

# Basics of Quality Pavement Construction

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- Prior to asphalt paving operations, it is important to properly prepare the existing surface
- The performance of a hot mix asphalt pavement is strongly related to the condition of the surface on which it was placed
- Proper surface preparation prior to paving is often overlooked and not specified
  - Surface repair and prep can be time consuming /costly
  - “Overlay will cover up the existing distress”
- The most common surfaces to be overlaid are:
  - Subgrade
  - Granular Base Course (Aggregate Base)
  - **Existing Asphalt Pavement**
  - Existing PC Concrete Pavement

## Preparing to Overlay Existing HMA



ROAD CLEANING EQUIPMENT, SHOWING BROOM AND BLOWER MOUNTED ON A FORDSON TRACTOR. THE BLOWER REMOVES THE DUST THAT HAS NOT BEEN ENTIRELY SWEEPED OFF BY THE BROOM.



Thoroughly clean the surface

Or it may involve one or more of the following:

- Patching
- Cleaning and filling cracks
- Placing a leveling course
- Milling the surface

Failed areas **MUST** be cleaned, repaired and brought into good structural condition before overlaying.

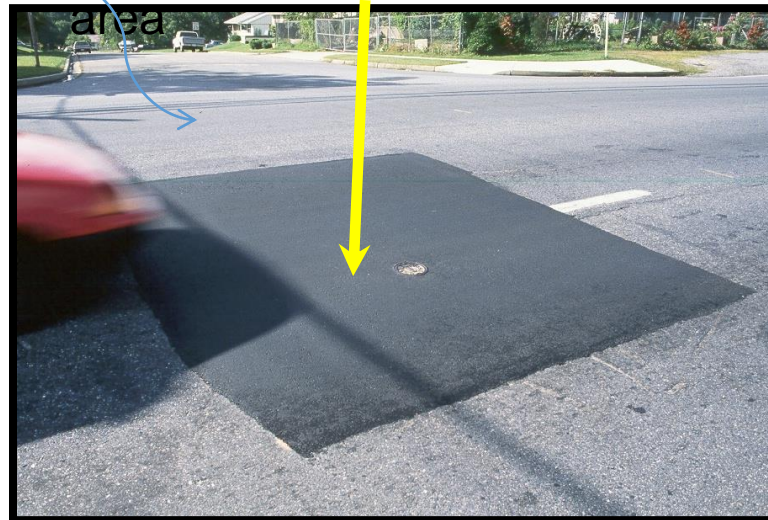


- Layout well into the sound pavement when marking for removal
- Use good straight lines and cut with vertical faces
- Remove all loose material
- Tack base and all vertical surfaces
- Strong enough to become a part of the permanent structure
- Failure means re-patching



Irregular patch - getting proper compaction is going to be difficult on this one.

Nice straight lines, no distress visible outside the patched area



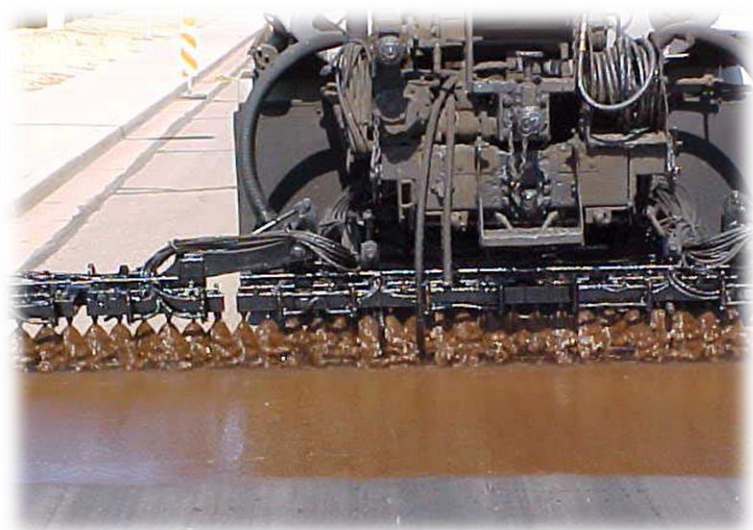
# Advantages of Cold Milling



- Efficiently removes deteriorated pavement
- Grade and cross-slope corrections
- Provides opportunity to improve smoothness
- Provides RAP for recycling operations

- Mill below depth of distress
  - Rutting
  - Surface-initiated cracking (Top-down)
- Don't leave “scabs” of HMA
  - Avoid milling within 1 inch of interface w/granular base
- Consider properties of existing HMA before milling
  - Increasing value of RAP obtained





- Full and adequate bond is essential to ensure that stresses caused by pavement loading are uniformly transferred to the lower supporting layers
- A 30% loss in bonding can result in the loss of up to 70% of the expected pavement service life
- Poor layer bonding can result in three distress types:
  - Layer delamination
  - Slippage cracks
  - Fatigue cracking



- SS-1 is often used, but also SS-1h, CSS-1, CSS-1h, CRS-2, or even straight binder
- Clean the roadway before applying
- Coat all surfaces which will come into contact with the HMA
- Watch accidental pick-up
- Do not apply in cold or windy weather, or on wet surfaces with free standing water



**Full width of mat to  
minimize movement of  
unsupported edge**

Photo Courtesy of  
Jim Scherocman

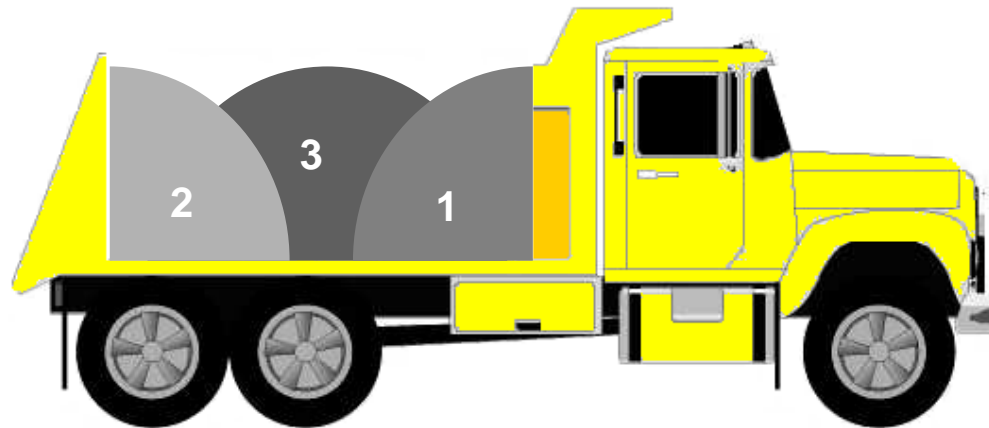
- **What is the Optimal Application Rate?**

- Surface Type
- Surface Condition

- **Recommended Ranges**

Surface Type	Residual Rate (gsy)	Appx. Bar Rate Undiluted* (gsy)	Appx. Bar Rate Diluted 1:1* (gsy)
New Asphalt	0.02 – 0.05	0.03 – 0.07	0.06 – 0.14
Existing Asphalt	0.04 – 0.07	0.06 – 0.11	0.12 – 0.22
Milled Surface	0.04 – 0.08	0.06 – 0.12	0.12 – 0.24
Portland Cement Concrete	0.03 – 0.05	0.05 – 0.08	0.10 – 0.16

\*Assume emulsion is 33% water and 67% asphalt.

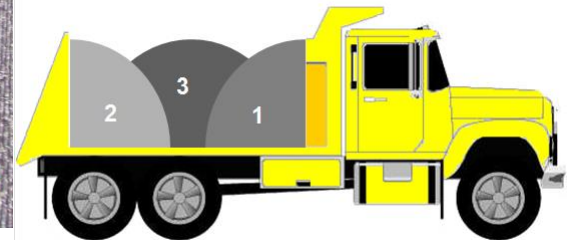


Make sure end dump trucks are loaded in this manner to help prevent segregation in the truck.



**Truck-end segregation is caused by segregation in the truck transferred through the paver.**

**Make sure the trucks are being loaded in**





## Wheeled Pavers

Easy to operate,  
inexpensive to  
maintain



## Tracked Pavers

Best for soft  
surfaces & when  
conditions require  
better traction



Break the load before opening the tailgate.  
Move the mix in a mass - no trickling!



Courtesy: Caterpillar Global Paving

- Trucking can affect mat quality
- Driver backed into paver
- Driver heavy on the brakes

## MTVs are intended to

- Help the paving train keep moving continuously
- Reduce potential for physical segregation
- Reduce potential for thermal segregation



## **One piece of equipment alone cannot eliminate segregation**

- Good loading practices
- Proper hauling, tarping, insulation
- Use proper release agents
- Proper unloading and dumpman operation
- Pay attention to temperature
- Have enough trucks for a continuous paving operation



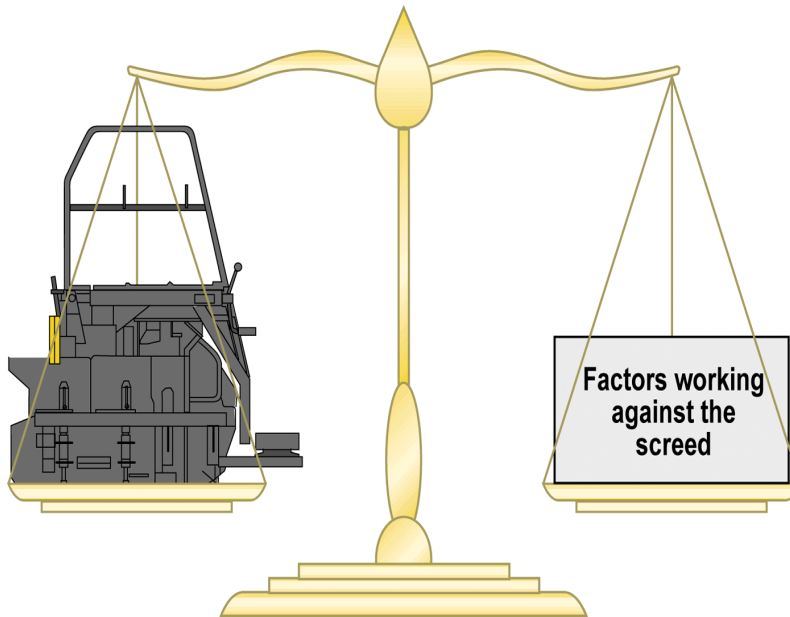
## Tractor Self-Leveling

- Screed is free to rise & fall
- Constant line of pull when set up properly
- Smooth surface over irregular grade



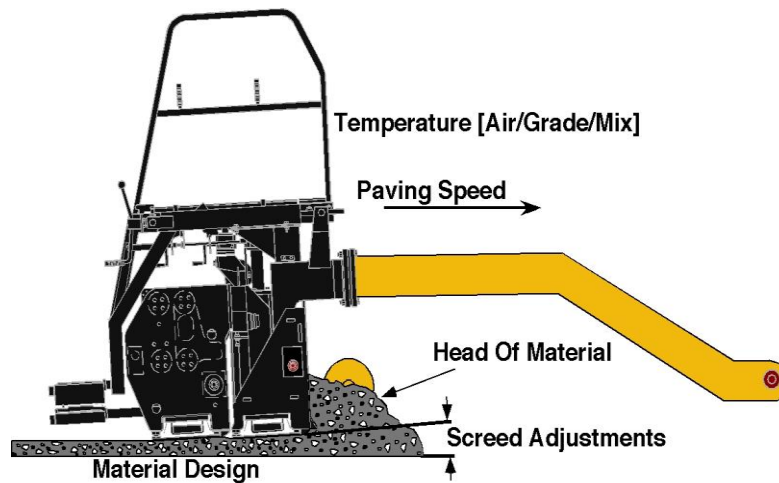
Keep the paver in good condition

- Scheduled inspection & maintenance
- Follow maintenance guidelines



## Free-Floating Screed

- Screed position determines mat thickness
- Screed position is constant as long as all factors remain constant



## Factors Affecting the Screed

- Paving speed
- Head of material
- Screed adjustments
- Mix design
- Mix temperature
- Air temperature
- Grade temperature



## Real World Paving

- Do not panic
- Stay with the plan
- Get rid of trucks in an orderly fashion
- Establish a uniform trucking pattern

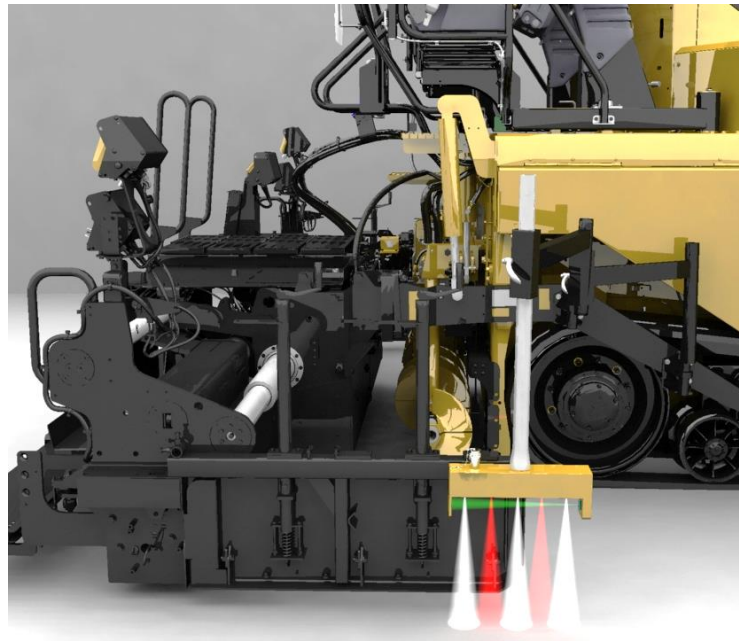


**Ski best for smoothness**  
**Averages optimum HMA thickness**  
**over entire length of ski.**

# Joint Matcher



**Joint Match**



# Importance of Compaction



# Importance of Compaction



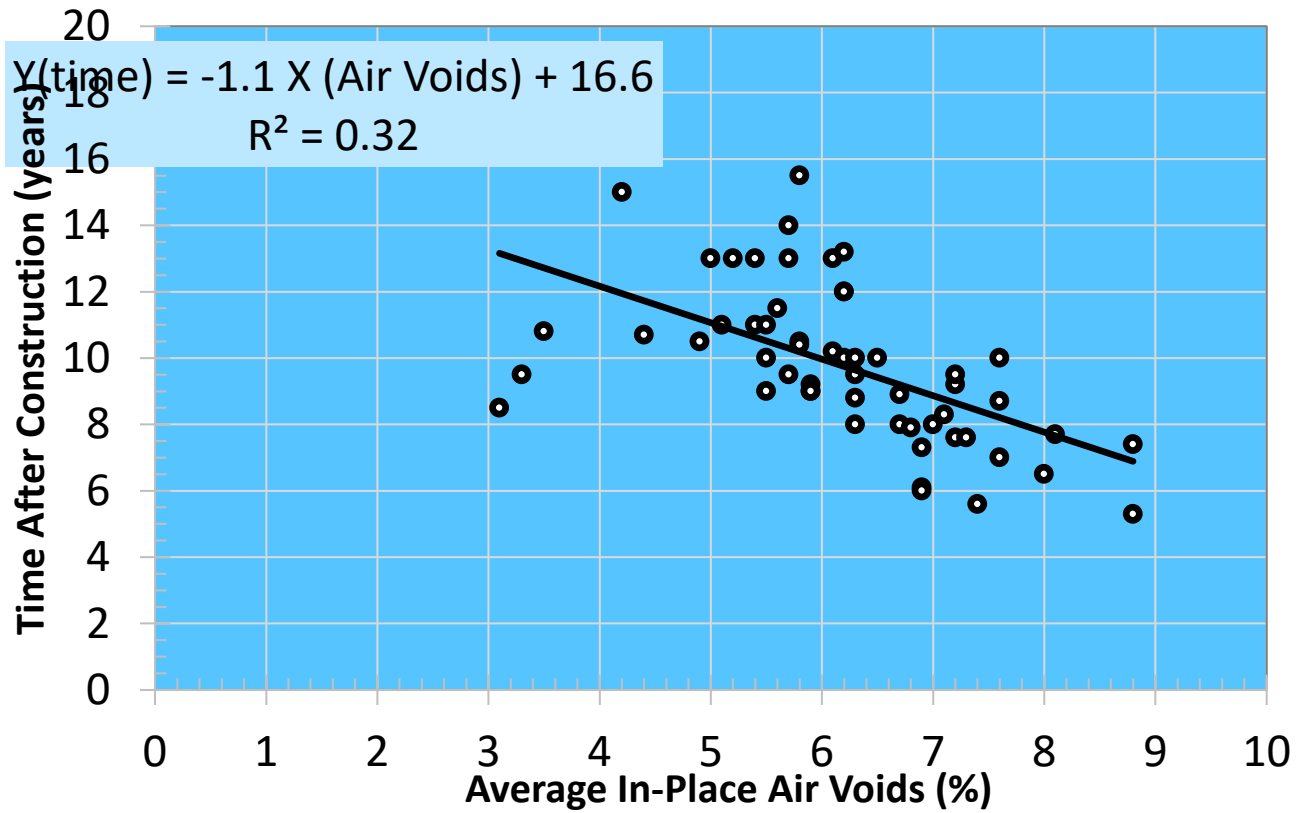
“Compaction is the single most important factor that affects pavement performance in terms of durability, fatigue life, resistance to deformation, strength and moisture damage.” – C. S. Hughes, NCHRP Synthesis 152, *Compaction of Asphalt Pavement*, (1989)



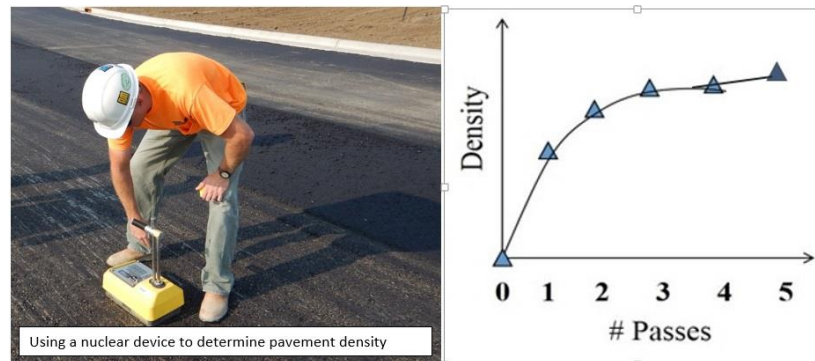
“The amount of air voids in an asphalt mixture is probably the single most important factor that affects performance throughout the life of an asphalt pavement. The voids are primarily controlled by asphalt content, compactive effort during construction, and additional compaction under traffic.” – E. R. Brown, NCAT Report No. 90-03, *Density of Asphalt Concrete—How Much is Needed?* (1990)

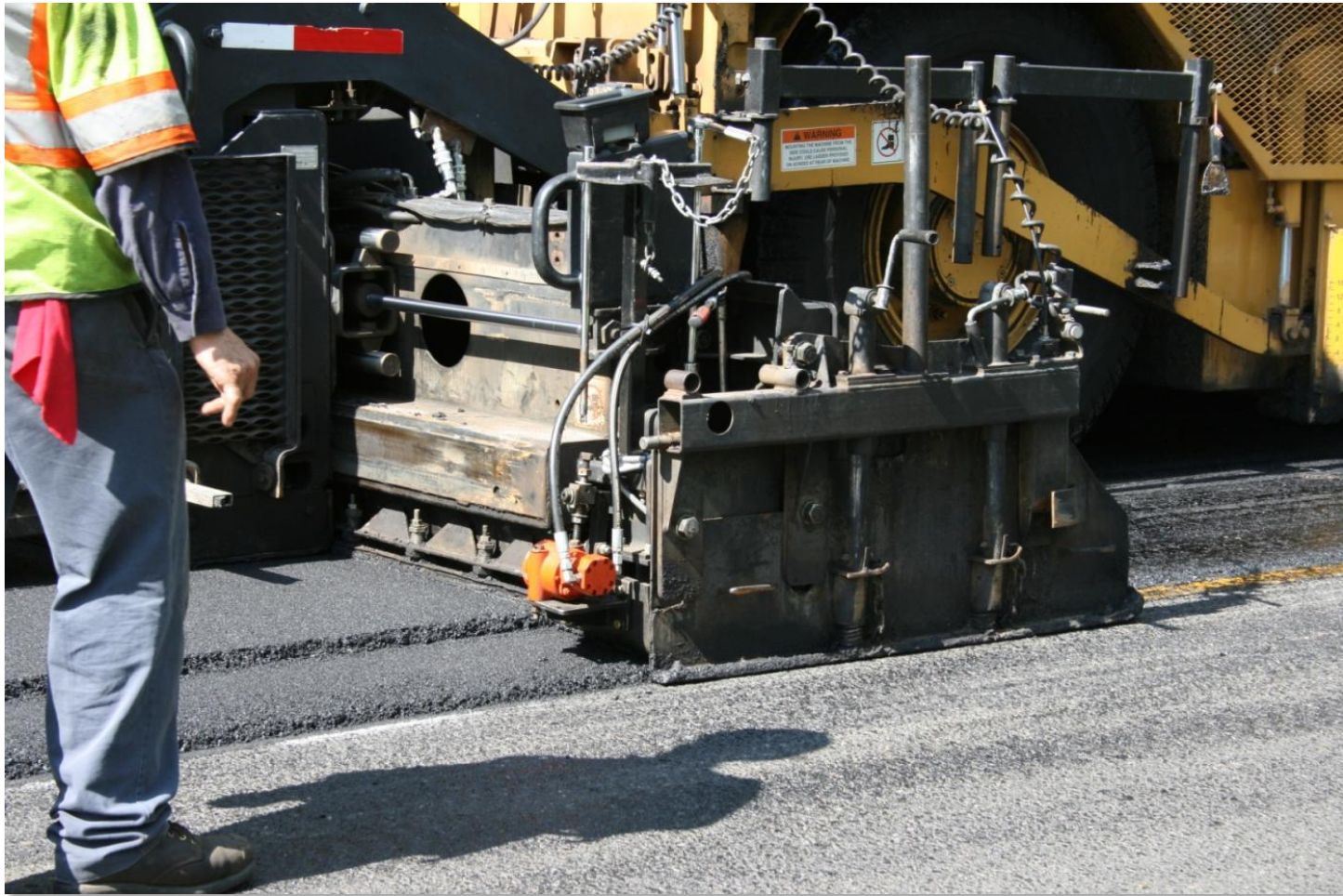
## Literature Review on connecting in-place density to performance

- 5 studies cited for fatigue life
- 7 studies cited for rutting
- “A **1% decrease in air voids** was estimated to improve the fatigue performance of asphalt pavements between 8.2 and 43.8%, to improve the rutting resistance by 7.3 to 66.3%, and to **extend the service life by conservatively 10%.**”

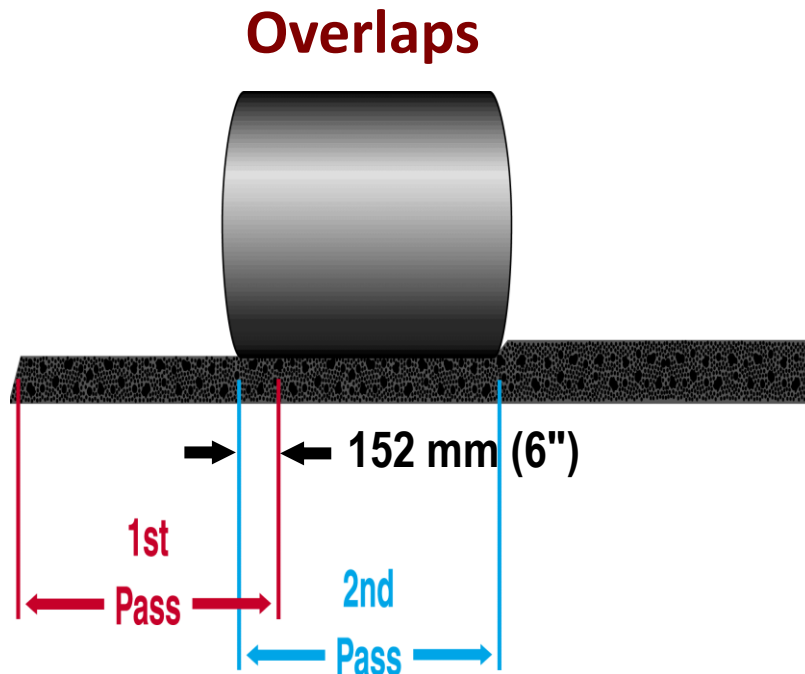


- It is important to construct a test section to determine roller requirements and details of compaction operation
  - Will change from one project to another
- Key takeaways from the test section:
  - Roller types to be used in each phase of compaction
  - Number of rollers to be used
  - Roller passes for each roller
  - Time available for compaction based on mat temperature

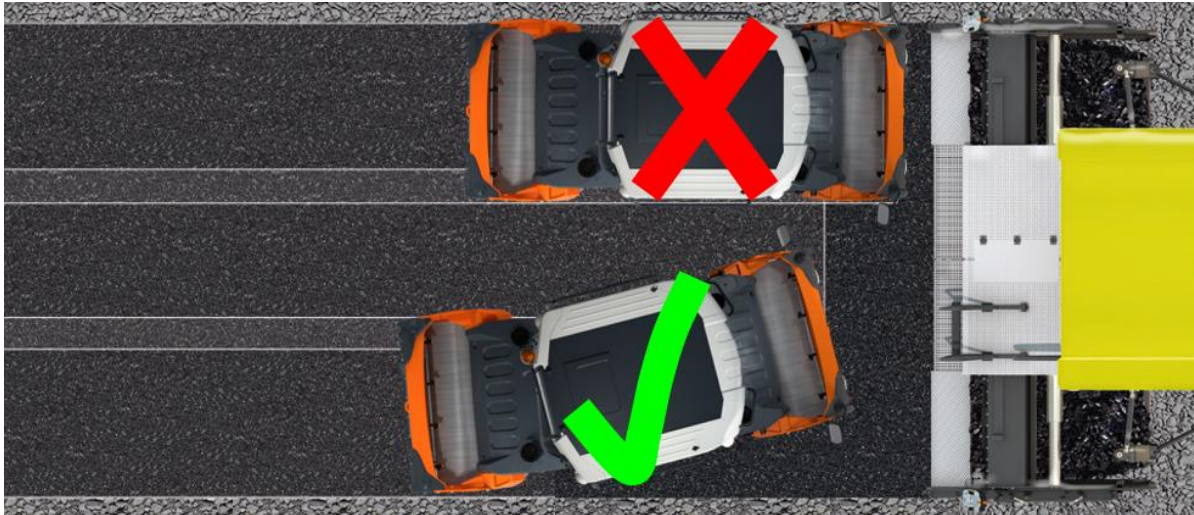




# General Rolling Procedures



- 6" overlap assures uniform compaction
- Include overlap selecting drum width
- Roller should cover mat in no more than 3 passes

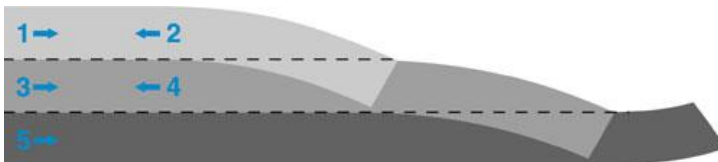


Always Stop/Reverse Direction on an Angle!  
Breakdown stay close to the paver



### Reversing Directions

- Avoid straight stops
- Turn toward center of mat
- Don't turn drum while stopped
- Next pass should roll out any marks created by reversing



**Reversing**



“Birdbath” from roller stopping on hot mat

# Longitudinal Joints

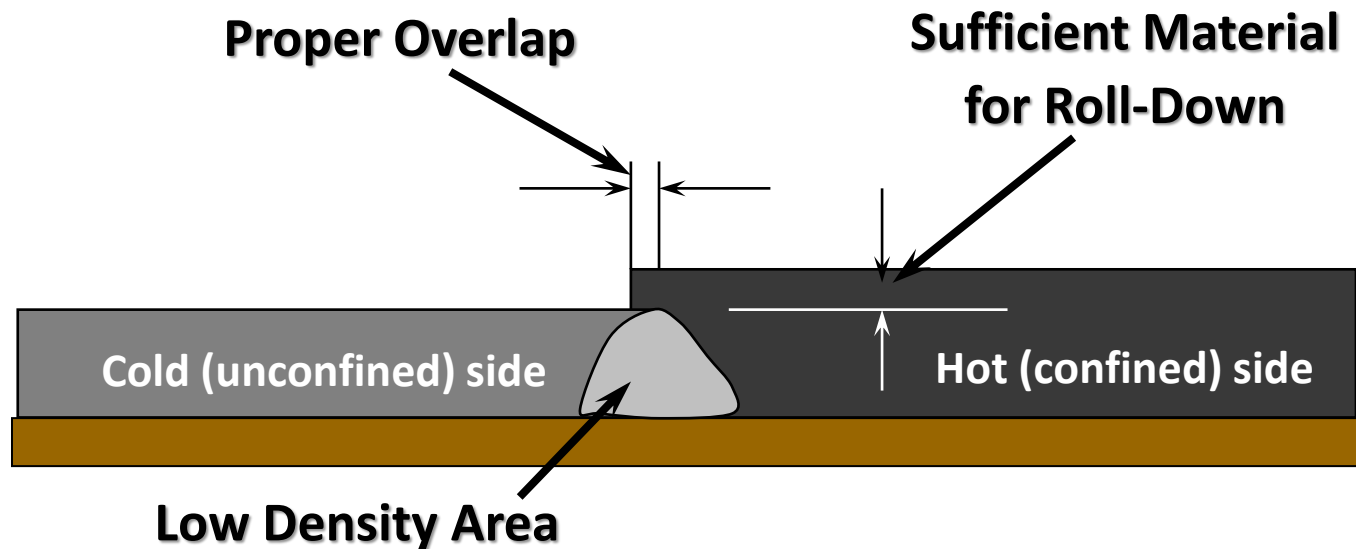


## The Best Longitudinal Joint: *Echelon Paving*



**But, the need to maintain traffic limits  
the opportunities to pave in echelon**

**Consequently, most longitudinal joints  
are built with a cold joint.**



Please note **Cold side** and **Hot side**, as they are terms used throughout this Workshop.

**string-line should be used to assure first pass is straight**



Stringline for reference, and/or Skip Paint, Guide for following

Notched Wedge



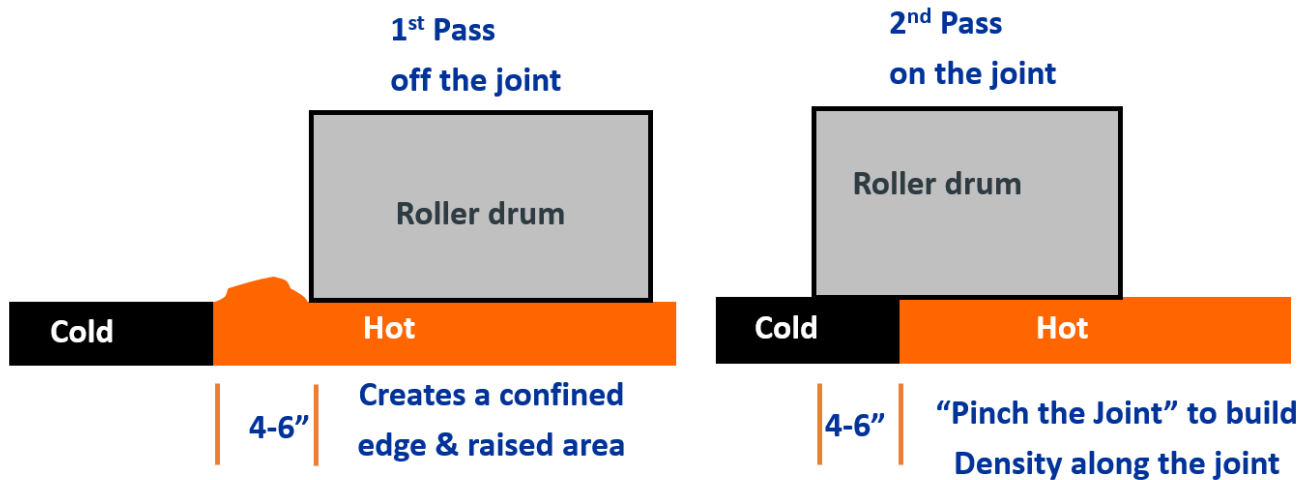
Butt



## Proper Overlap:

- $1.0 \pm 0.5$  inches
- Exception:  
Milled or sawed joint  
should be  
0.5 inches

## Confined Longitudinal Joints: AI recommendations



# Summary of “Good Practice”

- Properly prepare existing surfaces prior to placement of the new pavement
- Patches need to be structurally sound
- Uniform application of tack coat
- Load trucks and the paver properly
- Consistency consistency consistency - paver operations



# Summary of “Good Practice”

- Compact mat when it is hot!
- Conduct a density control strip at the beginning of the project
  - Determine optimum roller pattern
  - Stick with roller pattern throughout project unless something changes in the conditions
- Reverse directions properly
  - Turn into stops
  - Do not turn while standing
- Do not stop roller on hot mat
- Use proper technique when compacting longitudinal joints





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*In Loving Memory of  
Gregory M. Harder  
December 12, 2002  
December 21, 2022*

*#LLGH*

