CONSTRUCTION INSPECTOR TRAINING

PROJECT DEVELOPMENT
HIGHWAY PROGRAM

2019

OUTLINE

- Introductions
- Inspector Expectations
- Reference Materials
- Documentation Basics
- Standard Specification
  - 100, 200, 400, 600 Divisions
- Erosion Control
- Field Inspection Stations and Tools
- Questions and Answers

INTRODUCTIONS

- MaineDOT
- Consulting Firms
  - Acorn Engineering
  - Dubois & King
  - Gorrill-Palmer Consulting Engineers
  - Greenman-Pederson
  - HNTB Corporation
  - Hoyle, Tanner & Associates
  - John Turner Consulting

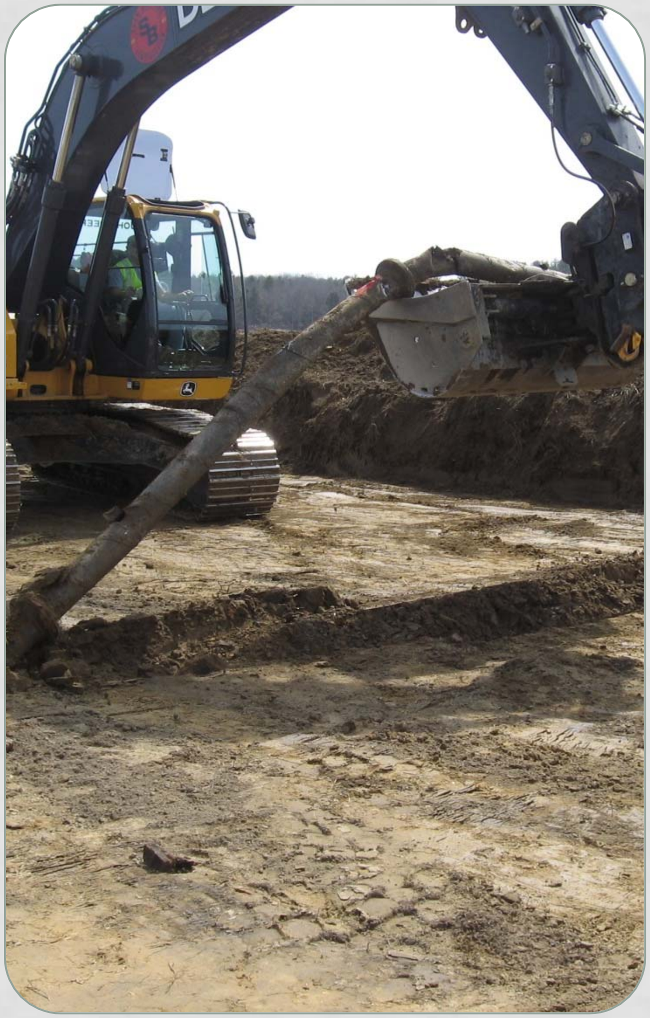
INTRODUCTIONS

- Kleinfelder
- Milone & MacBroom
- R.W. Gillespie & Associates
- SW Cole
- TY Lin International
- VHB
- W.P. Brogan & Associates
- WSP

AUTHORITY AND DUTIES OF THE CONSTRUCTION STAFF

Chain of Command

- Assistant Program Manager
- Con Support Manager
- Con Project Manager
- Resident Engineer
- Chief Inspector
- Inspector



AUTHORITY AND DUTIES OF THE CONSTRUCTION STAFF

- Assistant Program Manager
  - Scott Bickford
- Construction Support Managers
  - Shawn Smith, Denis Lovely, Brian Luce
- Construction Project Managers
  - Region 1 – Ryan Hodgman, John McDonough
  - Region 2 – Tom Stevens
  - Region 3 – Mark Shibles
  - Region 4 – Jeramy Parker
  - Region 6 – Ryan Sullivan
  - Statewide – Steve Groves

AUTHORITY AND DUTIES OF THE CONSTRUCTION STAFF

Project Manager

- Has overall supervision of Construction Projects and Staff
- Construction support for the Resident
- Elevates issues to Construction Support Manager when appropriate
- Attend Weekly Progress Meetings when issues are anticipated

AUTHORITY AND DUTIES OF THE CONSTRUCTION STAFF

Resident

- Manages project staff
- Ensures all specifications are met
- Communicates with municipalities, the public, utilities, etc.
- Makes field changes when necessary
- Co-chairs Weekly Progress Meetings and distributes minutes

AUTHORITY AND DUTIES OF THE CONSTRUCTION STAFF

Resident

- Manages the Department's Acceptance program
- Responsible for project documentation and submittal of Final Records
- Responsible for maintaining the project budget
- Submits Progress Estimates for payments to the contractor
- May have multiple contracts

AUTHORITY AND DUTIES OF THE CONSTRUCTION STAFF

Chief Inspector

- Assistant to the Resident
- Supervises on-site staffing
- Has daily contact with Resident
- Helps interpret plans and specifications
- Checks Contractor layout

AUTHORITY AND DUTIES OF THE CONSTRUCTION STAFF

Chief Inspector

- Maintains communication with contractor for daily scheduling
- Assists, coaches and guides inspectors with inspection and documentation

AUTHORITY AND DUTIES OF THE CONSTRUCTION STAFF

Inspectors

- Inspect all work done by the Contractor
- Inspect Contractor's layout and materials
- Help interpret plans and specifications
- Document, in detail, all work performed and materials being used in an Inspector's Diary

AUTHORITY AND DUTIES OF THE CONSTRUCTION STAFF

Inspectors

- Keep Chief Inspector informed of all issues and progress
- Safety is the first concern

AUTHORITY AND DUTIES OF THE CONSTRUCTION STAFF

Keeping up with Field Measurements and Documentation are of upmost importance to ensure timely payments to the contractor and to avoid non-participation by Federal Highway!

AUTHORITY AND DUTIES OF THE CONSTRUCTION STAFF

Project Diary

- Resident or Chief Inspector
- Should not contain computations
- Shall be kept up **DAILY**
- Is part of final documentation
- Original entries, later determined to be in error, must not be erased

AUTHORITY AND DUTIES OF THE CONSTRUCTION STAFF

Project Diary Information

The following information must be included, as long as it is pertinent to the project:

1. Day, Month, Year
2. Weather conditions, working day or calendar day number
3. Progress of work, equipment and personnel and hours worked
4. Site conditions

AUTHORITY AND DUTIES OF THE CONSTRUCTION STAFF

Project Diary Information

5. Important matters pertaining to the contract
6. Agreements or disagreements with Contractor
7. Public and Municipal conversations including phone calls and e-mails
8. General locations of work for the day

AUTHORITY AND DUTIES OF THE CONSTRUCTION STAFF

Project Diary Information

9. Utilities progress
10. Maintenance of traffic control
11. Erosion control.
12. Project Visitors
13. Staffing personnel
14. Any concerns that may have later disputes

Monday June 26, 2015 Sunny, 55 - 80

Win: 2021.00

Prime: Best Contractor INC. 8:15-13:25

Crew:

Superintendent: John Smith

Laborers: 3

Equipment:

APE: 1 Cat 318 Earth Roll 1 3-5 Ton

Truck: 1 Wheeler Lic: Me BCI 12 Dozer: 1 D3 Cat

Item 204.20 Shoulder Rehab

Prime Contractor

Station 10+00 to 13+25 Rt. This work is 10% complete

Inspector Cluff assigned to this operation.

Resident on site. Inspected existing material below Shoulder cut and approved material.

Note 1:

Resident (Mrs. Sam Jones) at 35 Elm St. claims the Prime contractor was blocking her Driveway with the big red truck. Chief Inspector notified Super. John Smith. Mr. Smith spoke With Mrs. Jones and settled the issue.

Item 652.38

Sub: Roadway Safety

Traffic Personnel: 2 / 8:30-13:00 1/2 Hr Lunch

Break Personnel: 1 / 10:30-11:00 No Lunch

Reference Flagging Report 2

CD 13 pg: 18

Item 652.34 Cones

Reference Inspectors Diary Book 3 pg 23

Item 652.35 Const. Signs (work zone)

Reference Inspectors Diary Book 3 pg 23

Item 652.36 maint. Of Traffic

All contractors followed the MUTCD Man. And the TCP for this project.

Item 656

Contractor followed the SEWCP submitted for this project.

NMP on site with One Truck and Two Line workers transferring lines Station 52+10-68+00 Rt.

Contractor had to stop their operation till NMP had set up Proper work zone signing. CMP only had work area ahead signs. They had a ln closer and flaggers operation.

Win: 2025.00 No work

Visitors: John Sam FWHA

Maine DOT: P.M. Jackson, Resident Martin

Consultants: P. Diddy PDH Inc. B. Cluff PDH Inc.

Chief Inspector: Sarah Kinney 6/26/15

AUTHORITY AND DUTIES OF THE CONSTRUCTION STAFF

Public's Perspective

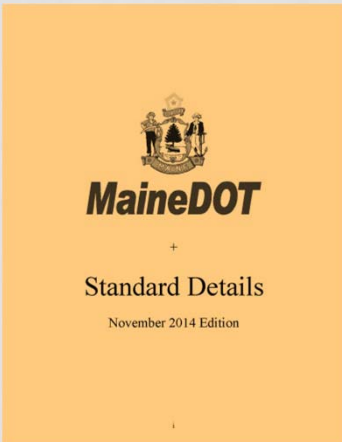
- You represent MaineDOT
- There are eyes and ears everywhere
- The public pays your salary (and many will remind you of that!)
- Take pride in your work and the public will notice

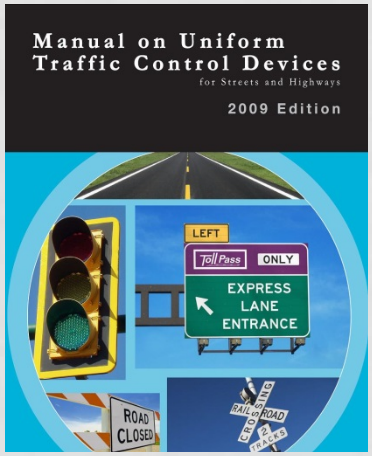
AUTHORITY AND DUTIES OF THE CONSTRUCTION STAFF

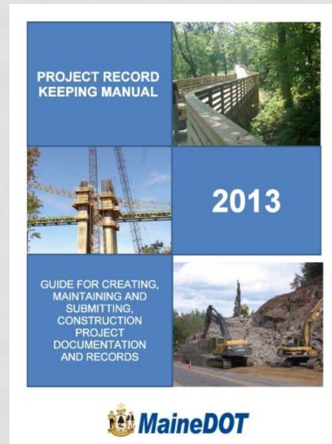
Team Work

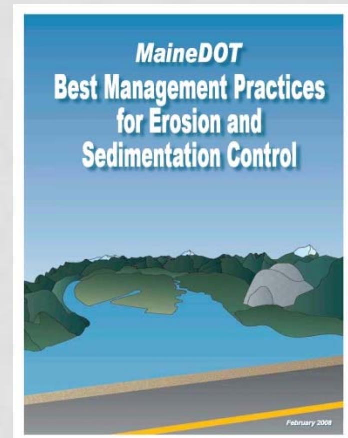
- Everyone has different skill sets
- Everyone needs to work together
- Questions are encouraged
- Communicate
- Stopping an issue from the start saves money
- Maintain professional attitude with the Contractor

REFERENCE MATERIALS



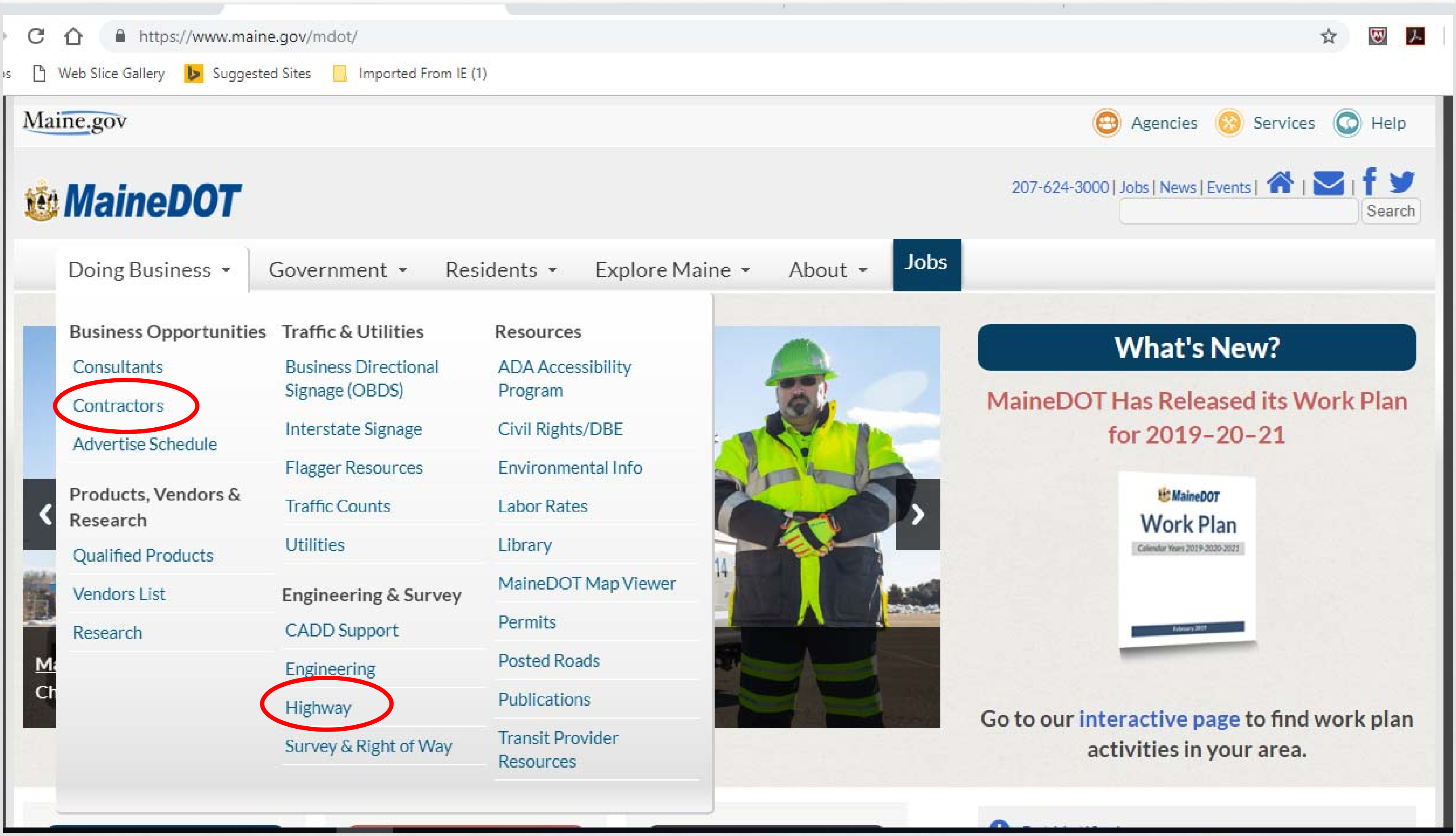






- MaineDOT Standard Specifications (2014)
- MaineDOT Standard Details (2014)
- MaineDOT Project Record Keeping Manual (2013)
- MUTCD (2009)
- MaineDOT BMP (2009)

REFERENCE MATERIALS



AUTHORITY AND DUTIES OF THE CONSTRUCTION STAFF

Personal Protection Equipment (PPE)

- Hard hat
- Class II vest (day work)
- Class III vest (night work)
- Steel toed shoes
- Proper clothing for duties being performe
- Safety glasses
- Hearing protection

END OF SECTION

Documentation Basics

How To Do It

Documentation Basics

- The Assignment
- What Do I Read?
- What Do I Record and How?
- What Equipment Do I Need?
- Example

Documentation Basics

- The Assignment
- What Do I Read?
- What Do I Record and How?
- What Equipment Do I Need?
- Example

The Assignment

- Your Resident or Chief Inspector assigns you to inspect an item of work.
- This work will have a pay item and a description.
- Examples could be:
  - Item 201.11 Clearing
  - Item 605.09 6 inch Underdrain Type B
  - Item 629.05 Hand Labor, Straight Time
- The work will also have a location. This is good to know.

Documentation Basics

- The Assignment
- What Do I Read?
- What Do I Record and How?
- What Equipment Do I Need?
- Example

What Do I Read?

- Look at the Plans (If the project has them)
- Look for the Special Provision (If there is one, it is in the Contract Book)
- Look for the Supplemental Specification (Repair Spec, End of the Contract Book)
- Look at the Standard Specifications (Look for the chapter with the same whole number as item number)
- Look at Construction Notes (On plans for plan job, In Contract Book for book job)
- Look at General Notes (In Contract Book)
- Look at Standard Detail (Printable online)
- Look at “Project Record Keeping Manual” (Not a contract document but important)

Documentation Basics

- The Assignment
- What Do I Read?
- What Do I Record and How?
- What Equipment Do I Need?
- Example

What Do I Record And How?

- Check to find ruling Specification. (Standard, Supplemental, or Special)
- Check Plans, General Notes, and Construction Notes for information.
- Use "Project Record Keeping Manual" for direction on how to record what the Specification requires.
- Have a discussion with the Resident concerning method of recording information.
    - Books (Inspector's Diary, Construction Book, Drainage Book)(Use "Project Record Keeping Manual" for format)
    - Electronic (Excel Spreadsheets, Mobile inspector, IDR, other?)

What Do I Record and How?

- Inspector’s Diary
  - It is departmental policy that each inspector keep an individual job diary.
  - This diary is the inspector’s report of their work and operations inspected by them. Also includes conversations had between the inspector and others)
    - Book format is in the “Project Record Keeping Manual”.
    - The electronic format is the IDR on Field Manager (**I**nspector’s **D**aily **R**eport)
  - Your Resident might want notes of inspection done in the diary or referenced to another book such as the drainage book.

What Do I Record and How?

- Inspector’s Diary (Continued)
  - Pencil, not Pen.
  - Errors are lined through, not erased.
  - Part of Final Documentation. Shall be turned in.
  - Shall be filled out daily.
  - Shall be original Documentation. Not a beautiful copy of secret notebook.

Documentation Basics

- The Assignment
- What Do I Read?
- What Do I Record and How?
- What Equipment Do I Need?
- Example

What Equipment Do I Need?

- Working Tools
  - Pop Level
  - Calculator
  - English Folding Rule and Measuring Tape (with or without weight)
  - PPE (Yellow Light, Vest, Rain Gear, Ear Plugs, Safety Glasses, Steel Toes, Reflective Pants or Gators, other…)
- Depending on Inspection
  - Level, Tripod, and Rod
  - Thermometer, gloves, and clipboard
  - String and blocks
  - Plumb Bob
  - Other?

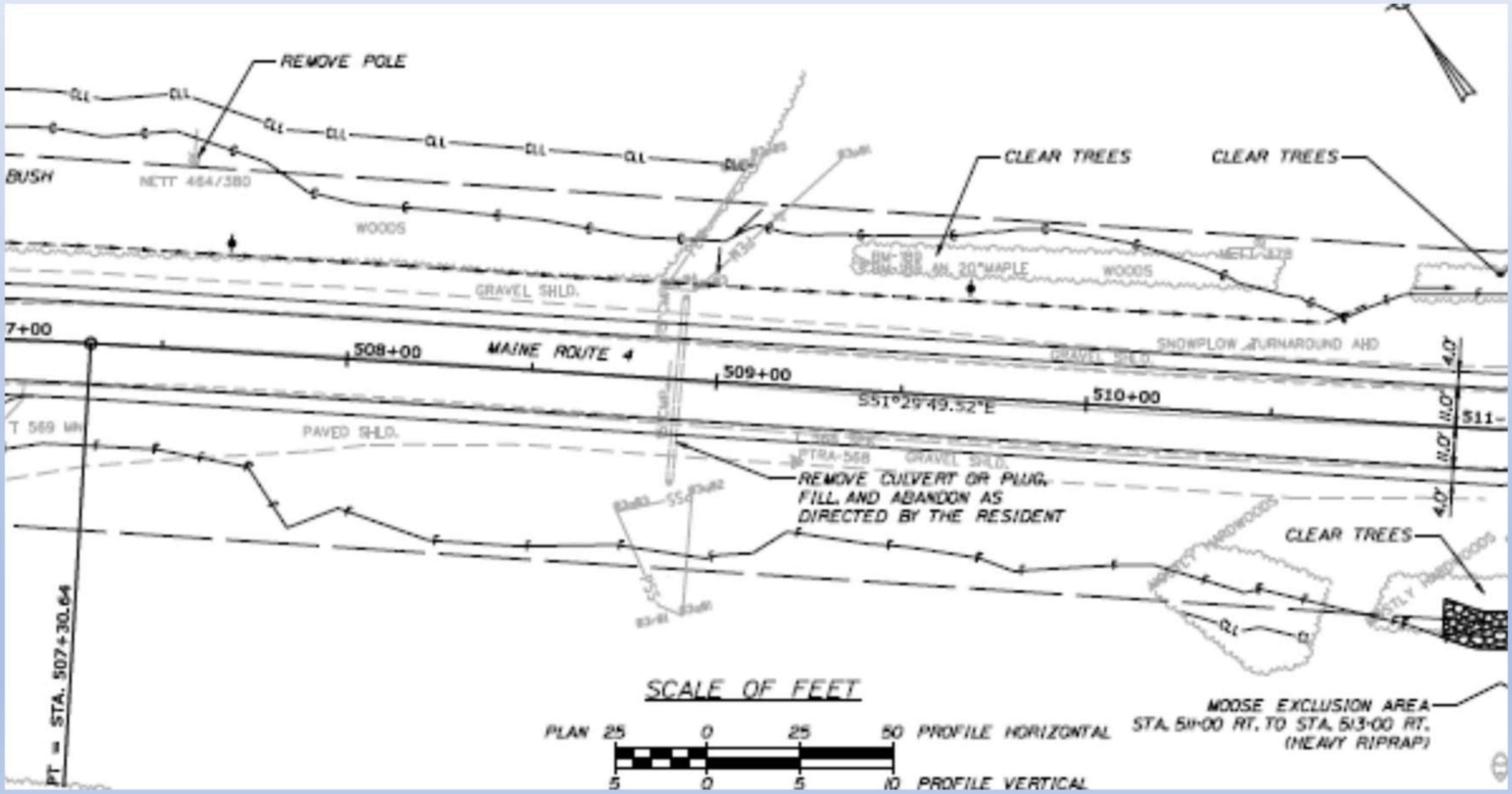
Documentation Basics

- The Assignment
- What Do I Read?
- What Do I Record and How?
- What Equipment Do I Need?
- Example

Example

Item 201.11 Clearing

The Plans (If The Project Has Them)



Special Provisions (Contract Book)

- This is usually in the middle of the contract book.
- It usually starts with Special Provision 104.
- This area includes project specific provisions
- If you have an item that is not in the Standard specification Book; this is where it is covered.

Supplemental Specifications (Repair Spec)(Contract Book)

- This set of specifications is near the end of the contract book.
- This set of provisions repair mistakes that were made in the standard specification.
- Look for the section number of the item you are inspecting and make changes.

Standard Specification

DIVISION 200 – EARTHWORK

SECTION 201 – CLEARING RIGHT-OF-WAY

Read the whole chapter. Pay close attention to paragraphs:

201.09 Method of Measurement

This tells you how the item shall be measured.

201.10 Basis of Payment

This tells you what to pay for and what is incidental.

Construction Notes
(Plans For Plan Job, Contract Book For Book Jobs)

CLEARING - **ITEM #201.11**

STATION	TO	STATION		STATION	TO	STATION	
501+62	TO	504+05	LT	500+92	TO	503+77	RT
504+15	TO	504+46	LT	503+65	TO	503+94	RT
505+79	TO	505+85	LT	504+09	TO	504+94	RT
506+09	TO	509+06	LT	510+21	TO	516+24	RT
509+36	TO	510+50	LT	517+74	TO	520+67	RT
510+86	TO	512+13	LT	524+43	TO	525+34	RT
514+88	TO	514+92	LT	531+98	TO	533+43	RT
518+86	TO	519+51	LT	533+68	TO	536+60	RT
528+85	TO	536+05	LT	537+02	TO	537+33	RT
537+18	TO	540+68	LT	538+15	TO	538+71	RT
541+43	TO	543+40	LT	538+67	TO	539+82	RT
543+79	TO	566+68	LT	539+82	TO	556+65	RT
567+66	TO	569+43	LT	557+54	TO	558+34	RT
569+58	TO	570+64	LT	559+87	TO	560+18	RT

General Notes
(In Contract Book)

GENERAL NOTES:

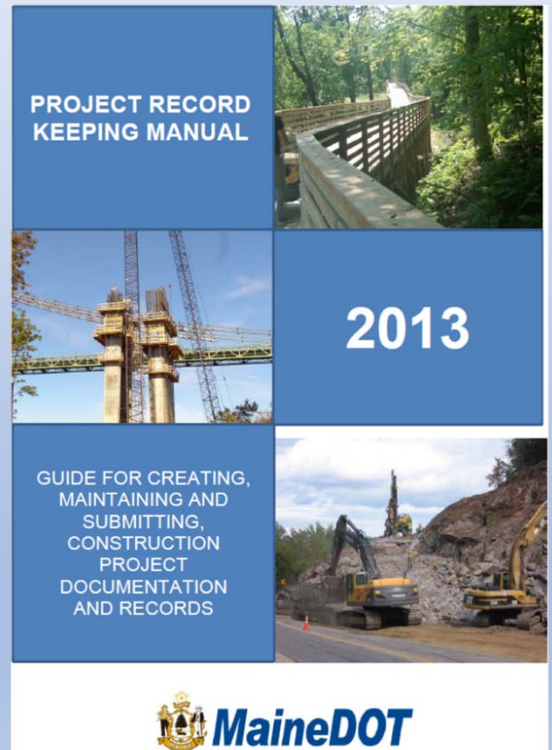
1. CLEARING LIMITS SHALL TYPICALLY BE 10' BEYOND AND PARALLEL TO THE CONSTRUCTION SLOPE LINES OR AS SHOWN ON THE PLANS UNLESS OTHERWISE AUTHORIZED BY THE RESIDENT.

2. STUMPS HAVE BEEN ESTIMATED TO BE REMOVED UNDER ITEM 201.24 REMOVE STUMP. HOWEVER, WHERE DIRECTED BY THE RESIDENT, ITEM 631.20 STUMP CHIPPER (INCLUDING OPERATOR) MAY BE USED TO REMOVE STUMPS.

Standard Detail
(Printable Online)

- Find this on the MaineDOT Internet site. Look up HIGHWAY tab under "Doing Business).
- Look up the chapter for the item you are inspecting. If there is a detail make sure to print a copy for yourself and one for the foreman who is doing the work.

“Project Record Keeping Manual”



"Project Record Keeping Manual"

Section 200 Earthwork

201.5 Clearing, Tree and Stump Removal 14
202.5 Removal of Structures, Obstructions, and Pavement 15
203.5 Excavation 16
203.6 Borrow 20
206.5 Structural Excavation 23

- Essential information on how to document an item so that contracting will accept it. (Federal Highway)
- Based on the Brown Spec and updated to the Green Spec. Make sure the information does not conflict with the yellow Spec.
- Written before Electronic Documentation. Tread carefully…

STANDARD SPECIFICATIONS

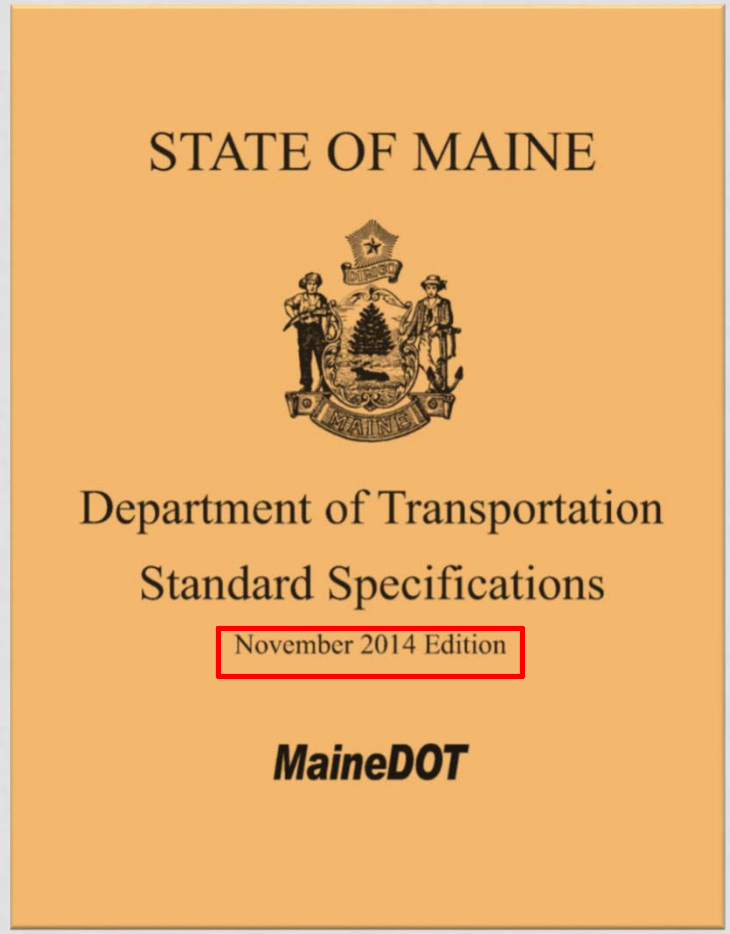
Division 100 – General Conditions

Division 200 – Earthwork

Division 300 – Bases

Division 400 – Pavements

Division 600 – Misc. Construction



DIVISION 100 – GENERAL CONDITIONS

DIVISION 100 - GENERAL CONDITIONS 1-1

SECTION 101 - CONTRACT INTERPRETATION 1-1

SECTION 102 - BIDDING 1-22

SECTION 103 - AWARD AND CONTRACTING 1-27

SECTION 104 - GENERAL RIGHTS AND RESPONSIBILITIES 1-32

SECTION 105 - GENERAL SCOPE OF WORK 1-47

SECTION 106 - QUALITY 1-72

SECTION 107 - TIME 1-89

SECTION 108 - PAYMENT 1-95

SECTION 109 - CHANGES 1-106

SECTION 110 - INDEMNIFICATION, BONDING AND INSURANCE 1-118

SECTION 111 - RESOLUTION OF DISPUTES 1-122

SECTION 112 - DEFAULT AND TERMINATION 1-128

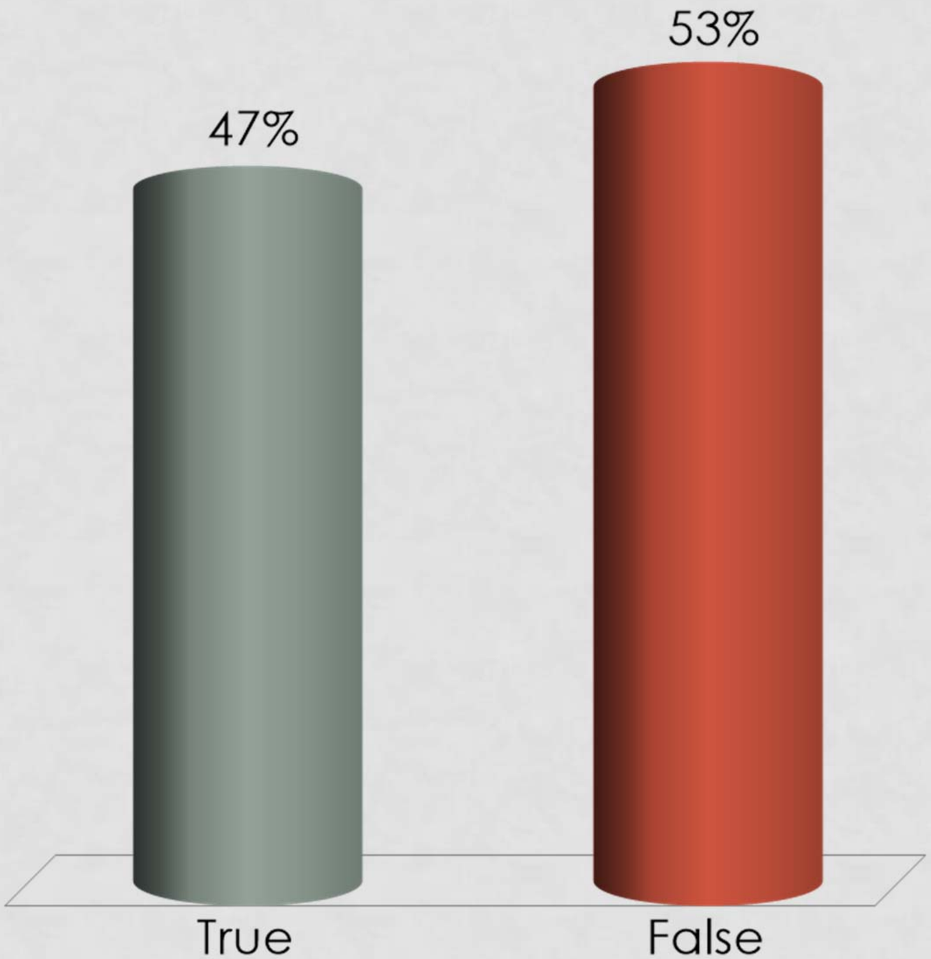
APPENDIX A TO DIVISION 100 .... A-1

DIVISION 100 – GENERAL CONDITIONS

A. True B. False

104.2.3 Authority of Project Manager and Resident –

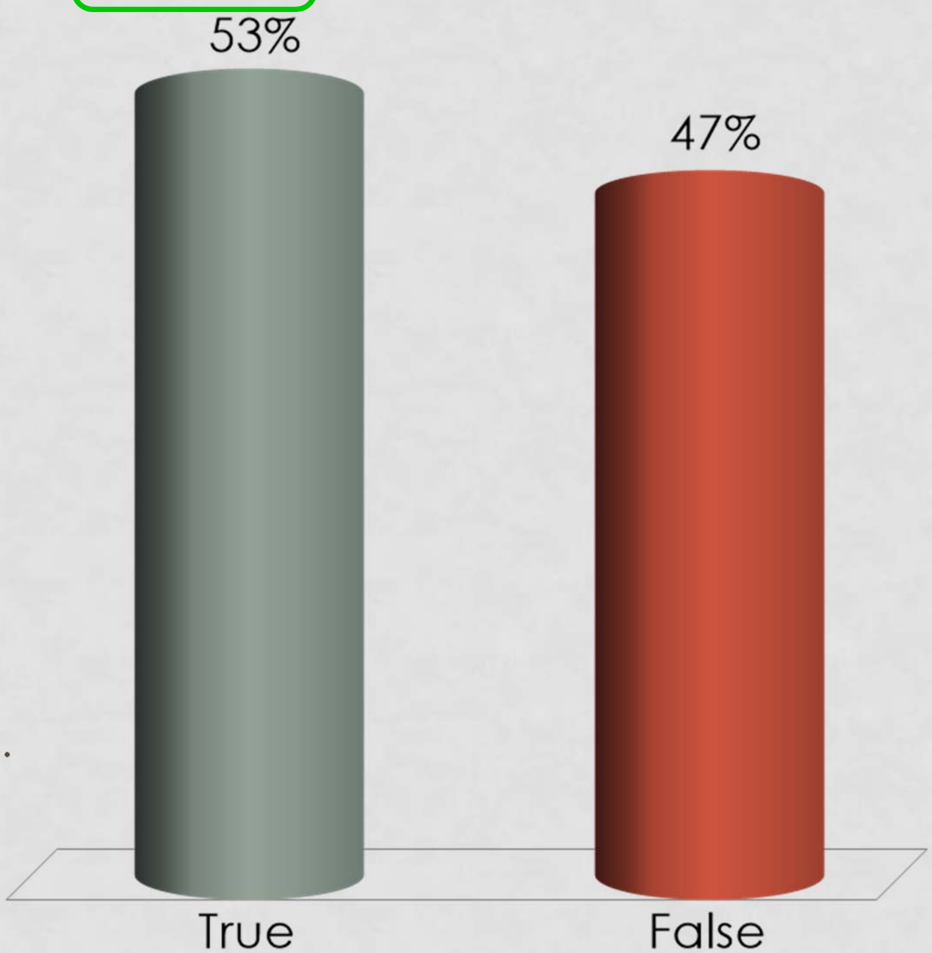
After Contract execution, the Project Manager and/or Resident has the authority to take all actions needed to assure that the Contractor is performing the Work in Conformity with the Contract. Except as provided elsewhere in the Contract, the Project Manager or the Resident will decide all questions regarding the quality and acceptability of Materials furnished, Work performed, suspensions of Work and the interpretation of the contract.



DIVISION 100 – GENERAL CONDITIONS

A. True B. False

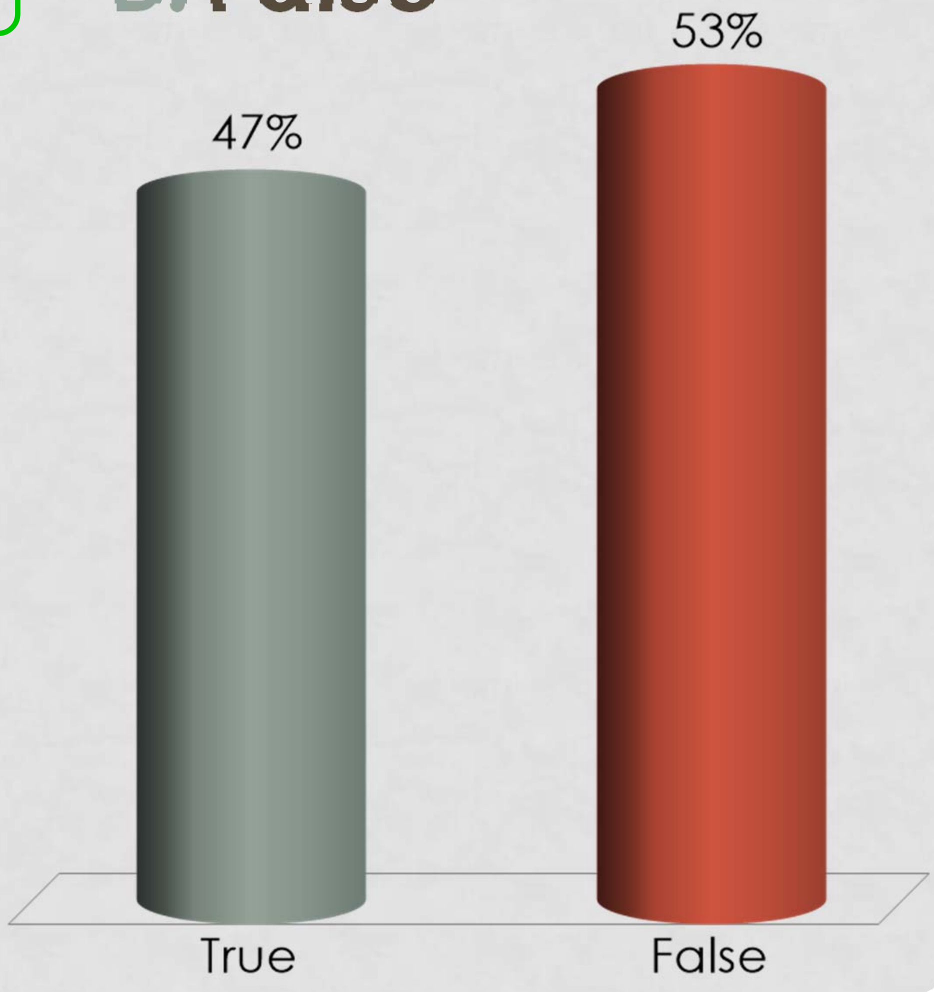
104.2.4 Authority of Residents and Inspectors –
Residents, inspectors and other Departmental employees or representatives working for the Department do not have the authority to make initial determinations regarding the Conformity of the work. Unless authorized by the Project Manager, Residents or Inspectors are not authorized to alter or waive the provisions of the Contract or to issue instructions contrary to the Contract. They may not act as a supervisor for the Contractor.



DIVISION 100 – GENERAL CONDITIONS

A. True   B. False

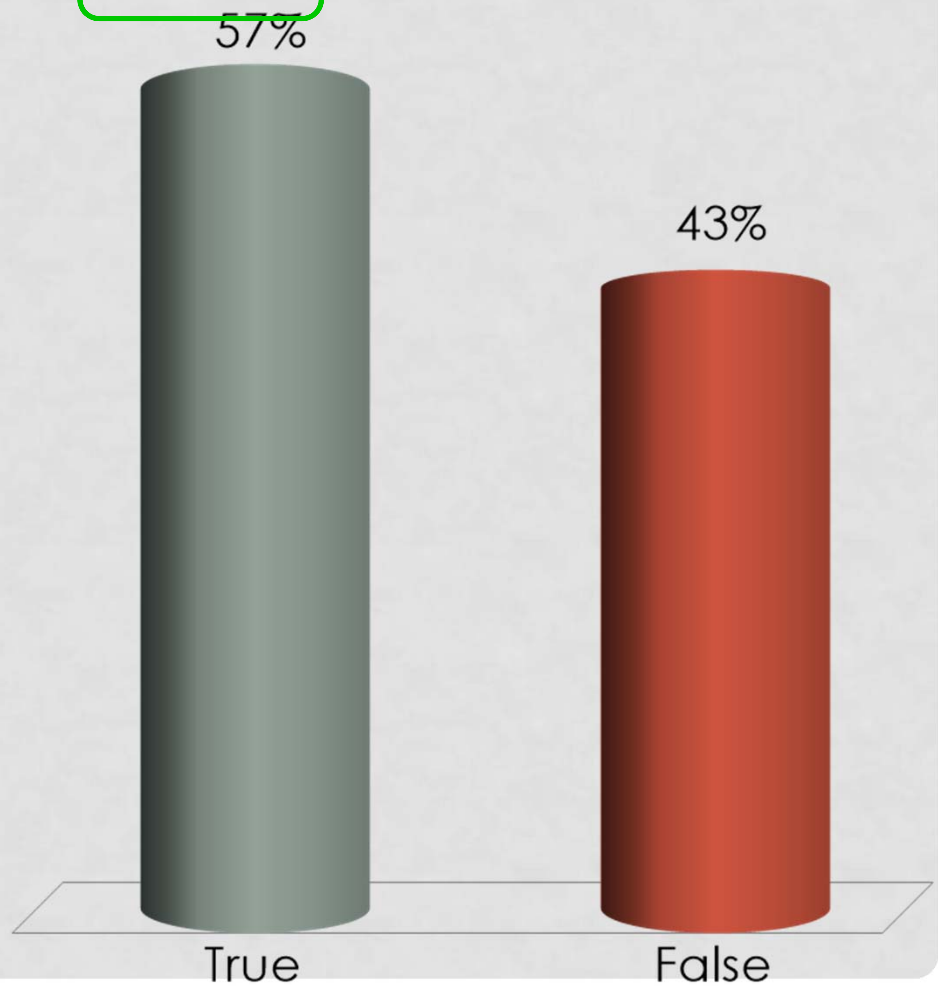
104.2.5 Right to Inspect Work
The Department has the authority to inspect all Materials and every detail of the work.



DIVISION 100 – GENERAL CONDITIONS

A. True B. False

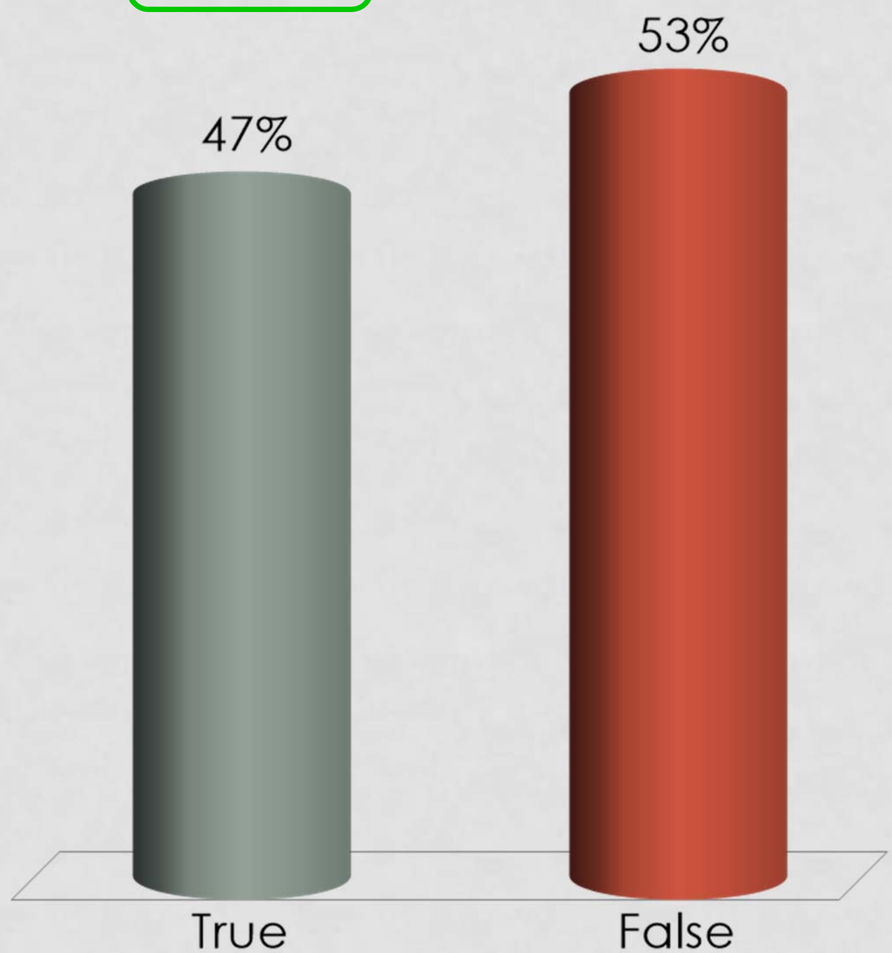
104.3.1 General Duty to Cooperate – The contractor shall cooperate with Department personnel. Utility companies, railroad personnel, marine traffic personnel, regulating agencies with jurisdiction, and other Contractors, Municipalities, and the public are the responsibility of the Department.



DIVISION 100 – GENERAL CONDITIONS

A. True B. False

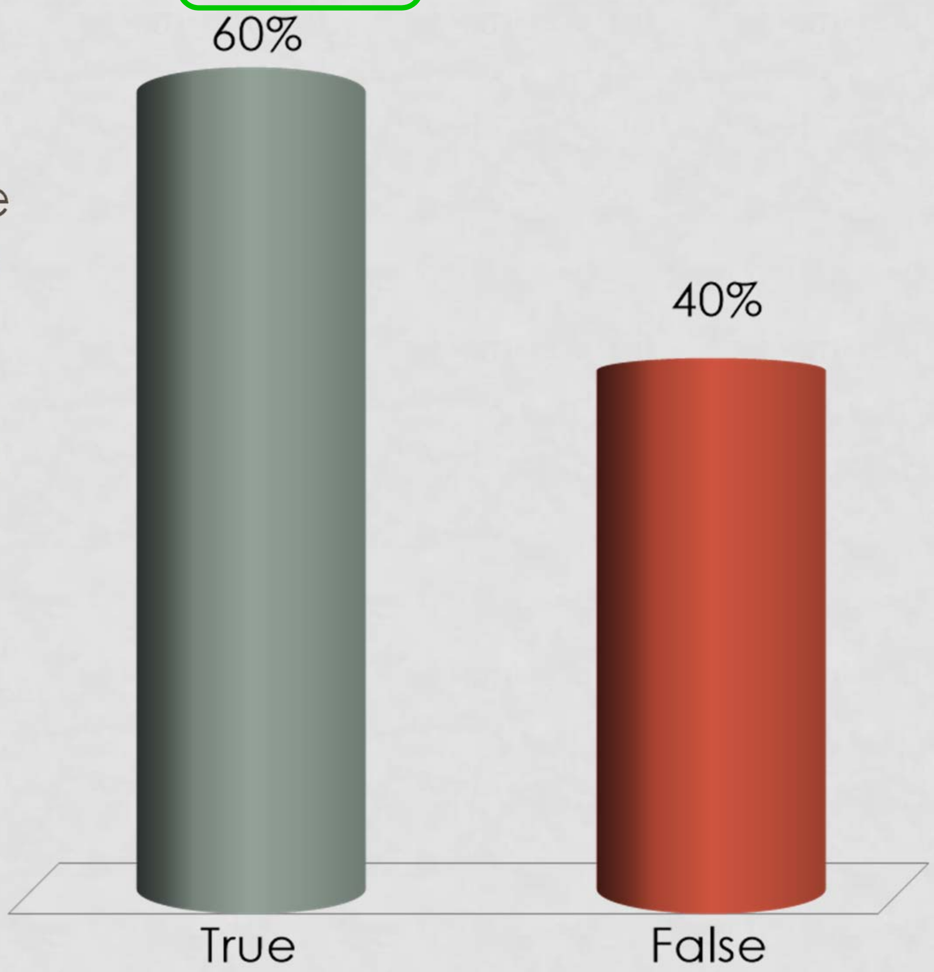
104.3.4 Workers and Equipment – Any person employed by the Contractor or by any Subcontractor or any officer or representative or agent of the Subcontractor, who, in the opinion of the Resident, is intemperate or disorderly, shall be removed immediately by the Contractor or Subcontractor employing such person. The employee shall not be employed again in any portion of the Work without first apologizing to and obtaining approval from the Resident.



DIVISION 100 – GENERAL CONDITIONS

A. True **B. False**

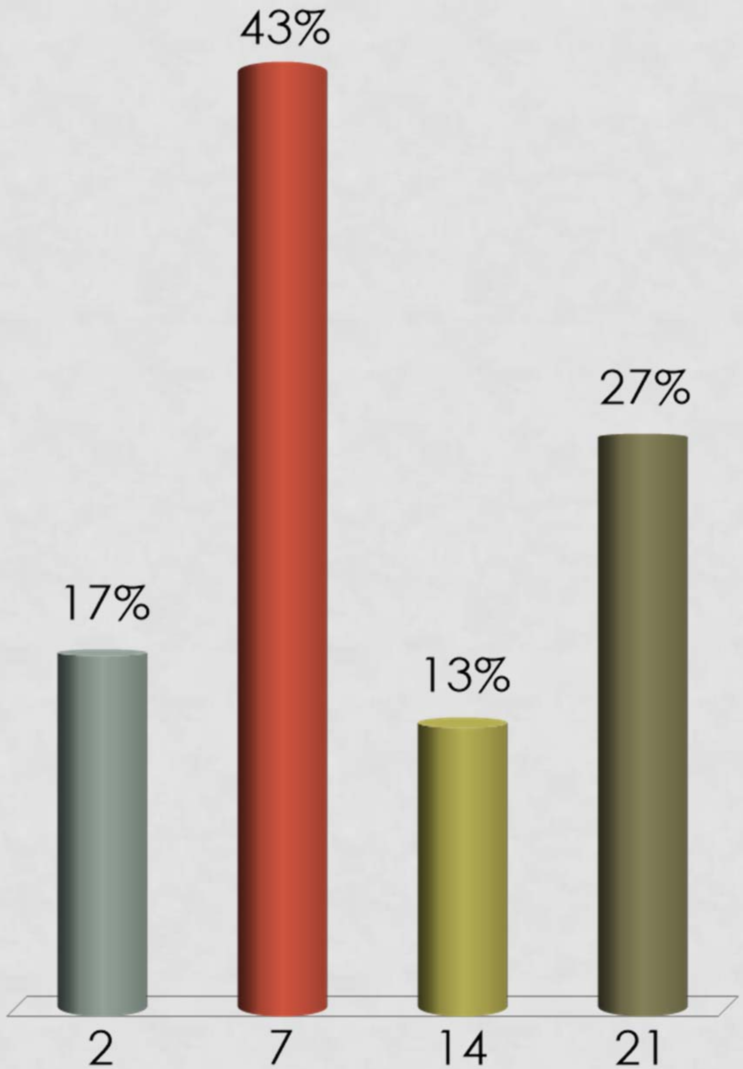
104.3.11 Responsibility for Property of Others –
The Contractor shall be responsible for all damage to public or private property of any kind resulting from any act, omission, neglect, or misconduct of the Contractor and its Subcontractors. The preceding sentence does not include damage to vehicles passing through a Work Zone.



DIVISION 100 – GENERAL CONDITIONS

105.3.1 Notices Required –
The Contractor shall plan granular material operations so that the Resident will have sufficient advance notification to provide a proctor for the material to be placed. Sufficient notification will be considered ____ days. Changes in source will also require notification. Failure to provide the above notification will result in the following actions; First offense – written warning, second and subsequent – liquidated damages will be charged for one calendar day.

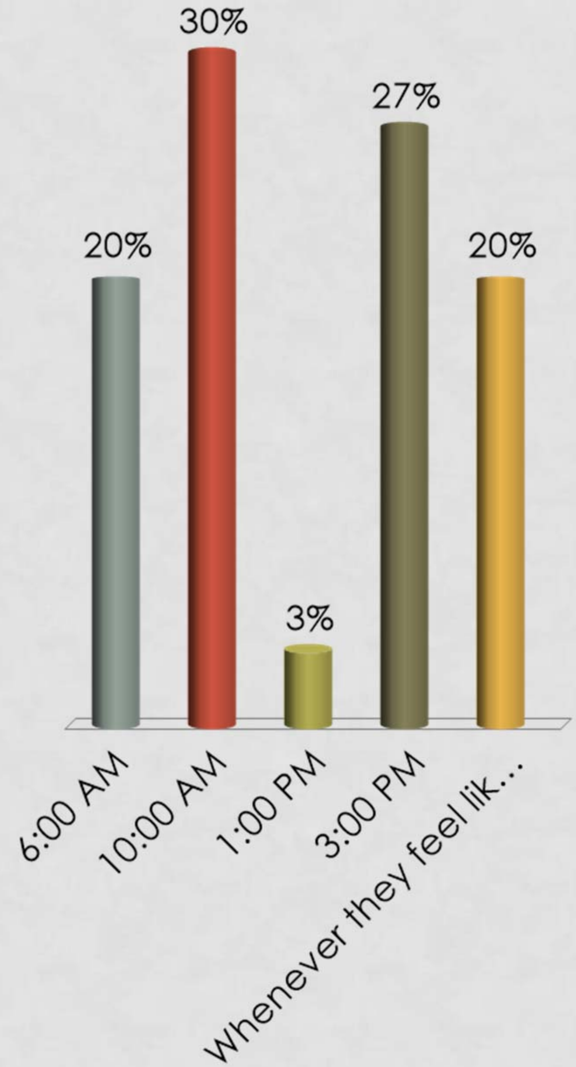
A. 2
B. 7
C. 14
D. 21



DIVISION 100 – GENERAL CONDITIONS

106.4.5 Inspection Requirements – The Contractor shall provide a copy of each completed QC report to the Department by ______ on the day following each construction activity, unless other arrangements are made with the Resident.

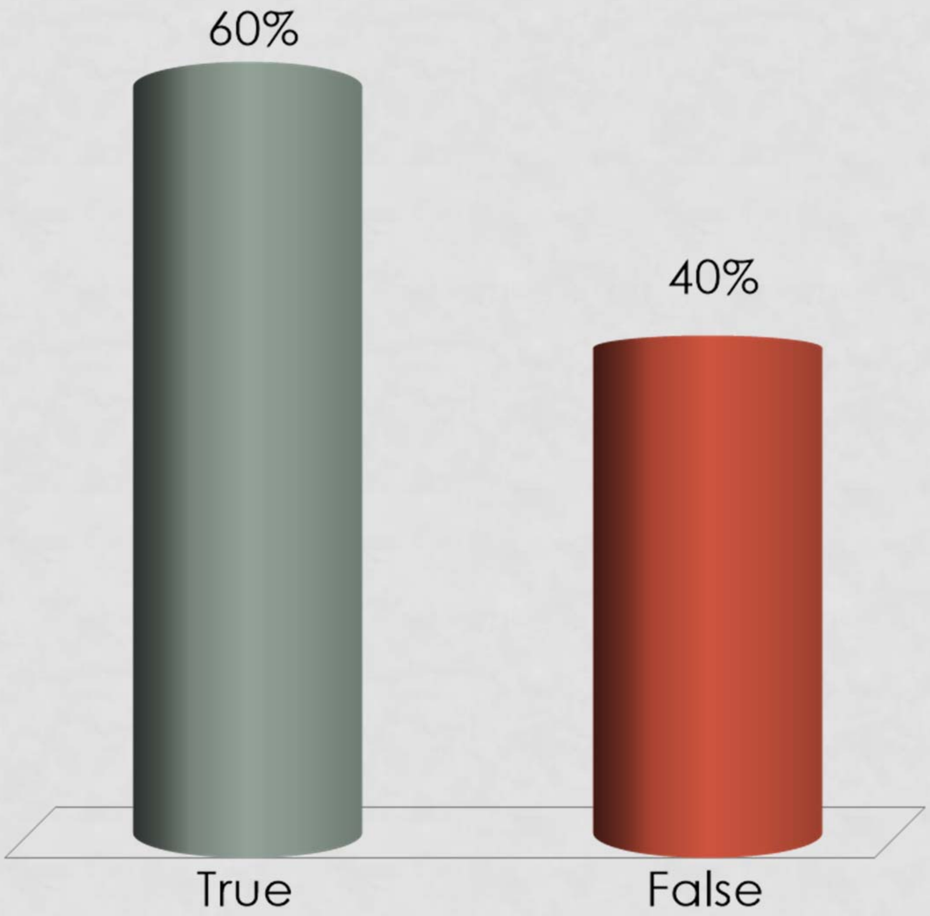
A. 6:00 AM
B. 10:00 AM
C. 1:00 PM
D. 3:00 PM
E. Whenever they feel like it



DIVISION 100 – GENERAL CONDITIONS

A. **True** B. **False**

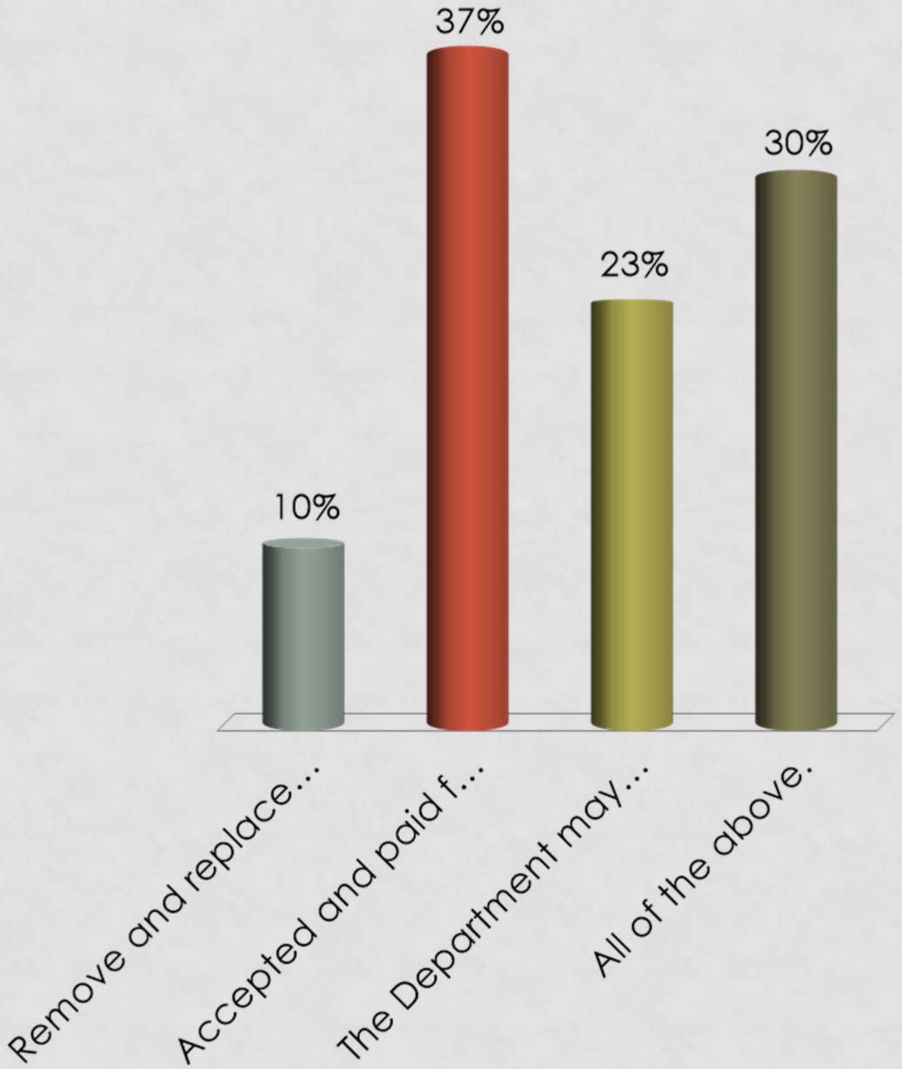
106.6 Acceptance–
The Department may not reject material, which appears to be defective based on visual inspection.



DIVISION 100 – GENERAL CONDITIONS

106.6 Acceptance–
At the Department's sole discretion, a Lot with a Quality Level of less than 50% within limits (PWL) will be:

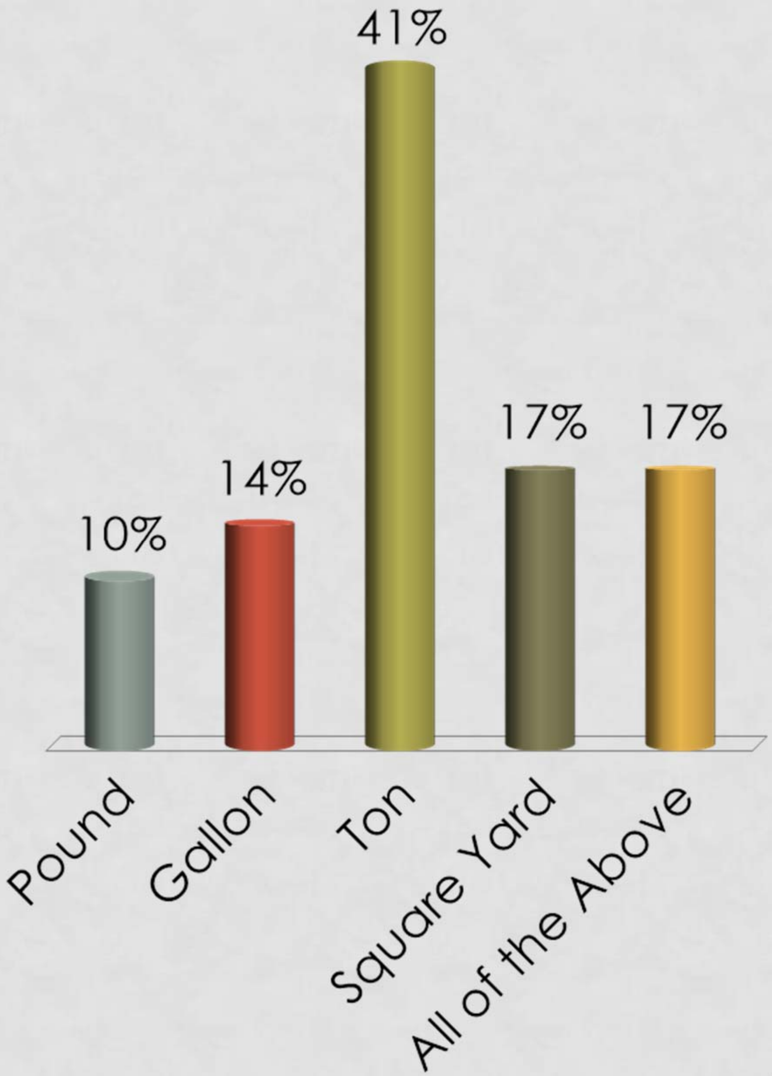
A. Remove and replaced with acceptable material at the Contractors expense
B. Accepted and paid for at a Pay Factor determined by the Department
C. The Department may also reject material with a Pay Factor at or above these levels, but such material will be removed and replaced by the Contactor at the Department's expense.
D. All of the above.



DIVISION 100 – GENERAL CONDITIONS

Certain Bituminous materials may be measured by:

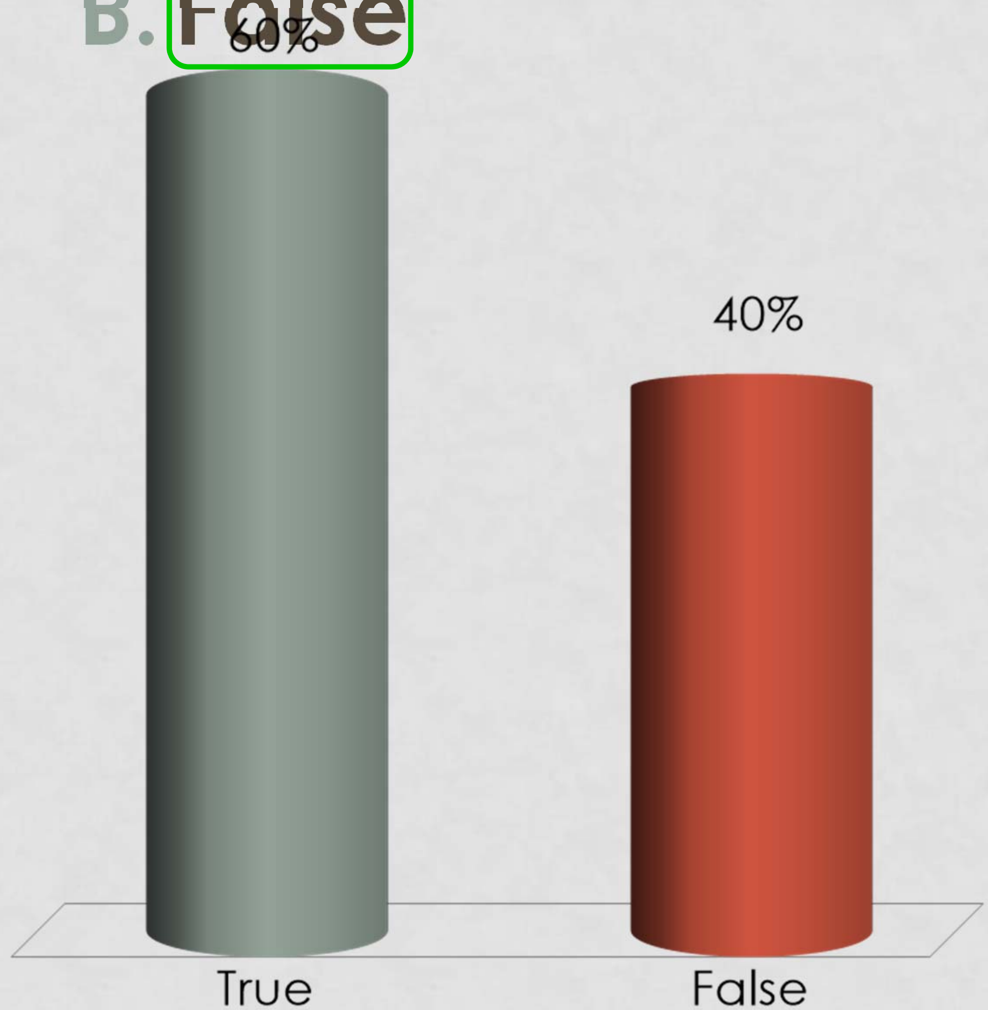
A. Pound
B. Gallon
C. Ton
D. Square Yard
E. All of the Above



DIVISION 100 – GENERAL CONDITIONS

A. True B. False

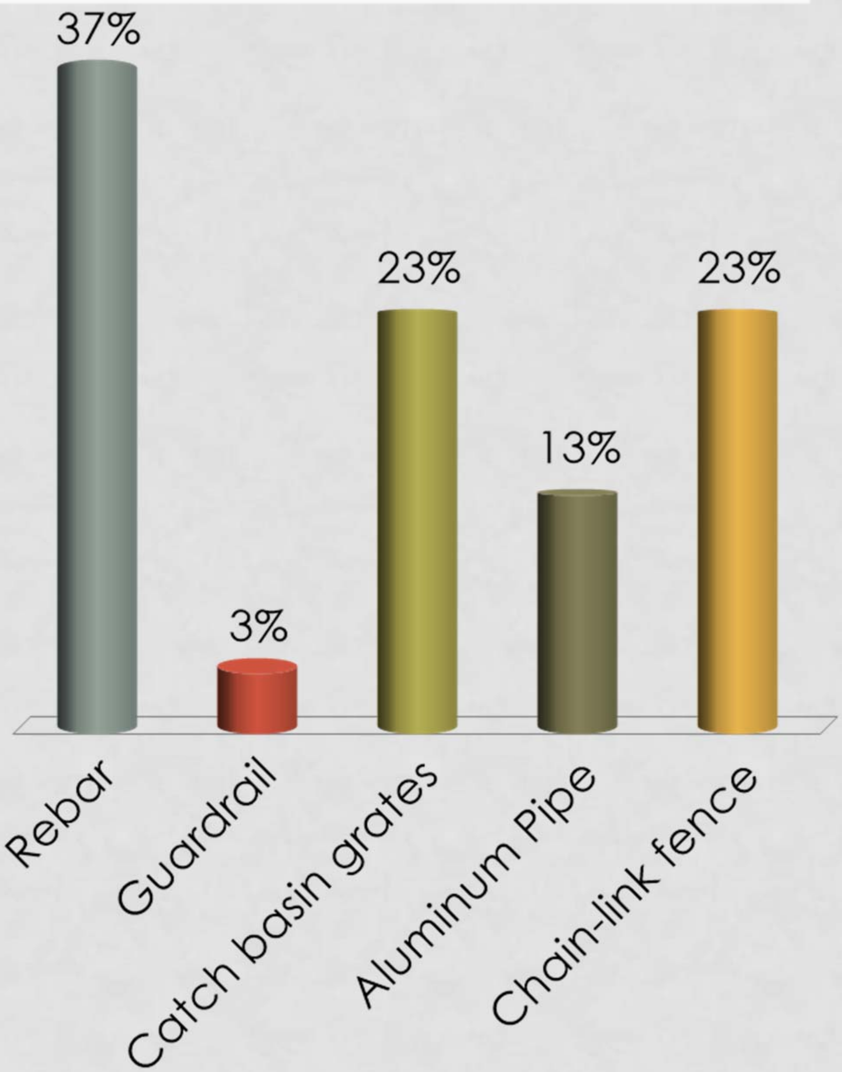
Appendix A Section 3 – For the purposes of Buy America, the United States does not include Guam and Puerto Rico.



DIVISION 100 – GENERAL CONDITIONS

Appendix A Section 3 – Which of the following materials is not subject to Buy America?

A. Rebar
B. Guardrail
C. Catch basin grates
D. Aluminum Pipe
E. Chain-link fence posts



WHAT WOULD YOU DO?

- We are going to through several field scenarios with multiple choices at the end of each.
- Choose the outcome that best describes how would you respond in the field.
- We will then discuss the possible outcomes

SCENARIO 1

- You are inspecting a drainage crew installing catch basins and 12” Type C underdrain.

- The crew is installing underdrain towards a previously installed catch basin that was installed at the correct elevation according to the plans.

- The underdrain is also being installed at the correct slope (1.5%) and elevation according to the plans.

- As the crew approaches the basin with the last 20ft section of underdrain, they discover that the core hole (fitted with a boot for HDPE pipe) was cut 4 inches lower than the pipe invert on the plans.

WHAT WOULD YOU DO?

A. Have the Contractor Remove & Reset the basin

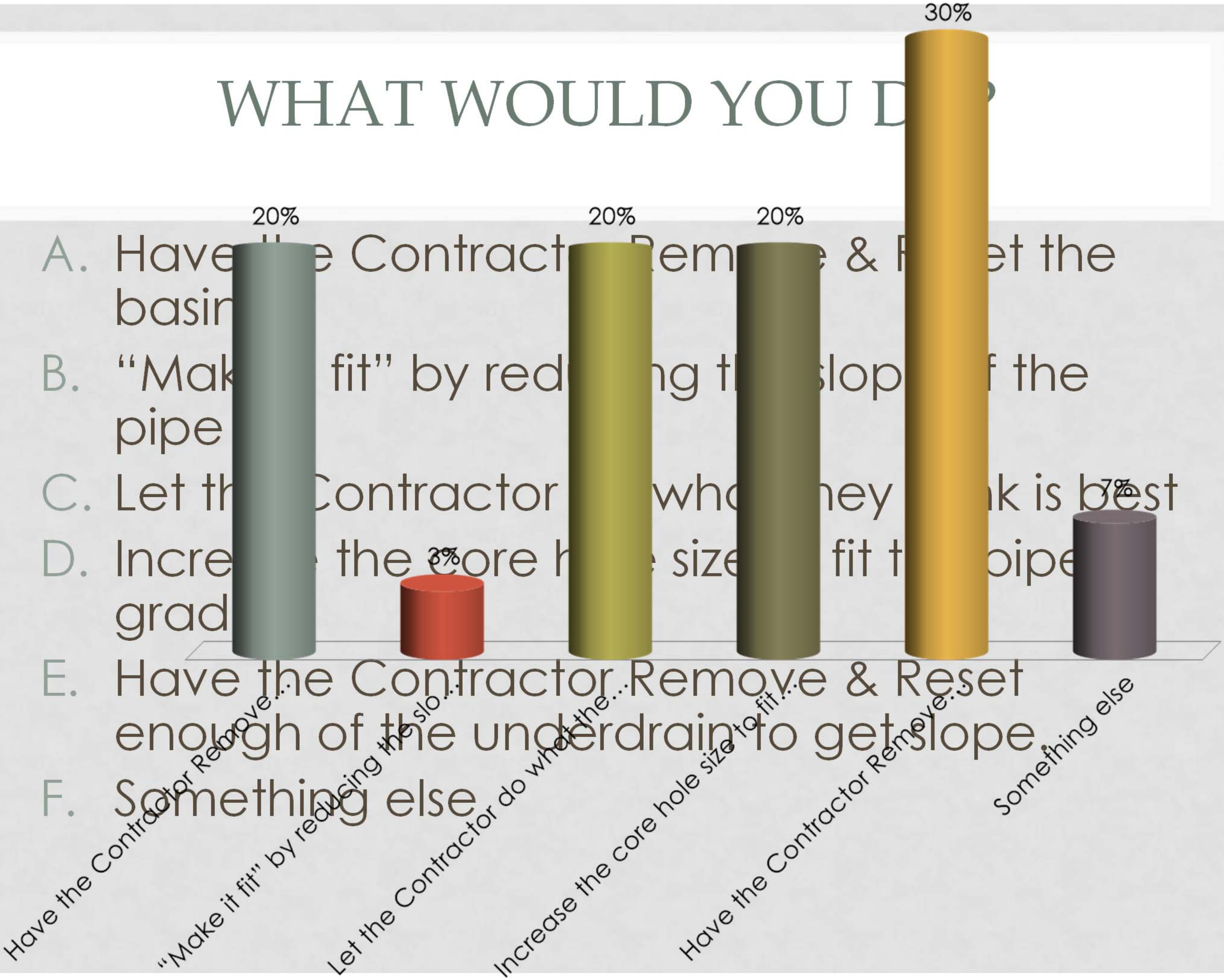
B. "Make it fit" by reducing the slope of the pipe

C. Let the Contractor do what they think is best

D. Increase the core hole size to fit the pipe grade

E. Have the Contractor Remove & Reset enough of the underdrain to get slope.

F. Something else



SCENARIO 2

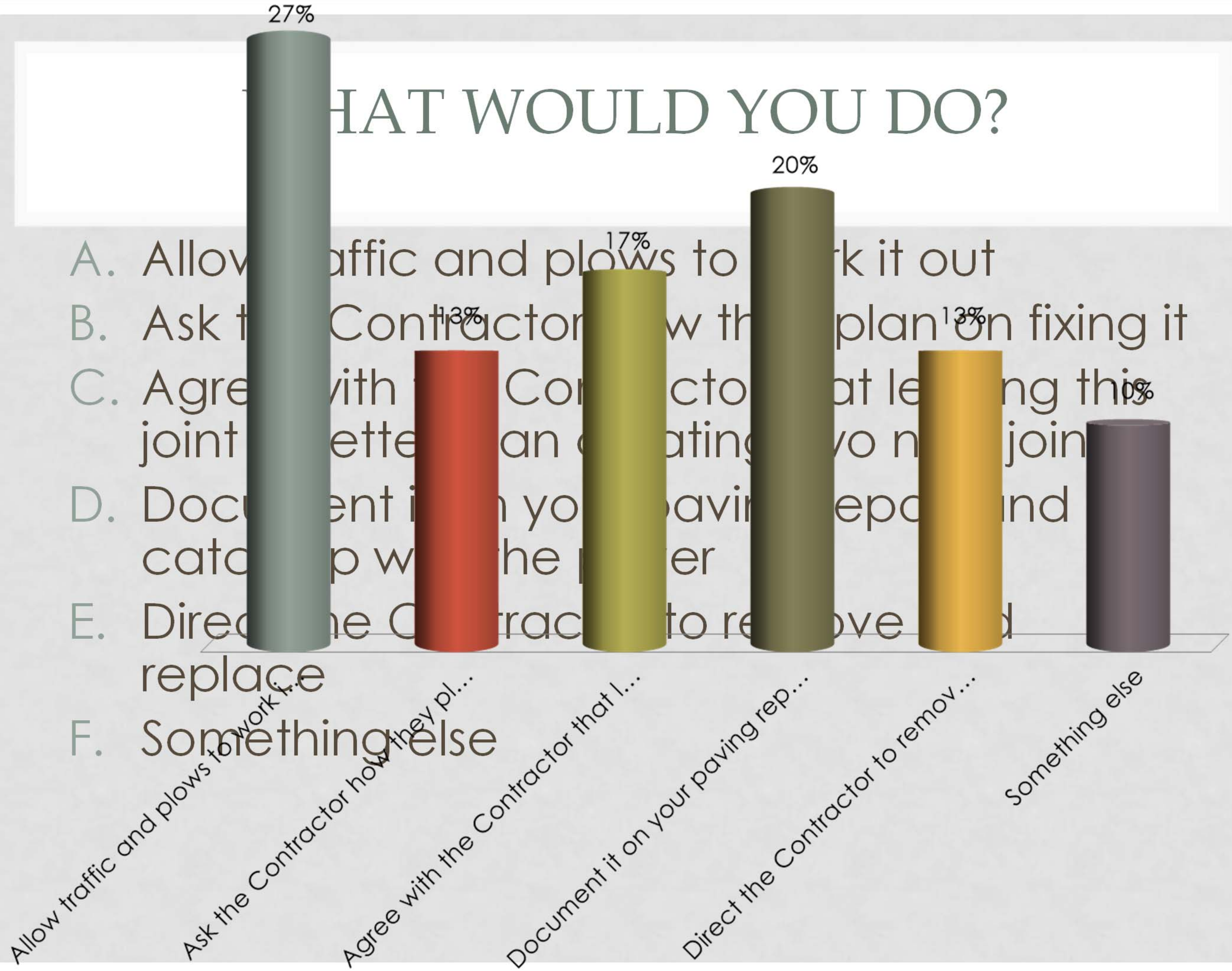
- You are a paving inspector reviewing the surface tolerance of a transverse joint on an urban 25mph roadway.

- After finish rolling, you string the joint and it measures 1/8” out of tolerance.

- The Contractor doesn’t believe the accuracy of your ruler. He/She strings the joint and comes out with the same result that you measured.

WHAT WOULD YOU DO?

A. Allow traffic and plows to work it out
B. Ask the Contractor how they plan on fixing it
C. Agree with the Contractor that leaving this joint is better than creating two new joints
D. Document it on your paving report and catch up with the paver
E. Direct the Contractor to remove and replace
F. Something else



SCENARIO 3

- You are an inspector on a project, the Prime Contractor’s paving sub is on-site and ready to pave a 1000ft section of base HMA on gravel.

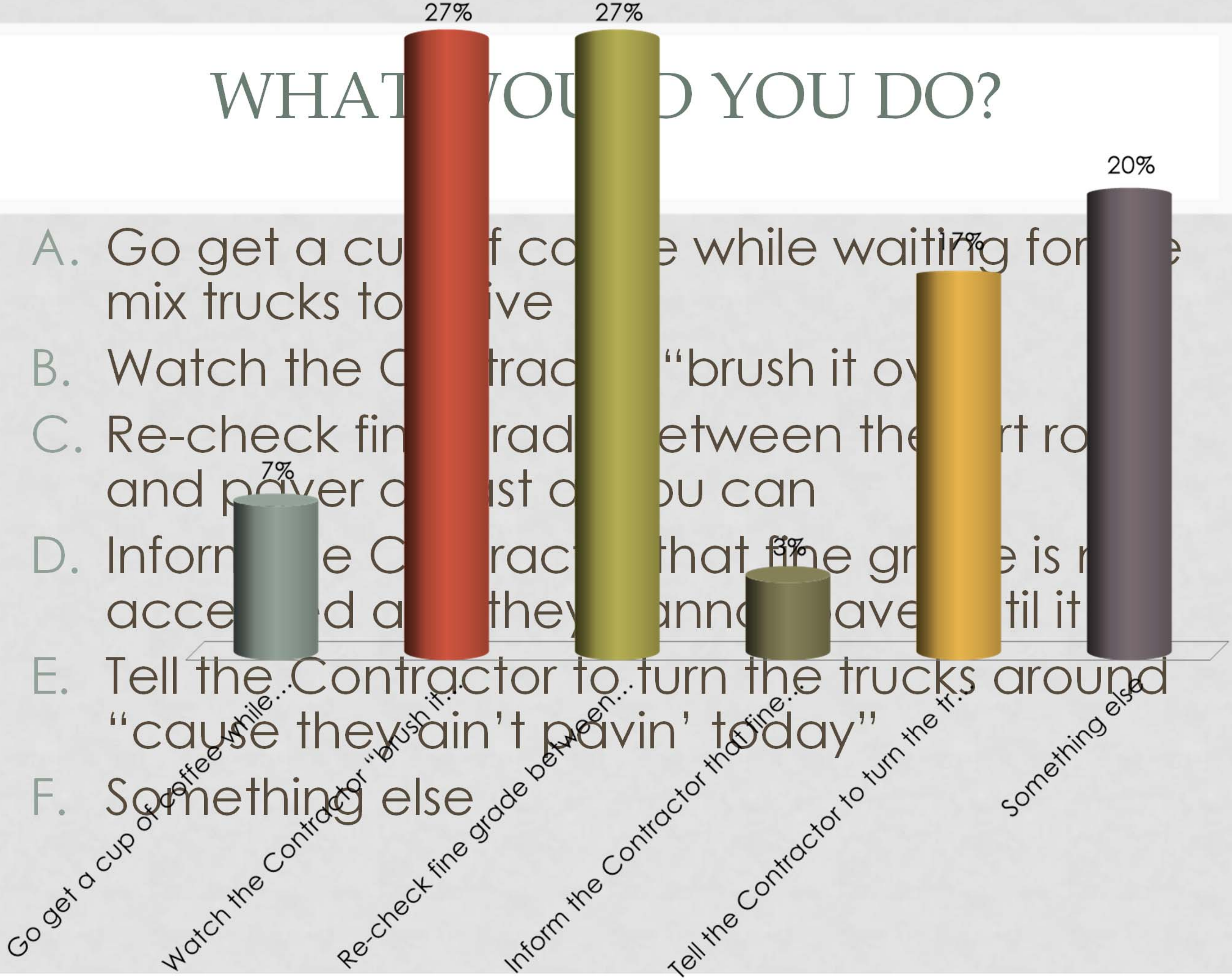
- 120 tons of HMA has already been loaded out of the plant and on its way to the project

- Yesterday’s paving was cancelled due to rain so the fine grade was accepted 72 hours ago

- The Prime Contractor tells you they are just going to "brush it over" in front of the paver.

WHAT WOULD YOU DO?

A. Go get a cup of coffee while waiting for the mix trucks to arrive
B. Watch the Contractor "brush it over"
C. Re-check fine grade between the dirt road and paver as fast as you can
D. Inform the Contractor that fine grade is not accepted and they cannot pave until it is
E. Tell the Contractor to turn the trucks around "cause they ain't pavin' today"
F. Something else



PAVEMENT MILLING

SPRING 2019

NEW INSPECTOR TRAINING

PAVEMENT MILLING PROCESSES TO DISCUSS :

- Removing Pavement Surface
- Pavement Butt Joints
- Roles & Responsibilities

REMOVING PAVEMENT SURFACE
MILLING 101

Milling machines are set up exactly like a modern paver:

- Comes with a grade control ski (most commonly built into the machine)
- Comes with slope control (by use of a gyro installed at the midpoint of the machine)

Slope Control Sensor
(Typically located under the operator's station at the center point of the machine)

Grade Control Sensors

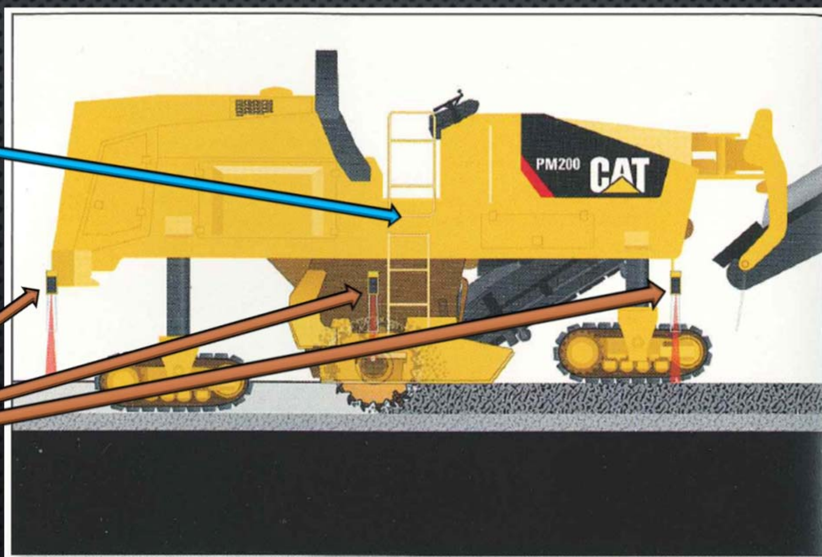


Figure 4-7: Cold planer with three grade sensors to create an averaging effect.

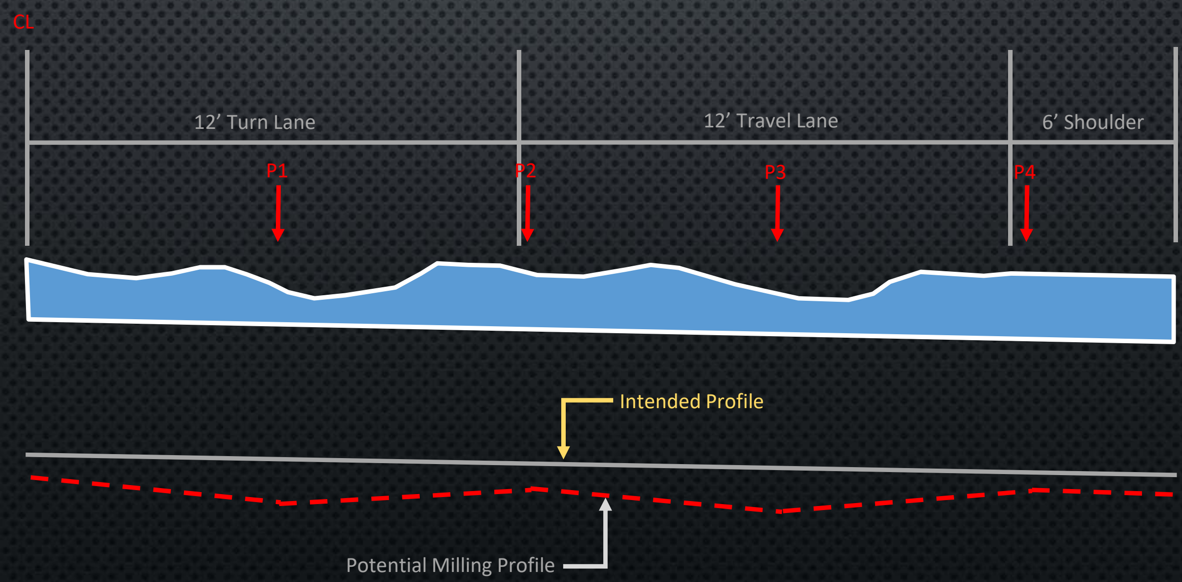
REMOVING PAVEMENT SURFACE
MILLING 101

BECAUSE OF THESE OPTIONS, MILLING MACHINES CAN BE UTILIZED IN VARIOUS WAYS:

- MILLING TO AN AVERAGE DEPTH (USE OF THREE GRADE SENSORS) – "MATCH EXISTING" PROJECTS
- MILLING TO SLOPE (USE OF SLOPE SENSOR) – MILLING TO A SPECIFIC SLOPE, "DAYLIGHTING"
- MILLING TO SLOPE & DEPTH (USE OF THREE GRADE SENSORS & SLOPE SENSOR) – HIGHER SPEED CORRIDOR MILL & FILL PROJECTS
- MILLING TO A SPECIFIC DEPTH (USE OF ONE GRADE SENSOR ONLY) – BUTT JOINTS

REMOVING PAVEMENT SURFACE
MILLING TO AVERAGE DEPTH

- MANY URBAN PROJECTS REQUIRE US TO MATCH TO AN AVERAGE DEPTH DUE TO VARIOUS IMPACTS SUCH AS CURB AND SIDEWALKS.
- THE PRIMARY CONCERN WITH THIS PROCESS IS THE CREATION OF INVERSIONS AND INCONSISTENT CROSS SLOPES.



Removing Pavement Surface
Milling to Average Depth

To avoid transferring the surface profile, markups must be completed every 50'.

- Establish a fixed height with the string line at each edge of the lane (Grade stakes work well)
- Measure the difference from the string to the existing surface at intervals equivalent to the milling cut width (typically 7 to 8 feet)
  - A measurement <u>less</u> than the fixed height means additional material will need to be taken.

    Mill Depth: Design Mill Depth + (Fixed Height – Measurement)
  - A measurement <u>greater</u> than the fixed height means less material will need to be taken.

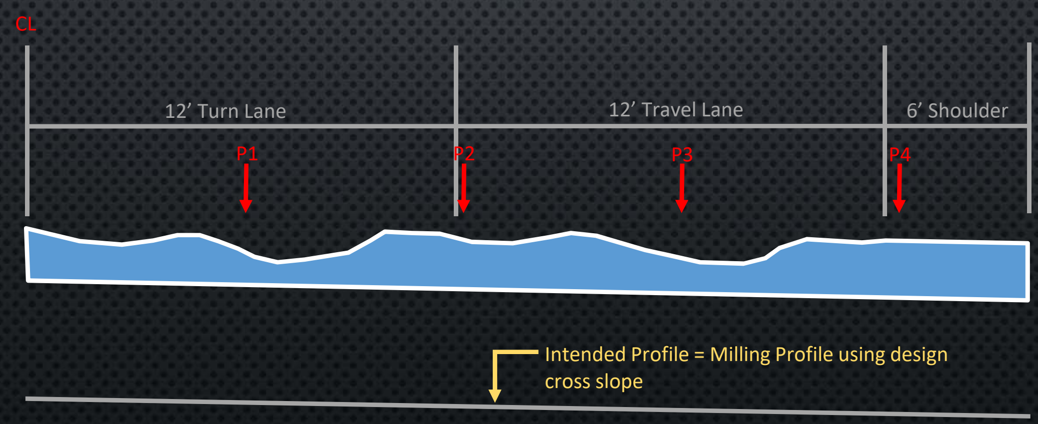
    Mill Depth: Design Mill Depth - (Measurement – Fixed Height)

While it is the <u>Contractor's</u> responsibility to perform the layout, it is the <u>Department's</u> responsibility to confirm that the layout is correct prior to milling. If we work together during the layout it can help save a step.

REMOVING PAVEMENT SURFACE
MILLING TO SLOPE & AVERAGE DEPTH

MILLING TO SLOPE & AVERAGE DEPTH HELPS TO REESTABLISH CROSS SLOPE WHILE MAINTAINING CURB GUTTER REVEAL OR SHOULDER MATCH POINTS.

IT IS THE DEPARTMENT'S EXPECTATION THAT THIS PROCESS IS FOLLOWED WHERE EVER SLOPE IS REQUIRED PER CONTRACT DOCUMENTS.



REMOVING PAVEMENT SURFACE
MILLING TO SLOPE & AVERAGE DEPTH

Milling to slope can be done several ways:

A. For travelway only or to the face of curb, the shoulder elevation controls. In this instance, establish your depth at the shoulder break or face of curb and work towards centerline.

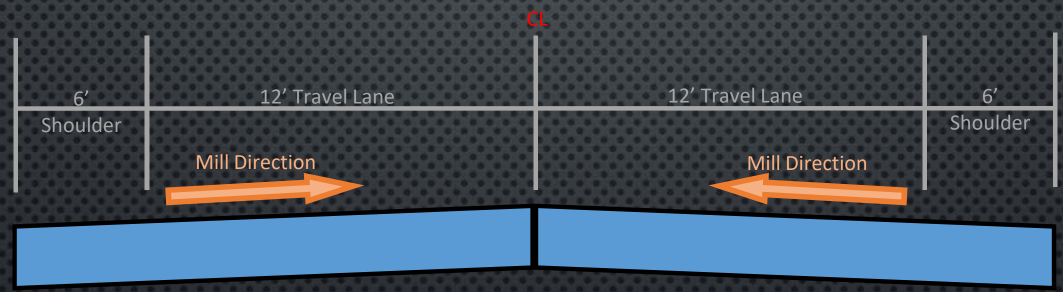
B. For full width, The centerline elevation controls so establish your depth at centerline and work outwards.

Layout is performed using the <u>contract</u> provided <u>cross slope sheets</u>. Again, layout is performed by the Contractor, but the Department is responsible for verifying that the layout is accurate to the field conditions.

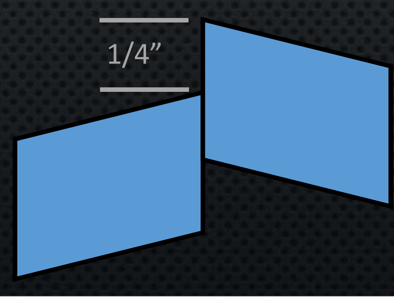
<u>major advantage</u>: only spot checks in normal sections and 50 foot checks in transitions are needed, instead of checks every 50 feet throughout the project length

Removing Pavement Surface
Milling to Slope & Average Depth

IMPORTANT: When milling to slope, it is best to work from the outside inward.



It is possible that the match point at centerline will not be a perfect match, we anticipate that in some cases it will be a ¼". Remember, that a ¼" is the surface tolerance of a milled surface, so a slight variation is acceptable. In some cases an additional pass to correct the variation may be necessary.



Removing Pavement Surface
Method Comparison

Milling to Depth

- Pro: Milling can be done from centerline out or from shoulder in.
- Pro: Existing pavement depths in addition to milling depths can be unknown.
- Pro: minimizes risk of shallow trench impacts.
- Con: Extensive layout in the field is required.
- Con: High risk of creating inversions and transferring surface discrepancies to the milled surface. Places additional risk and responsibility onto the inspector.

Both

- Require automation per standard specifications.
- Can be daylighted.
- Consistent mill depths not anticipated provided final profile is consistent.

Milling to Slope & Depth

- Pro: Minimal layout is required, uses cross slope sheets.
- Pro: Easier to inspect in the field.
- Pro: Contractor is responsible to achieve cross slope regardless of how many passes.
- Pro: Contractor's prefer this method, less guess work. Can set depth and slope and run.
- Con: Existing pavement depths need to be known.
- Con: Centerline may not match exactly, but ¼" or less is within milling tolerance.

PAVEMENT TEXTURE AND SPECIFICATIONS

202.202: Removing Pavement Surface

VS

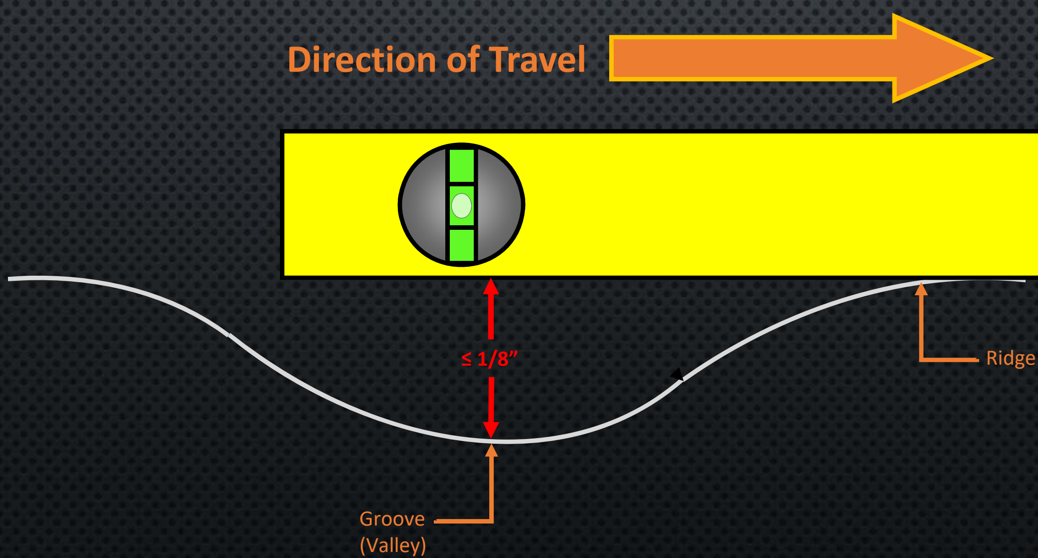
202.2023: Removing Pavement Surface (Medium Cut Drum)

PROFILE VS CROSS SLOPE

- Cross Slope:
  - The Pitch of the Road perpendicular to the direction of traffic.
    - Conventional Milling: Deviations of ½" or less
    - Medium Cut Milling: Deviations of ¼" or less
- Profile:
  - The shape of the road parallel to the direction of traffic.
    - All milling deviations of ½" or less.

WHAT IS RIDGE TO VALLEY HEIGHT?

- **EXAMPLE: THE DIFFERENCE IN HEIGHT FROM THE TOP OF ANY RIDGE TO THE BOTTOM OF THE GROOVE ADJACENT TO THAT RIDGE SHALL NOT EXCEED 1/8 INCH.**



PAVEMENT TEXTURE AND SPECIFICATIONS

202.202
Standard Cut

- No required tooth spacing.
- Height of Ridge to Valley shall not exceed 1/4"
- Cross Slope Deviations shall not exceed 3/8"
- Contractor "owns" the milled surface after 7 days.

Both

- 3 Grade Sensors Required
- Profile deviations of ½" or more must be corrected.
- Similar joint matching requirements

202.2023
Standard Cut

- Tooth spacing of 5/16" or less.
- Height of Ridge to Valley shall not exceed 1/8"
- Cross Slope Deviations shall not exceed 1/8"
- Contractor "owns" the milled surface after 21 days.

Pavement Texture and Specifications
Item 202.202 – Removing Pavement Surface

- For Vertical Longitudinal Joints:
  - 2" or less: A matching pass must be completed by the end of the next calendar day.
  - Greater than 2": Match Daily
- For 12:1: Tapered (Ramped) Longitudinal Joints:
  - 2" or Less: Must be matched by the weekend or by holiday suspension.
  - Greater than 2": Match by the end of the next calendar day.

Pavement Texture and Specifications
Item 202.2023 – Removing Pavement Surface (Medium Cut Drum)

- For Vertical Longitudinal Joints:
  - ¾" or Less: No match up requirements
  - 1" – 1 ¼": A matching pass must be completed by the weekend.
  - 1 ½" – 2": A matching pass must be completed by the end of the next calendar day.
  - Greater than 2": Match Daily
- For 12:1: Tapered (Ramped) Longitudinal Joints:
  - 2" or Less: Must be matched by the weekend or by holiday suspension.
  - Greater than 2": Match by the end of the next calendar day.

Pavement Texture and Specifications
Overlapping Specifications & Requirements

- Exposed Shoulder Joints:
  - 2" or Less: After 21 days
    - A 12:1 Taper
    - An additional 2 feet will be cut into the shoulder.
    - A Pavement layer needs to be placed to reduce the vertical edge to 1" or less.
  - Greater than 2": Immediately
    - A 12:1 Taper
    - An additional 2 feet will be cut into the shoulder.
    - A Pavement layer needs to be placed to reduce the vertical edge to 1" or less.

PAVEMENT TEXTURE AND SPECIFICATIONS
OVERLAPPING SPECIFICATIONS & REQUIREMENTS

IMPORTANT!!!

ALL VERTICAL EDGES LEFT AT THE END OF A SHIFT MUST BE DELINEATED!

- RPMS & TEMPORARY STRIPING ARE BOTH ACCEPTABLE
  - IN A PINCH BARRELS CAN BE USED, BUT SHOULD NOT BE "PERMANENT"
- UNEVEN LANE SIGNS ARE NEEDED FOR CENTERLINE AND SHOULDERS DIFFERENTIALS.

PAVEMENT TEXTURE AND SPECIFICATIONS
OVERLAPPING SPECIFICATIONS & REQUIREMENTS

- Weepers:
  - Shall typically be 18 – 24" inches in width, installed along each lane, at **A FREQUENCY OF APPROXIMATELY ONE PER HALF MILE** at locations as directed by the Resident or in areas that will provide drainage for the milled areas.
    - MEANING: If your project is 7 miles long, there should be at least 14 weepers on the project, however, this does not mean that there should be one every half-mile, whether it is on a high side of a curve, etc.
  - Need to be cut over the full width of the shoulder.

BUTT JOINTS
SUMMARY

The purpose of a Butt Joint is to allow a gradual and comfortable transition from a new pavement surface to an existing structure such as an existing pavement surface, bridge deck, or catch basin.

- There is no set length for a butt joint, although typical lengths are 25 feet to 50 feet, depending on layer thicknesses and site conditions.

  Note: A butt joint cannot only be 10 to 16 feet long, this is a specification to measure the differential of a joint after it is paved, not a length requirement.

- A contractor may opt to use a trimmer head for milling butt joints, but the same tolerances as a full size milling machine apply.

As with all other processes, the Contractor is <u>required</u> to lay out the butt joints, however, the Department is <u>required</u> to verify the work. On preservation projects, the expectation is that the MaineDOT representative work with the contractor to agree upon a location, length, and width of the butt joints. It is both the Contractor & the Department's responsibility to ensure that the butt joint provides a smooth a comfortable transition.

REMEMBER: Butt Joints are the FIRST and LAST thing the public feels on any project!

REMOVING PAVEMENT SURFACE
ROLES & RESPONSIBILITIES

CONTRACTOR

- PROJECT LAYOUT
- MARKUPS TO ENSURE CONSISTENT MILLING.
- SLOPE CHANGES IF PROJECT SPECIFIES.

BOTH

- FOLLOW SPECIFICATIONS AND PROVISIONS.
- CHECKING FOR INVERSIONS, PRIOR, DURING, AND AFTER MILLING.
- ENSURING A CONSISTENT MILL DURING AND AFTER MILLING

MAINEDOT

- SPOT CHECKS PRIOR TO THE BEGINNING OF CONSTRUCTION.
- RELAY CHANGES IN GRADES, DEPTHS, SLOPES, ETC. TO CONTRACTOR BEFORE CONSTRUCTION START.
- CHECKING OF CONTRACTOR MARKUPS PRIOR TO CONSTRUCTION.

PAVEMENT MILLING

QUESTIONS?

All About Asphalt

A MaineDOT Inspector Workshop

Presented by

MaineDot

Pavement Quality Section

What We'll Discuss Today

- We'll describe the properties of asphalt and asphalt concrete, its parts, and applications of asphalt products

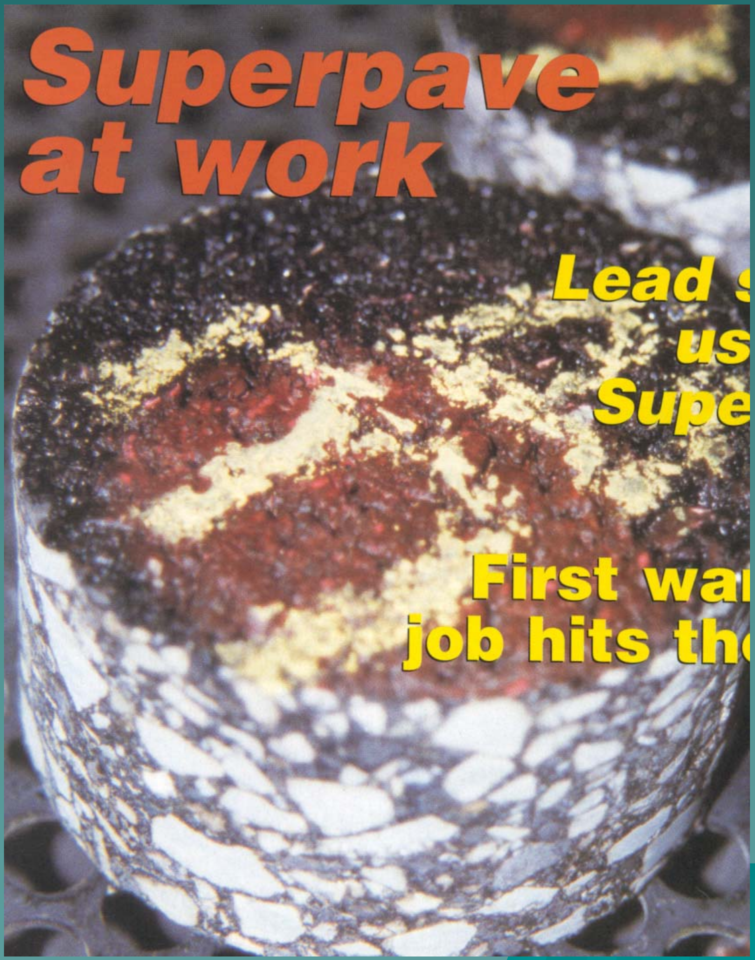
- Topics
  - Introduction
  - Hot Mix Asphalt and Its Parts
  - Cold Mix and Asphalt Emulsions
  - Common Concerns For Hot Mix

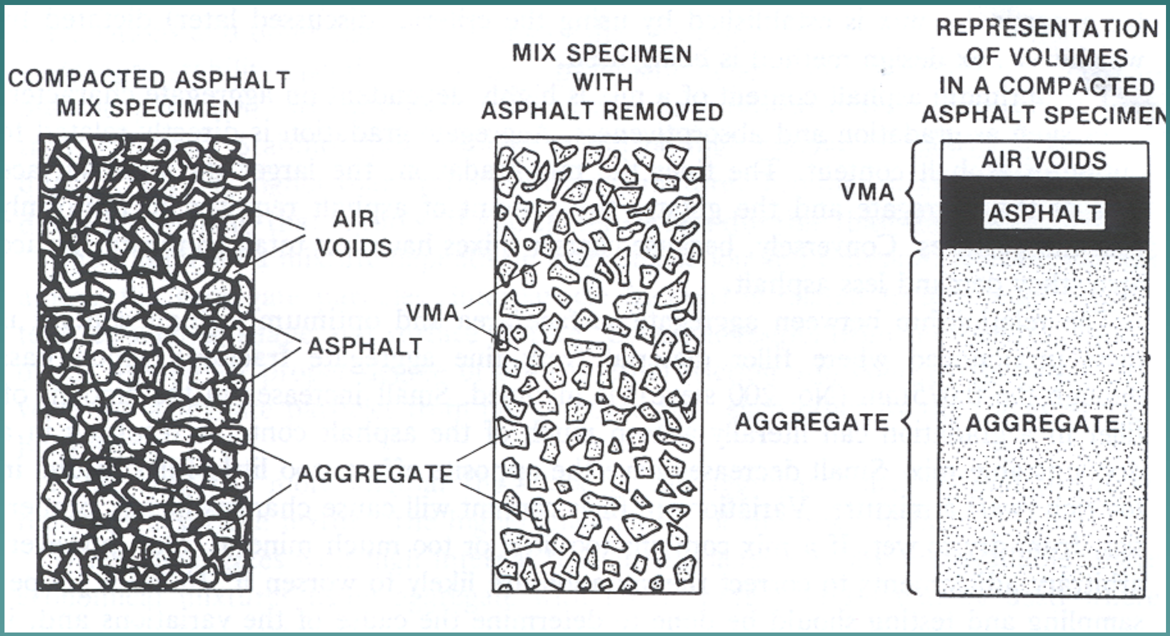
What Is HMA?

- HMA – Hot Mix Asphalt

- Consists of
  - Stone (aggregates)
    - Several different sizes
  - Asphalt Cement
    - Black sticky stuff
  - Air Voids
    - Space between rocks and glue

- Rock
- Glue
  (Asphalt)
- Air




COMPACTED ASPHALT MIX SPECIMEN
MIX SPECIMEN WITH ASPHALT REMOVED
REPRESENTATION OF VOLUMES IN A COMPACTED ASPHALT SPECIMEN
AIR VOIDS
VMA
ASPHALT
AGGREGATE
AIR VOIDS
ASPHALT
VMA
AGGREGATE
AGGREGATE

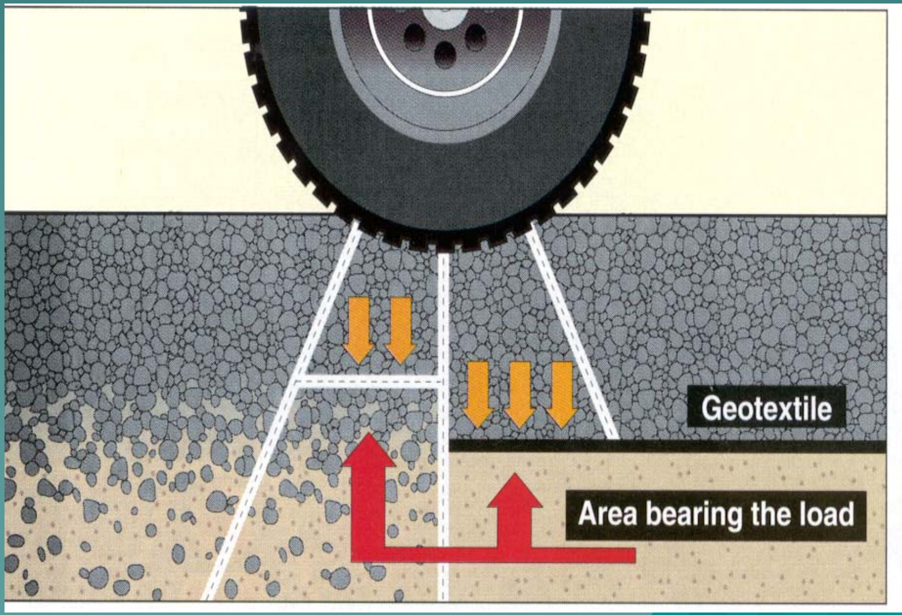
Its Not That Easy

- The keys to quality hot mix
  - Aggregates (durable)
  - Asphalt cement
  - Low air void percent
  - Temperatures
  - Mixing, storing, and hauling
  - Placement and compaction
  - Proper application
- If any key fails, the HMA can fail

Aggregate Size And Type

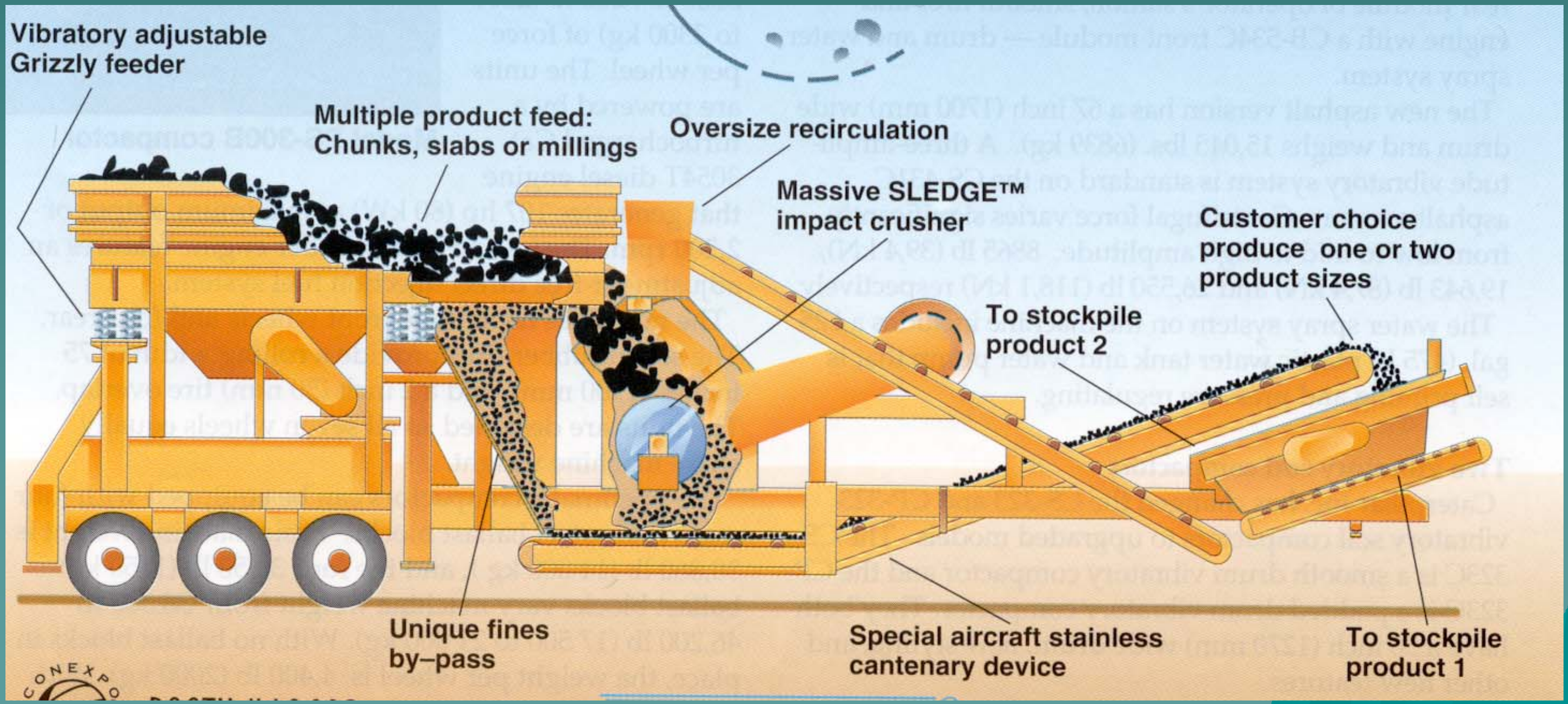
Important

- Stones carry the loads
- Sharp angular pieces
- Stone to stone matrix
- Asphalt glues it together



Aggregates

- Will any rock do?



Aggregates

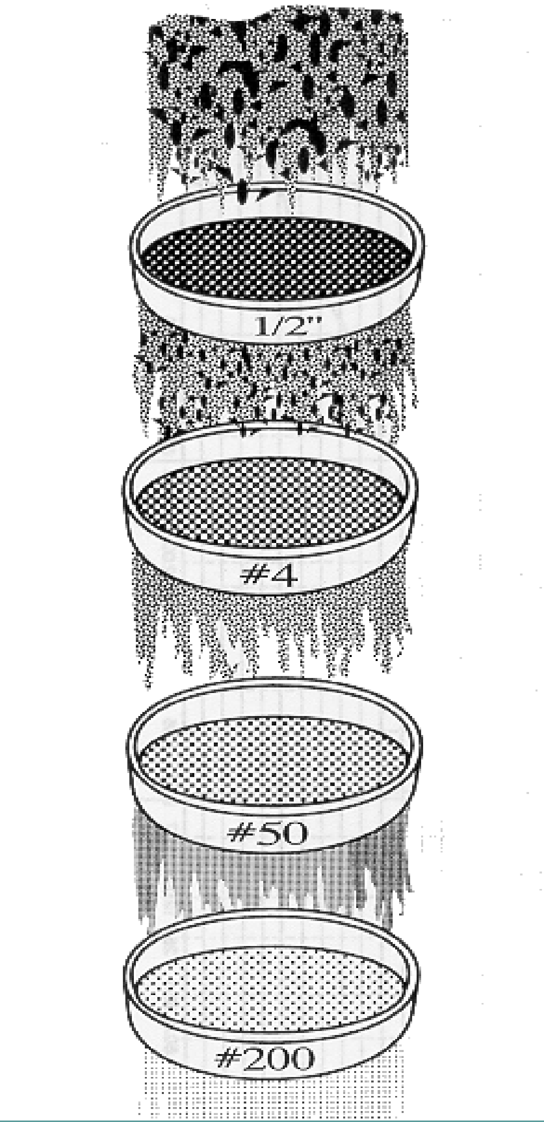
- Stone produced for hot mix should be
  - Crushed
  - Angular shape
  - Clean, washed if dry crushing process produces dirty aggregate
  - Tested to ensure wear and strength
  - Uniformly graded
- Hot Mix Asphalt requires all of the above

What Is Gradation?

- Gradation: The particle size distribution of the material

- Determined by a sieve analysis
  - Measures the particles passing through screens with smaller and smaller openings
  - Expressed as % by weight passing through each sieve

Sieve Analysis

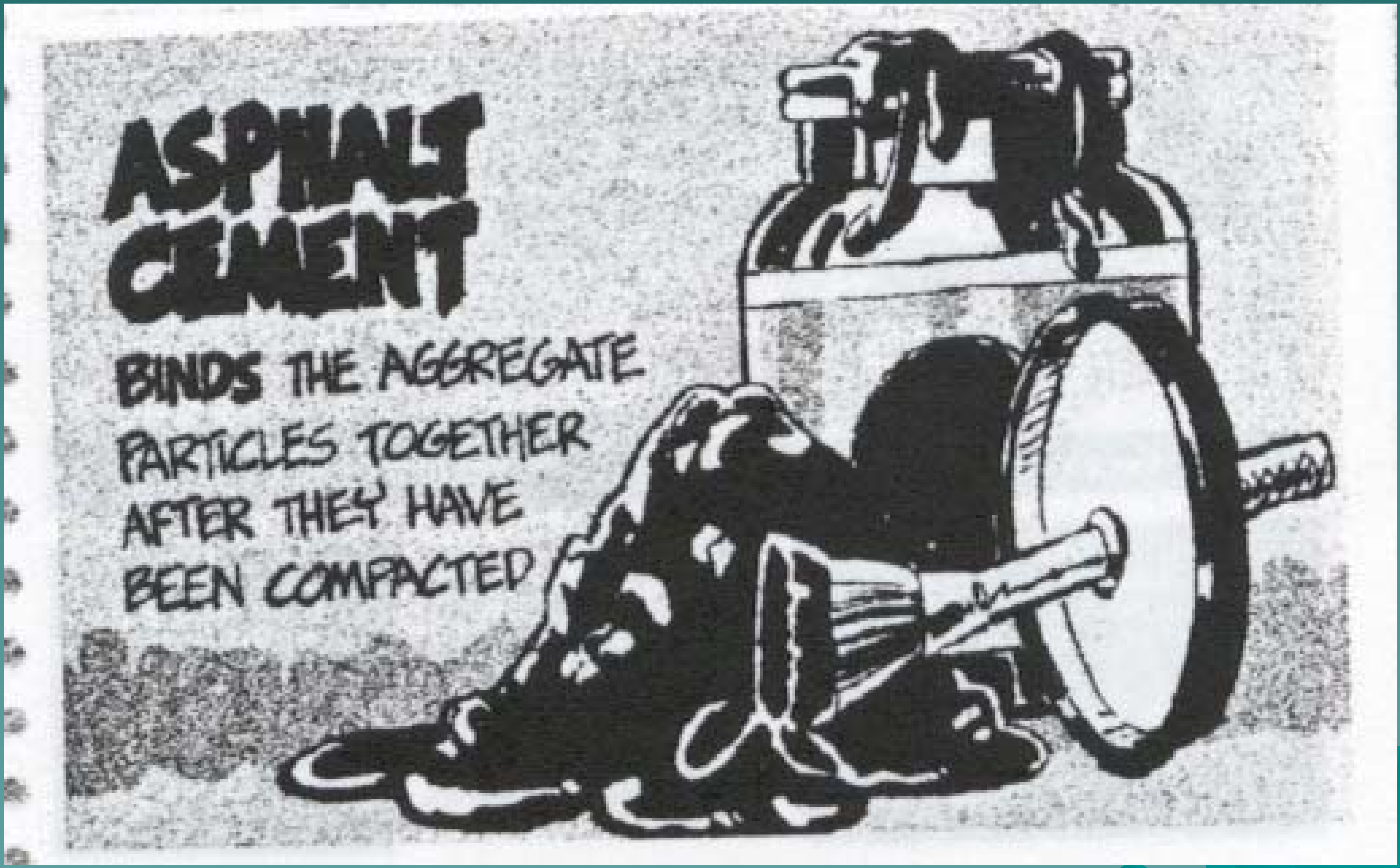


Sieve	Opening in mm	Opening in inches
2 inch	50.0	2.0
3/4 inch	19.0	0.75
No. 4	4.75	0.185
No. 8	2.36	0.093
No. 30	0.600	0.023
No. 100	0.147	0.006
No. 200	0.075	0.003

Asphalt Cement

- A dark brown to black cementitious material which occur in nature or are obtained in petroleum processing.
- The “sticky stuff”
- Called “asphalt,” “asphalt cement,” “ PGAB” and “bitumen.”
- Tar is incorrect

What Does The Asphalt Do?



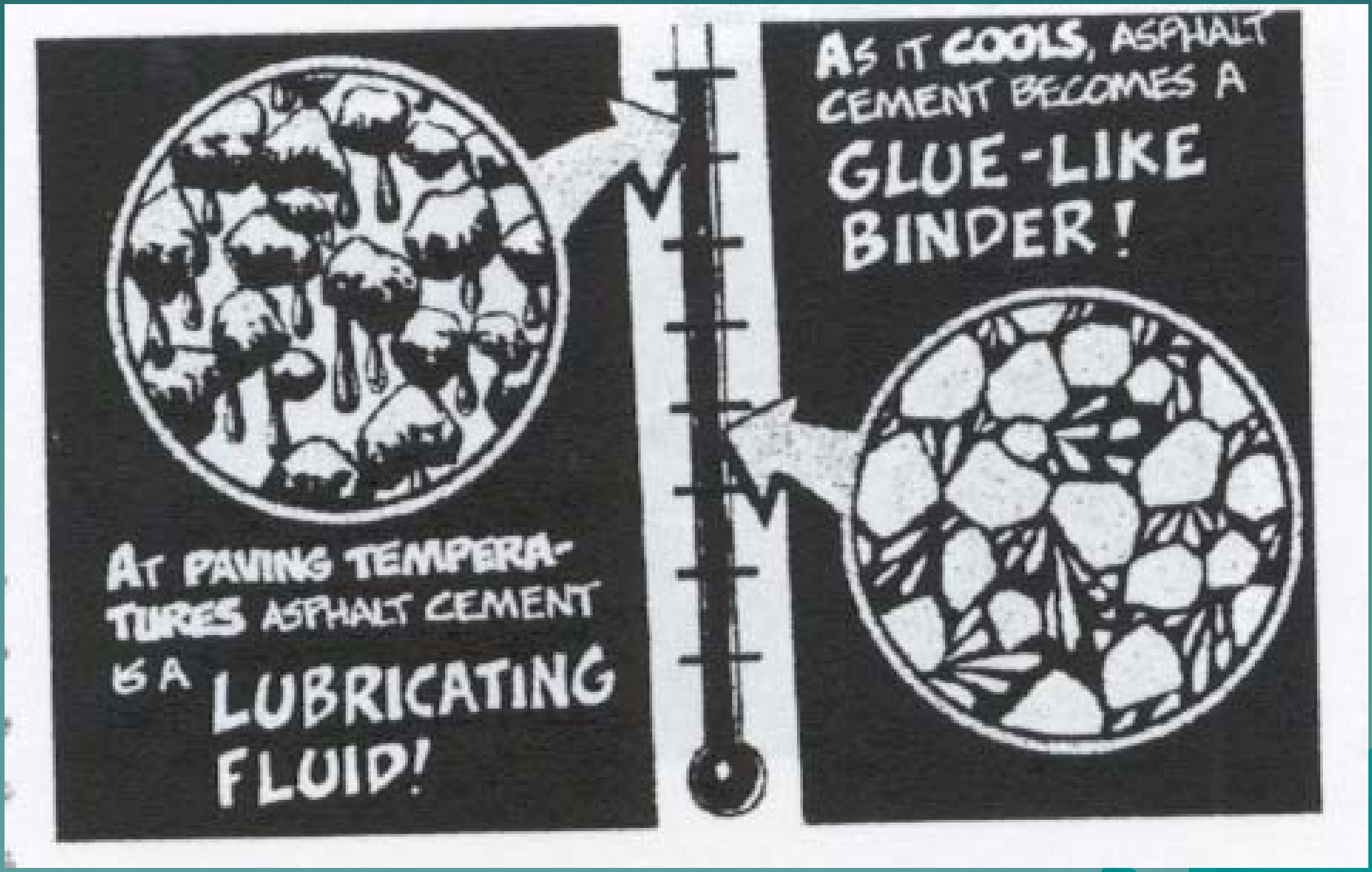
Asphalt Cement

- Performance Graded Asphalt Binder (PGAB) – new grading system for asphalts
- Grade used depends on expected min. and max. pavement temperatures
- MaineDOT mix designs use
  - PG 64-28 and 64E-28 Polymer Statewide
  - Other grades for specific projects

MaineDOT Mix Designs

- MAineDOT mix designs based on
  - Many years of research and experience
  - Based on gradation and % asphalt cement
  - “Desired” values are best mix designs
  - Suppliers and contractors familiar with these designs

How Does It Work?



What Are Voids?

- Air Voids: The spaces in the hot mix not filled by either aggregate particles or liquid asphalt
- Too many air voids, and the mat becomes:
  - Less stable- reduces number of particle to particle contacts
  - Permeable – air and water enters the mat, which shortens its life

Temperatures

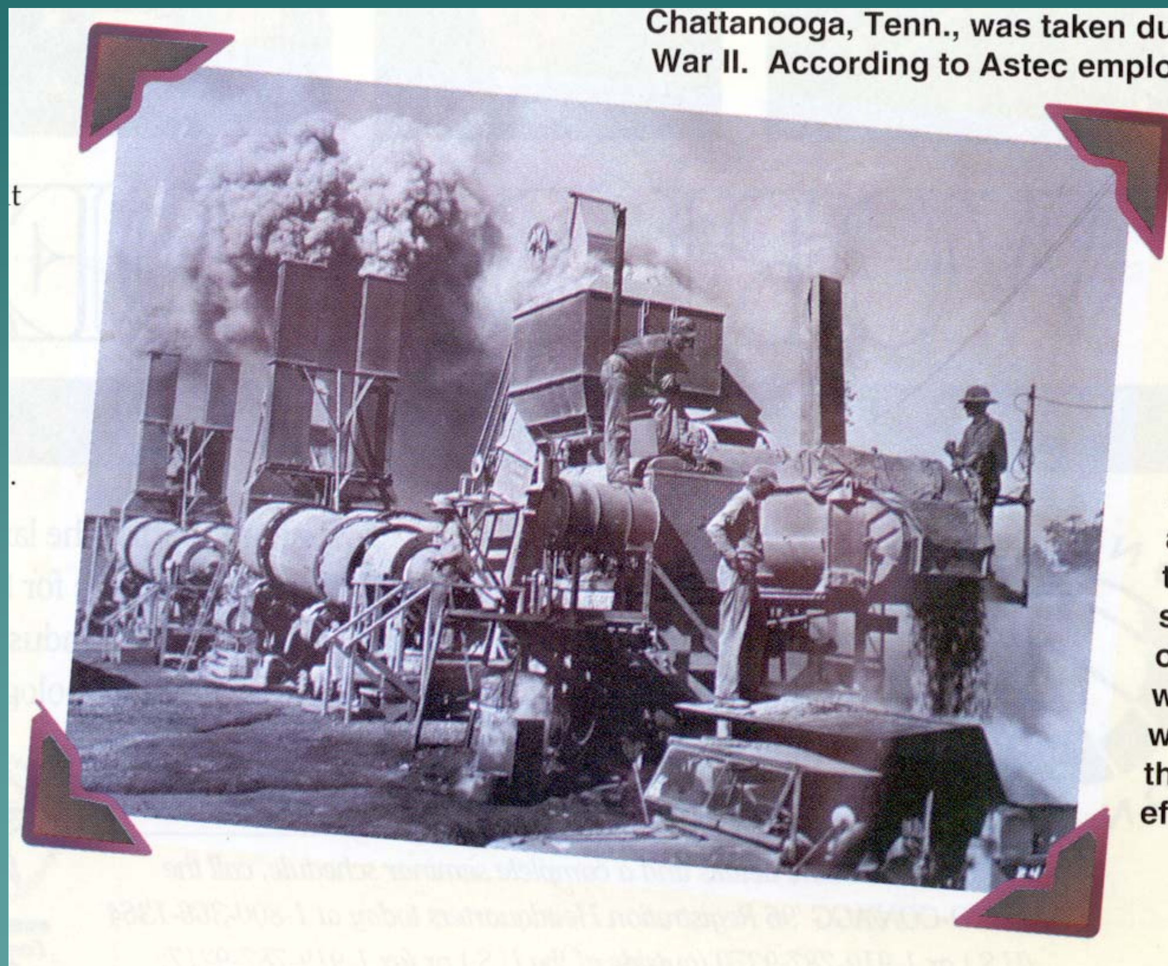
- Temperature changes asphalt cement properties. Temperature control is important.

- At plant
  - Aggregates dried and heated to minimum of 360°F
  - Bitumen heated between 250 and 350 °F
  - During mixing between 275 and 325 °F

Temperatures

- At the paving site, **do not**
  - Use asphalt delivered to spreader below 275°F
  - Apply HMA to a surface below 40°F (air) if a base lift
  - Apply HMA to a surface below 50°F (air) if a surface layer
  - Pave in the in the rain…

How We Mix It Is Important, Too



Today It's A Little Different

Batch Plant

- Batch Plants: A “batch” of mixed aggregate is blended with asphalt cement, discharged, and the process is repeated.

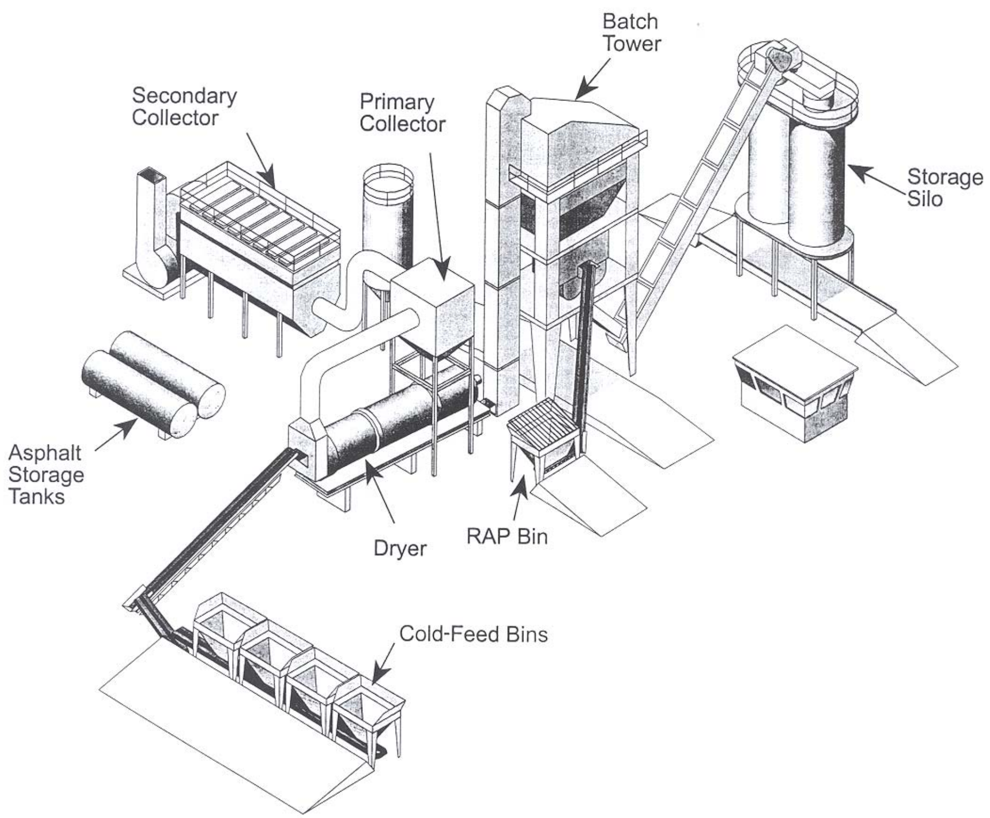


FIGURE 5-2 Major components of a batch plant.

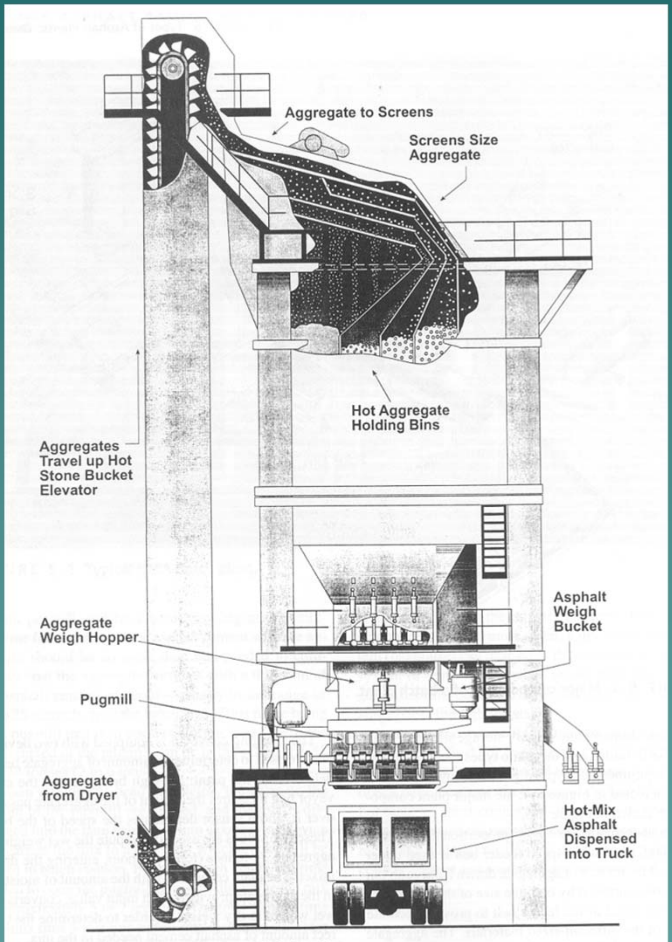


FIGURE 5-3 Flow of materials in batch tower.

Drum-Mix Plant

- Drum-Mix plants: Aggregate flows continuously into a drum, blended with the asphalt cement, and the mixture continuously is discharged.

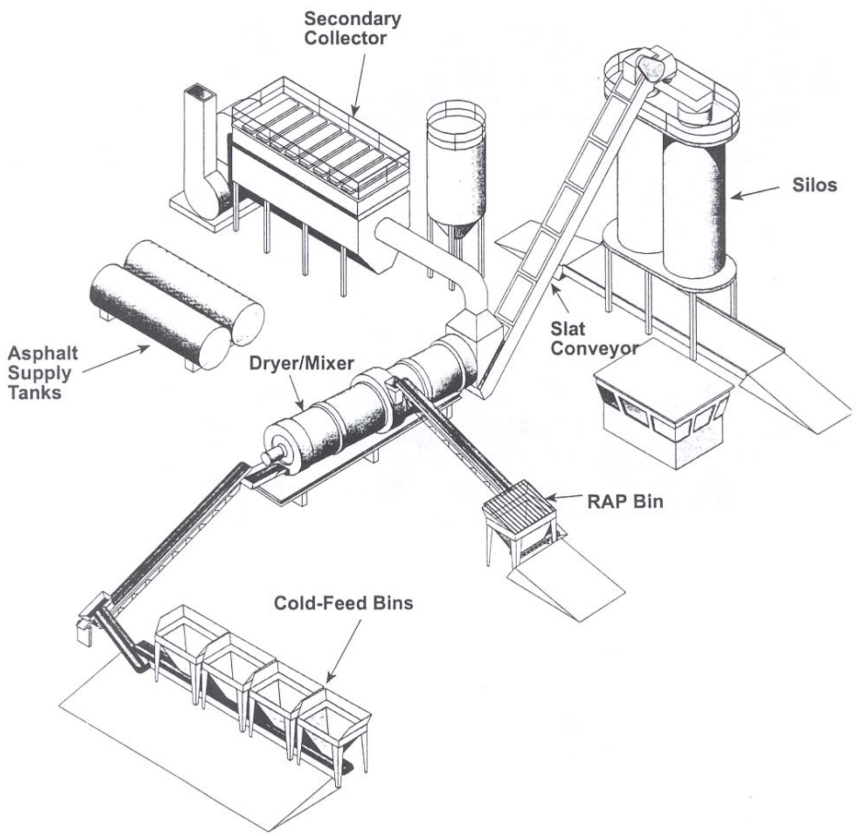
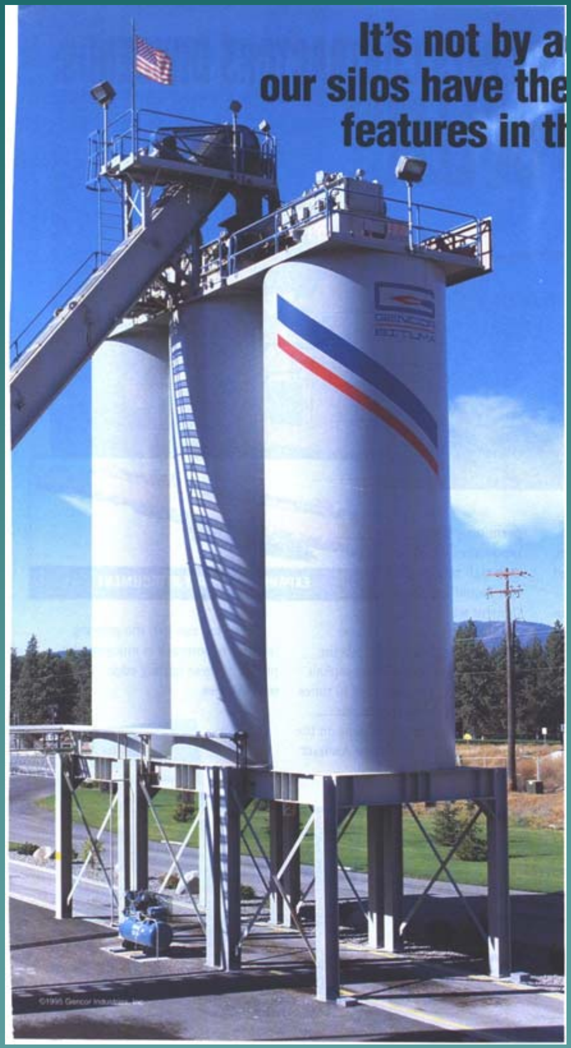


FIGURE 5-5 Major components of a parallel-flow drum-mix plant.

Hot-Mix
Asphalt Plants PDF

Storage



- HMA conveyed to insulated and enclosed storage bins, which must allow little loss in
  - Temperature
  - Asphalt migration
  - Segregation
  - Oxidation

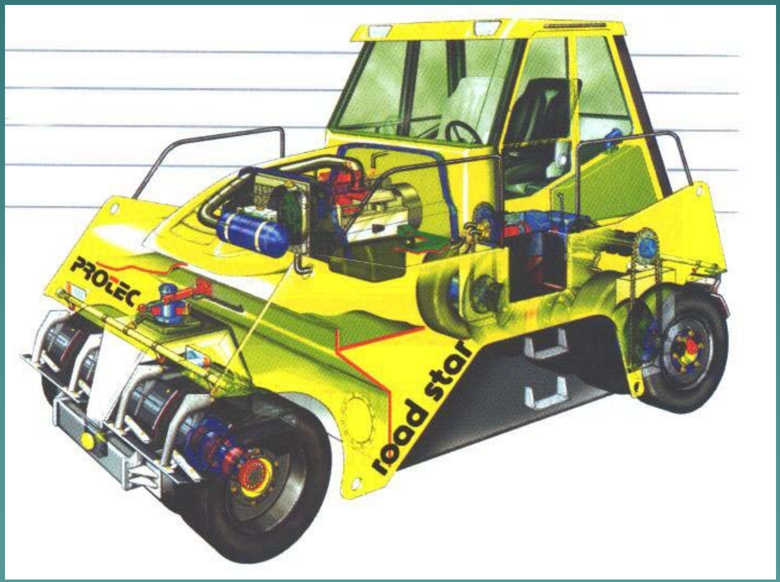
Hauling

- Trucks should have tight, smooth, metal beds cleaned of foreign materials
- Lubricate bed with approved release agents
- Cover with thick material to retain heat and protect product from weather
- You’ll record and pay by weight delivered
- Should have weight slips for each load


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

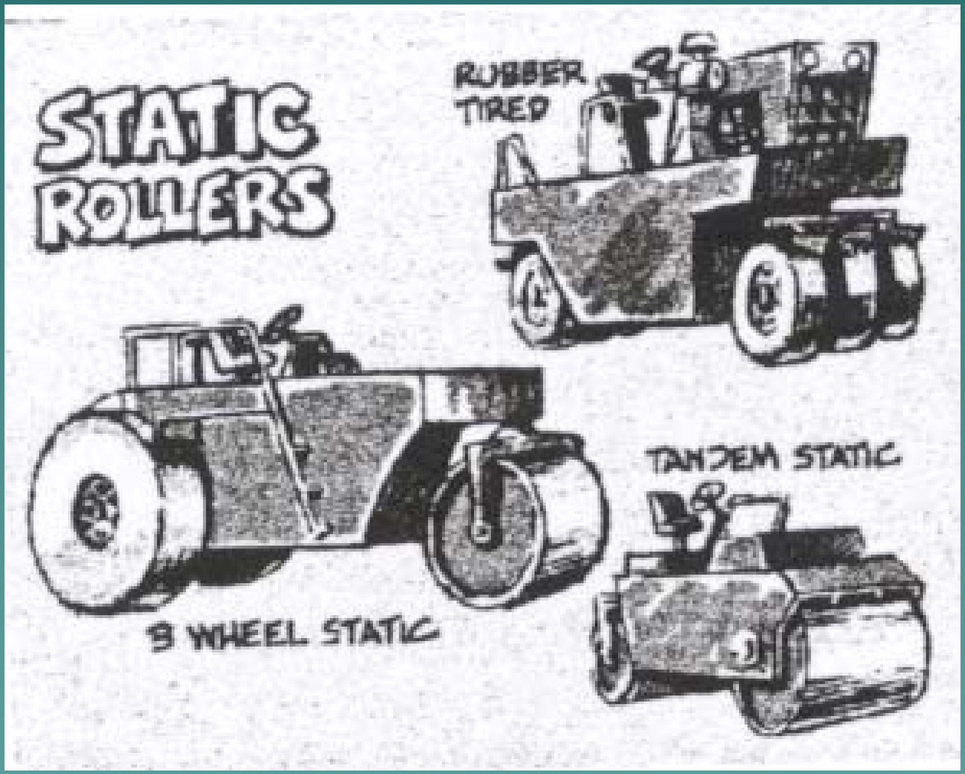
Compaction – Hot Mix

Why Compaction?



- Fresh from the paver, air voids make up about 15% of the volume of HMA (85% density)
- **Good** compaction reduces air to 5% (95% density)
- It also arranges aggregate for dense particle-to-particle contact

Rollers



- Initially with vibratory steel usually a 10 ton, roller
- Intermediate by a pneumatic-tired roller
- Final with a static or vibratory steel roller, or steel wheel 3-axle type, locked
- For base course can use dual vibratory steel drum rollers

HMA Compaction

- Roll parallel to the road centerline
- Maximum speed – 5 mph
- Base courses are rolled until density is obtained and all roller marks are eliminated
- Wearing courses are rolled until all roller marks are eliminated and 95% compaction obtained

HMA Compaction

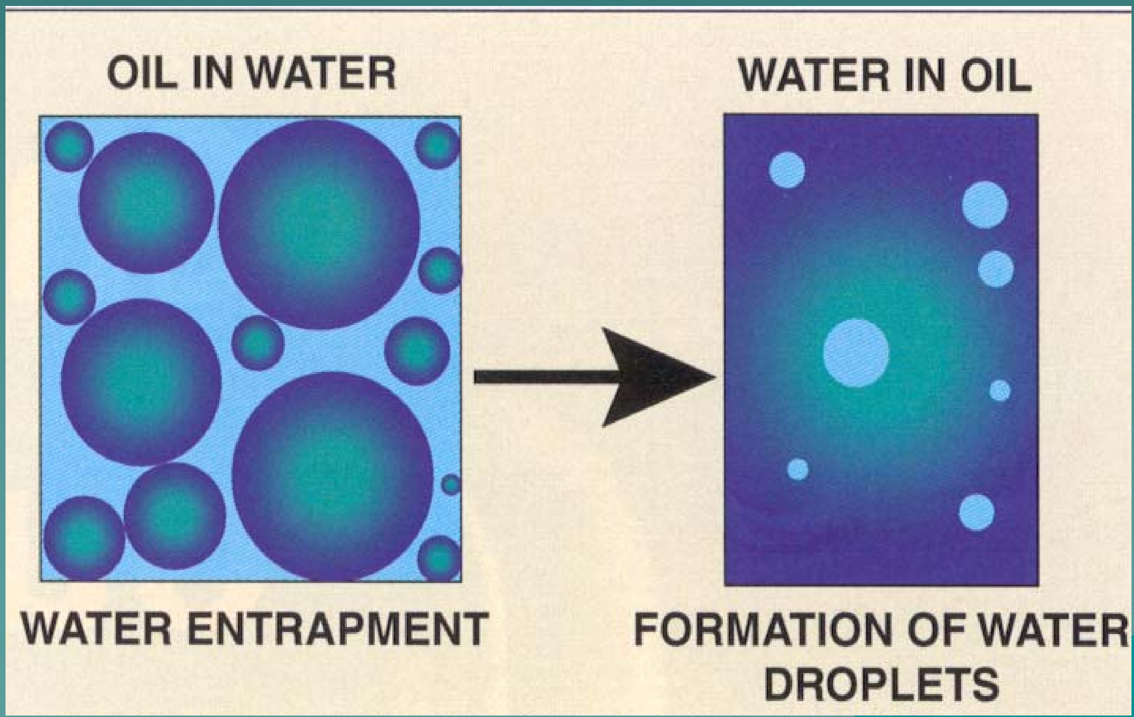
- For first lane, start at outside and progress toward road center
- When abutting previously placed lane, roll the longitudinal joint first, then outside toward road center
- Overlaps:
  - Wheeled rollers – 1/2 roller width
  - Vibratory rollers – 6 inches
  - Pneumatic-tired rollers – no overlap required

Compaction Issues

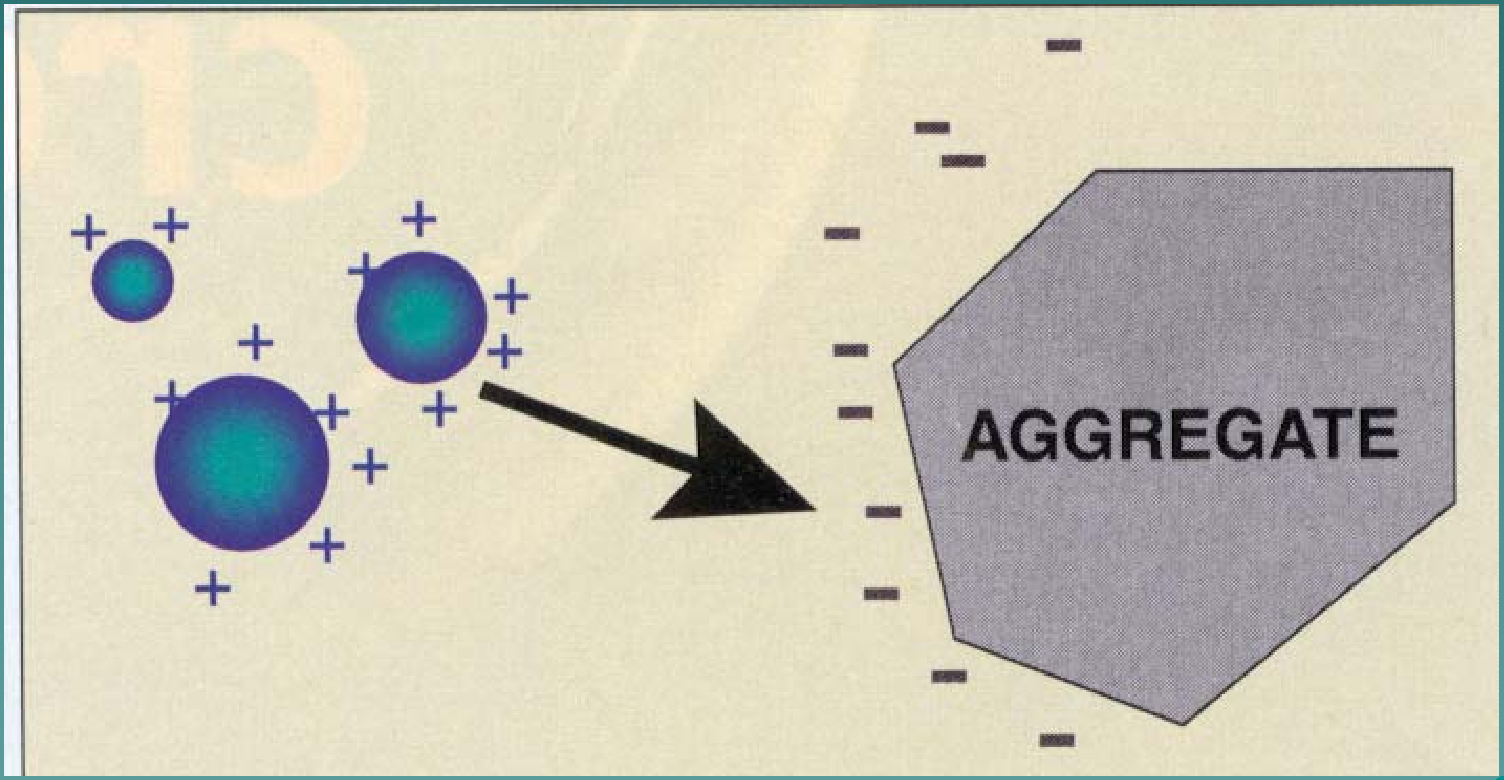
- What does the specification call for?
- Can you
  - Over roll?
  - Roll too early
  - Roll too late?
- Do you have the right weight roller?
- Do they have a temperature gun?
- Should the vibrator be on or off?
- How does these affect the end product?

What Are Emulsions?

- Asphalt (55-70%)
- Water
- Soap or emulsifiers



Cationic (+) or Anionic (-)



Cationic (+) or Anionic (-)

- Emulsions classified by electrical charges surrounding the particles
  - Cationic emulsions have positively charged particles
  - Anionic emulsions have negatively charged particles
- Select opposite of aggregate charge
  - Anionic for limestones
  - Cationic for siliceous materials (e.g., granites)

Grades By Setting Time

- Emulsions are classified by the relative time to return to the state of the original asphalt cement
  - RS Rapid Set
  - MS Medium Set
  - SS Slow Set
- Above notation indicates an anionic emulsion
- A “C” in front indicates cationic; e.g., CRS
- HFMS indicates a “high float; medium setting” emulsion, which can be laid in thicker films

Applications For Emulsions

Uses	Grade
Tack coat	RS-1, MS-1
Chip seal	CRS-2, CMS-2, HFMS-2, MS-5
Polymer modified chip seal	CRS-2P
Sand Seal	MS-5
Cold mix	CMS-5, HFMS-2, SS-1, SS-2
Stockpiled cold mix	MS-4

Other Uses

COUNTY COMBINES RAP PLUS EMULSION TO EQUAL SUCCESS

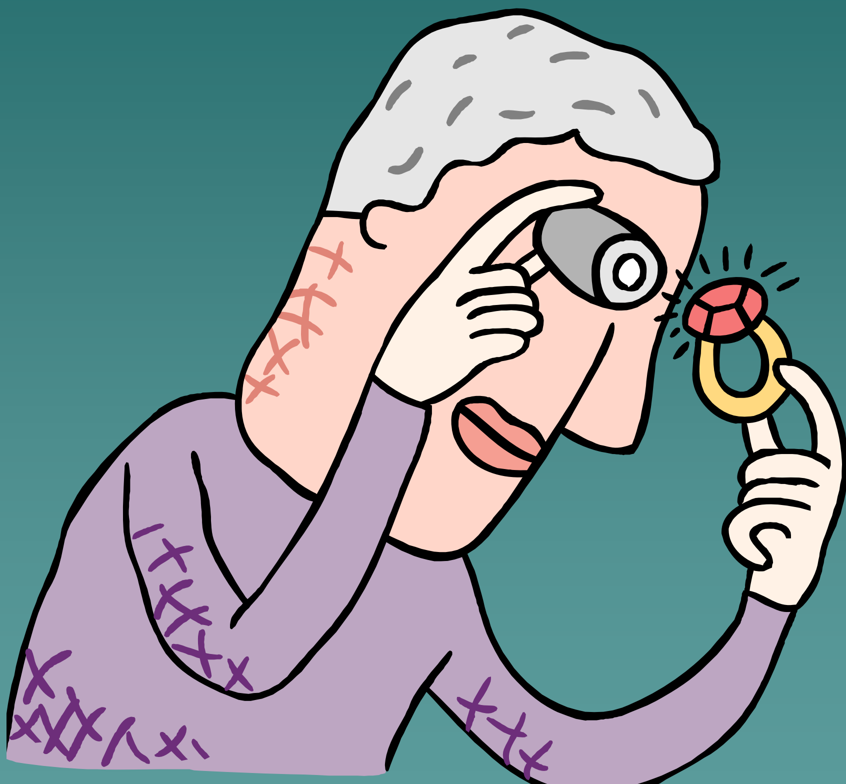
Innovative formulation results in quality, cost-effective roads for one Nevada county

Emulsions at work

Four years ago, Douglas County, Nevada, found itself in the middle of a dilemma. On the up side, the county's population was exploding — 10 times over what it had been 30 years before, in fact. On the down side, however, the county was faced with limited funds for increased road construction to accommodate the population growth. The valley's predominantly residential and farming communities provided minimal tax revenues for road construction.

The challenge present-

Proper Inspection



- Who's paying attention
- Who owns the final project?
- Who maintains the final project?
- Can you afford not to inspect?

Pavement Placement Tips

Visual Inspection of HMA

- **Blue Smoke – the temperature should be checked – it may be overheated**
  - **Other indications of overheated HMA**
  - **looks like coffee color – bubbling – snapping, could be burnt A/C**
  - **crackling sound (like Rice Crispies)**

- Temperature range should be as listed on the JMF – +/- 10 degrees F.

- Or in the range below:
- Max - 325°F

(have up to 14 min. to get density @ 60 deg. F)

- Min - 275°F

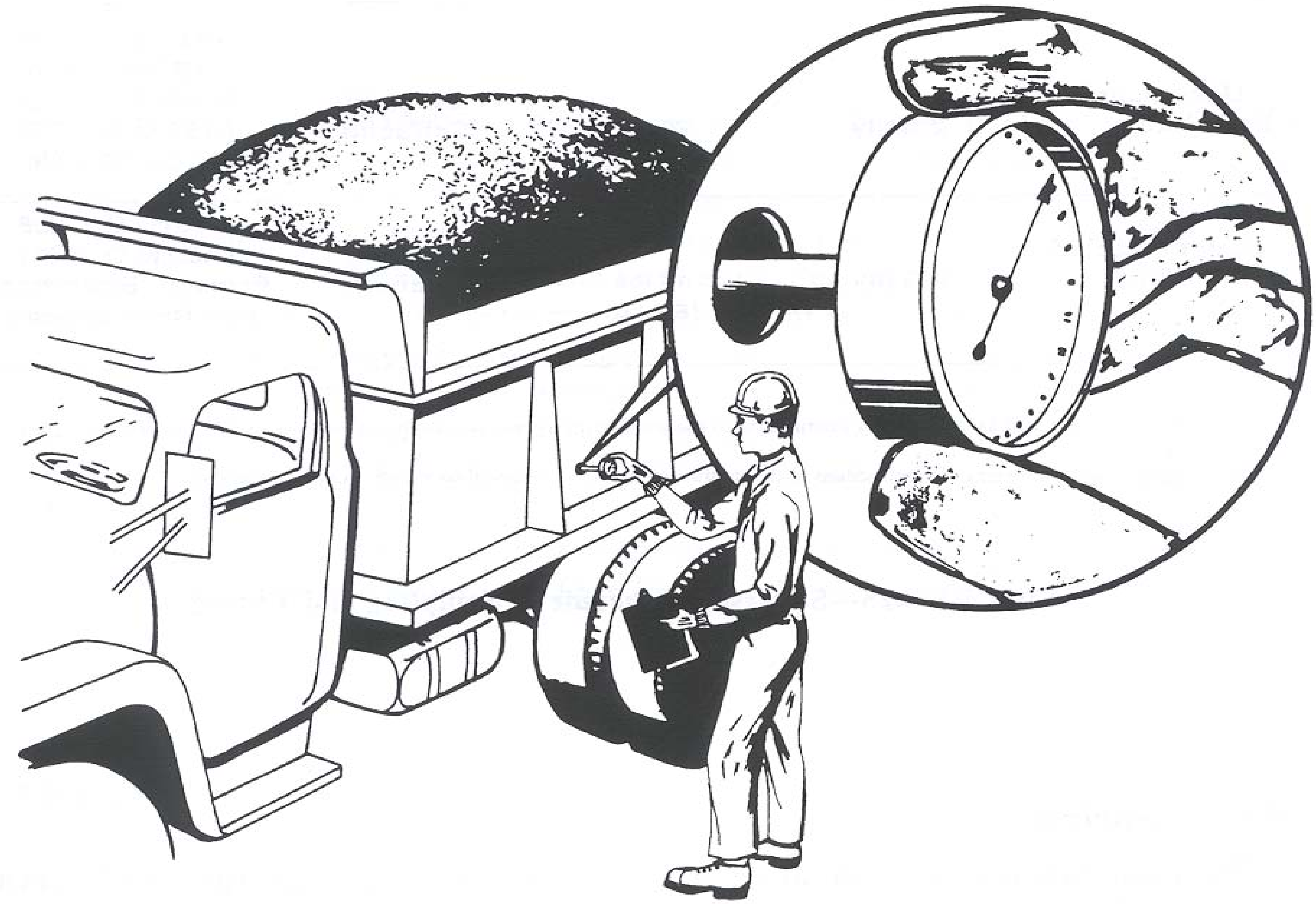
(have about 4 min. to get density @ 60 deg. F)

Polymer Asphalts may have a different range

Stiff Appearance

- – if it has an unusually high peak – or –
- as it's being dumped, it comes out in large chunks – it may be too cool.

- **Take the temperature……**



Do You Own A Gun?

- An inexpensive tool to protect assets
- Asphalt delivered to spreader below 275°F
- Air below 40°F if a base layer
- Air below 50°F if a surface layer
- Not for acceptance

Mix Slumped in Truck

- – mix is normally in the shape of a dome in the truck body. If it lies flat or nearly flat, it may contain too much asphalt – or excessive moisture (rising steam)

Mix peaked In the Truck

Lean, brown, dull appearance – **may contain too little asphalt**

Segregation

- – can happen with stockpiles – while dumping
- Lose ability to properly compact
  - Rough surface texture as mat is being laid
  - Stays porous looking after compaction

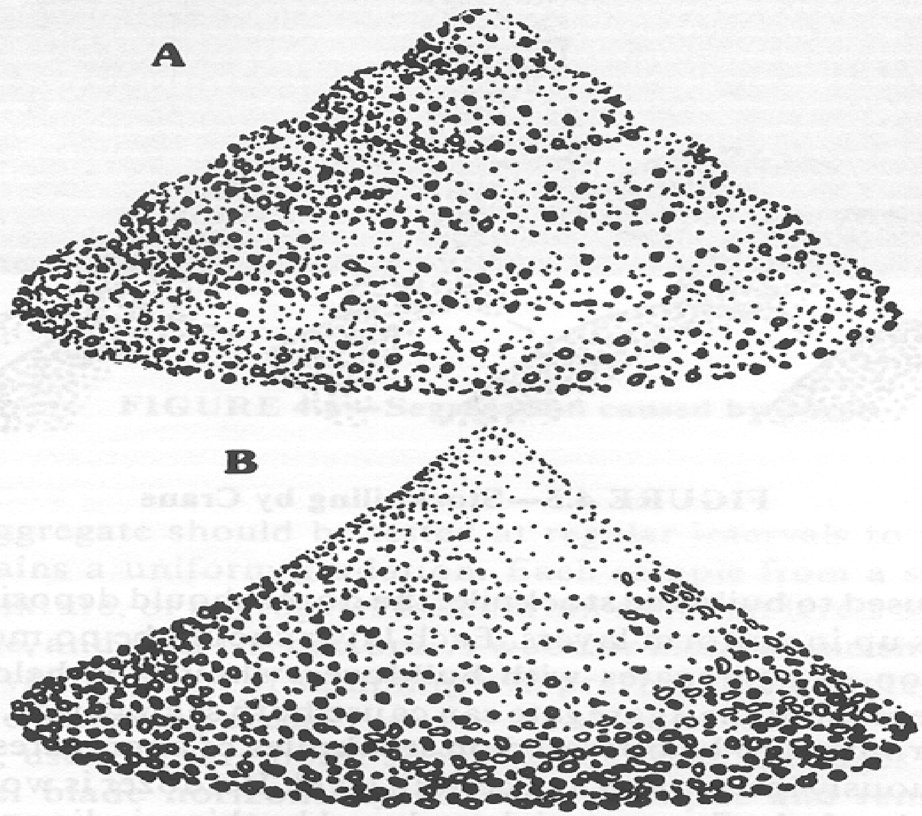


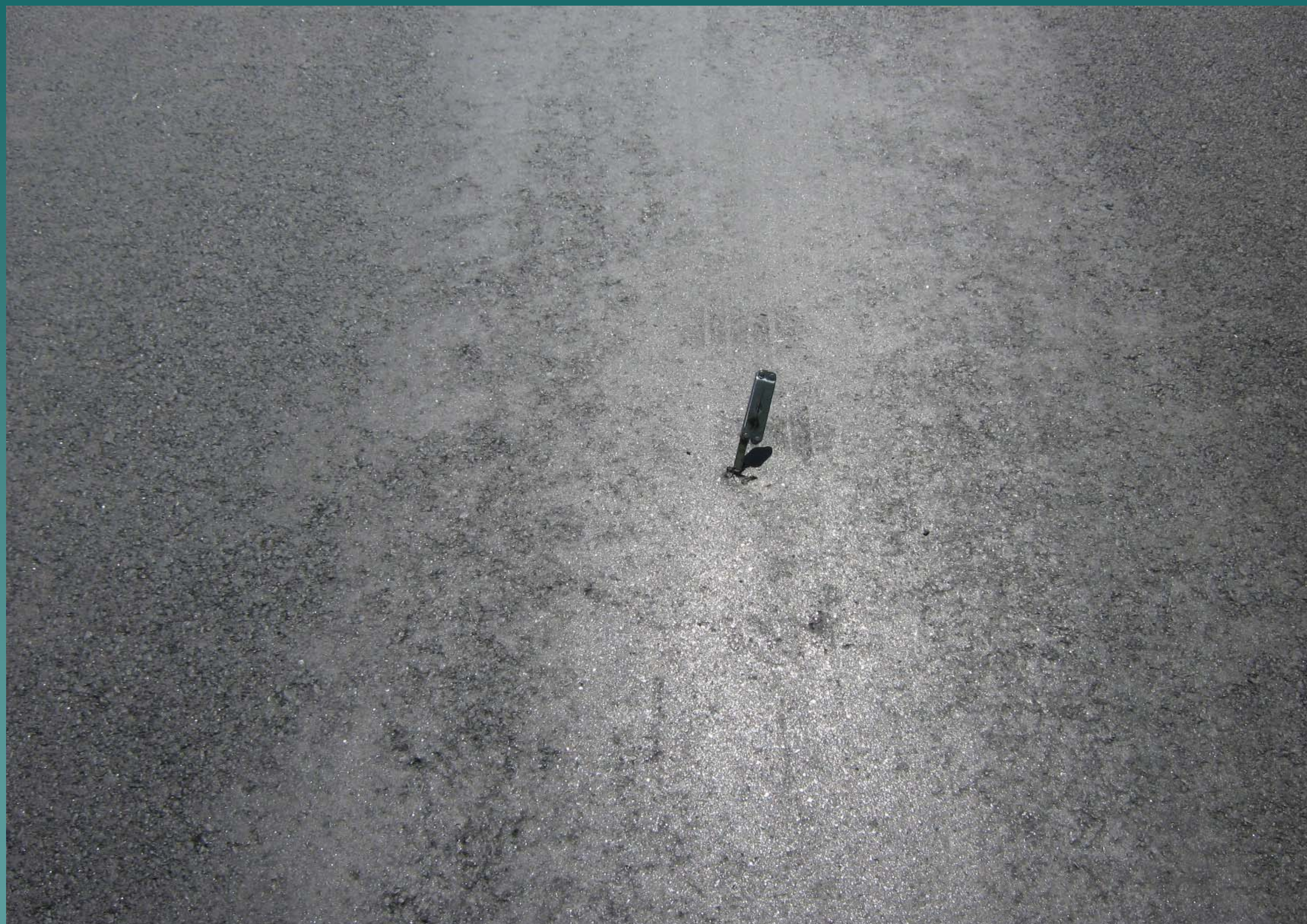
FIGURE 4.4—(A) Correct and (B) Incorrect Methods For Storing Aggregate Containing Large and Small Particles.

Contamination

❖

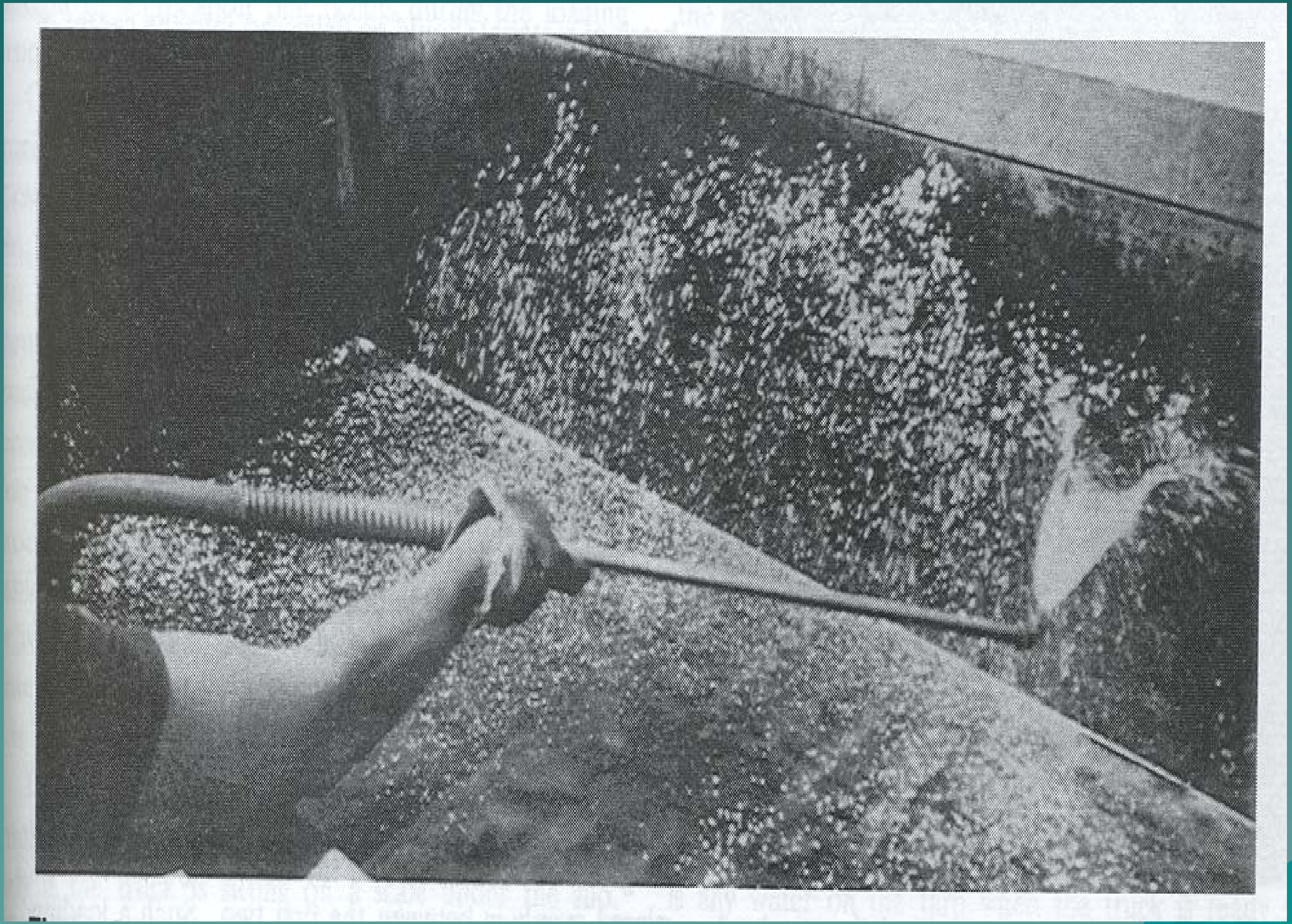
- ❖Dust on mix from plant – keep an eye out for this if the plant seems to be having a hard time to keep running. Make sure to check the first few trucks if the plant has been down

- ❖Diesel fuel – is sometimes used to clean out the dump bodies. The mix absorbs the fuel – which in turn dilutes the asphalt – causing it to ooze to the surface – causing FAT-SPOTS & BLEEDING and fail.



- Release agents – such as soap, lime water, approved release agents

Can be used to eliminate fuel contamination



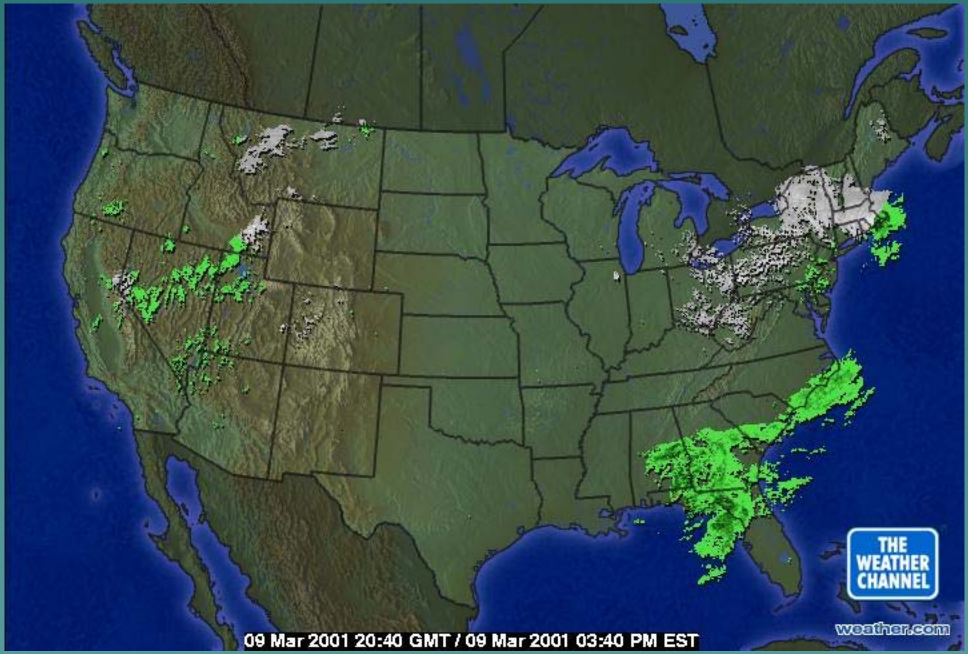
Diesel Fuel SHOULD NOT BE USED

May result in a QCP violation and removal of the mix

Top Ten Tips

- Weather
- Base
- Load tickets
- Dumping
- Proper head of material
- Screed
- Yield
- Longitudal joint
- Rolling

Weather


THE WEATHER CHANNEL
09 Mar 2001 20:40 GMT / 09 Mar 2001 03:40 PM EST
weather.com

Weather

- No precipitation – don't pave in the rain
  - Light Mist – MAYBE – if you are pave your base course of Mix over gravel (contractors discretion)

- Temperature
  - 40º for base and shim courses
  - 50º for surface courses

How's my base?

- Is the gravel ready to pave?

- Does the roadway need milling?

- Shimming?

Base

- The condition of the base – directly affect the quality of the placement of the pavement – also placing a direct effect of the life of the pavement

- Think tack

  If overlaying on existing pavement – we want to see a TACK coat

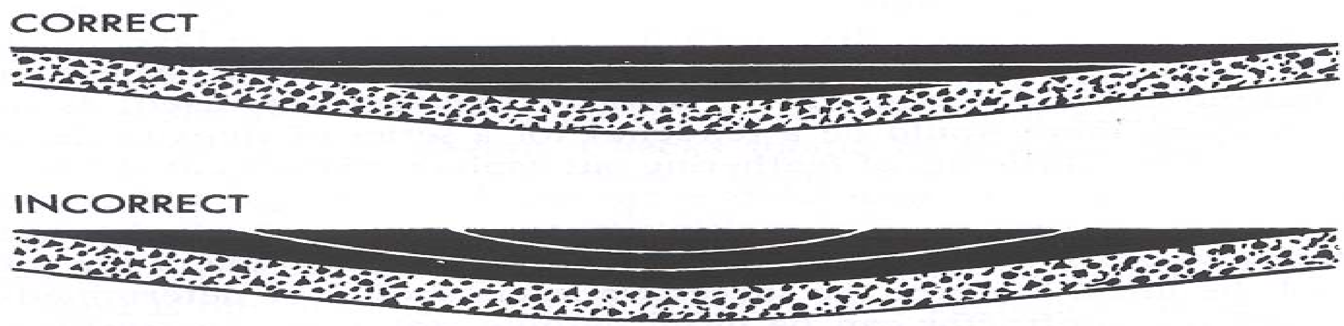


FIGURE 5.3—Correctly Placed Leveling Wedges Ensure Smoother Pavements.

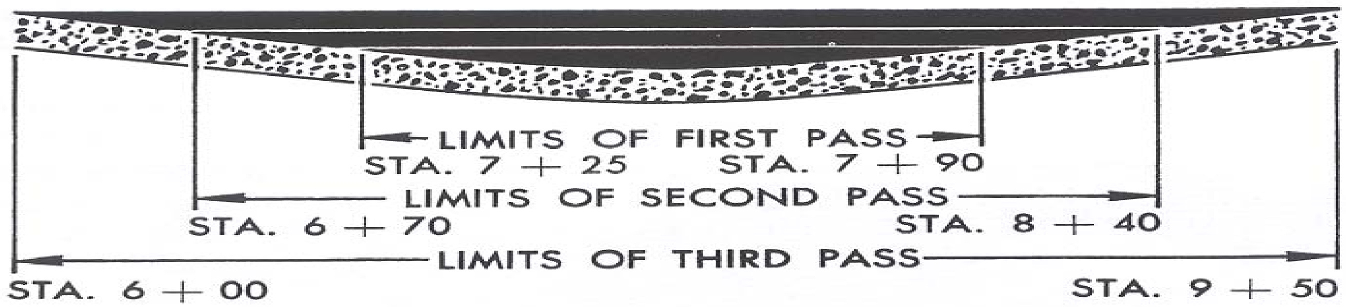


FIGURE 5.4—Limits for Multiple-Layer Leveling Wedges Should be Determined by Level.

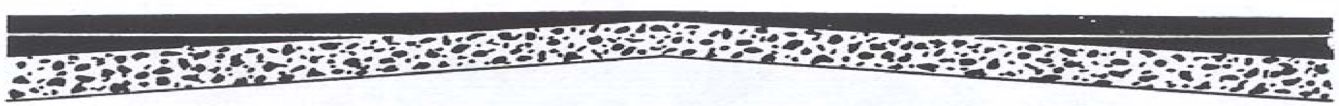
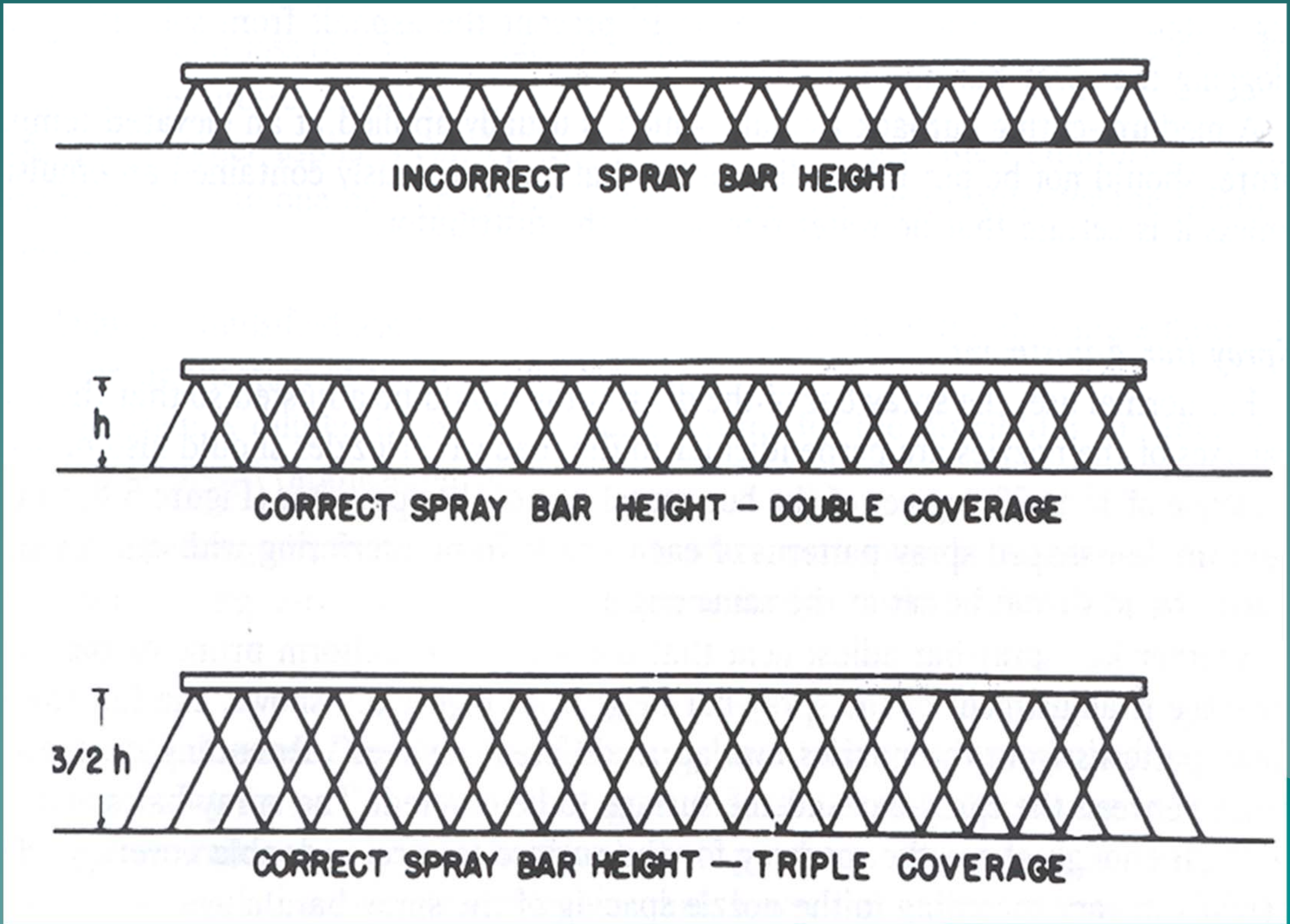


FIGURE 5.5—Correctly Placed Leveling Wedges for Overcoming Excessive Crown.

Think tack (emulsion)

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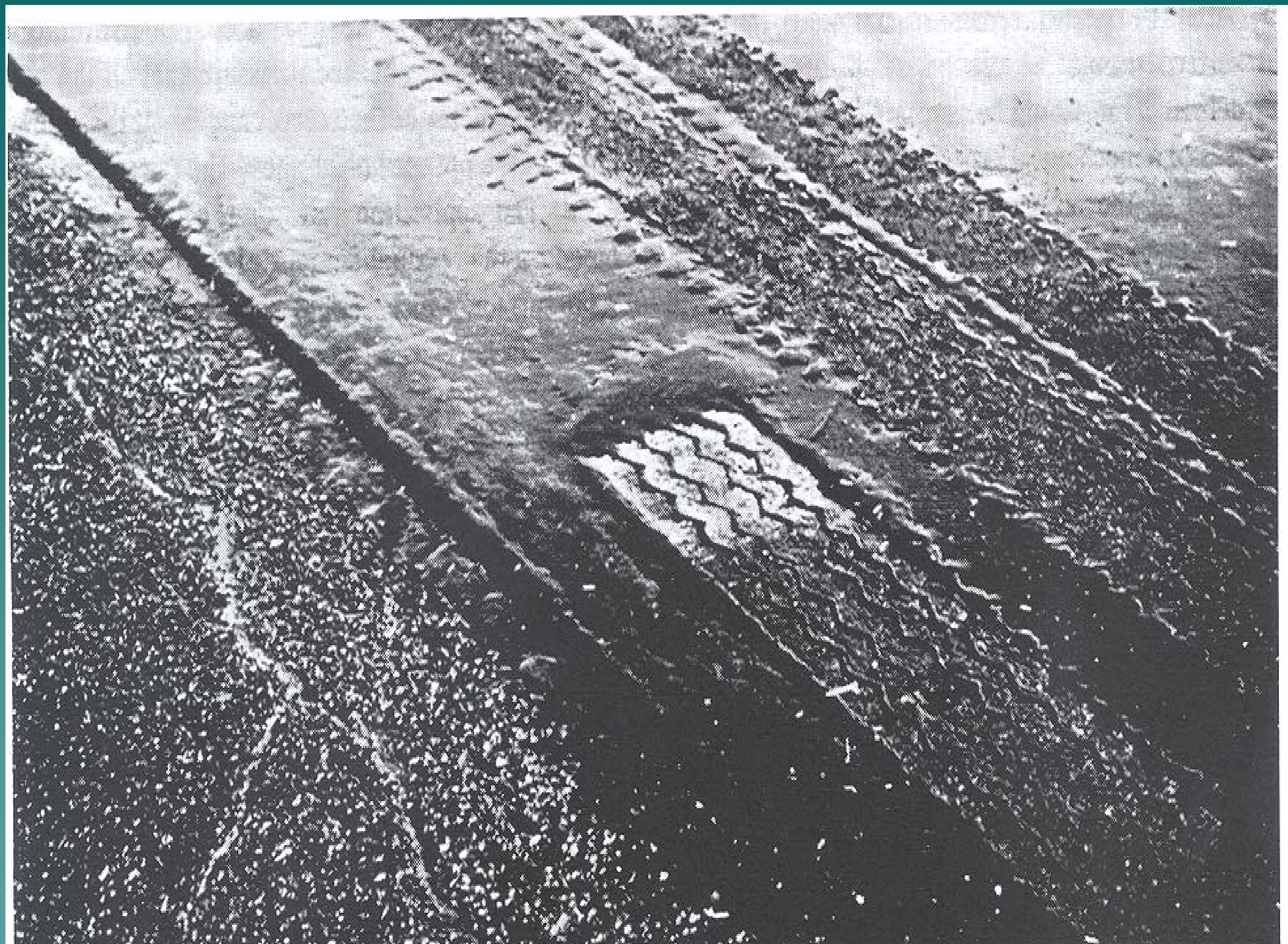
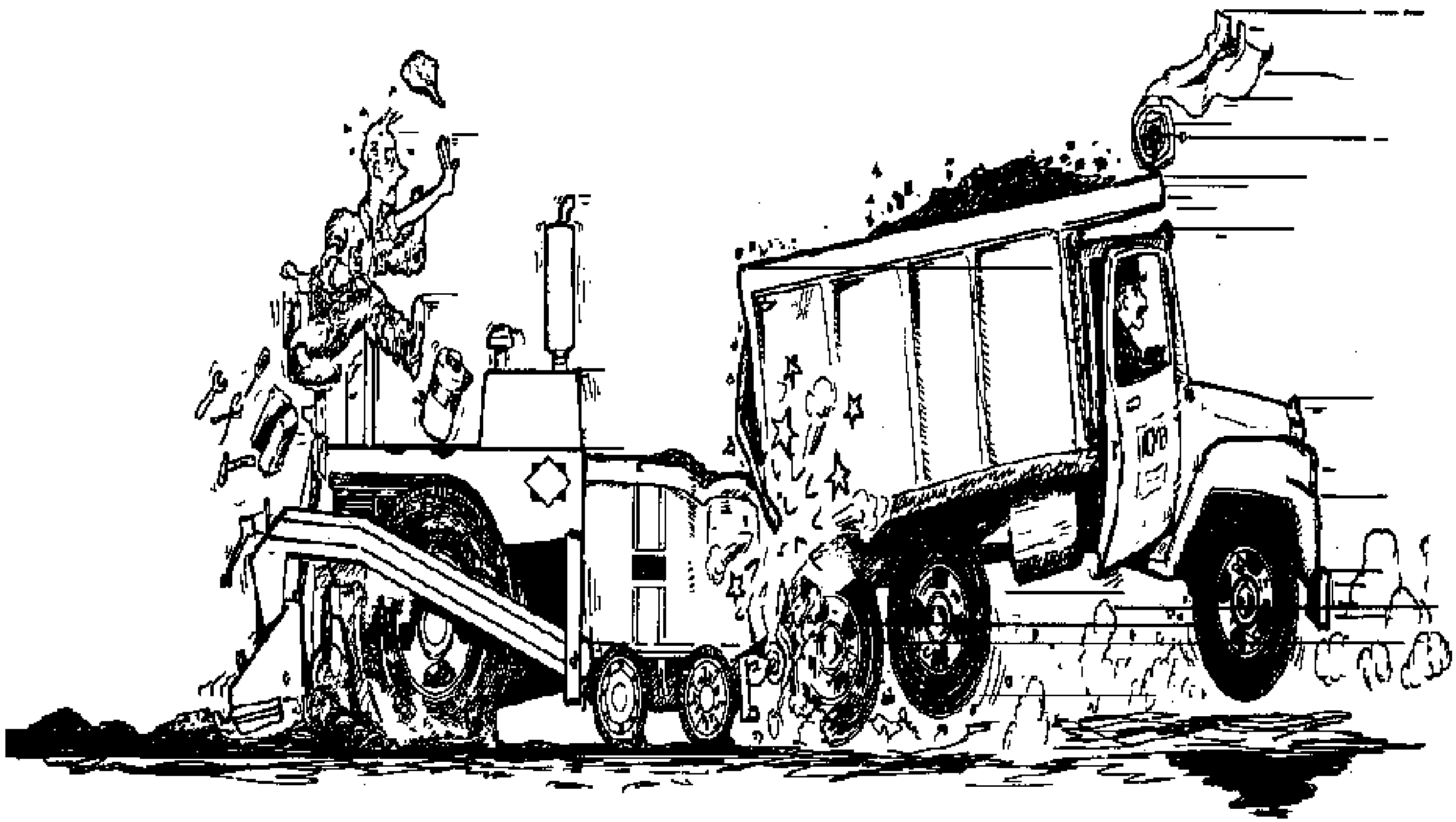


Dumping

- **Bumping into the paver should be avoided – as this will affect the screed angle and the uniformity of the mat – it is a common cause of marks and ridges**

You don’t want to see the truck overfill the hopper so that the mix spills in front of the paver – if it happens – don’t be shy – tell ‘em to shovel it up!

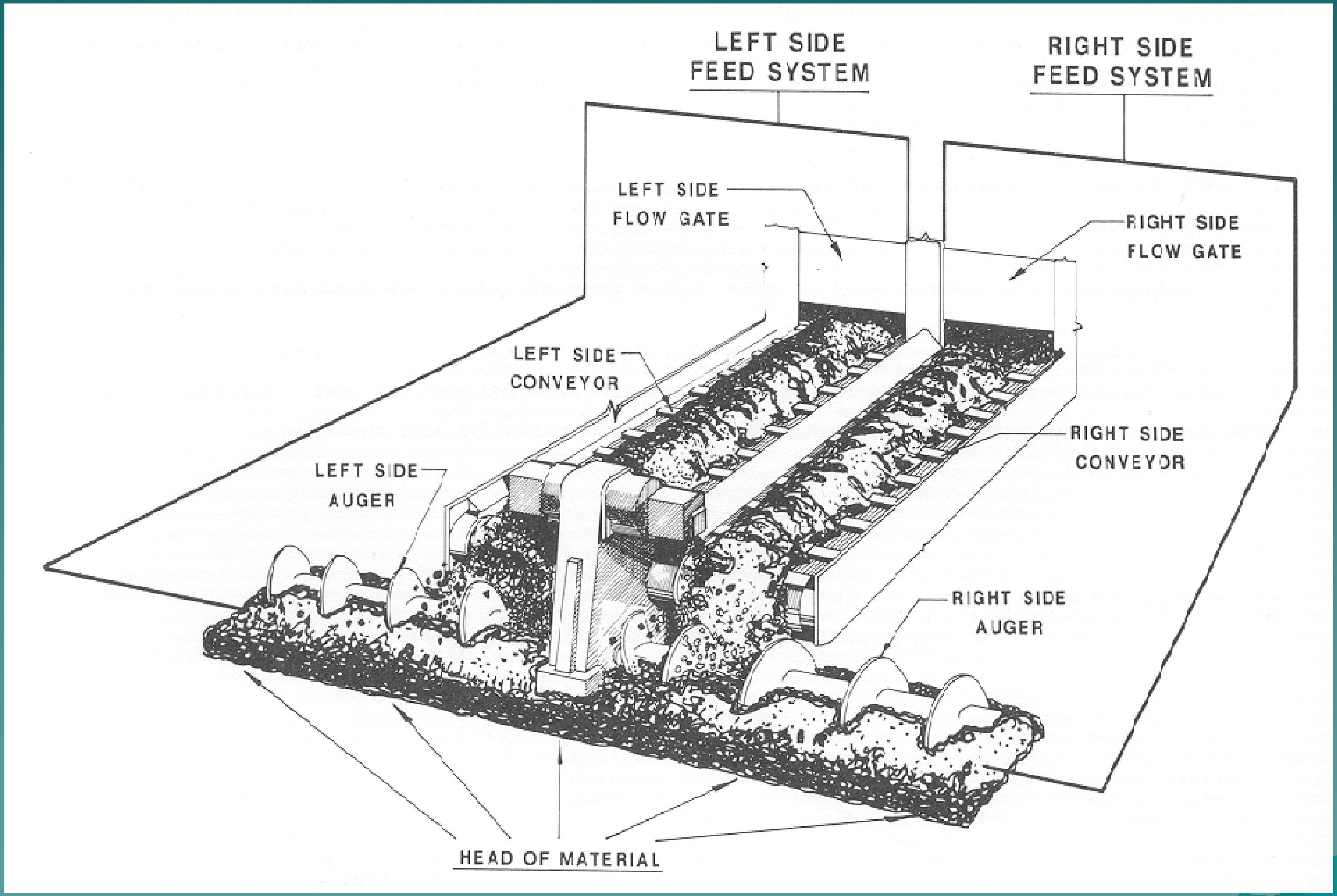


Load Tickets

- Issued at the plant
  - Numbered consecutively
  - They state the project number
  - The origin of the load
  - Truck weight and number
  - Type of mix – gradation – asphalt content – JMF
  - Sometimes even the temperature of the mix

Proper head of material

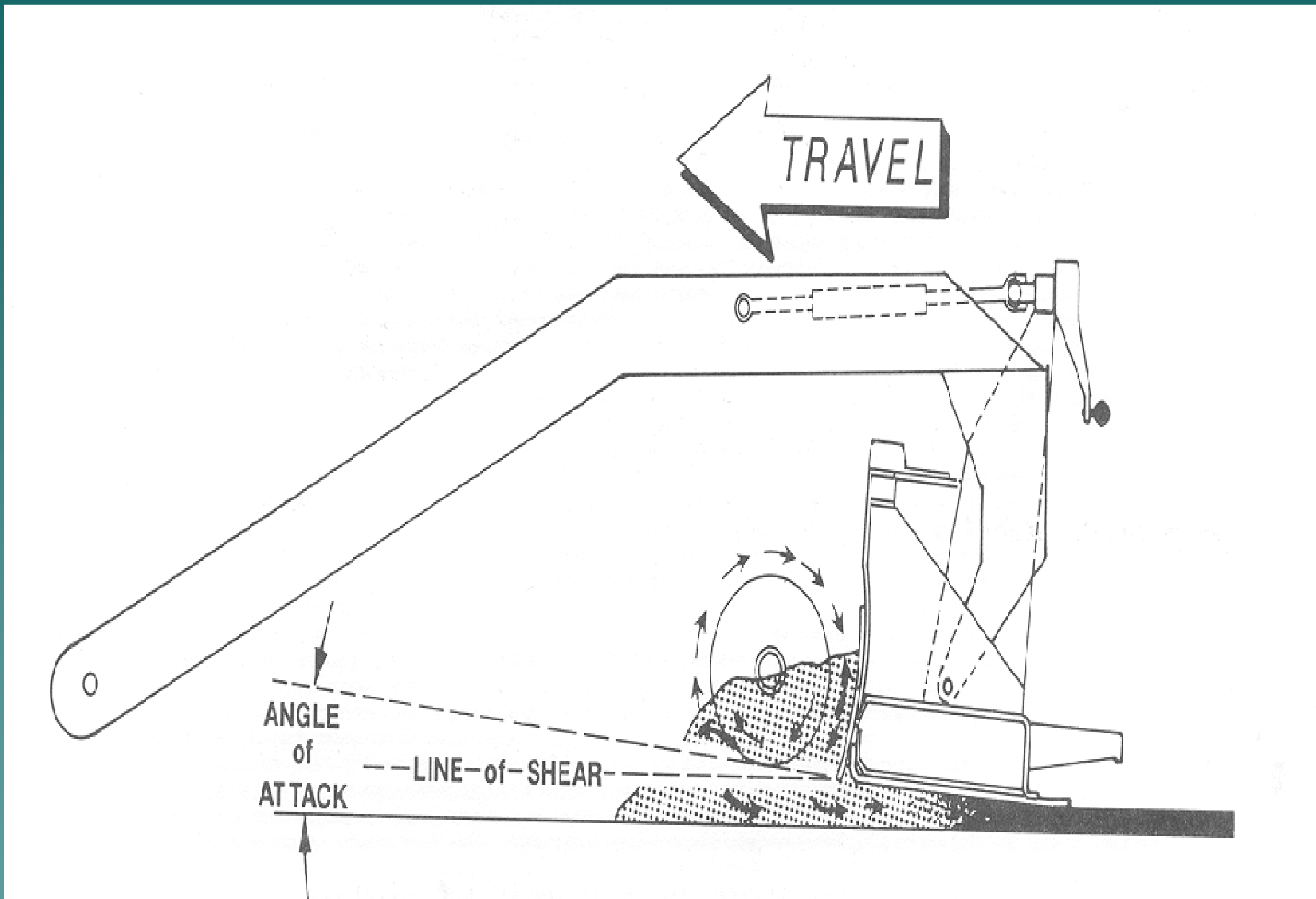
- Conveyor – you want to see mix left in the hopper between dumping of trucks – if not – you will keep a proper head of material fed to the auger. This will affect the density of the mat.


LEFT SIDE
FEED SYSTEM
RIGHT SIDE
FEED SYSTEM
LEFT SIDE
FLOW GATE
RIGHT SIDE
FLOW GATE
LEFT SIDE
CONVEYOR
RIGHT SIDE
CONVEYOR
LEFT SIDE
AUGER
RIGHT SIDE
AUGER
HEAD OF MATERIAL

Screed

- The condition of the screed will directly effect the quality of the mat

- Causes that effect uniformity
  - Inconsistent paver speed
  - Truck bumping paver
  - Truck holding brakes
  - Poor condition of screed


TRAVEL
ANGLE
of
ATTACK
LINE-of-SHEAR

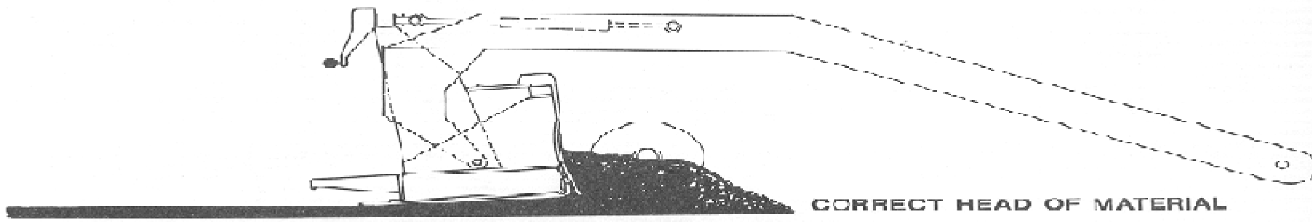


Figure 8

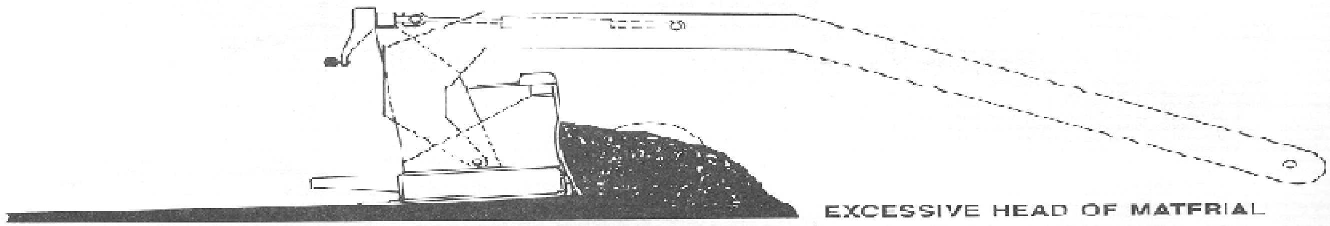


Figure 9

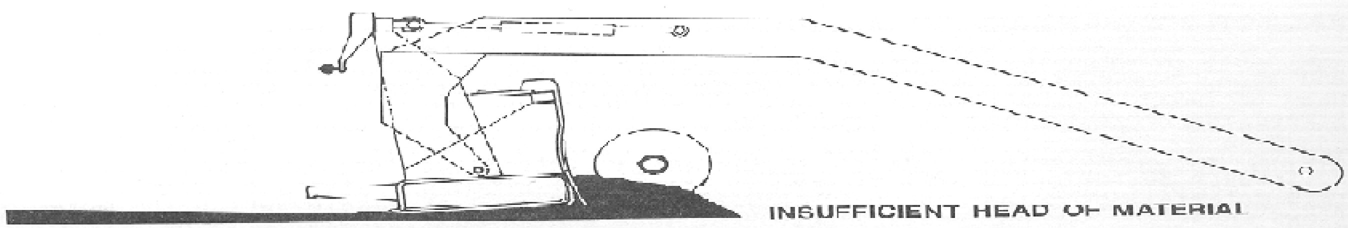
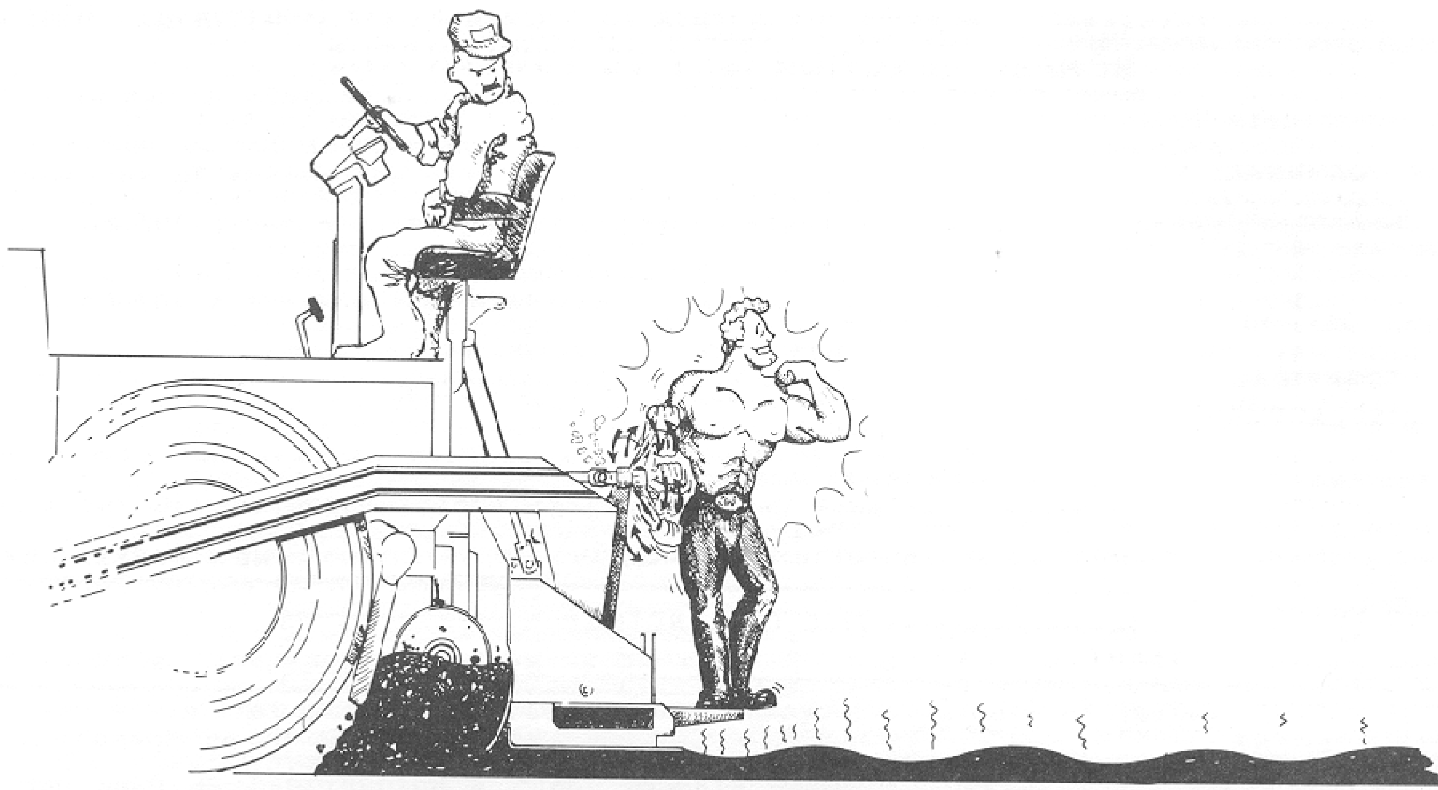


Figure 10

Remember

One full turn of the Depth Crank makes ¼" difference in the depth of the mat

It takes 5 lengths of the paver before the difference is made up for one full turn of the depth crank!



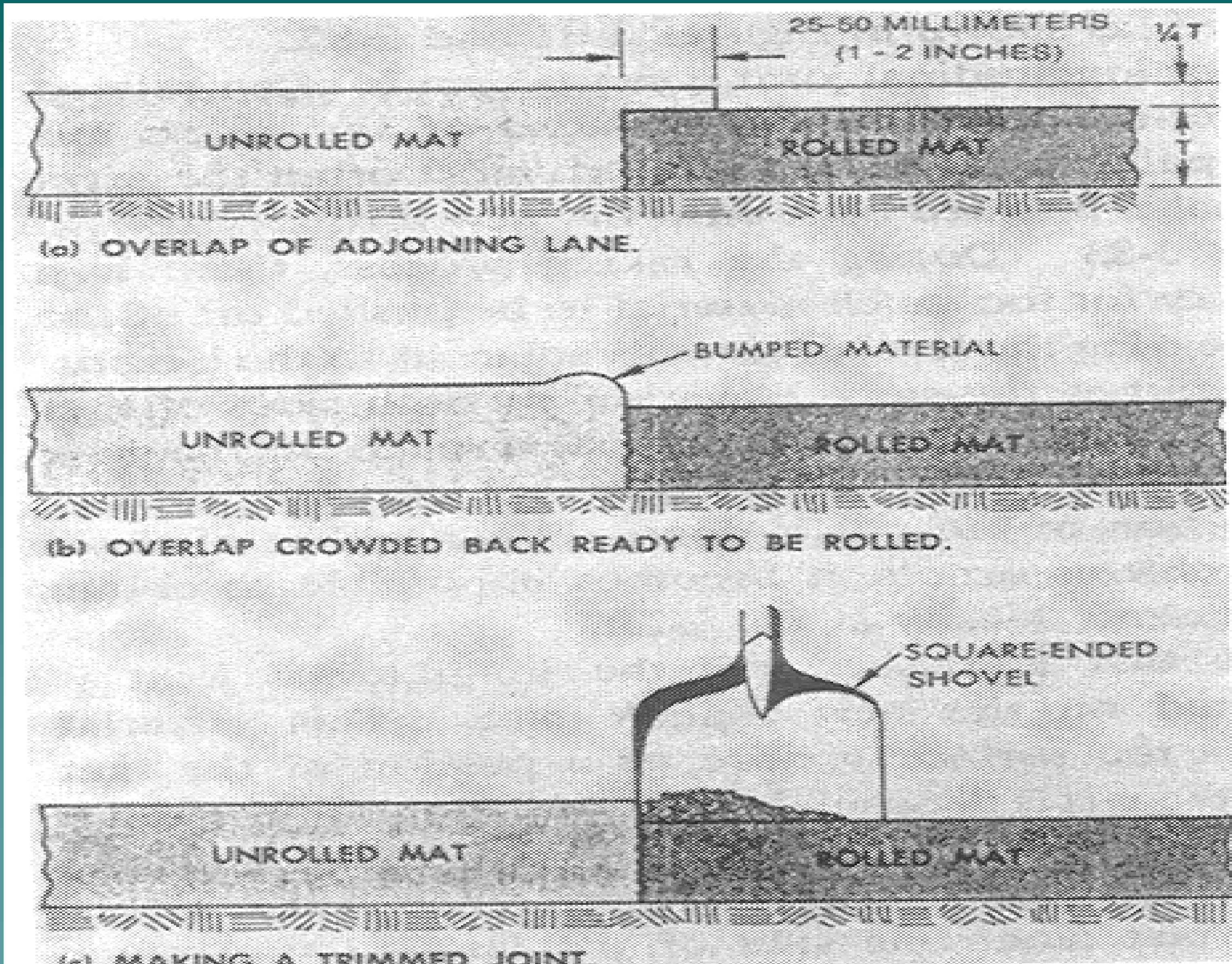
"WINDMILL JOHNNY" PUTS THE "WAVES" IN THE MAT!

Yield

- Yield in proper proportion to L * W * H
- ¼ inch fluff rule – for every inch of compacted mix – you want to measure 1¼” of uncompacted HMA
- Nominal – of, being, or relating to a designated or theoretical size that may vary from the actual

Longitudal joint

- Screed extension out 1½ to 2 inches
- Tack – we want to see tack
- Raking - we don't want to see excessive raking – we want to see them gently push the mix to the joint


25-50 MILLIMETERS
(1 - 2 INCHES)
¼ T
T
UNROLLED MAT
ROLLED MAT
(a) OVERLAP OF ADJOINING LANE.
BUMPED MATERIAL
UNROLLED MAT
ROLLED MAT
(b) OVERLAP CROWDED BACK READY TO BE ROLLED.
SQUARE-ENDED
SHOVEL
UNROLLED MAT
ROLLED MAT
(c) MAKING A TRIMMED JOINT.

Rolling

- Vibratory – have two types of compactive forces
  - Static weight – which is the weight of the roller caused by the weight of rolls and frame
  - Dynamic (impact) force – the vibrator inside the drum

Rolling

- **Steel Wheel Tandem – usually a minimum weight of 10 ton** (usually vibratory)

- **Pneumatic tired – they provide a more tightly knit, traffic resistant surface than steel**

Roller Speed

The speed of the rollers can greatly effect the compaction of the HMA

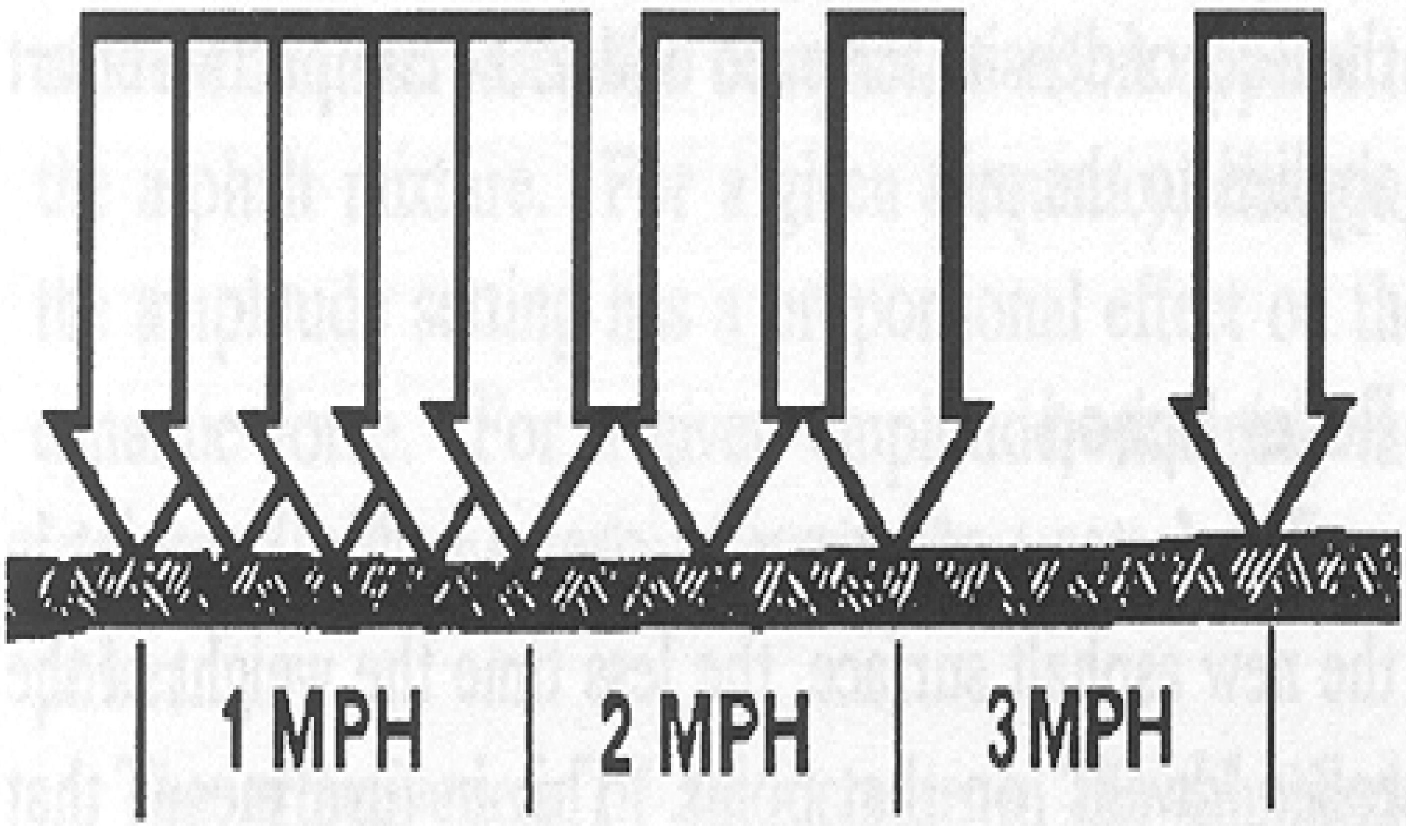


Figure 3-97. Effect of roller speed on impact spacing (*Asphalt Institute*).

Sequence of Rolling Operations

- Initial (breakdown) rolling – The first pass of the roller on the freshly placed mat. Most of the density comes from this roller
- Intermediate Rolling – All subsequent passes by the roller(s) to obtain required density before the mix cools to 185ºF
- Finish Rolling – Rolling done mostly for small increase in density, and improvement of the surface while the mix is still warm enough

Testing

- Material testing is critical to job performance and durability
  - Aggregates
  - Asphalt
  - Combined product
  - Compaction (density)

Understanding Mat Defects

- Presentation format
  - -- symptom
  - -- cause
  - -- prevention
- Continual learning process
- Doing fundamentals right is the key

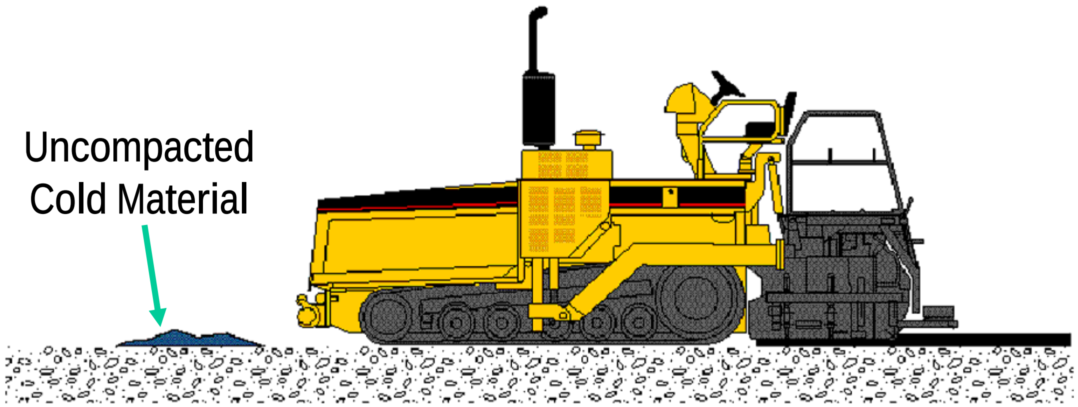
Grade Conditions

- Mat defects from grade conditions are unrelated to paving techniques
- High or low spots cause striping and mat damage
- Uneven compaction
- Correct grade defects or adjust paving

Material Dumped on Grade

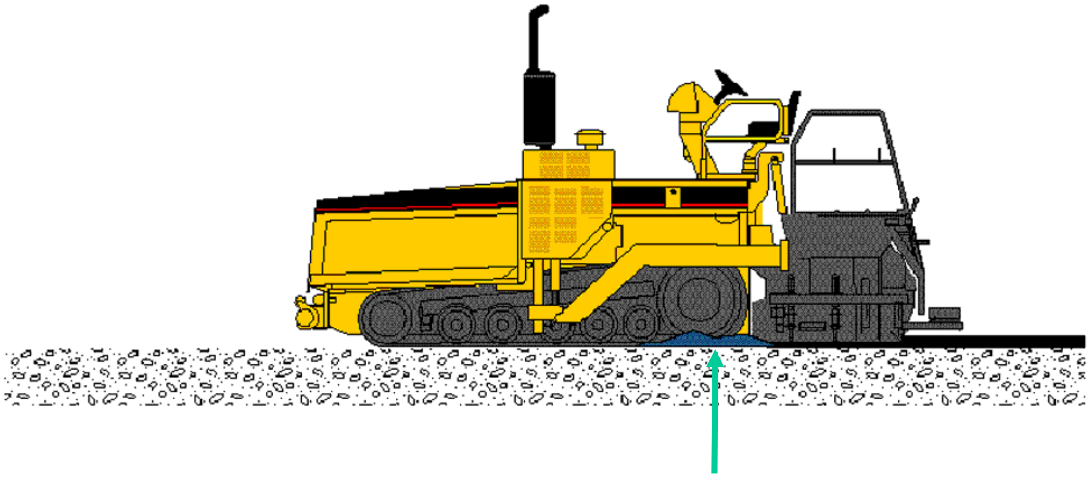
- High spots caused by mix dumped on grade
- Trucks clean out pulling away from paver
- Direct trucks away from paver to clean out

Material Dumped on Grade



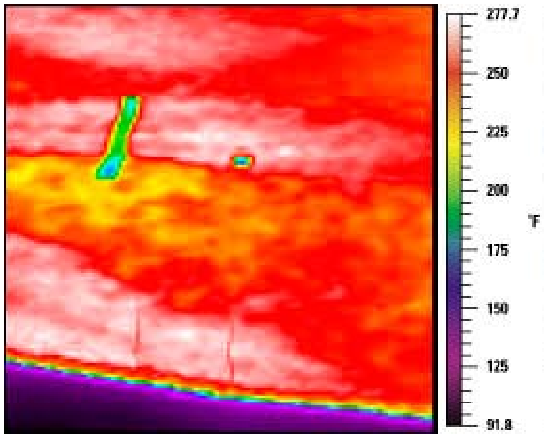
- Small volumes of uncompacted mix cause defects
- Cold mix creates temperature variations

Material Dumped on Grade



- Fresh mix laid over cold piles
- Cold mix just under surface or partially exposed

Material Dumped on Grade

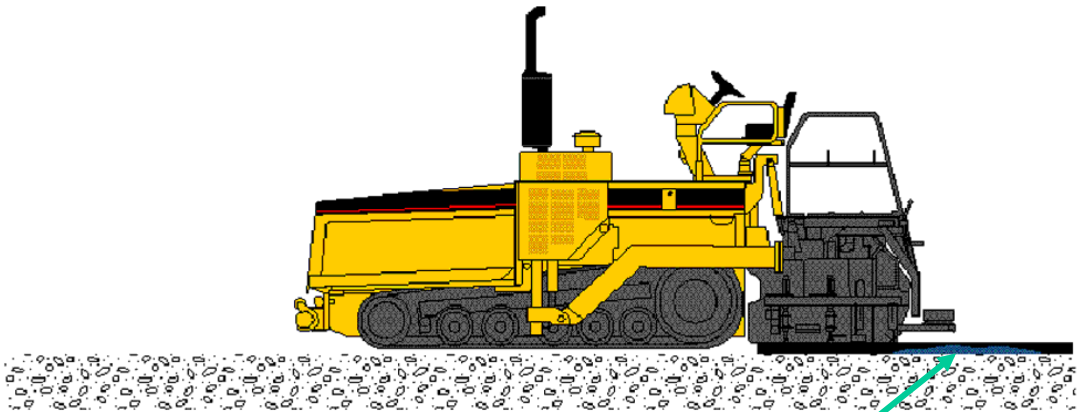


- Mat may not show any visual defect from small pile of mix
- Thermal image shows cold pile spread by screed
- Uneven compaction results
- Maybe a bump

Material Dumped on Grade

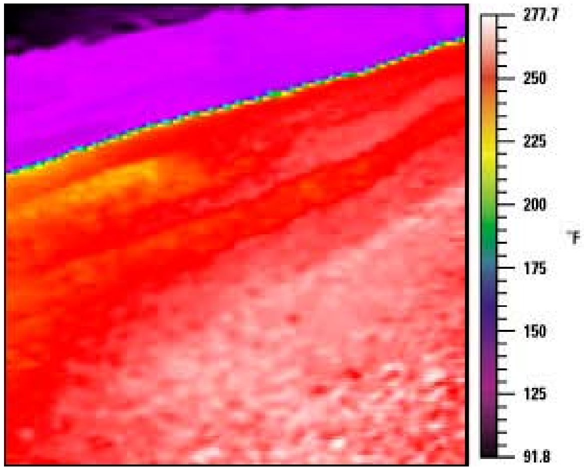
- Pile compacted by truck or paver
- May be completely covered by mat depending on thickness

Material Dumped on Grade



- Small compacted pile usually not visible in mat surface
- Thin layer of fresh mix for compaction
- Uneven compaction
- Bump
- Fractured aggregates

Material Dumped on Grade

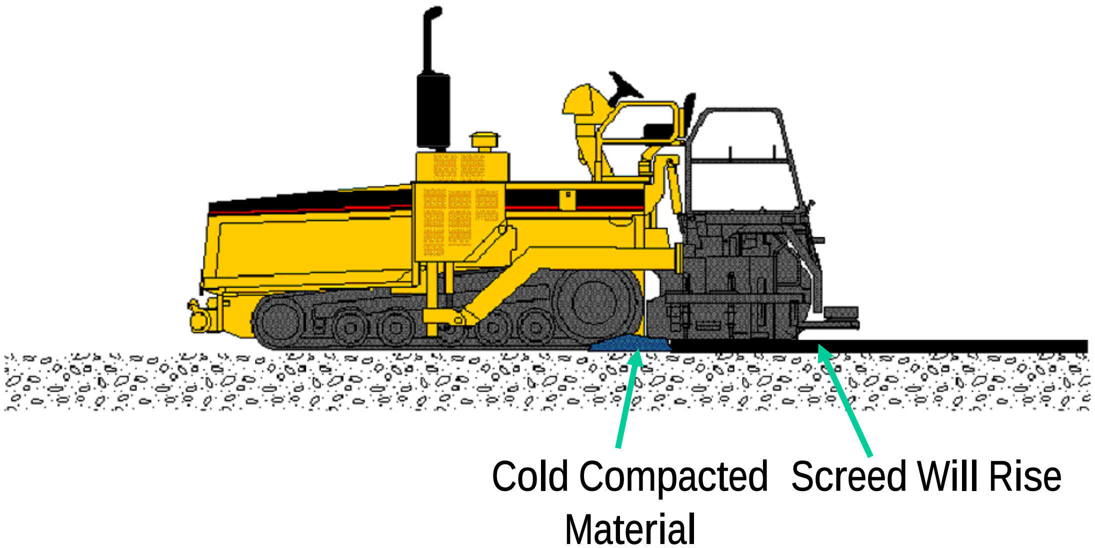


- Uncoated rock shows in mat surface
- Open texture over compacted pile
- Cold spot

Material Dumped on Grade

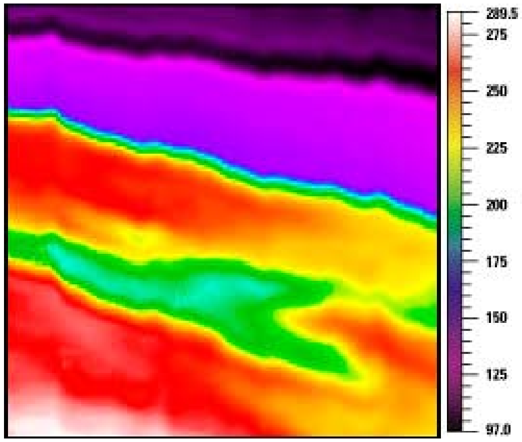
- Large volume dumped or spilled by truck
- Compacted pile thicker than mat
- Screed rides up on compacted pile

Material Dumped on Grade



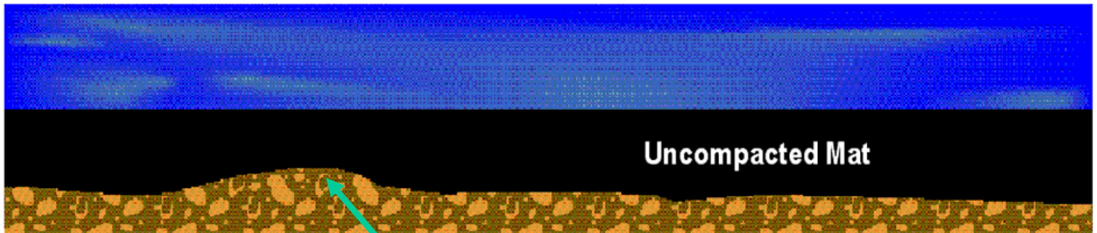
- Rising screed creates a bump
- Aggregates dragged
- Open texture

Material Dumped on Grade



- Mat shows open texture
- Thermal image shows cold spot
- Uneven compaction and poor ride
- Trucks <u>never</u> clean out in front of paver

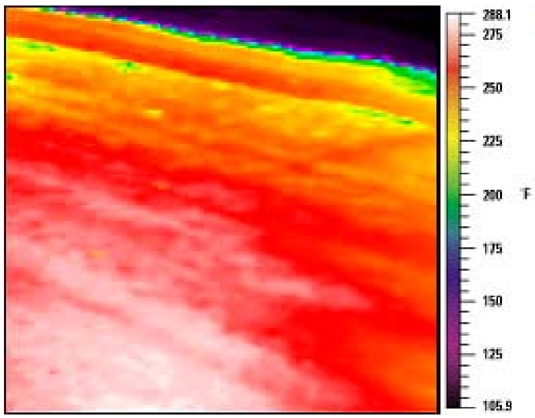
High Spot in Grade



High Point
Material Thickness Less Than
1 1/2 Times Aggregate Size

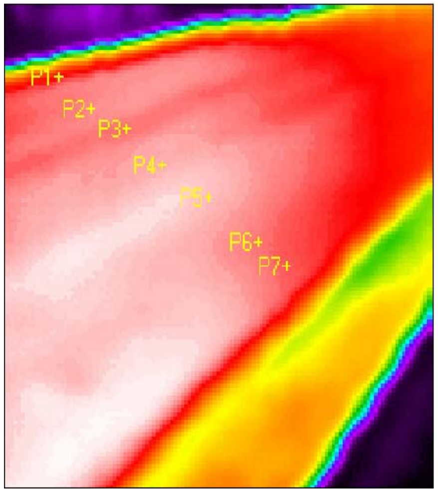
- High points cause thin mats
- Ratio of mat thickness/aggregate size too low
- Open texture
- Non-uniform density
- Bumps

High Spot in Grade



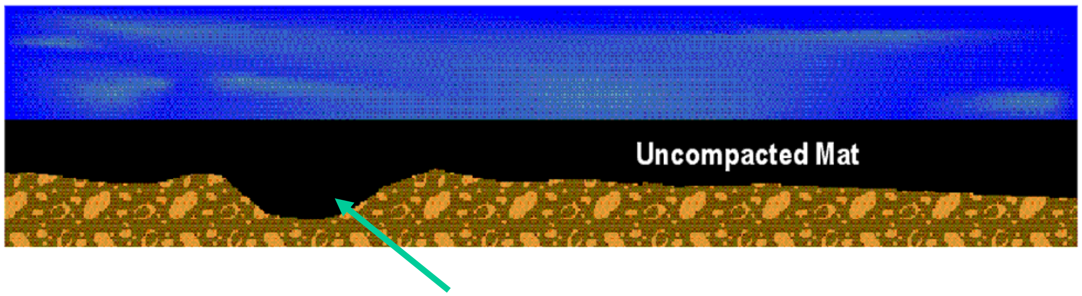
- Show up as loose aggregate at surface and fractured rock
- Large temperature variations
- Look same as high spots caused by material dumped on grade

Variable Grade



- Step between shoulder and driving lane
- Mat thinner over shoulder portion
- Visually little difference
- Large temperature difference
- Density variation

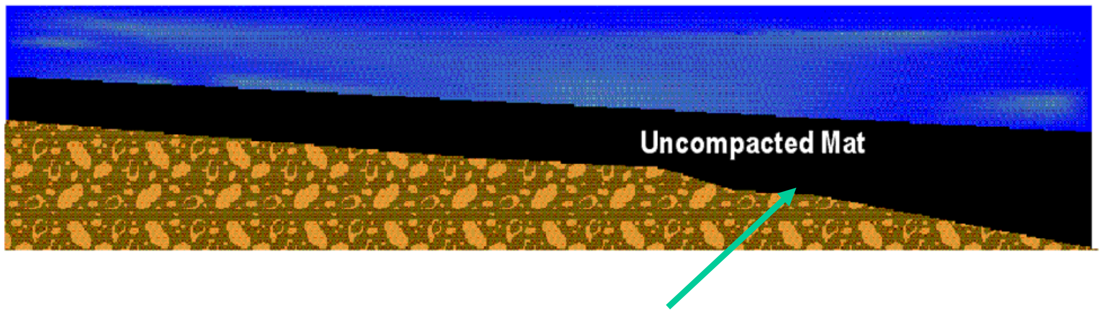
Low Spot in Grade



Low Point
Material Thickness Greater Than
Surrounding Areas

- Material thickness too great
- Compacts as a dip
- Compacts as a low density area
- May not show up visually
- Thermal image shows hot spot

Slope Change in Grade



Severe Slope Change on Grade

- Mat thickness varies according to severity of grade slope deviation
- Variable compaction rate

Preventing Defects--Grade Conditions

- Do not allow trucks to clean out on the grade in front of the paver
- Direct trucks to a place on the job where they can clean out and material can be managed
- Clean up all spills in front of the paver
- Check grade conditions before paving
- Correct grade defects

  -- mill high spots

  -- patch low spots

Trucking

- Mat defects can be caused by paver and truck interface
- Training is key to preventing mat defects related to trucking

Truck Bumping the Paver

- Common problem -- truck backs into paver
- Screed marks mat severely
- Often can't be cleaned up -- bump

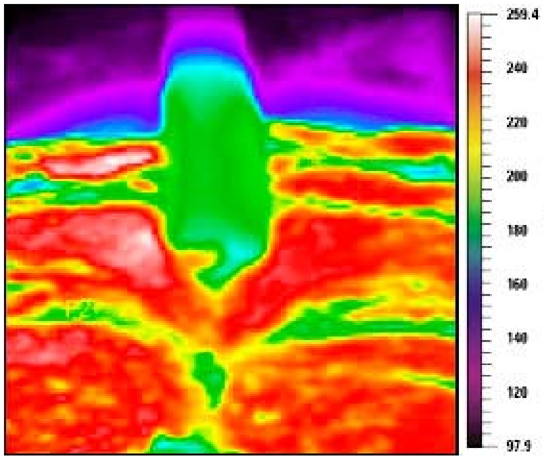
Dumping Load in front of Paver

- Truck rolls away from paver -- dumps load
- Clean up the entire pile
- Leaving big pile causes screed to rise
- Truck must apply light brake pressure
- Use truck hitch

Truck Alignment with Paver

- Misaligned truck causes steering problems
- Affects paver operation and smoothness
- Have ground man help trucks line up with paver

Dribbling Material out of Truck Bed



- Dribbling material prone to segregation
- Cooler crust doesn't mix with hot load
- Raise bed before releasing tail gate
- Keep bed up enough to create constant flow

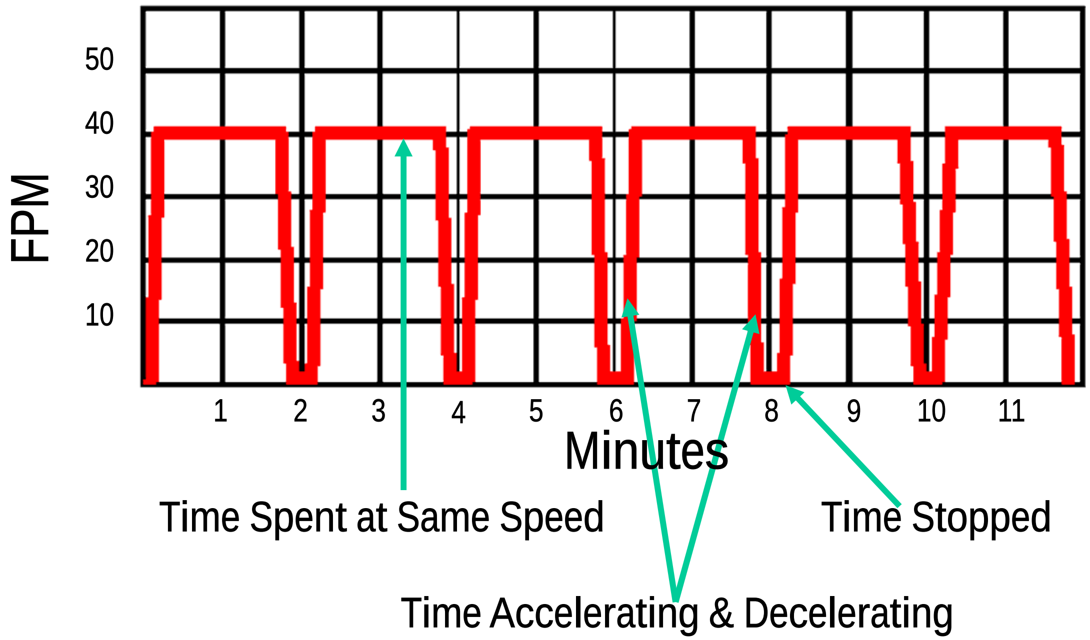
Preventing Defects -- Trucking

- Truck always stops short of paver - never back into paver
- Use truck hitch to maintain paver/truck contact, or
- Driver applies light brake pressure to maintain paver contact
- Align trucks in center of hopper
- Keep bed raised when dumping -- never dribble mix into hopper

Paving Speed

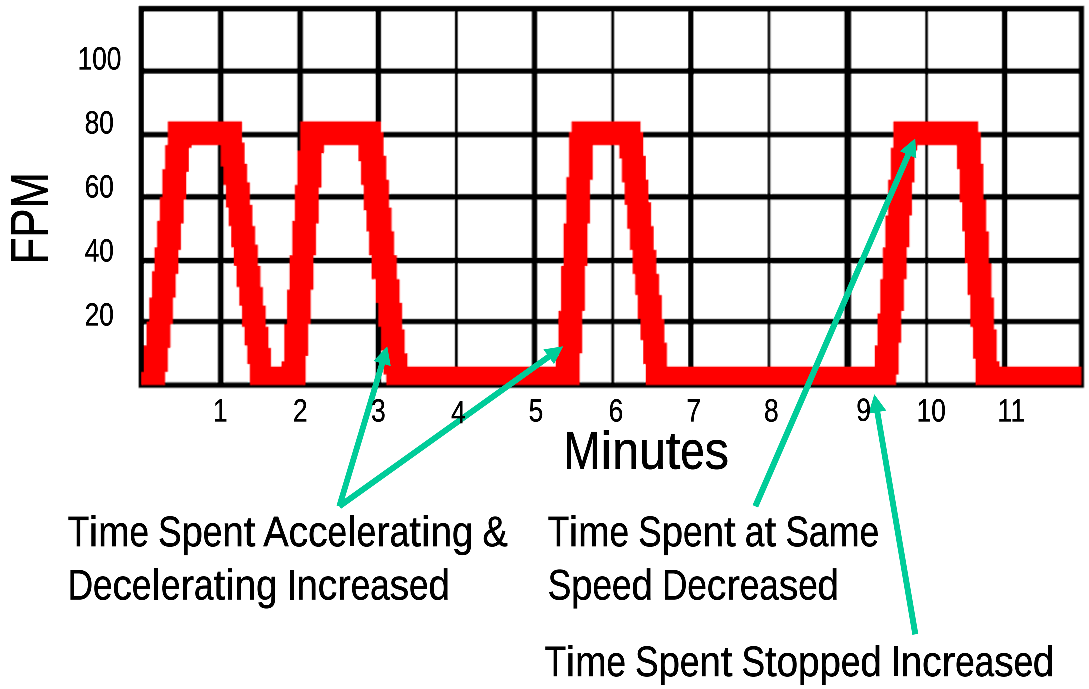
- Fundamental aspect of smooth paving
- Paving speed affects shear factor
- Constant shear factor equals smoothness
- Changing shear factor equals rough ride

Constant Paving Speed



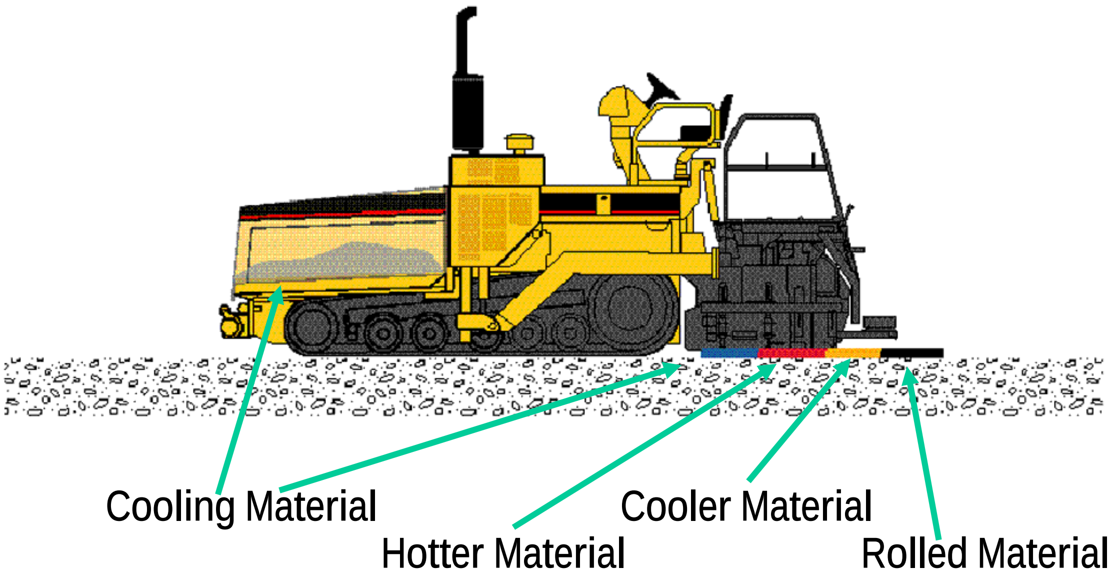
- Take each truck at same speed
- Use mix production in orderly fashion
- Target 75% paver efficiency

Paving Speed too Fast



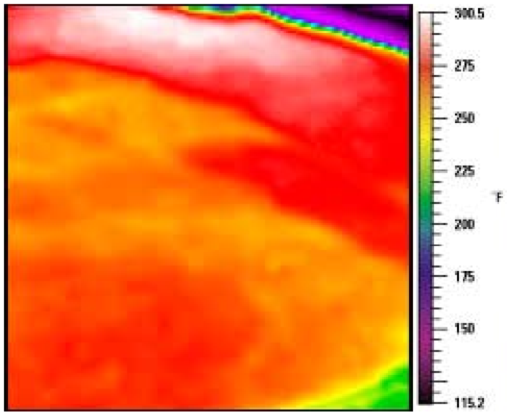
- Speed surpasses plant / trucking capabilities
- Prolonged stops
- Inefficient paving
- Accelerating and decelerating too long

Paver Stopped



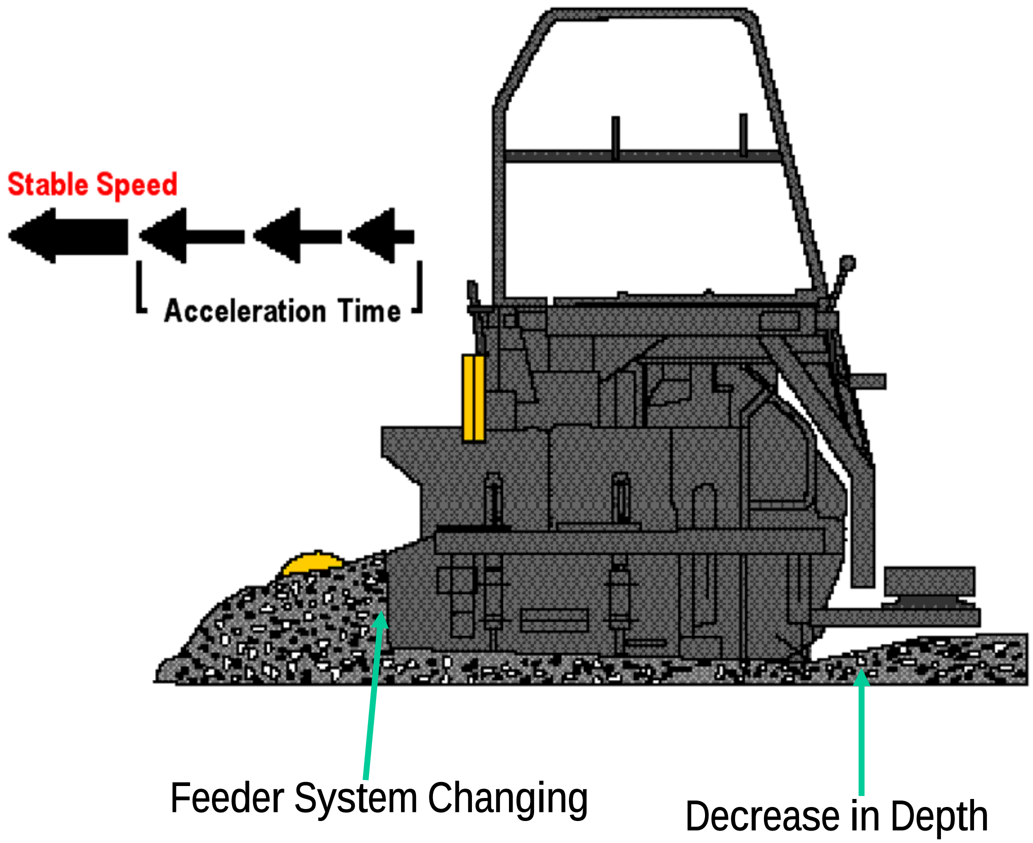
- Mix cools during stops
- Mix cools at varying rates
- Leads to variations in density and smoothness

Paver Stopped -- Variable Temperature



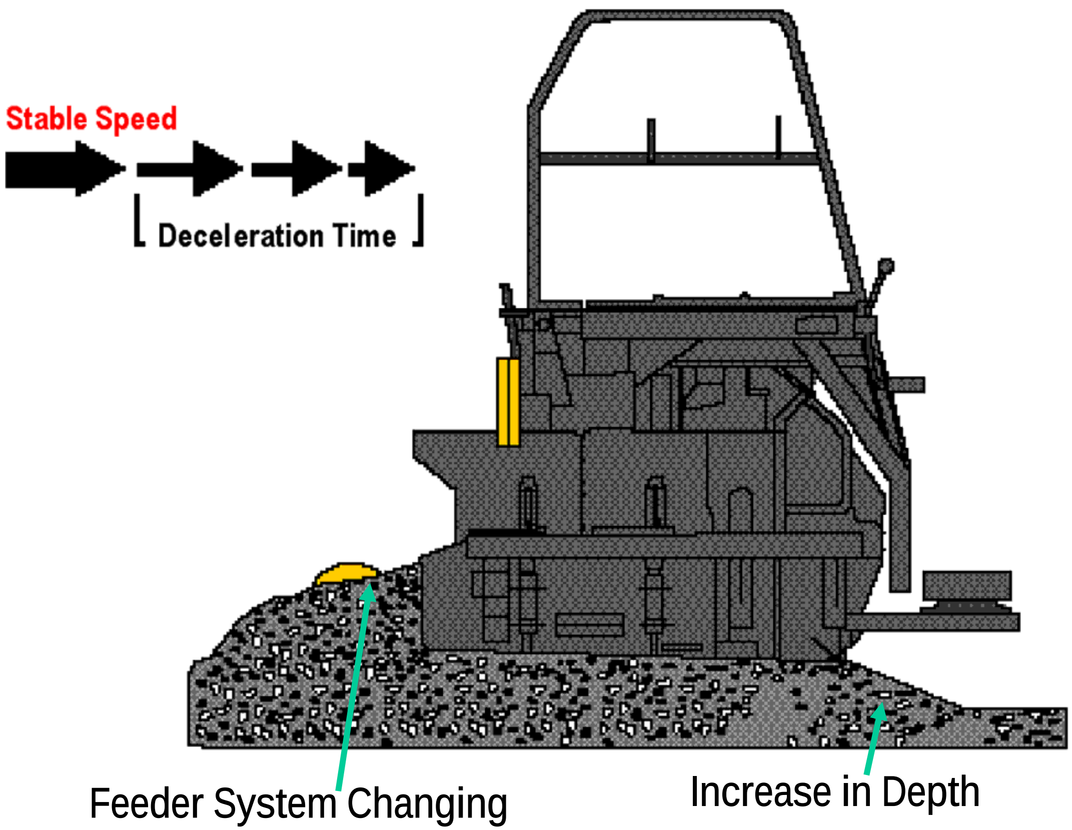
- Screed may dent mat during prolonged stops
- Mat covered by screed stays hot
- Mat behind screed cools faster
- Compaction rate affected by variation in temperature

Acceleration to high Paving Speed



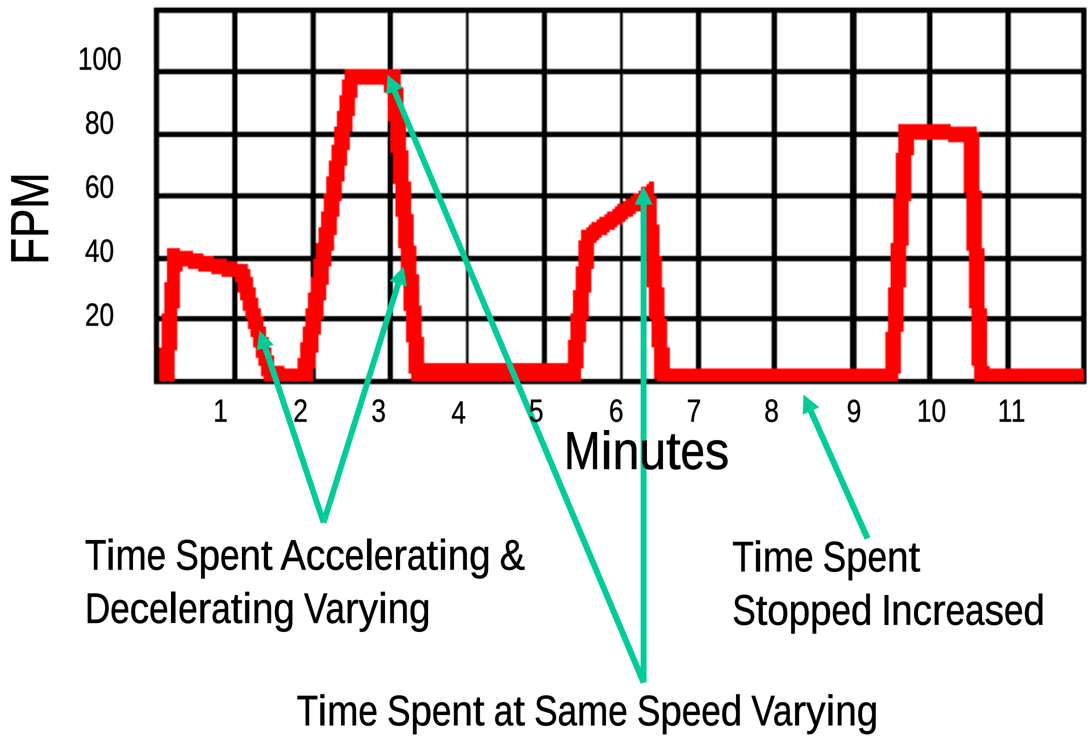
- Long acceleration time starves auger chamber
- Screed drops
- Loss of smoothness

Deceleration from high Paving Speed



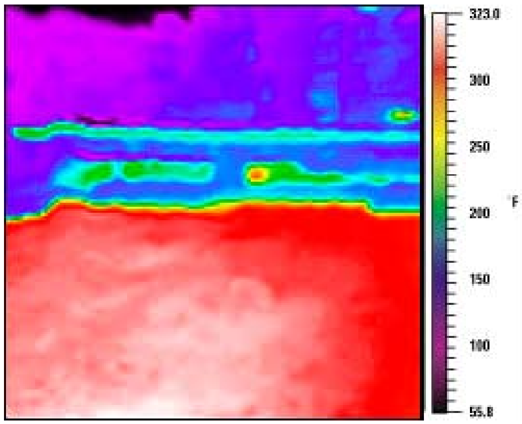
- Long deceleration time overloads auger chamber
- Screed climbs
- Loss of smoothness

Erratic Paving Speeds



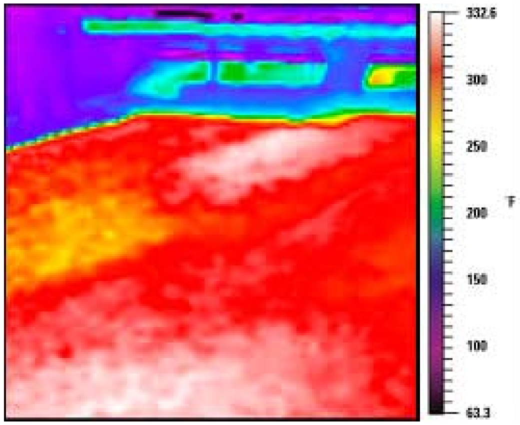
- Operator varies speed to match availability of trucks
- Variable mat temperature
- Variable mat texture

High Speed -- Segregation Stripes



- Speed increased 50% because trucks stacked up
- Auger speed at 60-70 rpm because of increased demand
- Large aggregates segregated - visible stripes
- No temperature variation

Low Speed -- Patch Segregation



- Reducing speed makes feeder system run on/off
- Mix does not move in a uniform manner
- Patch segregation where augers stop
- Also cool spot in mat

Preventing Defects -- Paving Speed

- Set paving speed that consumes mix available at the job site in an efficient manner
- Target a minimum of 75% paver efficiency
- Take each truck at the same speed
- Avoid prolonged stops
- Avoid erratic paving speeds
- Adjust feeder system whenever paving speed is changed

Preventing Defects -- Truck Exchange

- Truck dumping still a common practice
- Follow an established procedure
- Operator and dump person work together

Truck Exchange - Release Truck

- Follow four step routine
- Step one - release truck as soon as bed is empty
- Truck lowers bed and pulls away
- Continue paving at normal speed

Truck Exchange - Continue Paving

- Step two - continue paving as truck pulls away
- Pave until level of mix permits cycling hopper wings without spillage
- Next truck getting position

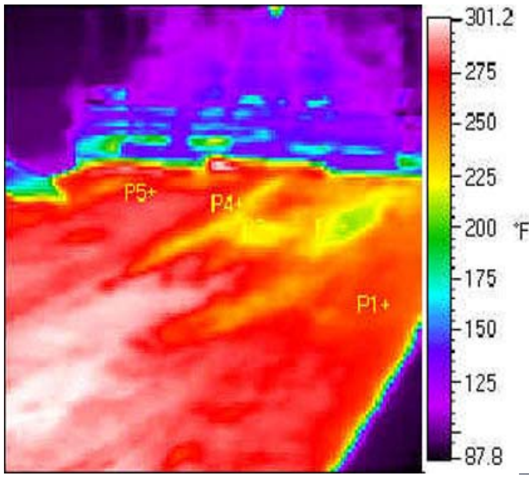
Truck Exchange - Cycle Hopper

- Step three - cycle hopper wings
- Combines mix from sides with mix in center
- Continue paving until level in hopper is below flashing

Truck Exchange - Stop Paver

- Step four - stop paver and lower hopper wings
- Level in hopper covers deck and conveyors
- Mix in hopper will be covered by next load

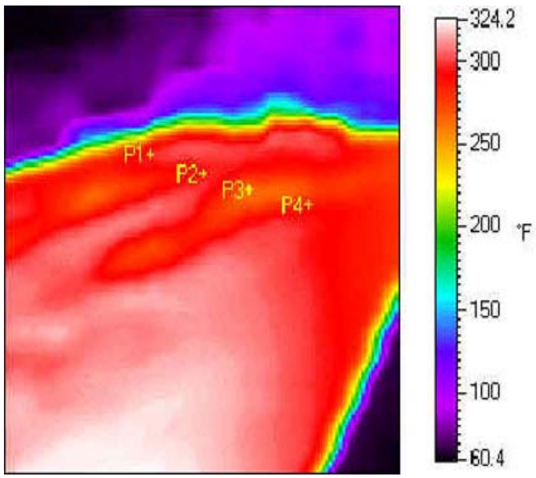
Poor Truck Exchange



Point	Temp
P1	261° F
P2	213° F
P3	223° F
P4	243° F
P5	278° F

- Hopper run empty; wings cycled too late
- Cold spots show in mat
- Affects density and smoothness
- Operator training required

Normal Truck Exchange



Point	Temperature
P1	295° F
P2	294° F
P3	262° F
P4	287° F

- Minor variations may occur during truck exchanges
- Quick exchanges reduce variation
- Exchanges should take 1-2 minutes
- Screed marks should roll out

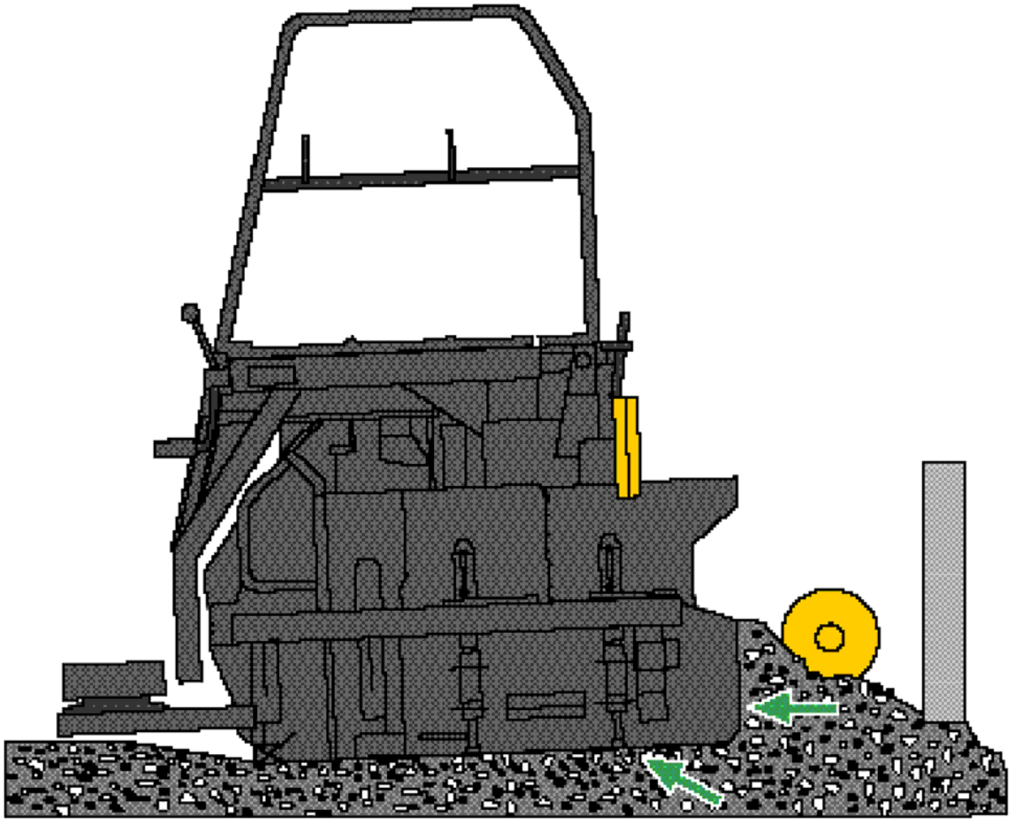
Preventing Defects -- Truck Exchange

- Follow 4-step procedure
- Never pave out material in hopper
- Cycle hopper wings when conveyors are still covered with mix
- Avoid prolonged stops

Preventing Defects -- Feeder System

- Feeder system has major impact on mat quality
- Deliver material in a uniform manner
- Consistency and fundamentals are the keys

Head of Material -- too low

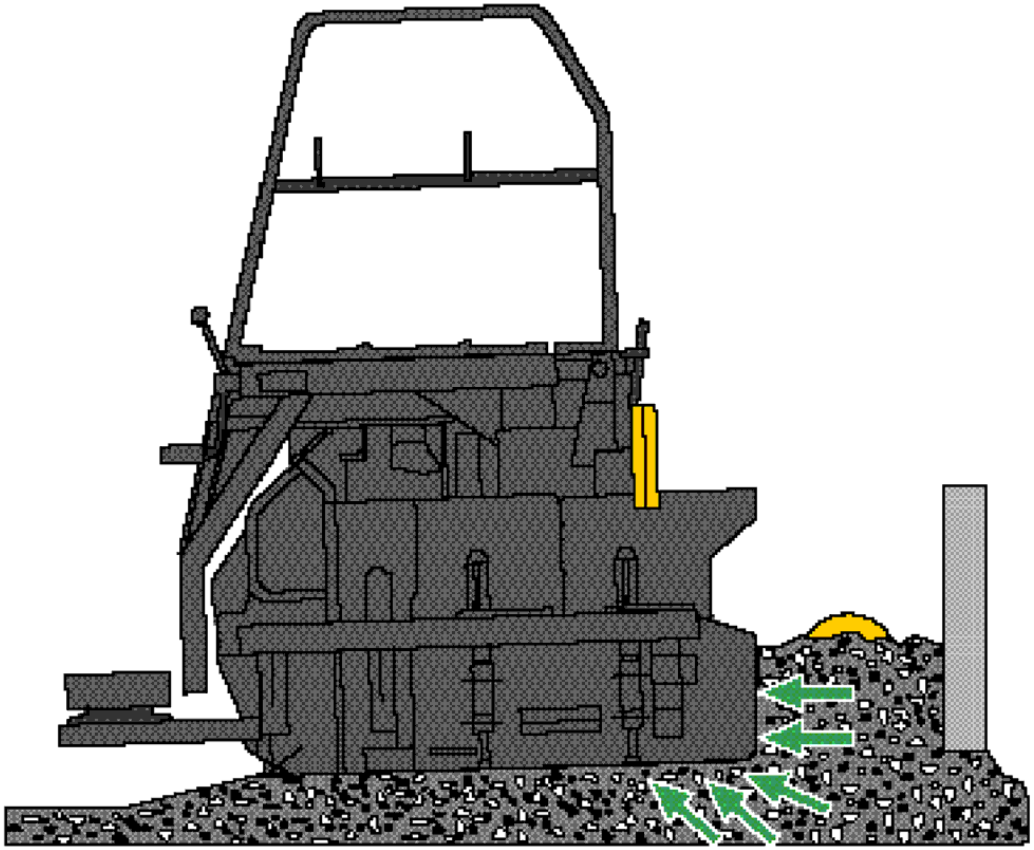


- Proper head of material covers one half the auger shaft
- Low level causes screed to drop
- Often happens during truck exchanges

Head of Material -- too low

- Head of material low in front of extension
- Open texture due to decreased mat thickness
- Variations in density and smoothness
- Hard to match curbs and adjacent mat

Head of Material -- too high

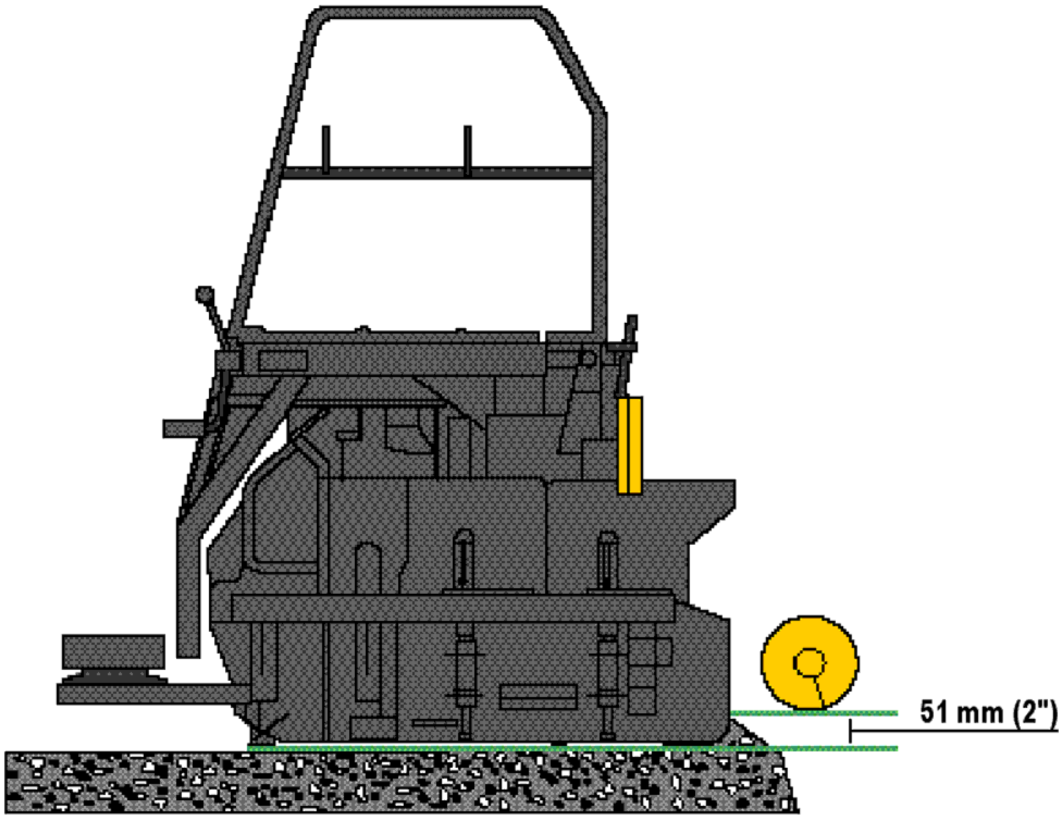


- Forces acting on screed increase
- Screed rises
- Often results from use of feeder system manual overrides

Head of Material -- too high

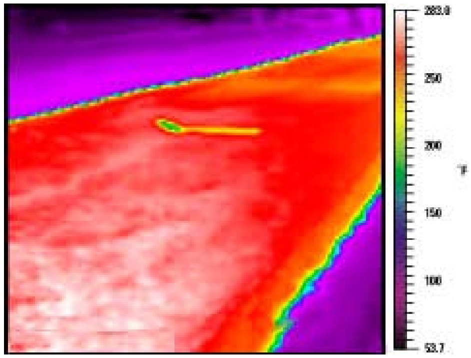
- Gross overfill causes large hump in the mat
- May need to shovel out
- Can be caused by improper sensor position or calibration

Auger Height -- starting Adjustment



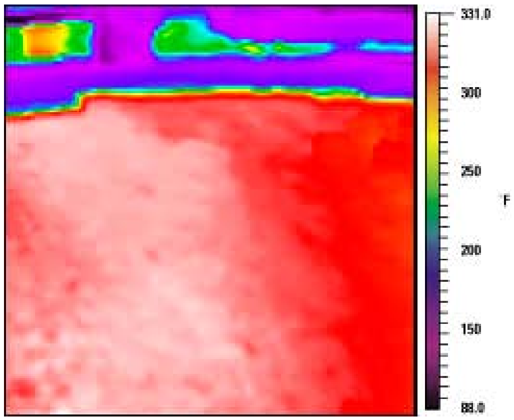
- Auger height affects head of material and mat texture
- 51 mm (2”) above mat is normal position
- Check auger height at the start of each shift

Auger Height -- too low



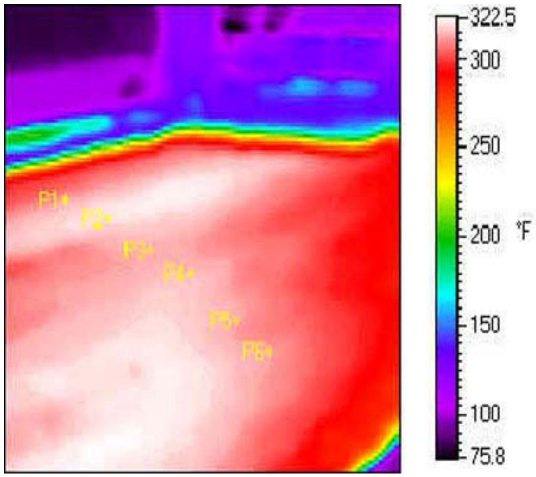
- Texture stripes appear directly behind the augers
- Especially common when mix has large aggregates
- Raise augers until mat is tight and uniform

Auger Height -- too high



- Head of material too high -- screed rises
- Angle of attack decreased so screed runs flat
- Open texture across entire mat
- Lower augers and correct angle of attack

Auger Speed Correct

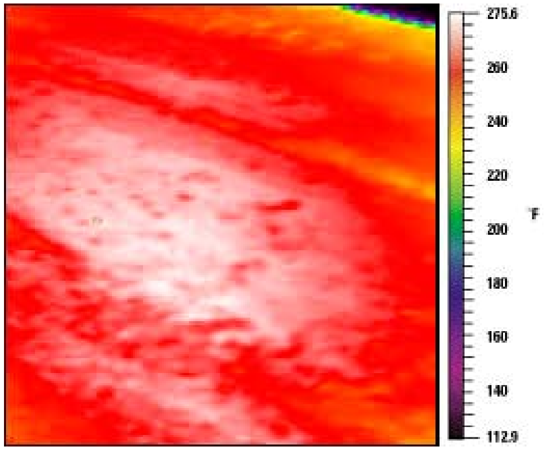


Point	Temp
P1	313° F
P2	319° F
P3	313° F
P4	315° F
P5	312° F

Point	Temp
P6	312° F

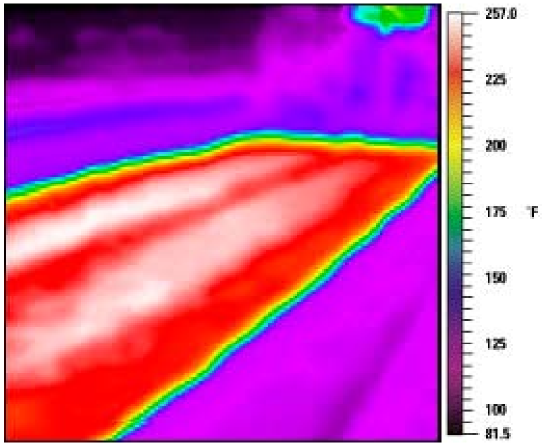
- Auger speed affects mat texture, segregation and temperature
- Target 30-40 rpm
- Conveyor flow, sensor position and sensitivity affect auger speed
- Make adjustments when paving speed changes

Auger Speed Low -- Stripes



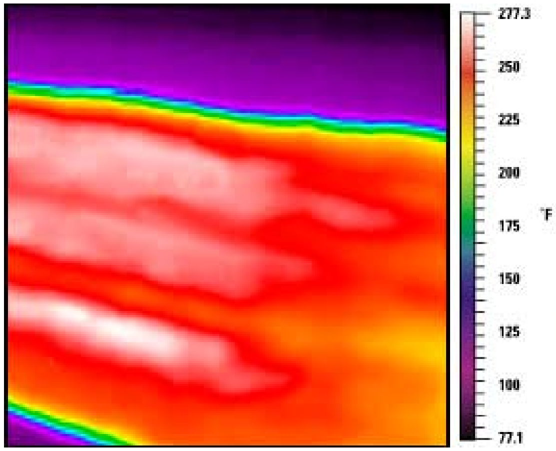
- Mix moves in non-uniform manner
- Mix rolls under chain case and bearing supports
- May see segregation stripes or temperature stripes
- Increase auger speed by reducing conveyor flow

Auger Speed High -- Stripes



- Causes segregation stripes at outer edges
- May see centerline stripe
- Open texture loses heat faster
- Reduce auger speed by increasing flow off conveyors

Auger Speed Erratic - Variable Stripes



- Causes intermittent striping and uneven head of material
- Changes in paving speed or sensors improperly positioned
- Sensor target pile of mix 18” outside of auger
- Keep paving speed constant

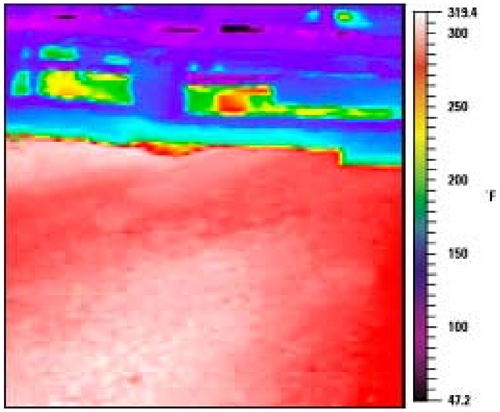
Auger Extensions

- Add extensions when paving wide width
- Reduces head of material in front of extension
- Helps reduce segregation

Bulkhead Extensions

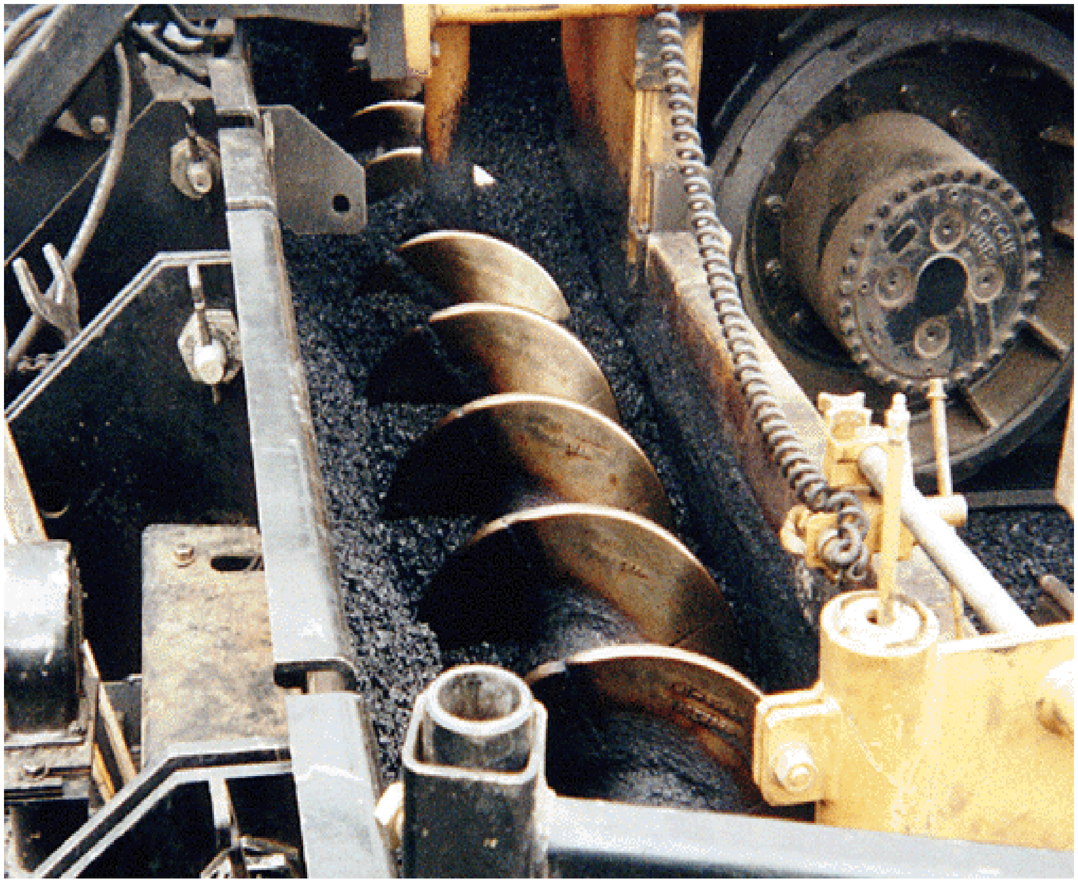
- Bulkhead extensions channel mix out to end gate
- Help prevent rolling of large aggregate

No Extensions -- Segregation Stripe



- Paving base course 15’ wide
- Stripe in line with edge of main bulkhead
- Most evident when auger speed was low

Extensions Added



- Correct head of material out to end gate
- Auger speed 30-40 rpm
- Feeder sensor positioned correctly
- No segregation

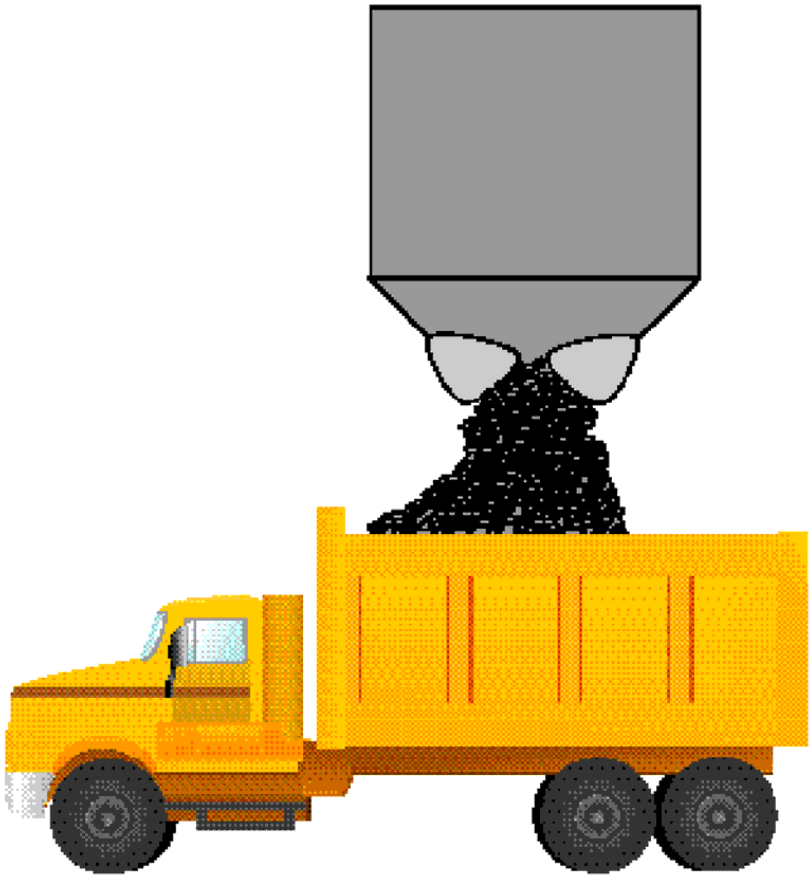
Preventing Defects -- Feeder System

- Head of material covering one half the auger shaft
- Auger height set at 51 mm (2”) above mat at start of paving
- Auger speed uniform in the 30-40 rpm range
- Sensors properly positioned and calibrated
- Auger and bulkhead extensions added for wide width paving

End-of-load Segregation

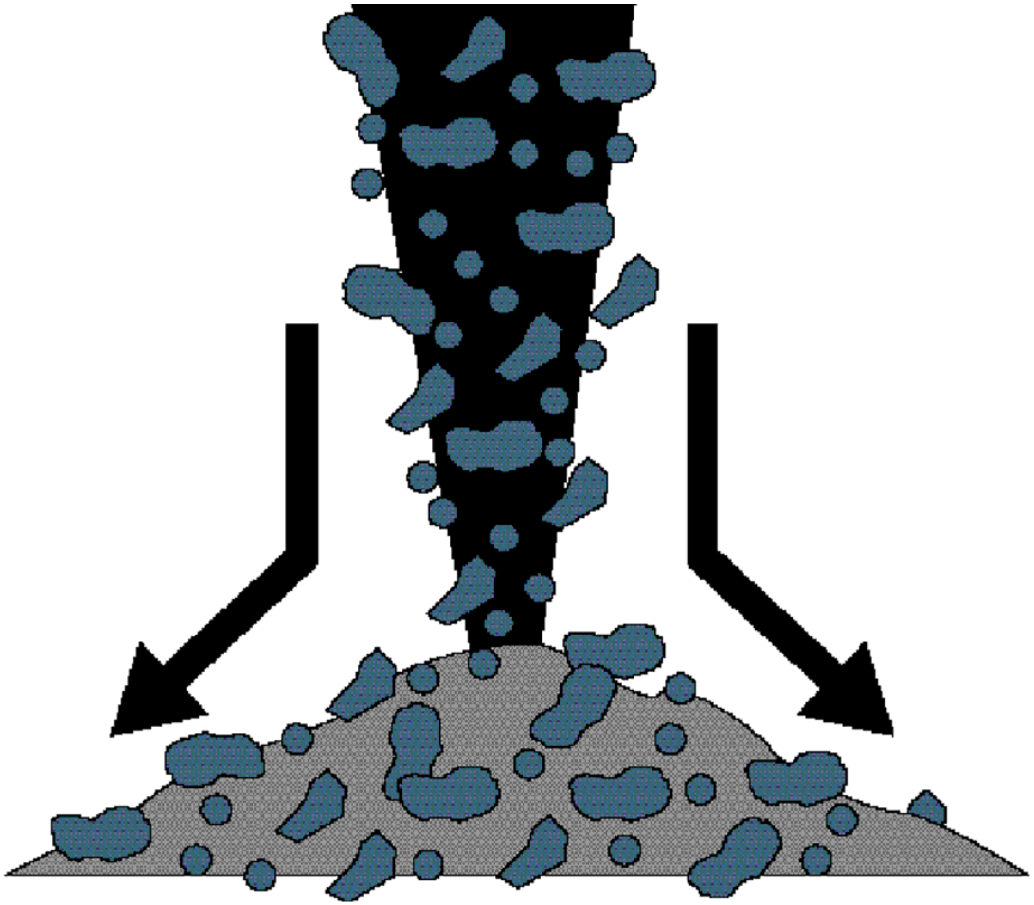
- End-of-load segregation occurs at regular intervals
- Interval equals length of mat paved by one truckload
- Can be caused by more than one factor
- Troubleshoot methodically

Segregation from Single-drop Loading



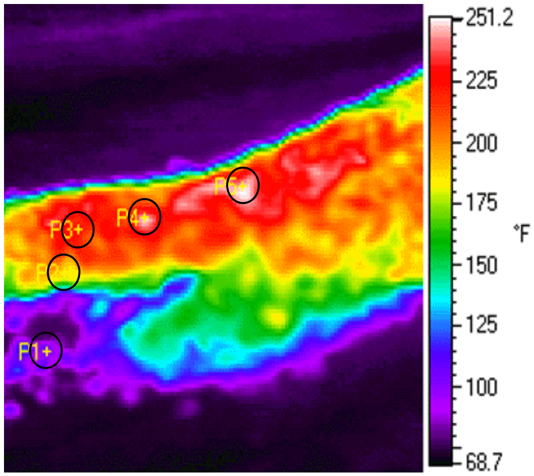
- Check truck loading method
- Single-drop loading is incorrect procedure

Segregation from Single-drop Loading



- Material dropped from a height forms conical pile
- Large aggregates separate and roll to sides of pile
- Segregation started in the truck

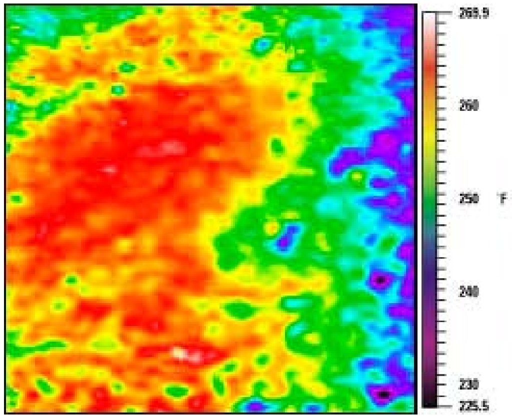
Segregation from Single-drop Loading



Point	Temperature
P1	41° C (105° F)
P2	87° C (189° F)
P3	106° C (223° F)
P4	120° C (248° F)
P5	121° C (249° F)

- "Bone" pile appears at end of load from truck
- Lacks small aggregates and fines
- Loses heat faster

Segregation from Single-drop Loading



- "Bone" piles show up in the mat as cyclical patches
- Re-mixing can't cure severe segregation in truck loads
- Density affected by material segregation and temperature variations

Prevent Defects -- Three-drop Method

- First drop at front
- Second drop at rear
- Third drop in center
- Significant reduction in material roll-down
- Very important when paving with large stone mixes

End-of-load Segregation

- Check truck exchange procedure
- Good truck exchanges maintain head of material and prevent segregation

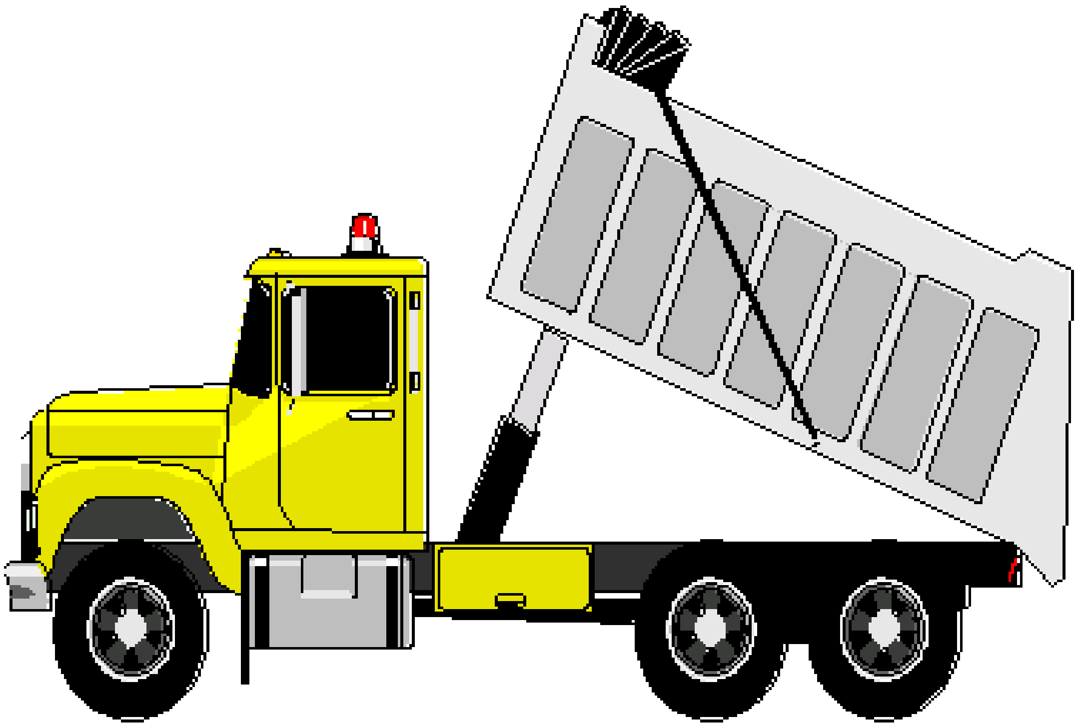
Cycling Hopper Wings too Late

- Conveyors run empty or low on mix
- Cycling hopper wings can cause end-of-load segregation
- May want to stop cycling hopper wings

Cycling Hopper Wings -- Yes or No

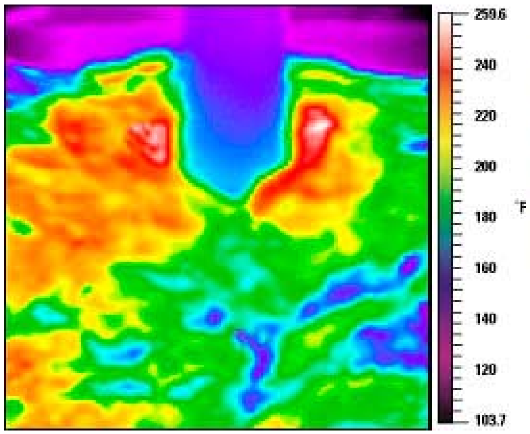
- Mix not segregating in hopper -- OK to cycle hopper wings
- Mix segregating in hopper -- cycling hopper wings not recommended

Proper Truck Dumping



- Cover up
- Bed raised slightly
- Release tail gate
- Raise bed enough to dump mass of mix into hopper -- not trickle mix into hopper

Keep Truck Bed Raised

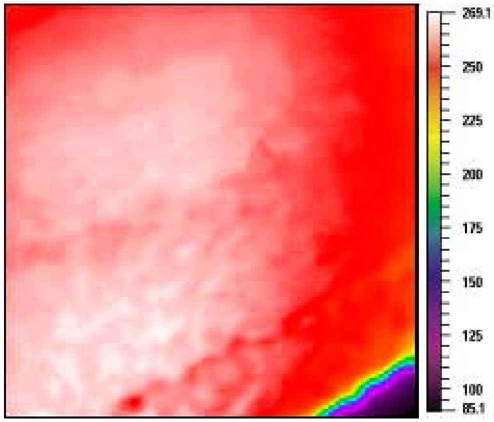


- Signal truck driver to keep bed angle high
- Don’t allow crust crust or large aggregates to trickle into the hopper

Preventing End-of-load Segregation

- Load trucks using three-drop method
- Keep truck bed raised high to prevent trickling into hopper
- Do not run hopper empty between trucks
- Do not cycle hopper wings on empty conveyors

Random Patch Segregation

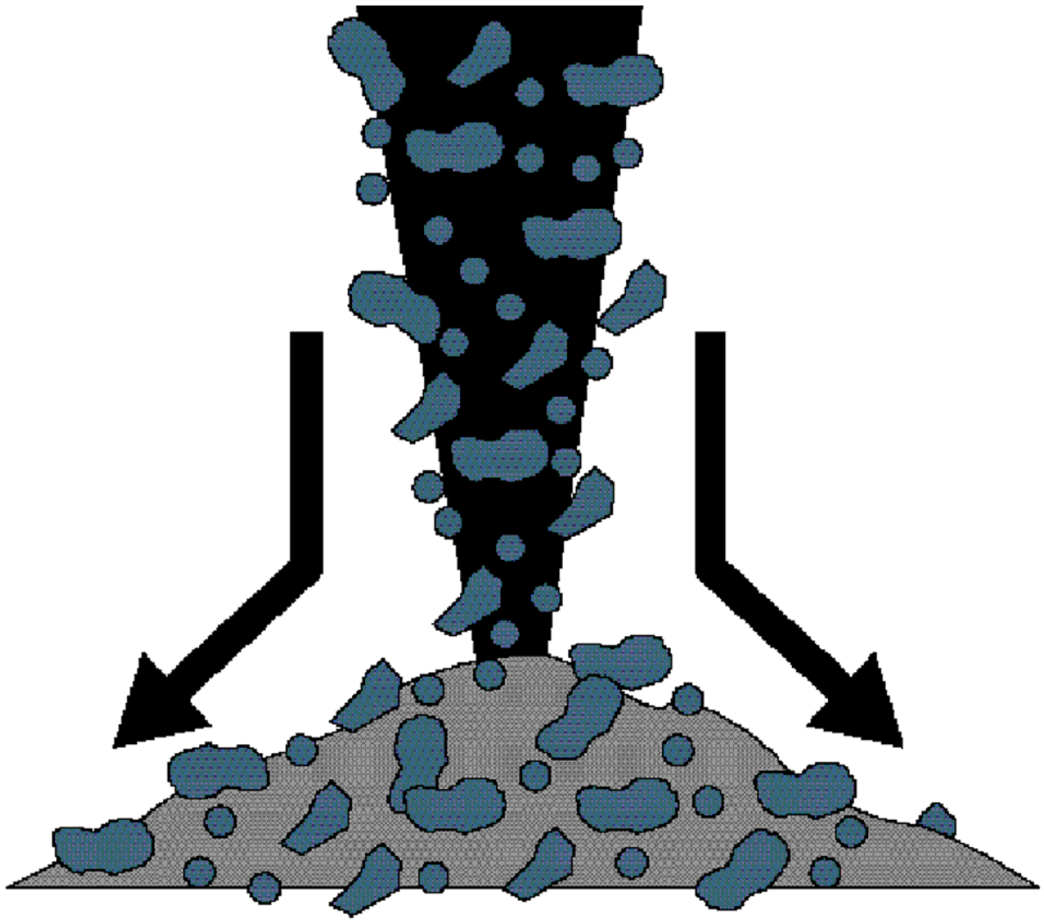


- Do not appear at regular intervals
- Looks like end-of-load segregation
- Can be caused by feeder system operation
- Also caused by running insert or MTV empty

Loading by MTD

- Material transfer devices common in some areas
- Drop mix into hopper or hopper insert
- Drop height can cause segregation in hopper or insert

Segregation from High Drop



- Material dropped from a height forms conical pile
- Large aggregates separate and roll to sides of pile
- Segregation started in the hopper or insert

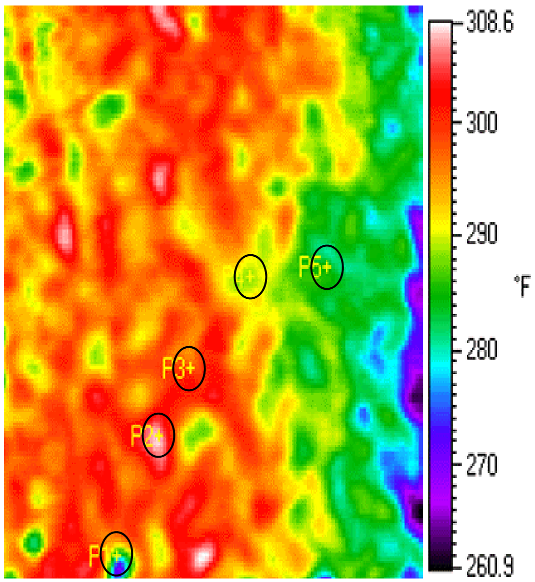
Insert Full

- Keep hopper or insert at least 2/3 full
- Less drop height minimizes segregation
- Emptying insert may create random segregation
- Match paver speed to mix delivery
- Don’t pave out mix in insert

Insert Empty

- Tendency to empty insert at end of pass or at bridge approach
- Expect segregation patches if insert or MTV is emptied

Random Patch -- Insert Emptied



- Insert emptied at approach to an overpass
- Large stone mix had segregated in hopper insert
- Area of low density and rough ride
- Better to salvage bottom half of mix in insert

Preventing Patch Segregation

- Keep hopper or insert at least 2/3 full
- Keep drop height short when loading with MTD
- Match paver speed to mix delivery
- Don't pave out insert at end of pass

Preventing Defects -- Screed Adjustments

- Screed adjustments have major impact on mat quality
- Affect finish and texture
- Set up screed at start of each shift
- Adjust screed as needed

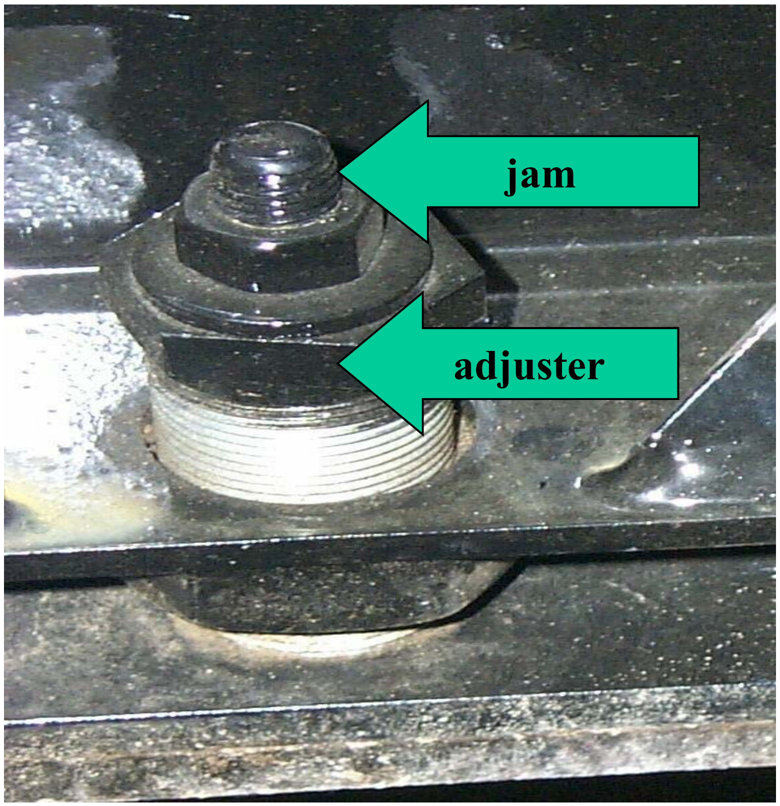
Angle of Attack too High

- Correct angle of attack is 3mm (1/8”) to 6 mm (1/4”)
- Right extension angle of attack too high
- Shiny appearance caused by screed riding on trailing edge

Angle of Attack too Low

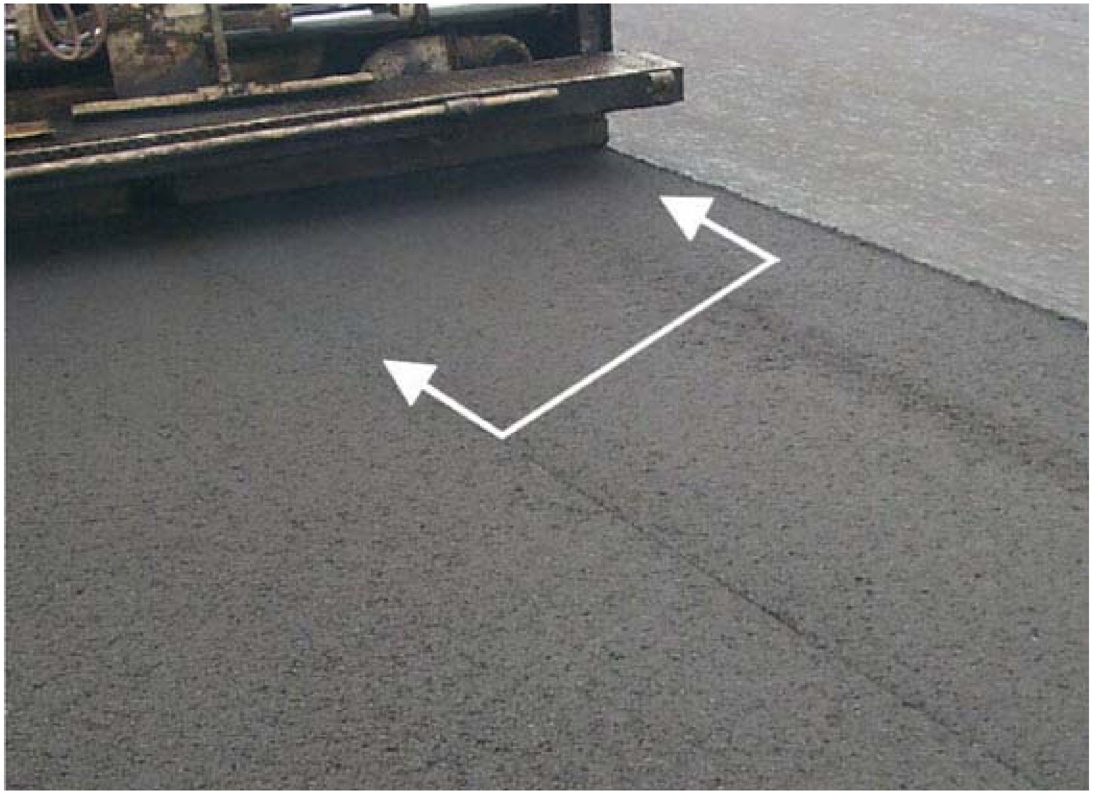
- Left screed extension running nose down
- Open texture appears when angle of attack too low
- Correct defect by adjusting screed angle of attack

Adjusting Angle of Attack



- To decrease angle of attack, turn adjusters counterclockwise
- To increase angle of attack, turn adjusters clockwise
- Make adjustments until mat is uniform full width

Extension too Low

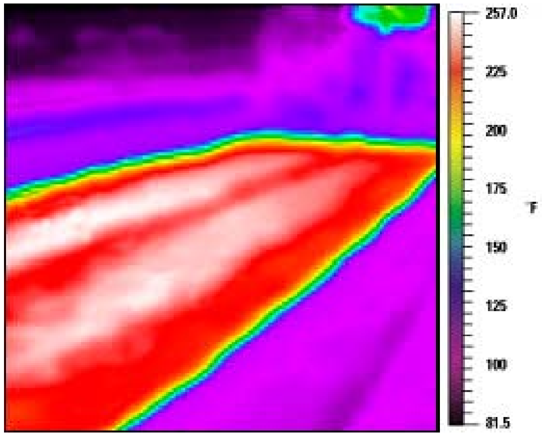


- Line appears when extension height is too low or too high
- Mark in line with inner edge of extension when extension too low
- Raise extension to eliminate mark

Extension too High

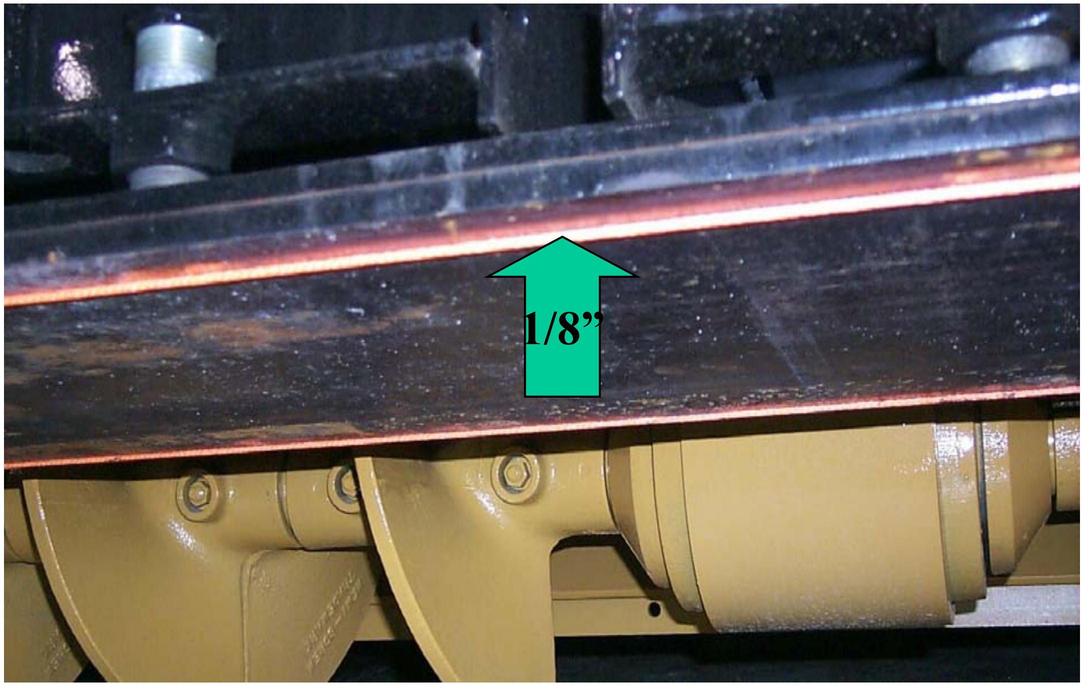
- Mark in line with outer edge of main screed when extension high
- Set height when screed is on starting reference
- Rear mount 1/4” up
- Front mount 1/4” down
- Adjust after pulling off starting point

Lead Crown



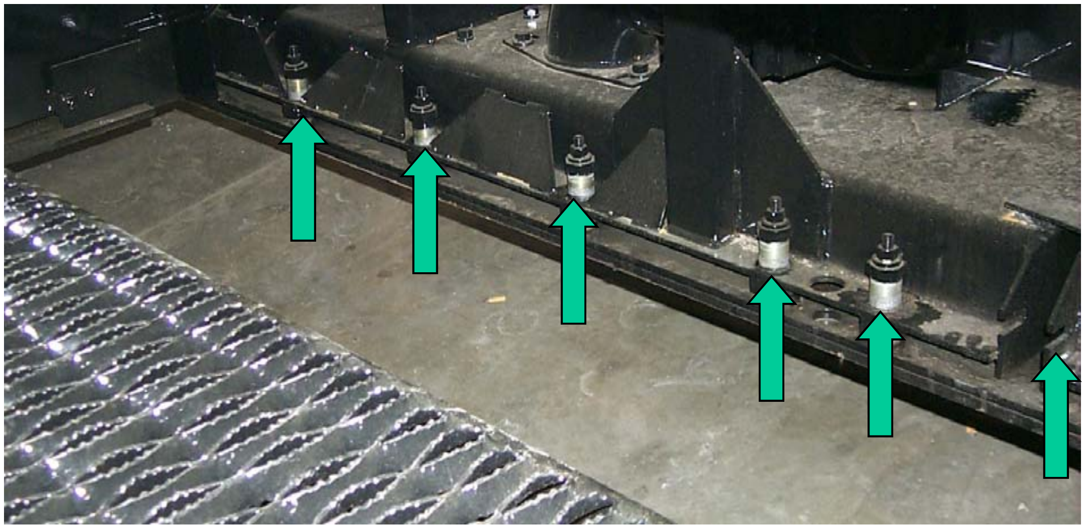
- Zero lead crown for most mixes
- Large stone mixes may require lead crown
- Open texture stripe in center indicates need for lead crown
- Install 3 mm (1/8”) lead crown

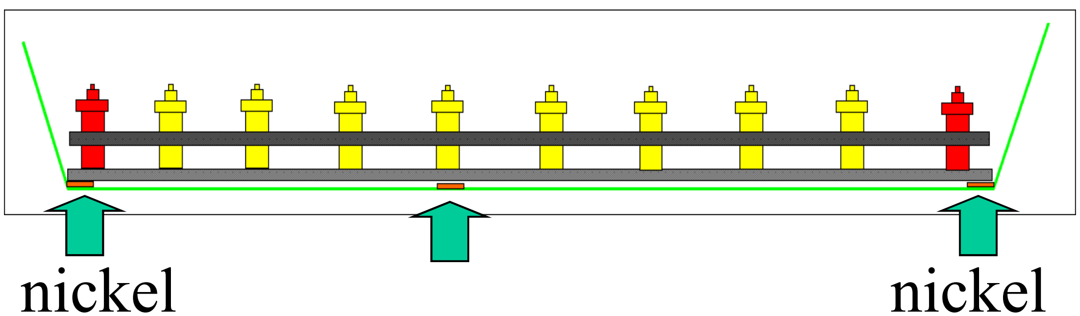
Installing Lead Crown



- Place stringline on front and rear of main screed.
- Adjust main screed crown until 3mm (1/8”) gap is present in center of main screed

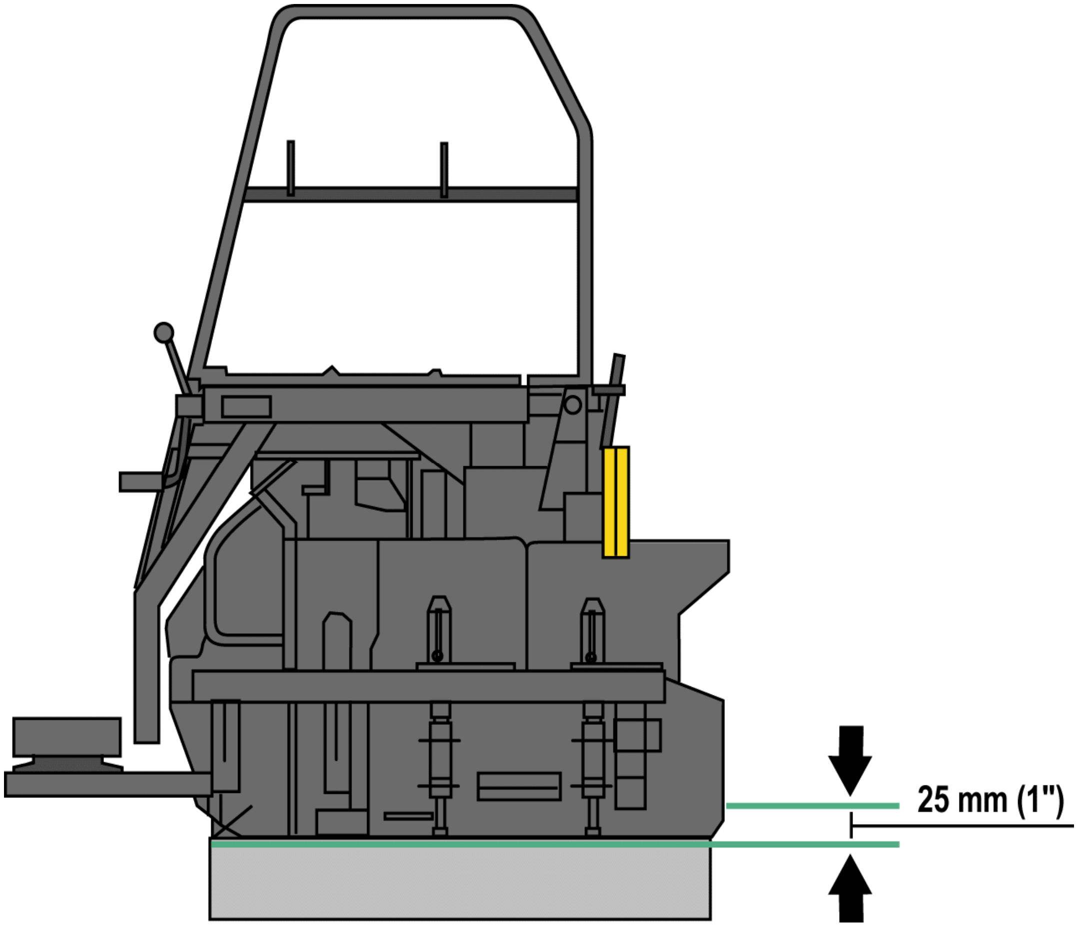
Installing Lead Crown





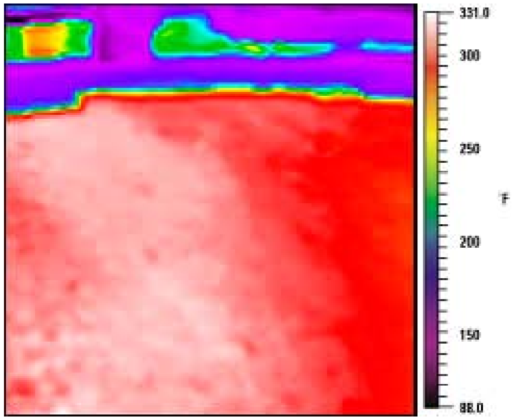
- Do NOT disturb outer adjusters.
- Adjust all other adjusters until trailing edge of main screed is flat.
- Leading edge retains 3 mm (1/8”) crown.

Strike-off Adjustment



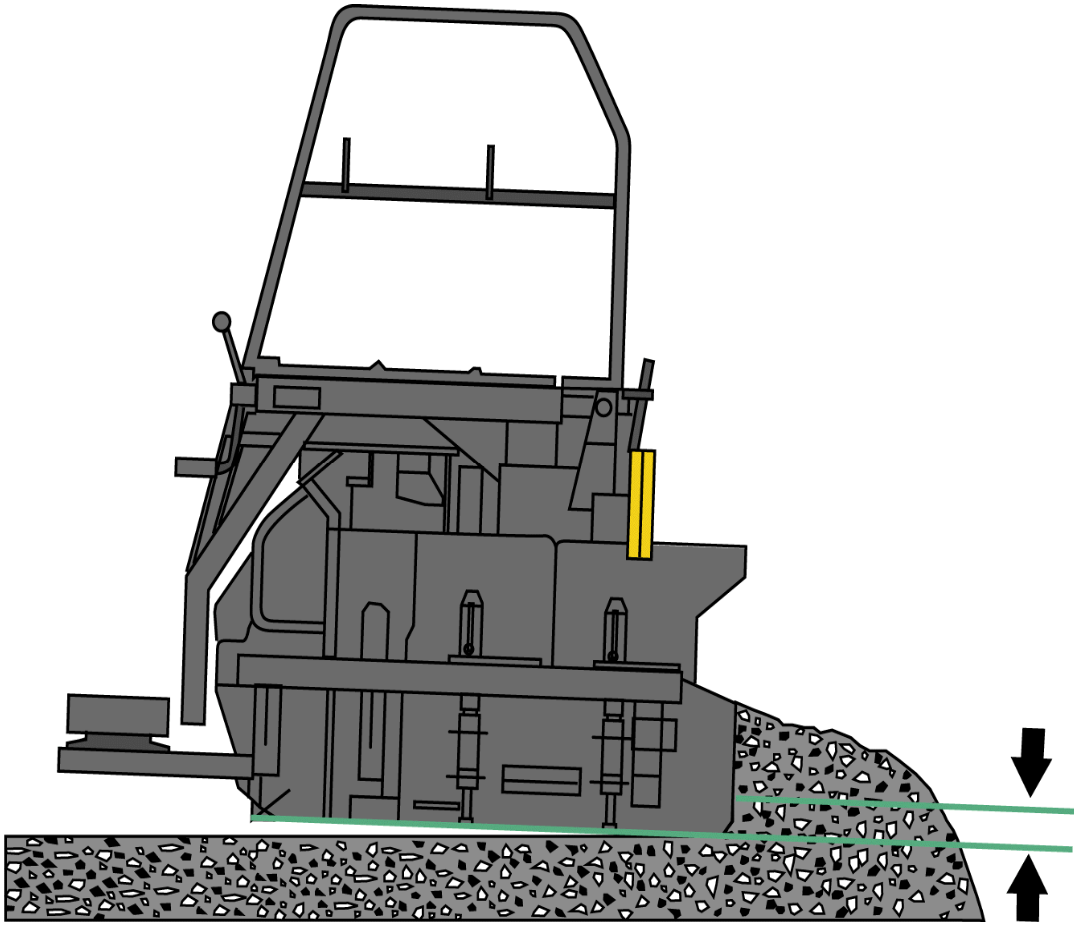
- Strike-off setting affects angle of attack and mat texture
- 25 mm (1”) above screed is right for most mixes
- Check height at beginning of each shift
- Adjust as required

Strike-off too High



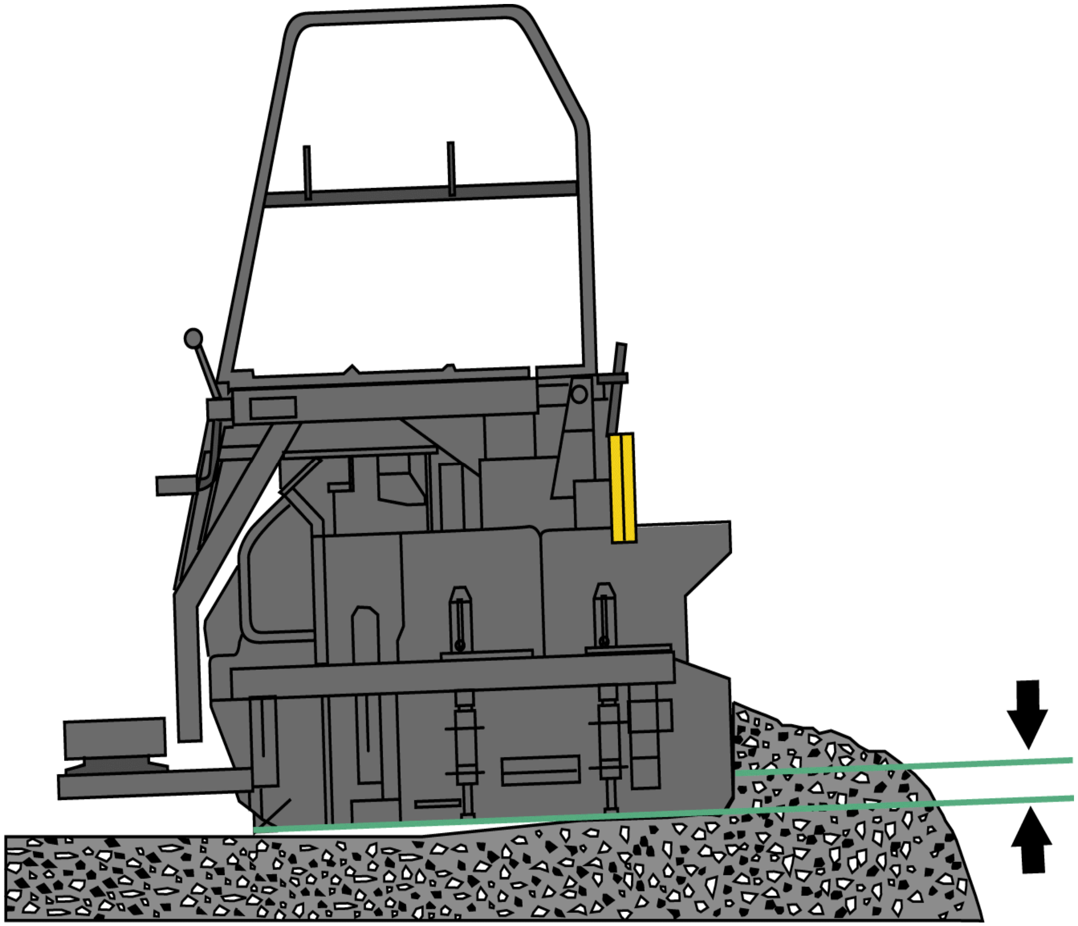
- Open texture surface when strike-off is too high
- 25 mm (1”) setting is too high for large stone mixes
- Temperature is fairly uniform

Strike-off too High



- Large stone mixes create added lift
- Screed rides up
- Screed personnel decrease angle of attack
- Screed rides on its nose
- Open texture results

Strike-off too low



- Sandy mixes decrease lift
- Screed drops
- Screed personnel increase angle of attack
- Screed rides on trailing edge
- Shiny surface results
- Erratic screed control

Cold Screed

- Mix sticks to cold screed plates
- Screed drops
- Scuffed texture
- Heat screed before starting to pave

Preventing Defects -- Screed Adjustments

- Set screed angle of attack at 3 mm (1/8” to 6 mm (1/4”).
- Set extension height in same plane as main screed.
- No lead crown for most mixes; install lead crown if needed.
- Set strike-off 25 mm (1”) above screed; adjust if needed.
- Heat screed before starting to pave.

Understanding Mat Defects

Maine Department of Transportation

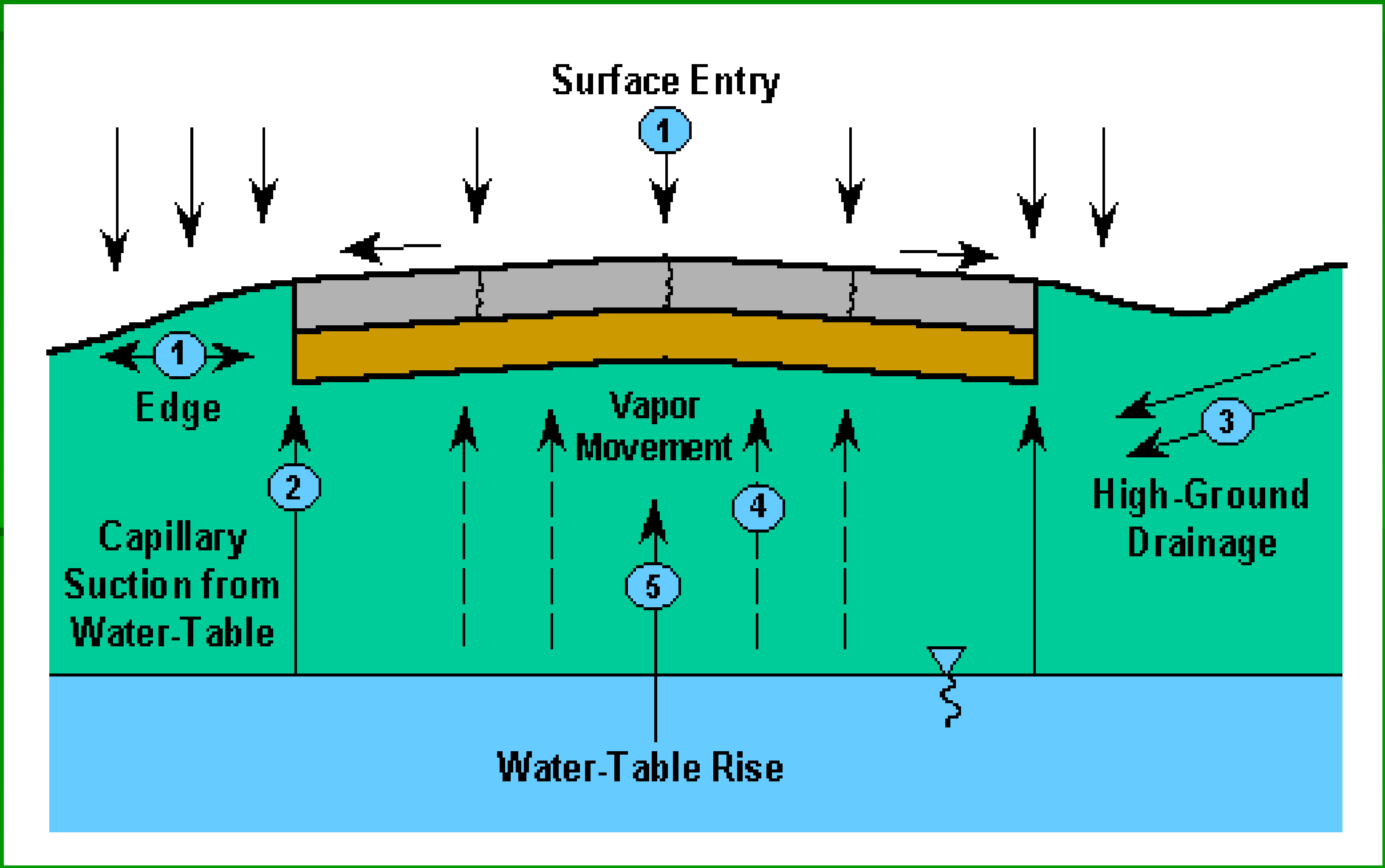
Construction Practices

Drainage

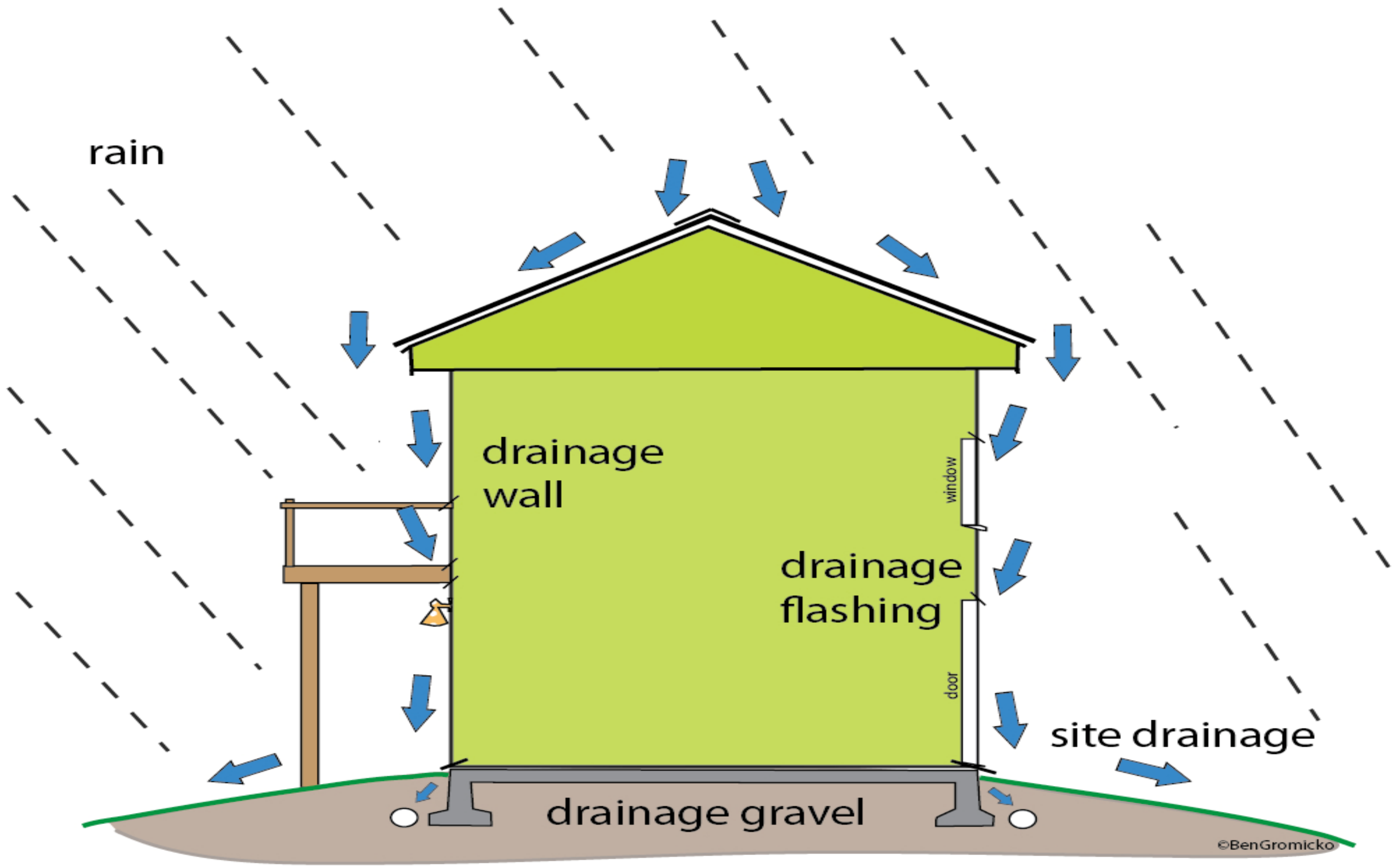
What is drainage?

- Two basic types
- Surface
- Subsurface

Water comes from all sides



Surface drainage

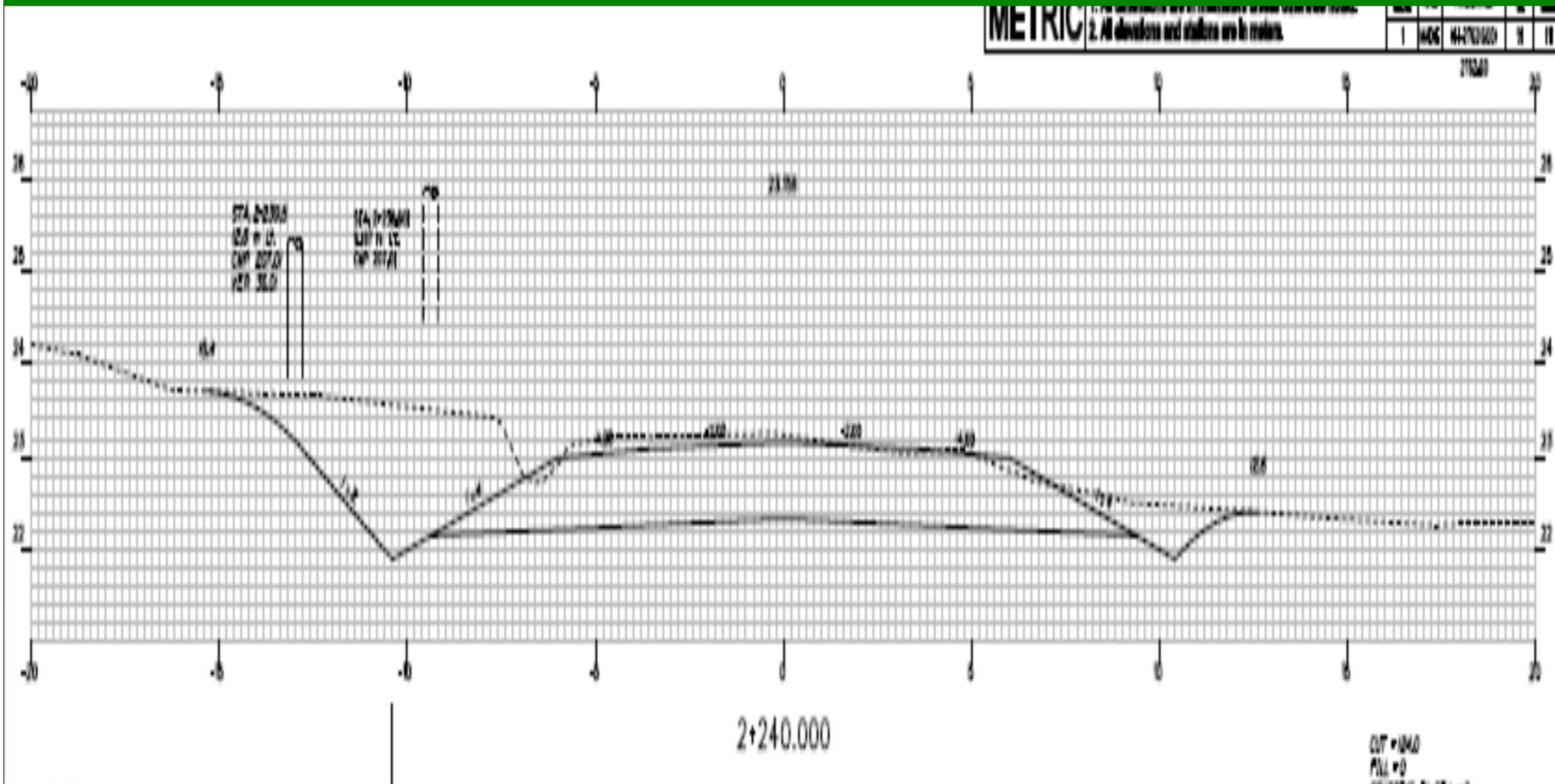


Pavement is the “roof”

Ditching

Terms

- Inslope-the slope between the edge of shoulder to the bottom of ditch
- Backslope-the slope from the bottom of the ditch towards the ROW line.
- Rounding-backslope shaping used in lawn areas to improve mowing ease for residents.
- V-ditch-inslope meets the back slope at the bottom of the ditch.
- Flat bottom ditch-a ditch with a level grade between the in-slope and the back slope. Varies in width depending on water flow and available ROW.
- Erosion Control Mat or Blanket-sometimes referred to as Jute Mesh or Jute. A machine produced bio-degradable blanket used to line a ditch where steep slopes increase the erosion potential.
- Check damns-stone dams used to slow water to reduce erosion.


METRIC
2. All elevations and stations are in meters.
2+240.000

Rip Rap & Stone ditch

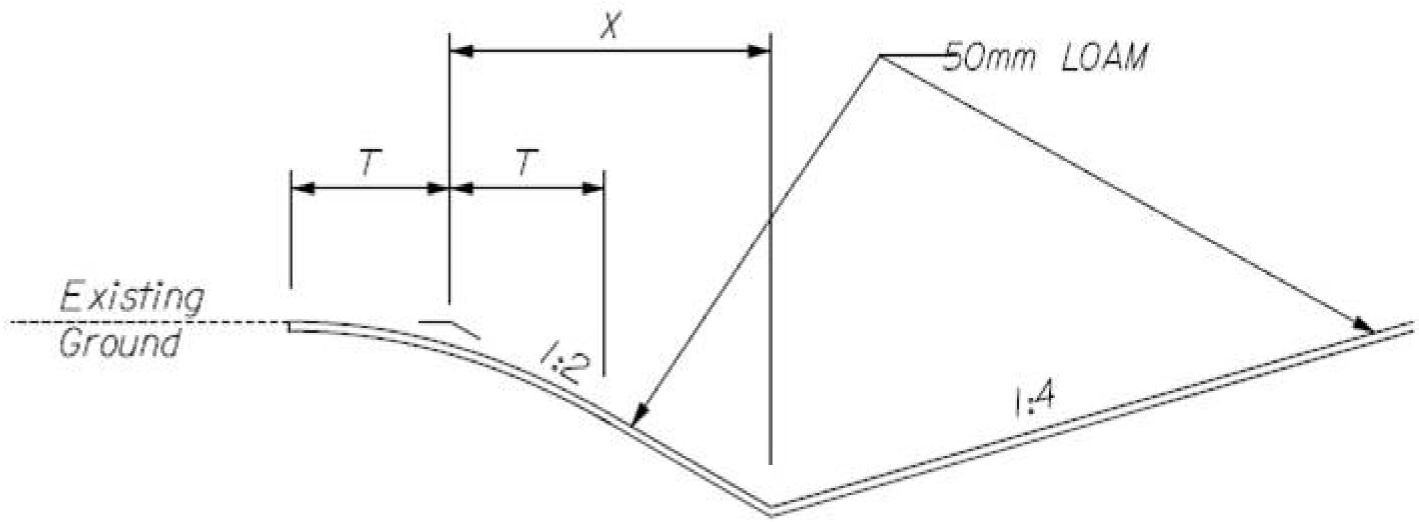
- Stone Ditch Protection

Process

- Start at outlet end and work upgrade
- Smooth ditch line with a rake to assure proper flow and to get a good match to the Erosion Control Blanket
- Install erosion control measures (Rip Rap, Stone Check Dams, Erosion Control Blanket) as you go
- Apply mulch at the end of the day

Backslope Rounding

BACK-SLOPE ROUNDING DETAIL IN LAWN AREAS



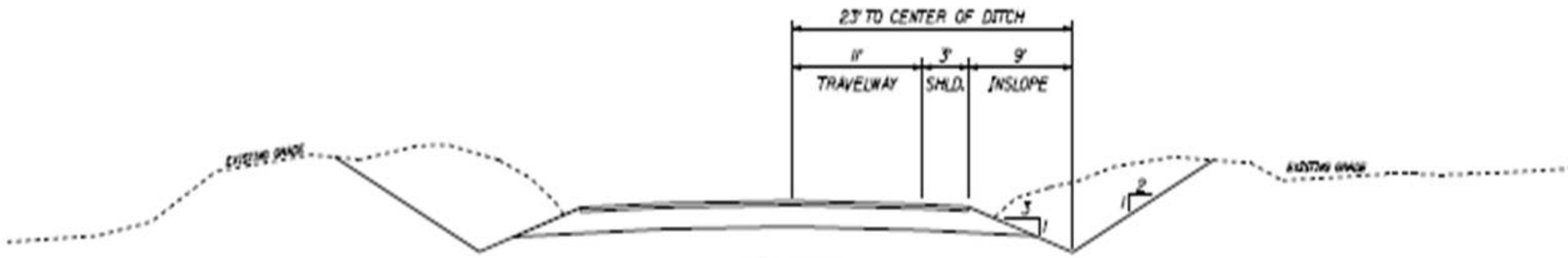
When:
X > 1.5m , Then T= 1.5m
X ≤ 1.5m , Then T= X
This formula may be modified in the field by the Resident to avoid property damage.

Sol

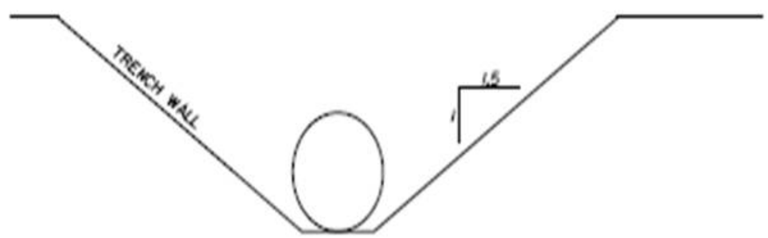
Slide 13

SoM1 State of Maine, 3/28/2008

DEPTH OF DITCH IS 3.9' BELOW EXISTING CENTERLINE OF ROAD



ROAD SECTION



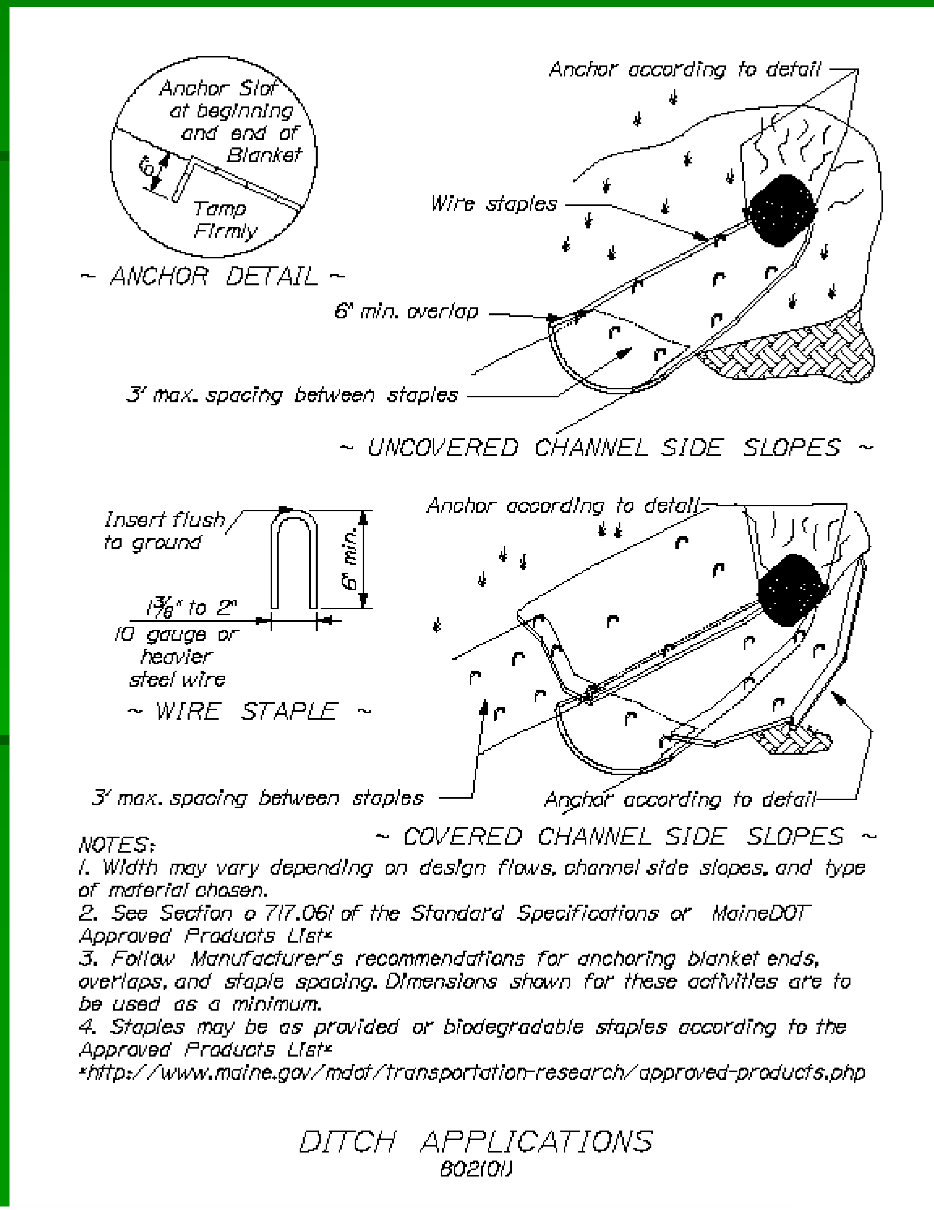
TRENCH SECTION

PLANS

STA.12+969.772 TO STA. 13+388

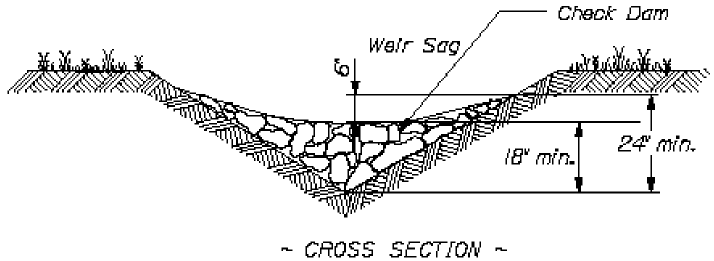
Erosion Control Blanket

Erosion Control Blanket

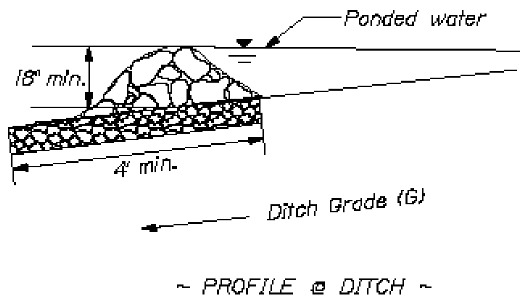


Stone Check Dam

Stone Check Dam



NOTE:
Unless specified, stone shall meet requirements of material specification 703.29 stone ditch protection.



REF: Best Management Practice for Erosion and Sediment Control - Check Dam

STONE CHECK DAM
802(06)

Culverts

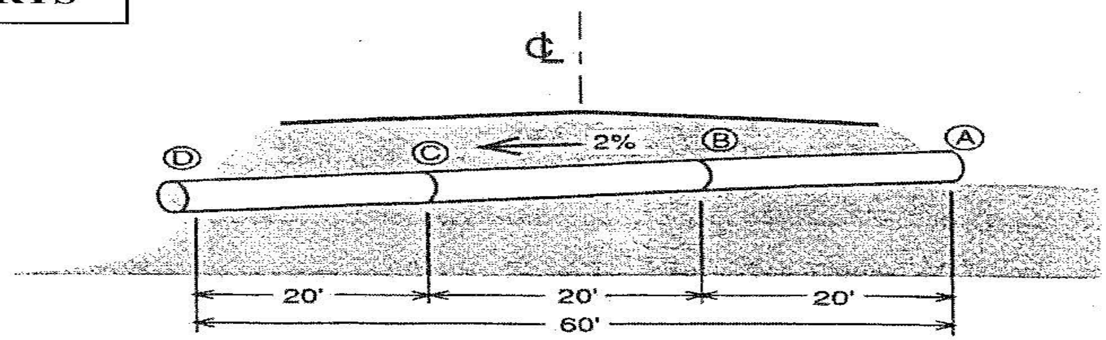
Terms

- Culvert- A device used to channel water. It may be used to allow water to pass underneath a road, railway, or embankment for example. Culverts can be made of many different materials; steel, polyvinyl chloride (PVC) and concrete are the most common. Formerly, construction of stone culverts was common.
- Band- strip of metal used to connect pipe sections.
- Bedding- granular material used to line the bottom of the excavation prior to culvert installation.
- Haunching- name given to the compaction effort from the bottom of the pipe to the spring line.
- Spring line-midpoint of the culvert pipe

Haunching

Pipe Ties

CULVERTS



Your job is to install a new culvert across a road at a 2% slope.

$$2\% = \frac{2ft.}{100ft.} = \frac{24"}{100ft.} = \frac{0.24in.}{1ft.} = \frac{1/4in}{1ft.}$$

1. What is the vertical drop from point A to B when you install the first 20 ft. pipe?

$\frac{1/4in.}{1ft.} \times 20$ ft. $=$ <u>5 inches</u>

2. What is the vertical drop from A to C?

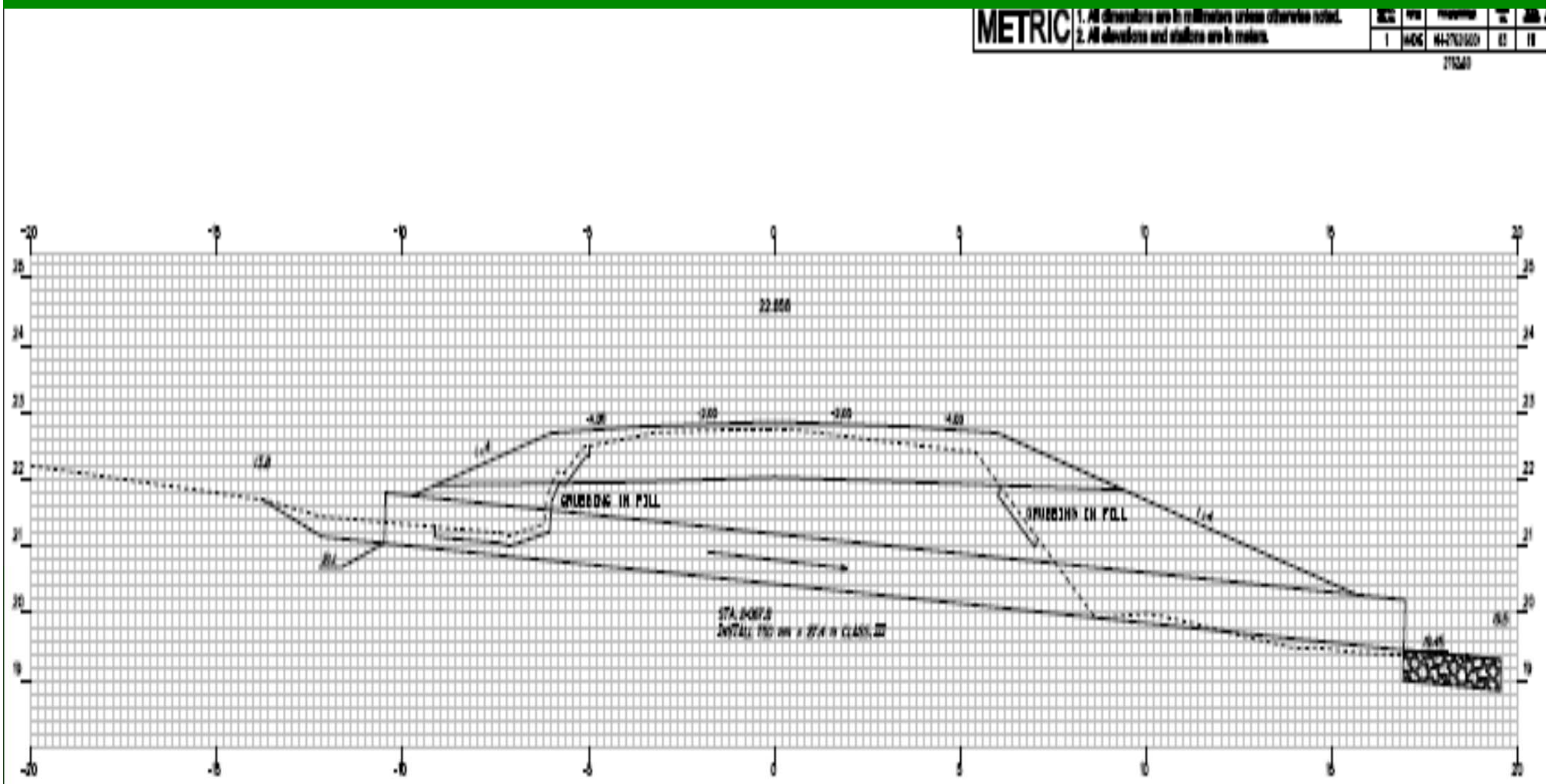
$\frac{1/4in.}{1ft.} \times 40$ ft. $=$ <u>10 inches</u>

3. What is the vertical drop from A to D?

$\frac{1/4in.}{1ft.} \times 60$ ft. $=$ <u>15 inches</u>

Culvert Installation

- Define limits of excavation. Based on pipe size and installation technique (trench box vs. sloping). Saw cut pavement at the excavation limits.
- Remove all pavement Apply maintenance of traffic gravel to lane carrying traffic.
- Remove and stockpile gravel
- Remove and stockpile excavation
- Remove and dispose of old culvert.


METRIC
1. All dimensions are in millimeters unless otherwise noted.
2. All elevations and stations are in meters.
GRUBBING IN FILL
GRUBBING IN FILL

2+067.500

Installation Process

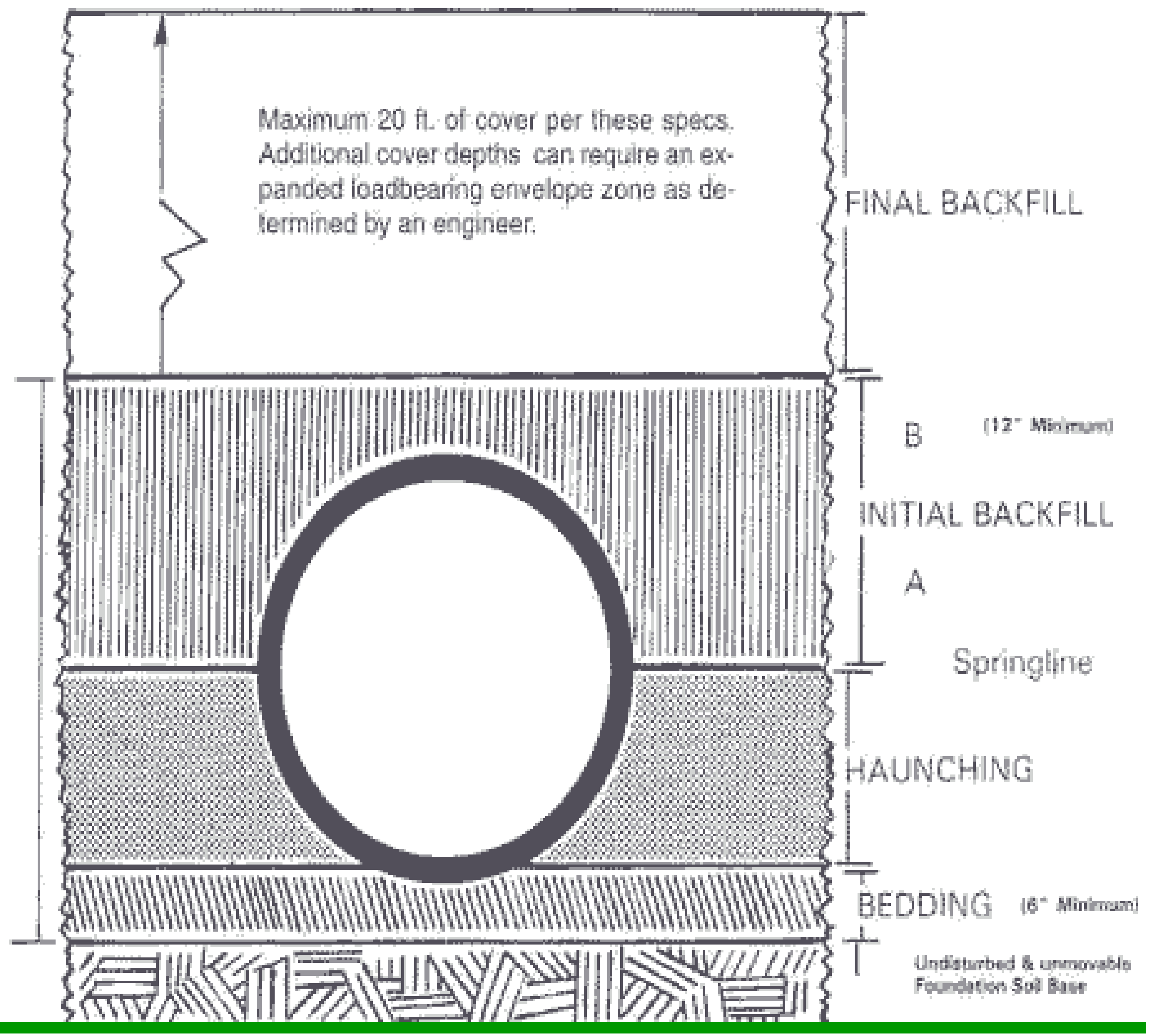
- Smooth bottom of culvert trench
- Place bedding material if needed
- Install culvert
- Place haunch material to spring line and compact. Haunch compaction is the most critical procedure to ensure a successful and long term culvert installation.
- Back fill from spring line to 12" over the top of the culvert. Use existing material if possible.
- Compacting in 8" lifts up to gravel grade.
- Install gravel compacting in 8" lifts. To top of existing pavement.
- Switch traffic and repeat.
- Prepare excavation for pavement by removing gravel the thickness of the proposed paving depth. In most cases this should equal the existing pavement depth
- Place pavement in 2" maximum lifts. Cool pavement with water if necessary before placing next lift. Do not place next lift on hot pavement

PIPE

COVER

SEQUENCE

DIAGRAM



Backfill

- The backfill should be similar to the existing material in the road unless it is unworkable. If unworkable, try find similar material in the slopes of inslopes and backslopes of the road to use. Using dissimilar materials will require longer transitions (up to 20:1, i.e. 60' long for a 3' depth) and more digging to eliminate sharp frost transitions.

Sealing pipe ends

- Seal and armor the ends of pipes with dirty material (higher clay content) to keep water from flowing around the pipe and through the road base. If dirty material is used for backfill, this has already been accomplished but this provides an added degree of protection. If water flows through the road base, it will freeze in the winter and cause humping at the pipes. Use a non-woven geotextile to protected the material from erosion before placing Rip Rap.

CULVERT INLET PROTECTION

Riprap Stones

- Riprap Stones shall consist of sound durable rock which will not disintegrate by exposure to water or weather. Either field stone or quarry stone may be used. Exposed stones shall be angular and as nearly rectangular in cross-section as practicable. Rounded boulders or cobbles will not be permitted. Stones shall weigh from 10 lb to 200 lb except that when available suitable stones weighing more than 200 lb may be used. Approximately 50% of the stones by volume, shall exceed a mass of 50 lb each.

Heavy Riprap

- Heavy Riprap Stones shall consist of sound, durable rock, resistant to the action of air and water. Either field stone or quarry stone may be used. The exposed stones shall be angular. Round or thin, flat stones will not be permitted. Stones shall have a minimum weight of 500 lb each and at least 50% of the stones, by volume, shall exceed 1,000 lb each

6/7/01 FRIDAY SUNNY 70'S

ITEM 603.159 CULVERT PIPE OPTION III

REMOVED EXISTING 12" CMP AND
INSTALLED 48' OF 12" CORR. POLYETHYLENE PIPE
AT STA 12+75. PIPE WAS INSTALLED PER LINE,
GRADE AND SPEC. BACKFILLED WITH EXCAVATED
MATERIAL AND COMPACTED EACH 8" LIFT
THERE WAS ALSO AN UNDERCUT BELOW THIS PIPE
BECAUSE OF UNSTABLE UNDERLYING BLUE CLAY.
THIS UNDERCUT WAS APPROVED BY THE RESIDENT
ENGINEER

UNDERCUT MEASUREMENTS

ITEM 206.061 STRUCT EARTH EXC. - BELOW GRADE

THE PIPE WAS UNDERCUT BY 24"+/- FROM PROPOSED
FLOW LINE
AVERAGE DEPTH =22+27.5+26+24.5+23.5/5=24.7"
MAX WIDTH=PIPE DIA + 15"(EACH SIDE)=42"
LENGTH = 40'
QTY = (24.7"-12")X(15"+12"+15")X40'/27=5.5 CY

ITEM 203.25 GRANULAR BORROW

ITEM USED TO BACKFILL UNDERCUT
TOTAL QTY =5.5 CY

BORROW MEASUREED IN PLACE MUST BE
SWELLED BY 15%

TOTAL QTY =5.5 X 1.15 = 6.33 CY

ENTERED BY : BILL BITTERMAN 6-7-02

Subsurface

- Type “B” 6”
- Type “C” 12-36”

Underdrain

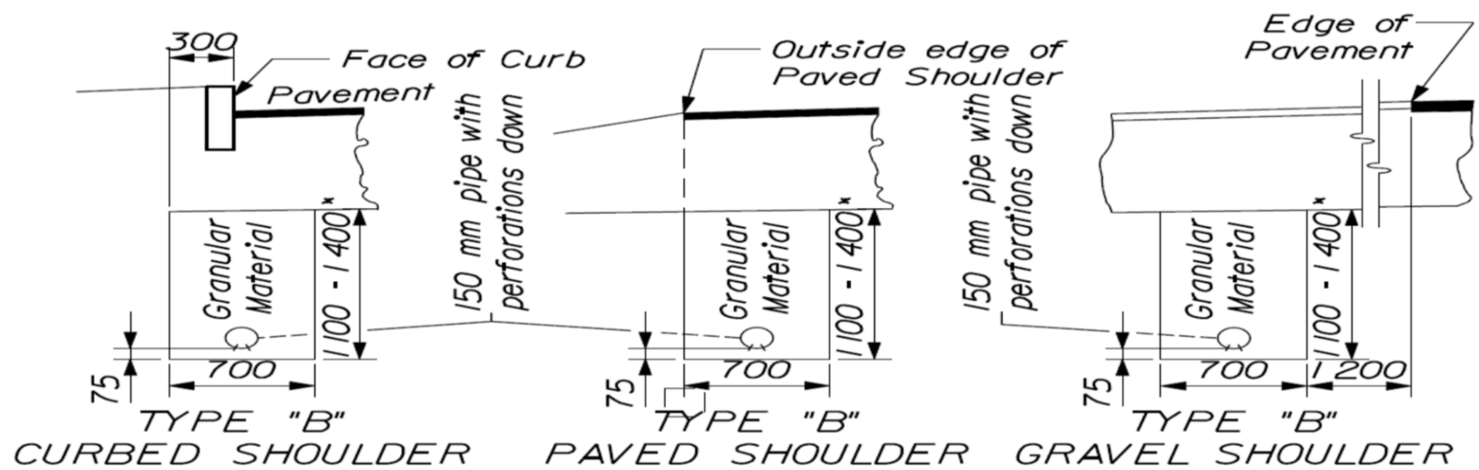
METRIC 1. All dimensions are in millimeters unless otherwise noted.
2. All elevations and stations are in meters.

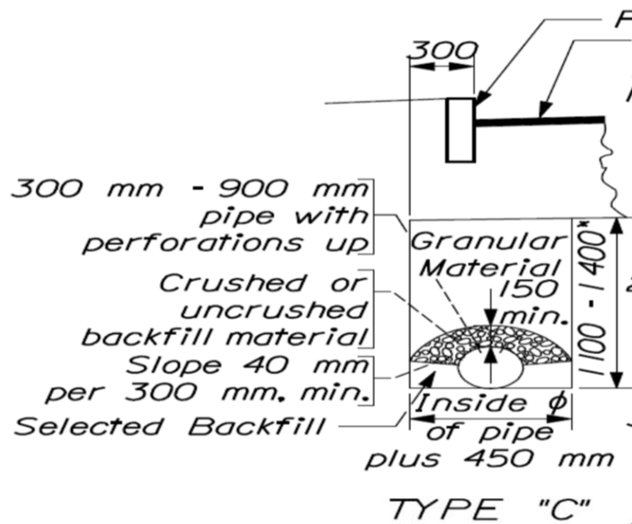
WINTERPORT ROUTE 1A

STA. 1+050 TO STA. 1+060

PLANS

Filename: ...\msta\031_XSMC10_dr_003.dgn Division: HIGHWAY Username: jody.harden Date: 3/18/2010





Notes:

1. The maximum vertical measurement of depth for payment of Structural Rock Excavation will be to a horizontal plane located 300 mm below the bottom of the invert of the pipe for Underdrain Type "B" and Underdrain Type "C".

2. The material for Elbows, Tees, & Wyes for Underdrain Types "B" and "C" shall be atleast as thick as the largest size pipe being connected.

3. The invert elevation of Underdrain Type "B" outlets shall be a minimum of 150 mm above the flow line of a ditch or the original ground.

4. Width of the trench for underdrain outlet will be the same as the underdrain trench.

5. No allowance for payment will be made for excavating or material excavated beyond the horizontal dimensions shown for Types "B" or "C" Underdrain.

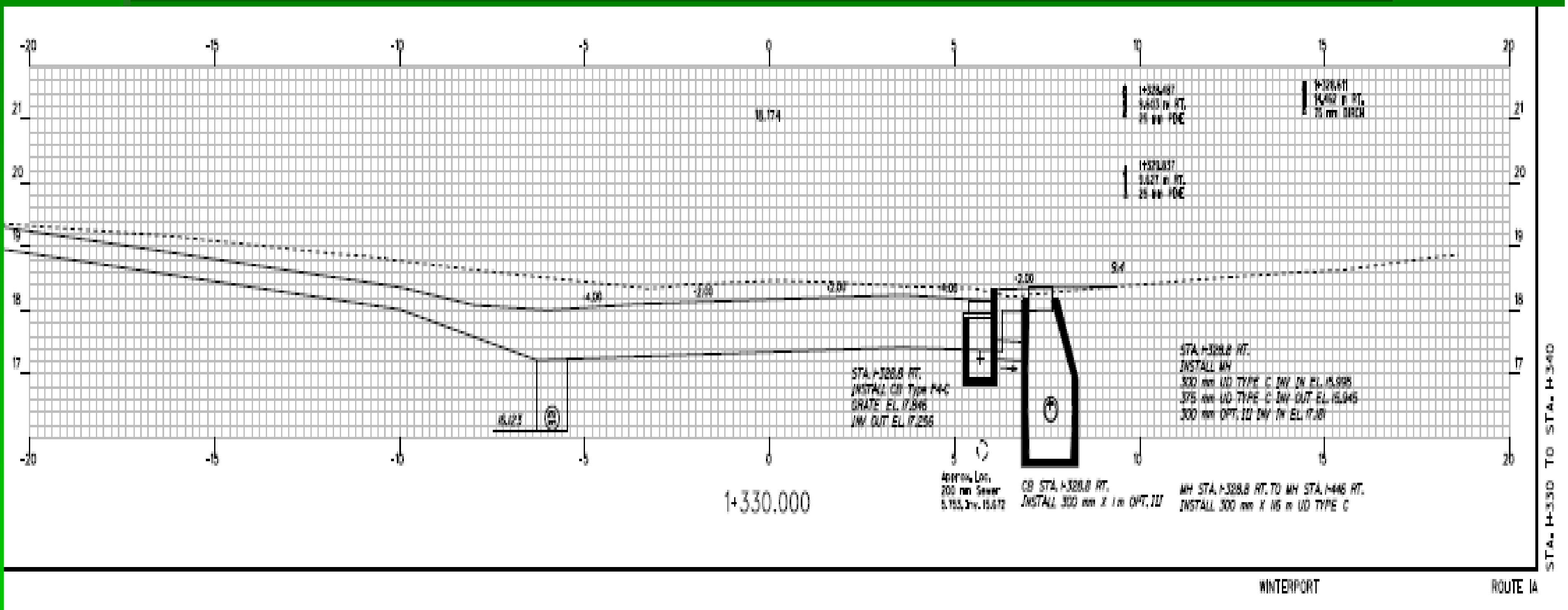
6. In "Box Sections" the edge of the trench shall be in line with the edge of box section.

* Unless otherwise shown on the plans

UNDERDRAIN

Standard Detail 605(01) ~ Scale 1:40


35


1+330.000
STA. 1+328.8 RT.
INSTALL CB Type F4-C
GRATE EL 17.846
INV OUT EL 17.256
STA. 1+328.8 RT.
INSTALL MH
CB STA. 1+328.8 RT.
MH STA. 1+328.8 RT. TO MH STA. 1+446 RT.
WINTERPORT
ROUTE 1A
STA. 1+330 TO STA. 1+340


EXIT
CSI
CSI


1 800 rent-a-car
50 MAINE MALL ROAD
HARRIS GOLF SHOP
MAINE GOLD & SILVER
AMERICA'S MATTRESS
VOLVO
CITGO

Underdrain Installation

- Smooth bottom of culvert trench
- Place bedding material if needed
- Install UD pipe
- Place haunch material to bottom of weeping holes and compact. Haunch compaction is the most critical procedure to ensure a successful and long term installation.
- Back fill from weeping holes to 8” MINIMUM over the top of the culvert with crushed stone.
- Compacting in 8” lifts with underdrain sand up to gravel grade.
- Install gravel compacting in 8” lifts. To top of existing pavement.

Compaction

Compaction Terms

- Compaction-mechanical means of soil or material stabilization
- Proctor-a compaction test to determine the maximum density
- Percent Compaction- an aim for compaction effort based on the proctor.

Types of Compaction Equipment

- Pneumatic Pogo Stick
- Jumping Jack
- Plate wacker
- Roller

Pneumatic Pogo

Jumping Jack

Plate Compactor

Remote Control Pod Foot

6/8/2001 TUESDAY SUNNY 70'S (3)

603.09 CB STA 33+28 RT

INSTALLED 8' PRECAST CB WITH 2' SUMP
FOR EXISTING 24" CIP. REMOVED A PORTION OF A
LARGE CONCRETE STRUCTURE IN ORDER TO INSTALL
CB SUMP. SEE OPPOSITE PAGE FOR PAY DEPTH &
QTY'S BACKFILLED WITH STONE FOR CB BEDDING.
OUTSIDE CB = 4' DIAMETER
EXCAVATED 18" OUTSIDE WALL AND USED A 235
B'HOE WITH HOE RAM TO REMOVE CONCRETE
BACKFILLED WITH EXCAVATED MATERIAL,
AND COMPACTED EACH LIFT.
ALL WORK DONE ACCORDING TO PLANS & SPEC

ITEM 203.07 STRUCTURAL ROCK EXCAVATION
BROKE OFF EXISTING CONCRETE STRUCTURE
TO INSTALL CB SUMP

BOTTOM OF SUMP CONC ELEV = 90.5' FROM PLANS ✓

AVERAGE ELEV OF TOP OF BURIED CONCRETE

TBM # 5	BS	HI	FS	ELEV.	
101.5	3.5	105 ✓			
			9.0	96 ✓	TP OF CONC
			9.3	95.7 ✓	TP OF CONC
			9.9	95.1 ✓	TP OF CONC
			10.0	95 ✓	TP OF CONC

AVERAGE TOP ELEV OF BURIED CONCRETE = 95.45'

BOTTOM OF UNDERCUT ELEV = 89.5'

DEPTH OF CONCRETE REMOVED = 95.45-89.5 = 5.95' ✓

WIDTH OF CONCRETE REMOVED
= 4' + 2(1.5') = 7' ✓

ITEM 203.07 STRUCT ROCK EXCAVATION

VOLUME = 3.14 X (7/2)2 X 5,95 = 65.42 CF / 27 = 2.42 CY ✓

ENTERED BY : BILL BITTERMAN 06-08-02
CHECKED BY: ABC 1-2-03 ✓

Underground Utilities

- Identification
- Coordination
- Dig Safe
- Specifications / Codes
- Contractor attention

Underground Utilities

- Identification

  Utility Layout

  Test Pits

Underground Utilities

Underground Utilities

- Dig Safe

  Underground facility damage prevention requirements per 23 MRSA § 3360-A.

  Responsibilites of designer

  Responsibilities of Contractor

Underground Utilities

- Dig Safe

  Member Operator

  Non-member Operator

Underground Utilities

- Dig Safe
    - Excavator’s responsibilites
    - Owner’s responsibilites
    - Incident Report Form


11/04/2004 11:21

Underground Utilities

- Contractor Attention

  Utility Specification

  Pre-Construction Utility Meeting

  Outages


CPM
CONSTRUCTORS
GENERAL CONTRACTORS
FREEPORT, MAINE
06/17/2005 12:27


06/17/2005 12:57

Construction Practices

- Drainage Questions?

Erosion and Sedimentation Control

Surface Water Quality Unit
Maine DOT

EROSION AND SEDIMENTATION

- Erosion = Movement of soil by action of water or wind.
  - Erosion is natural
  - Accelerated Erosion is not
- Sedimentation = “settling out” of soil particle from the water.

EROSION
POWER OF WATER

$$P = \text{Velocity} \times \text{Depth}$$

- Increase Depth – Increase Power
- Increase Velocity – Increase Power
- Increase Power – Increase Erosion

TYPES OF EROSION

- Raindrop
- Sheet
- Rill
- Gully

RAINDROP EROSION

Raindrops falling on exposed soil can break off soil particles to be lost in run-off water.

Courtesy - NETC, Victoria, AU

RAINDROP EROSION

- The harder the rain and the finer the soil texture, the more raindrop erosion will occur.
- Consider that a large raindrop will fall at a rate of 30 ft/sec and may be up to 250 time larger than a silt particle.
- Sand on the other-hand may be the same or only half the size of that raindrop
- Soil Sealing - Pounding the Surface

SHEET EROSION

- Sheet flow over bare soil pick up soil
- Plus soil that was splashed up by the raindrop is now in suspension and will move with the sheet of water.
- Sheet flow can be up to ½ inch deep
- 1/8th of and inch of soil loss per acre will fill a 10 wheel dump truck (15 cu.yds. or 25 tons).
- How fast and far this “sheet” of water flows depends on how deep the water is, the texture of the soil, and the steepness and smoothness of the land.

A surface film of water forming on a recently cultivated paddock.

Courtesy - NETC, Victoria, AU

RILL EROSION

- When sheet flow begins to concentrate depth, increases power and begins to cut.
- Rills are technically no more than 1.0 inches deep and will be spread out across a slope.
- Rills pull together and are short lived

GULLY EROSION

- Rills coming together on a slope
- Flow volume increases – Increase Depth
- Velocity = Slope (Critical)
- Power increases to a point that the bottom cuts down

GULLY EROSION

- They will continue to erode from the bottom up, or **head cut**.
- The side slopes are usually vertical and will then begin to collapse under their own weight.
- On Construction Sites they usually form in bottom of channels and move upstream
- A gully can be as small as 2 inches by 2 inches to as big as the Grand Canyon

EROSION CONTROL

- Limit the Depth (Volume) of Water on Site
  – Diversion, Detention, Infiltration
- Slow down the Velocity of Water on Site
  – Flatten the Slope, Grading
- Protect the Soil

–MULCH, MULCH, MULCH

SEDIMENTATION

- Sediment is soil suspended in water
- Sedimentation is the settling out of sediment
- Decrease Velocity = Sedimentation
  - Decrease Velocity – Ponding
    - **Usually occurs by grade change**

SEDIMENTATION

- Sands?
  - Always
- Silts ?
  - Sometimes
- Clays ?
  - Almost Never

SEDIMENTATION

- Sheet Flow and Shallow Concentrated
  - Flatten grade
  - Roughen surface - filter strip
  - Barriers – Silt Fence
- Channel Flow
  - Must Stop velocity – Ponding
  - Can put back in sheet flow – filter strips, buffers

SEDIMENT CONTROL

- Last Line of Defense
- Decrease Power = Sedimentation
  - Decrease Velocity – Ponding
    - **Silt Fence, Sediment ponds**
  - Decrease Velocity (and Depth) – Filtering Go from Concentrated Flow to Sheet Flow
    - **Level Lip Spreaders, Filter Strips, Buffers**

Best Management Practices
for
Erosion and Sedimentation Control
(MaineDOT BMP Manual)

Erosion and Sediment Control

Sheet and Rill Erosion

Concentrated Flow Erosion

MaineDOT, BMP Manual for Erosion & Sedimentation Control

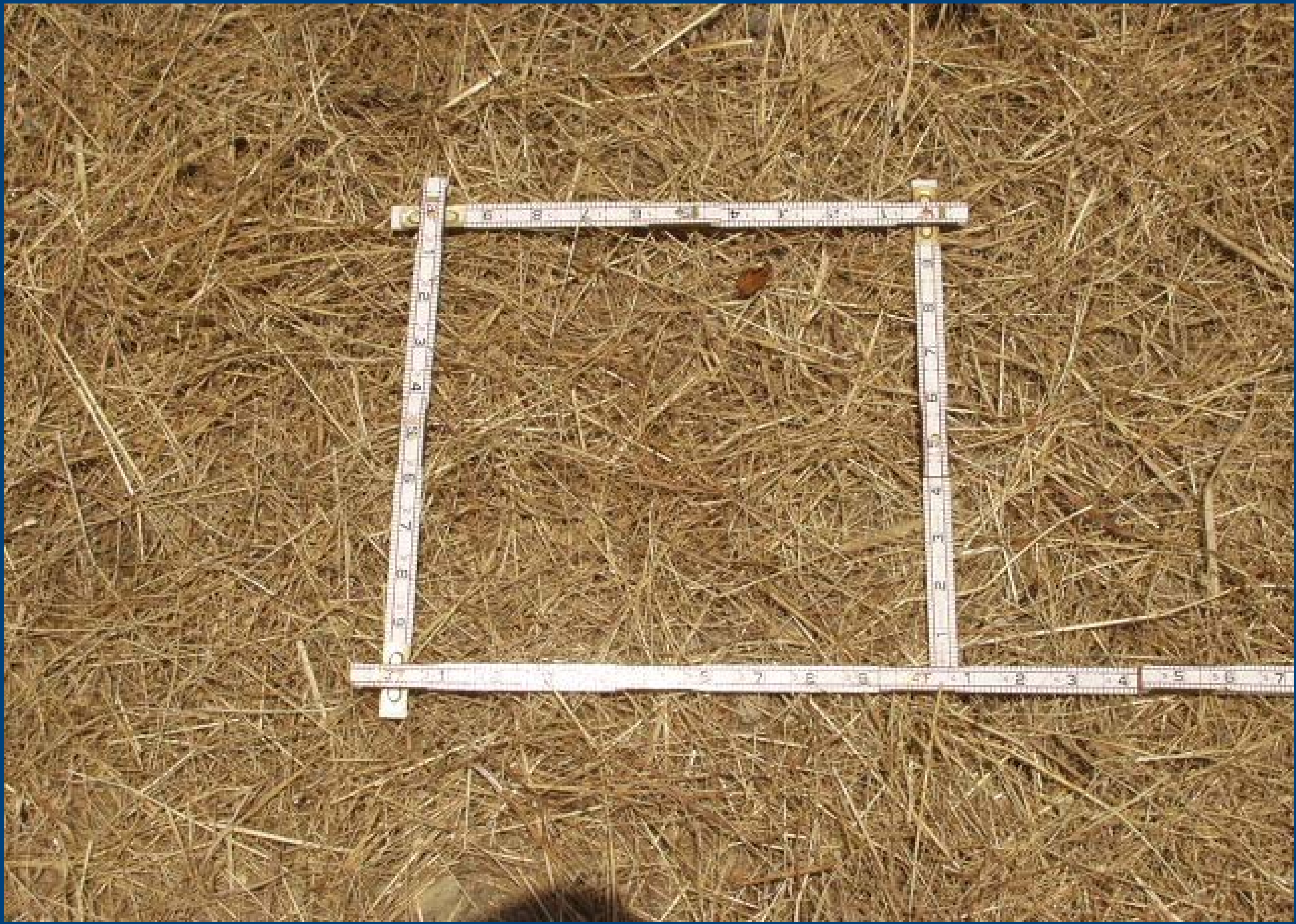
- SR-EC, Sheet & Rill-Erosion Control
- SR-SC, Sheet & Rill-Sediment Control
- CF-EC, Concentrated Flow-Erosion Control
- CF-SC, Concentrated Flow-Sediment Control
- In-Water Work
- Miscellaneous

Sheet & Rill, Erosion Control

- Hydraulic Mulch
- Hay & Straw Mulch
- Erosion Control Mix
- Erosion Control Blanket
- Turf Reinforced Matting
- Plastic Sheeting
- Seeding & Landscape Planting
- Surface Roughening
- Gradient Terrace
- Hillside Diversion

Hydraulic Mulch

Hay & Straw Mulch



Erosion Control Mix

ECM Slope Protection

Erosion Control Blanket

Turf Reinforcement Mat

Plastic Sheeting

Seeding & Landscape Planting

Hillside Diversion

Sheet & Rill, Sediment Control

- Silt Fence
- Erosion Control Mix Berm
- Continuous Containment Berm
- Vegetated Filter Strip

Silt Fence

Bad Install

Erosion Control Mix Berm


BUMP

Continuous Containment Berm

Vegetative Filter Strip

Concentrated Flow-Erosion Control

- Channel Lining
- Temporary Channel Lining-Plastic Sheeting
- Rip Rap Downspout
- Temporary Slope Drain
- Energy Dissipator
- Culvert – Inlet/Outlet Protection

Channel Lining

Temporary Channel Lining-Plastic Sheeting

Rip Rap Downspout


01 11 27

Temporary Slope Drain

Energy Dissipators

Culverts – Inlet/Outlet Protection

Concentrated Flow – Sedimentation Control

- Check Dams
- Sediment Traps
- Storm Drain Inlet Protection

Check Dam

Sediment Trap

Storm Drain Inlet Protection


08/10/2004

In-Water Work

- Floating Turbidity Curtain
- Temporary Stream Crossing
- Temporary Stream Diversion
- Cofferdams
- Dewatering
- Temporary Sediment Basins
- Filter Bag

In-Water Work

- ► Floating Turbidity Curtain
- ► Temporary Stream Crossing
- ► Temporary Stream Diversion
- ► Cofferdams
- ► Dewatering
- ► Temporary Sediment Basins
- ► Filter Bag

Handling the Water

- Dry Stream Bed – "Do it in the Dry"
  - Cofferdams
  - Bypass (Diversions)

Water Quality?

Wet and Muddy

Maintaining Water Quality During Construction

- ►Handle the Water
- ►Install Erosion and Sediment Control BMPs
- ►Final Stabilization (Button It Up)

In the Dry

Handle the Water - What Matters

- Project Scope
- Regulations
  - Tree Clearing Restriction 4/15-11/1, Bats
  - ACOE/USFWS Permit
  - Maine DEP/LUPC Permit
- Hydrology
  - Time of Year
  - Watershed/Stream Characteristics

Handle the Water – Project Scope

- ►Site Conditions
  - – Traffic
  - – Access
- ►Full Replacement
  - – Road opening
    - ►**Depth and width of cut**
    - ►**Increase options for bypass**
- ►Rehabilitation
  - – Slip Lining and Invert Lining

Handle the Water – Regulations

- In Steam Work Window
  - Federal – Army Corps of Engineers
  - State - Maine Department of Environmental Protection

July 15th through October 1st

- Other Regulations – MHPC, etc.

Containment

Jersey Barrier Cofferdam

Increase Flow Length

Concrete Block Cofferdam

Sheet Pile Cofferdam

Plate Steel Cofferdam

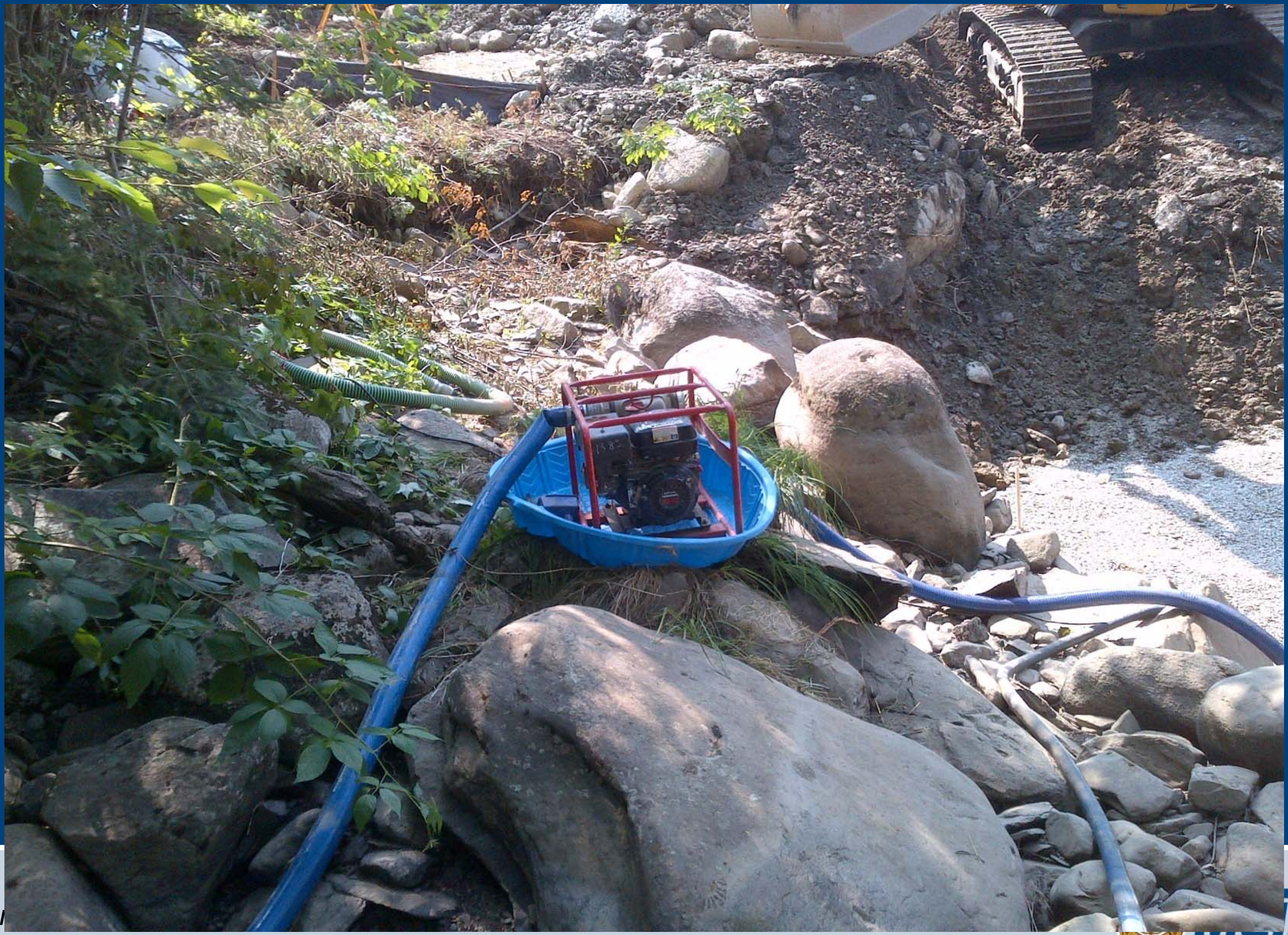
Not A Cofferdam

Sandbag Cofferdam

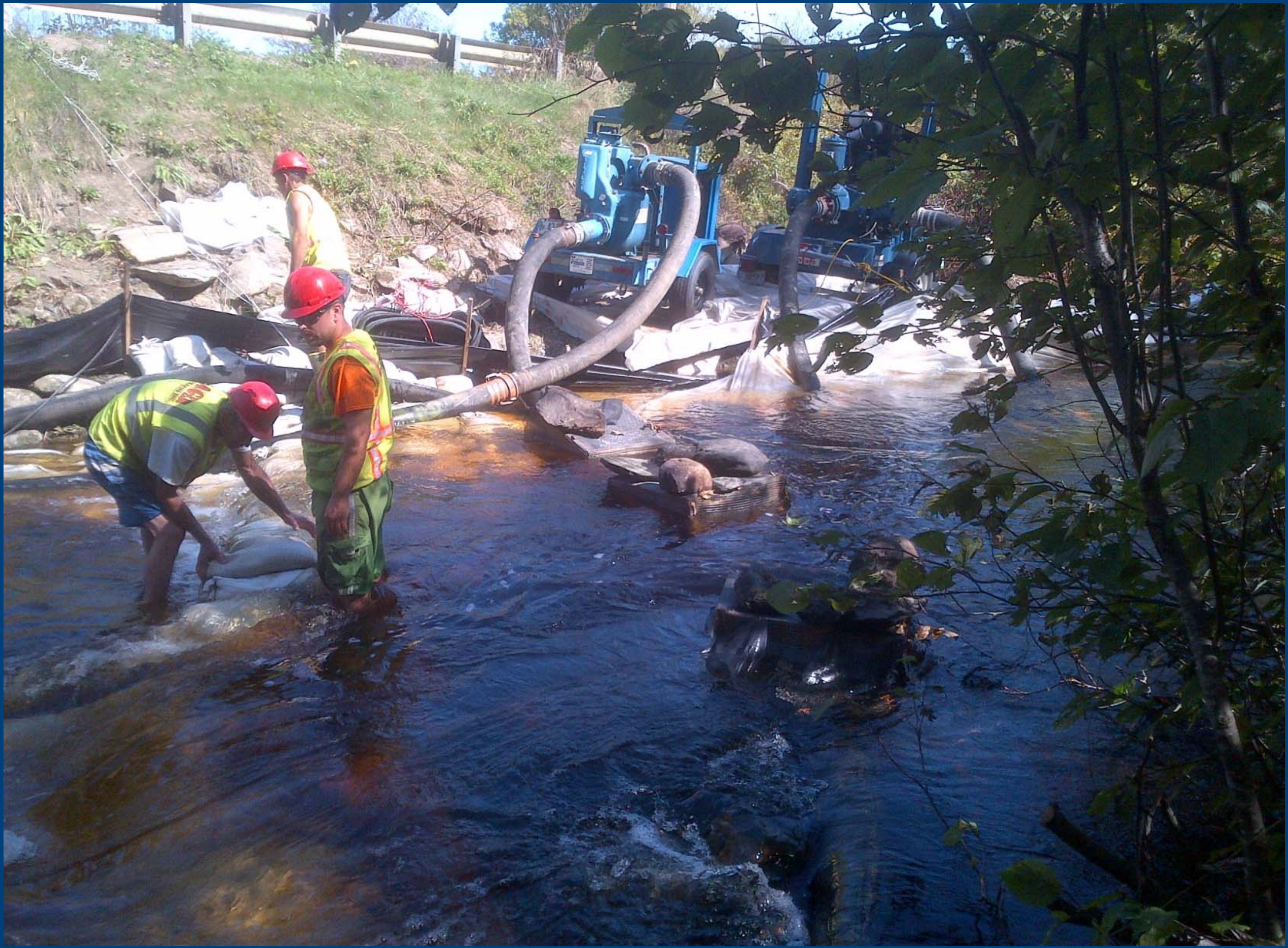
Three Inch Centrifugal Pump

Six Inch Centrifugal Pump

Three Inch Pump w/ Secondary Containment



Twin 6” Pumps w/ Secondary Containment

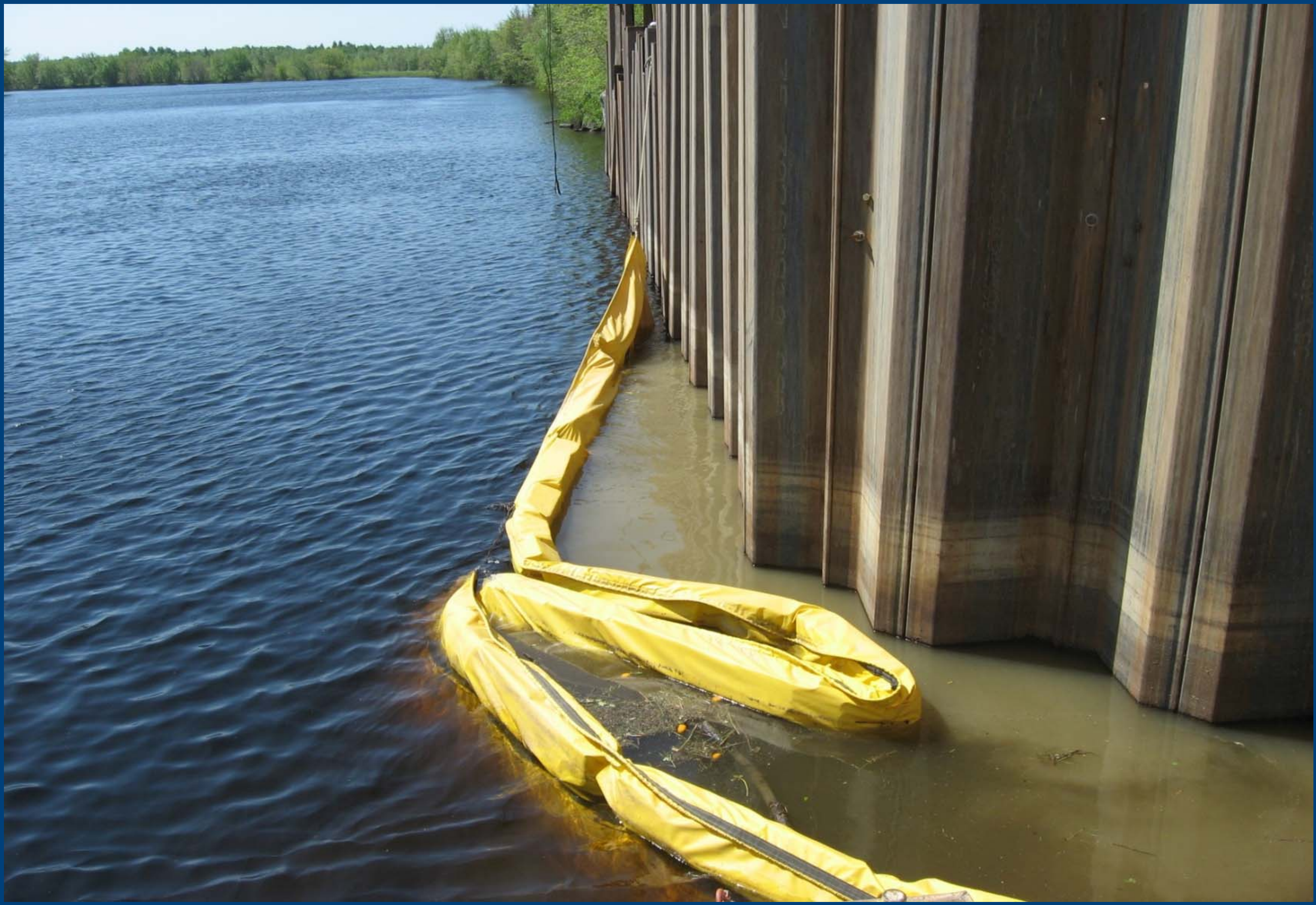


Twin Three Inch Pumps w/ Turtle Sandbox Containment

Temporary Sedimentation Basin

Filter Bags

Floating Turbidity Curtain



Miscellaneous

- Dust Control
- Sweeping & Vacuuming
- Construction Entrance/Exit
- Winter Stabilization

THE END