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Colorado DOT's End Result Longitudinal Joint Specification

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Motivation




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We've seen the good, the bad, and the ugly through the process




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What We'll Look At


- Data from 2003, 2004 and 2005
- What's been successful
- Other available techniques
- Next Steps



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Specification

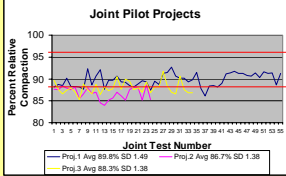
- Percent within limit specification
- Target 92% of theoretical maximum
- Range is +/- 4%
- Incentive and disincentive
- Weighting of joint element is 15%




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Summer 2001 and 2002 (Information Only)

Used on 20 projects
➤ Overall average was 89.5% relative compaction



Project	Average Relative Compaction (%)	Standard Deviation (SD)
Proj. 1	89.8%	1.49
Proj. 2	86.7%	1.38
Proj. 3	88.3%	1.38




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Summer 2003

Used on 30 projects & 43 processes

- 26 received a bonus
- 14 received a full bonus
- S(100) PG76-28
 - 2/5 processes received a bonus
- Overall average was 90.11% relative compaction (QL = 86.6)




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Summer 2004

Used on 34 projects & 46 processes

- 25 received a bonus
- 15 received a full bonus
- S(100) PG76-28
 - 2/6 processes received a bonus
 - 1 Contractor was 0/4 in receiving a bonus
 - 1 Contractor received a FULL bonus!




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Summer 2004

Average was 90.11% relative compaction (QL = 85.8)

- S(100) PG 76-28 89.3%
- All other mixes 90.2%
- All modified mixes 89.7%
- All non-modified mixes 90.8%




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Summer 2005

Used on 16 projects & 20 processes

- 16 received a bonus
- 14 received a full bonus
- S(100) PG76-28
 - 3/5 processes received a bonus
- Average was 90.68% relative compaction (QL = 93.5)



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What We'll Look At

- Data from 2003, 2004 and 2005
- What's been successful
- Other available techniques
- Next Steps



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What's Been Successful

- Paving in echelon



Most obvious




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What's Been Successful

- Paving in echelon
- Changing the rolling pattern


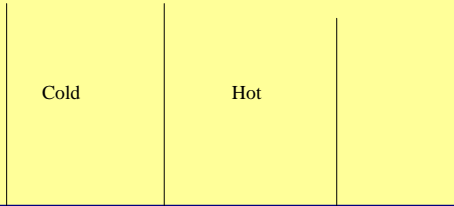
Most common



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Changing Roller Pattern


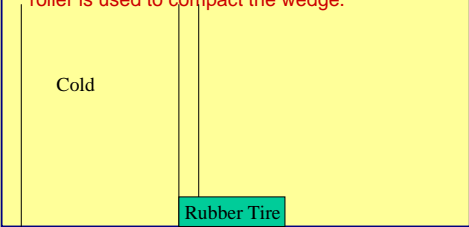
- The "Cold" side is the first paver pull.
- The "Hot" side is the second paver pull.



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Changing Roller Pattern

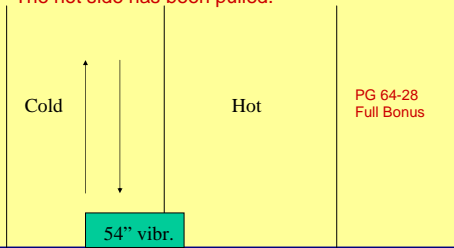
- While just the cold side is down, a pneumatic roller is used to compact the wedge.



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Changing Roller Pattern

- The hot side has been pulled.



PG 64-28 Full Bonus

80% overlap on cold side.




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What's Been Successful


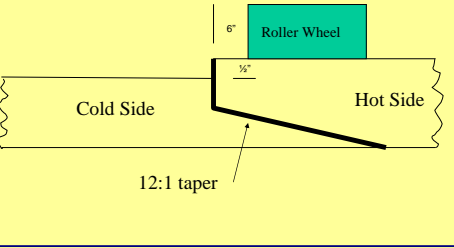
- Paving in echelon
- Changing the rolling pattern
- Building a notched wedge joint

Most necessary



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Building a Notched Wedge Joint



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Building a Notched Wedge Joint



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Building a Notched Wedge Joint




string




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Building a Notched Wedge Joint



S(100)(76-28)
PF increased
from 0.71
up to 1.04




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What's Been Successful



- Paving in echelon
- Changing the rolling pattern
- Building a notched wedge joint
- Adding a shoe and a rubber tire

Most creative





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Adding a Shoe and Rubber Tire




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Adding a Shoe and Rubber Tire



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Adding a Shoe and Rubber Tire



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Adding a Shoe and Rubber Tire



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What's Been Successful

- Paving in echelon
- Changing the rolling pattern
- Building a notched wedge joint
- Adding a shoe and a rubber tire
- Using a Hamm compactor

Most innovative

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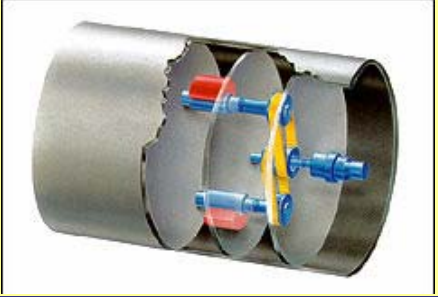
Using a Hamm Compactor



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Using a Hamm Compactor



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What's Been Successful



- Paving in echelon
- Changing the rolling pattern
- Building a notched wedge joint
- Adding a shoe and a rubber tire
- Using a Hamm compactor
- Cutting the joint

Most effective

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Cutting the Joint

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Cutting the Joint

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What's Been Successful

- Paving in echelon
- Changing the rolling pattern
- Building a notched wedge joint
- Adding a shoe and a rubber tire
- Using a Hamm compactor
- Cutting the joint
- Enforcing the specification


Most important!!



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First Week of Paving


<u>Date</u>	<u>% Relative Compaction</u>	
5-26-04	85.6	All five cores are out of specification
	82.0	
5-27-04	83.9	
	86.8	
	87.2	



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Second Week of Paving

<u>Date</u>	<u>% Relative Compaction</u>	
6-1-04	86.7	All seven cores are out of specification
	84.6	
	83.6	
	85.8	
6-2-04	82.6	
	84.6	
	83.0	





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Starting to Look Up ...

<u>Date</u>	<u>% Relative Compaction</u>	
6-6-04	85.6	CDOT stated that the specification will be enforced.
	86.5	
6-10-04	88.9	
	89.3	

By Thursday, the cores are in!

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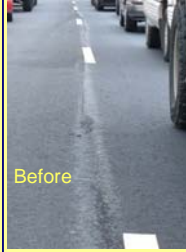

And for the Finish ...

Date	% Relative Compaction		
6-15-04	89.8	86.9	
and	90.1	89.5	Paving finished with the final twenty cores all in specification
beyond	90.2	88.9	
	90.9	89.5	
	91.5	88.8	
	93.3	89.2	
	91.3	90.1	
	89.9		

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The difference can be seen

S(100) PG76-28 at night

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Infrared Heater Mounted to the Paver



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Roller Attached to Paver



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Restrained-Edge Device



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Joint Maker

Figure 23. Joint Maker system.

Figure 24. Joint Maker mounted to paver (highlighted in red box).

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Crafco Sealant

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What else can a Contractor do?

A mix design that considers joint construction

- Low asphalt content
- HMA temperature when it arrives on the job?
- HMA temperature when the rollers get on it?

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Lessons Learned

- Tolerance for core location (+/- 1")
- Timeframe for QC testing (a maximum of weekly)
- Guidance on echelon paving (separate process)
- Applicability to lifts (Yes)
- Interruption of specification (As directed by the Engineer a new random location shall be selected)

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Thank You!

Questions?