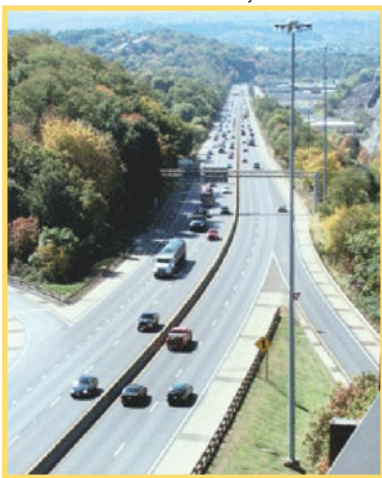


CONSTRUCTING QUALITY HOT-MIX PAVEMENTS IN PENNSYLVANIA LIST

2nd Edition – February 2007



*Pittsburgh, PA – Parkway West
Best Paving Project in the U.S.A. 2005*



The Pennsylvania Asphalt Pavement Association is committed to constructing high quality hot-mix asphalt pavements. We hope this "Constructing Quality Hot-Mix In Pennsylvania Checklist" will be beneficial in realizing our commitment.

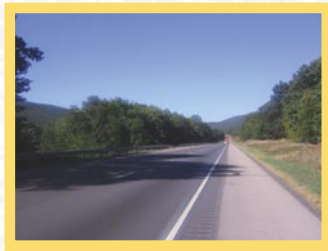
How Far Does 1-Ton of Hot-Mix Go?

(in feet) @ 110 lb/sy/in

Lane Width	Compacted		Thickness	
	1"	1.5"	2"	3"
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

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

$$5,280 \text{ ft} / 9.1 = 581 \text{ tons}$$



Note: Typical hot-mix will weigh in the range of 108 to 120 pounds per square yard inch based on the specific gravity of the aggregate. When making calculations, check the mix design for your project.

The area, in square yards, of a rectangle or a square is length in feet x width in feet divided by 9.

A parking lot is 150-feet by 300-feet. How many square yards are in the parking lot?

$$(300 \text{ ft} \times 150 \text{ ft}) / 9 = 45,000 \text{ sf} / 9 = 5,000 \text{ sy}$$

If you plan to place 3-inches of HMA base how many tons will it take?

$$(110 \text{ lb/sy/in} \times 3\text{-inches}) \times 5,000 \text{ sy} / 2,000 \text{ lb}$$

$$(330 \text{ lb/sy} \times 5,000 \text{ sy}) / 2,000 \text{ lb} = 825 \text{ ton}$$

Other Important Square Yard Formulas



The area, in square yards, of a circle is 3.14 times the radius, in feet, squared divided by 9.

A helicopter landing pad is 60-feet in diameter, radius 30-feet (D/2)

$$(3.14 \times [30\text{-feet} \times 30\text{-feet}]) / 9 = 314 \text{ sy}$$

If you plan to place a 2-inch HMA wearing surface, how many tons will you need?

$$(110 \text{ lb/sy/in} \times 2\text{-inches}) \times 314 \text{ sy} / 2,000 \text{ lb}$$

$$(220 \text{ lb/sy} \times 314 \text{ sy}) / 2,000 \text{ lb} = 34.5 \text{ tons}$$

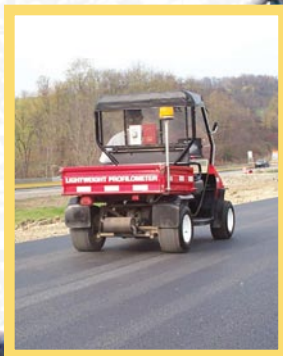
The Role of the **Field Technician**

- Have a clear understanding of the crew's goals for the day and what resources are available to achieve them
- Calibrate the density gauge yearly and standardize it daily
- Establish and monitor roller pattern to assure desired results are achieved
- Maintain communication with plant throughout the day. Monitor volumetrics testing 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, depth, width (roll out), and the appearance of the joint.
- Periodically check the mat behind the finish roller for things which might effect the appearance of the finished mat
- Communicate regularly with paving foreman and roller operators to achieve the highest quality mat
- Cut cores as soon as practical and run densities to verify density gage readings



Projects with a **Ride Specification**

- Understand requirements of the spec and the amount of material allotted to achieve them
- When practical, run profiler over the roadway before any work is done and profile each course to see the improvement that course achieved
- Use as long a ski as practical
- Mount sensors as close to midpoint of the reference as possible and closer to tow point than the screed
- Have someone readily available that is familiar with paver mechanics and grade sensing system
- Make adjustments to operation if improvement with each course does not assure you will be within specification limits



Pre-Construction

- Balance Plant/Truck/Paver/Rollers
- Prepare a Quality Control Plan for Paving Operations which includes an Outline for Sampling and Testing
- Paver in Good Operating Condition
- Sufficient Number of Rollers
- Rollers in Good Operating Condition
- Sufficient Trucks
- Air and Surface Temperatures Acceptable
 - Sec. 309 35°F and Rising
 - Sec. 409 40°F and Rising
- Existing Surface Dry
- Confirm Mix Design
- Acceptable Traffic Control Plan



Surface Preparation

- Verify Stability (proof roll) of Surface/Subgrade to be Paved
- Remove Existing Cold Patch Material
- Remove & Patch Fatigue Cracks
- Seal Cracks \geq 1/4-inch
- Cut Paving Notches
- Existing Surface Clean and Dry
- Apply Tack Coat (AE-T) in the range 0.02 to 0.07 gal/sy and wait for tack to break

Balance Plant / Trucks / Pavers / Rollers

Given: Plant produces 300 tons / hour and round trip for truck (hauling 20 tons) is 1 hour.

Assume: 80-percent efficiency for both the paver and vibratory roller.

Assume: vibrations/minute = 4,000

- A) How many trucks required?
- B) How many feet / minute should paver travel, if it places 1.5-inches 12-foot wide (4 yd)?
- C) How many MPH should roller travel making 3 passes, 2 coverages?
- D) Is roller able to keep up with paver if :

1) $300 \text{ tons/hour} / 20 \text{ tons} = 15 \text{ trucks}$

2) $2000 \text{ lb} / 165 \text{ lb/sy} = 12.12 \text{ sy/ton}$
 $12.12 \text{ sy/ton} \times 300 \text{ ton/hr} = 3,636 \text{ sy/hr}$
 $3,636 \text{ s/hr} / 4 \text{ yd} = 909 \text{ yd/hr (linear travel)}$
 $909 \text{ yd/hr (linear travel)} \times 3 \text{ ft} = 2,727 \text{ lf/hr}$
 $2,727 \text{ lf/hr} / 60 \text{ min/hr} = 45 \text{ lf/min}$
 $45 \text{ lf/min} / 0.80 = 56 \text{ ft/min}$

3) $2,727 \text{ lf/hr} \times 6 \text{ passes} = 16,362 \text{ ft/hr}$
 $16,362 \text{ ft/hr} / 0.80 = 20,453 \text{ ft}$
 $20,453 \text{ lf} / 5280 \text{ ft/mi} = 3.9 \text{ MPH}$

4) $4000 \text{ VPM} \times 60 \text{ min} = 240,000 \text{ vibrations/hr}$
 $240,000 \text{ VPH} / 20,453 \text{ lf} = 11.7 \text{ impact/ft}$
Minimum of 10 to 12 impact/ft recommended

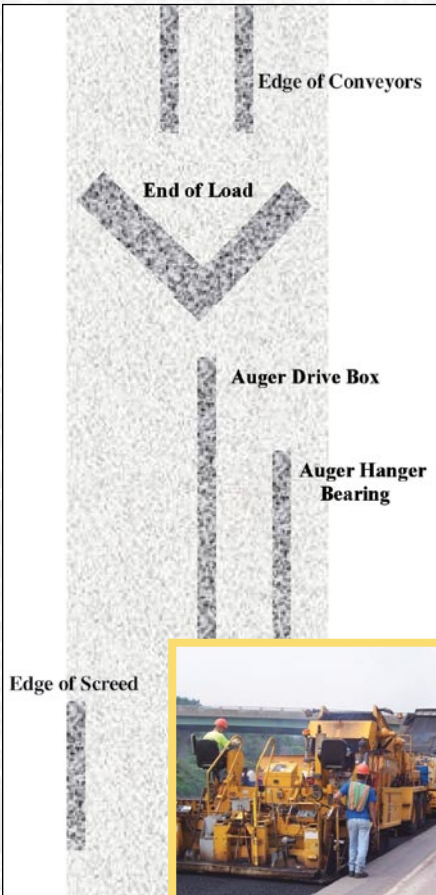
Mix Delivery

- Proper Release Agent Applied
- Dump Excess Release Agent
- Truck Loaded Using 3 Drop Method
- Truck Tarpred to Sufficiently Cover Entire Load
- Truck Insulated/Heated Body when Required

Placement

- Pre-heat Paver Screed
- Set Shims, Null Screed & Set Angle of Attack
- Set Paver's Grade & Cross-Slope, Activate Vibratory Screed
- Establish Straight Line for Longitudinal Joint
- Adjust Conveyor/Flow Gates & Feed to Maintain Head of Material
- Do Not Let the Material in the Hopper Drop Below the Bottom of the Flow Gates
- Mix at Proper Temperature
 - PG 58-28 260 to 310°F
 - PG 64-22 265 to 320°F
 - PG 76-22 285 to 330°F
- Maintain Uniform Speed, Minimize Starts & Stops; When Starting, Get to Paving Speed as Quickly as Possible
- Mat Uniform Texture; **Free of Segregation** & Contamination
- Perform Depth Checks Prior to Compaction
- Paint Longitudinal Joint w/PG 64-22
- Overlay Cold Mat by Approximately 1-inch

Possible Segregation Locations

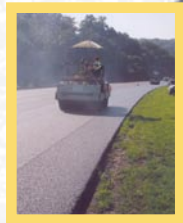


Compaction

- Make Sure Roller Drums are Clean and Water System Operational
- Establish Water Refill Plan
- Establish Roller Pattern for Optimum Density – VPM, Amplitude & Speed
- Vibrations/Minute – Strive for Approximately One Impact Per Inch
- Roll to Provide Uniform Mat Coverage
- End Each Pass with an Arc. Roll off Mat onto Previously Placed Course to Reverse Direction if Possible
- Rubber Tire Roller Required on Scratch Course
- Be aware of the Time Available for Compaction (TAC)

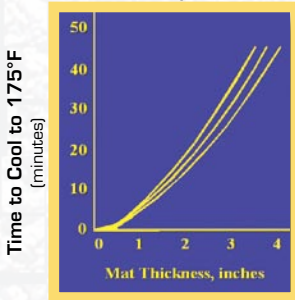
Acceptance/ Quality Control

- International Roughness Index (IRI) \leq Target
- 93% (90 for base) \leq Mat Density \leq 97% of G_{mm}
- Longitudinal Joint Density within 2-percent of Mat (Recommended)
- Do Not Open to Traffic Before Mat has Cooled to 60°C (140°F)
- Lift Box Samples and Density Cores for Each Lot in Accordance with PTM 1 and PTM 746



Time Available for Compaction (TAC)

Max. Temp. 300°F



Using Random Numbers for Stratified Box Sample Location

Select at random a series of consecutive numbers for the first Lot (2,500 tons) from PTM 1, and multiply by the number of tons in a Sublot (500 tons) to obtain the sample location.

<i>Random Numbers</i>	X	Y
# 17	.08	.70L
.08 x 500 ton	=	40th Ton
.70L x 12 ft	=	8.4 ft. from Left Edge

#18	.67	.68R
.67 x 500 ton	=	335th Ton + 500 = 835th Ton
.68R x 12 ft	=	8.2 ft. from Left Edge

Continue for Remaining Sublots Using Consecutive Numbers

MAT TROUBLE SHOOTING GUIDE

(Courtesy of Ingersoll Rand)

SYMPTOM	POSSIBLE CAUSE	CURE
Mat tearing at Full width	1. Excessive speed	1. Correct at machine
	2. Unstable mix (temp, agg, etc)	2. Correct at plant
	3. Strike-off too low	3. Raise strike-off
	4. Lead crown incorrect	4. Adjust as needed
	5. Worn Screed Plate	5. Replace screed plate
	6. Cold Screed	6. Check burners, review heating procedures
Edges only	7. Edger plate not square	7. Adjust as needed
	8. Cold material build up at end of augers	8. Extend augers
Quarter points only	9. Cold Material	9. Correct at plant
	10. Aggregate thicker than mat	10. Check mat depth
	11. Overloaded augers	11. Machine adjustment: auger speed, flow gates
	12. Extensions incorrectly installed	12. See machine operator's manual
	13. Auger worn out	13. Replace augers

Tearing behind main with extensions retracted

1. Extensions too low in front of main

1. Adjust up

Loose streak center of mat

1. Insufficient lead crown

1. Adjust as needed

2. Flow gates too low

2. Adjust as needed

3. Worn augers or kick-back paddles

3. Repair or replace

1. Overloaded augers

1. Educate operator

2. Auger worn out

2. Repair or replace auger

3. Waiting too long between loads

3. Inform operator to adjust paver speed

4. Varying mix temperatures

4. Inform plant and truck drivers

5. Grade sensor mounted at tow point

5. Move back on side arm

1. Trucks bumping paver / holding brakes

1. Educate drivers

2. Fluctuating head of material

2. Check paddle box locations, flow gate openings and speed of auger conveyor

3. Cold screed

3. Review/check heaters & heating procedures

4. Worn screed plate

4. Replace screed plate

5. Worn Augers

5. Repair or replace augers

6. Lack of vibration

6. Increase vib. at vib. control and/or reposition & coordinate concentric weights

SYMPTOM

Hydraulic Screed Ext. & OmniScreed

Transition lines between

main & extension

Extension area with voids

**Bright streaks down center
of mat**

Ripples

Hair line cracks

Poor longitudinal joints

POSSIBLE CAUSE**CURE**

7. Extensions set too high or too low	7. Adjust height of extensions
8. Extensions starved for material	8. Install additional augers & guards for constant extended width. Use kick-out paddles for variable extended width
1. Too much lead crown	1. Make necessary adjustments
2. Flow gates too high	2. Adjust as needed
3. Augers worn out	3. Repair or replace
1. Fluctuating head of material	1. Check machine adjustments; check material for inconsistency
2. Incorrect flow gate adjustment	2. Adjust as needed
3. Erratic speeds	3. Adjust paver speed to plant output
4. Loose or worn crank depth assembly	4. Repair, tighten or replace
5. Worn Augers	5. Repair or replace augers
6. Trucks holding brakes	6. Educate drivers
7. Poor flow characteristics	7. Correct at plant
1. Poor rolling procedures	1. Check roller manufacturer
2. Fluctuating head of material	2. Review correct procedures
3. Excessive speed	3. Review correct procedures
4. Unstable mix	4. Correct at plant
1. Delay in rolling	1. Improve coordination

2. Over-correction of depth cranks	2. Review correct procedures
3. Overloaded augers	3. Review correct procedures
4. Head of material varying	4. Operational problems/machine adjustments
5. Too much overlap	5. Review correct procedures
1. Incorrect joint preparation	1. See recommended procedure
2. Fluctuating head of material inconsistencies in material	2. Check machine adjustments; check for
3. Incorrect nulling procedure	3. See recommended procedure
4. Cold screed	4. Check screed heaters and heating procedures
5. Poor rolling operation	5. See manufacturer's manual
6. Varying mix temperatures	6. Correct at plant
1. Excessive moisture in mix	1. Correct at plant
2. Excessive vibration	2. Reduce vibration
3. Tack Coat	3. Correct on job
1. Screed depth crank improperly set	1. Adjust screed angle of attack
2. Screed depth crank bearings badly worn	2. Replace bearings
3. Forward area of screed plate badly worn	3. Replace screed plate
4. Pre-strike-off set too high	4. Make adjustments per operators manual
5. Hydraulic screed extensions set too high when retracted	5. Make adjustments per operators manual
1. Improper set-up or adjustment	1. See automatic screed control instructions

Poor transverse joints

Bleeding

Screed rides nose down

Automatic screed control malfunction

Project # _____

LR _____ Sec _____

Mix _____ PG ____ - ____

Deliver Temp. Max ____ Min ____

Target Density _____ lb/cf

Min. _____ (%)

Max _____ (%)

IRI _____

Notes:

**PENNSYLVANIA ASPHALT
PAVEMENT ASSOCIATION**

3540 N. Progress Ave., Suite 206

Harrisburg, PA 17110

(717) 657-1881

www.pahotmix.org