

Constructing Quality Asphalt Pavements in Pennsylvania

Check List



4th Edition – 2025

*Pictured: Lindy Paving, I-90 Erie Co. Project
2024 Sheldon G. Hayes Award Winner
NAPA's Top National Paving Award*

PAPA

The Pennsylvania Asphalt Pavement Association is committed to promoting and providing to our customers the best available asphalt pavement technology and quality. We hope this "Constructing Quality Asphalt Pavements in Pennsylvania Check List" will be beneficial in realizing our commitment.

www.pa-asphalt.org

How Far Does 1-Ton of Mix Go?

Ref. "Caterpillar Paving Calculator"

https://www.cat.com/en_US/articles/solutions/paving/paving-calculator-app.html

(in feet) assuming 110 lb/sy/in or 147 lbs/cf:

| Mat Width | Compacted Thickness | | | |
|-----------|---------------------|-------|-------|------|
| | 1.0" | 1.5" | 2.0" | 3.0" |
| 8' | 20.5' | 13.7' | 10.3' | 6.8' |
| 9' | 18.0' | 12.1' | 9.2' | 6.1' |
| 10' | 16.5' | 11.0' | 8.3' | 5.5' |
| 11' | 14.9' | 9.9' | 7.4' | 5.0' |
| 12' | 13.7' | 9.1' | 6.8' | 4.5' |
| 14' | 11.7' | 7.8' | 5.8' | 3.9' |
| 16' | 10.2' | 6.8' | 5.1' | 3.4' |

Q How many tons will it take to pave a 12-foot wide lane for 1-mile (5,280 ft) if the compacted mat thickness is 1.5 inches?

A $5280 \text{ ft} \div 9.1 \text{ ft / ton} = 581 \text{ tons}$

Q What will be the yield (lineal feet of paving) for a 22-ton truckload of mix when paving a 12-foot wide lane and the compacted mat thickness is 2-inches?

A $22\text{-tons} \times 6.8 \text{ ft / ton} = 150 \text{ feet}$

Q How many tons of mix will it take to pave a 150-feet by 300-feet parking lot with a 3-inch thick compacted base layer? The area, in square yards, of a rectangle or square is length X width in feet divided by 9 sft/sy.

A $300 \text{ ft} \times 150 \text{ ft} \div 9 \text{ sf / sy} = 45,000 \text{ sf} \div 9 \text{ sf / sy} = 5,000 \text{ sy}$
 $110 \text{ lb / sy / in} \times 3\text{-inches} \times 5,000 \text{ sy} = 1,650,000 \text{ lbs}$
 $1,650,000 \text{ lbs} \div 2,000 \text{ lb / ton} = 825 \text{ tons}$

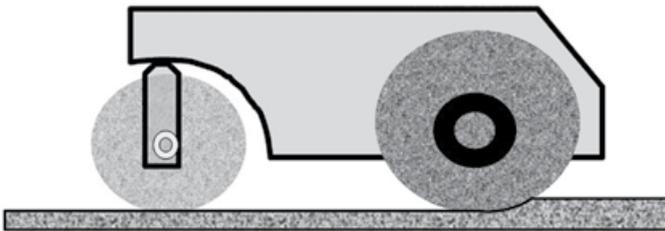
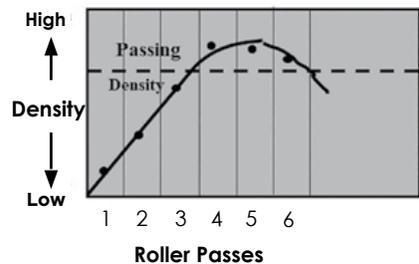


Note: A typical compacted asphalt mix will weigh 108 to 120 pounds per square yard per inch thickness (lbs/sy/in) or 144 to 160 pounds per cubic foot (lbs/cf). This varies with the specific gravity of the aggregate, AC content, and in-place density. When making calculations, check the mix design (JMF) for your project to get this specific information. Multiply the maximum theoretical density in lbs/cf from the JMF by 0.75 and by 0.94 (the assumed average in-place density) to get pounds per square yard per inch of thickness (lbs/sy/in).

Actions of the Field Technician

- **Communicate** regularly with the paving foreman and roller operators to achieve the highest quality mat.
- **Have a clear understanding** of the crew's production goals for the day and what resources are available to achieve them.
- **Ensure** the proper JMF is being produced and delivered to the project.
- **Calibrate** the density gauge yearly and standardize it, at a minimum, daily.
- **Establish and monitor** roller pattern to assure desired results are achieved.
- **Monitor** tack coat application for the correct rate and uniform coverage, and to ensure tack coat has "broken" before paving.
- **Maintain** communication with the plant throughout the day. Monitor volumetrics testing results as they may affect compactive efforts in the field. Inform the plant if noticeable changes in the mix occur.
- **Continually monitor** the mat for density, surface texture, temperature, thickness, width (roll out), appearance, and construction of the joints.
- **Periodically check** the mat behind the finish roller for things such as segregation, flushing, shear cracking and crushed aggregate.
- **Specify** loose box sample and core locations (PTM 1)
- **Observe** cutting cores as soon as practical.
- **Take custody** of acceptance samples.

Develop a Rolling Pattern



Projects with a Ride Specification

(SECTION 404)

- **Understand** the requirements of the spec and the number of construction operations provided to achieve them.
- **Ensure** balanced production and placement operations.
- **Strive** for continuous and consistent paving speed. This would be facilitated by the use of an MTV.
- **Check** equipment and operator's certifications
- **When practical**, run the profiler over the roadway before any work is done and profile each course to **determine** the ride improvement that has been achieved.
- **Use** as long a ski on the paver as practical.
- **Mount** sensors as close to the midpoint of the reference as possible and closer to the tow point than the screed.
- **Have a readily available contact** who is familiar with the paver mechanics and grade sensing automation.
- **Make adjustments** to the operation if improvements in ride with each course or operation do not assure that final results will be within specification limits.



Certified Lightweight Profiler

Pre-Pave Meeting

- **Review** applicable specifications, special provisions, and drawings
- **Discuss** contractor's QC plan and sequence of operations
- **Review** the Traffic Control Plan
- **Review** acceptance sampling procedures and care/custody of samples
- **Review** surface preparation requirements
- **Discuss** JMFs for the project materials
- **Discuss** mix and paving temperature requirements
- **Review** types and quantities of various equipment on the project
- **Ensure** proper preparation of density gauges (PTMs 402 and 403)
- **Review** applicable PTMs (1, 428, 729, 737, 746, 747, 751)
- **Discuss** paving and compaction equipment

Surface Preparation

- **Verify** existing stability (proof roll) of surface/subgrade to be paved
- **Remove** existing "cold patch" material and all unstable material
- **Remove** full depth and patch fatigued cracked areas
- **Seal** cracks $\geq \frac{1}{4}$ in. and < 1 in. in width
- **Cut** or mill paving notches
- **Ensure** existing surfaces are dry and clean
- **Apply** tack coat at least 6 inches beyond the width of the mat and in accordance with Section 460 in the range of 0.03 to 0.08 gal/sy of residue given the existing surface type (Table B). Wait for the tack to "break" before paving.

Balance Plant/Trucks/Paver/Rollers

Ref. "Caterpillar Paving Calculator"

https://www.cat.com/en_US/articles/solutions/paving/paving-calculator-app.html

Given: The schedule calls for placing 1600 tons of 9.5mm wearing course in an 8 hour shift (200 tons/hr), and the round-trip time for a truck (hauling 20 tons of mix) is 1.5 hours.

Assume: 80% efficiency for both the paver and vibratory roller and a frequency of 4,000 vibrations per minute (VPM).
The weight of compacted wearing course equals 110 lbs/sy/in.

A.) How many trucks are required?

B.) How many lineal feet per minute should the paver travel for non-stop paving if it places 1.5 inches of compacted material 12 feet wide (12 sf = 1.33 sy/lin ft)?

C.) How many MPH should the roller travel when making 3 passes and 2 coverages (7 total passes)?

D.) At this speed, and frequency, what is the impact spacing?

A.) $(8 \text{ hrs}) / (1 \text{ shift}) \times (1 \text{ trip/truck}) / (1.5 \text{ hrs}) = 5.3 \text{ trips/truck/shift}$

Round down to 5 trips/truck/shift

For 1 shift: 5 trips/truck X 20 tons/trip = 100 tons/truck

1600 tons ÷ 100 tons/truck = **16 trucks** needed (round up)

B.) $2000 \text{ lbs/ton} \div (110 \text{ lbs/sy/in} \times 1.5 \text{ in}) = 12.12 \text{ sy/ton}$

$12.12 \text{ sy/ton} \times 200 \text{ tons/hr} = 2424 \text{ sy/hr}$

$2424 \text{ sy/hr} \div 1.33 \text{ sy/lin-ft} = 1823 \text{ lin-ft/hr}$

$1823 \text{ lin-ft/hr} \div 60 \text{ min/hr} = 30 \text{ lin-ft/min}$ (at 100% efficiency)

$30 \text{ lin-ft/min} \div 0.80 = 38 \text{ lin-ft/min (FPM)}$

C.) $1823 \text{ lin-ft/hr} \times 7 \text{ passes} = 12,761 \text{ lin-ft/hr}$ (at 100% efficiency)

$12,761 \text{ lin-ft/hr} \div 0.80 = 15,951 \text{ lin-ft/hr}$

$15,951 \text{ lin-ft/hr} \times 5280 \text{ ft/mile} = \mathbf{3.0 \text{ MPH}}$

D.) $15,951 \text{ lin-ft/hr} \div 60 \text{ min/hour} = 266 \text{ FPM}$

$4,000 \text{ VPM} \div 266 \text{ FPM} = \mathbf{15 \text{ impacts/ft}}$

10 - 12 impacts/ft is recommended

Mix Delivery

- **Use** biodegradable release agent
- **Dump** excess release agent in approved area
- **Load** truck using 3-drop method to reduce segregation
- **Always tarp** the truck body to sufficiently cover the entire load
- **Use** insulated/heated truck body when required
- **"Break"** load against tailgate before opening
- **Paver** engages and pushes the truck while material is dumped into paver hopper

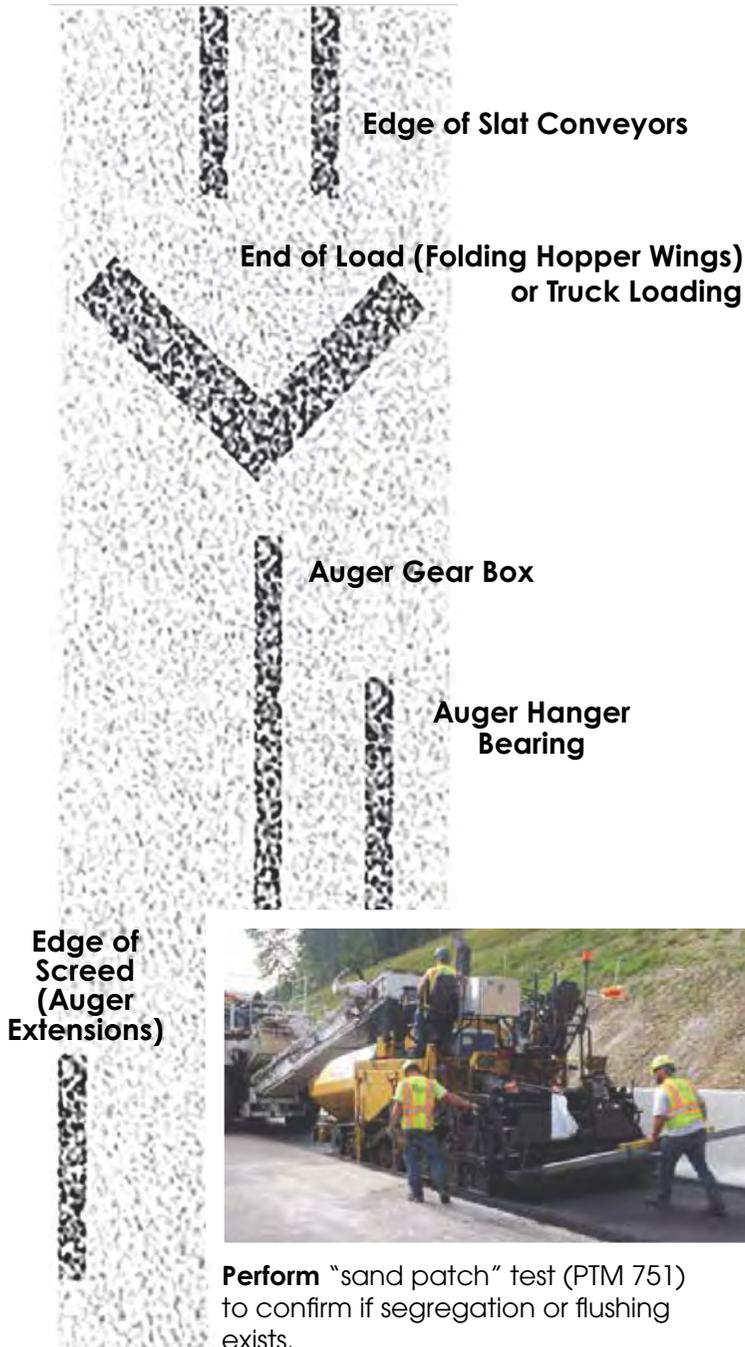
Mix Placement

- **Pre-heat** paver screed
- **Set** shims, null screed and set angle of attack
- **Set** grade and cross-slope of the paver
- **Always activate** screed vibrator
- **Establish** straight line with initial pass for longitudinal joint
- **Adjust** conveyors/flow gates and feed to maintain a constant head of material at or slightly above auger shaft
- **Always maintain** material in the hopper at least above the bottom of the flow-gates. Never expose the slat conveyors
- **Maintain** a full hopper if it is necessary to stop the paver
- **Ensure** mix is in the proper temperature range:

| | <u>Minimum</u> | | <u>Maximum</u> |
|-------------|----------------|----------|----------------|
| | Foaming | Chemical | |
| ➤ PG 58S-28 | 230° F | 215° F | 310° F |
| ➤ PG 64S-22 | 240° F | 220° F | 320° F |
| ➤ PG 64E-22 | 260° F | 240° F | 330° F |

- **Maintain** consistent paver speed, minimize stops and starts. When starting, get paver up to desired speed as quickly as possible
- **Dump** hopper wings frequently into full hopper as the truck pulls away or not at all until the end of the shift
- **Extend** augers at least to within 18 inches of the end plate
- **Overband** finished longitudinal joint with PG 64S-22

Possible Segregation Locations



Compaction

- **Good** compaction is the mat characteristic that is most well correlated with pavement longevity!
- **Establish** a roller pattern (number of roller passes, density testing, impact spacing) for optimum and uniform density.
- **Ensure** the roller pattern is accomplished to provide uniform mat coverage throughout the project.
- **Balance** the number of and types of compaction equipment with the paver speed to maintain an appropriate rolling zone for good compaction.
- **Use** “best practices” rolling sequence.
- **End** each pass with an arc. Roll off the mat onto a previously placed course to reverse direction, if possible.
- **Ensure** roller drums are clean and water systems operational.
- **Establish** a water refill plan.
- **Use** rubber tire rollers on scratch course.
- **Be aware** of the Time Available for Compaction (TAC) given project environmental conditions (see page 11).

Acceptance/Quality Control

- **Maintain** the International Roughness Index (I.R.I.) less than the target value (Section 404.4, Table A)
- **Mat density** for RPS needs to be $\geq 92\%$ and $\leq 98\%$ of maximum theoretical (Gmm) density (Section 413.3(h), Table E). For SMA mixes, density needs to be $\geq 93\%$ and $\leq 98\%$ of Gmm (Section 419.3(i), Table F).
- **Target** mat density at the center of the acceptable range, around 95% of Gmm for wearing and binder courses.
- **Maintain** minimum density for base is 90% of Gmm
- **Do not open** to traffic before mat has cooled to 140°F or if mat is unstable
- **Obtain** combination of loose box samples and density cores for each subplot in accordance with PTMs 1, 729, and 746.



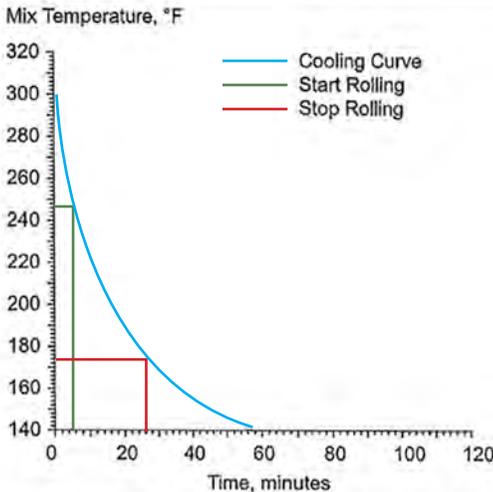
Pave Cool 3.0 Report



Ref. www.dot.state.mn.us/app/pavecool

www.asphaltpavement.org/expertise/engineering/resources

| | | | | | |
|-------------------------|---------------------|-----------------------|-----------------------|----------------------|--|
| Date & Time | | Start Rolling* | | Stop Rolling* | |
| 4/23/2019 9:39 AM | | 5 minutes (248 °F) | | 26 minutes (175 °F) | |
| Mix Type | Binder Grade | Thickness | Delivery Temp. | | |
| Fine/Dense | PG 76-22 | 2.00 in. | 300 °F | | |
| Air Temp. | Wind Speed | Sky | Latitude | | |
| 50 °F | 5 mph | Humid & Hazy | 42 ° North | | |
| Existing Surface | Moisture | State | Surface Temp. | | |
| Asphalt | | | 50 °F | | |



*Some asphalt mixtures will require compaction times and temperatures different from those recommended by this program. Good judgement must be exercised in order to ensure a properly compacted surface. Special considerations should be made for polymer modified asphalt binders and warm-mix asphalt (WMA). In these cases, manufacturer guidelines should supersede recommendations made by this program. Consult the Help file for further details. In no event will the Minnesota Department of Transportation, the University of Minnesota or their suppliers be liable for damages or expenses arising out of the use of this program.

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- **Applications use 175°F** as the stop rolling temperature in determining the Time Available for Compaction (TAC). Rolling a mat that has cooled too much may result in fractured aggregates in some cases.

Determining Lots and Sublots

(SECTION 413.3(h)2.a: TABLE D)



Scan QR code to view PennDOT video on Lots and Sublots

Notes:

- Lots established cumulatively and specifically for **each** JMF
- Normal lot size = 2500 tons
- Normal subplot size = 500 tons (5 per lot)
- Different random numbers are used for loose box samples and cores

Rules:

1. For total JMF quantity ≤ 500 tons, the tonnage may be considered a lot if density acceptance is by pavement cores; however, mixture acceptance will be by certification. The lot will be divided into 3 EQUAL sublots.
2. For total JMF quantity > 500 tons and < 2500 tons, the tonnage will be considered a lot, and the lot will be divided into 5 EQUAL sublots.
3. For total JMF quantity ≥ 2500 tons, lot sizes and associated number of sublots will be re-adjusted in accordance with TABLE D Section 413.3(h)2.a only using the remaining total JMF quantities beyond the last full 2500 ton lot.

Procedure:

1. Determine which rule applies. See following steps for Rule #3
2. Determine the remaining quantity following the last full lot.
3. Refer to Section 413.3(h)2.a, Table D for how to adjust the last subplot.
 - i. Note, sublots remain at 500 tons except the last subplot which may be less than or greater than 500 tons. While, a combination of loose box samples and core samples is desired, it may not be obtainable. The size of the last subplot is based on whether the random number results in a tonnage within the last potential subplot. See the following example.

Determining Lots and Sublots

(SECTION 413.3(h)2.a: TABLE D)



Scan QR code to view PennDOT video on Lots and Sublots

Example: The project calls for 3745 tons of 9.5mm SuperPave wearing course at 1 ½ in thick. How many total LOTS and SUBLOTS will you have?

Case 1: You intend to get a **combination** of mixture acceptance box and density core samples for each subplot.

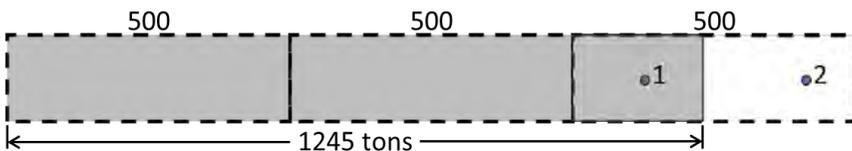
Case 2: You do **NOT** get a combination of three box samples and three cores from the 1245 tons of material.

Case 1: Combination of loose box sample and core

- $3745 > 2500$, therefore, 1st LOT = 2500 tons = 5 SUBLOTS with 500 tons each
- $3745 \text{ tons} - 2500 \text{ tons} = 1245 \text{ tons}$ remaining from total JMF quantity
- Using TABLE D, for 1000 tons to < 1500 tons and a combination box sample and core for each subplot, a new LOT is defined with 3 SUBLOTS.
- 2nd LOT = 1245 tons = 3 SUBLOTS (2 with 500 tons each, 1 with 245 tons)
- **TOTAL: 2 LOTS; 8 SUBLOTS (1st LOT = 5 SUBLOTS; 2nd LOT = 3 SUBLOTS)**

Next, apply PTM 1 to determine if a sample can be obtained in the last potential subplot:

1. Assume the random "X" value is 0.25 for the last potential subplot. Then, $0.25 \times 500 \text{ tons} = 125 \text{ tons}$; $125 \text{ tons} < 245 \text{ tons}$, so a sample **CAN** be obtained.
2. Assume the random "X" value is 0.75 for the last potential subplot. Then, $0.75 \times 500 \text{ tons} = 375 \text{ tons}$; $375 \text{ tons} > 245 \text{ tons}$, so a sample **CANNOT** be obtained. In this situation, Case 2 (see next page) would then apply.



Case 1: 1 new lot and 3 sublots (2 with 500 tons each, 1 with 245 tons)

Determining Lots and Sublots

(SECTION 413.3(h)2.a: TABLE D)



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Example: The project calls for 3745 tons of 9.5mm SuperPave wearing course at 1 ½ in thick. How many total LOTS and SUBLOTS will you have?

Case 1: You intend to get a **combination** of mixture acceptance box and density core samples for each subplot.

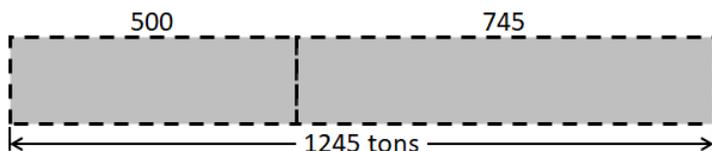
Case 2: You do **NOT** get a combination of three box samples and three cores from the 1245 tons of material.

Case 2: No combination of loose box sample and core

- From TABLE D, for 1000 tons to < 1500 tons without a combination of three box samples and three cores, two new sublots are defined and included in the previous lot:

| | |
|--|--|
| 1,000 tons to less than 1,500 tons without a combination of three mixture acceptance samples and three cores** | Two new sublots defined and quantity combined with the previous lot. (n=7) |
|--|--|

- 6 sublots with 500 tons each, 1 subplot with 745 tons (1245 - 500)
- TOTAL: 1 LOT and 7 SUBLOTS**



Case 2: 2 sublots added to first lot (1 subplot of 500 tons and 1 subplot with the remaining tonnage, 745 tons)

Sampling Asphalt Paving Mixtures (PTM 746)



Scan QR code to view PennDOT video on sampling,
packaging and identification



- Using a flat-bottomed, high sided scoop, sample un-compacted mixture directly from the paving mat at the pre-determined location.
- The scoop must go through the entire depth of the lift being sampled.



- Transfer to a clean cardboard sample box.
- Sample enough material to fill the sample container (appropriate sized container is based on NMAS of the mix):
 - NMAS of 19 mm or less:
box dimensions: 3 3/4" x 4 3/4" x 9 1/2"
 - NMAS of 25 mm or greater:
box dimensions: 5" x 5 1/2" x 9"



- Using a putty knife scrap the **INSIDE** of the scoop to ensure any fines sticking to the scoop are transferred to the sample box.
- When complete, tape the box closed and label with the TR-447 Sample Reference Number on the outside of the box and place the bar code sticker on the outside of the box.



- Do **NOT** scrap the outside of the scoop

Non-Testable Areas for Core Sampling

(PTM 729)

Adjustments for non-testable areas:

- Exclude one foot on both edges of the paved mat.
- For manhole covers and other obstructions, move at least one foot beyond the edge of the obstruction in the direction of paving

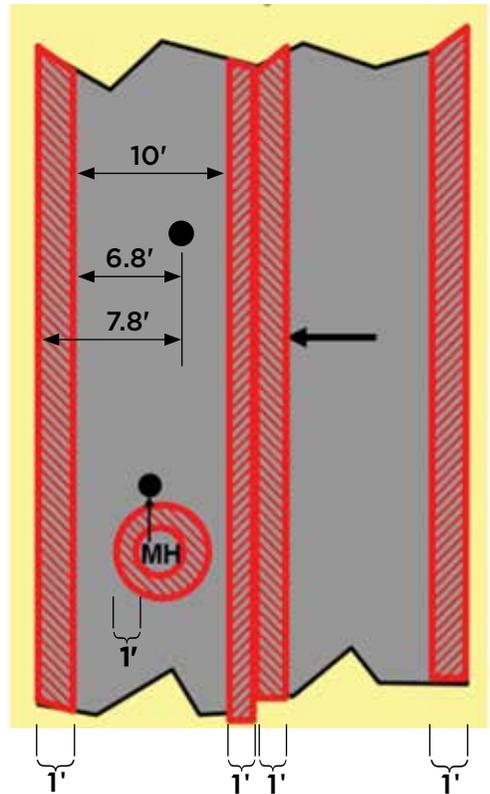
Example: Sublot 2

Random Numbers:

| | <u>X</u> | <u>Y</u> |
|-----|----------|----------|
| #18 | 0.67 | 0.68L |

0.67 X 500 tons = 335th ton in sublot 2
 (0.67 x 4,545 lin-ft = 3,045 ft in sublot 2)

Testable width = 12 ft - 2 ft = 10 ft
 0.68 X 10 ft = 6.8 ft L
 6.8 ft + 1 ft = **7.8 ft from the left edge of paved mat**

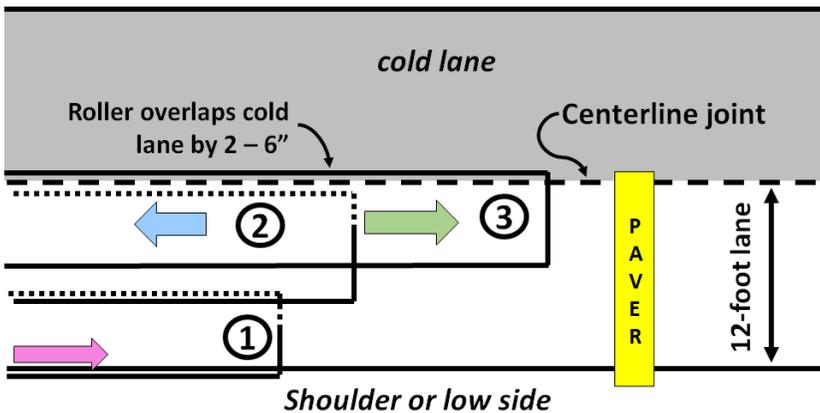
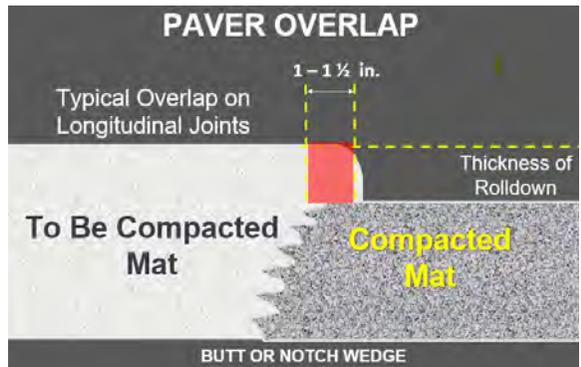


Longitudinal Joint Construction



Scan QR code to view PennDOT video on Longitudinal Joint Construction:

- **Offset** joint 6 inches from underlying paving joint
- **Extend** tack coat 6 - 12 inches from paving joint
- **Tack** paving joint with PG 64S-22
- **Provide** 1 - 1.5 inches of overlap on compacted mat (cold lane), see figure to right
- **Overlap** roller passes, see figure below
- **Offset** paint lines from paving joint 4 - 6 inches
- **Overband** paving joint with PG 64S-22



- 1st pass:** overhangs outside edge of shoulder by 3 to 6 in.
2nd pass: overlaps 1st pass and leaves 6 to 12 in. from uncompacted joint for vertical joint or at least 18 in. from uncompacted joint for notched wedge joint
3rd pass: overlaps 2nd pass and overlaps cold lane by 2 to 6 in.

Asphalt Paving Safety!

24/7, 365

- **Know and wear** what Personal Protective Equipment is needed to work on the project.
- **Do not wear** loose clothing or jewelry that could be caught on things like moving equipment parts.
- **Be continuously aware** of your surroundings. Know traffic flow direction and areas, location of traffic control devices, and any obstacles that could cause tripping hazards or impede escape from work zone.
- **Keep constantly aware** of the location of equipment. Watch out for equipment that is just starting in motion.
- **Pay attention** to back-up alarms.
- **Use tablets and smart phones** only as tools for the project and not for personal issues. USE OF THESE ELECTRONIC DEVICES SHOULD ONLY BE AT SAFE LOCATIONS AWAY FROM EQUIPMENT AND TRAFFIC.
- **NO DRUG OR ALCOHOL USE** SHALL BE ALLOWED!
- **Pay attention** to all DANGER, WARNING, and CAUTION labels on equipment and around the project.
- **Only trained and competently qualified** personnel shall be allowed to operate the equipment.
- **Asphalt materials** are very hot and can cause extreme injury. Know the proper emergency response procedures. Know where and how to get assistance in case of emergency.
- **Know** where the first aid kit is located.
- **When trucks are dumping** into the paver hopper, STAND CLEAR!
- **Stay hydrated** by drinking plenty of water and observe conditions of other workers.
- **Watch out** for overhead power lines and other obstructions.





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- **All references to specification SECTIONS are from PennDOT Publication 408**
- **All references to Pennsylvania Test Methods (PTMs) are from PennDOT Publication 19**