Rocky Mountain Asphalt Education Center

Laboratory for the Certification of Asphalt Technicians (LabCAT)

Level A - Laydown

2020 Presentation Manual

In cooperation with the Colorado Asphalt Pavement Association,
the Colorado Department of Transportation, and the
Federal Highway Administration

–Welcome to the
LABORATORY for the
CERTIFICATION of
ASPHALT TECHNICIANS
(LabCAT)
2020

1

Asphalt Technicians
Certification Program,
Levels A, B, C and C minus Design

2

Introductions

- Introduction of CAPA & RMAEC Staff
  - LabCAT Board of Directors
  - LabCAT Technical Committee
- Program Description
- Safety
- General Information

3

Colorado Asphalt Pavement Association (CAPA)
Rocky Mountain Asphalt Education Center (RMAEC)

- Tom Peterson, P.E. CAPA Executive Director
- Tom Clayton, SET CAPA/RMAEC Dir & Member Support
- Mike Skinner, P.E. Director of Pavement Engineering
- Diane Hammond RMAEC Training Coordinator
- Cindy Rutkoski RMAEC Instructor

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LabCAT Board of Directors

Brenda Shuler, Aggregate Industries WCR
Ed Wells, Connell Resources
Gary DeWitt - CDOT Region 4 RME
Vacant - FHWA
Bill Caires. Cesare Inc
Tim Webb - CDOT Region 5 RME
Cary Jones - Kumar and Associates
Tom Peterson - CAPA

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LabCAT Technical Committee

John Cheever	Aggregate Industries
Mike Stanford	CDOT Asphalt Pave. Program (Co-Chair)
Patrick Kowing	FHWA – CFL
Dahir Egal	FHWA
Johnny Lam	CDOT
Cindy Rutkoski	RMAEC
Ethan Wiechert	Earth Engineering
Tom Clayton	RMAEC (Co-Chair)
Clayton Goodwin	City & County of Denver
Todd Genovese	Martin Marietta
David Fife	United Companies
Mike Gallegos	CDOT R-1
Jessica Ebel	CDOT R-5

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Asphalt Technician Certification Program

- Certification A – Laydown
- Certification B – Plant Materials Control
- Certification C – Volumetrics, Gyratory, Stability & Lottmans
- Certification C minus Design – Volumetrics and Gyratory Compaction
- Certification E – Aggregates
- Certification I – Asphalt Inspector

7

Certification Schedule Tuesday

8:00 am
Certification Level A

PC/OA Program	Technician Responsibilities
Random Sampling Plans	CP 75
Sampling Aggregate	CP 30
Sampling Asphalt Mix	CP 41,
Bulk SP G for Roadway Cores	CP 44, Method B
Compaction Test Section	CP 82,Field Cores
In-Place Density by Nuclear Method	CP 81

Certification Level A written Exam on CDOT Procedures – 60 Minutes

Following the written exam, laboratory proficiency testing will occur.

8

Certification Schedule – Wednesday

<u>Certification Level B</u>

Verification of Lab Equipment	CP 76
Reducing Asphalt Mixture	CP 55
Bulk SpG for Lab compacted Specimens	CP 44
Maximum Specific Gravity	CP 51
Asphalt Content by Ignition Method	CP-L 5120
Asphalt Content by Nuclear Oven	CP 85
Splitting Aggregate	CP 32
-200 Wash & Sieve Analysis	CP 31, AASHTO T11/T27

Certification Level B written exam on CDOT/AASHTO Procedures: 75 minutes

Following the written exam, laboratory proficiency testing will occur.

9

Certification Schedule Wednesday

<u>Laboratory –Certification Level B</u>

Reducing Asphalt Mixture	CP 55
Bulk SpG of Lab Compacted Specimens	CP 44
Maximum Specific Gravity	CP 51
Ignition Oven	CP-L 5120
Determination of Moisture in HMA	CP 43
Asphalt Nuclear Content Gauge	CP 85
Splitting Aggregate	CP 32
-200 & Sieve Analysis	AASHTO T11/T27, CP 31

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Certification Schedule Thursday

Classroom –Certification Level C

Mixture Volumetric Properties

Superpave Gyratory Compactor CP-L 5115

Hveem Stability CP-L 5106

Resistance to Moisture Induced Damage CP-L 5109

Certification Level C written Exam on: CDOT Procedures – 60 minutes

Following the written exam, laboratory proficiency testing will occur.

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RMAEC Requirements

- Relax
- Don't be late from breaks
- Questions/Comments are welcome and encouraged during presentations
- CEU's are available (See Diane)
- Please Silence Cell Phones

12

Safety Issues?

- Materials
  - Heated Mixture samples (Level C only)
  - Compacted Specimens (Level B and C)
- Equipment
  - Nuclear Gauges (Sourceless)
  - Forced Draft Ovens (Level C only)
  - Compression Testing Machine (Level C only)
  - Gyratory Compactors (Level C only)

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General Information

- ▶Coffee & Refreshments, Counter in lobby Area
- ▶Pop Machine
- ▶Lunch ~ provided
- ▶Breaks ~ As needed
- ▶Restrooms, Main building hallway on the left.

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Handouts

- ▶LabCAT Presentation Manual (slide presentations)
- ▶Evaluations (First page in the presentation manual)
- ▶CDOT Manuals
  - ▶Field Materials Manual–Levels A & B (Are available but not supplied, only the required sections are provided during the written test)
  - ▶Laboratory Manual of Test Procedures–Level C (Are available but not supplied, only the required sections are provided during the written test)
- ▶AASHTO Procedures (In the back of the presentation book)

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LabCAT Program Policies

Written Test:

- ▶ Written exams are closed book. No personal notes are allowed during testing. Written tests are timed, times are stated at top of exams & will be adhered to.
- ▶ Before beginning the written exam, the instructor will distribute copies of the CDOT procedures per level. These handouts are for quick reference. Please be prepared, as all written exams are timed.
- ▶ Handouts will be collected at the completion of the written exams.
- ▶ Each level of the written exams is divided into sections. A score of 70% or higher must be achieved per section, with an overall score of 80% or higher to pass the written exam portion of certification.
- ▶ If any section of the written exam score is less than 70%, the technician will be advised.
- ▶ Re-testing of the failed section is allowed if the total number of failed sections per level does not exceed the maximum. The maximum number of failed sections per level is as follows: Level A – 2 sections, Level B – 2 sections and Level C, 1 section, C minus Design no sections.

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LabCAT Program Policies

- The technician will be allowed to briefly review the failed section of the first exam (Test 1). The instructor will not coach the technician regarding the failed questions. The Re-test (Test 2), will be immediately administered.
- 15 minutes will be allowed for re-test of one section, 30 minutes will be allowed for two or more re-test sections.
- If the technician fails (Test 2), e.g. "an overall score of less than 80%", the technician will not be allowed to continue the certification process or proceed to the Laboratory portion of certification. The technician must re-register for certification. Please note: If the technician fails (Test 2) and is not allowed to continue, the entire registration fee will still be invoiced.

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LabCAT Program Policies

- Written exam re-test fees are $25 per level.
- A letter will be sent to the appropriate company advising them of the failure and what is required for the technician to successfully complete the certification program.
- These new policies are being applied to encourage technicians to come prepared for certification testing and for the companies to provide necessary training.

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2020 LabCAT Policies

- <u>Laboratory Procedures are graded Pass or Fail.</u>
- Laboratory Procedure Proficiency Testing is closed book. Technicians will be required to independently demonstrate proficiency in each Laboratory Procedure per level. Additional training or coaching by the laboratory exam proctor will not be allowed.
- If the technician does not Pass the first attempt (Trial 1) a second attempt (Trial 2) is allowed. The second attempt (Trial 2) will be immediately administered. However, the maximum number of Failed Procedures is limited per level.

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2020 LabCAT Policies

- Laboratory Proficiency Testing

If the maximum number of Failed Procedures is exceeded, the technician will not be allowed to continue the certification process.

Maximum number of failed proficiencies allowed:

1 – Level A
2 – Level B
1 – Level C
0 – Level C minus Design

- <u>Laboratory Procedure Re-Testing Fees</u>
  - Laboratory Procedure re-test fees are $150 per level.

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Failure/Retest Policy (con't)

– Lab Proficiencies

If at or below the number allowed to be eligible to re-test, you will be required to perform an additional proficiency from the same level to ensure competency at that level.

- ***No Refund or consideration*** will be given to a Technician who begins a session and chooses not to complete the session on the scheduled day. A Technician who chooses to leave a session will be considered as failing and will need to retest as described in the ***"Retest Policy".***

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Supplemental Examiners (Proctors)

- Where our proctors come from:
  - *CDOT*
  - *Local Agency*
  - *Contractors*
  - *Consultants*
- Time needed for proficiency testing is based on the number of proctors available during the certification session.
- How do I become a proctor?

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Presentation Information

- Information presented during LabCAT Certification is based on CDOT Procedures where indicated by type in **Blue, Bold and Underlined** are specific to CDOT and vary from AASHTO.
- All other information presented is based on AASHTO procedures.
- In any situation where the **CDOT** procedure is present, it will supersede the AASHTO procedure and the technician will be tested on the **CDOT** Procedure.

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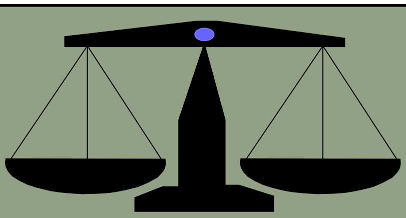
Who you are is important too!

Self Introductions

- Name
- Organization
- General responsibilities
- Years in the construction field

24



A Clean Lab is A Safe, Productive Lab!
Please help us to keep the lab clean!

25

Questions ??????

Let's Get Started!

26

WHAT IS A PROCESS CONTROL PROGRAM?

Why is accurate materials sampling, splitting and testing so important on Highway Construction Projects?

1

WHAT IS CDOT'S OWNER ACCEPTANCE (OA) PROCESS CONTROL (PC) PROGRAM?

- Owners Acceptance (OA) All those planned and systematic actions necessary to provide confidence that a product or facility will perform satisfactorily in service; or making sure the quality of a product is what it should be.
- Process Control (PC), A program performed by the contractor. The system used by a Contractor / vendor to monitor, assess and adjust their production or placement processes to ensure that the final product will meet the specified level of quality. Quality Control includes sampling, testing, inspection, and corrective action (where required) to maintain continuous control of a production or placement process (and to fulfill contract requirements).

2

WHAT IS THE CONTRACTOR'S PC PROGRAM

The contractor shall develop a PC Program for each element listed in table 106-1 of the project special provisions:

- Frequency of test or measurement
- Test result chart
- Quality Level chart

3

WHAT IS INCLUDED IN THE CDOT OA PROGRAM

The OA Program will provide for:

- An Acceptance Program
- Frequency Guide Schedule, Identification of specific sampling location
- Project verification sampling and testing
- Independent Assurance Program
- Project Materials Certification
- Retention of sampling and testing records

4

WHAT IS THE TESTER'S RESPONSIBILITY IN THE ACCEPTANCE PROGRAM

- To conduct the sampling, splitting and testing of asphalt according to proper procedures (CDOT or AASHTO).
- LIMS program. The test results are input into LIMS on CDOT projects bid after July 1, 2014.
- The following programs now run in the background of LIMS.
  - Voids 03 for voids acceptance projects
  - Asphalt 03 for non-voids acceptance projects
- Communication-CDOT and the Contractor

5

WHY ARE YOUR TEST RESULTS SO IMPORTANT?

- The sampling, splitting and overall handling techniques can affect test results.
- Test results may have an effect on asphalt acceptance programs.
- The overall quality of pavement, short term and long term.

6

Item 403S Cost/ton: $35.00

% Max Density

Upper Test Limit: 96.0 V Factor: 1.10
Lower Test Limit: 92.0 W Factor: 0.40

Test No.	Date	Quant Repr.	Total Quant.	Density	MQL
1	06/11/00	500	500	94.20	
2	06/12/00	500	1000	92.40	
3	06/12/00	500	1500	93.60	100
4	06/12/00	500	2000	93.30	100
5	06/13/00	500	2500	94.20	100
6	06/13/00	500	3000	92.90	100
7	06/14/00	500	3500	94.20	100
8	06/14/00	500	4000	93.90	100
9	06/15/00	500	4500	93.90	100
10	06/15/00	500	5000	93.90	100
11	06/18/00	500	5500	94.40	100
12	06/18/00	500	6000	94.30	100
13	06/19/00	500	6500	93.90	100
14	06/19/00	500	7000	94.30	100
15	06/20/00	500	7500	94.70	100
16	06/20/00	500	8000	92.70	100
17	06/20/00	500	8500	93.60	100
18	06/21/00	500	9000	92.70	100
19	06/21/00	500	9500	94.10	100
20	06/22/00	500	10000	94.20	100
21	07/06/00	500	10500	93.20	100
22	07/06/00	500	11000	94.50	100
23	07/10/00	500	11500	93.60	100
24	07/10/00	500	12000	92.70	100
25	07/10/00	500	12500	93.70	100
26	07/10/00	500	13000	93.00	100
27	07/11/00	500	13500	93.40	100
28	07/11/00	500	14000	94.80	100
29	07/12/00	500	14500	94.50	100
30	07/12/00	500	15000	95.00	100
31	07/12/00	500	15500	92.20	99
32	07/13/00	500	16000	93.00	96

% Max Density Process Summary
Process 1 Tests 1-32 Quantity 16000 tons PF= 1.05500 I/DP=$12,320.00
Mean: 93.719 Std.Dev: 0.736 QL = 99.213

7

Item 403S Cost/ton: $35.00

% Max Density

Upper Test Limit: 96.0 V Factor: 1.10
Lower Test Limit: 92.0 W Factor: 0.40

Test No.	Date	Quant Repr.	Total Quant.	Density	MQL
1	06/11/00	500	500	94.20	
2	06/12/00	500	1000	92.40	
3	06/12/00	500	1500	93.60	100
4	06/12/00	500	2000	93.30	100
5	06/13/00	500	2500	94.20	100
6	06/13/00	500	3000	92.90	100
7	06/14/00	500	3500	94.20	100
8	06/14/00	500	4000	93.90	100
9	06/15/00	500	4500	93.90	100
10	06/15/00	500	5000	93.90	100
11	06/18/00	500	5500	94.40	100
12	06/18/00	500	6000	94.30	100
13	06/19/00	500	6500	93.90	100
14	06/19/00	500	7000	94.30	100
15	06/20/00	500	7500	94.70	100
16	06/20/00	500	8000	92.70	100
17	06/20/00	500	8500	93.60	100
18	06/21/00	500	9000	92.70	100
19	06/21/00	500	9500	94.10	100
20	06/22/00	500	10000	94.20	100
21	07/06/00	500	10500	93.20	100
22	07/06/00	500	11000	94.50	100
23	07/10/00	500	11500	93.60	100
24	07/10/00	500	12000	92.70	100
25	07/10/00	500	12500	93.70	100
26	07/10/00	500	13000	93.00	100
27	07/11/00	500	13500	93.40	100
28	07/11/00	500	14000	94.80	100
29	07/12/00	500	14500	94.50	100
30	07/12/00	500	15000	95.00	100
31	07/12/00	500	15500	92.20	99
32	07/13/00	500	16000	93.00	96
33	07/13/00	500	16500	90.60	70

% Max Density Process Summary
Process 1 Tests 1-33 Quantity 16500 tons PF= 1.05201 I/DP=$12,014.13
Mean: 93.624 Std.Dev: 0.905 QL = 96.341

8

Item 403S Cost/ton: $35.00

% Max Density

Upper Test Limit: 96.0 V Factor: 1.10
Lower Test Limit: 92.0 W Factor: 0.40

Test No.	Date	Quant Repr.	Total Quant.	Density	MQL
1	06/11/00	500	500	94.20	
2	06/12/00	500	1000	92.40	
3	06/12/00	500	1500	93.60	100
4	06/12/00	500	2000	93.30	100
5	06/13/00	500	2500	94.20	100
6	06/13/00	500	3000	92.90	100
7	06/14/00	500	3500	94.20	100
8	06/14/00	500	4000	93.90	100
9	06/15/00	500	4500	93.90	100
10	06/15/00	500	5000	93.90	100
11	06/18/00	500	5500	94.40	100
12	06/18/00	500	6000	94.30	100
13	06/19/00	500	6500	93.90	100
14	06/19/00	500	7000	94.30	100
15	06/20/00	500	7500	94.70	100
16	06/20/00	500	8000	92.70	100
17	06/20/00	500	8500	93.60	100
18	06/21/00	500	9000	92.70	100
19	06/21/00	500	9500	94.10	100
20	06/22/00	500	10000	94.20	100
21	07/06/00	500	10500	93.20	100
22	07/06/00	500	11000	94.50	100
23	07/10/00	500	11500	93.60	100
24	07/10/00	500	12000	92.70	100
25	07/10/00	500	12500	93.70	100
26	07/10/00	500	13000	93.00	100
27	07/11/00	500	13500	93.40	100
28	07/11/00	500	14000	94.80	100
29	07/12/00	500	14500	91.90	92
30	07/12/00	500	15000	91.80	77
31	07/12/00	500	15500	92.00	71
32	07/13/00	500	16000	91.90	63

% Max Density Process Summary
Process 1 Tests 1-32 Quantity 16000 tons PF= 1.04963 I/DP=$11,117.83
Mean: 93.497 Std.Dev: 0.869 QL = 95.919

9

WHY ARE THE RESPONSIBILITIES OF A TECHNICIAN PERFORMING ACCURATE SAMPLING, SPLITTING AND TESTING SO IMPORTANT ON A PROJECT?

The test results obtained are the basis for the contractor's incentive or disincentive payment and to help determine the overall pavement quality.

10

QUESTIONS????

11

RANDOM SAMPLING OF MATERIALS PROCEDURE
CDOT CP 75
ASTM D 3665

1

This covers the random selection of materials to be sampled and tested.

The sampling and testing procedures to be followed are specified in the procedures of the tests required.

Sampling is one of the most critical steps in materials testing.

2

RANDOM SAMPLING

Most CDOT specifications call for using the *Stratified Random Sampling Process.*

This ensures that any portion of the material on a project has an equal chance of being selected.

Bias is introduced when judgment is used.

3

IMPORTANCE OF STRATIFIED RANDOM SAMPLING OF MATERIALS

- If not chosen randomly, the tests may not reflect the true characteristics of the material being evaluated.
- Stratified random sampling requires that one random sample is selected from each sub lot.
- Ensures that samples are selected uniformly throughout the entire production process.

4

IMPORTANCE OF STRATIFIED RANDOM SAMPLING OF MATERIALS
(CONTINUED)

- No material is excluded from the chance of being selected unless it is specified in the specifications.
- It is the nature of random sampling that some samples will represent below average or above average material.
- The random number schedule should be predetermined and not shared with the supplier or contractor before sample is taken.

5

RANDOM NUMBER SCHEDULES

- It is the responsibility of the tester to ensure that the minimum sampling frequency is met.
- In some cases there will be a minimum sampling frequency of one per day.
- CDOT's random schedule program is found in the Asphalt 03 or Voids 03 computer programs under Tools.
- CP 75 contains complete instructions on accessing and using the programs.

6

RANDOM NUMBER SCHEDULES (CONTINUED)

As stated before, random sampling times and locations should not be shared with the contractors prior to the time samples are obtained or density tests are to be performed,

however it is acceptable and encouraged for contractors to take split samples or perform density testing that coincides with the OA testing schedule.

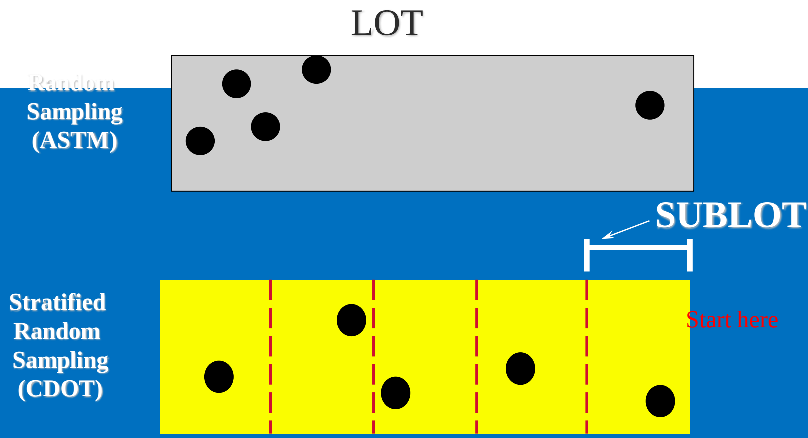
7

RANDOM NUMBER SCHEDULES (CONTINUED)

- Sampling should take place as close as possible to the values represented on the sampling schedule. Fill in the "Taken At" column of random schedule as samples are taken.
- Major deviations from the sampling schedules should be noted and explained on the form.

8

LOTS AND SUBLOTS



Stratified Random Sampling methods will be used on ALL CDOT Projects!

9

10

QUESTIONS????

11

Standard Method for
Sampling of Aggregates
CDOT CP 30
AASHTO T 2
ASTM D-75

1

CP 30

These methods are intended to apply to the sampling of aggregates used in acceptance and quality control from the points of acceptance as designated for construction materials including aggregate base course and aggregates for asphalt mixtures.

2

Summary of the procedure

- Sampling is equally as important as the testing of the aggregate material
- Samples must be taken accurately to represent the characteristics of the material
- Always avoid segregation
- Samples must be selected from all the material being produced via CP-75 (Random Sampling)

3

Securing Samples

- Aggregates used in asphalt shall be sampled by the contractor and witnessed by an authorized state representative
- Samples for preliminary approval or production control may be submitted by the producer, but read and consider CP 52 Contractor Asphalt Mix Design Approval Procedures.

4

Sampling Locations

1. Flowing Aggregate Stream – Belt Discharge using hand tools, automatic belt samplers or power equipment.
2. Stopped conveyor belt.
3. Stockpiles – with power equipment & without power equipment.
4. Roadway – Bases & Subbases
5. Processed Windrows
6. Cover Coat Material Spreader

5

Belt Discharge using Hand Tools

- If safe and practical to stand within 2' of belt discharge
- Obtain one or more equal increments
- Combine to form field sample that equals or exceeds the minimum recommended in Table 30-1 Size of Field Samples
- Several quick passes from entire cross section of flow
- Container shall be at least 12" diameter with sufficient capacity to hold entire sample

6

Automatic Belt Sampler

- Must cut the full charge of the belt without any loss of any portion
- Take one or more field samples that combined equals or exceeds the minimum recommended in Table 30-1 Size of Field Samples

7

Belt Discharge using Power Equipment

- Front-end loader bucket positioned under belt discharge
- Material placed in separate small sampling stock pile using the following procedure

8

Sampling with Power Equipment should always follow this procedure

- Combine and mix the material in a separate small pile

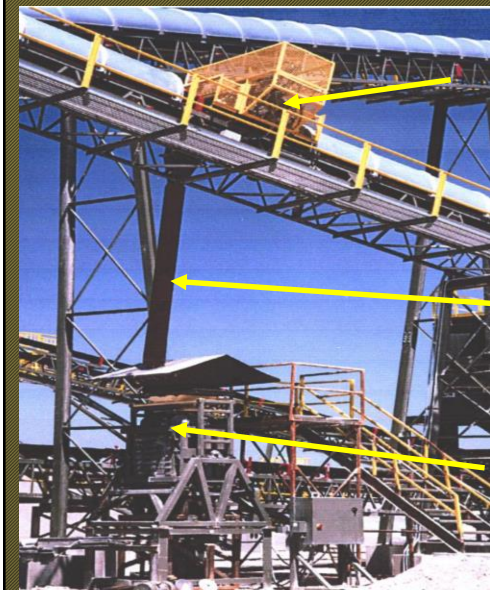
- Flatten the pile not thicker than approx. 1 ft

9

Sampling with Power Equipment (continued)

- Sample from at least 3 locations through full depth of the pile created using a flat, square end shovel.
- Combine all portions

10



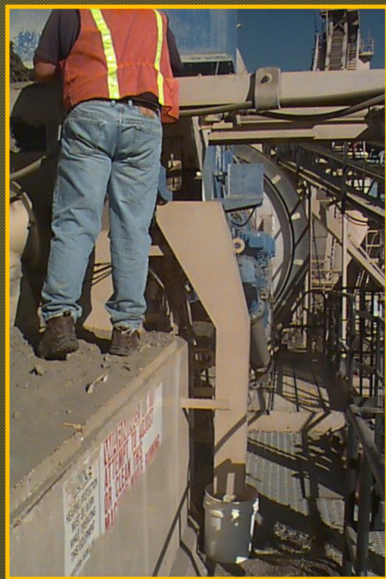
Automatic belt sampling device

Tube transfer device

Automatic gradation unit

11

12



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Storage Bin Discharge

- Bin discharge – is not for acceptance testing

14

Dry Batch

- When sampling a dry batch an initial dry batch must be wasted
- For the second batch position a frontend loader bucket, truck or similar equipment under the pugmill to obtain a large sample in one increment
- Use extreme care to avoid segregation and loss of dust sized particles
- Use procedure for power equipment

15

Stopped Conveyor Belt

- Obtain at least 3 <u>[one or more CDOT]</u> increments selected at random
- Stop the conveyor belt
- Insert two templates contoured to fit the belt

16

Stopped Conveyor Belt

- Distance between templates to yield an increment of the required weight
- Remove all material between the templates

17

Stopped Conveyor Belt

- Include all of the finer aggregates
- Use a brush and dust pan
- Combine all portions

18

Stockpiles

- Stockpile sampling should be avoided if possible (MSHA/OSHA)
- Sampling should only be done by or under the direction of experienced personnel
- Mechanical equipment should be used if stockpiles are to be sampled

19

Power Equipment

- Remove segregated material from the stockpile sides.
- Expose a representative face.
- Channel the face from bottom to top

20

Power Equipment

- Combine and mix to form a small sampling pile

21

Power Equipment

- Flatten the pile to a depth not thicker than approximately 1ft
- Sample from at least three (3) locations, to full depth of pile if possible
- Combine all portions

22

Stockpiles (Manually)

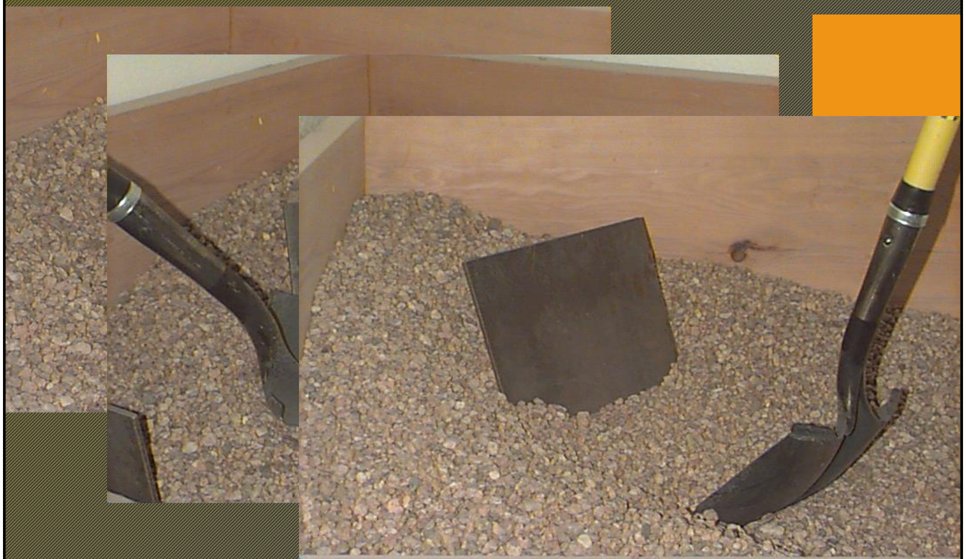
- Obtain portions of the sample from the top third, mid-point and bottom third of the stockpile
- Take two sets of three samples 180° apart

23

Stockpiles – Coarse & Mixed Size Aggregate

- Place shelf up slope from the sampling point
- Remove top six (6) inches outer layer of material
- Use a flat square end shovel or a scoop with sides
- Sample to full depth of shovel
- If possible use front end loader or backhoe

24



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Stockpiles – Fine Aggregate (– 3/ 8 in.)

- Same as coarse and mixed sized aggregate

or

- Sampling tube

26

Stockpiles – Fine Aggregate (– 3/ 8 in.) using a sampling tube

- Sampling tube approximately 1.25 in. minimum diameter by 6 ft. long inserted horizontally at a minimum of 5 locations to form the sample

27

Roadway

- Sample from random location
- Minimum of 3 approximately equal increments
- Use flat square end shovel or scoop

28

Roadway

- Sample full depth of lift

29

Roadway

- Take care to exclude any underlying material
- Combine all portions

30

Processed Windrows

- Material should contain sufficient moisture to maintain a near vertical face
- Remove material from one side toward the center to the full depth until a representative face is exposed
- Channel the exposed face from bottom to top and obtain a sample of required weight

31

Processed Windrows

- Sample from at least three equally spaced locations on the exposed face
- Use a flat, square end shovel
- Do not lose particles off the shovel

32

Cover Coat Material Spreader

- Last possible location prior to placement on the pavement
- Spreader must be stopped
- Samples will be taken from minimum of three individual gates as it is falling from the spreader
- Combine all samples to equal or exceed minimum requirement

33

Cover Coat Material Spreader

- If there is a belt transfer device, samples may be taken from the stopped belt as per the Sampling from the Stopped Conveyor Belt method.
- Under the engineers approval, material may be sampled from the stockpile as per 4.3.3

34

Definition:
(Aggregate for Item 403)

- Nominal Maximum Particle Size is one sieve size larger than the first sieve that retains more than 10% of the aggregate sample (SHRP/Superpave)

35

Example

Sieve Size mm (in.)	Aggregate – % Passing A	B	C
19 (3/4)	*100*	100	100
12 (1/2)	88	*93*	*90*
9.5 (3/8)	78	88	79

36

Sample Size Requirements are based on the

Nominal Maximum Particle Size and can be found in Table 30-1 Size of Field Samples

37

Questions???

38

TABLE 30-1: SIZE OF FIELD SAMPLES

Nominal Maximum Size of Aggregates	Approximate Minimum Mass of Field Samples

Fine Aggregate	lbs	kg
No. 8 (2.36 mm)	10	5
No. 4 (4.75 mm)	10	5

Coarse Aggregate	lbs	kg
3/8 inch (9.5 mm)	15	7
½ inch (12.5 mm)	20	10
¾ inch (19.0 mm)	25	12
1 inch (25.0 mm)	30	15
1 ½ inch (37.5 mm)	40	20
2 inch (50.0 mm)	45	22
2 ½ inch (63.0 mm)	50	25
3 inch (75.0 mm)	55	27
3 ½ inch (90.0 mm)	60	30

Standard Method of Test for Sampling Asphalt Paving Mixtures

AASHTO T – 168

CDOT CP 41

1

Significance and use:

- Sampling is equally as important than the testing of Asphalt pavement materials.
- Samples must be taken to accurately represent the characteristics of the material.

2

Securing Samples

- Samples for acceptance or assurance testing shall be sampled by the contractor and witnessed by an authorized representative of CDOT.

3

Sampling Asphalt Mixtures

- Method A: Tube Sampler (sample can)
- Method B: Point of Delivery
  - Windrow prior to Laydown
  - Paving Machine Augers
  - Roadway prior to Compaction
- Roadway after Compaction

4

Tube Sampler Apparatus (Plant Swing Arm)

- Tube sampler holder with metal collar to hold sample with 3 foot handle or two tube arrangement with handle length dependent on discharge set-up.

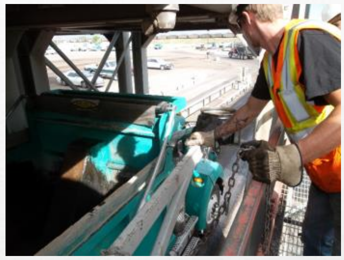
Two methods:

- Swing arm with tube through discharge fast enough to obtain a representative sample filling the tube.
- Prior to discharge center tube directly under discharge flow, after return of tube to storage position, strike off material above top of rim.

5

The sampler is required to pass completely through the discharge

6



7

The CDOT specs for the sample cans when samples are to be submitted to any CDOT lab are as follows:

A container with 3 to 4 gallon capacity made of at least 30 gauge non galvanized metal, having a "bail" type handle and a tight fitting lid.

9

Sampling Asphalt Mixtures Point of Delivery

- Locations
  - Windrow
  - Paving machine spreading screws (auger chamber)
  - Mat behind paver

10

Sampling Asphalt Mixtures Windrow

- Select 3 or more random locations based on CP 75.
- Remove material from one side of windrow full depth towards the center to expose a representative face.
- Trench the exposed face from bottom to top avoiding segregation.
- Deposit sample into container.

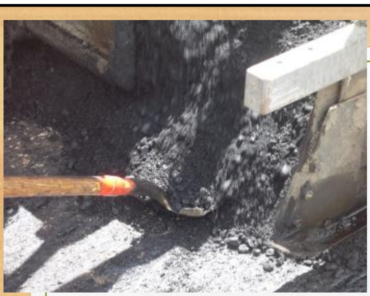
11

12

Sampling Asphalt Mixtures– Spreading Screws (Auger Chamber)

- Observe auger rotation.
- Augers should be operating at least 80 % or more of the time.
- Auger area should be at least 2/3 (1/2 the auger) covered with mixture.

13



14

Sampling Asphalt Mixtures Behind Paver (AASHTO & CDOT)

- Apparatus
  - small flat scoop with sides or sampling device.
  - container, with tight fitting lid, of suitable capacity

17

Sampling Asphalt Mixtures Behind Paver

- Use a random method to determine sampling locations.
- Obtain at least 3 approximately equal size increments immediately behind paving machine.
- Increments shall be the full depth of lift.
- Templates which are placed before mixture is spread can be helpful.

18

19

Sampling from Roadway After Compaction

- Select the units to be sampled by a random method.
- Obtain at least 3 approximate equal samples for the full depth of material, taking care to exclude any underlying material.
- Each increment shall be obtained by coring, sawing or other methods in such a manner to ensure a minimum disturbance of the material.

20

Questions??

21

Standard Method of Test
for
Bulk Specific Gravity and Percent Compaction of Compacted Bituminous Mixtures Using SSD Specimens

CDOT CP 44

AASHTO T - 166

1

Purpose

- This procedure provides methods for determining bulk specific gravity to calculate the percent relative compaction of HMA and air void analysis.
- The Bulk Sp G is also used in determining the correlation factor for nuclear density gauges.

2

Test Specimens

- Method B (Rapid Test for Pavement Cores)
- Method C (COREDRY Test)
- Size of Specimens.

  Diameter should be at least 4 times the maximum size of the aggregate.

  Thickness at least 1.5 times the maximum size of the aggregate.

3

Specimen Preparation

- Avoid distortion, bending or cracking during and after removal from pavement.
- Stored in safe, cool place.
- Separating specimen layers should be done by sawing or suitable means.
- Specimens shall be free from foreign materials such as seal coat, tack coat, foundation material, etc.

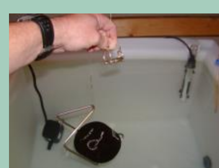
4

Testing Apparatus required

- Balance, with suspension apparatus.
- Wire of the smallest practical size at the penetration point of the water surface.
- Water bath with overflow outlet.
- Flannel or terry cloth towel.

5

Procedure for Method B Roadway Cores using Rapid Test



- Check water level.
- Check water temperature 77 ± 1.8°F (25 ± 1.0°C).
- Immerse specimen in water 4 ± 1 minutes.
- Record immersed mass.
- Remove specimen from water, blot with freshly wrung out, damp towel and record SSD mass.

6

Method B Drying Cores to Constant Mass Rapid Test

- Tare pan, record mass of specimen and place pan and specimen into a forced draft oven at 230 ± 9 °F (110 ± 5C).
- Leave 5 ½ inch (140 mm) or larger, or porous or wet cores in oven until they can be separated into pieces no larger than 2 inches (50 mm).
- Dry the specimens for 3 hours and determine the mass.
- Determine the mass at 2 hour intervals until constant mass (no change of more 0.00)%) has been attained or 24 hour maximum.
- Cool specimen to room temperature and determine the dry mass.

7

Method C (CoreDry Test)

- May be used for pavement cores in place of Method B, and for cores that can then be saved.
- May be used on cores containing moisture.
- Tested the same day – quick results.
- Allowing cores to warm to room temperature, towel blot any free standing moisture on cores.
- Place core on side on wire mesh in vacuum chamber.
- Follow procedure in 11.4 of Method C for use of CoreDry apparatus to obtain dry weight.
- Determine the weight in water and SSD weights as in Method B.

8

CoreDry Procedure (11.4)

- Turn the CoreDry to ON position.
- Allow to warm up & go through preparation cycles until "Systems Ready" prompt appears.
- Allow cores to warm to room temperature & towel dry samples of free standing moisture.
- Place core on its side on wire mesh in the vacuum chamber.
- Make sure that moisture trap is cleaned out.
- Place lids on vacuum chamber & moisture trap.
- Press START.
- CoreDry will cycle until drying is complete. If moisture is visible on core surface, clean moisture trap and run again.
- Record dry weight & use as dry mass in equation.

9

Bulk Specific Gravity Calculation

$$G_{mb} = \frac{A}{(B - C)}$$

where:

A = mass (in grams) of dry sample in air
B = mass (in grams) of SSD sample, in air
C = mass (in grams) of sample in water

10

Percent Relative Compaction

$$Percent\ Relative\ Compaction = \frac{Bulk\ Specific\ Gravity}{Maximum\ Specific\ Gravity}\ X\ 100$$

11

Air Voids (Va) Calculation

$$Va = \frac{Rice - Bulk}{Rice} x100$$

or

$$Air\ Voids = 100 - \%\ Relative\ Compaction$$

12

Convert Specific Gravity (Gs) to pounds per cubic ft (pcf)

CDOT uses:

- Specific gravity x 62.4= pcf
- Pcf / 62.4 = specific gravity

13

Questions ??

14

COMPACTION TEST SECTIONS

1

What is a Compaction Test Section?

- A section of road is constructed to determine the number and type of rollers and most effective rolling pattern to achieve the specified density.
- On CDOT Projects – The test strip *should* be constructed using the First 500 tons of production.
  - *First 300 tons placed to determine the process.*
  - *Last 200 tons placed to test for density correction.*

2

Procedure

- The contractor determines the methods and procedures to be used for the test section and all subsequent placement of asphalt mixtures for the project.
- These processes are used uniformly over the final 200 tons placed in the test section.
- Data which should be recorded, includes but not limited to:
  - Type, size, amplitude, frequency, and speed of roller.
  - Tire pressure for rubber tire rollers.
  - Passes using vibratory type rollers, vibratory or static.
  - Surface temperature of mix behind laydown machine.
  - Subsequent temperatures and densities after each roller pass.
  - Sequence and distance from laydown machine for each roller.
  - Number of passes of each roller to obtain specified density.

3

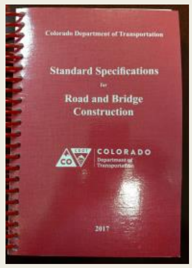
Nuclear/Core Corrections as per
CP 82

- *Perform 7 random Nuclear density tests on final 200 tons of material placed for the test section.*
- *Obtain duplicate cores from footprint location of each test Nuclear test performed.*
  - Contractor cuts 2 cores from each location, one set to CDOT.
  - Contractor tests the other set.
  - CDOT observes coring and testing by contractor.
- *Correlate Nuclear Tests to Cores*
  - Average core bulk specific gravities of all 7 cores.
  - Average specific gravities or wet densities from the 7 nuclear test.
  - Calculate and record correction factor for each gauge. Determine acceptability of the test section.

4

Acceptability of Test Section

- As per Section 401.17 of the Spec Book, a new CTS shall be constructed when a change in the compaction process is implemented.
- A new CTS may be required for different layers of pavement.
- Core locations should be distributed across the mat



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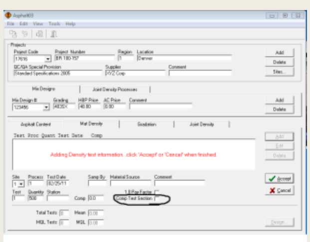
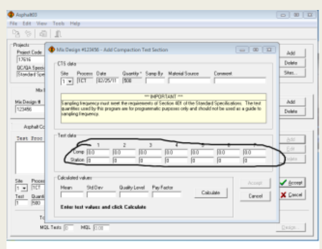
Acceptability of Test Section

- The actual <u>Core Results</u> (not the corrected gauge results) are what should be recorded into the CDOT program.
- Click on the <u>CTS Button</u> in the program to record the core results and determine the acceptability of the CTS.



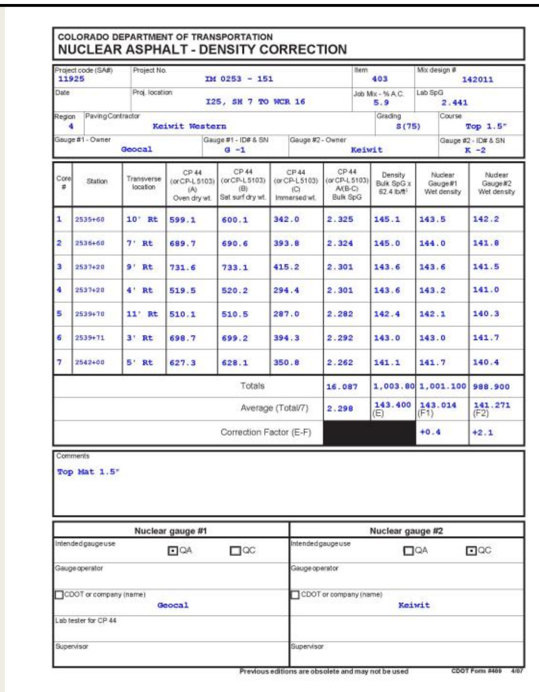


6

CP 82

- Provides for the development of a correction factor that should be valid until the ingredients in the bituminous pavement change (new mix design),or the underlying material changes.
- May also be used whenever variations in conditions bring the Moisture/Density Gauge readings into question.

7



COLORADO DEPARTMENT OF TRANSPORTATION

NUCLEAR ASPHALT - DENSITY CORRECTION

Project code (SA#) 11925	Project No. IM 0253 - 151	Item 403	Mix design # 142011
Date	Proj. location I25, SH 7 TO WCR 16	Job Mix - % A.C. 5.9	Lab SpG 2.441
Region 4	Paving Contractor Keiwit Western	Grading S(75)	Course Top 1.5"
Gauge #1 - Owner Geocal	Gauge #1 - ID# & SN G -1	Gauge #2 - Owner Keiwit	Gauge #2 - ID# & SN K -2

Core #	Station	Transverse location	CP 44 (or CP-L 5103) (A) Oven dry wt.	CP 44 (or CP-L 5103) (B) Sat surf dry wt.	CP 44 (or CP-L 5103) (C) Immersed wt.	CP 44 (or CP-L 5103) A/(B-C) Bulk SpG	Density Bulk SpG x 62.4 lb/ft³	Nuclear Gauge #1 Wet density	Nuclear Gauge #2 Wet density
1	2535+60	10' Rt	599.1	600.1	342.0	2.325	145.1	143.5	142.2
2	2536+60	7' Rt	689.7	690.6	393.8	2.324	145.0	144.0	141.8
3	2537+20	9' Rt	731.6	733.1	415.2	2.301	143.6	143.6	141.5
4	2537+20	4' Rt	519.5	520.2	294.4	2.301	143.6	143.2	141.0
5	2539+70	11' Rt	510.1	510.5	287.0	2.282	142.4	142.1	140.3
6	2539+71	3' Rt	698.7	699.2	394.3	2.292	143.0	143.0	141.7
7	2542+00	5' Rt	627.3	628.1	350.8	2.262	141.1	141.7	140.4
					Totals	16.087	1,003.80	1,001.100	988.900
					Average (Total/7)	2.298	143.400 (E)	143.014 (F1)	141.271 (F2)
					Correction Factor (E-F)			+0.4	+2.1

Comments

Top Mat 1.5"

Nuclear gauge #1	Nuclear gauge #2
Intended gauge use ☒ QA ☐ QC	Intended gauge use ☐ QA ☒ QC
Gauge operator	Gauge operator
☐ CDOT or company (name) Geocal	☐ CDOT or company (name) Keiwit
Lab tester for CP 44	
Supervisor	Supervisor

Previous editions are obsolete and may not be used CDOT Form #469 4/07

9

HANDLING OF CORES

10

Why is it important to handle cores with care?

- They are representative samples of the pavement.
  - *Correlating for Density Tests*
  - *Assisting in the determination of density*
- They can damage easily.
  - *Keep out of heat/cold.*
  - *Store/transport on longest side.*
  - *Never stack cores.*
  - *Wrap or support perimeter.*
  - *Transport in tight container.*
- Takes time and $$ to re-sample.

11

Thank You

14

Standard Method of Test for Density and Percent Relative Compaction of HMA Pavement by the Nuclear Method
CDOT CP 81

1

Purpose

For the in-place determination of density of HMA for acceptance testing.

2

CP 15 Certification of Consultant Nuclear M/D or Thin Lift Gauges

- Refer to CP 15 for complete instructions for requirements for gauges to be used on CDOT projects.
- Equipment used shall pass requirements for stat & drift test in CP-L 5302 & CP-L 5304.
- CP-L 5302 M/D Nuclear Gauges-CDOT
- CP-L 5303 Calibration of CDOT Gauges
- CP-L 5304 Nuclear Thin Lift Gauges-CDOT
- CP-L 5306 Certification of Consultant Nuclear M/D & Thin Lift Gauge

3

Apparatus Required

- Gauge
- Portable reference standard

4

Procedure

- Standardization
  - At the start of each day, whenever a gauge is turned off and when a gauge readings are in question.
- Test
- Calculations

5

Standardization Requirements

- Turn gauge on and allow to warm up for 20 minutes.
  - (CPN Gauge, take out of hibernation and allow to stabilize ~ 1 minute.
- Check gauge operation with portable standard block.
- Place gauge on reference standard correctly.
  - Handle on side opposite metal plate (Troxler, Instrotek).
  - On raised bumps (CPN).
- Take a four-minute base count.
- Record count on log sheet.
- If the reading is not within 1% of the average of the previous 4 standards, re-run standard.

6

Measurement Requirements

- Standardization
  - 33 feet from other radio-active sources.
  - Clear of large masses of water or hydrogenous material.
  - Taken in the same environment as the actual measurement counts.
- Testing
  - 33 feet from other radio-active sources
  - 6 inches away from any vertical projection.
  - Long axis of test site shall be parallel to the direction of the paver.
  - Sites should be at least 1 foot away from longitudinal joints.

8

Instrotek Explorer Gauge

9

Campbell Pacific Nuclear am (CPN)

10

Troxler Electronic Laboratories

11

Test

For successful determination of density:

- Select a surface free of loose material and deformations.
  - The maximum void beneath the gauge shall not exceed 1/8 inch (3mm).
  - Optimum condition is total contact between the bottom of the gauge and the surface. Check that bottom of gauge is clean.
  - If necessary, use mineral filler or sand to fill voids. The depth of the filler should not exceed 1/8 inch (3mm) and the total area filled should not exceed 10% of the bottom area of the gauge.
  - Test location should be 1 foot or more away from confined or unconfined longitudinal joints.

12

Gauge Settings

- Set gauge to the "MA" or Backscatter mode (for testing asphalt) versus "PR" (soils) and sets gauge to perform the calculations on the wet density basis.
- Verify that the correct Maximum Mixture Density (that represents the mix being placed – Average Daily Rice converted) is input in the gauge or available for doing calculations.
- Verify correction factor for the gauge being used is accurate for the materials being placed.

14

Test Procedure

- Lower probe to backscatter position.
- Select Wet Density readings on gauge.
- Ensure that the rod is securely locked into the bottom of the notch of the depth slot.
- Set gauge flush on asphalt pavement test site.
- Perform two 1-minute readings, record direct wet density measurements.
- Mark gauge location.



15

Test Procedure
(continued)

- Turn gauge 180 degrees, taking care to place it within the marks of the original 2-one minute readings.
- Perform two more 1-minute readings, record direct wet density measurements on CDOT form No. 428 (CDOT), or appropriate form (Consultants/contractors).
- Test results may be affected by chemical composition, sample heterogeneity, and surface texture. Also, exhibit spatial bias in that the gauge is more sensitive to certain regions of the material under test.
- If total roadway thickness is less than 4 inches, underlying subgrade density variations can cause gauge test inconsistencies.

16

Calculations using wet density

- Average the four wet densities obtained.
- Add the known correction factor from the test section of the project (as per CP 82) to the average wet density to establish the adjusted wet density.
- Divide the adjusted wet density by the lab maximum mixture density (rice x 62.4) to determine the relative % density.

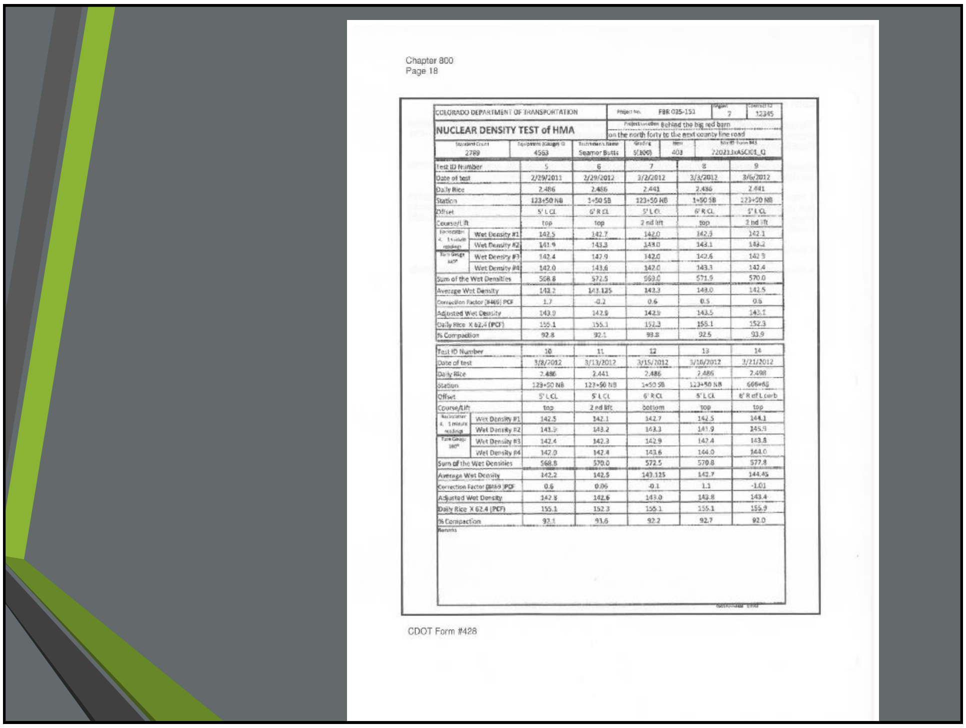
17

Convert Specific Gravity (Gs) to pounds per cubic ft (Wet Density)

CDOT

- Specific gravity x 62.4= pcf
- Pcf / 62.4 = specific gravity

18



Chapter 800
Page 18

COLORADO DEPARTMENT OF TRANSPORTATION		Project No. FBR 025-151		Region 2	Contract ID 12345
NUCLEAR DENSITY TEST of HMA		Project Location Behind the big red barn on the north forty to the next county line road			
Standard Count 2789	Equipment (Gauge) ID 4563	Technician's Name Seamor Butts	Grading S(100)	Item 403	Mix ID Form 43 720213xASCI01_Q

Test ID Number		5	6	7	8	9
Date of test		2/29/2011	2/29/2012	3/2/2012	3/3/2012	3/6/2012
Daily Rice		2.486	2.486	2.441	2.486	2.441
Station		123+50 NB	1+50 SB	123+50 NB	1+50 SB	123+50 NB
Offset		5' L CL	6' R CL	5' L CL	6' R CL	5' L CL
Course/Lift		top	top	2 nd lift	top	2 nd lift
Backscatter 4, 1 minute readings	Wet Density #1	142.5	142.7	142.0	142.5	142.1
	Wet Density #2	141.9	143.3	143.0	143.1	143.2
Turn Gauge 180°	Wet Density #3	142.4	142.9	142.0	142.6	142.3
	Wet Density #4	142.0	143.6	142.0	143.3	142.4
Sum of the Wet Densities		568.8	572.5	569.0	571.5	570.0
Average Wet Density		142.2	143.125	142.3	143.0	142.5
Correction Factor (#469) PCF		1.7	-0.2	0.6	0.5	0.6
Adjusted Wet Density		143.9	142.9	142.9	143.5	143.1
Daily Rice X 62.4 (PCF)		155.1	155.1	152.3	155.1	152.3
% Compaction		92.8	92.1	93.8	92.5	93.9

Test ID Number		10	11	12	13	14
Date of test		3/8/2012	3/13/2012	3/15/2012	3/16/2012	3/21/2012
Daily Rice		2.486	2.441	2.486	2.486	2.498
Station		123+50 NB	123+50 NB	1+50 SB	123+50 NB	666+66
Offset		5' L CL	5' L CL	6' R CL	5' L CL	6' R of L curb
Course/Lift		top	2 nd lift	bottom	top	top
Backscatter 4, 1 minute readings	Wet Density #1	142.5	142.1	142.7	142.5	144.1
	Wet Density #2	143.9	143.2	143.3	141.9	145.9
Turn Gauge 180°	Wet Density #3	142.4	142.3	142.9	142.4	143.8
	Wet Density #4	142.0	142.4	143.6	144.0	144.0
Sum of the Wet Densities		568.8	570.0	572.5	570.8	577.8
Average Wet Density		142.2	142.5	143.125	142.7	144.45
Correction Factor (#469) PCF		0.6	0.06	-0.1	1.1	-1.01
Adjusted Wet Density		142.8	142.6	143.0	143.8	143.4
Daily Rice X 62.4 (PCF)		155.1	152.3	155.1	155.1	155.9
% Compaction		92.1	93.6	92.2	92.7	92.0

Remarks

CDOT Form #428

19

20

You have not completed LabCAT Level A Certification until you complete check out with the Instructor!

Items needed to complete Check out:

- ☐ Completed Proficiency Tracking Form
- ☐ Completed Program Critique Form

21

Standard Specifications For Transportation Materials and Methods of Sampling and Testing

AASHTO

THE VOICE OF TRANSPORTATION

American Association of State Highway and Transportation

Level A

Standard Practice for Reducing Samples of Aggregate to Testing Size

AASHTO Designation: R 76-16[1,2]

Release: Group 3 (August 2016)

ASTM Designation: C702/C702M-11

---

1. SCOPE

1.1. These methods cover the reduction of large samples of aggregate to the appropriate size for testing, employing techniques that are intended to minimize variations in measured characteristics between the test samples so selected and the large sample.

1.2. The values stated in SI units are to be regarded as the standard.

1.3. *This standard does not purport to address all of the safety concerns associated with its use. It is the responsibility of the user of this procedure to establish appropriate safety and health practices and to determine the applicability of regulatory limitations prior to its use*.

---

2. REFERENCED DOCUMENTS

2.1. *AASHTO Standards*:

- T 2, Sampling of Aggregates
- T 84, Specific Gravity and Absorption of Fine Aggregate

2.2. *ASTM Standard*:

- C125, Standard Terminology Relating to Concrete and Concrete Aggregates

---

3. TERMINOLOGY

3.1. *Definitions*—the terms used in this standard are defined in ASTM C125.

---

4. SIGNIFICANCE AND USE

4.1. Specifications for aggregates require sampling portions of the material for testing. Other factors being equal, larger samples will tend to be more representative of the total supply. The methods described in this standard provide for reducing the large sample obtained in the field or produced in the laboratory to a convenient size for conducting a number of tests to describe the material and measure its quality. These methods are conducted in such a manner that the smaller test sample portion will be representative of the larger sample and, thus, of the total supply. The individual test methods provide for minimum masses of material to be tested.

4.2. Under certain circumstances, reduction in size of the large sample prior to testing is not recommended. Substantial differences between the selected test samples sometimes cannot be avoided, as, for example, in the case of an aggregate having relatively few large-sized particles in the sample. The laws of chance dictate that these few particles may be unequally distributed among the reduced-size test samples. Similarly, if the test sample is being examined for certain contaminants occurring as a few discrete fragments in only small percentages, caution should be used in interpreting results from the reduced-size test sample. Chance inclusion or exclusion of only one or two particles in the selected test sample may importantly influence interpretation of the characteristics of the original sample. In these cases, the entire original sample should be tested.

Failure to carefully follow the procedures in these methods could result in providing a nonrepresentative sample to be used in subsequent testing.

5. SELECTION OF METHOD

5.1. *Fine Aggregate*—Samples of fine aggregate that are drier than the saturated surface-dry condition (Note 1) shall be reduced in size by a mechanical splitter according to Method A. Samples having free moisture on the particle surfaces may be reduced in size by quartering according to Method B, or by treating as a miniature stockpile as described in Method C.

5.1.1. If the use of Method B or Method C is desired, and the sample does not have free moisture on the particle surfaces, the sample may be moistened to achieve this condition, thoroughly mixed, and then the sample reduction performed.

Note 1—The method of determining the saturated surface-dry condition is described in T 84. As a quick approximation, if the fine aggregate will retain its shape when molded in the hand, it may be considered to be wetter than saturated surface-dry.

5.1.2. If use of Method A is desired and the sample has free moisture on the particle surfaces, the entire sample may be dried to at least the surface-dry condition, using temperatures that do not exceed those specified for any of the tests contemplated, and then the sample reduction performed. Alternatively, if the moist sample is very large, a preliminary split may be made using a mechanical splitter having wide chute openings 38 mm ($1^1/_2$ in.) or more to reduce the sample to not less than 5000 g. The portion so obtained is then dried, and reduction to test sample size is completed using Method A.

5.2. *Coarse Aggregates*—Reduce the sample using a mechanical splitter in accordance with Method A (preferred method) or by quartering in accordance with Method B. The miniature stockpile Method C is not permitted for coarse aggregates or mixtures of coarse and fine aggregates.

5.3. *Combined Coarse and Fine Aggregate*—Samples that are in a dry condition may be reduced in size by either Method A or Method B. Samples having free moisture on the particle surfaces may be reduced in size by quartering according to Method B. When Method A is desired and the sample is damp or shows free water, dry the sample until it appears dry or until clumps can be easily broken by hand (Note 2). Dry the entire sample to this condition, using temperatures that do not exceed those specified for any of the tests contemplated, and then reduce the sample. The miniature stockpile Method C is not permitted for combined aggregates.

Note 2—The dryness of the sample can be tested by tightly squeezing a small portion of the sample in the palm of the hand. If the cast crumbles readily, the correct moisture range has been obtained.

6. SAMPLING

6.1. The samples of aggregate obtained in the field shall be taken in accordance with T 2, or as required by individual test methods. When tests for sieve analysis only are contemplated, the size of field sample listed in T 2 is usually adequate. When additional tests are to be conducted, the user shall determine that the initial size of the field sample is adequate to accomplish all intended tests. Similar procedures shall be used for aggregate produced in the laboratory.

METHOD A—MECHANICAL SPLITTER

7. APPARATUS

7.1. *Sample Splitter*—Sample splitters shall have an even number of equal-width chutes, but not less than a total of eight for coarse aggregate, or twelve for fine aggregate, which discharge alternatively to each side of the splitter. For coarse aggregate and mixed aggregate, the minimum width of the individual chutes shall be approximately 50 percent larger than the largest particles in the sample to be split (Note 3). For dry fine aggregate in which the entire sample will pass the 9.5-mm ($^3/_8$-in.) sieve, the minimum width of the individual chutes shall be at least 50 percent larger than the largest particles in the sample and the maximum width shall be 19 mm ($^3/_4$ in.). The splitter shall be equipped with two receptacles to hold the two halves of the sample following splitting. It shall also be equipped with a hopper or straightedged pan, which has a width equal to or slightly less than the overall width of the assembly of chutes, by which the sample may be fed at a controlled rate to the chutes. The splitter and accessory equipment shall be so designed that the sample will flow smoothly without restriction or loss of material (see Figure 1).

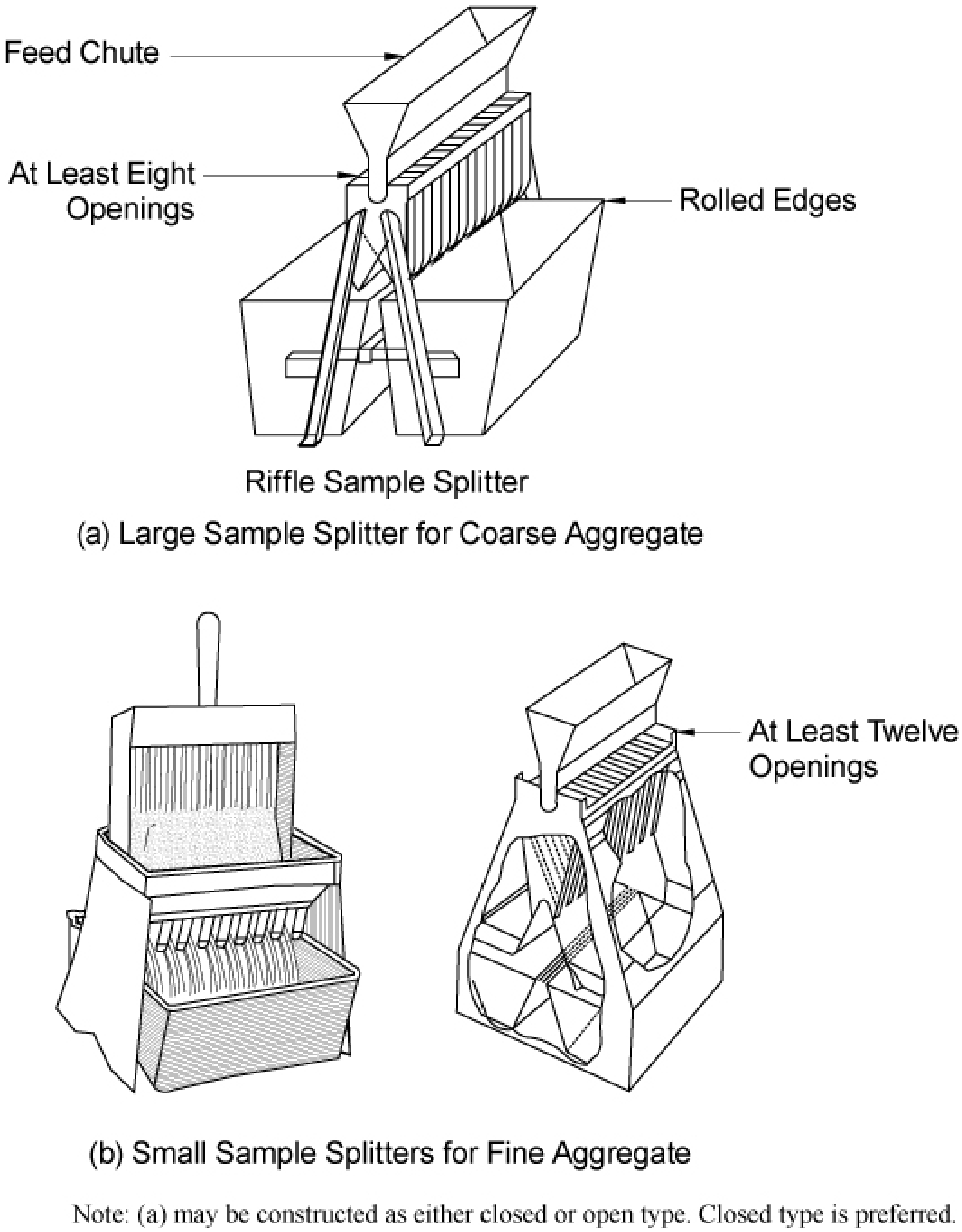


Figure 1—Sample Splitters (Riffles)

Note 3—Mechanical splitters are commonly available in sizes adequate for coarse aggregate having the largest particle not over 37.5 mm ($1^1/_2$ in.).

8.2. 8. PROCEDURE

8.1. Place the original sample in the hopper or pan and uniformly distribute it from edge to edge, so that when it is introduced into the chutes, approximately equal amounts will flow through each chute. The rate at which the sample is introduced shall be such as to allow free flowing through the chutes into the receptacles below.

Reintroduce the portion of the sample in one of the receptacles into the splitter as many times as necessary to reduce the sample to the size specified for the intended test. The portion of the material collected in the other receptacle may be reserved for reduction in size for other tests.

METHOD B—QUARTERING

9. APPARATUS

9.1. Apparatus shall consist of a straightedge; straightedged scoop, shovel or trowel; a broom or brush; and a canvas blanket or tear-resistant tarp approximately 2 by 2.5 m (6 by 8 ft).

10. PROCEDURE

10.1. Use either the procedure described in Section 10.1.1 or 10.1.2, or a combination of both.

10.1.1. Place the original sample on a hard, clean, level surface where there will be neither loss of material nor the accidental addition of foreign material. Mix the material by turning the entire sample over at least three times until the material is thoroughly mixed. With the last turning, form the entire sample into a conical pile by depositing individual lifts on top of the preceding lift. Carefully flatten the conical pile to a uniform thickness and diameter by pressing down the apex with a shovel or trowel so that each quarter sector of the resulting pile will contain the material originally in it. The diameter should be approximately four to eight times the thickness. Divide the flattened mass into four equal quarters with a shovel or trowel and remove two diagonally opposite quarters, including all fine material, and brush the cleared spaces clean. The two unused quarters may be set aside for later use or testing, if desired. Successively mix and quarter the remaining material until the sample is reduced to the desired size (see Figure 2).

10.1.2. As an alternative to the procedure in Section 10.1.1 or when the floor surface is uneven, the field sample may be placed on a canvas blanket or tear-resistant tarp and mixed with a shovel or trowel as described in Section 10.1.1, leaving the sample in a conical pile. As an alternative to mixing with the shovel or trowel, lift each corner of the blanket or tarp and pull it over the sample toward the diagonally opposite corner, causing the material to be rolled. After the material has been rolled a sufficient number of times (a minimum of four times), so that it is thoroughly mixed, pull each corner of the blanket or tarp toward the center of the pile so the material will be left in a conical pile. Flatten the pile as described in Section 10.1.1. Divide the sample as described in Section 10.1.1, or insert a stick or pipe beneath the blanket or tarp and under the center of the pile, then lift both ends of the stick, dividing the sample into two equal parts. Remove the stick, leaving a fold of the blanket between the divided portions. Insert the stick under the center of the pile at right angles to the first division and again lift both ends of the stick, dividing the sample into four equal parts. Remove two diagonally opposite quarters, being careful to clean the fines from the blanket or tarp. The two unused quarters may be set aside for later use or testing, if desired. Successively mix and quarter the remaining material until the sample is reduced to the desired size (see Figure 3).

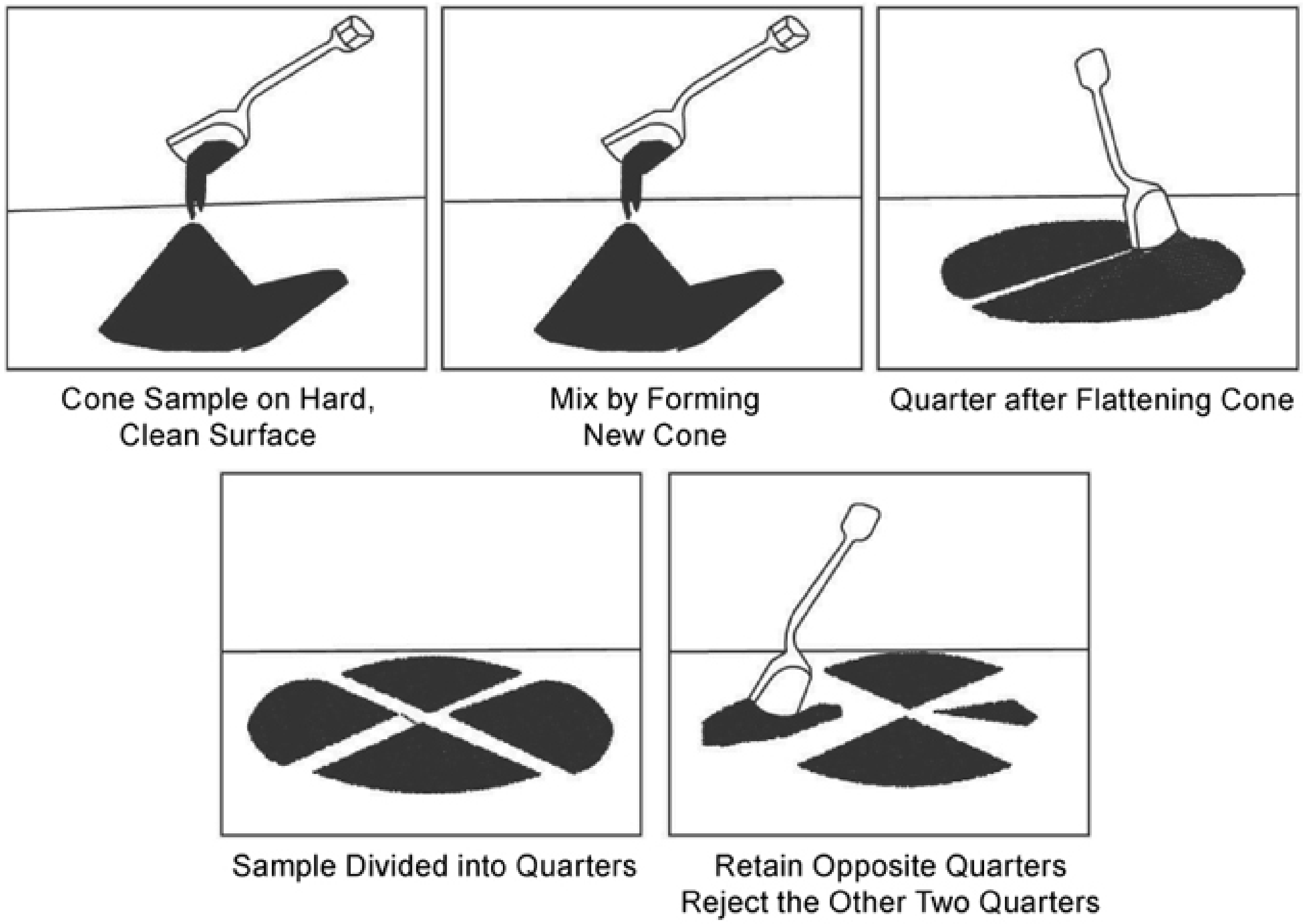


Figure 2—Quartering on a Hard, Clean, Level Surface

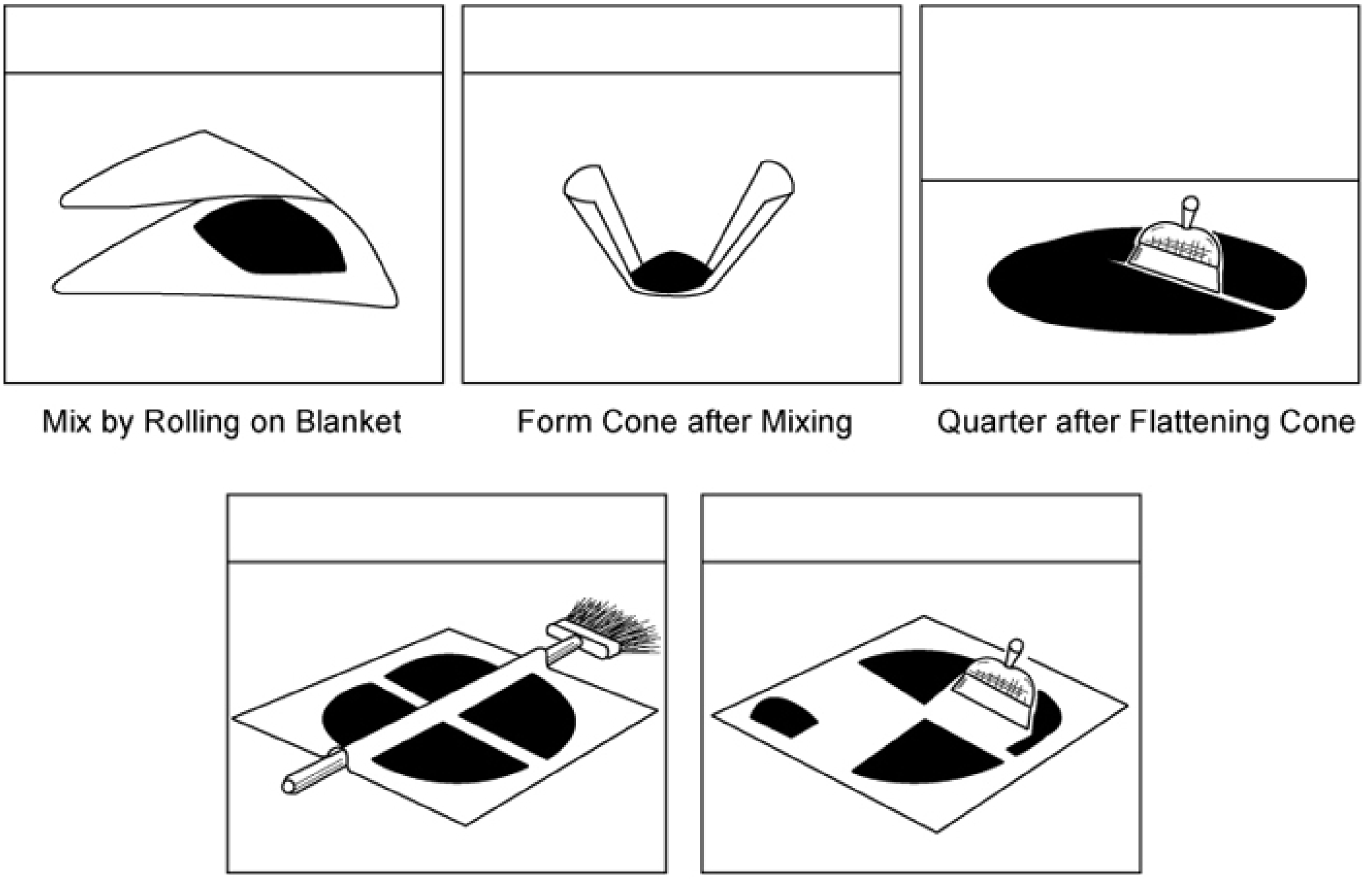


Figure 3—Quartering on a Canvas Blanket or Tear-Resistant Tarp

METHOD C—MINIATURE STOCKPILE SAMPLING (DAMP FINE AGGREGATE ONLY)

11. APPARATUS

11.1. Apparatus shall consist of a straightedge; straightedged scoop, shovel, or trowel for mixing the aggregate; and either a small sampling thief, small scoop, or spoon for sampling.

12. PROCEDURE

12.1. Place the original sample of damp fine aggregate on a hard, clean, level surface where there will be neither loss of material nor the accidental addition of foreign material. Mix the material by turning the entire sample over at least three times until the material is thoroughly mixed. With the last turning, form the entire sample into a conical pile by depositing individual lifts on top of the preceding lift. If desired, the conical pile may be flattened to a uniform thickness and diameter by pressing the apex with a shovel or trowel so that each quarter sector of the resulting pile will contain the material originally in it. Obtain a sample for each test by selecting at least five increments of material at random locations from the miniature stockpile, using any of the sampling devices described in Section 11.1.

13. KEYWORDS

13.1. Aggregate; aggregate sample; mechanical splitter; quartering.

[1] Technically equivalent but not identical to ASTM C702/C702M-11.

[2] Formerly T 248. First published as a practice in 2016.

Standard Method of Test for Sampling Bituminous Paving Mixtures

AASHTO Designation: T 168-03 (2016)

Release: Group 3 (August 2016)

ASTM Designation: D979-01(2006)$^{\varepsilon1}$

AASHTO T 168-03 (2016) is identical to ASTM D979-01(2006)$^{\varepsilon1}$ except for the following provisions:

1. All references to the ASTM standards listed in the following table shall be replaced with the corresponding AASHTO standard:

Referenced Standard	
ASTM	AASHTO
C702	R 76

2. Insert an additional section between Sections 4.1.1 and 4.1.2 containing the following:

   Care shall be taken in sampling to avoid segregation of coarse aggregate and asphalt mortar. Care shall be taken also to prevent contamination by dust or other foreign matter.

3. Insert new Sections 5.2.3.3, 5.2.3.4, and 5.2.3.5 after Section 5.2.3.2 as follows:

   5.2.3.3. If the mixture is in a windrow (cold mix), random samples of the windrow at intervals of not more than 150 m (500 ft) shall be secured and tested separately. Samples of the windrow shall be secured by flattening it at one point into a layer approximately 0.3 m (1 ft) thick and coring this layer at three or more random points to obtain the required sample size as shown in Table 1.

   5.2.3.4. If the mix has been bladed into a relatively uniform layer, samples shall be secured at intervals of not more than 150 m (500 ft).

   5.2.3.5. Samples from a stockpile shall be obtained by combining equal quantities of the mixture taken from holes dug into points near the top, middle, and bottom of the stockpile. Reduction of the sample to the required size shall be as described in Section 5.3.2.

4. Insert an additional section between Sections 6.2.3 and 6.2.4 containing the following:

   Lot number.

Standard Method of Test for Sampling of Aggregates

AASHTO Designation: T 2-91 (2015)

ASTM Designation: D75-03

AASHTO T 2-91 (2015) is identical to ASTM D75-03 except that all references to ASTM C702 contained in ASTM D75-03 shall be replaced with R 76.
