805+75.00	815+30.63	6.0	955.6	637.1				70.239	637.1	70.239	637.1	35.836	637.1	4.214	4.214	2.150				637.1	
I-35	NB	796+97.59	815+74.46	6.0	1876.9	1251.2				137.950	1251.2	137.950	1251.2	70.383	1251.2	8.277	8.277	4.223				1251.2	
I-35	NB	Bridge and approaches																					
I-35	NB	821+04.10	828+88.42	6.0	784.3	522.9				57.648	522.9	57.648	522.9	29.412	522.9	3.459	3.459	1.765				522.9	
I-35	NB	Bridge and approaches																					
I-35	NB	834+02.25	843+49.89	6.0	947.6	631.8				69.652	631.8	69.652	631.8	35.537	631.8	4.179	4.179	2.132				631.8	
I-35	NB	Bridge and approaches																					
I-35	NB	848+30.11	849+90.00	6.0	159.9	106.6				11.752	106.6	11.752	106.6	5.996	106.6	0.705	0.705	0.360				106.6	
I-35	NB	849+90.00	861+52.22	6.0	1162.2	774.8				85.423	774.8	85.423	774.8	43.583	774.8	5.125	5.125	2.615				774.8	
I-35	NB	Bridge and approaches																					
I-35	NB	867+27.50	900+50.00	6.0	3322.5	2215.0				244.204	2215.0	244.204	2215.0	124.594	2215.0	14.652	14.652	7.476				2215.0	
I-35	SB	805+75.00	815+30.63	6.0	955.6	637.1				70.239	637.1	70.239	637.1	35.836	637.1	4.214	4.214	2.150				637.1	
I-35	SB	796+97.59	815+74.46	6.0	1876.9	1251.2				137.950	1251.2	137.950	1251.2	70.383	1251.2	8.277	8.277	4.223				1251.2	
I-35	SB	Bridge and approaches																					
I-35	SB	821+04.10	828+87.42	6.0	783.3	522.2				57.574	522.2	57.574	522.2	29.374	522.2	3.454	3.454	1.762				522.2	
I-35	SB	Bridge and approaches																					
I-35	SB	834+01.25	844+47.15	6.0	1045.9	697.3				76.874	697.3	76.874	697.3	39.221	697.3	4.612	4.612	2.353				697.3	
I-35	SB	Bridge and approaches																					

HMA PAVEMENT

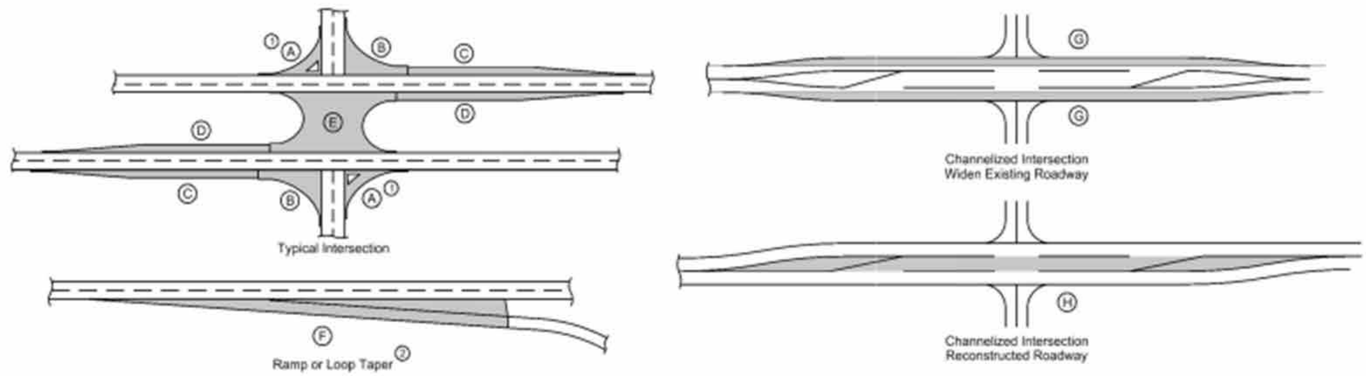


1. Does not include raised island area or curb. Refer to tabulation 112-4 for quantities.
2. Refer to PV-410, PV-411, PV-412, and PV-414.
3. Quantity includes Pavement Header.

Calculations assume a surface course unit weight (lbs/cf) of 147, an intermediate course unit weight (lbs/cf) of 147, an interlayer course unit weight (lbs/cf) of 150, and a special backfill unit weight (lbs/cf) of 140.

Location				Mainline			Area			Bid Items: Hot Mix Asphalt Pavement						Binder (6%)							
Road Identification	Direction of Travel	Station to Station		Width	Length	Area	A (1)	B	F (2)	Surface Very High 1/2" L-2 Mix		Intermediate Very High 1/2" Mix		Interlayer 3/8" Mix		Surface PG 58-28V	Intermediate PG 58-28V	Interlayer PG 58-34E	Special Backfill	Modified Subbase	Granular Subbase	Pavement Scarification	Remarks
				FT	FT	SY	SY	SY	SY	TONS	SY	TONS	SY	TONS	SY	TONS	TONS	TONS	TONS	CY	SY	SY	
I-35	SB	848+47.61	861+31.32	6.0	1283.7	855.8				94.353	855.8	94.353	855.8	48.139	855.8	5.661	5.661	2.888				855.8	
I-35	SB	Bridge and approaches																					
I-35	SB	867+06.60	900+50.00	6.0	3343.4	2228.9				245.740	2228.9	245.740	2228.9	125.378	2228.9	14.744	14.744	7.523				2228.9	
MAINLINE - OUTSIDE SHOULDER PAVEMENT SCARIFICATION ONLY																							
I-35	NB	805+75.00	815+30.63	10.0	955.6	1061.8																1061.8	
I-35	NB	796+97.59	802+00.00	10.0	502.4	558.2																558.2	
I-35	NB	802+00.00	803+20.00	10.0	120.0	133.3																133.3	
I-35	NB	803+20.00	809+00.00	10.0	580.0	644.4																644.4	
I-35	NB	809+00.00	815+74.46	10.0	674.5	749.4																749.4	
I-35	NB	Bridge and Approaches																					
I-35	NB	821+04.10	828+60.25	10.0	756.1	840.2																840.2	
		828+60.25	828+88.42	10.0	28.2	31.3																31.3	
I-35	NB	Bridge and Approaches																					
I-35	NB	834+05.25	836+20.00	10.0	214.8	238.6																238.6	
I-35	NB	836+20.00	843+49.89	10.0	729.9	811.0																811.0	
I-35	NB	Bridge and Approaches																					
I-35	NB	848+30.11	849+90.00	10.0	159.9	177.7																177.7	
I-35	NB	849+90.00	850+91.60	10.0	101.6	112.9																112.9	
I-35	NB	850+91.60	854+59.00	10.0	367.4	408.2																408.2	
I-35	NB	854+59.00	861+52.22	10.0	693.2	770.2																770.2	
I-35	NB	Bridge and Approaches																					
I-35	NB	867+27.50	875+48.80	10.0	821.3	912.6																912.6	
I-35	NB	875+48.80	886+23.44	10.0	1074.6	1194.0																1194.0	
I-35	NB	886+23.44	888+00.00	10.0	176.6	196.2																196.2	
I-35	NB	888+00.00	900+50.00	10.0	1250.0	1388.9																1388.9	
I-35	SB	805+75.00	814+33.00	10.0	858.0	953.3																953.3	
I-35	SB	814+33.00	815+30.63	10.0	97.6	108.5																108.5	
I-35	SB	796+97.59	797+46.00	10.0	48.4	53.8																53.8	
I-35	SB	797+46.00	808+70.60	10.0	1124.6	1249.6																1249.6	
I-35	SB	808+70.60	815+74.46	10.0	703.9	782.1																782.1	
I-35	SB	Bridge and Approaches																					
I-35	SB	821+04.10	827+77.92	10.0	673.8	748.7																748.7	
I-35	SB	827+77.92	828+87.42	10.0	109.5	121.7																121.7	
I-35	SB	Bridge and Approaches																					
I-35	SB	834+04.25	844+47.15	10.0	1042.9	1158.8																1158.8	
I-35	SB	Bridge and Approaches																				0.0	
I-35	SB	848+47.61	852+27.11	10.0	379.5	421.7																421.7	
I-35	SB	852+27.11	861+32.32	10.0	905.2	1005.8																1005.8	
I-35	SB	Bridge and Approaches																					
I-35	SB	867+06.60	873+92.13	10.0	685.5	761.7																761.7	
I-35	SB	873+92.13	879+74.09	10.0	582.0	646.6																646.6	
I-35	SB	879+74.09	880+53.94	10.0	79.9	88.7																88.7	
I-35	SB	880+53.94	900+50.00	10.0	1996.1	2217.8																2217.8	

HMA PAVEMENT

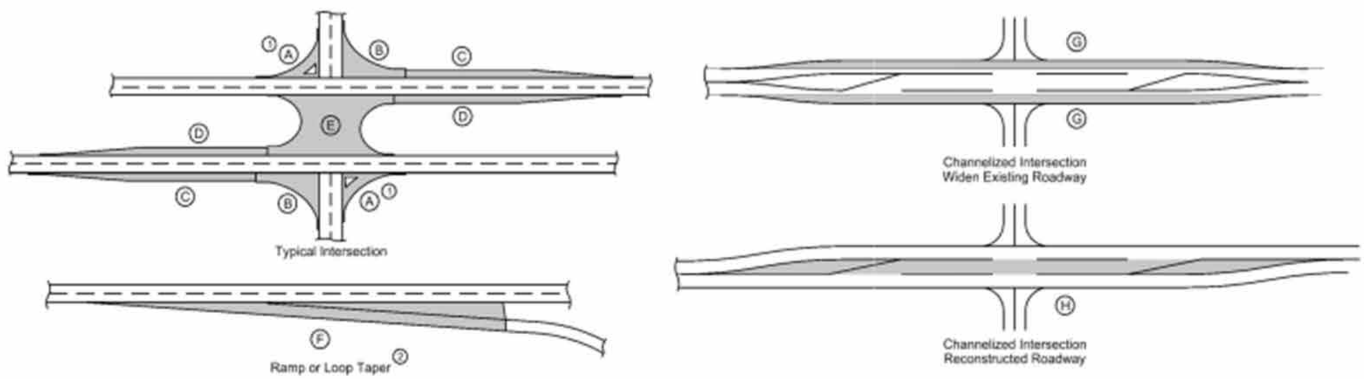


1. Does not include raised island area or curb. Refer to tabulation 112-4 for quantities.
2. Refer to PV-410, PV-411, PV-412, and PV-414.
3. Quantity includes Pavement Header.

Calculations assume a surface course unit weight (lbs/cf) of 147, an intermediate course unit weight (lbs/cf) of 147, an interlayer course unit weight (lbs/cf) of 150, and a special backfill unit weight (lbs/cf) of 140.

Location				Mainline			Area			Bid Items: Hot Mix Asphalt Pavement						Binder (6%)							
Road Identification	Direction of Travel	Station to Station		Width	Length	Area	A (1)	B	F (2)	Surface Very High 1/2" L-2 Mix		Intermediate Very High 1/2" Mix		Interlayer 3/8" Mix		Surface PG 58-28V	Intermediate PG 58-28V	Interlayer PG 58-34E	Special Backfill	Modified Subbase	Granular Subbase	Pavement Scarification	Remarks
				FT	FT	SY	SY	SY	SY	TONS	SY	TONS	SY	TONS	SY	TONS	TONS	TONS	TONS	CY	SY	SY	
MAINLINE - OUTSIDE SHOULDER RUNOUTS PAVEMENT SCARIFICATION ONLY																							
I-35	NB	804+25.00	805+75.00	10.0	150.0	166.7																166.7	
I-35	NB	815+74.46	817+24.46	10.0	150.0	166.7																166.7	
I-35	NB	819+54.10	821+04.10	10.0	150.0	166.7																166.7	
I-35	NB	828+88.42	830+38.42	10.0	150.0	166.7																166.7	
I-35	NB	832+52.25	834+02.25	10.0	150.0	166.7																166.7	
I-35	NB	843+49.89	844+99.89	10.0	150.0	166.7																166.7	
I-35	NB	846+80.11	848+30.11	10.0	150.0	166.7																166.7	
I-35	NB	861+52.22	863+02.22	10.0	150.0	166.7																166.7	
I-35	NB	865+77.50	867+27.50	10.0	150.0	166.7																166.7	
I-35	NB	900+50.00	902+00.00	10.0	150.0	166.7																166.7	
I-35	SB	804+25.00	805+75.00	10.0	150.0	166.7																166.7	
I-35	SB	815+74.46	817+24.46	10.0	150.0	166.7																166.7	
I-35	SB	819+54.10	821+04.10	10.0	150.0	166.7																166.7	
I-35	SB	828+87.42	830+37.42	10.0	150.0	166.7																166.7	
I-35	SB	832+51.25	834+01.25	10.0	150.0	166.7																166.7	
I-35	SB	844+47.15	845+97.15	10.0	150.0	166.7																166.7	
I-35	SB	846+97.61	848+47.61	10.0	150.0	166.7																166.7	
I-35	SB	861+31.32	862+81.32	10.0	150.0	166.7																166.7	
I-35	SB	865+56.60	867+06.60	10.0	150.0	166.7																166.7	
I-35	SB	900+50.00	902+00.00	10.0	150.0	166.7																166.7	
MAINLINE AND INSIDE SHOULDER RUNOUTS																							
I-35	NB	804+25.00	805+75.00	30.0	150.0	500.0				55.125	500.0	55.125	500.0	28.125	500.0	3.308	3.308	1.688				500.0	
I-35	NB	815+74.46	817+24.46	30.0	150.0	500.0				55.125	500.0	55.125	500.0	28.125	500.0	3.308	3.308	1.688				500.0	
I-35	NB	819+54.10	821+04.10	30.0	150.0	500.0				55.125	500.0	55.125	500.0	28.125	500.0	3.308	3.308	1.688				500.0	
I-35	NB	828+88.42	830+38.42	30.0	150.0	500.0				55.125	500.0	55.125	500.0	28.125	500.0	3.308	3.308	1.688				500.0	
I-35	NB	832+52.25	834+02.25	30.0	150.0	770.8				84.981	770.8	84.981	770.8	43.358	770.8	5.099	5.099	2.601				770.8	
I-35	NB	843+49.89	844+99.89	42.0	150.0	700.0				77.175	700.0	77.175	700.0	39.375	700.0	4.631	4.631	2.363				700.0	
I-35	NB	846+80.11	848+30.11	42.0	150.0	700.0				77.175	700.0	77.175	700.0	39.375	700.0	4.631	4.631	2.363				700.0	
I-35	NB	861+52.22	863+02.22	30.0	150.0	500.0				55.125	500.0	55.125	500.0	28.125	500.0	3.308	3.308	1.688				500.0	
I-35	NB	865+77.50	867+27.50	30.0	150.0	500.0				55.125	500.0	55.125	500.0	28.125	500.0	3.308	3.308	1.688				500.0	
I-35	NB	900+50.00	902+00.00	30.0	150.0	500.0				55.125	500.0	55.125	500.0	28.125	500.0	3.308	3.308	1.688				500.0	
I-35	SB	804+25.00	805+75.00	30.0	150.0	500.0				55.125	500.0	55.125	500.0	28.125	500.0	3.308	3.308	1.688				500.0	
I-35	SB	815+74.46	817+24.46	30.0	150.0	500.0				55.125	500.0	55.125	500.0	28.125	500.0	3.308	3.308	1.688				500.0	
I-35	SB	819+54.10	821+04.10	30.0	150.0	500.0				55.125	500.0	55.125	500.0	28.125	500.0	3.308	3.308	1.688				500.0	
I-35	SB	828+87.42	830+37.42	30.0	150.0	500.0				55.125	500.0	55.125	500.0	28.125	500.0	3.308	3.308	1.688				500.0	
I-35	SB	832+51.25	834+01.25	42.0	150.0	700.0				77.175	700.0	77.175	700.0	39.375	700.0	4.631	4.631	2.363				700.0	
I-35	SB	844+47.15	845+97.15	42.0	150.0	700.0				77.175	700.0	77.175	700.0	39.375	700.0	4.631	4.631	2.363				700.0	
I-35	SB	846+97.61	848+47.61	30.0	150.0	500.0				55.125	500.0	55.125	500.0	28.125	500.0	3.308	3.308	1.688				500.0	
I-35	SB	861+31.32	862+81.32	30.0	150.0	500.0				55.125	500.0	55.125	500.0	28.125	500.0	3.308	3.308	1.688				500.0	
I-35	SB	865+56.60	867+06.60	30.0	150.0	500.0				55.125	500.0	55.125	500.0	28.125	500.0	3.308	3.308	1.688				500.0	

HMA PAVEMENT



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Location				Mainline			Area			Bid Items: Hot Mix Asphalt Pavement						Binder (6%)							
Road Identification	Direction of Travel	Station to Station		Width	Length	Area	A (1)	B	F (2)	Surface Very High 1/2" L-2 Mix		Intermediate Very High 1/2" Mix		Interlayer 3/8" Mix		Surface PG 58-28V	Intermediate PG 58-28V	Interlayer PG 58-34E	Special Backfill	Modified Subbase	Granular Subbase	Pavement Scarification	Remarks
				FT	FT	SY	SY	SY	SY	TONS	SY	TONS	SY	TONS	SY	TONS	TONS	TONS	TONS	CY	SY	SY	
I-35	SB	900+50.00	902+00.00	30.0	150.0	500.0				55.125	500.0	55.125	500.0	28.125	500.0	3.308	3.308	1.688				500.0	
4th Ave. S. - INCLUDING INSIDE AND OUTSIDE SHOULDERS																							
Ramp A		1517+19.90	1525+19.59	26.0	799.7	2310.2				254.701	2310.2	254.701	2310.2			15.282	15.282					2310.2	
Ramp B		2517+00.41	2524+97.01	26.0	796.6	2301.3				253.717	2301.3	253.717	2301.3			15.223	15.223					2301.3	
Ramp C		3509+10.04	3517+32.38	26.0	822.3	2375.6				261.915	2375.6	261.915	2375.6			15.715	15.715					2375.6	
Ramp D		4508+86.71	4517+62.32	26.0	875.6	2529.5				278.882	2529.5	278.882	2529.5			16.733	16.733					2529.5	
US 18 - INCLUDING INSIDE AND OUTSIDE SHOULDERS																							
Ramp A		1545+17.48	1550+15.00	26.0	497.5	1437.3				158.460	1437.3	158.460	1437.3			9.508	9.508					1437.3	
Ramp A		1550+15.00	1550+75.00	26 to 32	60.0	193.0				21.278	193.0	21.278	193.0			1.277	1.277					193.0	
Ramp A		1550+75.00	1552+00.00	32.0	125.0	444.4				49.000	444.4	49.000	444.4			2.940	2.940					444.4	
Ramp A		1552+00.00	1553+20.00	32 to 40	120.0	480.0				52.920	480.0	52.920	480.0			3.175	3.175					480.0	
Ramp A		1553+20.00	1553+52.17	40.0	32.2	143.0				15.763	143.0	15.763	143.0			0.946	0.946					143.0	
Ramp B		2546+96.53	2552+20.00	26.0	523.5	1512.2				166.725	1512.2	166.725	1512.2			10.004	10.004					1512.2	
Ramp B		2552+20.00	2553+40.00	26 to 36	120.0	413.0				45.533	413.0	45.533	413.0			2.732	2.732					413.0	
Ramp B		2553+40.00	2555+57.80	36.0	217.8	871.2				96.050	871.2	96.050	871.2			5.763	5.763					871.2	
Ramp C		3538+24.97	3547+85.94	26.0	961.0	2776.1				306.069	2776.1	306.069	2776.1			18.364	18.364					2776.1	
Ramp D		4538+81.88	4547+40.02	26.0	858.1	2479.1				273.318	2479.1	273.318	2479.1			16.399	16.399					2479.1	
4th Ave. S. - RUNOUTS INCLUDING INSIDE AND OUTSIDE SHOULDERS																							
Ramp A		1525+19.59	1525+93.92	26.0	74.3	214.7				23.674	214.7	23.674	214.7			1.420	1.420					214.7	
		1525+93.92	1526+69.59	16.0	75.7	134.5	178.0	104.7															
Ramp B		2524+97.01	2525+76.20	26.0	79.2	228.8				25.222	228.8	25.222	228.8			1.513	1.513					228.8	
		2525+76.20	2526+47.01	16.0	70.8	125.9	170.5	138.3															
Ramp C		3507+60.04	3508+34.07	16.0	74.0	131.6	131.0	185.0		49.349	447.6	49.349	447.6			2.961	2.961					447.6	
		3508+34.07	3509+10.04	26.0	76.0	219.5																	
Ramp D		4507+36.71	4508+15.10	16.0	78.4	139.4	126.5	190.7		50.336	456.6	50.336	456.6			3.020	3.020					456.6	
		4508+15.10	4508+86.71	26.0	71.6	206.9																	
US 18 - RUNOUTS INCLUDING INSIDE AND OUTSIDE SHOULDERS																							
Ramp A		1553+52.17	1555+02.17	24.0	150.0	400.0	348.9	156.0		99.765	904.9	99.765	904.9			5.986	5.986					904.9	
Ramp B		2555+57.80	2556+23.62	36.0	65.8	263.3				29.027	263.3	29.027	263.3			1.742	1.742					263.3	
		2556+23.62	2557+07.80	26.0	84.2	243.2	194.0	37.4															
Ramp C		3536+74.97	3537+88.12	16.0	113.2	201.2	63.7	342.0		66.906	606.9	66.906	606.9			4.014	4.014					606.9	
		3537+88.12	3538+24.97	26.0	36.8	106.5																	
Ramp D		4537+31.88	4538+81.88	16.0	150.0	266.7	77.3	349.8		76.488	693.8	76.488	693.8			4.589	4.589					693.8	
TOTALS:										12116.500	109900.2	12116.500	109900.2	4827.246	85817.7	726.990	726.990	289.635				133781.2	

SHOULDERS

(1) Lane(s) to which the shoulder is adjacent.
(2) See Typ. 7156, 7157, or 7158.
(3) Bid Item.
(4) Applies only for Paved Shoulders constructed on project with existing granular shoulders.
(5) Bid Item. Typ. 7156, 7157, or 7158.
(6) Does not include shrink.

Calculations assume a HMA unit weight (lbs/cf) of 145, a Special Backfill unit weight (lbs/cf) of 140, and a Granular Shoulder unit weight (lbs/cf) of 140.

Location: Road Identification	Direction of Traffic (1)	Station	to Station	Side	(P) Width FT	(P56) Width FT (2)	(G) Width FT	(L) Length FT	Quantities: Class 13 Excavation (4) CY (3)	Hot Mix Asphalt TON	Hot Mix Asphalt TON/STA	Binder TONS	Paved Shoulder SY (5)	9" Paved Shoulder at Guardrail SY (5)	Reinforced Paved Shoulder SY (5)	Special Backfill HMA Alternate TON (2)	Special Backfill HMA Alternate TON/STA	Special Backfill PCC Alternate TON (2)	Special Backfill PCC Alternate TON/STA	Subbase CY (3)	Granular Shoulder TON (3)	Granular Shoulder TON/STA	Earth Shoulder Construction Alternates STA (5)	Earth Shoulder HMA CY (6)	Earth Shoulder PCC CY (6)	Remarks
MAINLINE																										
I-35	NB	805+75.00	815+30.63	OUT	10.0			955.6		311.774	32.625	18.706	1061.8										9.6	7.1		
I-35	NB	796+97.59	802+00.00	OUT	10.0			502.4		163.911	32.625	9.835	558.2										5.0	3.7		
I-35	NB	802+00.00	803+20.00	OUT	10 to 6			120.0		29.580	24.650	1.775	106.7										1.2	0.9		
I-35	NB	803+20.00	809+00.00	OUT	6.0			580.0		109.330	18.850	6.560	386.7										5.8	4.3		
I-35	NB	809+00.00	815+74.46	OUT	10.0			674.5		220.043	32.625	13.203	749.4										6.7	5.0		
I-35	NB	Bridge and Approaches																								
I-35	NB	821+04.10	828+60.25	OUT	10.0			756.1		246.694	32.625	14.802	840.2										7.6	5.6		
I-35	NB	828+60.25	828+88.42	OUT	6.0			28.2		5.310	18.850	0.319	18.8										0.3	0.2		
I-35	NB	Bridge and Approaches																								
I-35	NB	834+05.25	836+20.00	OUT	6 to 10			214.8		52.936	24.650	3.176	190.9										2.1	1.6		
I-35	NB	836+20.00	843+49.89	OUT	10.0			729.9		238.127	32.625	14.288	811.0										7.3	5.4		
I-35	NB	Bridge and Approaches																								
I-35	NB	848+30.11	849+90.00	OUT	10.0			159.9		52.164	32.625	3.130	177.7										1.6	1.2		
I-35	NB	849+90.00	850+91.60	OUT	10 to 6			101.6		25.044	24.650	1.503	90.3										1.0	0.8		
I-35	NB	850+91.60	854+59.00	OUT	6.0			367.4		69.255	18.850	4.155	244.9										3.7	2.7		
I-35	NB	854+59.00	861+52.22	OUT	10.0			693.2		226.163	32.625	13.570	770.2										6.9	5.1		
I-35	NB	Bridge and Approaches																								
I-35	NB	867+27.50	875+48.80	OUT	10.0			821.3		267.949	32.625	16.077	912.6										8.2	6.1		
I-35	NB	875+48.80	886+23.44	OUT	6.0			1074.6		202.570	18.850	12.154	716.4										10.7	8.0		
I-35	NB	886+23.44	888+00.00	OUT	6 to 10			176.6		43.522	24.650	2.611	156.9										1.8	1.3		
I-35	NB	888+00.00	900+50.00	OUT	10.0			1250.0		407.813	32.625	24.469	1388.9										12.5	9.3		
I-35	SB	805+75.00	814+33.00	OUT	10.0			858.0		279.923	32.625	16.795	953.3										8.6	6.4		
I-35	SB	814+33.00	815+30.63	OUT	10 to 7.4			97.6		27.251	27.913	1.635	94.4										1.0	0.7		
I-35	SB	796+97.59	797+46.00	OUT	7.4 to 6			48.4		10.178	21.025	0.611	36.0										0.5	0.4		
I-35	SB	797+46.00	808+70.60	OUT	6.0			1124.6		211.987	18.850	12.719	749.7										11.2	8.3		
I-35	SB	808+70.60	815+74.46	OUT	10.0			703.9		229.634	32.625	13.778	782.1										7.0	5.2		
I-35	SB	Bridge and Approaches																								
I-35	SB	821+04.10	827+77.92	OUT	10.0			673.8		219.834	32.625	13.190	748.7										6.7	5.0		
I-35	SB	827+77.92	828+87.42	OUT	6.0			109.5		20.641	18.850	1.238	73.0										1.1	0.8		
I-35	SB	Bridge and Approaches																								
I-35	SB	834+04.25	844+47.15	OUT	10.0			1042.9		340.246	32.625	20.415	1158.8										10.4	7.7		
I-35	SB	Bridge and Approaches																								
I-35	SB	848+47.61	852+27.11	OUT	6.0			379.5		71.536	18.850	4.292	253.0										3.8	2.8		
I-35	SB	852+27.11	861+32.32	OUT	10.0			905.2		295.325	32.625	17.719	1005.8										9.1	6.7		
I-35	SB	Bridge and Approaches																								
I-35	SB	867+06.60	873+92.13	OUT	10.0			685.5		223.654	32.625	13.419	761.7										6.9	5.1		
I-35	SB	873+92.13	879+74.09	OUT	6.0			582.0		109.699	18.850	6.582	388.0										5.8	4.3		
I-35	SB	879+74.09	880+53.94	OUT	6 to 10			79.9		19.683	24.650	1.181	71.0										0.8	0.6		
I-35	SB	880+53.94	900+50.00	OUT	10.0			1996.1		651.215	32.625	39.073	2217.8										20.0	14.8		
MAINLINE - OUTSIDE SHOULDER RUNOUTS																										
I-35	NB	804+25.00	805+75.00	OUT	10.0			150.0		32.081	21.388	1.925	166.7										1.5	1.1		
I-35	NB	815+74.46	817+24.46	OUT	10.0			150.0		32.081	21.388	1.925	166.7										1.5	1.1		
I-35	NB	819+54.10	821+04.10	OUT	10.0			150.0		32.081	21.388	1.925	166.7										1.5	1.1		
I-35	NB	828+88.42	830+38.42	OUT	6.0			150.0		23.381	15.588	1.403	100.0										1.5	1.1		
I-35	NB	832+52.25	834+02.25	OUT	6.0			150.0		23.381	15.588	1.403	100.0										1.5	1.1		
I-35	NB	843+49.89	844+99.89	OUT	10.0			150.0		32.081	21.388	1.925	166.7										1.5	1.1		
I-35	NB	846+80.11	848+30.11	OUT	10.0			150.0		32.081	21.388	1.925	166.7										1.5	1.1		
I-35	NB	861+52.22	863+02.22	OUT	10.0			150.0		32.081	21.388	1.925	166.7										1.5	1.1		
I-35	NB	865+77.50	867+27.50	OUT	10.0			150.0		32.081	21.388	1.925	166.7										1.5	1.1		
I-35	NB	900+50.00	902+00.00	OUT	10.0			150.0		32.081	21.388	1.925	166.7										1.5	1.1		
I-35	SB	804+25.00	805+75.00	OUT	10.0			150.0		32.081	21.388	1.925	166.7										1.5	1.1		
I-35	SB	815+74.46	817+24.46	OUT	10.0			150.0		32.081	21.388	1.925	166.7										1.5	1.1		
I-35	SB	819+54.10	821+04.10	OUT	10.0			150.0		32.081	21.388	1.925	166.7										1.5	1.1		
I-35	SB	828+87.42	830+37.42	OUT	6.0			150.0		23.381	15.588	1.403	100.0										1.5	1.1		
I-35	SB	832+51.25	834+01.25	OUT	10.0			150.0		32.081	21.388	1.925	166.7										1.5	1.1		
I-35	SB	844+47.15	845+97.15	OUT	10.0			150.0		32.081	21.388	1.925	166.7										1.5	1.1		
I-35	SB	846+97.61	848+47.61	OUT	6.0			150.0		23.381	15.588	1.403	100.0										1.5	1.1		
I-35	SB	861+31.32	862+81.32	OUT	10.0			150.0		32.081	21.388	1.925	166.7										1.5	1.1		
I-35	SB	865+56.60	867+06.60	OUT	10.0			150.0		32.081	21.388	1.925	166.7										1.5	1.1		
I-35	SB	900+50.00	902+00.00	OUT	10.0			150.0		32.081	21.388	1.925	166.7										1.5	1.1		
MAINLINE - INSIDE EARTH SHOULDERS																										
I-35	NB	805+75.00	815+30.63					955.6															9.6	7.1		
I-35	NB	796+97.59	815+74.46					1876.9															18.8	13.9		
I-35	NB	Bridge and approaches																						0.0		
I-35	NB	821+04.10	828+88.42					784.3															7.8	5.8		
I-35	NB	Bridge and approaches																						0.0		

SHOULDERS

1. Lane(s) to which the shoulder is adjacent.
2. See Typ. 7156, 7157, or 7158.
3. Bid Item.
4. Applies only for Paved Shoulders constructed on project with existing granular shoulders.
5. Bid Item. Typ. 7156, 7157, or 7158.
6. Does not include shrink.

Calculations assume a HMA unit weight (lbs/cf) of 145, a Special Backfill unit weight (lbs/cf) of 140, and a Granular Shoulder unit weight (lbs/cf) of 140.

Location: Road Identification	Direction of Traffic (1)	Station	to Station	Side	(P) Width FT	($P_{1/4}$) Width FT (2)	(G) Width FT	(L) Length FT	Class 13 Excavation (4) CY (3)	Hot Mix Asphalt TON	Hot Mix Asphalt TON/STA	Binder TONS	Paved Shoulder SY (5)	9" Paved Shoulder at Guardrail SY (5)	Reinforced Paved Shoulder SY (5)	Special Backfill HMA Alternate TON (3)	Special Backfill HMA Alternate TON/STA	Special Backfill PCC Alternate TON (3)	Special Backfill PCC Alternate TON/STA	Subbase CY (3)	Granular Shoulder TON (3)	Granular Shoulder TON/STA	Earth Shoulder Construction Alternates STA (5)	Earth Shoulder Construction Alternates HMA CY (6)	Earth Shoulder Construction Alternates PCC CY (6)	Remarks
I-35	NB	834+02.25	843+49.89					947.6															9.5	7.0		
I-35	NB	Bridge and approaches																						0.0		
I-35	NB	848+30.11	849+90.00					159.9															1.6	1.2		
I-35	NB	849+90.00	861+52.22					1162.2															11.6	8.6		
I-35	NB	Bridge and approaches																						0.0		
I-35	NB	867+27.50	900+50.00					3322.5															33.2	24.6		
I-35	SB	805+75.00	815+30.63					955.6															9.6	7.1		
I-35	SB	796+97.59	815+74.46					1876.9															18.8	13.9		
I-35	SB	Bridge and approaches																						0.0		
I-35	SB	821+04.10	828+87.42					783.3															7.8	5.8		
I-35	SB	Bridge and approaches																						0.0		
I-35	SB	834+01.25	844+47.15					1045.9															10.5	7.7		
I-35	SB	Bridge and approaches																						0.0		
I-35	SB	848+47.61	861+31.32					1283.7															12.8	9.5		
I-35	SB	Bridge and approaches																						0.0		
I-35	SB	867+06.60	900+50.00					3343.4															33.4	24.8		
MAINLINE - PAVED SHOULDER IN FRONT OF GUARDRAIL																										
I-35	NB	814+24.31	814+44.31	OUT		3.1		20.0	1.7					6.9									0.2	3.0		
I-35	NB	814+44.31	814+92.07	OUT		3.1 to 1.2		47.8	2.9					11.4									0.5	7.1		
I-35	NB	814+92.07	816+51.44	OUT		1.2		159.4	5.3					21.2									1.6	23.6		
I-35	NB	813+86.81	814+06.81	MED		3.7		20.0	2.1					8.2									0.2	3.0		
I-35	NB	814+06.81	814+54.59	MED		3.7 to 1.8		47.8	3.6					14.6									0.5	7.1		
I-35	NB	814+54.59	816+51.44	MED		1.8 to 1.3		196.9	8.5					33.9									2.0	29.2		
I-35/4th Ramp B	NB	826+90.57	827+10.05	OUT		7.7		19.5	4.2					16.7									0.2	2.9		
I-35/4th Ramp B	NB	827+10.05	827+56.16	OUT		7.7 to 5.8		46.1	8.6					34.6									0.5	6.8		
I-35/4th Ramp B	NB	827+56.16	827+66.26	OUT		5.8		10.1	1.6					6.5									0.1	1.5		
I-35/4th Ramp B	NB	827+66.26	827+80.11	OUT		5.8 to 4.3		13.9	1.9					7.8									0.1	2.1		
I-35/4th Ramp B	NB	827+80.11	828+19.56	OUT		4.3 to 4.2		39.4	4.7					18.6									0.4	5.8		
I-35/4th Ramp B	NB	828+19.56	828+56.48	OUT		4.2 to 4.4		36.9	4.4					17.6									0.4	5.5		
I-35/4th Ramp B	NB	828+56.48	829+01.27	OUT		4.4		44.8	5.5					21.9									0.4	6.6		
I-35/4th Ramp B	NB	829+01.27	829+46.06	OUT		4.4 to 2.7		44.8	4.4					17.7									0.4	6.6		
I-35/4th Ramp B	NB	829+46.06	829+64.58	OUT		2.7 to 1.3		18.5	1.0					4.1									0.2	2.7		
I-35/4th Ramp B	NB	829+64.58	829+67.05	OUT		1.3		2.5	0.1					0.4									0.0	0.4		
I-35	NB	826+96.60	827+16.60	MED		3.1		20.0	1.7					6.9									0.2	3.0		
I-35	NB	827+16.60	827+64.38	MED		3.1 to 1.2		47.8	2.9					11.4									0.5	7.1		
I-35	NB	827+64.38	829+65.40	MED		1.2		201.0	6.7					26.8									2.0	29.8		
I-35	NB	834+48.24	834+68.24	OUT		7 to 7.2		20.0	3.9					15.8									0.2	3.0		
I-35	NB	834+68.24	835+16.01	OUT		7.2 to 5.3		47.8	8.3					33.2									0.5	7.1		
I-35	NB	835+16.01	836+76.63	OUT		5.3		160.6	23.6					94.6									1.6	23.8		
I-35	NB	842+03.33	842+23.33	OUT		3.0		20.0	1.7					6.7									0.2	3.0		
I-35	NB	842+23.33	842+71.11	OUT		3 to 1		47.8	2.7					10.6									0.5	7.1		
I-35	NB	842+71.11	844+26.87	OUT		1.0		155.8	4.3					17.3									1.6	23.1		
I-35	NB	841+74.36	841+94.36	MED		3.0		20.0	1.7					6.7									0.2	3.0		
I-35	NB	841+94.36	842+42.15	MED		3 to 1		47.8	2.7					10.6									0.5	7.1		
I-35	NB	842+42.15	844+26.87	MED		1.0		184.7	5.1					20.5									1.8	27.4		
I-35	NB	848+17.64	848+37.64	OUT		7.2		20.0	4.0					16.0									0.2	3.0		
I-35	NB	848+37.64	848+85.42	OUT		7.2 to 5.3		47.8	8.3					33.2									0.5	7.1		
I-35	NB	848+85.42	850+58.52	OUT		5.3		173.1	25.5					101.9									1.7	25.6		
I-35	NB	860+13.12	860+33.12	OUT		2.9		20.0	1.6					6.4									0.2	3.0		
I-35	NB	860+33.12	860+80.90	OUT		2.9 to 1		47.8	2.6					10.4									0.5	7.1		
I-35	NB	860+80.90	862+29.20	OUT		1 to 1.3		148.3	4.7					18.9									1.5	22.0		
I-35	NB	859+67.25	859+87.25	MED		3.2		20.0	1.8					7.1									0.2	3.0		
I-35	NB	859+87.25	860+35.04	MED		3.2 to 1.3		47.8	3.0					11.9									0.5	7.1		
I-35	NB	860+35.04	862+29.20	MED		1.3		194.2	7.0					28.0									1.9	28.8		
I-35	SB	820+21.13	821+80.48	OUT		1.2		159.3	5.3					21.2									1.6	23.6		
I-35	SB	821+80.48	822+28.27	OUT		1.2 to 3.1		47.8	2.9					11.4									0.5	7.1		
I-35	SB	822+28.27	822+48.27	OUT		3.1		20.0	1.7					6.9									0.2	3.0		
I-35	SB	820+21.13	822+17.98	MED		1.2		196.8	6.6					26.2									2.0	29.2		
I-35	SB	822+17.98	822+65.77	MED		1.2 to 3.1		47.8	2.9					11.4									0.5	7.1		
I-35	SB	822+65.77	822+85.77	MED		3.1		20.0	1.7					6.9									0.2	3.0		
I-35	SB	833+21.23	834+72.22	OUT		1.4		151.0	5.9					23.5									1.5	22.4		
I-35	SB	834+72.22	835+20.01	OUT		1.4 to 3.3		47.8	3.1					12.5									0.5	7.1		
I-35	SB	835+20.01	835+40.01	OUT		3.3		20.0	1.8					7.3									0.2	3.0		
I-35	SB	833+21.25	835+09.74	MED		1.3		188.5	6.8					27.2									1.9	27.9		
I-35	SB	835+09.74	835+57.52	MED		1.3 to 3.2		47.8	3.0					11.9									0.5	7.1		
I-35	SB	835+57.52	835+77.51	MED		3.2		20.0	1.8					7.1									0.2	3.0		
I-35	SB	847+64.01	849+59.16	OUT		1.0		195.2	5.4					21.7									2.0	28.9		
I-35	SB	849+59.16	850+06.88	OUT		1 to 3		47.7	2.7					10.6									0.5	7.1		

112-9M
Modified

SHOULDERS

(1) Lane(s) to which the shoulder is adjacent.
(2) See Typ. 7156, 7157, or 7158.
(3) Bid Item.
(4) Applies only for Paved Shoulders constructed on project with existing granular shoulders.
(5) Bid Item. Typ. 7156, 7157, or 7158.
(6) Does not include shrink.

Calculations assume a HMA unit weight (lbs/cf) of 145, a Special Backfill unit weight (lbs/cf) of 140, and a Granular Shoulder unit weight (lbs/cf) of 140.

Location					P	P_{SG}	G	L	Quantities																	
Road Identification	Direction Of Traffic (1)	Station to Station		Side	Width	Width	Width	Length	Class 13 Excavation (4)	Hot Mix Asphalt		Binder	Paved Shoulder	9" Paved Shoulder at Guardrail	Reinforced Paved Shoulder	Special Backfill				Subbase	Granular Shoulder		Earth Shoulder Construction Alternates			Remarks
																HMA Alternate		PCC Alternate						HMA	PCC	
					FT	FT (2)	FT	FT	CY (3)	TON	TON/STA	TONS	SY (5)	SY (5)	SY (5)	TON (3)	TON/STA	TON (3)	TON/STA	CY (3)	TON (3)	TON/STA	STA (5)	CY (6)	CY (6)	
I-35	SB	850+06.88	850+26.87	OUT		3.0		20.0	1.7					6.7									0.2	3.0		
I-35	SB	847+64.59	849+49.07	MED		1.0		184.5	5.1					20.5									1.8	27.3		
I-35	SB	849+49.07	849+96.85	MED		1 to 3		47.8	2.7					10.6									0.5	7.1		
I-35	SB	849+96.85	850+16.85	MED		3.0		20.0	1.7					6.7									0.2	3.0		
I-35	SB	866+23.57	867+71.88	OUT		1.3		148.3	5.4					21.4									1.5	22.0		
I-35	SB	867+71.88	868+19.66	OUT		1.3 to 3.2		47.8	3.0					11.9									0.5	7.1		
I-35	SB	868+19.66	868+39.66	OUT		3.2		20.0	1.8					7.1									0.2	3.0		
I-35	SB	866+23.57	868+17.74	MED		1.3		194.2	7.0					28.0									1.9	28.8		
I-35	SB	868+17.74	868+65.53	MED		1.3 to 3.2		47.8	3.0					11.9									0.5	7.1		
I-35	SB	868+65.53	868+85.53	MED		3.2		20.0	1.8					7.1									0.2	3.0		
TOTALS:									268.8	5989.815	1249.538	359.389	21541.5	1075.1									444.1	951.1		

112-10
10-20-20

MILLED RUMBLE STRIPS

See PV-12 and PV-13

* Calculated at 18" width for Shoulder.

Location				Rumble Strip Type (Centerline, Rt or Lt Shoulder)	L	Installation Length		Fog Seal* (Milled Rumble Strip)	Effective Shoulder Width			Remarks
Road Identification	Station to Station		Shoulder Pavement Type			PCC	HMA	Shoulder	PCC Paved	HMA Paved	Granular\ Earth	
					IN	STA	STA	GAL	FT	FT	FT	
MAINLINE												
I-35 NB	804+25.00	902+00.00	HMA	Right Shoulder	12"		97.75	105.9		10.0		
I-35 NB	804+25.00	902+00.00	HMA	Left Shoulder	12"		97.75	105.9		6.0		
I-35 SB	804+25.00	902+00.00	HMA	Right Shoulder	12"		97.75	105.9		6.0		
I-35 SB	804+25.00	902+00.00	HMA	Left Shoulder	12"		97.75	105.9		10.0		
TOTALS:							391.00	423.6				

108-13A
08-01-08

SAFETY CLOSURES

Refer to Section 2518 of the Standard Specifications

Station	Closure Type		Remarks
	Road Qty.	Hazard Qty.	
I-35/4th Ave. S.			
1517+19.90	1		Ramp A
2517+00.41	1		Ramp B
3507+60.04	1		Ramp C
4507+36.71	1		Ramp D
I-35/US 18			
1545+17.48	1		Ramp A
2546+96.53	1		Ramp B
3536+74.97	1		Ramp C
4537+31.88	1		Ramp D
TOTAL:	8		

110-7A
04-17-12

REMOVAL OF STEEL BEAM GUARDRAIL

(1) Lane(s) to which the installation is adjacent.
(2) Includes length of End Terminals and End Anchors.

No.	Location: Direction of Traffic (1)	Location: Milepost to Milepost		Location: Side	Removal of Guardrail (2) LF
1	NB	1+93.22	1+93.26	MED	211.2
2	NB	1+93.22	1+93.26	RT	211.2
3	NB	1+93.47	1+93.51	MED	211.2
4	NB	1+93.47	1+93.51	RT	211.2
5	NB	1+93.60	1+93.62	RT	105.6
6	NB	1+93.75	1+93.79	MED	211.2
7	NB	1+93.75	1+93.79	RT	211.2
8	NB	1+93.86	1+93.88	RT	105.6
9	NB	1+94.09	1+94.13	MED	211.2
10	NB	1+94.09	1+94.13	RT	211.2
11	SB	1+94.22	1+94.18	MED	211.2
12	SB	1+94.22	1+94.18	RT	211.2
13	SB	1+93.87	1+93.83	MED	211.2
14	SB	1+93.87	1+93.83	RT	211.2
15	SB	1+93.79	1+93.78	RT	52.8
16	SB	1+93.60	1+93.56	MED	211.2
17	SB	1+93.60	1+93.56	RT	211.2
18	SB	1+93.35	1+93.51	MED	844.8
19	SB	1+93.35	1+93.51	RT	844.8
	TOTAL:				4910.4

107-23
10-18-11

GRADING FOR GUARDRAIL INSTALLATIONS

(1) Lane(s) to which the installation is adjacent.

Refer to EW-301

No.	Direction of Traffic (1)	Station	Side	Foreslope at Guardrail	X1	Y1	X2	Y2	X3	Y3	X4	Y4	Z	Excavation Class 10 CY	Embankment In Place CY	Remarks
	NB	817+05.69	OUT		35.5	5.0	---	---	213.5	5.5	261.3	6.8	45.6		50.0	
	NB	817+05.69	MED		35.5	5.0	---	---	213.5	5.0	298.8	7.5	48.0		50.0	
	NB	830+27.98	OUT		63.2	5.1	246.9	8.1	261.5	9.5	319.8	11.4	62.3		50.0	Ramp D Outside Shoulder
	NB	830+27.98	MED		35.5	5.0	---	---	263.5	5.0	311.3	6.9	45.7		50.0	
	NB	836+15.63	OUT		99.5	9.0	---	---	---	---	147.3	11.0	56.7		50.0	Sign Truss footing protection
	NB	844+84.71	OUT		35.5	4.7	178.0	4.7	---	---	261.3	6.7	45.0		50.0	
	NB	844+93.25	MED		35.5	4.7	251.0	4.7	---	---	298.8	6.7	45.0		50.0	
	NB	849+97.52	OUT		112.0	9.0	---	---	---	---	159.9	11.4	61.0		50.0	Sign Truss footing protection
	NB	862+94.50	OUT		35.5	5.0	---	---	213.5	4.8	261.3	6.6	44.8		50.0	
	NB	862+86.14	MED		35.5	5.0	---	---	251.0	5.0	298.8	7.0	46.0		50.0	
	SB	819+66.88	MED		35.5	4.9	---	---	251.0	4.9	298.8	6.8	45.6		50.0	
	SB	819+66.88	OUT		35.5	4.9	---	---	213.5	4.9	261.3	6.8	45.7		50.0	
	SB	832+58.64	MED		35.5	5.0	---	---	251.0	5.0	298.8	7.0	46.0		50.0	
	SB	832+58.62	OUT		35.5	5.0	---	---	213.5	5.1	261.3	7.1	46.4		50.0	
	SB	846+97.97	MED		35.5	4.7			251.0	4.7	298.8	6.7	45.0		50.0	
	SB	847+06.76	OUT		36.9	4.8			252.2	4.8	300.0	6.7	45.2		50.0	
	SB	865+66.64	MED		35.5	5.0			251.0	5.0	298.8	7.0	46.0		50.0	
	SB	865+58.28	OUT		35.5	5.0			213.5	5.0	261.3	7.0	46.0		50.0	
		TOTAL:													900.0	

108-8A
10-16-18

STEEL BEAM GUARDRAIL AT CONCRETE BARRIER OR BRIDGE RAIL END SECTION

Possible Standards: BA-200, BA-201, BA-202, BA-205, BA-206, BA-210, BA-211, BA-221, BA-225, BA-250, BA-260, LS-625, LS-626, LS-630, LS-635, SI-172, SI-173 and SI-211.

(1) Lane(s) to which the obstacle is adjacent.
(2) Not a bid item. Incidental to guardrail installation.

No.	Location: Direction of Traffic (1)	Side: O = Outside, M = Median	Station	Offset FT	Layout Lengths (BA-250, BA-260, LS-630, or LS-635): VT1 LF	VF LF	VT2 LF	ET LF	Long-Span System BA-211 STATION	BA-211 TYPE	Delineators and Object Markers (2): SI-211 TYPE	Delineator SI-172 Type 1 White EACH	Object Marker SI-173 Type 2 OM2-2 EACH	Type 3 OM3-L EACH	Type 3 OM3-R EACH
	NB	O	817+05.69		212.500			47.7			3				1
	NB	M	817+05.69		250.000			47.7			3			1	
	NB	O	830+27.98		69.000	187.50	18.50	47.7			3				1
	NB	M	830+27.98		262.500			47.7			3			1	
	NB	O	844+84.71		212.500			47.7			3				1
	NB	M	844+93.25		250.000			47.7			3			1	
	NB	O	862+94.50		212.500			47.7			3				1
	NB	M	862+86.14		250.000			47.7			3			1	
	SB	M	819+66.88		250.000			47.7			3				1
	SB	O	819+66.88		212.500			47.7			3			1	
	SB	M	832+58.64		250.000			47.7			3				1
	SB	O	832+58.62		212.500			47.7			3			1	
	SB	M	846+97.97		250.000			47.7			3				1
	SB	O	847+06.76		250.000			47.7			3			1	
	SB	M	865+66.64		250.000			47.7			3				1
	SB	O	865+58.28		212.500			47.7			3			1	
			TOTALS:											8	8

Station	Bid Items: Bolted End Anchor BA-202 TYPE	Bolted End Anchor BA-202 EACH	Post Adapter BA-210 EACH	Steel Beam Guardrail BA-200 LF	BA-250 or LS-630: Barrier Transition Section BA-201 EACH	End Terminal Tangent BA-205 EACH	End Terminal Flared BA-206 EACH	End Terminal Tangent LS-625 EACH	End Terminal Flared LS-626 EACH	BA-260 or LS-635: Barrier Transition Section BA-221 EACH	End Terminal Tangent BA-225 EACH	Remarks
817+05.69	B	1		175.0	1	1						
817+05.69	B	1		212.5	1	1						
830+27.98	B	1		237.5	1	1						Ramp Shoulder
830+27.98	B	1		225.0	1	1						
844+84.71	B	1		175.0	1	1						
844+93.25	B	1		212.5	1	1						
862+94.50	B	1		175.0	1	1						
862+86.14	B	1		212.5	1	1						
819+66.88	B	1		212.5	1	1						
819+66.88	B	1		175.0	1	1						
832+58.64	B	1		212.5	1	1						
832+58.62	B	1		175.0	1	1						
846+97.97	B	1		212.5	1	1						
847+06.76	B	1		212.5	1	1						
865+66.64	B	1		212.5	1	1						
865+58.28	B	1		175.0	1	1						
TOTALS:		16		3212.5	16	16						

PAVEMENT MARKING LINE TYPES

See PM-110

*BCY4 - Place on the same side of the roadway to match existing markings near the project.
**NPY4 - For estimating purposes only. No Passing Zone Lines will be located in the field.
***MNY4 - Factor of 1.00 as value includes number of 4-inch passes to cover median nose area.

ELY4: Edge Line Left (Yellow) @ 0.67
ELY6: Edge Line Left (Yellow) @ 1.00
CHW10: Channelizing Line (White) @ 1.67
BLW4: Broken Lane Line (White) @ 0.17
BLW6: Broken Lane Line (White) @ 0.25
RLY6: Ramp Edge Line Left (Yellow) @ 1.00
ELW4: Edge Line Right (White) @ 0.67
ELY6: Edge Line Left (Yellow) @ 1.00
RLW6: Ramp Edge Line Right (White) @1.00
DLW4: Dotted Line (White) @ 0.22
DLW6: Dotted Line (White) @ 0.33
SLW2: Stop Line (White) @ 4.00
CHW8: Channelizing Line (White) @ 1.33
LDW10: Lane Drop (White) @ 0.42
SLW4: Solid Lane Line (White) @ 0.67

Location								Length by Line Type (Unfactored)															
Road ID	Station to Station		Dir. of Travel	Marking Type	Side			ELY4	BLW4	ELW4	DLW4	CHW8	ELY6	BLW6	ELY6	DLW6	LDW10	CHW10	RLY6	RLW6	SLW2	SLW4	Remarks
					L	C	R	STA	STA	STA	STA	STA	STA	STA	STA	STA	STA	STA	STA	STA	STA	STA	
INTERMEDIATE LIFT (INITIAL PAVEMENT MARKING)																							
I-35	804+25.00	815+30.63	NB		X	X		11.06	11.06														
I-35	796+97.59	902+00.00	NB		X	X		105.02	105.02														
INTERMEDIATE LIFT (SECOND PAVEMENT MARKING)																							
I-35	804+25.00	815+30.63	NB				X			11.06													
I-35	796+97.59	802+00.00	NB				X			5.02													
I-35	802+00.00	804+99.02	NB				X			2.99	2.99												
I-35	804+99.02	809+01.92	NB				X			4.03		4.03											
I-35	809+01.92	828+60.25	NB				X			19.58													
I-35	828+60.25	834+56.66	NB				X			5.96		5.96											
I-35	834+56.66	837+06.66	NB				X			2.50		2.50											
I-35	837+06.66	848+52.87	NB				X			11.46	11.46												
I-35	848+52.87	851+02.87	NB				X			2.50		2.50											
I-35	851+02.87	854+59.60	NB				X			3.57		3.57											
I-35	854+59.60	875+48.82	NB				X			20.89													
I-35	875+48.82	881+84.01	NB				X			6.35		6.35											
I-35	881+84.01	902+00.00	NB				X			20.16													
INTERMEDIATE LIFT (THIRD PAVEMENT MARKING)																							
I-35	804+25.00	815+30.63	NB		X	X			11.06				11.06										
I-35	796+97.59	902+00.00	NB		X	X			105.02				105.02										
FINAL PAVEMENT MARKINGS																							
I-35	804+25.00	815+30.63	NB			X	X							11.06	11.06								
I-35	796+97.59	802+00.00	NB			X	X							5.02	5.02								
I-35	802+00.00	804+99.02	NB			X	X							2.99	2.99	2.99							
I-35	804+99.02	809+01.92	NB			X	X							4.03	4.03		4.03						
I-35	809+01.92	828+60.25	NB			X	X							19.58	19.58								
I-35	828+60.25	834+56.66	NB			X	X							5.96	5.96		5.96						
I-35	834+56.66	837+06.66	NB			X	X							2.50	2.50		2.50						
I-35	837+06.66	848+52.87	NB			X	X							11.46	11.46			11.46					
I-35	848+52.87	851+02.87	NB			X	X							2.50	2.50		2.50						
I-35	851+02.87	854+59.60	NB			X	X							3.57	3.57		3.57						
I-35	854+59.60	875+48.82	NB			X	X							20.89	20.89								
I-35	875+48.82	881+84.01	NB			X	X							6.35	6.35		6.35						
I-35	881+84.01	902+00.00	NB			X	X							20.16	20.16								
INTERMEDIATE LIFT (INITIAL PAVEMENT MARKING)																							
I-35	804+25.00	815+30.63	SB		X	X		11.06	11.06														
I-35	796+97.59	902+00.00	SB		X	X		105.02	105.02														
INTERMEDIATE LIFT (SECOND PAVEMENT MARKING)																							
I-35	804+25.00	814+33.09	SB				X			10.08													
I-35	814+33.09	815+30.63	SB				X			0.98													
I-35	796+97.59	802+86.15	SB				X			5.89													
I-35	802+86.15	808+70.63	SB				X			5.84		5.84											
I-35	808+70.63	827+77.92	SB				X			19.07													
I-35	827+77.92	831+76.58	SB				X			3.99		3.99											
I-35	831+76.58	834+26.58	SB				X			2.50		2.50											
I-35	834+26.58	843+89.10	SB				X			9.63	9.63												
I-35	843+89.10	852+27.11	SB				X			8.38		8.38											
I-35	852+27.11	873+92.13	SB				X			21.65													
I-35	873+92.13	877+73.54	SB				X			3.81		3.81											
I-35	877+73.54	880+94.04	SB				X			3.21	3.21												
I-35	880+94.04	902+00.00	SB				X			21.06													
INTERMEDIATE LIFT (THIRD PAVEMENT MARKING)																							
I-35	804+25.00	815+30.63	SB		X	X			11.06				11.06										
I-35	796+97.59	902+00.00	SB		X	X			105.02				105.02										
FINAL PAVEMENT MARKINGS																							
I-35	804+25.00	814+33.09	SB				X							10.08	10.08								
I-35	814+33.09	815+30.63	SB				X							0.98	0.98								

PAVEMENT MARKING LINE TYPES

108-22
04-16-13

See PM-110

*BCY4 - Place on the same side of the roadway to match existing markings near the project.
**NPY4 - For estimating purposes only. No Passing Zone Lines will be located in the field.
***MNY4 - Factor of 1.00 as value includes number of 4-inch passes to cover median nose area.

ELY4: Edge Line Left (Yellow) @ 0.67
ELY6: Edge Line Left (Yellow) @ 1.00
CHW10: Channelizing Line (White) @ 1.67
BLW4: Broken Lane Line (White) @ 0.17
BLW6: Broken Lane Line (White) @ 0.25
RLY6: Ramp Edge Line Left (Yellow) @ 1.00
ELW4: Edge Line Right (White) @ 0.67
ELY6: Edge Line Left (Yellow) @ 1.00
RLW6: Ramp Edge Line Right (White) @1.00
DLW4: Dotted Line (White) @ 0.22
DLW6: Dotted Line (White) @ 0.33
SLW2: Stop Line (White) @ 4.00
CHW8: Channelizing Line (White) @ 1.33
LDW10: Lane Drop (White) @ 0.42
SLW4: Solid Lane Line (White) @ 0.67

Location								Length by Line Type (Unfactored)															
Road ID	Station to Station		Dir. of Travel	Marking Type	Side			ELY4	BLW4	ELW4	DLW4	CHW8	ELY6	BLW6	ELY6	DLW6	LDW10	CHW10	RLY6	RLW6	SLW2	SLW4	Remarks
					L	C	R	STA	STA	STA	STA	STA	STA	STA	STA	STA	STA	STA	STA	STA	STA	STA	
I-35	796+97.59	802+86.15	SB				X							5.89	5.89								
I-35	802+86.15	808+70.63	SB				X							5.84	5.84		5.84						
I-35	808+70.63	827+77.92	SB				X							19.07	19.07								
I-35	827+77.92	831+76.58	SB				X							3.99	3.99		3.99						
I-35	831+76.58	834+26.58	SB				X							2.50	2.50		2.50						
I-35	834+26.58	843+89.10	SB				X							9.63	9.63			9.63					
I-35	843+89.10	852+27.11	SB				X							8.38	8.38		8.38						
I-35	852+27.11	873+92.13	SB				X							21.65	21.65								
I-35	873+92.13	877+73.54	SB				X							3.81	3.81		3.81						
I-35	877+73.54	880+94.04	SB				X							3.21	3.21	3.21							
I-35	880+94.04	902+00.00	SB				X							21.06	21.06								
4th Ave. S.																							
Ramp A	1517+19.90	1526+69.59	SB		X		X												9.50	9.50	65.00		
Ramp B	2517+00.41	2526+47.01	NB		X		X												9.47	9.47	65.00		
Ramp C	3507+60.04	3517+32.38	SB		X		X												9.72	9.72			
Ramp D	4507+36.71	4517+62.32	NB		X		X												10.26	10.26			
US 18																							
Ramp A	1545+17.48	1552+91.35	SB		X		X												7.74	7.74			
Ramp A	1552+91.35	1555+02.17	SB		X	X	X												2.11	2.11	65.00	2.11	
Ramp B	2546+96.53	2557+07.80	NB		X		X												10.11	10.11	50.00		
Ramp C	3536+74.97	3547+85.94	SB		X		X												11.11	11.11			
Ramp D	4537+31.88	4547+40.02	NB		X		X												10.08	10.08			
								232.16	464.32	232.16	27.28	49.44	232.16	232.16	232.16	6.20	49.44	21.09	80.09	80.09	245.00	2.11	
				Factored Total: Waterborne/Solvent Paint				155.55	78.93	155.55	6.00	65.75	232.16	58.04	232.16	2.04	20.76	35.22	80.09	80.09	980.00	1.41	
				Bid Quantity: Painted Pavement Markings, Waterborne or Solvent-Based					**2183.77**														

PAVEMENT MARKING SYMBOLS AND LEGENDS

108-29
04-21-15

Refer to PM-111

Road Identification	Location															SCHOOL	XING	STOP	AHEAD	ONLY	BIKE	LANE	EXIT	Groove Cuts	Remarks
	Station	Side	STAW	RTAW	LTAW	CSRW	CSLW	CSTW	CRLW	FFRW	LLRW	RLRW	RRCW	BLSW	WCSW	WPSB	SCLW	XNGW	STPW	AHDW	ONLW	BIKW	LANW	XITW	EACH	
I-35/US18																										
Ramp A	1553+00.00			1			1																			
Ramp A	1554+50.00			1			1																			
TOTALS:				2			2																			

Appendix B

Yield Calculation

Yield Calculation

- Comparison of actual to plan quantity
  - Load tickets vs. Plan design rate quantities
  - Expressed as % of plan quantity
- Warns of quantity over-runs
- Asphalt Mixture
  - Yields for each mix type
  - Two-hour, Half-day, Daily or To-date yields

Yield Calculation

Example:

Contractor is placing one southbound lane of HMA Surface Course on the I-35 Project in Cerro Gordo Co.

HMA tickets had the following running totals for loads placed at the approximate stations shown.

Find the yield.

Yield Calculation

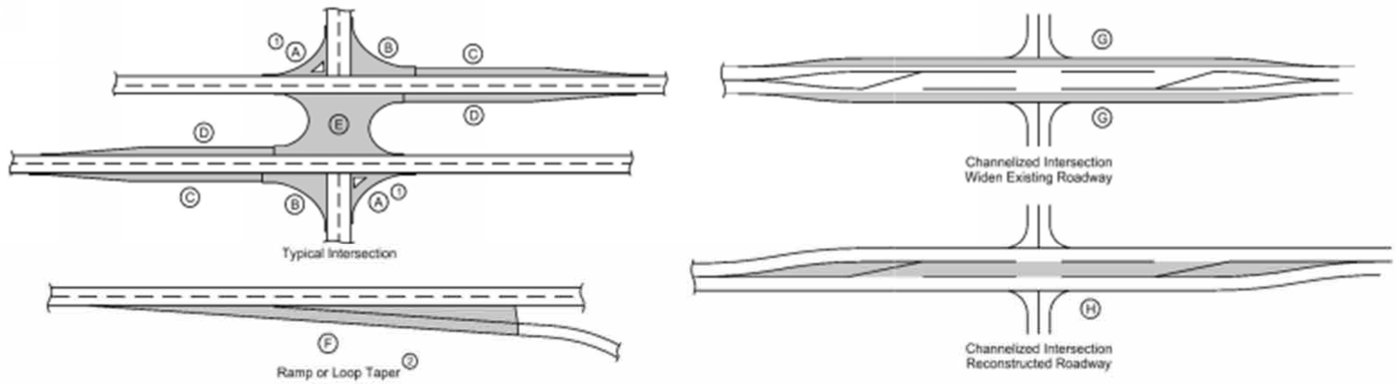
Station	Quantity
800+00	290 tons placed
810+00	445 tons placed

Length (81000ft) – (80000ft) = <u>1000ft</u>

Tons placed 445 – 290 = <u>155 tons</u>

100-25M
Modified

HMA PAVEMENT



① Does not include raised island area or curb. Refer to tabulation 112-4 for quantities.

② Refer to PV-410, PV-411, PV-412, and PV-414.

③ Quantity includes Pavement Header.

Calculations assume a surface course unit weight (lbs/cf) of 147, an intermediate course unit weight (lbs/cf) of 147, an interlayer course unit weight (lbs/cf) of 150, and a special backfill unit weight (lbs/cf) of 140.

Location				Mainline			Area			Bid Items: Hot Mix Asphalt Pavement						Binder (6%)							
Road Identification	Direction of Travel	Station to Station		Width	Length	Area	A ①	B	F ②	Surface Very High 1/2" L-2 Mix		Intermediate Very High 1/2" Mix		Interlayer 3/8" Mix		Surface PG 58-28V	Intermediate PG 58-28V	Interlayer PG 58-34E	Special Backfill	Modified Subbase	Granular Subbase	Pavement Scarification	Remarks
				FT	FT	SY	SY	SY	SY	TONS	SY	TONS	SY	TONS	SY	TONS	TONS	TONS	TONS	CY	SY	SY	
MAINLINE																							
I-35	NB	805+75.00	815+30.63	24.0	955.6	2548.3				280.955	2548.3	280.955	2548.3	143.345	2548.3	16.857	16.857	8.601				2548.3	
I-35	NB	796+97.59	815+74.46	24.0	1876.9	5005.0			1404.9	706.690	6409.9	706.690	6409.9	360.556	6409.9	42.401	42.401	21.633				6409.9	
I-35	NB	Bridge and approaches																					
I-35	NB	821+04.10	828+88.42	24.0	784.3	2091.5			111.8	242.916	2203.3	242.916	2203.3	123.937	2203.3	14.575	14.575	7.436				2203.3	
I-35	NB	Bridge and approaches																					
I-35	NB	834+02.25	836+20.00	24.0	217.8	666.5			350.0	112.069	1016.5	112.069	1016.5	57.178	1016.5	6.724	6.724	3.431				1016.5	
I-35	NB	836+20.00	843+49.89	36.0	729.9	2919.6				321.881	2919.6	321.881	2919.6	164.225	2919.6	19.313	19.313	9.854				2919.6	
I-35	NB	Bridge and approaches																					
I-35	NB	848+30.11	849+90.00	36.0	159.9	639.6				70.511	639.6	70.511	639.6	35.975	639.6	4.231	4.231	2.159				639.6	
I-35	NB	849+90.00	861+52.22	24.0	1162.2	3099.3			1143.6	467.775	4242.9	467.775	4242.9	238.661	4242.9	28.066	28.066	14.320				4242.9	
I-35	NB	Bridge and approaches																					
I-35	NB	867+27.50	900+50.00	24.0	3322.5	8860.0			2195.0	1218.814	11055.0	1218.814	11055.0	621.844	11055.0	73.129	73.129	37.311				11055.0	
I-35	SB	805+75.00	815+30.63	24.0	955.6	2548.3			16.3	282.752	2564.6	282.752	2564.6	144.261	2564.6	16.965	16.965	8.656				2564.6	
I-35	SB	796+97.59	815+74.46	24.0	1876.9	5005.0			2156.2	789.521	7161.2	789.521	7161.2	402.817	7161.2	47.371	47.371	24.169				7161.2	
I-35	SB	Bridge and approaches																					
I-35	SB	821+04.10	828+87.42	24.0	783.3	2088.9			467.4	281.827	2556.3	281.827	2556.3	143.789	2556.3	16.910	16.910	8.627				2556.3	
I-35	SB	Bridge and approaches																					
I-35	SB	834+01.25	844+47.15	36.0	1045.9	4183.6				461.242	4183.6	461.242	4183.6	235.327	4183.6	27.675	27.675	14.120				4183.6	
I-35	SB	Bridge and approaches																					
I-35	SB	848+47.61	861+31.32	24.0	1283.7	3423.2			1170.3	506.436	4593.5	506.436	4593.5	258.386	4593.5	30.386	30.386	15.503				4593.5	
I-35	SB	Bridge and approaches																					
I-35	SB	867+06.60	900+50.00	24.0	3343.4	8915.7			1405.0	1137.861	10320.7	1137.861	10320.7	580.541	10320.7	68.272	68.272	34.832				10320.7	
INSIDE SHOULDER																							
I-35	NB	805+75.00	815+30.63	6.0	955.6	637.1				70.239	637.1	70.239	637.1	35.836	637.1	4.214	4.214	2.150				637.1	
I-35	NB	796+97.59	815+74.46	6.0	1876.9	1251.2				137.950	1251.2	137.950	1251.2	70.383	1251.2	8.277	8.277	4.223				1251.2	
I-35	NB	Bridge and approaches																					
I-35	NB	821+04.10	828+88.42	6.0	784.3	522.9				57.648	522.9	57.648	522.9	29.412	522.9	3.459	3.459	1.765				522.9	
I-35	NB	Bridge and approaches																					
I-35	NB	834+02.25	843+49.89	6.0	947.6	631.8				69.652	631.8	69.652	631.8	35.537	631.8	4.179	4.179	2.132				631.8	
I-35	NB	Bridge and approaches																					
I-35	NB	848+30.11	849+90.00	6.0	159.9	106.6				11.752	106.6	11.752	106.6	5.996	106.6	0.705	0.705	0.360				106.6	
I-35	NB	849+90.00	861+52.22	6.0	1162.2	774.8				85.423	774.8	85.423	774.8	43.583	774.8	5.125	5.125	2.615				774.8	
I-35	NB	Bridge and approaches																					
I-35	NB	867+27.50	900+50.00	6.0	3322.5	2215.0				244.204	2215.0	244.204	2215.0	124.594	2215.0	14.652	14.652	7.476				2215.0	
I-35	SB	805+75.00	815+30.63	6.0	955.6	637.1				70.239	637.1	70.239	637.1	35.836	637.1	4.214	4.214	2.150				637.1	
I-35	SB	796+97.59	815+74.46	6.0	1876.9	1251.2				137.950	1251.2	137.950	1251.2	70.383	1251.2	8.277	8.277	4.223				1251.2	
I-35	SB	Bridge and approaches																					
I-35	SB	821+04.10	828+87.42	6.0	783.3	522.2				57.574	522.2	57.574	522.2	29.374	522.2	3.454	3.454	1.762				522.2	
I-35	SB	Bridge and approaches																					
I-35	SB	834+01.25	844+47.15	6.0	1045.9	697.3				76.874	697.3	76.874	697.3	39.221	697.3	4.612	4.612	2.353				697.3	
I-35	SB	Bridge and approaches																					

FILE NO. | ENGLISH | DESIGN TEAM Flattery\Bell\Schmitz | CERRO GORDO COUNTY | PROJECT NUMBER IMN-035-7(083)193--0E-17 | SHEET NUMBER C.6

Yield Calculation

From Plans C sheet:

Lift Thickness = 2”

Surface unit weight (Density) = 147lbs/ft^3

Calculate Theoretical Yield

(Length x Width x Depth) x Unit Weight

(1000ft x 12ft x 2/12ft) x 147lbs/ft^3 = 294000lbs

Convert to tons → 294000lbs/2000 = 147tons

This is what should have been placed according to plans

Yield Calculation

We placed 155 tons

Plans theoretical yield is 147 tons

YEILD:

(155 tons/147 tons) x 100 = **<u>105.4%</u>**

IS THIS OK?

ESTIMATED PROJECT QUANTITIES AND REFERENCE NOTES

Item no.	Item Code	Item	Unit	Quantities Estimated Roadway Items	Estimate Reference Notes
1	2102-2625000	EMBANKMENT-IN-PLACE	CY	900	See Tab. 107-23 in the C Sheets for locations and details. No payment will be allowed for overhaul.
2	2102-2713070	EXCAVATION, CLASS 13, ROADWAY AND BORROW	CY	268.8	See Tab. 112-9M in the C Sheets for locations and details. No payment will be allowed for overhaul.
3	2123-7450000	SHOULDER CONSTRUCTION, EARTH	STA	444.1	See B Sheets and Tab. 112-9M in the C Sheets for location and details.
4	2212-0475095	CLEANING AND PREPARATION OF BASE	MILE	5.9	This bid item includes: _1.5___ miles of ramps _2.2___ miles of NB four lane roadway _2.2___ miles of SB four lane roadway _5.9___ miles total
5	2212-5070310	PATCHES, FULL-DEPTH REPAIR	SY	375.6	See Tab. 102-6C in the C Sheets for locations and details.
6	2212-5070330	PATCHES BY COUNT (REPAIR)	EACH	25	See Tab. 102-6C in the C Sheets for locations and details.
7	2214-5145150	PAVEMENT SCARIFICATION	SY	133,781.2	See Tab. 100-25M in the C Sheets for locations and details.
8	2303-0002380	HOT MIX ASPHALT MIXTURE INTERLAYER BASE COURSE, 3/8 IN. MIX	TON	5,068.6	See B Sheets and Tab. 100-25M in the C Sheets for locations and details. Additional 5% added to bid quantity for irregularities.
9	2303-1031500	HOT MIX ASPHALT STANDARD TRAFFIC, BASE COURSE, 1/2 IN. MIX	TON	6,289.3	See B Sheets and Tab. 112-9M in the C Sheets for locations and details. Additional 5% added to bid quantity for irregularities.
10	2303-1052500	HOT MIX ASPHALT VERY HIGH TRAFFIC, INTERMEDIATE COURSE 1/2 IN. MIX	TON	12,722.3	See B Sheets and Tab. 100-25M in the C Sheets for locations and details. Additional 5% added to bid quantity for irregularities.
11	2303-1053502	HOT MIX ASPHALT VERY HIGH TRAFFIC, SURFACE COURSE, 1/2 IN. MIX, FRICTION L-2	TON	12,722.3	See B Sheets and Tab. 100-25M in the C Sheets for locations and details. Additional 5% added to bid quantity for irregularities.

Yield Calculation

- HMA Surface Course Item Quantity includes <u>5%</u> for <u>irregularities</u> (see Estimate Reference Notes).

- In our case 5.4 percent is reasonable because we account for 5% for irregularities in our estimate quantity

- Usually like to stay within ~ 3% of plan qty.
  – Varies with office, engineer, & project budget

Yield Calculation

→ Always contact your supervisor if:

- You find a significant error in the plan quantity
- Yields indicate a project will over-run the contract quantity

DFR Does Yield Calculation For You for DAILY CHECKS!!!

Date :				IOWA DOT DFR 2															Placed Density (Pounds/CF)=		
Let Date:	1/27/2024																				
gency User:																					
				Placement Record							Additional width to DEDUCT from Field Voids								150		
Item #	Category	One Mix Design Per DFR Mix Design #	Project #	Lane	Plans only show Milepost (no stationing found) Station From	Station To	Total Length Placed (FT)	ML or Widening Placement Width	Thickness (inches)	Additional Width (ft)	Thickness (in)	"Pay" Est "SY"	SY to be PAID (If Diff. than Est SY)	Mix Delivered	Waste (Tons)	Mix Used (Tons)	Calculated Field Voids Tons	Yield	Bid Item Description		
0080	0001	ABD23-4052	NHS-080-3(282)118--11-25		12+50	100+20	8770	12	2					1,325.00	2	1,323.00	1315	101%	HOT MIX ASPHALT STANDARD TRAFFIC, BASE COURSE, 1/2 IN. MIX		
0380	0001	ABD23-4052	BRF-080-3(283)118--11-25		12+50	100+20	8770	6	2					700	2	698.00	657.	106%	HOT MIX ASPHALT STANDARD TRAFFIC, BASE COURSE, 1/2 IN. MIX		
							0														
							0														
							0														
							0														
							0														
							0														
							0														
							0														

Bid Item (In Order of Placement) — **HMA Plant Report Tank Sheet Info**

Items	Today's Placement	Project #	Bid Item Plan Quantity	Contract Mix Price	Contract Binder Price	Plan Thickness (in)	SY Item	Mix Delivered	Waste (Tons)	Mix Used (Tons)	11 Digit Item Code and Description
0080	Intermediate (Travel Lane)	NHS-080-3(282)118--11-25	587.00	$41.50	500	2	-	1,325.00	2.00	#######	2303-1031500 (HOT MIX ASPHALT STANDARD TRAFFIC, BASE COURSE, 1/2 IN. MIX)
0380	Shoulder	BRF-080-3(283)118--11-25	72.00	$83.50	450	22	-	700.00	2.00	698.00	2303-1031500 (HOT MIX ASPHALT STANDARD TRAFFIC, BASE COURSE, 1/2 IN. MIX)
		0					-	-	-	-	()
		0					-	-	-	-	0
		0					-	-	-	-	0

Hot Box Sample

Test A	Test B	Test C	Test D	Test E	
12	12	12	12	12	Hot Box ID Number

Mat Temperatures °F

Time	Temp
7:00	295

Intended Thickness: 2

Appendix C

Coring

Coring

- **Core Sampling of HMA to determine:**
  - Density / Field Voids
  - Thickness
  - Composition (materials - quantity & properties)
    - aggregate
    - asphalt binder
  - Identify or verify problems
    - stripping
    - segregation

Coring

- **Inspectors / Plant Monitor duties:**
  - Identify & mark core sampling locations.
  - Direct & witness core drilling.
  - Measure & examine cores to determine if "valid" for testing
    - Condition (no cracks)
    - Length (70 to 150% of intended).
  - Take an additional core in area adjacent to failed core location.

Coring

- **Inspectors / Plant Monitor duties:**
  - Transport cores to field lab
    - Identify & secure cores for transport by others.
    - No additional security if chain of custody by agency maintained.
  - Test (weigh) cores in the lab.
  - Monitoring duties in C.M. Appendix 3-4.

5

6

7

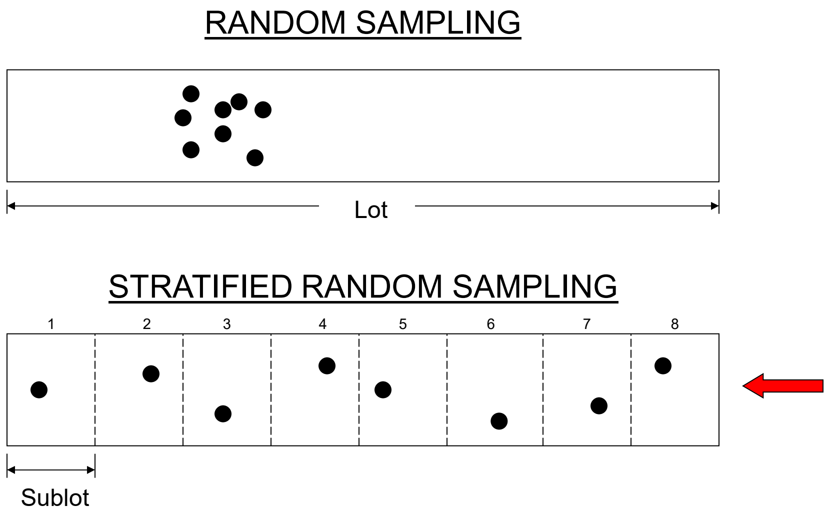
8

Mat Coring – Random Samples

Mat Coring – Random Samples

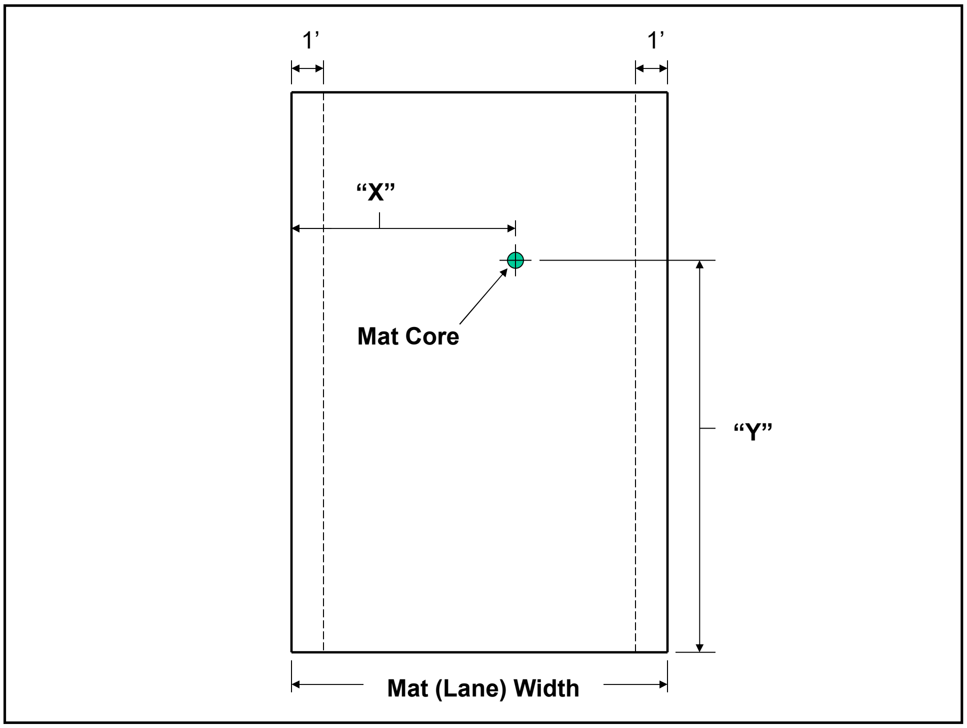
- Each day's run is a Lot.
- 8 samples (sublots) taken for each lot.
- 8 samples also taken for test strips.
- I.M. 204 lists sampling frequency.
- Sampling locations are Random.
  - Random Sampling
  - Stratified Random Sampling

Mat Coring – Random Samples



Mat Coring – Random Samples

- No mat cores to be taken:
  - within 1 foot of edge of pass
  - from paved shoulder areas placed concurrently with mainline
  - within 1 foot of structures
  - from tapers or runout transitions
- Use approx. 16” circle to mark location.
- No “hunting” with nuclear gauge.



Coring – Random Numbers

- Previously
  - Cast Lots (Roll Dice)
  - Random Number Tables / Generators
  - Hand Calculations using random numbers to determine core locations

Determining Core Locations

- Currently
  - Spreadsheets
  - Computer Programs
  - Other Methods?
- MUST BE RANDOM!
- Future (now)
  - GPS coordinates (Locator App. to log data) *"On Station"*

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Random Core Location Program

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Random Core Location Program

- Available on DOT internet site via Construction & Materials Bureau links
- Computes stratified random locations:
  - Normal Daily Lot (8 mat cores)
  - Test Strip (8 mat cores)
  - *Centerline Joint Cores* → *More on this later*
  - Cold In-Place Recycling (10 test sites for M&D)

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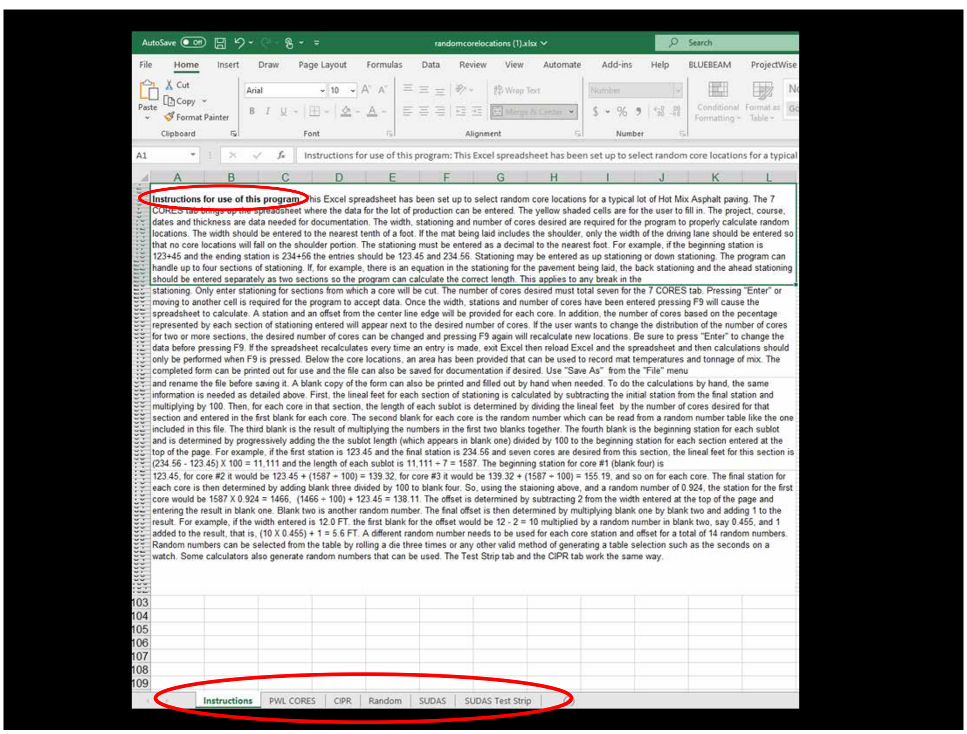
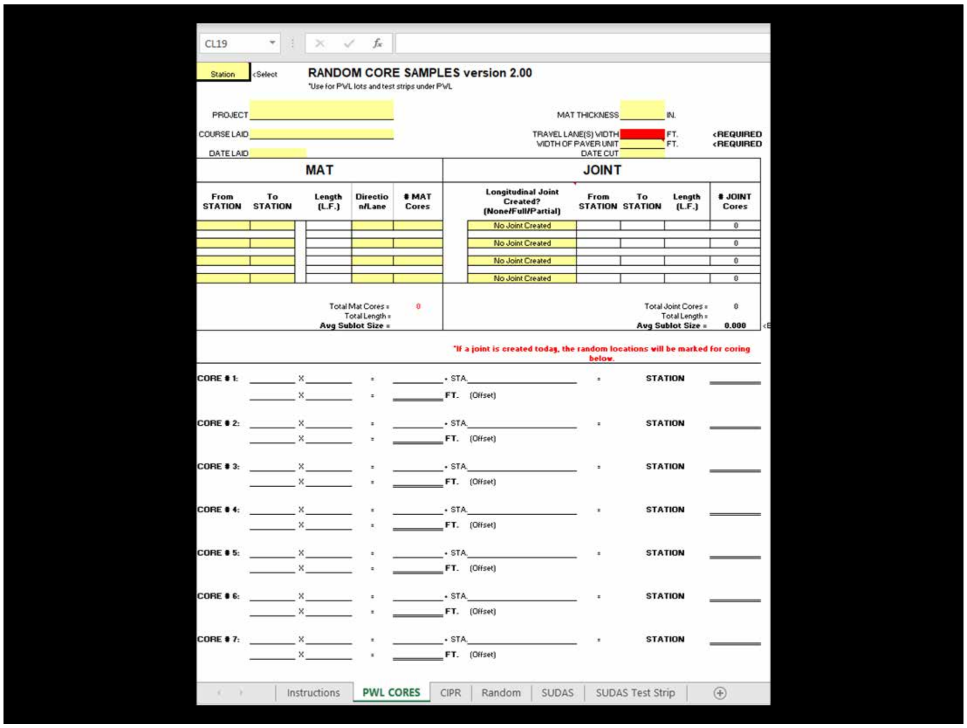


18



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Longitudinal Joint Coring

20

Joint Coring & Testing

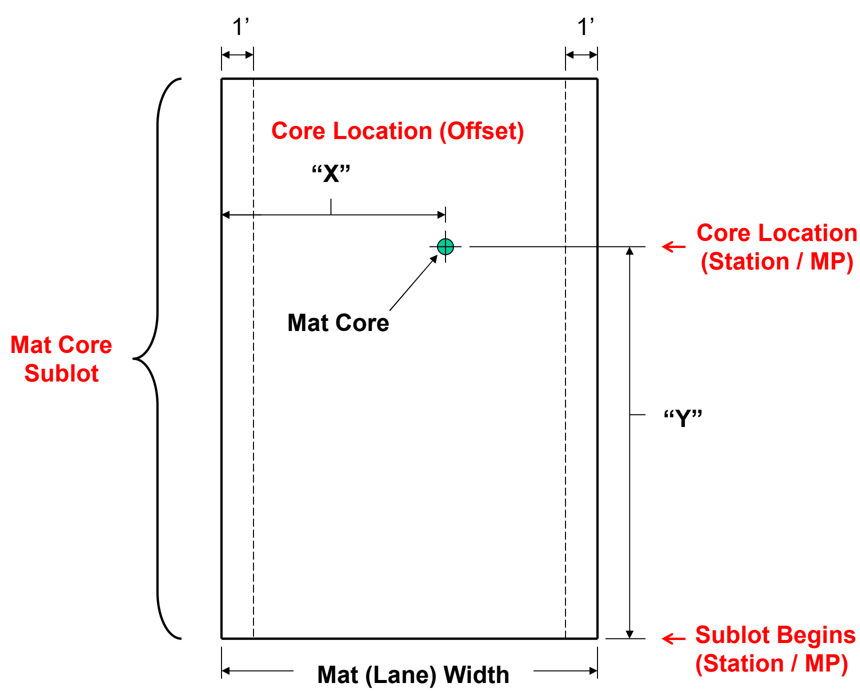
- **DS-23016 "Evaluation of Longitudinal Joint Quality for Flexible Paving Mixtures with Incentive/Disincentive"**
  - **DS-23016** applies lot payment adjustments (Incentive/Disincentive) by equation, based on the average joint density.
  - Maximum Disincentive is $0.80 per foot
  - Maximum Incentive is $0.40 per foot

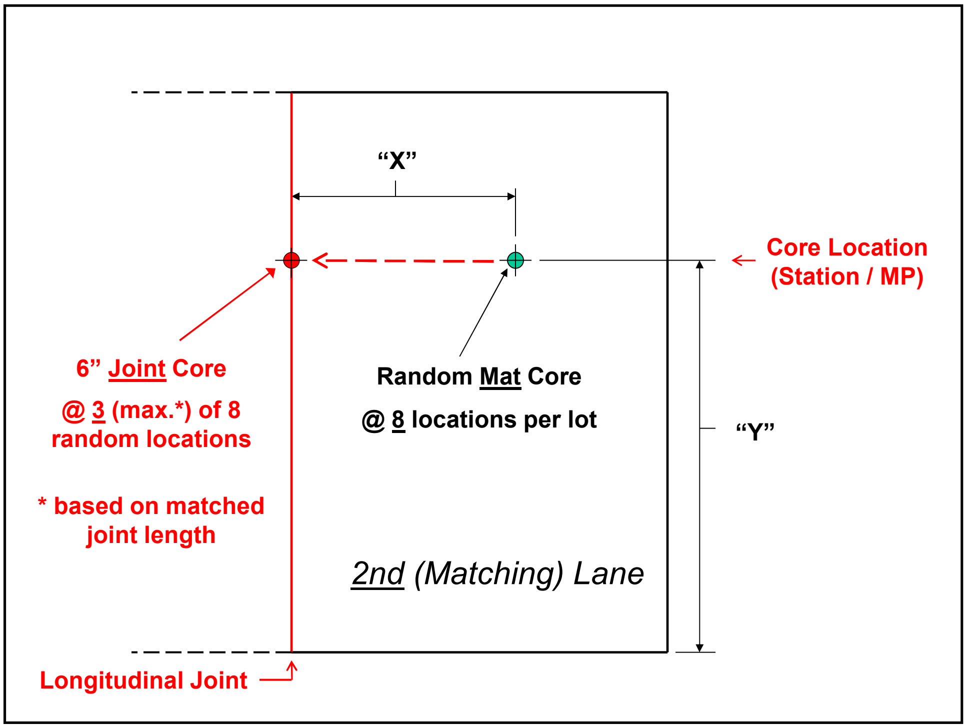
Longitudinal Joint Coring

- Random daily **Mat** cores (no changes)
  - 8 per lot (8 equal length sublots)
  - base, intermediate & surface courses
- Random daily **Joint** cores – taken between mainline lanes on surface course only
  - 3 joint cores, if matched length is 3+ mat sublots.
  - 2 joint cores, if matched length is at least 2 but < 3 mat sublots.
  - 0 joint cores, if matched length is < 2 mat sublots.

Longitudinal Joint Coring

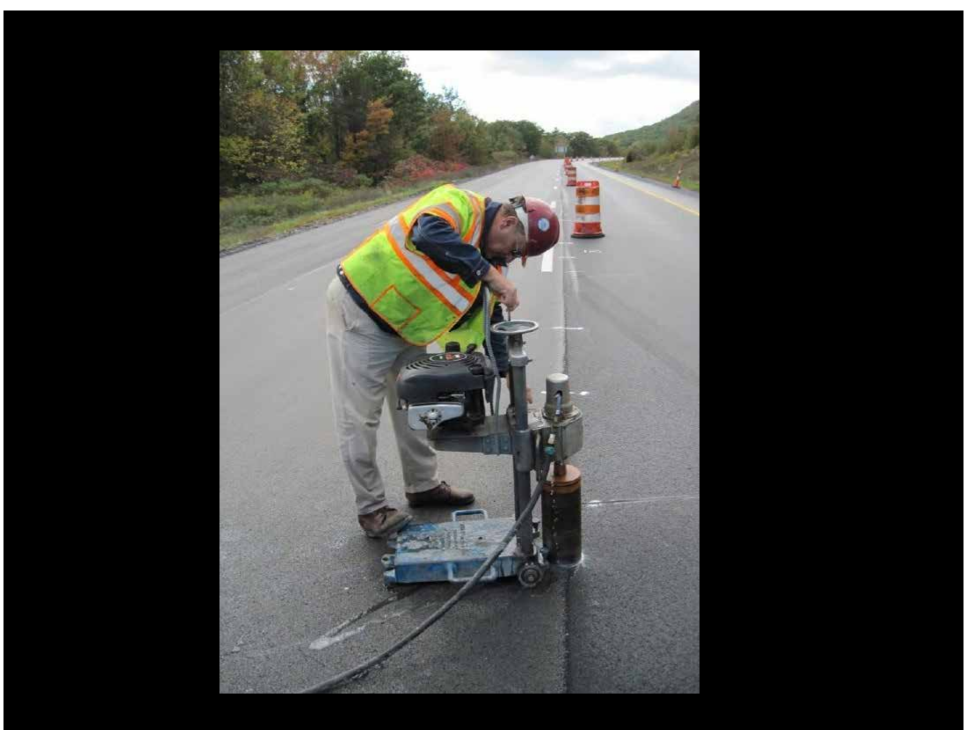
- Location (Station / Milepost) of joint cores based on location of selected mat cores for matching lane (2nd side of joint).
- Move laterally to joint at selected locations.
- Mark core based on type of joint placed
  - Vertical (Butt) Joint - centered on seam
  - Notched Wedge Joint - centered 4” off seam, toward 2nd (matching) side
- Random Core Location Program
  - revised to include above changes





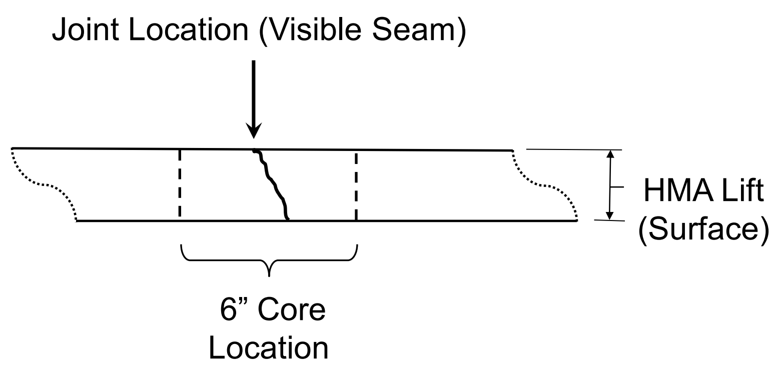
"X"
Core Location
(Station / MP)
6" Joint Core
@ 3 (max.*) of 8
random locations
* based on matched
joint length
Random Mat Core
@ 8 locations per lot
"Y"
2nd (Matching) Lane
Longitudinal Joint

25



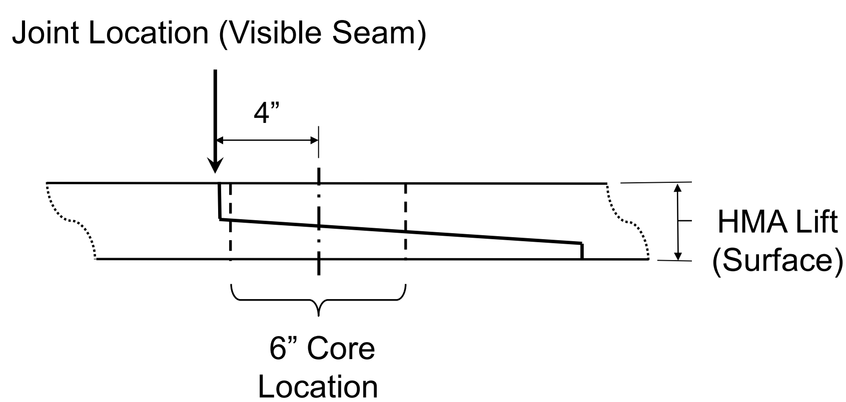
26

Coring - Vertical (Butt) Joint



27

Coring - Notched Wedge Joint



Example – Random Samples

- HMA Overlay - Surface Course
  - Intermittent paving sections (2) in NB lane
  - Paved lane width = 12’
  - Intended (compacted) lift thickness = 1.5”
  - This lane finished a joint for all sections
- Compute (stratified) random core locations
  - Normal Daily Lot = 8 mat cores
  - 3 Joint cores because a joint was made (ON SURFACE COURSE!)

Station <Select

RANDOM CORE SAMPLES version 2.00

*Use for PWL lots and test strips under PWL

For Class I Compaction, only the quantity within the 12.0 ft area is included for a PWL field voids lot

PROJECT	Example	MAT THICKNESS	1.50	IN.
COURSE LAID	Surface	TRAVEL LANE(S) WIDTH	12.0	FT. <REQUIRED
		WIDTH OF PAVER UNIT	12.0	FT. <REQUIRED
DATE LAID	11/17/2025	DATE CUT	11/18/2025	

Sta. 350+00

MAT

From STATION	To STATION	Length (L.F.)	Direction/ Lane	# MAT Cores
350.00	372.50	2,250.00	NB	2
425.00	482.25	5,725.00	NB	6
		0.00		
		0.00		

Total Mat Cores = 8
Total Length = 7,975.00
Avg Sublot Size = 996.875

JOINT

Longitudinal Joint Created? (None/Full/Partial)	From STATION	To STATION	Length (L.F.)	# JOINT Cores
Full (2,250 ft) Joint Created			2,250.00	1
Full (5,725 ft) Joint Created			5,725.00	2
No Joint Created				0
No Joint Created				0

Total Joint Cores = 3
Total Length = 7,975.00
Avg Sublot Size = 2,658.333

PROJECT	Example		MAT THICKNESS	1.50	IN.
COURSE LAID	Surface		TRAVEL LANE(S) WIDTH	12.0	FT. <REQUIRED
			WIDTH OF PAVER UNIT	12.0	FT. <REQUIRED
DATE LAID	11/17/2025		DATE CUT	11/18/2025	

MAT					JOINT				
From STATION	To STATION	Length (L.F.)	Direction/Lane	# MAT Cores	Longitudinal Joint Created? (None/Full/Partial)	From STATION	To STATION	Length (L.F.)	# JOINT Cores
350.00	372.50	2,250.00	NB	2	Full (2,250 ft) Joint Created			2,250.00	1
425.00	482.25	5,725.00	NB	6	Full (5,725 ft) Joint Created			5,725.00	2
		0.00			No Joint Created				0
		0.00			No Joint Created				0
		Total Mat Cores =		8			Total Joint Cores =		3
		Total Length =		7,975.00			Total Length =		7,975.00
		Avg Sublot Size =		**996.875**			**Avg Sublot Size =**		**2,658.333**

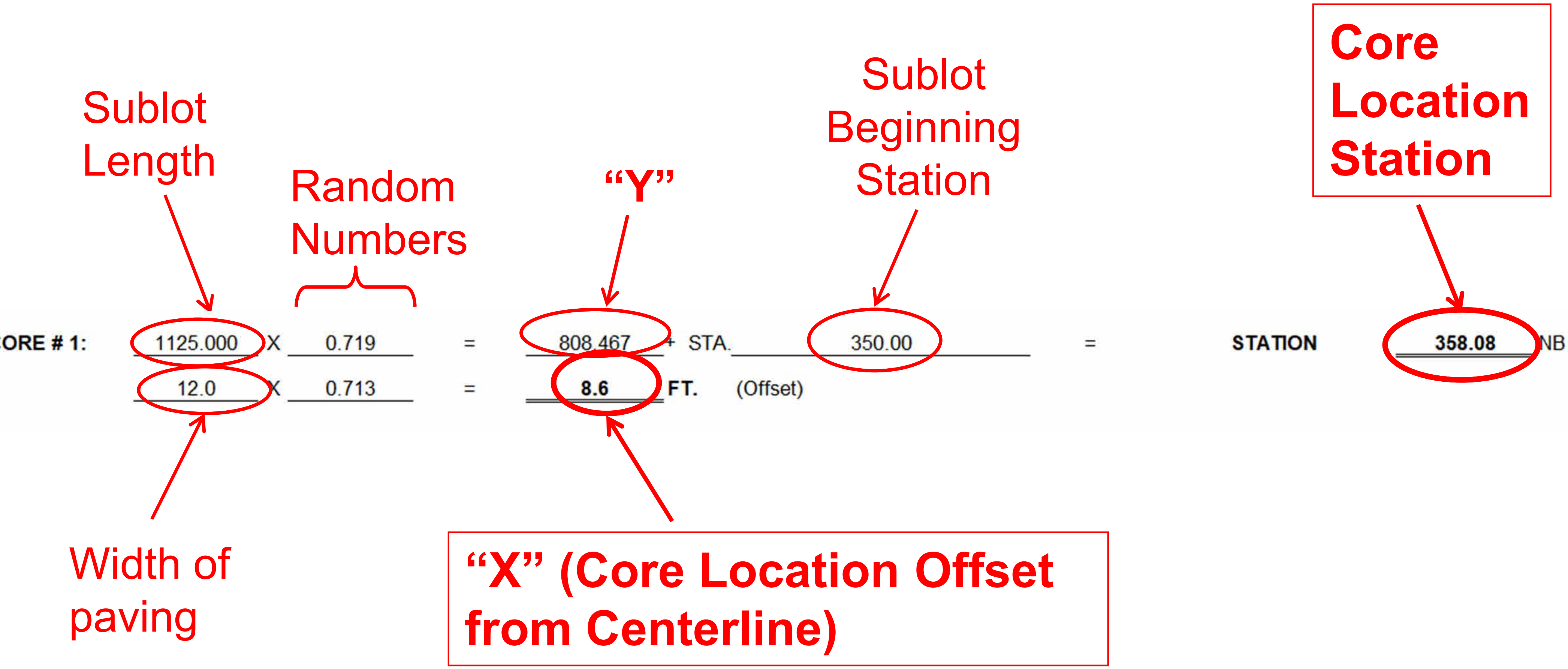
<Enter this value in the coreworksheet_20

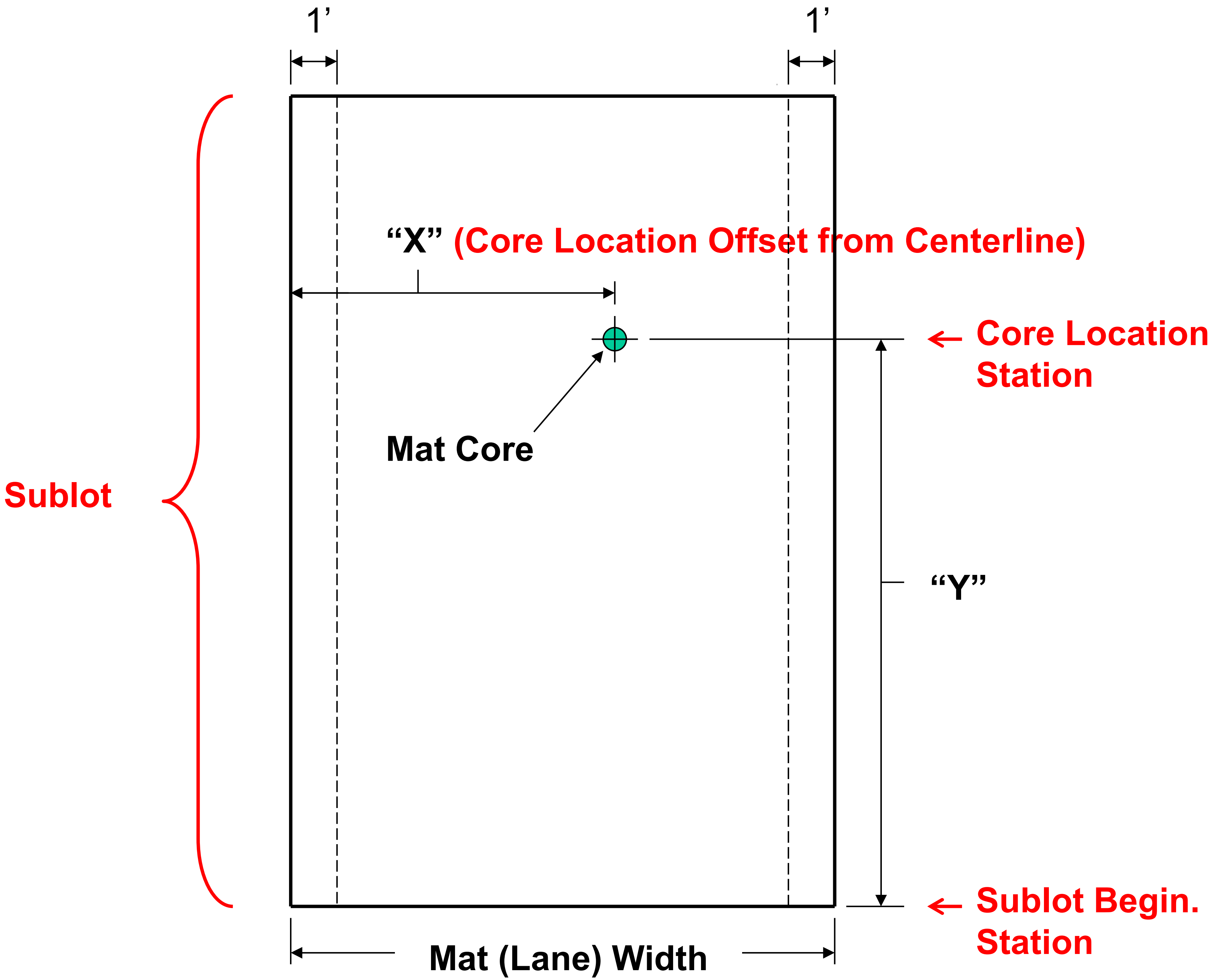
***If a joint is created today, the random locations will be marked for coring below.**

CORE # 1:	1125.000	X	0.719	=	808.467	+ STA.	350.00	=	**STATION**		**358.08**	NB	Joint Core # 1
	12.0	X	0.713	=	**8.6**	**FT.**	(Offset)						
CORE # 2:	1125.000	X	0.317	=	356.406	+ STA.	361.25	=	**STATION**		**364.81**	NB	
	12.0	X	0.546	=	**6.6**	**FT.**	(Offset)						
CORE # 3:	954.167	X	0.404	=	385.398	+ STA.	425.00	=	**STATION**		**428.85**	NB	
	12.0	X	0.938	=	**11.0**	**FT.**	(Offset)		11.0 FT. max				
CORE # 4:	954.167	X	0.030	=	28.837	+ STA.	434.54	=	**STATION**		**434.83**	NB	
	12.0	X	0.541	=	**6.5**	**FT.**	(Offset)						
CORE # 5:	954.167	X	0.932	=	889.359	+ STA.	444.08	=	**STATION**		**452.98**	NB	Joint Core # 2
	12.0	X	0.783	=	**9.4**	**FT.**	(Offset)						
CORE # 6:	954.167	X	0.320	=	305.749	+ STA.	453.63	=	**STATION**		**456.68**	NB	
	12.0	X	0.133	=	**1.6**	**FT.**	(Offset)						
CORE # 7:	954.167	X	0.739	=	704.979	+ STA.	463.17	=	**STATION**		**470.22**	NB	
	12.0	X	0.272	=	**3.3**	**FT.**	(Offset)						
CORE # 8:	954.167	X	0.021	=	20.380	+ STA.	472.71	=	**STATION**		**472.91**	NB	Joint Core # 3
	12.0	X	0.484	=	**5.8**	**FT.**	(Offset)						

Instructions | PWL CORES | CIPR | Random | SUDAS | SUDAS Test Strip | +

CORE # 1:	1125.000	X	0.719	=	808.467	+ STA.	350.00	=	**STATION**	**358.08**	NB	Joint Core # 1
	12.0	X	0.713	=	**8.6**	**FT.**	(Offset)					


Sublot Length
Random Numbers
"Y"
Sublot Beginning Station
Core Location Station
ORE # 1:
1125.000 X 0.719 = 808.467 + STA. 350.00 = STATION 358.08 NB
12.0 X 0.713 = 8.6 FT. (Offset)
Width of paving
"X" (Core Location Offset from Centerline)


1’
1’
“X” (Core Location Offset from Centerline)
Core Location
Station
Mat Core
Sublot
“Y”
Sublot Begin.
Station
Mat (Lane) Width

Station <Select

RANDOM CORE SAMPLES version 2.00

*Use for PWL lots and test strips under PWL

PROJECT ____ MAT THICKNESS ____ IN.

COURSE LAID ____ TRAVEL LANE(S) WIDTH ____ FT. <REQUIRED

WIDTH OF PAVER UNIT ____ FT. <REQUIRED

DATE LAID ____ DATE CUT ____

MAT					JOINT				
From STATION	To STATION	Length (L.F.)	Direction/ Lane	# MAT Cores	Longitudinal Joint Created? (None/Full/Partial)	From STATION	To STATION	Length (L.F.)	# JOINT Cores
					No Joint Created				0
					No Joint Created				0
					No Joint Created				0
					No Joint Created				0

Total Mat Cores = 0
Total Length =
Avg Sublot Size =

Total Joint Cores = 0
Total Length =
Avg Sublot Size = 0.000 <Enter this value in the coreworksheet_2015.xlsx

***If a joint is created today, the random locations will be marked for coring below.**

CORE # 1: ____ X ____ = ____ + STA. ____ = **STATION** ____ 0

____ X ____ = ____ **FT.** (Offset)

Instructions | PWL CORES | QPR | Random | SUDAS | SUDAS Test Strip

Ready Calculate 85%

Station <Select

RANDOM CORE SAMPLES version 2.00

*Use for PWL lots and test strips under PWL

PROJECT

COURSE LAID Intermediate

DATE LAID

MAT THICKNESS IN.

TRAVEL LANE(S) WIDTH 0.0 FT. <REQUIRED

WIDTH OF PAVER UNIT FT. <REQUIRED

DATE CUT

MAT

From STATION	To STATION		Length (L.F.)	Direction/Lane	# MAT Cores
0.00	0.00				0
		##			

Mat cores only

Total Mat Cores = 0

Total Length =

Avg Sublot Size =

CORE # 1: ______ X ______ = ______ + STA. ______ = STATION ______

Instructions | PWL CORES | CIPR | Random | SUDAS | SUDAS Test Strip

Ready 90%

Station <Select

RANDOM CORE SAMPLES version 2.00

*Use for PWL lots and test strips under PWL

PROJECT ______ MAT THICKNESS ______ IN.

COURSE LAID Surface TRAVEL LANE(S) WIDTH 0.0 FT. <REQUIRED

WIDTH OF PAVER UNIT ______ FT. <REQUIRED

DATE LAID ______ DATE CUT ______

MAT

From STATION	To STATION		Length (L.F.)	Direction/Lane	# MAT Cores
0.00	0.00				0
		##			

Total Mat Cores = 0
Total Length =
Avg Sublot Size =

JOINT

Longitudinal Joint Created? (None/Full/Partial)	From STATION	To STATION	Length (L.F.)	# JOINT Cores
Partial (<00 ft) Joint Created	0.00	0.00		0
No Joint Created				0
No Joint Created				0
No Joint Created				0

Total Joint Cores = 0
Total Length =
Avg Sublot Size = 0.000 <Enter this value in the coreworkshe

***If a joint is created today, the random locations will be marked for coring below.**

CORE # 1: ______ X ______ = ______ + STA. ______ = **STATION** ______

Instructions | PWL CORES | CIPR | Random | SUDAS | SUDAS Test Strip

Ready 90%

Station <Select

RANDOM CORE SAMPLES version 2.00

*Use for PWL lots and test strips under PWL

For Class I Compaction, only the quantity within the 12.0 ft area is included for a PWL field voids lot

PROJECT EXAMPLE

MAT THICKNESS 2.00 IN.

COURSE LAID Surface

TRAVEL LANE(S) WIDTH 12.0 FT. <REQUIRED

WIDTH OF PAVER UNIT 12.0 FT <REQUIRED

DATE LAID 4/1/2015

DATE CUT 4/2/2015

MAT					JOINT				
From STATION	To STATION	Length (L.F.)	Direction/ Lane	# MAT Cores	Longitudinal Joint Created? (None/Full/Partial)	From STATION	To STATION	Length (L.F.)	# JOINT Cores
100.00	200.00	10,000.00	NB	8	No Joint Created				0
		0.00			No Joint Created				0
		0.00			No Joint Created				0
	#	0.00			No Joint Created				0

Total Mat Cores = 8
Total Length = 10,000.00
Avg Sublot Size = 1250.000

Total Joint Cores = 0
Total Length = 0.00
Avg Sublot Size = 0.000 <Enter this value in the coreworksheet 2015.xlsx

No **Joint** Cores
(1st side placed)

*If a joint is created today, the random locations will be marked for coring below.

CORE # 1:	1250.000	X	0.987	=	1233.833	+ STA.	100.00	=	**STATION**	**112.34** NB
	12.0	X	0.117	=	**1.4**	**FT.**	(Offset)			
CORE # 2:	1250.000	X	0.693	=	866.685	+ STA.	112.50	=	**STATION**	**121.17** NB
	12.0	X	0.470	=	**5.6**	**FT.**	(Offset)			
CORE # 3:	1250.000	X	0.812	=	1015.457	+ STA.	125.00	=	**STATION**	**135.15** NB
	12.0	X	0.911	=	**10.9**	**FT.**	(Offset)			

Instructions | PWL CORES | CIPR | Random | SUDAS | SUDAS Test Strip

Ready 70%

Station <Select

RANDOM CORE SAMPLES version 2.00

*Use for PWL lots and test strips under PWL

For Class I Compaction, only the quantity within the 12.0 ft area is included for a PWL field voids lot

PROJECT: EXAMPLE — MAT THICKNESS: 2.00 IN.

COURSE LAID: Surface — TRAVEL LANE(S) WIDTH: 12.0 FT. <REQUIRED

WIDTH OF PAVER UNIT: 12.0 FT <REQUIRED

DATE LAID: 4/1/2015 — DATE CUT: 4/2/2015

MAT					JOINT				
From STATION	To STATION	Length (L.F.)	Direction/ Lane	# MAT Cores	Longitudinal Joint Created? (None/Full/Partial)	From STATION	To STATION	Length (L.F.)	# JOINT Cores
100.00	200.00	10,000.00	NB	8	Partial (<10,000 ft) Joint Created	100.00	125.00	2,500.00	2
		0.00			No Joint Created				0
		0.00			No Joint Created				0
	#	0.00			No Joint Created				0
		Total Mat Cores =		8				Total Joint Cores =	2
		Total Length =		10,000.00				Total Length =	2,500.00
		Avg Sublot Size =		**1250.000**				**Avg Sublot Size =**	**1,250.000**

<Enter this value in the coreworksheet_2015.xlsx

2 Joint Cores

(more than 2 but less than 3 mat sublots. Mat sublot is 10000ft/8 = 2000ft)

*If a joint is created today, the random locations will be marked for coring below.

CORE # 1:	1250.000	X	0.569	=	711.721	+ STA.	100.00	=	**STATION**	**107.12** NB	Joint Core # 1
	12.0	X	0.186	=	**2.2**	**FT.**	(Offset)				
CORE # 2:	1250.000	X	0.602	=	752.738	+ STA.	112.50	=	**STATION**	**120.03** NB	Joint Core # 2
	12.0	X	0.167	=	**2.0**	**FT.**	(Offset)				
CORE # 3:	1250.000	X	0.203	=	253.335	+ STA.	125.00	=	**STATION**	**127.53** NB	
	12.0	X	0.732	=	**8.8**	**FT.**	(Offset)				

Instructions | PWL CORES | CIPR | Random | SUDAS | SUDAS Test Strip

Ready 70%

Station <Select

RANDOM CORE SAMPLES version 2.00

*Use for PWL lots and test strips under PWL

For Class I Compaction, only the quantity within the 12.0 ft area is included for a PWL field voids lot

PROJECT: EXAMPLE — MAT THICKNESS: 2.00 IN.

COURSE LAID: Surface — TRAVEL LANE(S) WIDTH: 12.0 FT. <REQUIRED

WIDTH OF PAVER UNIT: 12.0 FT. <REQUIRED

DATE LAID: 4/1/2015 — DATE CUT: 4/2/2015

MAT						JOINT				
From STATION	To STATION		Length (L.F.)	Direction/ Lane	# MAT Cores	Longitudinal Joint Created? (None/Full/Partial)	From STATION	To STATION	Length (L.F.)	# JOINT Cores
100.00	200.00		10,000.00	NB	8	Full (10,000 ft) Joint Created			10,000.00	3
			0.00			No Joint Created				0
			0.00			No Joint Created				0
		#	0.00			No Joint Created				0

Total Mat Cores = 8
Total Length = 10,000.00
Avg Sublot Size = 1250.000

Total Joint Cores = 3
Total Length = 10,000.00
Avg Sublot Size = 3,333.333 <Enter this value in the coreworksheet_2015.xlsx

3 **Joint** Cores
(3 or more mat sublots)

*If a joint is created today, the random locations will be marked for coring below.

CORE # 1:	1250.000	X	0.271	=	338.244	+ STA.	100.00	=	**STATION**	**103.38**	NB	Joint Core # 1
	12.0	X	0.953	=	**11.0**	**FT.**	(Offset)		11.0 FT. max			
CORE # 2:	1250.000	X	0.486	=	582.675	+ STA.	112.50	=	**STATION**	**118.33**	NB	
	12.0	X	0.487	=	**5.8**	**FT.**	(Offset)					
CORE # 3:	1250.000	X	0.180	=	225.518	+ STA.	125.00	=	**STATION**	**127.26**	NB	
	12.0	X	0.550	=	**6.6**	**FT.**	(Offset)					

Instructions | PWL CORES | CIPR | Random | SUDAS | SUDAS Test Strip

Ready 70%

*If a joint is created today, the random locations will be marked for coring below.

CORE # 1:	1250.000	X	0.271	=	338.244	+ STA	100.00	=	**STATION**	**103.38**	NB	Joint Core # 1
	12.0	X	0.953	=	**11.0**	**FT.**	(Offset)		11.0 FT. max			
CORE # 2:	1250.000	X	0.466	=	582.675	+ STA	112.50	=	**STATION**	**118.33**	NB	
	12.0	X	0.487	=	**5.8**	**FT.**	(Offset)					
CORE # 3:	1250.000	X	0.180	=	225.518	+ STA	125.00	=	**STATION**	**127.26**	NB	
	12.0	X	0.550	=	**6.6**	**FT.**	(Offset)					
CORE # 4:	1250.000	X	0.343	=	428.812	+ STA	137.50	=	**STATION**	**141.79**	NB	Joint Core # 2
	12.0	X	0.869	=	**10.4**	**FT.**	(Offset)					
CORE # 5:	1250.000	X	0.668	=	834.504	+ STA	150.00	=	**STATION**	**158.35**	NB	
	12.0	X	0.069	=	**1.0**	**FT.**	(Offset)		1 FT. min			
CORE # 6:	1250.000	X	0.109	=	135.877	+ STA	162.50	=	**STATION**	**163.86**	NB	
	12.0	X	0.713	=	**8.6**	**FT.**	(Offset)					
CORE # 7:	1250.000	X	0.496	=	620.172	+ STA	175.00	=	**STATION**	**181.20**	NB	
	12.0	X	0.501	=	**6.0**	**FT.**	(Offset)					
CORE # 8:	1250.000	X	0.426	=	532.023	+ STA	187.50	=	**STATION**	**192.82**	NB	Joint Core # 3
	12.0	X	0.611	=	**7.3**	**FT.**	(Offset)					

Instructions | **PWL CORES** | CIPR | Random | SUDAS | SUDAS Test Strip

Ready 70%

Station <Select

RANDOM CORE SAMPLES version 2.00

*Use for PWL lots and test strips under PWL

For Class I Compaction, only the quantity within the 12.0 ft area is included for a PWL field voids lot

PROJECT: EXAMPLE

COURSE LAID: Surface

DATE LAID: 4/1/2015

MAT THICKNESS: 2.00 IN.

TRAVEL LANE(S) WIDTH: 12.0 FT. <REQUIRED

WIDTH OF PAVER UNIT: 12.0 FT. <REQUIRED

DATE CUT: 4/2/2015

MAT					JOINT				
From STATION	To STATION	Length (L.F.)	Direction/ Lane	# MAT Cores	Longitudinal Joint Created? (None/Full/Partial)	From STATION	To STATION	Length (L.F.)	# JOINT Cores
100.00	200.00	10,000.00	NB	8	Partial (<10,000 ft) Joint Created	100.00	120.00	2,000.00	0
		0.00			No Joint Created				0
		0.00			No Joint Created				0
	#	0.00			No Joint Created				0

Total Mat Cores = 8
Total Length = 10,000.00
Avg Sublot Size = 1250.000

Total Joint Cores = 0
Total Length = 2,000.00
Avg Sublot Size = 0.000 <Enter this value in the coreworksheet_2015.xlsx

Need at least 2,500 ft (2 mat sublots) to core the joint".Jointcoreswaived

"If a joint is created today, the random locations will be marked for coring below.

CORE # 1:	1250.000	X	0.265	=	331.866	+ STA.	100.00	=	**STATION**	**103.32** NB
	12.0	X	0.536	=	**6.4**	**FT.**	(Offset)			
CORE # 2:	1250.000	X	0.568	=	710.002	+ STA.	112.50	=	**STATION**	**119.60** NB
	12.0	X	0.407	=	**4.9**	**FT.**	(Offset)			
CORE # 3:	1250.000	X	0.079	=	98.704	+ STA.	125.00	=	**STATION**	**125.99** NB
	12.0	X	0.224	=	**2.7**	**FT.**	(Offset)			

Instructions | **PWL CORES** | CIPR | Random | SUDAS | SUDAS Test Strip

Ready 70%

<u>No</u> **Joint** Cores
(< 2 mat sublots)

Appendix D

HMA Daily Field Report

HMA Daily Field Report

- Why?
- Ensure the Certified Plant Inspector (CPI) is getting all the correct data needed to properly fill out the Plant Report.
  - Timely reporting with fewer errors.
  - Accuracy of Pay Items.
  - Fewer revisions of Plant Reports.
- Standardize the procedure.
  - Statewide consistency.
  - Electronic “paper trail” for audits / resolving disputes.

HMA Daily Field Report

- What?
- Electronic format (Excel spreadsheet).
- Used to gather daily quantities, measurements & other project information, for entry into the Daily Plant Program.
- Single document shared between inspector, plant monitor and contractor’s CPI to exchange, verify & update information.

HMA Daily Field Report

- Daily Field Report (DFR) to be used by Iowa DOT, County, City & Consultant inspection staff.
- DFR is intended to be shared with CPI & others via email.
- DFR program is available to download from Construction & Materials page on Iowa DOT website: www.iowadot.gov/construction_materials

Construction & Materials

Construction and Materials Bureau ensures quality roads and bridges by overseeing projects, testing materials, setting standards, and supporting contractors

- Earthwork and erosion control →
- Hot Mix Asphalt (HMA) →
- Inspection Tools and Resources →
- Material Forms →
- Foundations & Structures →
- Portland Cement Concrete (PCC) →

On this page...

- HMA Plant Programs
- HMA Worksheets
- RAP
- Microsurfacing Mix Design
- HMA Sample Programs
- HMA Paving Field Inspection Manual
- Other Links
- Bid Item Guidance

Latest version: **v1-15 (NEW v1-16 COMING)**

Same Excel File (DFR) used for Entire Project.

- INPUT Tab
- EMAIL ADDRESSES Tab
- RANDOM CORE LOCATOR Tab
- HMA Samples (Hot Box) Tab
- DFR - 100 Tabs (One for each day of production)
- New Import feature from AWP

Input Tab

FILLED OUT ONCE PER PROJECT

IOWA | DOT DFR MASTER INPUT

AASHTOWare PROJECT

Version 2.01 AWP

Residency	
Contractor	
Contract ID	

Calculate Totals

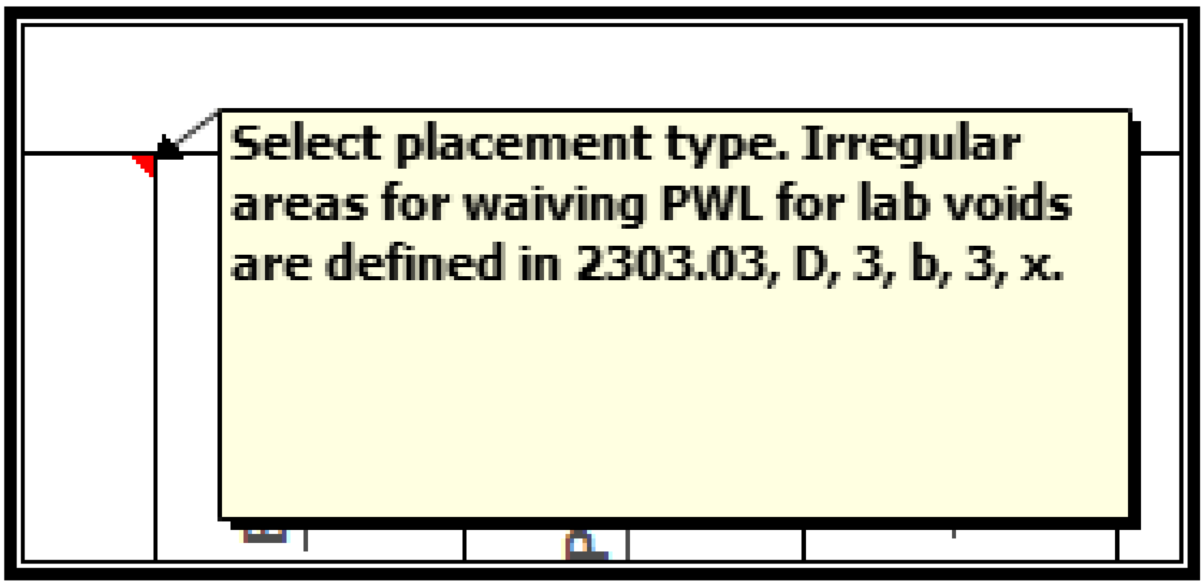
Item #	Category	Project Number	Mix Design Number	Plant	Current Plan Quantity	Contract Mix Price	Contract Binder Price	Plan Thickness inches	Mix Pay Units	Pay Quantity (Ton or SY)	Mix Delivered (Tons)	Waste on Road TOTAL	Tons of Mix TOTAL
0080	0001	NHS-080-3(282)118--11-25	ABD23-4052	Pelling1	587.00	$41.50	$ 500.00	4	TON	-		-	-
0090	0001	NHS-080-3(282)118--11-25	ABD23-4052	Pelling1	11,989.00	$31.00	$ 500.00	4	TON	-		-	-
0090	0002	NHS-080-3(282)118--11-25	ABD23-4052	Pelling1	128.00	$31.00	$ 500.00	2	TON	-		-	-
0100	0001	NHS-080-3(282)118--11-25	ABD23-4052	Pelling1	7,349.00	$31.00	$ 500.00	4	TON	-		-	-
0100	0002	NHS-080-3(282)118--11-25	ABD23-4052	Pelling1	43.00	$31.00	$ 500.00	2	TON	-		-	-
0090	0001	NHS-080-3(283)118--11-25	ABD23-4052-A	Pelling1	11,989.00	$31.00	$ 500.00	4	TON	-		-	-
2000	0001	NHS-080-3(282)118--11-25	ABD23-4052	Pelling1	500.00	$2000.00	$ -	9	SY	-		-	-
					-	$ -			-	-		-	-
					-	$ -			-	-		-	-
					-	$ -			-	-		-	-
					-	$ -			-	-		-	-
					-	$ -			-	-		-	-
					-	$ -			-	-		-	-
					-	$ -			-	-		-	-
					-	$ -			-	-		-	-
					-	$ -			-	-		-	-
					-	$ -			-	-		-	-
					-	$ -			-	-		-	-
					-	$ -			-	-		-	-
					-	$ -			-	-		-	-

Input | Email Addresses | Random Core Locator | 1 | 2

Hint:

HOVER CURSOR OVER THE RED TRIANGLE IN UPPER RIGHT CORNER OF A CELL.

THIS WILL GIVE YOU A HINT OF WHAT SHOULD BE PLACED IN THAT CELL.



E-Mail Address List

PERSONS TO RECEIVE THE DFR

	Email Address List	Enter "X" to Ignore
1	Brian.johnson@iowadot.us	
2		
3		
4		
5		
6		
7		
8		
9		
10		

Date :

IOWA DOT HMA Daily Field Report (DFR)

Placed Density (Pounds/CF)= 150

☐ Plans only show Milepost (no stationing found)

Item #	Category	Mix Design #	Project #	Lane	Station From	Station To	Total Length Placed (FT)	ML or Widening Placement	Thickness (inches)	Additional Width (ft) (width to DEDUCT from Field Voids)	Thickness (in) (width to DEDUCT from Field Voids)	"Pay" Est "SY"	SY to be PAID (If Diff. than Est SY)	Mix Delivered	Waste (Tons)	Mix Used (Tons)	Calculated Field Voids Tons	Yield
0080	0001	ABD23-4052	NHS-080-3(282)118--11-25	NB/EB Drive Ln	12+50	13+50	100	12	2					21.00	5	16.00	15.0	107%
0090	0001	ABD23-4052	NHS-080-3(282)118--11-25	NB/EB Pass Ln	1+00	5+00	400	12	2	4	2			87		87.00	80.0	109%
0090	0002	ABD23-4052	NHS-080-3(282)118--11-25	NB/EB Lt Shldr	2+00	6+00	400	12	2					75	10	65.00	60.0	108%
0080	0001	ABD23-4052	NHS-080-3(282)118--11-25	SB/WB Rt Turn	3+00	4+00	100	12	2					20		20.00	15.0	133%
0100	0001	ABD23-4052	NHS-080-3(282)118--11-25	SB/WB Rt Shldr	4+00	6+50.25	250.25	12	2					40		40.00	37.5	107%
2000	0001	ABD23-4052	NHS-080-3(282)118--11-25	SB/WB Drive Ln	5+00	7+25	225	12	3			133.33		55		55.00	50.6	109%
2000	0001	ABD23-4052	NHS-080-3(282)118--11-25	SB/WB Left Turi	6+00	7+89	189	12	6			711.11	700	90		90.00	85.1	106%
							0											
							0											
							0											

Bid Item (In Order of Placement)

If you have two 11 Digit Item codes with different costs then a NEW DFR needs cre One mix design per DFR

11 Digit Item Code	Items	Project #	Bid Item Plan Quantity	Contract Mix Price	Contract Binder Price	Plan Thickness (in)	Mix Delivered	Waste (Tons)	Mix Used (Tons)	SY Item	Today's Placement
2303-1031500	0080	NHS-080-3(282)118--11-25	587.00	$41.50	500	4	41.00	5.00	36.00	-	Intermediate (Travel Lane)
2303-1042500	0090	NHS-080-3(282)118--11-25	11,989.00, 128.00	$31.00	500	4, 2	162.00	10.00	152.00	-	Base (Travel Lane)
2303-1043504	0100	NHS-080-3(282)118--11-25	7,349.00	$31.00	500	4	40.00	-	40.00	-	Bridge Approach
2304-0100000	2000	NHS-080-3(282)118--11-25	500	$2000.00	0	9	145.00	-	145.00	833.33	Temporary Pavement
							-	-	-	-	

Hot Box Sample

Test A	Test B	Test C	Test D	Test E	
					Hot Box ID Number
					Hot Box Sample Tons:
					Time:
					Station/MP:
					Bar Code ID.:
					Compaction Temp. °F:

Mat Temperatures °F

Time	Temp
7:00	
9:00	
11:00	
1:00	
3:00	
5:00	
7:00	

Intended Thickness:
Cores Waived?
Small Quantity Statement?
Scale Check Done?
Tack Tickets Today?

The Below Comments should show up on the plant report

Comments:

The Below Notes are for the CPI from the field or Plant Monitor

Notes:

RANDOM CORE LOCATIONS

Core #	Station	Offset,ft	Joint Statio	Lane
1				
2				
3				
4				
5				

Lists | AWP Input | 101_HMA | Email Addresses | Print Sheet | Random Core Locator | HMA Samples | Binder | Example | Input | New1

HMA Daily Field Report

PLACEMENT RECORD (Fill out YELLOW CELLS)

- Total Length, Pay Est. SY, Mix Used Tons, Field Voids, % Yield

Date :

IOWA DOT HMA Daily Field Report (DFR)

Placed Density (Pounds/CF)= 150

☐ Plans only show Milepost (no stationing found)

Item #	Category	Mix Design #	Project #	Lane	Station From	Station To	Total Length Placed (FT)	ML or Widening Placement	Thickness (inches)	width to DEDUCT from Field Voids: Additional Width (ft)	width to DEDUCT from Field Voids: Thickness (in)	"Pay" Est "SY"	SY to be PAID (If Diff. than Est SY)	Mix Delivered	Waste (Tons)	Mix Used (Tons)	Calculated Field Voids Tons	Yield
0080	0001	ABD23-4052	NHS-080-3(282)118--11-25	NB/EB Drive Ln	12+50	13+50	100	12	2					21.00	5	16.00	15.0	107%
0090	0001	ABD23-4052	NHS-080-3(282)118--11-25	NB/EB Pass Ln	1+00	5+00	400	12	2	4	2			87		87.00	80.0	109%
0090	0002	ABD23-4052	NHS-080-3(282)118--11-25	NB/EB Lt Shldr	2+00	6+00	400	12	2					75	10	65.00	60.0	108%
0080	0001	ABD23-4052	NHS-080-3(282)118--11-25	SB/WB Rt Turn	3+00	4+00	100	12	2					20		20.00	15.0	133%
0100	0001	ABD23-4052	NHS-080-3(282)118--11-25	SB/WB Rt Shldr	4+00	6+50.25	250.25	12	2					40		40.00	37.5	107%
2000	0001	ABD23-4052	NHS-080-3(282)118--11-25	SB/WB Drive Ln	5+00	7+25	225	12	3			133.33		55		55.00	50.6	109%
2000	0001	ABD23-4052	NHS-080-3(282)118--11-25	SB/WB Left Tur	6+00	7+89	189	12	6			711.11	700	90		90.00	85.1	106%
							0											
							0											
							0											

HMA Daily Field Report

PLACEMENT RECORD (Calculations are in BLUE)

- Total Length, Pay Est. SY, Mix Used Tons, Field Voids, % Yield

Date :

IOWA | DOT HMA Daily Field Report (DFR)

Placed Density (Pounds/CF)= 150

☐ Plans only show Milepost (no stationing found)

Item #	Category	Mix Design #	Project #	Lane	Station From	Station To	Total Length Placed (FT)	ML or Widening Placement	Thickness (inches)	width to DEDUCT from Field Voids: Additional Width (ft)	width to DEDUCT from Field Voids: Thickness (in)	"Pay" Est "SY"	SY to be PAID (If Diff. than Est SY)	Mix Delivered	Waste (Tons)	Mix Used (Tons)	Calculated Field Voids Tons	Yield
0080	0001	ABD23-4052	NHS-080-3(282)118--11-25	NB/EB Drive Ln	12+50	13+50	100	12	2					21.00	5	16.00	15.0	107%
0090	0001	ABD23-4052	NHS-080-3(282)118--11-25	NB/EB Pass Ln	1+00	5+00	400	12	2	4	2			87		87.00	80.0	109%
0090	0002	ABD23-4052	NHS-080-3(282)118--11-25	NB/EB Lt Shldr	2+00	6+00	400	12	2					75	10	65.00	60.0	108%
0080	0001	ABD23-4052	NHS-080-3(282)118--11-25	SB/WB Rt Turn	3+00	4+00	100	12	2					20		20.00	15.0	133%
0100	0001	ABD23-4052	NHS-080-3(282)118--11-25	SB/WB Rt Shldr	4+00	6+50.25	250.25	12	2					40		40.00	37.5	107%
2000	0001	ABD23-4052	NHS-080-3(282)118--11-25	SB/WB Drive Ln	5+00	7+25	225	12	3			133.33		55		55.00	50.6	109%
2000	0001	ABD23-4052	NHS-080-3(282)118--11-25	SB/WB Left Tur	6+00	7+89	189	12	6			711.11	700	90		90.00	85.1	106%
							0											
							0											
							0											

HMA Daily Field Report

TANK SHEET

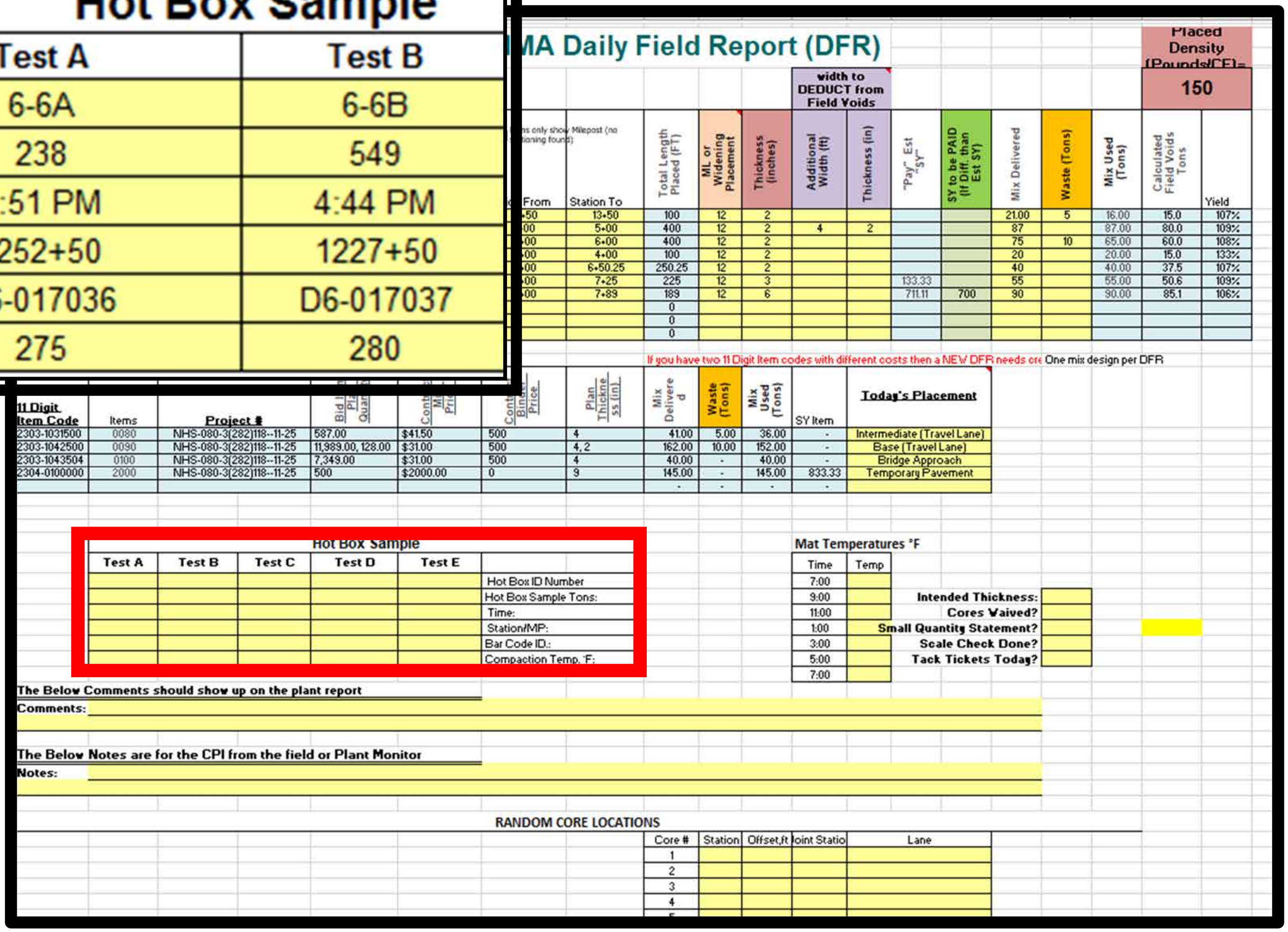
- Inputs information from the Input tab and AWP import function

Bid Item (In Order of Placement)							If you have two 11 Digit Item codes with different costs then a NEW DFR				
11 Digit Item Code	Items	Project #	Bid Item Plan Quantity	Contract Mix Price	Contract Binder Price	Plan Thickness (in)	Mix Delivered	Waste (Tons)	Mix Used (Tons)	SY Item	Today's Placement
2303-1031500	0080	NHS-080-3(282)118--11-25	587.00	$41.50	500	4	41.00	5.00	36.00	-	Intermediate (Travel Lane)
2303-1042500	0090	NHS-080-3(282)118--11-25	11,989.00, 128.00	$31.00	500	4, 2	162.00	10.00	152.00	-	Base (Travel Lane)
2303-1043504	0100	NHS-080-3(282)118--11-25	7,349.00	$31.00	500	4	40.00	-	40.00	-	Bridge Approach
2304-0100000	2000	NHS-080-3(282)118--11-25	500	$2000.00	0	9	145.00	-	145.00	833.33	Temporary Pavement
							-	-	-	-	

HMA Daily Field Report

HOT BOX SAMPLES

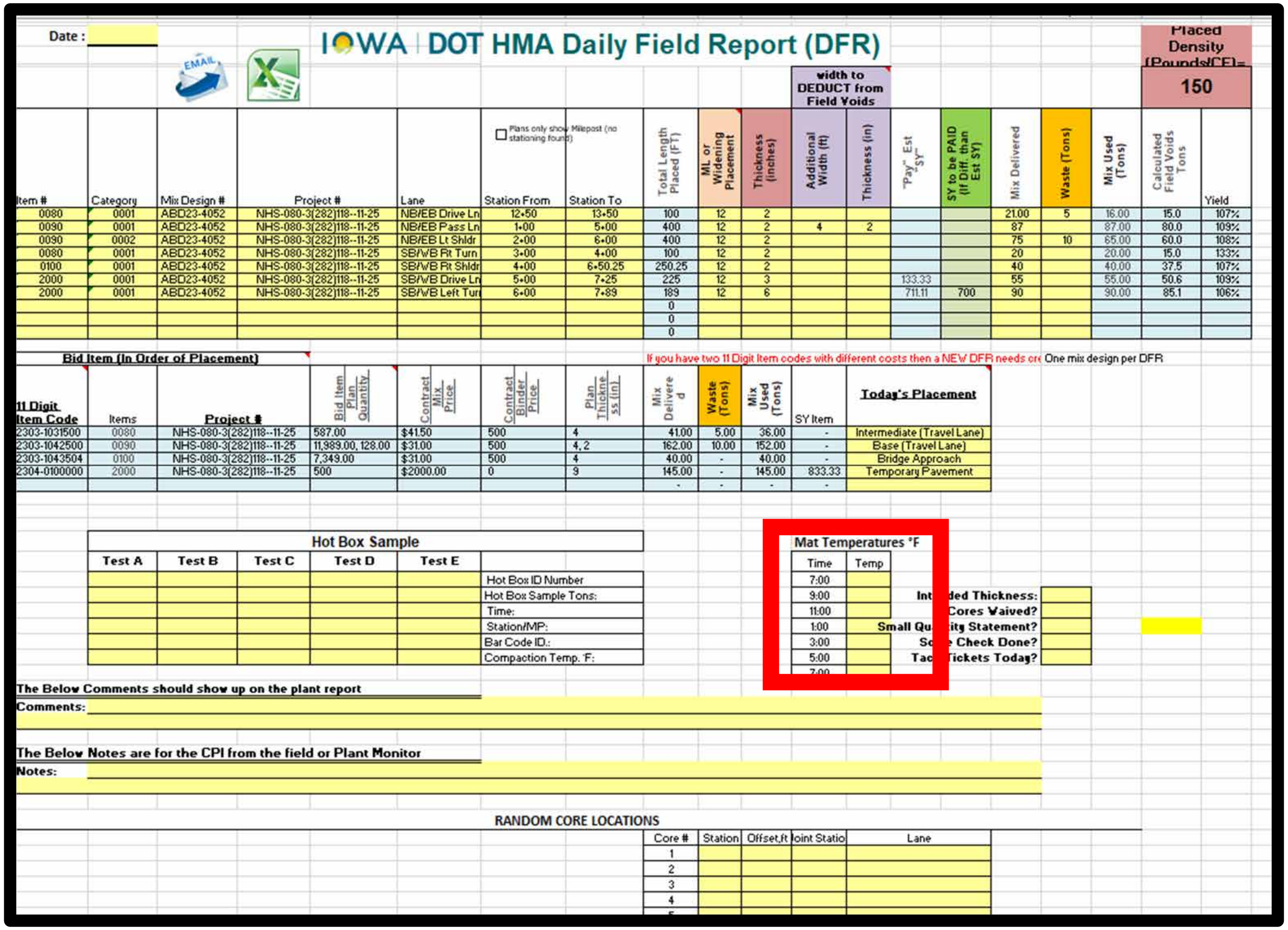
Hot Box Sample	Test A	Test B
Hot Box ID Number	6-6A	6-6B
Hot Box Sample Tons:	238	549
Time:	2:51 PM	4:44 PM
Station/MP:	1252+50	1227+50
Bar Code ID.:	D6-017036	D6-017037
Compaction Temp. °F:	275	280



HMA Daily Field Report

MAT TEMPERATURES

Mat Temperatures °F	
Time	Temp
7:00	
9:00	
11:00	
1:00	292
3:00	297
5:00	285
7:00	288



Date :

IOWA | DOT HMA Daily Field Report (DFR)

Placed Density (Pounds/CF)= 150

Item #	Category	Mix Design #	Project #	Lane	Station From	Station To	Total Length Placed (FT)	ML or Widening Placement	Thickness (inches)	Additional Width (ft)	Thickness (in)	"Pay" Est "SY"	SY to be PAID (If Diff. than Est SY)	Mix Delivered	Waste (Tons)	Mix Used (Tons)	Calculated Field Voids Tons	Yield
0080	0001	ABD23-4052	NHS-080-3(282)118--11-25	NB/EB Drive Ln	12+50	13+50	100	12	2					21.00	5	16.00	15.0	107%
0090	0001	ABD23-4052	NHS-080-3(282)118--11-25	NB/EB Pass Ln	1+00	5+00	400	12	2	4	2			87		87.00	80.0	109%
0090	0002	ABD23-4052	NHS-080-3(282)118--11-25	NB/EB Lt Shldr	2+00	6+00	400	12	2					75	10	65.00	60.0	108%
0080	0001	ABD23-4052	NHS-080-3(282)118--11-25	SB/WB Rt Turn	3+00	4+00	100	12	2					20		20.00	15.0	133%
0100	0001	ABD23-4052	NHS-080-3(282)118--11-25	SB/WB Rt Shldr	4+00	6+50.25	250.25	12	2					40		40.00	37.5	107%
2000	0001	ABD23-4052	NHS-080-3(282)118--11-25	SB/WB Drive Ln	5+00	7+25	225	12	3			133.33		55		55.00	50.6	109%
2000	0001	ABD23-4052	NHS-080-3(282)118--11-25	SB/WB Left Tur	6+00	7+89	189	12	6			711.11	700	90		90.00	85.1	106%
							0											
							0											
							0											

Bid Item (In Order of Placement)

If you have two 11 Digit Item codes with different costs then a NEW DFR needs cre One mix design per DFR

11 Digit Item Code	Items	Project #	Bid Item Plan Quantity	Contract Mix Price	Contract Binder Price	Plan Thickness (in)	Mix Delivered	Waste (Tons)	Mix Used (Tons)	SY Item	Today's Placement
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2303-1042500	0090	NHS-080-3(282)118--11-25	11,989.00, 128.00	$31.00	500	4, 2	162.00	10.00	152.00	-	Base (Travel Lane)
2303-1043504	0100	NHS-080-3(282)118--11-25	7,349.00	$31.00	500	4	40.00	-	40.00	-	Bridge Approach
2304-0100000	2000	NHS-080-3(282)118--11-25	500	$2000.00	0	9	145.00	-	145.00	833.33	Temporary Pavement
							-	-	-	-	

Hot Box Sample					
Test A	Test B	Test C	Test D	Test E	
					Hot Box ID Number
					Hot Box Sample Tons:
					Time:
					Station/MP:
					Bar Code ID.:
					Compaction Temp. F:

Mat Temperatures °F	
Time	Temp
7:00	
9:00	
11:00	
1:00	
3:00	
5:00	
7:00	

Int[illegible]ded Thickness:
[illegible]Cores Waived?
Small Qu[illegible]ity Statement?
S[illegible] Check Done?
Tac[illegible]Tickets Today?

The Below Comments should show up on the plant report
Comments:

The Below Notes are for the CPI from the field or Plant Monitor
Notes:

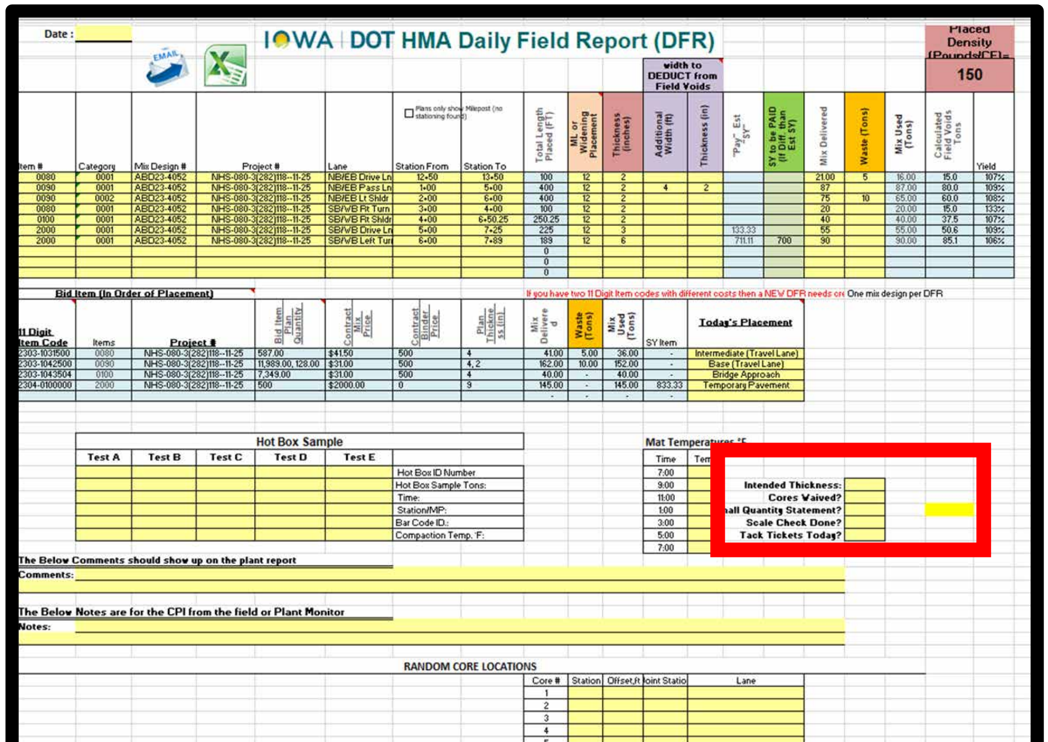
RANDOM CORE LOCATIONS

Core #	Station	Offset,ft	Joint Station	Lane
1				
2				
3				
4				

HMA Daily Field Report

SMALL QUANTITY STATEMENT?
CORES WAIVED?

Small Quantity Statement?	No
Cores Waived?	No

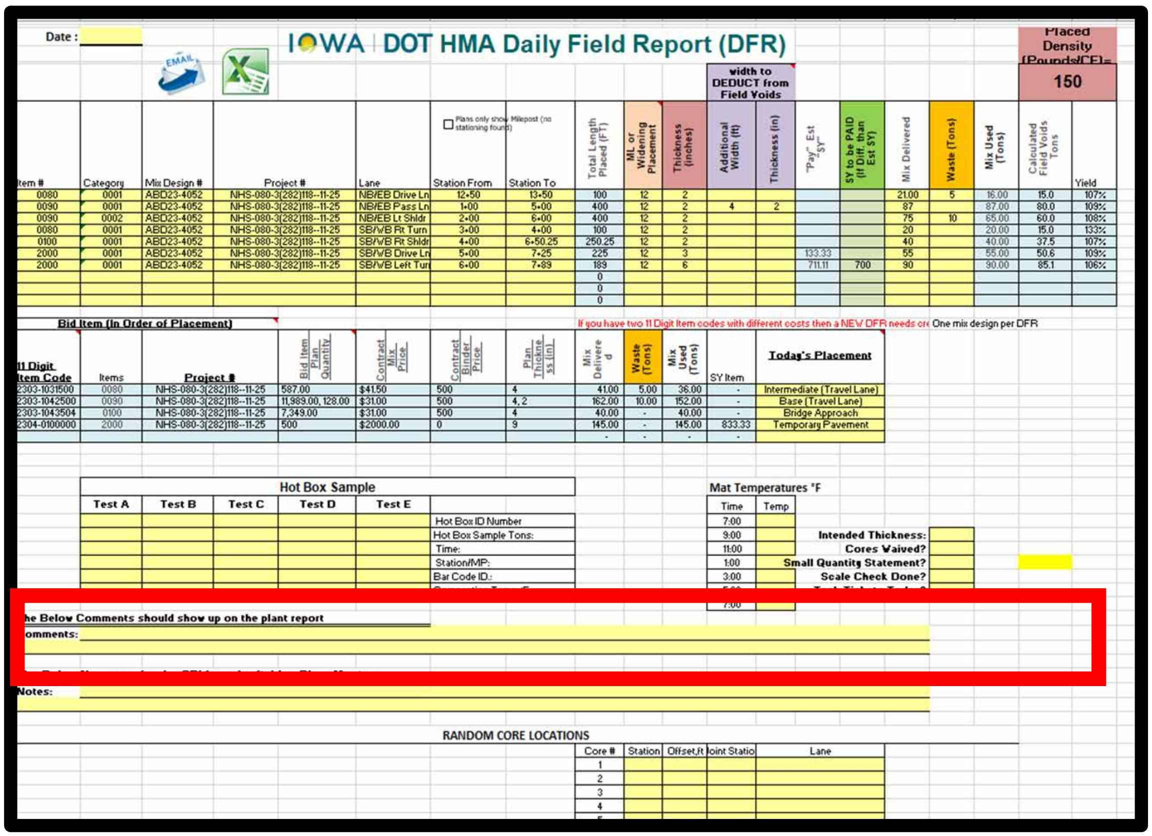


HMA Daily Field Report

PLANT REPORT COMMENTS

The Below Comments should show up on the plant report

Comments:

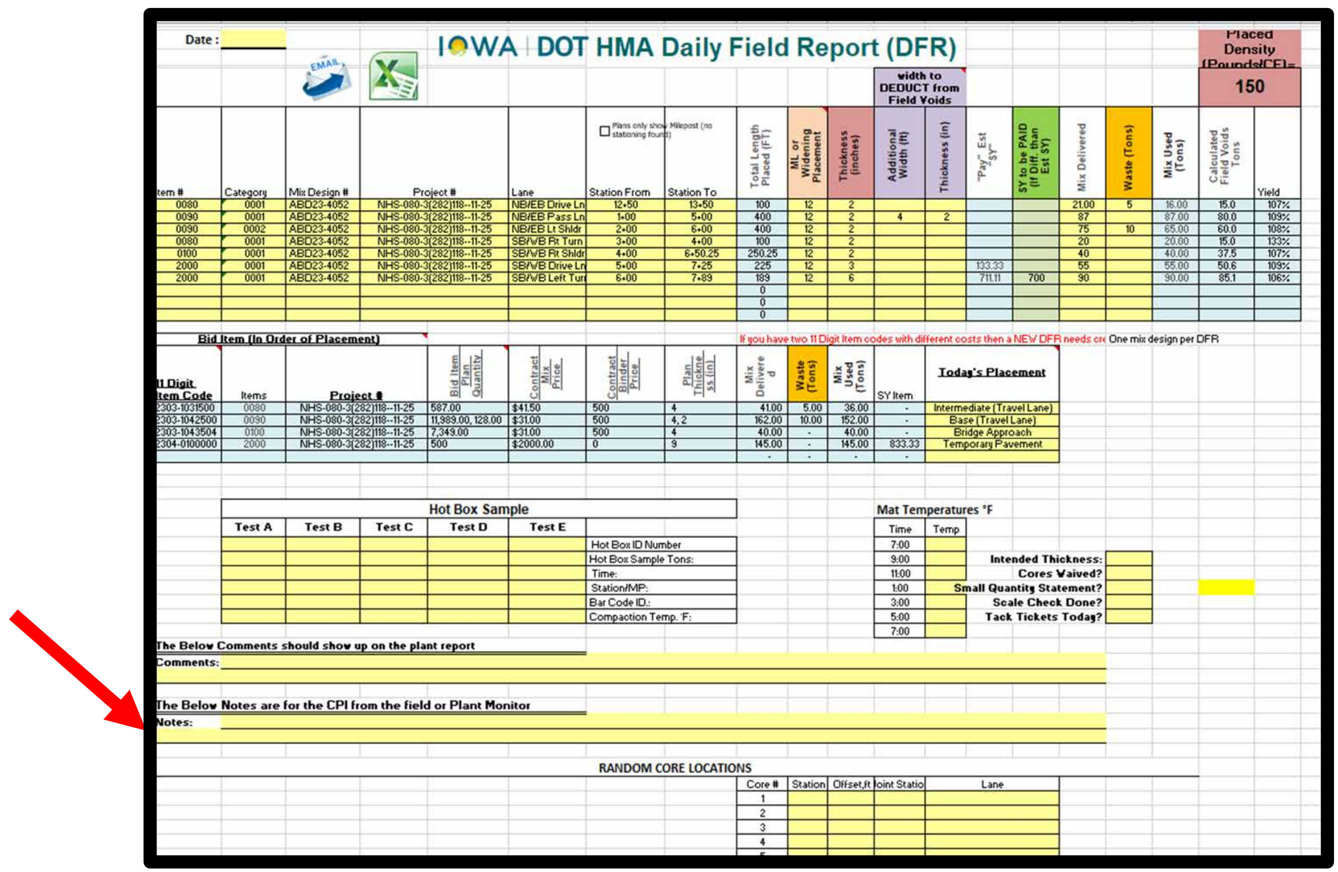


HMA Daily Field Report

NOTES TO THE CPI FROM THE FIELD

The Below Notes are for the CPI from the field or Plant Monitor

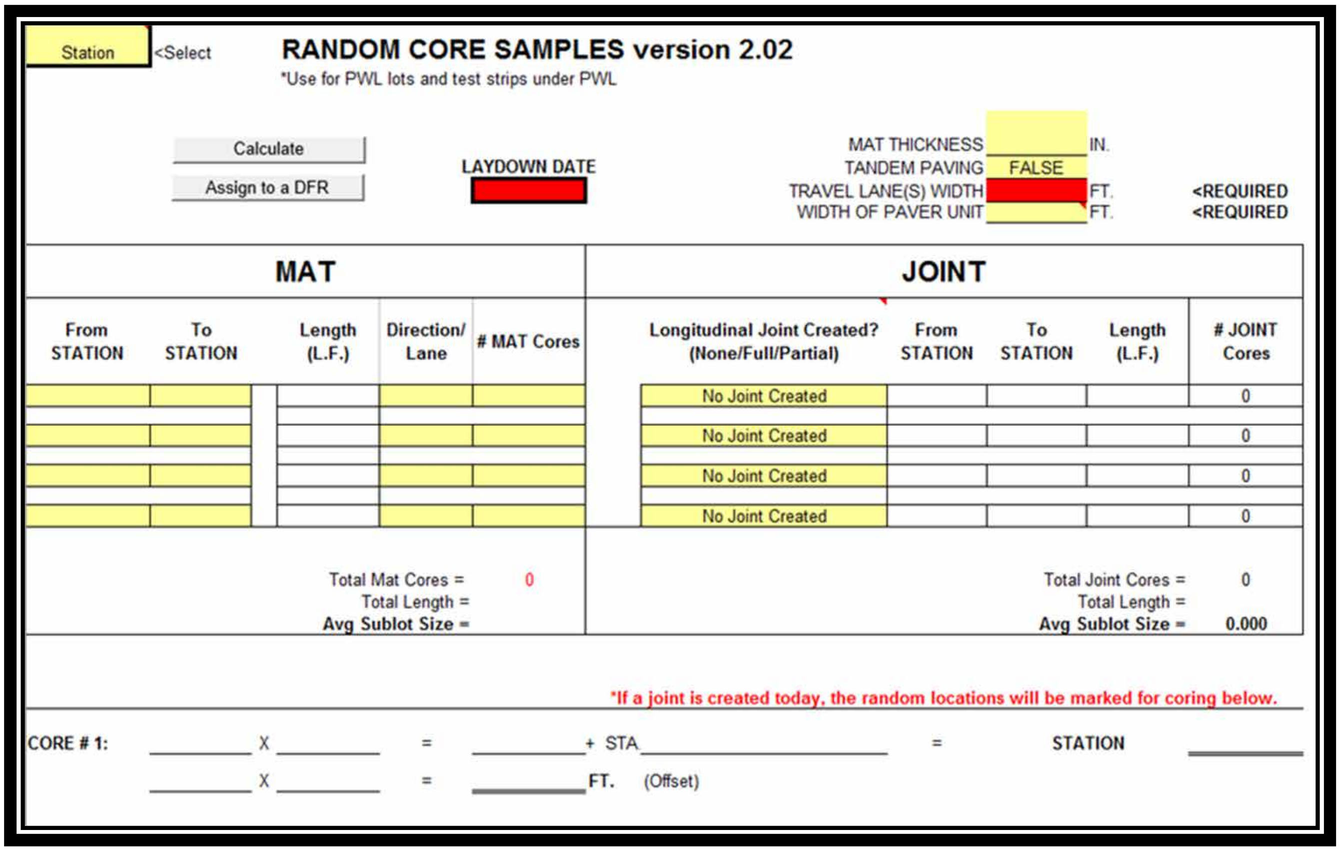
Notes:

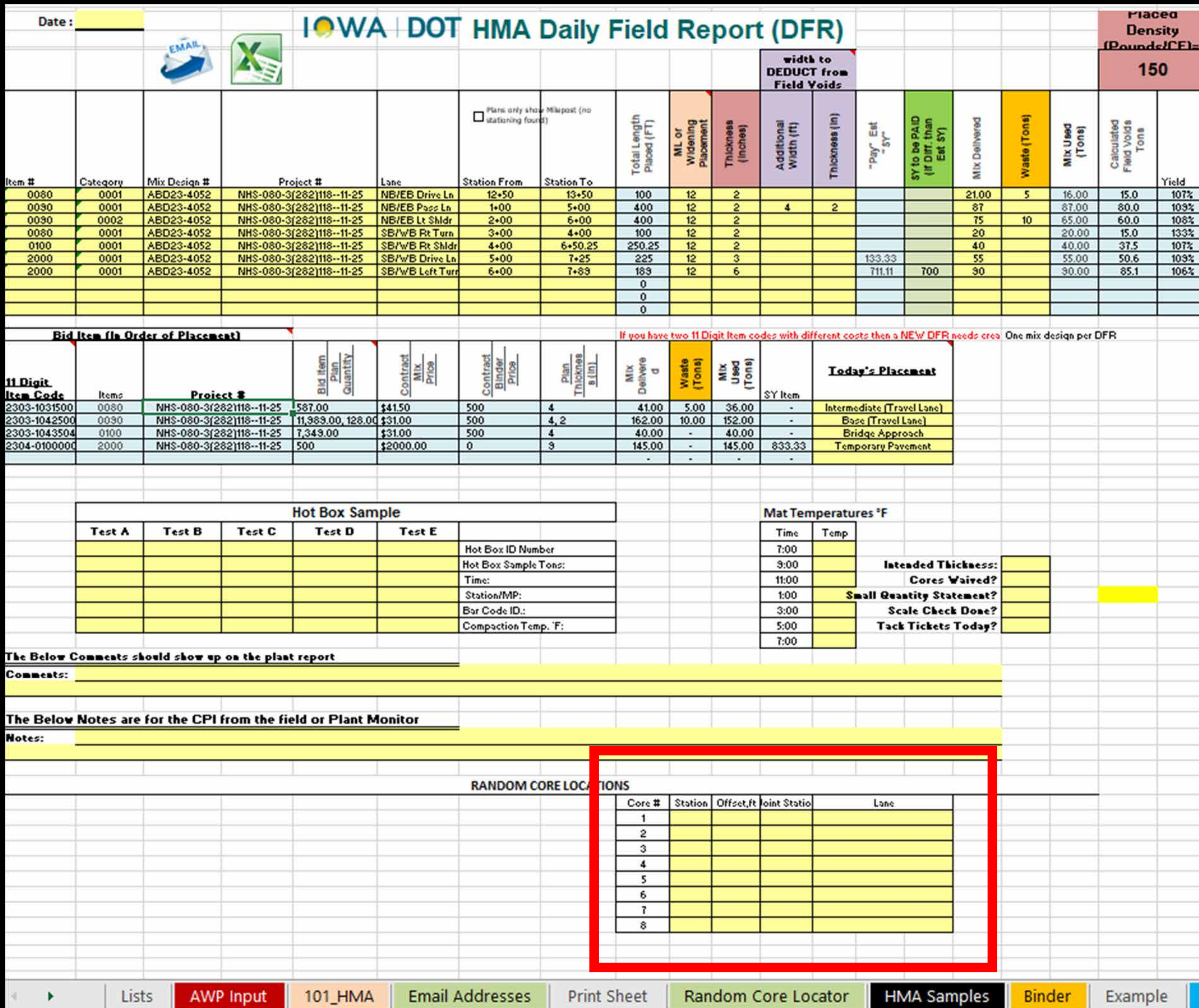


Random Core Locator

SAME CORE LOCATOR PROGRAM

- ABILITY TO ASSIGN THE REPORT TO A SPECIFIC DFR.





Date :

IOWA | DOT HMA Daily Field Report (DFR)

Placed Density (Pounds/CF)= 150

width to DEDUCT from Field Voids

☐ Plans only show Milepost (no stationing found)

Item #	Category	Mix Design #	Project #	Lane	Station From	Station To	Total Length Placed (FT)	ML or Widening Placement	Thickness (inches)	Additional Width (ft)	Thickness (in)	"Pay" Est "SY"	SY to be PAID (If Diff. than Est SY)	Mix Delivered	Waste (Tons)	Mix Used (Tons)	Calculated Field Voids Tons	Yield
0080	0001	ABD23-4052	NHS-080-3(282)118--11-25	NB/EB Drive Ln	12+50	13+50	100	12	2					21.00	5	16.00	15.0	107%
0090	0001	ABD23-4052	NHS-080-3(282)118--11-25	NB/EB Pass Ln	1+00	5+00	400	12	2	4	2			87		87.00	80.0	103%
0090	0002	ABD23-4052	NHS-080-3(282)118--11-25	NB/EB Lt Shldr	2+00	6+00	400	12	2					75	10	65.00	60.0	108%
0080	0001	ABD23-4052	NHS-080-3(282)118--11-25	SB/WB Rt Turn	3+00	4+00	100	12	2					20		20.00	15.0	133%
0100	0001	ABD23-4052	NHS-080-3(282)118--11-25	SB/WB Rt Shldr	4+00	6+50.25	250.25	12	2					40		40.00	37.5	107%
2000	0001	ABD23-4052	NHS-080-3(282)118--11-25	SB/WB Drive Ln	5+00	7+25	225	12	3			133.33		55		55.00	50.6	109%
2000	0001	ABD23-4052	NHS-080-3(282)118--11-25	SB/WB Left Turn	6+00	7+89	189	12	6			711.11	700	90		90.00	85.1	106%
							0											
							0											
							0											

Bid Item (In Order of Placement)

If you have two 11 Digit Item codes with different costs then a NEW DFR needs crea One mix design per DFR

11 Digit Item Code	Items	Project #	Bid Item Plan Quantity	Contract Mix Price	Contract Binder Price	Plan Thickness (in)	Mix Delivered	Waste (Tons)	Mix Used (Tons)	SY Item	Today's Placement
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2303-1042500	0090	NHS-080-3(282)118--11-25	11,989.00, 128.00	$31.00	500	4, 2	162.00	10.00	152.00	-	Base (Travel Lane)
2303-1043504	0100	NHS-080-3(282)118--11-25	7,349.00	$31.00	500	4	40.00	-	40.00	-	Bridge Approach
2304-0100000	2000	NHS-080-3(282)118--11-25	500	$2000.00	0	9	145.00	-	145.00	833.33	Temporary Pavement
							-	-	-	-	

Hot Box Sample

Test A	Test B	Test C	Test D	Test E	
					Hot Box ID Number
					Hot Box Sample Tons:
					Time:
					Station/MP:
					Bar Code ID.:
					Compaction Temp. °F:

Mat Temperatures °F

Time	Temp
7:00	
9:00	
11:00	
1:00	
3:00	
5:00	
7:00	

Intended Thickness:	
Cores Waived?	
Small Quantity Statement?	
Scale Check Done?	
Tack Tickets Today?	

The Below Comments should show up on the plant report

Comments:

The Below Notes are for the CPI from the field or Plant Monitor

Notes:

RANDOM CORE LOCATIONS

Core #	Station	Offset,ft	Joint Statio	Lane
1				
2				
3				
4				
5				
6				
7				
8				

Lists | AWP Input | 101_HMA | Email Addresses | Print Sheet | Random Core Locator | HMA Samples | Binder | Example

HMA Daily Field Report

RANDOM CORE LOCATIONS

- FILLED OUT UNDER THE TAB “RANDOM CORE LOCATOR”
- AFTER ASSIGNING THE DATE, THIS WILL SHOW UP ON THE DFR THAT WILL BE SENT TO THE CPI.

RANDOM CORE LOCATIONS

Core #	Station	Offset, ft	Joint Station	Lane
1	1160+89	1		NB
2	1174+37	4.4		NB
3	1181+56	9.2		NB
4	1188+17	7.1		NB
5	1205+86	3.6		NB
6	1220+28	7.8		NB
7	1228+3	3.4		NB
8	1247+87	9.9		NB

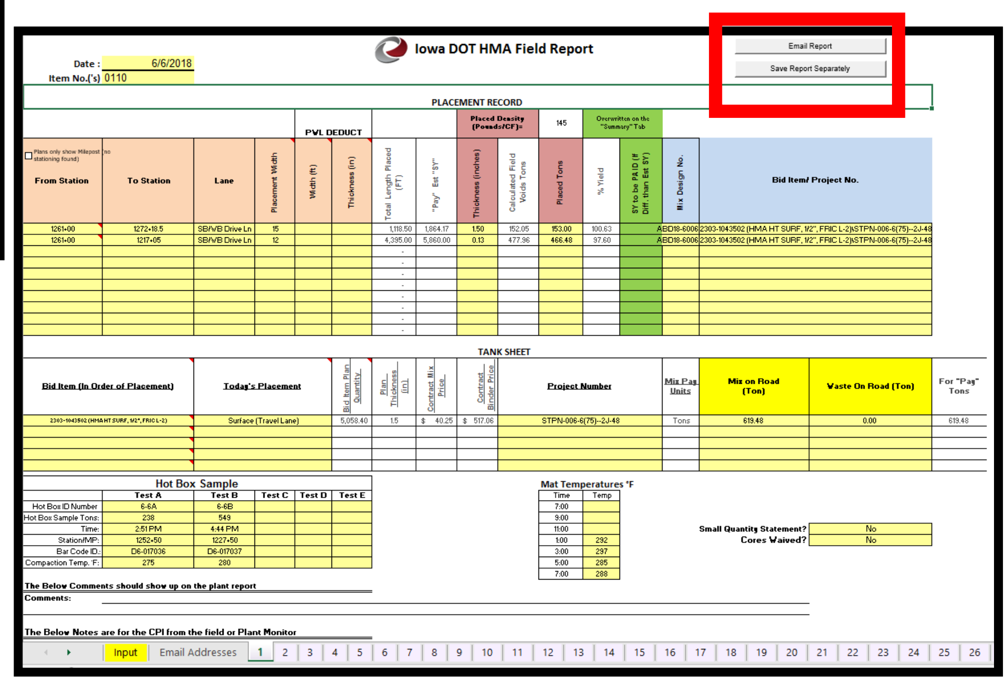
Joint Sublot Size, ft

-

HMA Daily Field Report

SENDING THE REPORT TO THE CPI

- ➢ E-MAIL REPORT BUTTON
  - ➢ SENDS E-MAIL TO ALL LISTED ON THE E-MAIL ADDRESS TAB.
  - ➢ SEPARATE EXCEL FILE FOR CPI TO IMPORT DIRECTLY INTO THE PLANT REPORT (NO TYPING OF DATA).
- ➢ ALSO, BUTTON TO SAVE DFR INTO SEPARATE EXCEL FILE.



HMA Daily Field Report

SENDING THE REPORT TO THE CPI

Send

To... Wilkinson, Cedric

Cc...

Subject HMA DFR 6/6/2018 - STPN-006-6(75)--2J-48

Attached DFR STPN-006-6(75)--... 22 KB

Iowa DOT Davenport RCE Daily Field Report

Project: STPN-006-6(75)--2J-48
County:
Contractor: Contractor1

Date Placed: 6/6/2018
Contract ID: 48-1511-035

Cores Waived? No
Small Quantities? No

Placement Record

From Station	To Station	Lane	Placement Width	PWL Deduct Width (ft)	PWL Deduct Thickness (in)	Placed Tons	Agreed SY	Mix Design No	Bid Item	Project
1261+00	1272+18.5	SB/WB Drive Ln	15			153.00		ABD18-6006T1	2303-1043502 (HMA HT SURF, 1/2", FRIC L-2)	STPN-006-6(75)--2J-48
1261+00	1217+05	SB/WB Drive Ln	12			466.48		ABD18-6006T1	2303-1043502 (HMA HT SURF, 1/2", FRIC L-2)	STPN-006-6(75)--2J-48

Appendix E

Appendix E

Asphalt Terminology (Glossary)

Absorption
The property of an aggregate particle to take in and hold a fluid.
For our purposes, usually asphalt binder or water.

Aggregate
Any hard, inert, mineral material used for mixing in graduated fragments.
It includes sand, gravel, crushed stone, and slag.

Aggregate Storage Bins
Bins that store the necessary aggregate sizes and feed them to the dryer in substantially the same proportions as are required in the finished mix.

Air Voids
Internal spaces in a compacted mix surrounded by asphalt-coated particles, expressed as a percentage by volume of the total compacted mix.

Alligator Cracks
Interconnected cracks forming a series of small blocks resembling an alligator's skin, caused by excessive deflection of the surface over unstable subgrade or lower courses of the pavement.

Asphalt Binder
A dark brown to black cementitious material, which occurs in nature or is obtained in petroleum processing. Asphalt binder is classified according to the *Standard Specification for Performance Graded Asphalt Binder, AASHTO Designation MP1*. It is also commonly referred to as Asphalt Cement.

Asphalt Binder Content
A measurement (by weight) of the asphalt binder in the mix, usually expressed as a percentage.

Asphalt Cement – See **Asphalt Binder**

Asphalt Cement Concrete – See **Hot Mix Asphalt**

Asphalt Distributor
A truck or a trailer having an insulated tank, heating system and distribution system. The distributor applies asphalt to a surface at a uniform rate.

Asphalt Emulsion
An emulsion of asphalt binder and water that contains a small amount of an emulsifying agent. Emulsified asphalt droplets may be of either the anionic (negative charge), cationic (positive charge), or nonionic (neutral).

Asphalt Joint Sealer
An asphalt product used for sealing cracks and joints in pavements and other structures.

Asphalt (Flexible) Pavements
Pavements consisting of a surface course of asphalt concrete over supporting courses such as asphalt concrete bases, crushed stone, slag, gravel, Portland Cement Concrete (PCC), brick, or block pavement.

Asphalt Primer
Low viscosity asphalt (highly liquid) that penetrates into a non-bituminous surface upon application.

Average Absolute Deviation (AAD)
The absolute value of the difference of a test result from a specified value, averaged for a specified set of values.

Base Course
Lift(s) of HMA pavement placed on the subgrade or subbase on which successive layers are placed.

Batch Plant
This type of HMA production plant is used to produce individual batches of mix by making use of a pugmill (see *IM 508* for additional information).

Binder Course – See **Intermediate Course**

Bitumen – See **Asphalt Binder**

Bleeding or Flushing Asphalt
The upward migration of asphalt binder in an asphalt pavement, resulting in the formation of asphalt film on the surface.

Blow-Up
The localized buckling or upward movement of a PCC pavement caused primarily by excessive expansion.

Break and Seat
A fractured slab technique used in the rehabilitation of Reinforced Concrete Pavement (RCP) that minimizes slab action by fracturing the PCC layer into

smaller segments. This reduction in slab length (and debonding from the reinforcement steel) minimizes reflective cracking in new HMA overlays.

Breaking
The phenomenon when asphalt and water separate in an asphalt emulsion beginning the curing process. The rate of breaking is controlled primarily by the emulsifying agent, and somewhat dependent on environmental conditions.

Certified Plant Inspection (CPI)
A specified method of quality control using a Certified Plant Inspector (see *Section 2521* of the *Standard Specifications* for additional information).

Coarse Aggregate
The aggregate particles retained on the #4 (4.75 mm) sieve.

Coarse-Graded Aggregate
A blend of aggregate particles having a continuous grading in sizes of particles from coarse through fine with a predominance of coarse sizes. A gradation below the maximum density line.

Cohesion
Bonding of aggregates by asphalt binder in HMA, increasing stability of the mixture.

Cold-Feed Gradation
The aggregate proportioning system employing calibrated bins to deliver aggregate to the dryer (see *IM 508* for additional information).

Cold In-Place Recycling (CIR)
A method of rehabilitating the HMA surface by milling, adding a stabilizing agent, relaying and compacting in a continuous operation (see *IM 504* for additional information).

Cold In-Place Recycling Train
A unit consisting of a large milling machine towing a screening/crushing plant and pugmill mixer for the addition of rejuvenating agent and production of cold mix base.

Compaction
The act of compressing a given volume of material into a smaller volume.

Consensus Properties
Aggregate characteristics that must follow certain criteria to satisfy a Superpave mix design. Specified test values for these properties are not source specific but widely agreed upon. They include Coarse Aggregate Angularity, Fine Aggregate Angularity, Flat or Elongated Particles, and Clay Content.

Consistency (Asphalt Binder)
The degree of fluidity of asphalt binder (cement) at any particular temperature. The consistency of asphalt binder varies with its temperature; therefore, it is necessary to use a common or standard temperature when comparing the consistency of one asphalt binder with another.

Corrugations (Washboarding) and Shoving
A type of pavement distortion, typically occurring on HMA layers that lack stability. Corrugation is a form of plastic deformation typified by ripples across the pavement surface. These distortions usually occur at points where traffic starts and stops, on hills where vehicles brake on the downgrade, on sharp curves, or where bumps cause vehicles to bounce up and down.

Crack
An approximately vertical random cleavage of the pavement caused by traffic loading, thermal stresses and/or aging of the binder.

Crack and Seat
A fractured slab technique used in the rehabilitation of PCC pavements, that minimizes slab action in a jointed concrete pavement by fracturing the PCC layer into smaller segments. This reduction in slab length minimizes reflective cracking in HMA overlays.

Crack-Relief Layer
An open-graded asphalt mixture placed over a distressed pavement that minimizes reflective cracking by absorbing the energy produced by movement in the underlying pavement.

Curing
The development of the mechanical properties of the asphalt binder. This occurs after the emulsion has broken and the emulsion particles coalesce and bond to the aggregate.

Cutback Asphalt
Liquid asphalt composed of asphalt binder and a petroleum solvent. Cutback asphalts have three types (Rapid Curing (RC), Medium Curing (MC), and Slow

Curing (SC)). The petroleum solvent, also called diluents, can have high volatility (RC) to low volatility (SC).

Deep Strength Asphalt Pavement
Pavement containing at least four inches on HMA over non-stabilized base courses.

Deflection
A load-induced, downward movement of a pavement section.
Delivery Tolerances
Permissible variations from the exact desired proportions of aggregate and bituminous material as manufactured by an asphalt plant.

Dense-Graded Aggregate
An aggregate that has a particle size distribution such that when it is compacted, the resulting voids between the aggregate particles, expressed as a percentage of the total space occupied by the material, are less the 10%.

Densification
The act of increasing the density of a mixture during the compaction process.

Density
The unit weight or the weight of a specific volume of mix.

Design ESAL
The total number of equivalent 80-kN (18,000-lb.), single-axle load applications (equivalent single axle loads) expected throughout the design period.

Design Lane
The lane on which the greatest number of equivalent 80-kN (18,000-lb.) single axle loads (ESAL) is expected. This will normally be either lane of a two-lane roadway of the outside lane of a multi-lane highway.

Design Period
The number of years from the initial application of traffic until the first planned major resurfacing or overlay. This term should not be confused with pavement life or analysis period. Adding HMA overlays as required will extend pavement life indefinitely or until geometric considerations (or other factors) make the pavement obsolete.

Disintegration
The breaking up of a pavement into small, loose fragments caused by traffic or weathering.

Distortion
Any change of a pavement surface from its original shape.

Drum Mix (Continuous) Plant
This type of HMA production plant is a continuously operating plant, which mixes the aggregate, asphalt binder and RAP (if used) in the drum (See *IM 508* for additional information).

Dryer
An apparatus that will dry the aggregates and heat them to the specified temperatures.

Durability
The property of an asphalt paving mixture that describes its ability to resist the detrimental effects of air, water and temperature. Included under weathering are changes in the characteristics of asphalt, such as oxidation and volatilization, and changes in the pavement and aggregate due to the action of water, including freezing and thawing.

Edge Joint Cracks
The separation of the joint between the pavement and the shoulder, commonly caused by the alternate wetting and drying beneath the shoulder surface. Other causes are shoulder settlement, mix shrinkage, and trucks straddling the joint.

Effective Thickness
The ratio of the thickness of an existing pavement material compared to the equivalent thickness of a new HMA later.

Emulsified Asphalt
Composed of asphalt binder and water, and a small quantity of emulsifying agent, which is similar to detergent. They may be of either the Anionic, electro-negatively-charged asphalt globules, or Cationic, electro-positively-charged asphalt globules types, depending upon the emulsifying agent. Emulsified asphalt is produced in three grades (Rapid-Setting (RS), Medium-Setting (MS), and Slow-Setting (SS)).

Emulsifying Agent or Emulsifier
The chemical added to the water and asphalt that keeps the asphalt in stable suspension in the water. The emulsifier determines the charge of the emulsion and controls the breaking rate.

ESAL (Equivalent Single Axle Loads)
The effect on pavement performance of any combination of axle loads of varying magnitude equated to the number of 80-kN (18,000-lb.) single-axle loads that are required to produce an equivalent effect.

Fault
A difference in elevation of two slabs at a joint or crack.

Fatigue Resistance
The ability of asphalt pavement to withstand repeated flexing caused by the passage of wheel loads.

Field Density
The density ($G_{mb\ (field)}$) of HMA based on field roller compaction.

Field Voids
The percent by volume of air voids in cores cut from the finished pavement.

Fine Aggregate
Aggregate particles passing the #4 (4.75 mm) sieve.

Fine-Graded Aggregate
A blend of aggregate particles having a continuous grading in sizes of particles from coarse through fine with a predominance of fine sizes. A gradation above the maximum density line.

Flexibility
The ability of an asphalt paving mixture to be able to bend slightly, without cracking, and to conform to gradual settlements and movements of the base and subgrade.

Foamed Asphalt
A combination of high temperature asphalt binder and water to produce foaming.

Fog Seal
A light application of emulsion diluted with water that is applied without mineral aggregate cover.

Flux or Flux Oil
A thick, relatively nonvolatile fraction of petroleum, which may be used to soften asphalt binder to a desired consistency.

Fractured Slab Techniques
Processes used to rehabilitate PCC pavements by eliminating slab action through the reduction of slab size (Crack/Break and Seat) or the pulverization of the PCC slab (Rubblization) into essentially a granular base.

Full-Depth® Asphalt Pavement
The term Full-Depth® certifies that the pavement is one in which asphalt mixtures are employed for all courses above the prepared subgrade or subbase. A Full-Depth® asphalt pavement is laid directly on the prepared subgrade or subbase.

Gilsonite
A form of natural asphalt, hard and brittle, which is mined.

Gradation
The description given to the proportions of aggregate on a series of sieves. Usually defined in terms of the % passing successive sieve sizes.

Grade Depressions
Localized low areas of limited size.

Hot Mix Asphalt (HMA)
Asphalt binder/aggregate mixture produced at a batch or drum-mixing facility that must be spread and compacted while at an elevated temperature. To dry the aggregate and obtain sufficient fluidity of the binder, both must be heated prior to mixing – giving origin to the term "hot mix."

Hot Mix Asphalt (HMA) Overlay
One or more lifts of HMA constructed on an existing pavement. The overlay may include a leveling course or scarification to correct the contour of the old pavement, followed by uniform course or courses to provide needed thickness.

Impermeability
The resistance an asphalt pavement has to the passage of air and water into or through the pavement.

Intermediate Course
An HMA pavement course between a base course and a surface course.

Job Mix Formula (JMF)
The JMF is the mix design used to begin a HMA project. It is also used as the basis for the control of plant produced mixture. It sets the proportions of the aggregate and amount of asphalt binder.

Kinematic Viscosity
A measure of the viscosity of asphalt, measured in centistokes, conducted at a temperature of 135ºC (275ºF).

Lab Density
The density ($G_{mb\ (lab)}$) of HMA based on laboratory compaction.

Lab Voids
The percent by volume of air voids in laboratory compacted specimens.

Lane Joint Cracks
Longitudinal separations along the seam between two paving lanes.

Leveling Course
A course of hot mix asphalt of variable thickness used to eliminate irregularities in the contour of an existing surface prior to placing the subsequent course.

Lift
A layer or course of paving material applied to a base or a previous layer.

Lime
A product used to enhance the bond between aggregate and asphalt binder. It is composed of dust from crushed limestone. Hydrated lime is often specified for surface mixes.

Load Equivalency Factor
The number of 80-kN (18,000-lb.) single-axle load applications (ESAL) contributed by one passage of an axle.

Longitudinal Crack
A vertical crack in the pavement that follows a course approximately parallel to the centerline.

Maintenance Mix
A mixture of asphalt emulsion and mineral aggregate for use in relatively small areas to patch holes, depressions, and distressed areas in existing pavements. Appropriate hand or mechanical methods are used in placing and compacting the mix.

Manufactured Sand
The predominately minus #4 (4.75 mm) material produced from crushing ledge rock or gravel.

Mechanical Spreaders
Spreader boxes that are mounted on wheels. The spreaders are attached to and pushed by dump trucks (HMA boxes are pulled and chip spreaders are pushed).

Medium-Curing (MC) Asphalt
Cutback asphalt composed of asphalt cement and a diluent of medium volatility.

Mesh
The square opening of a sieve.

Microsurfacing
A mixture of polymer modified asphalt emulsion, crushed dense graded aggregate, mineral filler, additives, and water. It provides a resurfacing of 10 to 20 mm (3/8 to 3/4 inch) to the pavement.

Milling Machine
A self-propelled unit having a cutting head equipped with carbide-tipped tools for the pulverization and removal of layers of asphalt materials from pavements.

Mineral Dust
The portion of the fine aggregate passing the 0.075 mm (No. 200) sieve.

Mineral Filler
A finely divided mineral product at least 70 percent of which will pass a #200 (75 μm) sieve. Pulverized limestone is the most commonly manufactured filler, although other stone dust, hydrated lime, Portland cement, fly ash and certain natural deposits of finely divided mineral matter are also used.

Mixed-In-Place (Road Mix)
An HMA course produced by mixing mineral aggregate and cutback or emulsified asphalt at the road site by means of travel plants, motor graders, or special road-mixing equipment.

Modified Binder
These are asphalt binders, which have been physically- and/or chemically-altered (usually with an additive) to bring the characteristics of the binder to what is desired for the application. This process includes polymer modification.

Natural (Native) Asphalt
Asphalt occurring in nature, which has been derived from petroleum through natural processes of evaporation of volatile fractions, leaving the asphalt fractions. The native asphalt of most importance is found in the Trinidad and Bermudez Lake deposits. Asphalt from these sources is often called lake asphalt.

Natural Sand
A loose, granular material found in natural deposits.

Nondestructive Testing (NDT)
In the context of pavement evaluation, NDT is deflection testing, without destruction to the pavement, to determine a pavement's response to pavement loading.

Open-Graded Aggregate
A blend of aggregate particles containing little or no fine aggregate and mineral filler and the void spaces in the compacted aggregate are relatively large

Overlay
The placement of hot asphalt over existing asphalt bound with a tack coat. Otherwise referred to as Resurfacing.

Pay Factor
A calculated multiplier used to determine adjustments to payment to the contractor. Pay factors greater than 1.000 are referred to as “incentive” and pay factors less than 1.000 are referred to as “disincentive” or “penalties”

Pavement Structure
The entire pavement system of selected materials from subgrade to the surface.

Percent Within Limits (PWL)
A statistical estimation of the percentage of a material that falls between specified limits based on sampling and testing of the material. PWL is used to calculate the pay factor.

Performance Graded Asphalt (PG)
The identification associated with the grading of the binder. Prior identification methods have been penetration and viscosity grading. For example, a PG 64-22 would indicate a performance-graded binder with a high temperature confidence of 64°C and a low temperature confidence of -22°C.

Permeability
The resistance that an asphalt pavement has to the passage of air and water into or through the pavement.

Planned Stage Construction
A construction process where stages of the project are performed sequentially according to design and a predetermined time schedule.

Plant Screens
Screens located between the dryer and hot bins, which separate heated aggregates into proper hot bin sizes.

Plant (Cold) Mix
A mixture, produced in an asphalt mixing facility that consists of mineral aggregate uniformly coated with asphalt binder, emulsified asphalt, or cutback asphalt.

Pneumatic-Tire Roller
A compactor with a number of tires spaced so their tracks overlap delivering a kneading type of compaction.

Polished Aggregate
Aggregate particles in a pavement surface that have been worn smooth by traffic.

Polymer-Modified Asphalt Binder
Conventional asphalt cement to which one or more polymer compounds have been added to improve resistance to deformation at high pavement temperatures and often cracking resistance at low temperatures.

Potholes
Bowl-shaped openings in the pavement resulting from localized disintegration.

Power Sweeper
A power operated rotary broom used to clean loose material from the pavement surface.

Present Serviceability
The ability of a specific section of pavement to serve its intended use in its existing condition.

Prime Coat
An application of asphalt primer to an absorbent surface. It is used to prepare an untreated base for an asphalt surface. The prime penetrates or is mixed into the surface of the base and plugs the voids, hardens the top and helps bind it to the overlying asphalt course.

Pumping
Slab deflection under passing loads sometimes resulting in the discharge of water and subgrade soils along joints, cracks, and pavement edges.

Quality Management of Asphalt (QMA)
A specified quality control procedure where the contractor is responsible for the mix design and the control of the mix properties during production (see *IM 511* for additional information). The agency is responsible for quality assurance and verification.

Rapid-Curing (RC) Asphalt
Cutback asphalt composed of asphalt cement and a naphtha or gasoline-type diluent of high volatility.

Raveling
The progressive separation of aggregate particles in a pavement from the surface downward or from the edges inward.

Reclaiming Machine
A self-propelled unit having a transverse cutting and mixing head inside a closed chamber, for the pulverization and mixing of existing pavement materials with asphalt emulsion. Asphalt emulsion (and mixing water) may be added directly through the machine by a liquid additive system and spray bar.

Recycled Asphalt Mix
A mixture produced after processing existing asphalt pavement materials. The recycled mix may be produced by hot or cold mixing at a plant, or by processing the materials cold and in-place.

Recycled Asphalt Pavement (RAP)
HMA removed and processed, generally by milling. This material may be stored and used in mixtures in addition to virgin aggregate and binder. This is also referred to as Reclaimed Asphalt Pavement.

Recycled Asphalt Shingles (RAS)
Roofing shingles, either waste from a shingle manufacturer or tear off shingles from reroofing operations. Shingles contain a high percentage of asphalt as well as fibers and fine aggregate. Shingles are processed into a fine material and handled similar to RAP.

Reflection Cracks
Cracks in asphalt overlays (usually over deteriorated PCC pavements) that reflect the crack or joint pattern in the pavement structure below it.

Residue
The asphalt binder that remains from an asphalt emulsion after the emulsifying agent has broken and cured, or the remains of a cutback after the volatiles have cured.

Resilient Modulus of Elasticity
A laboratory measurement of the behavior of pavement materials to characterize their stiffness and resiliency. A confined or unconfined test specimen (core or recompacted) is repeatedly loaded and unloaded at a prescribed rate. The resilient modulus is a function of load duration, load frequency, and number of loading cycles.

Roadway
All facilities on which motor vehicles are intended to travel, such as Interstate highways, secondary roads, and city streets.

Rubblization
The pulverization of a Portland cement concrete pavement into smaller particles, reducing the existing pavement layer to a sound, structural base that will be compatible with subsequent asphalt overlay.

Rutting (Channeling)
Channeled depressions that sometimes develop in the wheel paths of an asphalt pavement, usually due to extreme temperatures combined with high wheel loads.

Sand
Fine aggregate (any fraction below a No. 8 sieve), resulting from natural disintegration and abrasion or processing of rock.

Sand Asphalt
A mixture of sand and asphalt binder, cutback, or emulsified asphalt. It may be prepared with or without special control of aggregate grading and may or may not contain mineral filler. Either mixed-in-place or plant-mix construction may be employed.

Saw-Cut and Seal
A method of controlling reflective cracking in HMA overlays that involves construction of joints in the new overlay exactly over the joints in the existing pavement.

Scaling
The peeling away or disintegrating of the surface of Portland cement concrete.

Seal Coat
A thin asphalt surface treatment used to waterproof and improve the texture of an asphalt wearing surface. Depending on the purpose, seal coats may or may not be covered with aggregate. The main types of seal coats are aggregate seals, fog seals, emulsion slurry seals and sand seals.

Self-Propelled Spreaders
Spreaders having their own power units and two hoppers. The spreader pulls the truck as it dumps its load into the receiving hopper. Conveyor belts move the aggregate forward to the spreading hopper.

Sheet Asphalt
A hot mixture of binder with clean angular, graded sand and mineral filler.

Shoving
A form of plastic movement resulting in localized bulging of the pavement.

Shrinkage Cracks
Interconnected cracks forming a series of large blocks, usually with sharp corners or angles.

Sieve
An apparatus for laboratory work in which the openings in the mesh are square for separating sizes of material.

Skid Hazard
Any condition that might contribute to the reduction of friction forces on the pavement surface.

Skid Resistance
The ability of a paved surface, particularly when wet, to resist to tire slipping or skidding. Proper asphalt content and aggregate with a rough surface texture are the greatest contributors. The aggregate must also resist polishing.

Slag
A nonmetallic byproduct, consisting essentially of silicates and aluminosilicates of lime and of other bases that develops simultaneously with iron in a blast furnace, during steel production.

Slippage Cracks
Crescent-shaped cracks resulting from traffic-induced horizontal forces that are open in the direction of the thrust of wheels of the pavement surface. They result when severe or repeated shear stresses are applied to the surface and there is a lack of bond between the surface layer and the course beneath.

Slurry Seal
A mixture of emulsified asphalt, fine aggregate, and mineral filler, with water added to produce flowing consistency.

Soil/Cement Base
A hardened material formed by curing a mechanically mixed and compacted mixture of pulverized soil, Portland cement and water used as a layer in a pavement system to reinforce and protect the subgrade.

Solubility
A measure of the purity of asphalt binder (cement). The ability of the portion of the asphalt binder that is soluble to be dissolved in a specified solvent.

Source Properties
Aggregate characteristics that must follow certain criteria to satisfy a Superpave mix design. They include Toughness, Soundness, and Deleterious Materials.

Spalling
The breaking or chipping of a PCC pavement at joints, cracks, or edges, usually resulting in fragments with featheredges.

Specific Gravity
The weight to volume relationship of material in relation to water.

Stability
The ability of asphalt paving mixtures to resist deformation from imposed loads. Unstable pavements are marked by channeling (ruts), and corrugations (washboarding). Stability is dependent upon both internal friction and cohesion.

Stationary Plants
Asphalt plants that are so constructed that moving them is not considered economically feasible.

Steel-Wheel Static Rollers
Tandem or three-wheel rollers with cylindrical steel rolls that apply their weight directly to the pavement.

Steel-Wheel Vibratory Rollers
A compactor having single or double cylindrical steel rolls that applies compactive effort with weight and vibration. The amount of compactive force is adjusted by changing the frequency and amplitude of vibration.

Structural Overlay
An HMA overlay constructed for the purpose of increasing the structural value and ride quality of the pavement system.

Subbase
The course in the asphalt pavement structure immediately below the base course.

Subgrade
The soil prepared to support a pavement structure or a pavement system. It is the foundation of the pavement structure.

Subgrade, Improved
Subgrade that has been improved as a working platform by the incorporation of granular materials or stabilizers such as asphalt, lime, or Portland cement into the subgrade soil.

Superpave
Short for "Superior Performing Asphalt Pavement", a pavement-based system for selecting and specifying asphalt binders and for designing asphalt mixtures.

Superpave Gyratory Compactor
A device used during Superpave mix design or quality control activities for compacting samples of hot mix asphalt into specimens used for volumetric analysis. Continuous densification of the specimen is measured during the compaction process.

Superpave Mix Design
An asphalt mixture design system that integrates the selection of materials (asphalt, aggregate) and volumetric proportioning with the project's climate and design traffic.

Surface Course
The top lift(s) of HMA pavement, sometimes called asphalt wearing course.

Surface Treatments
A broad term embracing several types of asphalt or asphalt-aggregate applications, usually less than 1 in. (25 mm) thick, to a road surface. The types range from a light application of emulsified or cutback asphalt (Fog seal) to a single or multiple surface layers made up of alternating applications of asphalt and aggregate (chip seal).

Tack Coat
A very light application of asphalt, usually asphalt emulsion diluted with water. It is used to ensure a bond between the existing pavement surface and the overlay.

Transverse Crack
A crack that follows a course approximately at right angles to the centerline.

Travel Plants
Self-propelled pugmill plants that proportion and mix aggregates and asphalt as they move along the road.

Truck Factor
The number of ESALs contributed by one passage of a vehicle. Truck Factors can apply to vehicles of a single type or class or to a group of vehicles of different types.

Upheaval
The localized upward displacement of a pavement, due to swelling of the subgrade or some portion of the pavement structure.

Viscosity
A measure of a liquid's resistance to flow with respect to time. The higher the viscosity, the greater the resistance to flow.

Voids in the Mineral Aggregate (VMA)
Void spaces that exist between the aggregate particles in the compacted mix, including spaces filled with asphalt binder. It represents the space available to accommodate effective volume of asphalt binder and air voids in the compacted mix.

Warm Mix Asphalt (WMA)
A group of technologies which allow a reduction in the temperatures at which asphalt mixtures are produced and placed. The most common technologies are foaming, organic (wax) additives and chemical (emulsions), all of which act to reduce viscosity and increase workability of asphalt binder at a given temperature. WMA is fundamentally the same as HMA.

Well-Graded Aggregate
Aggregate that is uniformly graded from coarse to fine.
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Wet Mixing Period
The interval of time between the beginning of application of asphalt materials into a pugmill and the opening of the discharge gate.

Workability
The ease with which paving mixtures may be placed and compacted.

Superpave (Gyratory Mix Design) Discussion

In 1987, the Strategic Highway Research Program (SHRP) began developing a new system for specifying asphaltic materials. The final product of the SHRP asphalt research program is a new system called Superpave, which is short for Superior Performing Asphalt Pavements. Superpave represents an improved system for specifying asphalt binders and mineral aggregates, developing HMA mixture design, and analyzing and establishing pavement performance prediction. The system was developed to provide the tools necessary to design HMA mixes that will perform better under heavy traffic and extreme temperatures. The goal is to provide pavements that are resistant to rutting, fatigue cracking, and low temperature cracking. The Superpave asphalt binder specification and mix design system include various test equipment, test methods, and criteria.

The unique feature of Superpave system is that it is a performance-based specification system. The tests and analyses have direct relationships to field performance. The Superpave asphalt binder tests measure physical properties that can be related directly to field performance by engineering principles.

Superpave mixes tend to be more coarse than conventional mixes. The coarse-graded Superpave designed mixtures with high coarse aggregate content do typically act differently than the fine-graded mixtures, and this must be considered during compaction. Coarse-graded mixtures often tend to cool more quickly, resulting in less time available for rolling. This may require that additional rollers be provided, and closer attention be paid to pavement compaction temperature.

It is important that the personnel working at the laydown site communicate with the plant personnel. If the mixture is acting differently underneath the rollers, then something may have changed at the plant. One of the most common changes in the plant-produced mixture is moisture content. A change in moisture content will have a significant effect on the handling and compaction characteristics of a Hot Mix Asphalt (HMA) mixture. Sometimes very small changes at the plant can cause significant changes during compaction. So, if the mixture appears to be acting differently, call the plant and see if something has changed.

The contractor must understand mixtures and their relationship to compaction. This understanding can be gained with experience, but only if one learns from the past mistakes and from procedures that have been successful.

Equipment should be selected specifically for a project. Different mixtures require different compaction techniques. A set of rollers and a rolling pattern that worked on one project may not be satisfactory for another project. This can be evaluated during construction of a test strip.

Rollers should generally stay close behind the paver. If the mix begins to shove when rolled, additional rolling with steel-wheel rollers will likely be detrimental. The shoving mixture can usually be rolled with a rubber-tire roller without detrimental movement. When modifiers are used in a mixture, rubber-tire rollers may tend to pick up the asphalt and thus may have to be removed from the project.

If the contact pressure is too low, it may be difficult or impossible to meet density requirements. The contact pressure can be increased in steel-wheel rollers by increasing the weight of the roller. The contact pressure can be increased in rubber-tired rollers by increasing the tire pressure and/or increasing the weight.

On some Superpave designed mixtures, a tender zone has been identified in temperature ranges of approximately 200-240 F. The mixture can be satisfactorily compacted above this range or below this range, but the mixture is tender within the temperature range and cannot be adequately compacted. This is not true for all mixtures, but it has been observed for some Superpave designed mixtures. The mix can often be satisfactorily rolled with rubber-tire rollers within this tender range but may experience pick-up problems when modifier binders are used.

When a mixture is being produced that is tender within the mid-temperature range, the preferred compaction method is to obtain density prior to cooling to the tender zone. This may require additional rollers, or in some cases, the mixture temperature may be increased slightly to provide more compaction time.

It has been suggested that tenderness at mid-range temperatures may be due to incomplete drying of the aggregate in the mix. Moisture trapped in the cracks and fissures of the stone is ultimately released by manipulation of the mix, causing the mix to become more fluid (tender). While this theory has not been conclusively proven, it does suggest that close attention be paid to the aggregate drying process. In addition, use of proper stockpiling and aggregate handling procedures will help minimize the potential for excess moisture in the mix.

Hot Mix Asphalt (HMA) Paving In Iowa – A Brief History

Historically, the state was the designer and inspector of hot mix asphalt mixes. The contractor's role back then was simple: to use a recipe given to them by the state, mix the materials in their plant and place it on the roadway. The Department of Transportation would do inspection and take samples of the mix for laboratory testing. The next day, or several days later, the results of the lab testing would indicate whether the mix met contract specifications. At that point in time, the roadway was already in place, leaving perhaps miles of deficient work.

Quality Management Asphalt (QMA):
During the 1980's and 1990's the construction industry and the Iowa Department of Transportation worked together to improve the quality of the HMA and the methods by which project testing was accomplished. In 1992, the Quality Management - Asphalt (QMA) program was implemented on all projects over 5000 tons. Quality Management changed the way that HMA pavements were designed and placed. Components of QMA are still in place today.

Under QMA, the contractor's personnel develop the mix design using aggregate that keeps them competitive (often local sources), and creating a mix they believe will be economical and long lasting. The mix design is then submitted to the DOT for acceptance. During construction, the contractor's personnel are responsible for process (quality) control testing (with random samples done several times daily). If something unusual is occurring to the mix, it can be monitored instantly, and changes can be made to ensure that poor quality mix does not get to the roadway. The morning test results are available to the quality control technician within hours of starting up the plant, giving the contractor information right away to affect the quality of mix being produced. Under this agreement, the contractor retains controls of their product and process. The contractor does random sampling on their materials and tests them multiple times each day. The agency receives split samples of the materials and tests them on a less frequent basis to verify the contractor's work. Verification is done by comparing the contractor's test results to the agency's test results (on the same sample) and assuring that it correlates. This quality assurance is an important check on the contractor's work. QMA looks at individual test results to determine if they are in specification, and sometimes looks at running average's (an average of the last 4 tests) to determine if the trend in the test data is good.

Under the old QMA system (1992-2010), contractors could incur penalties if their mix was not up to specification but could not earn incentive pay for laboratory test results that were very good.

Percent Within Limits (PWL):
Beginning with the October 2010 letting, the Iowa DOT implemented the new *Section 2303* of the *Standard Specifications*. This specification takes the next step beyond QMA and provides incentives to the contractor to produce HMA that is consistently within specification and on target.

To accomplish this, methods were developed to analyze the test data and determine the amount of material that complies with the specifications. The result of the analysis is called the "Percent Within Limits" or PWL. The previous QMA specification did not provide for incentive payments to the contractor for providing a superior quality product, only disincentives for poor quality. The PWL specification provides incentive payments for field voids up to a maximum of 6% and lab voids up to a maximum of 6%. The contractor can earn these bonuses by controlling the production and construction operations to provide a consistent mixture on target – and a mat compaction that is both consistent and thorough. The goal is to "make quality pay" for those contractors that provide the best product.

Both incentive and disincentive are based on equations that provide a more smooth and continuous payment schedule than the stepped price adjustment schedules used in the past. Field voids are analyzed daily, with eight core density values that are obtained each day. Lab voids require grouping of days or lots to obtain a minimum of eight test values before the PWL incentive/ disincentive pay factors will be calculated. It is important that a minimum of 8 test results are used, to ensure valid results from the statistical formulas involved in PWL. Less than 8 test results are not sufficient to perform a statistical analysis.

The HMA Plant Report Program and the Quality Control charting Program were modified from the existing QMA version to the new PWL version, to accumulate the needed test data and calculate the pay factors for the mix.

Average Absolute Deviation (AAD):
Average Absolute Deviation (AAD) is a statistical term meaning the average of the "deviation from target". It's a statistical average. When there are not 8 test results (as mentioned above) to conduct PWL analysis, an AAD analysis is done instead on mainline paving. This was part of the PWL program initiated in 2010. In 2012**,** the specification changed so that AAD is the method of analysis for all non-mainline paving, and mainline paving with less than 8 total test

results. AAD allows the contractor to be penalized for poor results but does not provide incentive for superior results.

In Summary:

The industry continues to involve. The test results have not changed much in the last 30 years, but the method of analyzing test data and reporting requirements have changed significantly over the past 10 years. Technicians involved in Hot Mix Asphalt projects need to be familiar with PWL, AAD, control charts, reporting, specification compliance, etc., and the effect that these items will make to the contractor's operations and to contract administration.

Factors Influencing Compaction

Item	Effect	Corrections*
Aggregate		
Smooth Surfaces	Low interparticle friction	Use light rollers; lower mix temperature
Rough Surfaced	High interparticle friction	Use heavy rollers
Unsound	Breaks under steel-wheeled rollers	Use sound aggregate; use pneumatic rollers
Absorptive	Dries mix – difficult to compact	Increase asphalt in mix
Asphalt		
Viscosity		
– High	Particle movement restricted	Use heavy rollers; increase temperature
– Low	Particles move easily during compaction	Use light rollers; decrease temperature
Quantity		
– High	Unstable & plastic under roller	Decrease asphalt in mix
– Low	Reduced lubrication – difficult compaction	Increase asphalt in mix; use heavy rollers
Mix		
Excess Coarse Aggregate	Harsh mix – difficult to compact	Reduce coarse aggregate; use heavy rollers
Oversanded	Too workable – difficult to compact	Reduce sand in mix; use light rollers
Too Much Filler	Stiffens mix – difficult to compact	Reduce filler in mix; use heavy rollers
Too Little Filler	Low cohesion – mix may come apart	Increase filler in mix
Mix Temperature		
High	Difficult to compact – mix lacks cohesion	Decrease mixing temperature
Low	Difficult to compact – mix too stiff	Increase mixing temperature
Course Thickness		
Thick Lifts	Hold heat – more time to compact	Roll normally
Thin Lifts	Lose heat – less time to compact	Roll before mix cools; increase mix temperature
Weather Conditions		
Low Air Temperature	Cools mix rapidly	Roll before mix cools
Low Surface Temperature	Cools mix rapidly	Increase mix temperature
Wind	Cools mix – crusts surface	Increase lift thickness

* Corrections may be made on a trial basis at the plant or job site. Additional remedies may be derived from changes in mix design.

Mat Problem Trouble-Shooting Guide

Problem \ Causes	Fluctuating Head of Material	Feeder Screws Overloaded	Finisher Speed Too Fast	Too Much Lead Crown in Screed	Too Little Lead Crown in Screed	Overcorrecting Thickness Control Screws	Excessive Play in Screed Mechanical Connection	Screed Riding on Lift Cylinders	Screed Plates Worn Out or Warped	Screed Plates Not Tight	Cold Screed	Moldboard on Strikeoff Too Low	Running Hopper Empty Between Loads	Feeder Gates Set Incorrectly	Kicker Screws Worn Out or Mounted Incorrectly	Incorrect Nulling of Screed	Screed Starting Blocks Too Short	Screed Extensions Installed Incorrectly	Vibrators Running Too Slow	Grade Control Mounted Incorrectly	Grade Control Hunting (Sensitivity Too High)	Grade Control Wand Bouncing on Reference	Grade Reference Inadequate	Sitting Long Period Between Loads	Improper Joint Overlap	Improper Mat Thickness for Maximum Aggregate Size	Trucks Bumping Finisher	Truck Holding Brakes	Improper Base Preparation	Improper Rolling Operation	Reversing or Turning Too Fast of Rollers	Parking Roller on Hot Mat	Improper Mix Design (Aggregate)	Improper Mix Design (Asphalt)	Mix Segregation	Moisture in Mix	Variation of Mix Temperature	Cold Mix Temperature
Wavy Surface – Short Waves (Ripples)	✓	✓	✓				✓	✓		✓										✓	✓	✓	✓						✗	✗			✗	✗	✗	✗	✗	
Wavy Surface – Long Waves	✓	✓				✓	✓	✓					✓	✓						✓			✓	✓			✗	✗	✗		✗	✗			✗		✗	
Tearing of Mat – Full Width			✓						✓		✓															✗							✗	✗	✗	✗	✗	✗
Tearing of Mat – Center Streak					✓				✓		✓			✓	✓																							✗
Tearing of Mat – Outside Streaks				✓					✓		✓	✓		✓				✓																				✗
Mat Texture – Nonuniform	✓	✓	✓					✓	✓	✓	✓		✓					✓	✓					✓		✗			✗				✗	✗	✗		✗	✗
Screed Marks							✓																				✗	✗										
Screed Not Responding to Correction			✓				✓	✓		✓										✓						✗							✗	✗	✗		✗	✗
Auger Shadows		✓																																				
Poor Precompaction			✓					✓											✓							✗			✗									✗
Poor Longitudinal Joint	✓	✓				✓		✓												✓	✓	✓			✓					✗								✗
Poor Transverse Joint		✓					✓	✓		✓						✓	✓													✗								✗
Transverse Cracking (Checking)																													✗	✗			✗	✗		✗	✗	
Mat Shoving Under Roller																													✗	✗	✗		✗	✗		✗	✗	
Roller Marks																													✗	✗	✗	✗					✗	
Poor Mix Compaction																													✗	✗	✗	✗	✗	✗		✗	✗	✗

Procedure for Using Table
1. Find problem above.
2. Checks indicate causes related to the paver.
   X's indicate other problems to be investigated.

NOTE: Many times a problem can be caused by more than one item, therefore, it is important that each cause listed be eliminated to assure solving the problem.

HMA Paving Field Inspection Checklist

Duty	Frequency	Specification / Resource	Commentary
Prior to HMA Placement			
Check material certifications	As needed	Materials IMs	Check for accuracy and timeliness of required certification submittals. Do not allow incorporation of materials without required certifications.
Check proof rolling of subgrade	Everywhere, prior to final subgrade trimming. (when applicable)	Specification 2109.03, A, 10 Specification 2115.03, B, 2 Modified Subbase	All subgrades should be proof rolled with a sheep's foot roller no more than 1 week prior to trimming of the final grade. In addition, when Modified Subbase is used, the subgrade is to be proof rolled with a loaded truck to identify soft spots, etc.
Check trimmed subgrade	10/mile (when applicable)	Specification 2109.03, A, 10 (plus or minus 0.05 foot) IM 204	Check to ensure subgrade is trimmed to the proper cross slope and elevation. Usual check is by placing string across subgrade from stringline to stringline and measuring down to top of subgrade. When stringline is not available, a survey rod and level may be used. Laser levels have been used but are less common. GPS rovers have also been used, but are not accurate enough to measure within the specification tolerances.
Check trimmed subbase (modified)	10/mile (when applicable)	Modified Subbase Specification 2115.03 (plus 0 and minus 0.05 foot) IM 204 Appendix C	Check to ensure subbase is trimmed to the proper cross slope and elevation. This, along with the subgrade checks, will ensure proper subbase thickness. Usually checked by placing string across subbase from stringline to stringline and measuring down to top of subbase. When stringline is not available, a level may be used. Laser levels have been used but are less common. The width of the subbase should also be checked at this time to ensure that the proper placement width is being achieved.
Check slab fracturing of existing PCC pavement	Periodically (when applicable)	Specification section 2216 Specification section 2217	Cracking and Seating: Use test section to ensure process used to fracture PCC slab results in specified crack spacing and consistency. Rolling must be adequate to ensure contact/support by underlying base without damage to aggregate interlock. Rubblization: Ensure equipment and process used to fracture pavement results in uniform and appropriate size fragments, based on visual inspection of surface. Verify multiple passes with a vibratory roller to compact and seat the fragments, as well as remove distortion prior to HMA overlay.
Check pavement scarification	Periodically	Specification section 2214	Verify equipment to be used is wide enough and suitable for the method of operation. Check that the scarification is to the specified depth, and results in a cross-section that is true within the specification tolerance. Ensure that all millings are removed and stored / stockpiled in compliance with contract documents.
Sampling & Testing RAP	First Day + One per week	Specification 2318.02 IM 204 App. K	Determine frequency / timing of random sampling; Take 10 lb. sample & test to determine maximum RAP size. Ensure top size does not exceed 50% of the depth of the compacted recycled mat.
Sampling CIR stabilizing agent (foamed asphalt)	One per day (First day + one per week to District lab)	Specification 2318.03, I, 2 IM 204 App. K Form 820193	Determine frequency / timing of random sampling. Take 1 qt. sample (or direct & witness sampling by contractor) & deliver to DME lab for verification testing (maintain agency custody) or, Identify (Form 820193) and secure samples for transportation by others.

HMA Paving Field Inspection Checklist

Duty	Frequency	Specification / Resource	Commentary
Sampling CIR stabilizing agent (standard emulsion)	One per day (First day + one per week to District lab)	Specification 2318.03, I, 2 IM 204 App. K IM 360 Form 820193	Determine frequency / timing of random sampling. Take 1 qt. sample in a plastic bottle (or direct & witness sampling by contractor) & deliver to DME lab for verification testing (maintain agency custody) or, Identify (Form 820193) and secure samples for transportation by others.
Sampling uncompacted CIR mixture	One per lot	Specification 2318.03, I, 6 IM 204 App. K IM 504 Form 820193	Determine frequency / timing & location of random sampling. Take 40 lb. sample in a sealed container (or direct & witness contractor sampling) & deliver to DME lab for verification testing (maintain agency custody) or, Identify (Form 820193) and secure samples for transportation by others.
Direct & witness moisture & density testing on compacted CIR layer	10 per lot	Specification 2318.03, I, 6 IM 204 App. K IM 504	Determine & layout moisture and density test random locations. Direct & witness contractor performing nuclear gauge moisture & density testing within 24 hours of completing each lot. Recompact sublots that do not achieve minimum required density.
Check preparation of existing surface	Periodically + prior to HMA overlay	Specification 2212.03, B, 1 Specification 2303.03, C, 2	Check repair/patching of existing base pavement is as required by specification, plans or as otherwise directed by Engineer. Prior to HMA resurfacing, ensure that the base pavement is free from all foreign materials & debris.
Check / Inspect contractor's equipment (general)	Daily, or as needed	Specification 1107.08 Specification Section 2001	Before use on project, ensure that equipment to be used is of the type & size (and has required features) necessary to meet the specifications and perform the work intended; While in use, be sure that the equipment is properly operated and maintained to insure the safety of workers, inspectors and traveling public.
Check / Inspect haul trucks	Initial use & as needed	Specifications 2001.01 & 2001.03	Haul trucks must have tight metal or metal-lined bodies. Haul trucks must be equipped with a tarp, but are not typically required to be used between May 15 & October 1. Truck bodies are to be kept clean by heating, scraping, or use of approved release agents. Check trucks for fluid leaks and remove from service if necessary.
Check for proper use of release agents	Daily, or as needed	Specification 2001.01, D IM 491.15	Approved release agents are listed in IM 491.15. Diesel fuel, distillates or solvents are not acceptable release agents. Trucks found to have used improper release agents shall be removed from service and allowed to drain for a minimum of 5 hours before subsequent use hauling HMA. Do not allow cleaning solutions to be carried on a paver while in operation.
Check / Observe loading of HMA haul trucks at plant	Periodically	Specification 2303.03, C, 3, d	Check for signs of overheated mix (blue smoke). Check for clumps of cold mix remaining from previous load. Check mixing time and mix appearance for proper coating of aggregate. Check for proper and uniform mix temperature. Check that multiple drops of mix from the silo are used to minimize segregation (roll-down) of mix in trucks.
Check existing pavement surface temperature	Daily, before start-up	Specification 2303.03, C, 4	HMA shall not be placed when temperature of the shaded portion of road is less than shown in specification. Minimum temperature is based on thickness and location of lift to be placed. The Engineer may further limit placement if other conditions exist that would be detrimental to quality work.

HMA Paving Field Inspection Checklist

Duty	Frequency	Specification / Resource	Commentary
Check stringline	Daily, or as needed	Specification 2303.03, C, 4, f	Check for proper placement of stringline to identify centerline, guide paver and maintain alignment. Stringline should be held in place by nails; Additional nails, at reduced spacing, should be used to produce a smooth transition (reduce the "chord" effect) through horizontal curves. Check and correct edge alignment irregularities immediately, to minimize mismatched joints and other resulting problems.
Check for approval and proper use of MTV	Prior to initial use on project, and then periodically while in use	Construction Manual section 8.80	Before material transfer vehicles (MTVs) may be used on a DOT project, approvals must be obtained from the Office of Design and Office of Bridges & Structures. Conditions on approval must be observed, and MTV use monitored by inspector. If cracking or distress in the underlying pavement occurs, the equipment must be removed from the project and appropriate repairs made at the contractor's expense.
Check / Inspect tack distributor	Once each distributor	Specification 2001.12	Check that distributor is equipped with an accurate thermometer, burner & means of circulating the material, as well as manufacturer's instructions for use. Check that distributor has either been calibrated, or has a valid annual certification of calibration. Check for fluid leaks.
Check / Inspect HMA paver	Once each paver, and when modifications made	Specification 2001.19 Specification 2303.03, B, 2	Check that paver is of type and size capable of placing and initially compacting an HMA mixture. Check that paver is equipped with well-matched screed sections, with vibration along its entire length (including extensions). Ensure that paver is equipped with automatic screed controls to regulate thickness and crown, along with grade and slope control system and approved grade referencing system.
Check / Inspect HMA rollers	Once each roller, and when modifications made	Specification 2001.05 Specification 2303.03, B, 3	Steel Drum: Ensure proper drum size, equipped with properly operating water system and scraper bars. Vibratory: Should be operating at high frequency / low amplitude (can verify frequency of vibration using a Reed tachometer, if desired), with both drums vibrating similarly. Pneumatic: Tire size and tire (contact) pressures as specified. Check all rollers for fluid leaks.
Check tack coat application for uniformity, coverage & curing	Daily	Specification 2303.03, C, 2, b	Check that tack coat application coverage is uniform. Make sure that all spray nozzles are functioning, and providing a fan-shaped spray with uniform overlap. The tack application is properly cured when it feels "tacky" vs. slick underfoot, and its appearance changes from a brownish cast to black.
Check tack coat application rate (yield)	Daily, or as needed	Specification 2303.03, C, 2, b	Compare daily quantity available from Plant Report or Plant Monitor with area covered with tack coat to verify the application rate is within specification range.
Check for wet or damp existing pavement surface	As conditions warrant	Specification 2303.03, C, 4	HMA paving should not start if wet conditions exist, or rainfall is imminent. If paving is underway and rainfall begins, paving must stop. Paving may resume provided pavement is dry, tack coat is undamaged, and delivered HMA is of sufficient temperature.

HMA Paving Field Inspection Checklist

Duty	Frequency	Specification / Resource	Commentary
During HMA Placement			
Collect individual HMA load tickets	Periodically	Specification 2001.07, B	Ensure that all HMA load tickets are accounted for, and periodically check actual mix quantities (vs. plans) to guard against unexpected project over-runs.
Check HMA placement operation (general)	Periodically	Specification 2303.03, C, 3, d Specification 2303.03, C, 4	HMA should be supplied to the paver in a uniform and continuous manner, resulting in a minimal number of paver stoppages. HMA placement operation shall produce a mat with uniform temperature and composition, minimizing segregation to the extent that it is not visibly observed in the compacted surface.
Check / Observe unloading of truck into paver hopper	Periodically	Specification 2303.03, C, 3, d	Check for signs of overheated mix (blue smoke). Check for clumps of cold mix remaining from previous loads. Ensure proper dumping procedures used to keep mix flowing as a mass, to minimize coarse aggregate roll-down (segregation).
Check / Observe proper placement of mix into windrow	Periodically	Specification 2303.03, C, 3, d	Check that windrow is centered in lane to be placed. Check for uniformity of windrow size & shape. Check for excessive mix drop heights, leading to coarse aggregate segregation at base of windrow. Check for clumps of cold mix near end of loads. Ensure that haul trucks are not allowed to drive over (compact) existing windrow.
Check for uniform material flow through paver	Periodically	Specification 2303.03, C, 3, d	Restrictions to uniform flow of mix will result in segregation. Non-uniform head of material at the screed will result in waves in the mat, as well as variations in density. Check for uniform head of material in the paver hopper (typically 25 to 75% full), through the flow gates, along length of augers, and ahead of the screed.
Check temperature of uncompacted mat behind paver	Every two hours, or as needed	Specification 2303.03, C, 3, d	Check that temperature of mat is above applicable specification minimum for the location and thickness of lift being placed. Consistent mat temperatures are needed to ensure uniform compaction and resulting density.
Check / Observe uncompacted mat quality behind paver	Periodically	Specification 2303.03, C, 3, d	Check for non-uniform appearance (streaking, coarse / open texture, screed marks). Check for evidence of leaking fluids from equipment and take immediate action to remove equipment from operation if discovered.
Check / Observe loose (uncompacted) lift depth checks	Periodically	Specification 2303.03, C, 4	Ensure that the HMA mixture is spread at a depth such that, when compacted, will result in the required thickness. More frequent checks should be made on the first lift over an uneven surface, and following an adjustment to the screed. After adjusting screed, allow time for the screed to level out (approx. 5X tow arm length) before making subsequent checks.
Check / Observe HMA compaction (roller) operation	Periodically	Specification 2303.03, C, 5	Check for proper equipment and procedures. Check for consistent mat temperature & rolling pattern (with special attention to Class II compaction areas); Check surface for roller marks, mix pick-up, waves in mat, and possible segregation.
Check mat width & cross-slope	Periodically, and when plan width or cross-slope changes	Project plans	Periodically check both the uncompacted and compacted mat width and adjust, as necessary, to account for "roll out". More frequent checks should be made when the plan width changes. Checks of mat cross-slope should be made periodically, with additional emphasis in transition areas of super-elevated curves.

HMA Paving Field Inspection Checklist

Duty	Frequency	Specification / Resource	Commentary
Check longitudinal joints	Periodically	Specification 2303.03, C, 6	Check for proper overlap (typically 1" within 1/2" tolerance) and procedures used for longitudinal joint construction. Pavement edges should be carefully aligned and loose lift thickness set to result in well-matched centerline joint. Check for adequate mix at end of screed to reduce potential for segregation and mismatched joint.
Check longitudinal pavement runouts	As needed	Specification 2303.03, C, 6 Project plans	Check for proper runout at structures, existing pavement, and at end of day headers. For a transverse construction joint open to traffic, the runout is 10 ft. in length per inch of lift thickness. For permanent runouts, the length is shown on the plans, based on posted speed and overlay thickness. Check that runout design fits existing conditions.
Check transverse joints	As needed	Specification 2303.03, C, 6	Ensure header is sawed in straight line at right angles to provide a full depth vertical edge to match at joint. Check transverse joint off header at start-up for smoothness, using a 10 ft. straight edge. Corrections may be required before continued paving.
Check mix quantities & yields	Every two hours recommended	Project plans	Comparison should be made between the tons of HMA delivered/placed and the plan quantity (tons) of HMA calculated for a given area of pavement. Typically, the quantity placed will be within 5% of the quantity calculated using the plan rate.
Direct & witness sampling of asphalt binder	Daily	Specification 2303.03, D, 3, b, 1 IM 204 App. F IM 323 Form 820193	Direct & witness random sampling procedures by contractor personnel. Take possession of sample & deliver to field lab for testing (maintain agency custody) or, Identify (Form 820193) and secure samples for transportation by others.
Direct & witness sampling of aggregates (cold-feed)	First day	Specification 2303.03, D, 3, b, 2 IM 204 App. F IM 301 Form 820193	Direct & witness random sampling procedures by contractor personnel. Take possession of sample & deliver to field lab for testing (maintain agency custody) or, Identify (Form 820193) and secure samples for transportation by others.
Direct & witness sampling of loose / uncompacted mix (hot box)	One per sublot (up to 5 per day)	Specification 2303.03, D, 5, b IM 204 App. F IM 322 Form 820193	Determine frequency / timing of random sampling & notify contractor. Direct & witness sampling procedures by contractor personnel. Take possession of sample & deliver to field lab for testing (maintain agency custody) or, Identify (Form 820193) and secure samples for transportation by others.
Direct & witness sampling of compacted mix (field density cores)	Daily (min. 8 cores per lot)	Specification 2303.03, D, 4, a IM 204 App. F IM 320 Construction Manual Section 8.13 Form 820193	Determine & layout density core random locations. Direct & witness core drilling. Measure & inspect cores for defects & proper dimensions. Take possession of cores & deliver to field lab for testing (maintain agency custody) or, Identify (Form 820193) and secure samples for transportation by others.
Perform testing on compacted field density cores	Daily (min. 8 cores per lot)	Specification 2303.03, D, 5, c IM 204 App. F IMs 321 and 337	Following contractor preparation (cutting / trimming) of the core samples for testing, the cores are measured and tested (weighed) by inspection personnel to determine field density. Results should be agreed to by inspection and contractor personnel to avoid disputes later.

HMA Paving Field Inspection Checklist

Duty	Frequency	Specification / Resource	Commentary
After HMA Placement			
Check for Safety Edge or temporary granular fillet at pavement edge	Each time (prior to removing traffic control)	Specification 2305.03, A Specification 2121.03, C, 4, b	Safety Edge or temporary granular fillet is required to mitigate dropoff at pavement edge prior to moving traffic control and opening an adjacent lane to traffic.
Check completed pavement section visually for uniformity	Daily, or as needed	Construction Manual Section 2.53 Form 830245 Construction Manual App. 2-34(K)	Daily visual examination of mat surface is recommended to detect mix segregation as soon as possible, allowing timely changes in equipment or procedures to be made in order to minimize future occurrences. If segregation is suspected, the inspector should inform his supervisor and the contractor. A Noncompliance Notice (Form 830245) and subsequent price adjustment may follow, if warranted.
Check milled rumble strip placement	Periodically	Road Standards PV-12 and PV-13 Specification Section 2548	Milled rumble strips may be placed on the shoulder or centerline of the roadway. They are placed in the compacted HMA after mat has sufficiently cooled to resist tearing. Rumble strip placement should be checked to ensure proper spacing, depth, and location requirements are being met.
Check fog seal application coverage, uniformity & rate	Periodically	Specification 2548.03, C Specification 2308.03, D	Ensure that asphalt emulsion is not placed on a wet or damp surface. The fog seal application must uniformly cover the entire milled rumble strip, at the rate specified.
Review initial contractor smoothness information	Daily, until 3 consecutive days of 100% pay or better	Specification 2317 Specification 2316 IM 341	The contractor is required to submit smoothness information daily until they have paved for three consecutive days resulting in 100% payment or better. There are several reasons for this requirement. First is to identify if there are equipment or process issues causing placement problems in the paving operation. It is not desirable to allow the contractor to continue paving if acceptable smoothness levels are not being achieved. This requirement also may identify problems in the contractor's smoothness evaluation. It also gives inspection staff the opportunity to review the contractor's profilograph settings to make sure they are correct.
Review final contractor smoothness information	After submittal of final profilograph reports and traces	Specification 2317 Specification 2316 IM 341	The contractor is required to submit all final profilograph reports and traces to the Engineer within 14 days after completion of paving. After receipt of all final reports and traces, the information should be reviewed to ensure that all sections of pavement have been evaluated. In addition, the smoothness information should be evaluated to determine if the incentive or disincentive requested by the contractor is accurate.

HMA Paving Field Inspection Checklist

Duty	Frequency	Specification / Resource	Commentary
General			
Check for contractor compliance with Public Convenience and Safety requirements	Daily	Specification 1107.08	Check for compliance with on-the-road and off-the-road times (30 minutes after sunrise & 30 minutes before sunset, unless state otherwise in contract documents). Check that contractor operates equipment and performs their operations in a manner that provides safety for workers and traveling public.
Check traffic control	When approaching or travelling within work zone	Specification Section 2528 Project plans	Even though traffic control checks are a responsibility of the contractor, if problems or deficiencies are observed, inform the contractor when the observations are made so that corrections can be made in a timely manner. Specific areas to observe include traffic control, work zone length, flaggers, signing and pilot car operation.
Check contractor's traffic control daily diary	As needed	Specification 2528.1, C	The contractor is required to check traffic control and record significant information. It is a good practice to review the contractor's diary occasionally to ensure that documentation is being recorded as required. For instance, after noting damaged signing or deficiencies in the traffic control devices or setup, review the daily diary to ensure the deficiencies and the remedies are recorded.
Monitor the project for fugitive dust	Daily	Specification 1107.07, E	The contractor is responsible for controlling fugitive dust on the project. When dust is being generated and leaving the project site, the contractor should be reminded of their responsibility to control dust and a request should be made to take measures to do so. In urban areas, it is even more critical that dust be controlled as property owners will be more sensitive to dust generated by the project.
Monitor contractor haul roads	Daily	Construction Manual 2.12	The contractor is required to submit a request for haul road designation for roads used to haul materials for the project. Once designated as a haul route, the contractor is expected to use the haul route for the designated purpose. The contractor's operations should be observed daily to ensure that haul traffic is using the appropriate, approved haul routes.
Check for compliance with winter shutdown requirements	When applicable	Specification 2121.03, C Specification 2214.03, D Specification 2303.03, C, 6 Specification 2318.03, J Specification 2527.03	Ensure that following requirements are met prior to end of season on projects with winter shutdown period: Granular shoulder brought up to edge of pavement at design slope and width; All scarified surfaces covered with at least one full HMA lift; Headers shall be located across from each other; Temporary runouts shall be located adjacent to each other and be 25 feet in length per inch of lift thickness; Cold in-place recycled surfaces shall be covered with at least one full lift of HMA; All pavement markings completed (including edge lines and symbols).
Issue Noncompliance Notice	As required	Construction Manual Section 3.21 Form 830245	The owner is obligated to notify the contractor in writing when noncompliance occurs. This is done using Form 830245. Noncompliance Notices should be issued as quickly as practical after observation of the noncompliance to give the contractor ample time to take corrective action. The Noncompliance Notice also provides a written record of notification being provided to the contractor.

DS-23032
(New)

DEVELOPMENTAL SPECIFICATIONS
FOR
ELECTRONIC TICKETING

Effective Date
October 17, 2023

THE STANDARD SPECIFICATIONS, SERIES 2023, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE DEVELOPMENTAL SPECIFICATIONS AND THEY SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

23032.01 DESCRIPTION.

A. This work shall consist of providing electronic material tickets for all loads of flexible paving mixture or ready mixed PCC delivered to the project. Electronic ticketing will only be required for the primary material supplied to the project, i.e. flexible paving mixture for an HMA resurfacing project or PCC for a PCC paving project. Electronic tickets for other materials supplied to a project may be submitted at the Contractor's option. The Contractor/supplier can use the plant ticketing system of their choice to create the material ticket data.

B. Ticket data shall include the following:

1. After each truck is loaded, ticket data must be electronically captured, and ticket information uploaded via web service / Application Programming Interface (API) to the agency.

2. Material ticket data will be submitted to https://iowa.dot-portal.io via an HTTPS POST as JSON documents. Include the API key specific to each customer in each request as an HTTP header.

3. Material supplier must test to confirm that ticketing data can be shared from the originating system no less than 30 days prior to project start. Topic shall be discussed at the preconstruction meeting.

4. Ticket data must be available immediately upon project start so there are no delays to viewing tickets.

5. Provide the same data that is currently accessible and viewed by agency users previously on printed tickets specific to state projects.

6. Transmit ticket data before the truck leaves the plant and transmit any updates to the ticket data within 5 minutes of a change.

23032.02 CONSTRUCTION DATA.

Contractor shall submit material ticket data in accordance with the plant manufacturer's system recommendations to provide the following.

A. Net weight (or volume for ready mix concrete) of material being transported (to nearest 0.01 ton or cubic yard).

B. Running daily total of net weight of material (or volume for ready mix concrete) being transported (to the nearest 0.01 ton or cubic yard).

C. Each material ticket shall contain the following:

1. General Ticket information (All Material).

- **a.** Date.
- **b.** Iowa DOT Project Number.
- **c.** Name of Contractor
- **d.** Name of material supplier.
- **e.** Unique truck ID.
- **f.** Plant/scale name (source).
- **g.** Truck Status Times:
  - **1)** Loaded time (time batched) shall be available.
  - **2)** Provided other truck status times as available.
    - **a)** Ticketed.
    - **b)** Load time.
    - **c)** Left plant.
    - **d)** Arrive at project.
    - **e)** Begin unload.
    - **f)** Finish unload.
    - **g)** Leave project.

2. Portland Cement Concrete.

- **a.** Loaded time (water/cement time).
- **b.** Wet and dry batch weights (if computer generated).
- **c.** Water:
  - **1)** In aggregate.
  - **2)** Total water.
  - **3)** Water/cement ratio.
  - **4)** Max water/cement ratio. **5)** Allowable water to add.
- **d.** Admixtures (including brand names if available):
  - **1)** Retarder and weights.
  - **2)** Water reducer and weights.
  - **3)** Air entrainment and weights.
  - **4)** Special performance admixtures and weights. **5)** Concrete fibers.
- **e.** Cementitious material(s) and weights.
- **f.** CPI Name and certificate number.

3. Flexible Pavement Mixture.

- **a.** Type of material.
- **b.** Gross weight (if not automatic weighed).
- **c.** Tare weight (if not automatic weighed).
- **d.** Net weight.
- **e.** Mix design number.

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23032.03 METHOD OF MEASUREMENT.

None.

23032.04 BASIS OF PAYMENT.

Payment for electronic ticketing will be incidental to the material being provided.