

Constructing Quality Asphalt Pavements in Pennsylvania

Check
List



*Pictured: Lindy Paving, I-79 Butler Co. Project
2018 Sheldon G. Hayes Award Winner
NAPA's Top National Paving Award*

3rd Edition - 2019



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 Checklist" 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/cft

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

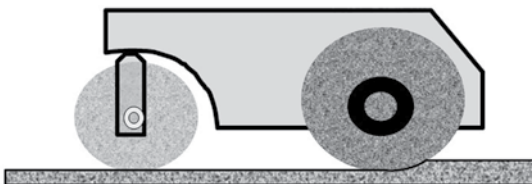
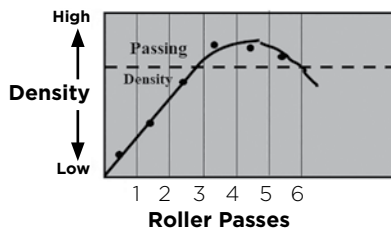


Note: A typical compacted asphalt mix will weigh in the range of 108 to 120 pounds per square yard per inch thickness (lbs/sy/in) or 144-160 lbs/cft. This varies with the specific gravity of the aggregate, AC content and in-place density. When making calculations, check the mix design (JMF) for your project to get this specific information.

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 rate and uniformity and 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** box sample and core locations (PTM1)
- **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.
- **When practical**, run the profiler over the roadway before any work is done and profile each course to see 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-Construction

- **Review** applicable specifications, special provisions, and drawings
- **Discuss** contractor's QC plan and sequence of operations
- **Review** the Traffic Control Plan
- **Review** acceptance sampling 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, 746, 747, 751)
- **Check** paving and compaction equipment
- **Establish** optimum rolling pattern

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. in width
- **Cut or mill** paving notches
- **Ensure** existing surfaces are dry and clean
- **Apply** Tack Coat 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 day, 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 VPM

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 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.) Is the roller able to keep up with the paver?
-

A.) $8 \text{ hrs} \div 1.5 \text{ hrs/trip} = 5.33 \text{ trips}$ (round down). SAY 5 trips / 8 hr shift
 $5 \text{ trips/shift} \times 20 \text{ tons/truck} = 100 \text{ tons/truck/shift}$
 $1600 \text{ tons/shift} \div 100 \text{ tons/truck/shift} = \mathbf{16 \text{ trucks}}$ needed (round up)

B.) $2000 \text{ lbs/ton} \div (110 \text{ lbs/sy/in} \times 1.5 \text{ in}) = 12.12 \text{ sy/ton}$
 $12.12 \text{ sy/ton} \times 200 \text{ tons/hour} = 2424 \text{ sy/hour}$
 $2424 \text{ sy/hour} \div 1.33 \text{ sy/lin ft} = 1823 \text{ lin ft/hour}$
 $1823 \text{ lin ft/hour} \div 60 \text{ min/hour} = 30 \text{ lin ft/min}$
 $30 \text{ in ft/min} \div 0.80 = \mathbf{38 \text{ lin ft/min (FPM)}}$

C.) $1823 \text{ lin ft/hour} \times 7 \text{ passes} = 12,761 \text{ lin ft/hour}$
 $12,761 \text{ lin ft/hour} \div 0.80 = 15,951 \text{ lin ft/hour}$
 $15,951 \text{ lin ft/hour} \div 5280 \text{ ft/mile} = \mathbf{3.0 \text{ MPH}}$

D.) $4,000 \text{ VPM} \times 60 \text{ min/hour} = 240,000 \text{ VPH}$
 $240,000 \text{ VPH} \div 15,951 \text{ lin ft/hour} = \mathbf{15 \text{ impacts/ft}}$
 $15 \text{ impacts/ft} > 12 \text{ impacts/ft}$ (recommended minimum)

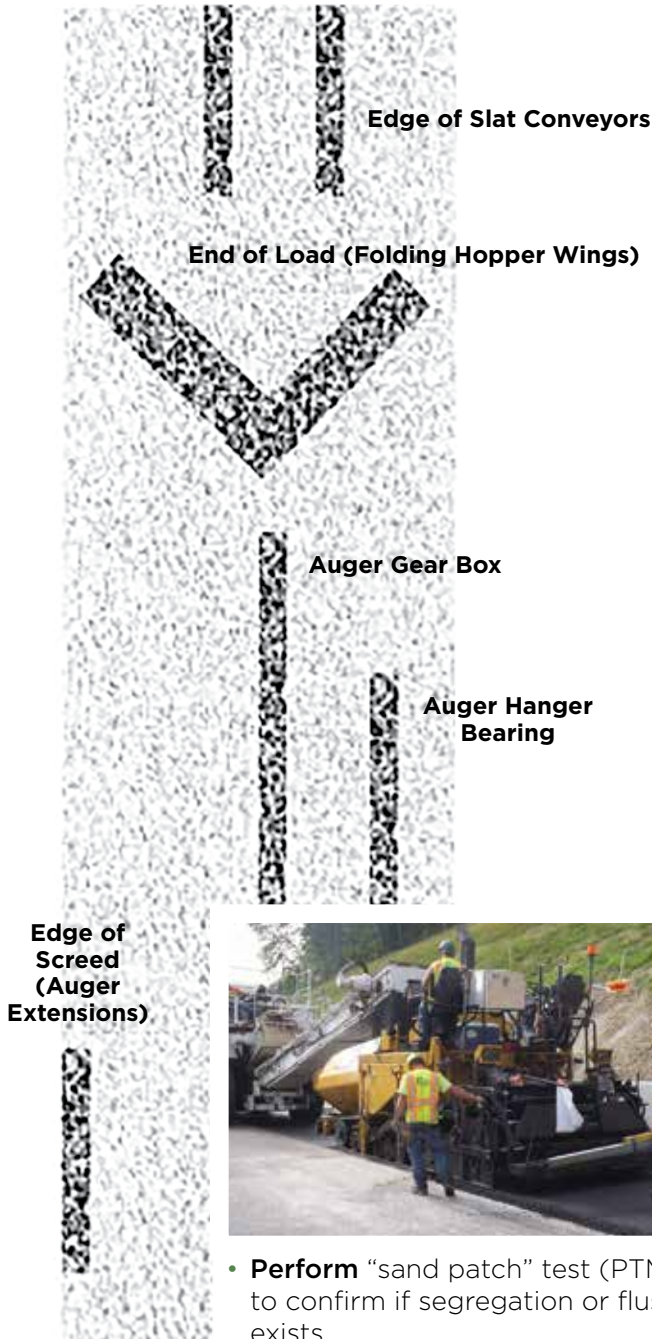
Mix Delivery

- **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 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
- **Ensure** mix is in the proper temperature range:
 - PG 58-28 230 to 310° F
 - PG 64-22 240 to 320° F
 - PG 76-22 255 to 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 gate
- **Overband** finished longitudinal joint with PG 64-22

Possible Segregation Locations



- **Perform** “sand patch” test (PTM 751) to confirm if segregation or flushing exists.

Compaction

- **Good compaction** is the mat characteristic that is most well correlated with pavement longevity!
- **Establish** a roller pattern (number of coverages, 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).

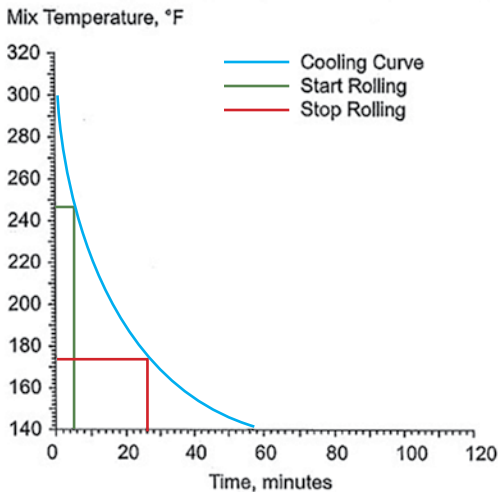
Acceptance/Quality Control

- **Maintain** the International Roughness Index (I.R.I.) less than the target value (Section 404)
- **Mat density** needs to be $\geq 92\%$ and $\leq 97\%$ of maximum theoretical (Gmm) density. Density needs to be $\geq 93\%$ and $\leq 98\%$ of Gmm for SMA mixes.
- **Target** mat density around 94-95% of Gmm at the center of the acceptable range.
- **Maintain** minimum density for base 90%.
- **Do not open** to traffic before mat has cooled to 140°F
- **Obtain** loose box samples and density cores for each subplot in accordance with PTMs 1, 729, and 746.

Pave Cool 3.0 Report

Reference: www.dot.state.mn.us/app/pavecool
www.asphaltpavement.org/multicool

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. Rolling a mat that has cooled too much may result in fractured aggregates in some cases.

Determining Lots and Sublots

(SECTION 409.3(h)2: TABLE D)

Rules

- Lots established cumulatively and specifically for each JMF
- Normal lot size = 2500 tons
- Normal subplot size = 500 tons (5 per lot)
- 1 box sample plus 1 core per subplot (PTM No. 1)
 1. For total JMF quantity \leq 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 \geq 2500 tons, lot sizes and associated number of sublots will be re-adjusted in accordance with TABLE D Section 409.3(h)2a. only with remaining total JMF quantities beyond the last full 2500 ton lot.

Example: The project calls for 3745 tons of 9.5mm SuperPave wearing course at 1 ½ in thick. You intend to get a combination of mixture acceptance box and density core samples for each subplot. How many total LOTS and SUBLOTS will you have?

Answer: For 3745 tons total JMF

- 1st LOT = 2500 tons = 5 SUBLOTS @ 500 tons each
- 3745 tons - 2500 tons = 1245 tons remaining quantity
- Using TABLE D, if you get a combination box sample and core for each subplot, a new LOT is defined with 3 SUBLOTS.
- 2nd LOT = 1245 tons = 3 SUBLOTS (2 @ 500 tons, 1 @ 245 tons)
- **TOTAL: 2 LOTS and 8 SUBLOTS**

Example: Using Table D, if you did **NOT** get a combination of three box samples and three core samples:

- Two new sublots are defined and included in the previous lot
- **TOTAL: 1 LOT and 7 SUBLOTS**

Using Random Numbers (PTM 1) For Stratified Box Sample Locations (PTM 746)

SECTION 409.3(h)2

Select a random series of consecutive numbers for the first lot (2500 tons) from PTM 1 table. Assume the first number “randomly” selected is #17 and the paving mat width is 12 feet.

	X	Y
#17	0.08	L0.70
#18	0.67	L0.68
#19	0.83	R0.97
#20	0.54	R0.58
#21	0.82	R0.50

Procedure:

- Determine lot size and number of sublots
- Randomly select a set of consecutive numbers from PTM 1 table — one for each subplot
- Values in X and Y columns give coordinates of the sample location
- X is in TONS or FEET. Y is the offset in feet from left or right edge of TESTABLE area

Sublot 1

Random Numbers

	X	Y
#17	0.08	0.70L

0.08 X 500 tons = **40th ton**

0.70L X 12 ft = **8.4 ft from left edge**

Sublot 2

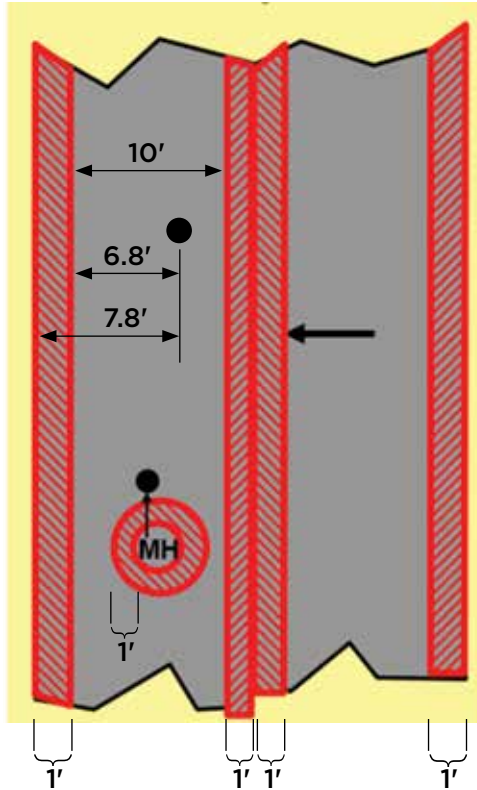
#18	0.67	0.68L
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0.67 X 500 tons = 335 ton + 500 tons = **835th ton**

0.68L X 12 ft = **8.2 ft from the left edge**

Continue for the remaining sublots using the consecutive random numbers.

Non-Testable Areas for Core Sampling (PTM 729)



Adjustments for non-testable edges

Sublot 2

Random Numbers

	X	Y
#18	0.67	0.68L

0.67 X 500 tons = 335th ton in 2nd sublot

0.68 (12ft-2ft) = 6.8ft L in testable area

6.80 + 1.00 ft = **7.80 ft from left edge of paving mat**

Adjustments for manhole covers and other obstructions

Move at least one foot beyond the edge of the obstruction in the direction of paving.

Project # _____

SR _____

Limits _____

Mix JMF # _____

PG _____ - _____

Deliver Temp Max _____ Min _____

Target Density _____ lb/cf

(Gmm) Min. _____ (_____ %)

Max _____ (_____ %)

IRI _____

Notes: _____



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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**

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.

