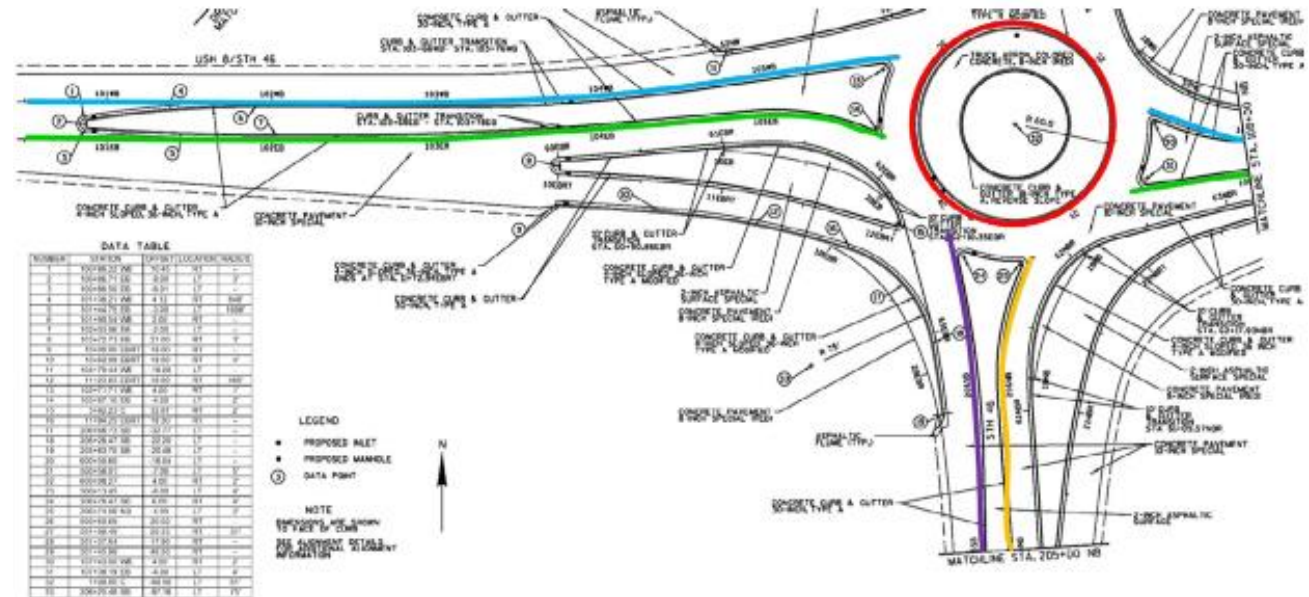


# Paving Roundabouts – Clockwise or Counter-clockwise?

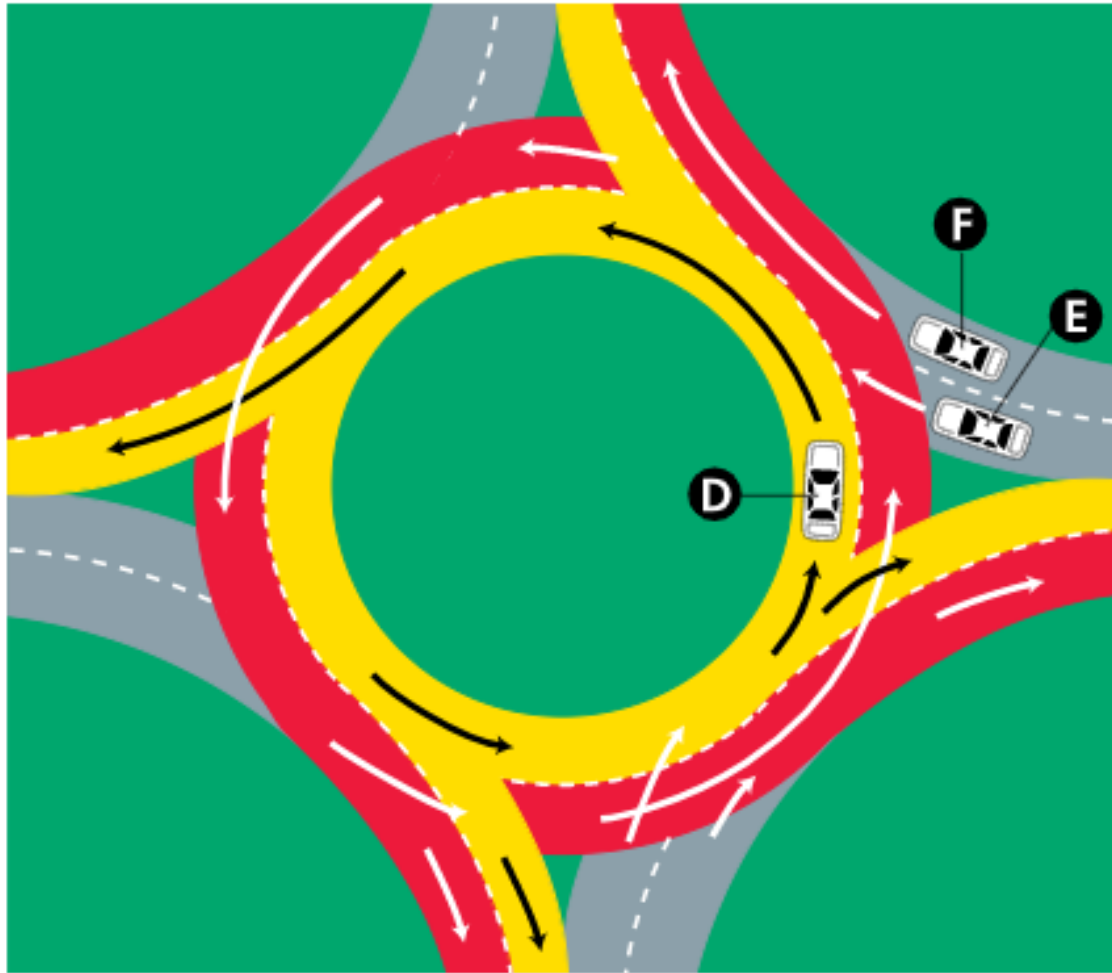


# Why Roundabouts?



- **Safety**
- **Environment**
- **Improved traffic flow**
- **[ODOT website link on Roundabouts](#)**

# How to use a Roundabout



Vehicle E must yield to vehicle D, while vehicles F and D may proceed together.



1. **Get in the lane you want before you enter**
2. **Yield to any pedestrian in a crosswalk**
3. **Yield to all traffic in the roundabout**
4. **Select a gap and enter**



# Outline



- **Traffic control plan**
- **Paving sequence**
- **Feeding mix to the paver**
- **Paving operation**
- **Compaction operation**



# Traffic Control - Planning



- **Maintain traffic flow**
  - Staged construction
- **New construction**
  - Closed to traffic?
- **Single lane or multiple lanes?**
- **Hot joints?**
- **Trucking plan/routes in and out**



# Traffic Control - Planning

- Detour or keep traffic moving?
- Sub-contract traffic control?
- Hire local law enforcement on-site
- Opportunity to “train” drivers to new configuration with proper signage & lane markings



# Single Lane Roundabouts - Planning



- **Pave through in direction of highest traffic flow**







# Roundabout – What's Different?

- **Traffic flow – safety - line of sight is limited**
  - Shutdowns or detours
- **High wear**
  - Turning traffic
  - Traffic with acceleration, start and stop
- **Difficult to perform paving**
  - Many joints
  - Truck access in/out
- **High proportion of “problem areas” in the pavement area**
  - Rutting the base course on radii (trucks, paver, MTV, other)
  - Grades & drainage

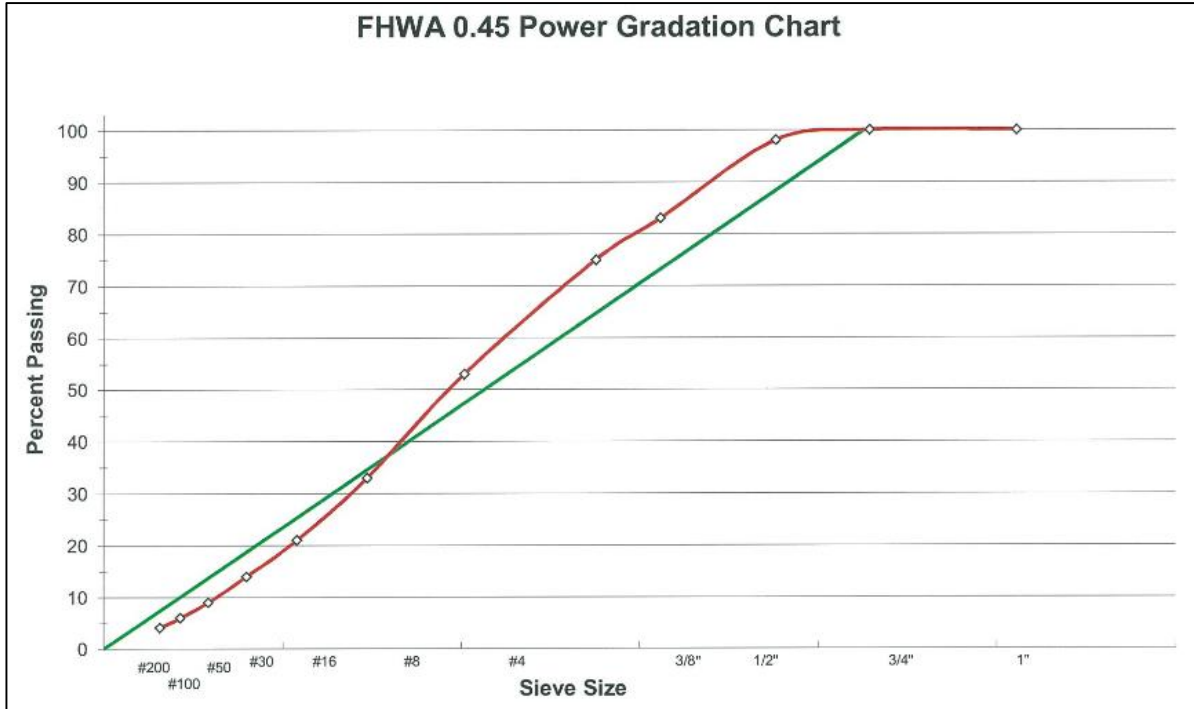
# Roundabouts – Basic Thoughts...



- How goes the traffic flow?
- How do we avoid problem areas?
- Paving with little or no traffic?
- Pave at night?
- Are base repairs needed?
- Is base graded properly?
- Mix type?
- Material transfer vehicle?
- Compaction & roller types



# Material Selection & Design

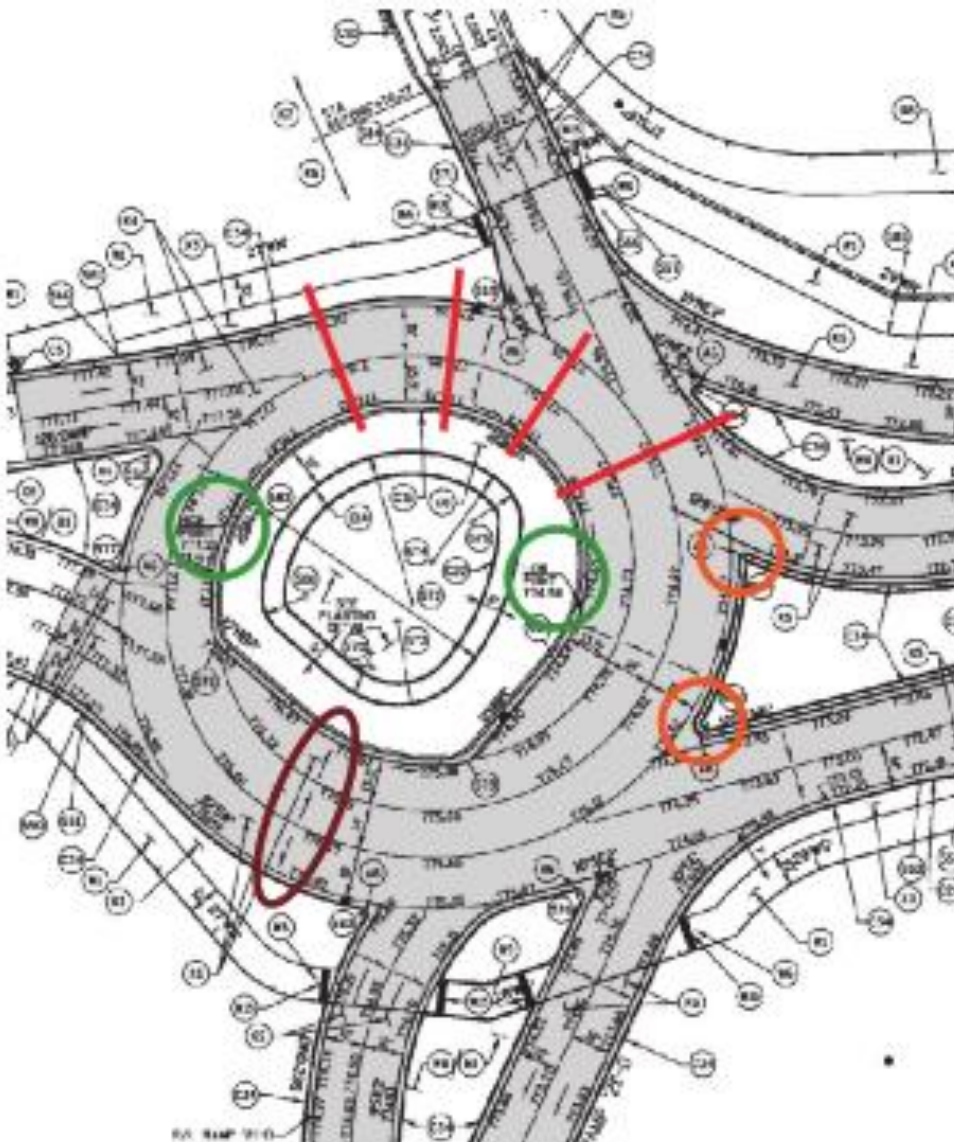


- Asphalt mix type?
  - Shoving, rutting?
- Stable mix with high crush count
- Most Superpave mixes meet this criterion when well-compacted in the field

Aggregate Gradations									
Sieve Size		Brigham 3/4" R	Brigham 1/2"	Pt E Squeegie	Brigham MF	McGuire Plant mix	Rap	Target W/ Rap	Target W/O Rap
19mm	3/4"	100.0	100.0	100.0	100.0	100.0	100.0	100	100
12.5mm	1/2"	30.8	100.0	100.0	100.0	99.3	100.0	89	86
9.5mm	3/8"	5.0	75.8	99.2	100.0	94.6	96.1	75	70
6.3mm	1/4"	2.9	18.7	87.0	97.1	79.9	83.4	57	53
4.75mm	#4	2.6	5.2	68.1	87.9	72.1	74.3	49	46
2.36mm	#8	2.2	2.9	15.4	58.3	58.4	56.3	28	24
1.18mm	#16	1.9	2.5	4.3	40.9	44.2	44.6	20	14
300µm	#50	1.4	1.9	1.4	21.3	20.7	24.4	11	8
75µm	#200	0.8	1.2	0.6	10.2	10.0	8.1	5.3	3.3
% of Agg. Blend		18	21	17	16	13	15	w/lime	w/o lime

1 % Lime will be added in a slurry form.

# Grading & Drainage Details



- Critical to get this right **BEFORE** paving
  - Earthwork (new)
  - Milling (existing rehab)
- **Costly and time-consuming to fix later**
- More complex with multiple entrance/exit points



# Hot Joints



- Paving in echelon
- Joints are more homogenous when done properly – density, smoothness (joint match) and appearance
- May only be possible if closed to traffic

# Planning – Paving Sequence



- **Traffic control**
  - Requirement to keep traffic moving or not
- **Pavement markings/signage**
  - **Training opportunity!**
- **Paving grade details**
- **Joints (lane line) details**



# Trucking Plan – Sequencing in/out



- **Smaller trucks**
- **Material transfer vehicle**
  - Allows easier steering of paver (no truck to push)
  - Less risk of tearing up base

# Problems we encounter...

**Joint match / density**

– **Smooth transition**





# Problems we encounter...

## Drainage / grades

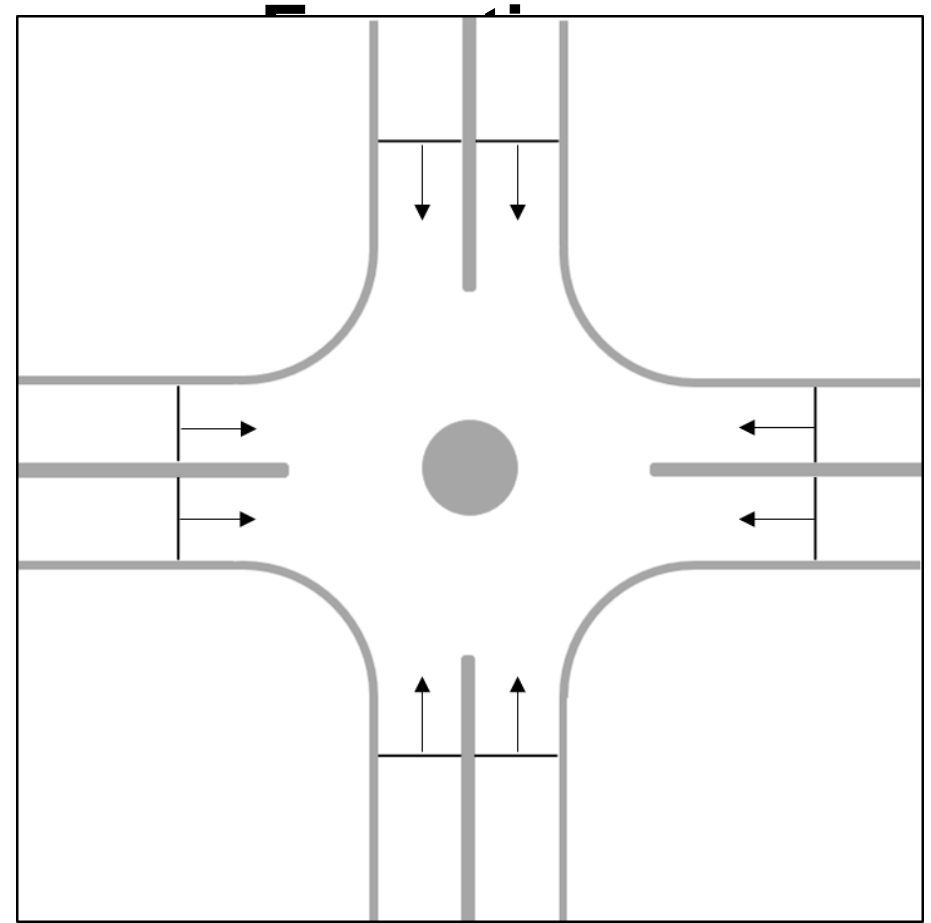


# One Successful Approach...

- Mill the whole surface (existing)
- Repairs in some areas if necessary
- Paving (no manual paving) “inserts” and “tie-ins”
- Mill “inserts” and “tie-ins”
- Paving (no manual paving) of mainline areas
- Seal all the joints “*cheap insurance*” ?

# Mill & Repair (if needed)

- **Mill the whole surface (existing)**
- **Repairs in some areas if necessary**
- Paving (no hand/manual paving) “inserts” and “tie-ins”
- Mill “inserts” and “tie-ins”
- Paving (no hand/manual paving) of main area
- Seal all the joints



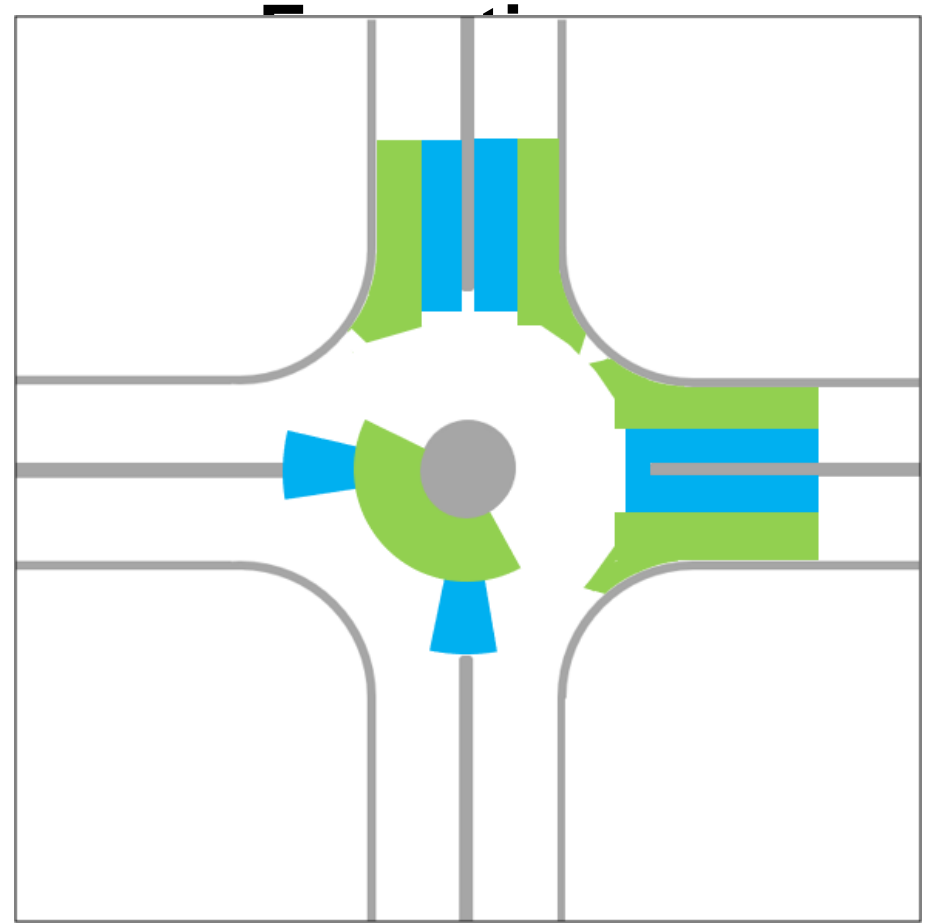


# Milling the Surface



# Pave “inserts” and “tie-ins”

- Mill the whole surface (existing)
- Repairs in some areas if necessary
- Paving (no hand/manual paving) “inserts” and “tie-ins”
- Mill “inserts” and “tie-ins”
- Paving (no hand/manual paving) of main area
- Seal all the joints





# Pave “inserts” and “tie-ins”





# Paving “inserts” & “tie-ins”

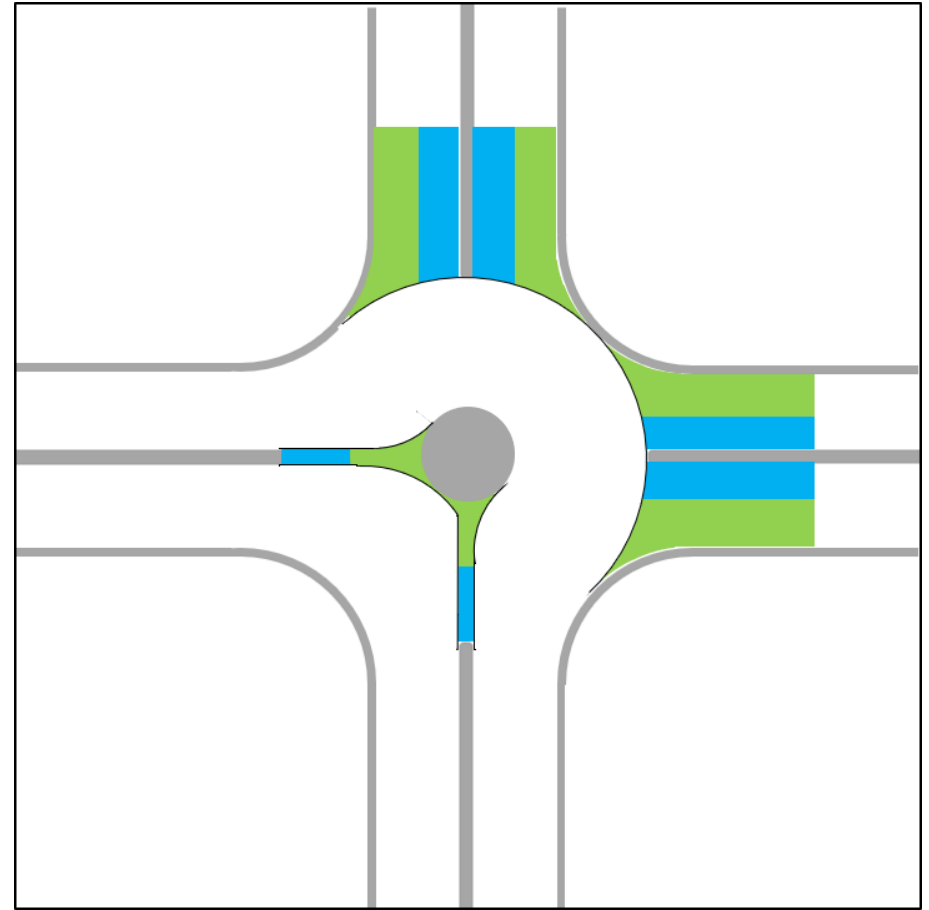


# Paving “inserts” & “tie-ins”



# Mill “inserts” and “tie-ins” for good joint

- Mill the whole surface (existing)
- Repairs in some areas if necessary
- Paving (no hand/manual paving)  
“inserts” and “tie-ins”
- Mill “inserts” and “tie-ins”
- Paving (no hand/manual paving) of  
main area
- Seal all the joints



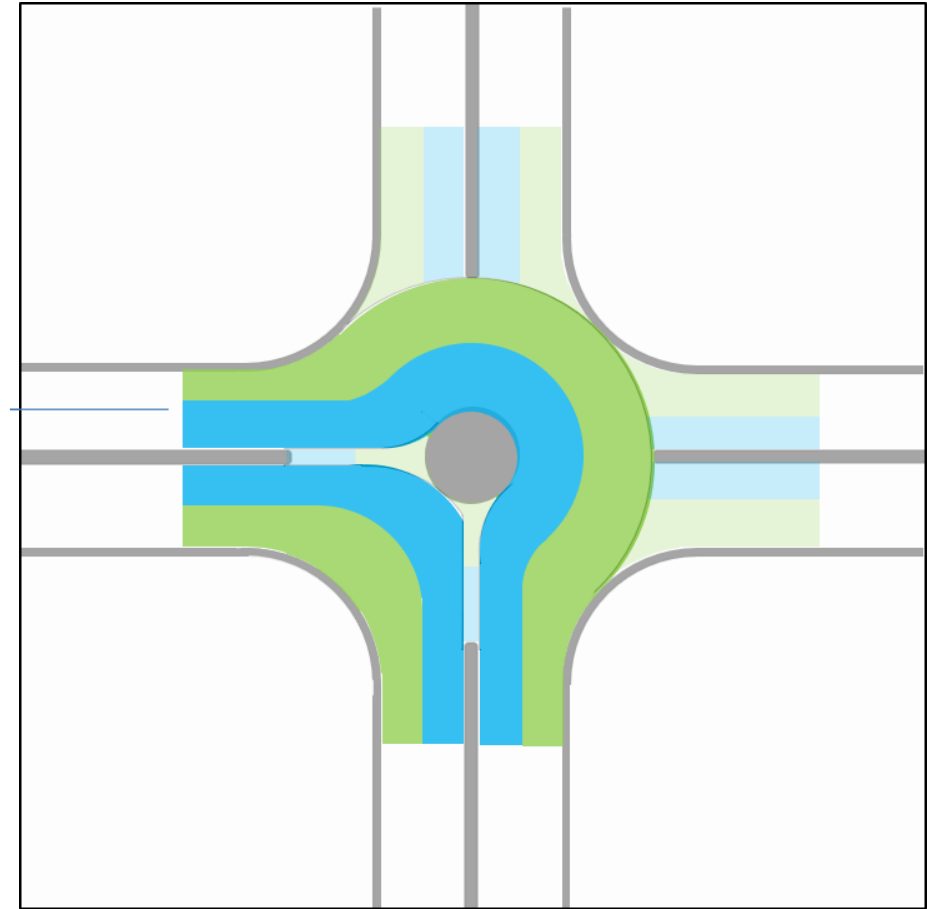


# Mill “inserts” and “tie-ins” for good joint



# Pave “Mainline” – Echelon if possible

- Mill the whole surface (existing)
- Repairs in some areas if necessary
- Paving (no hand/manual paving) “inserts” and “tie-ins”
- Mill “inserts” and “tie-ins”
- Paving (no hand/manual paving) of main area (echelon paving)
- Seal all the joints



# Paving Mainline – Echelon – Hot Joint



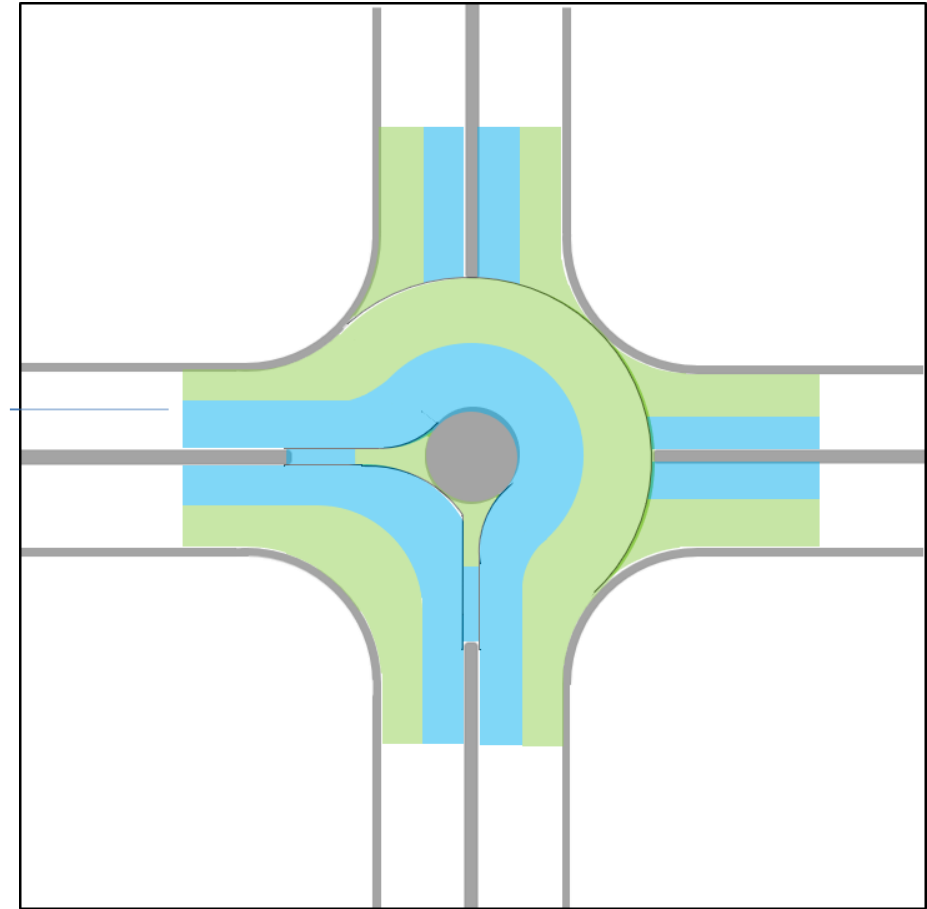


# Paving Mainline – Echelon – Hot Joint



# Seal Joints - optional

- Mill the whole surface (existing)
- Repairs in some areas if necessary
- Paving (no hand/manual paving) “inserts” and “tie-ins”
- Mill “inserts” and “tie-ins”
- Paving (no hand/manual paving) of main area
- Seal all the joints





# Sealing Joints - optional



- Some use joint sealant
- Typical emulsion used locally SS1-H
  - Same as used on saw-cut or milled joints





# **One Customer's Experience...profitability**

**Paving method versus conventional way:**

- Method is 10-15% higher cost compared to “conventional”**
- Increased life by 1 year; Higher cost in total**
- Increased life by 2 year; 0-10% Saving**
- Increased life by 4 year; 30-40% Saving**
- Increased life by 6 year; 60-70% Saving**

# Roundabout – this can happen ☹️



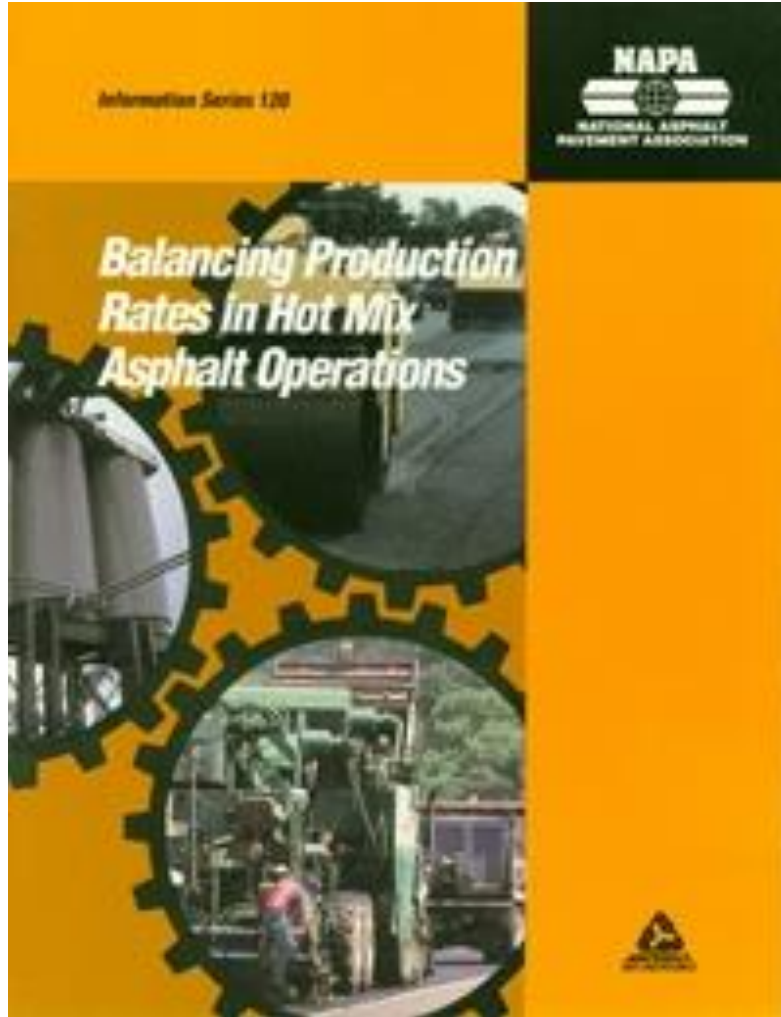
# Roundabout – this is what we want 😊

- This is what we want to achieve





# Why does this approach work?



- No manually-paved or hand-worked areas
  - Used automatic grade & slope control
- No cold mainline joints
- **Carefully planned**
- **Details controlled in the field**



# Why is this a good approach for Owner?

- The wearing course will determine when it's time to re-pave
- Attention to base conditions & grading = more durable pavement
- Break-even at 1.5 years increased life (based on added cost to the contractor)





# Paver Setup Considerations...



- **Maintaining grade with screed thru radii**
  - Outside edge moves faster
  - Feed system must feed outside faster than inside
  - Augers on/off - segregation
- **Good joint matching**
- **Tearing up the base**



# Paver Setup – Solutions



- Use automatic grade & slope control (2D)
- Setup feed system properly
- Use screed lock on radii (base must be perfect)
- Use “*friction steer*” option
- Consider smooth track paver
- 3D grade control?

# Sensor Position to Maintain Grade/Slope



- Sensor at auger for joint matching
- Follows existing reference – curb? stringline?
- Precise yield
- Fast reaction
- Tow point movement = 4x measured deviation, or 4:1



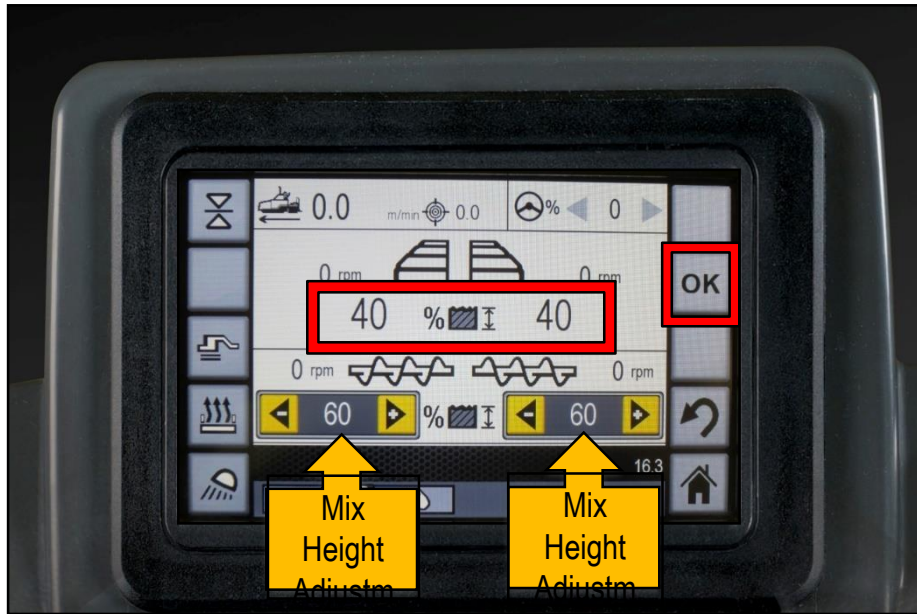


# Joint Matching – fast reaction of screed

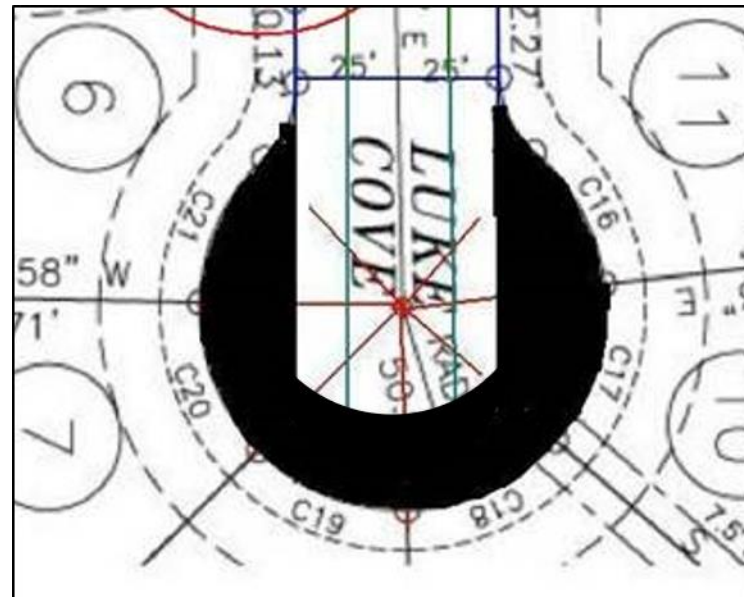
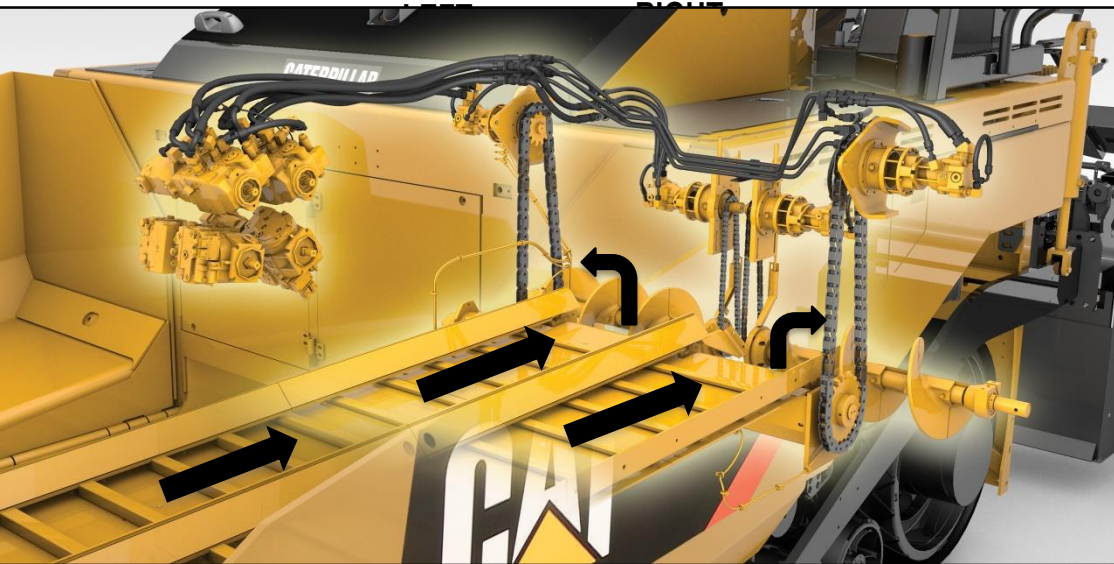




# Paver - Feed System



- Setup to feed more on one side
- Maintain 20 – 40 rpm auger speed
- Auger & tunnel extensions
- Slightly heavier head of material may be required



# Paver – Screed Lock / Hold



- Feature on many modern asphalt pavers
- Locks or holds the screed in position
- “last resort” generally if haven’t don the other things ‘right’
- Older pavers used “cylinder lock”



# Paver – Steering Guidance



- Friction steer maintains a constant turning radius - eliminating 'human error'
- Some systems guided by string
- Follow curb (if it's perfect)
- Smooth track paver on base?





# Compaction Considerations...



## Problems

- Roller checking - turns
- Pushing & shoving

## Equipment

- Narrower drum rollers
- Split drum rollers
- Combi roller?
- Articulated pneumatic
- Large pneumatic probably difficult

## Rolling pattern

# Bends, Tight Radius Compaction



- Paving lane is 12' wide
- 66" drum width breakdown roller
- Operator followed radius in continuous pass



# Bends, Tight Radius Compaction

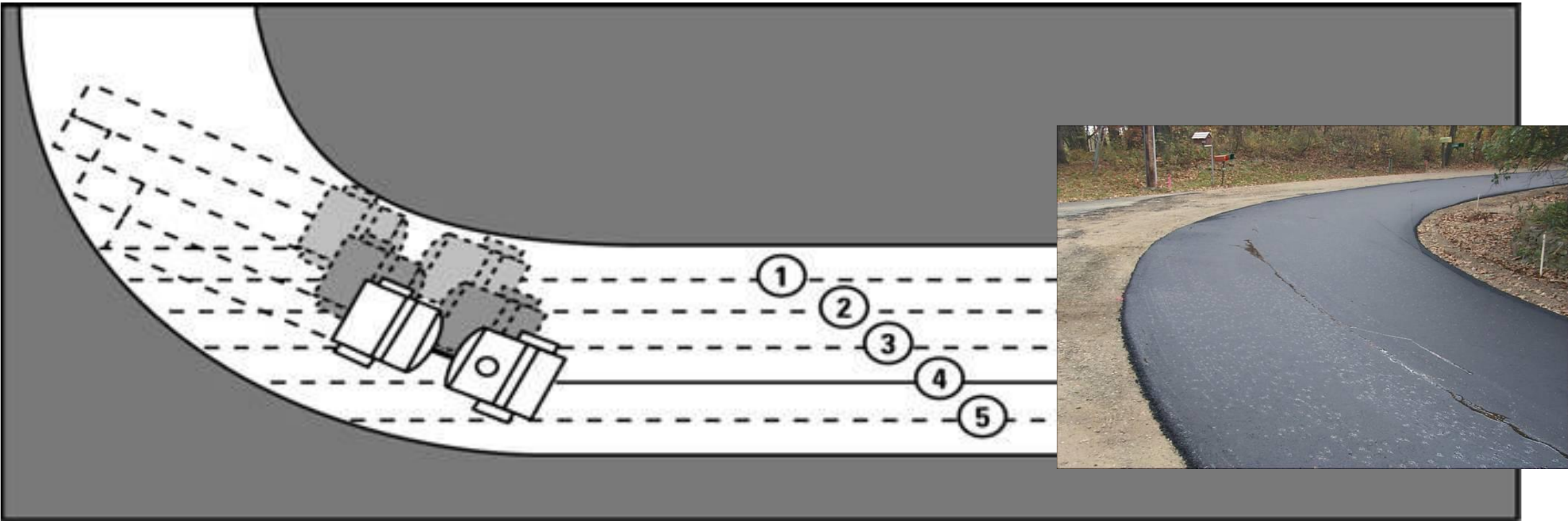


- Outside edge of drum is shoving hot mix
- Mat distorted and cracked



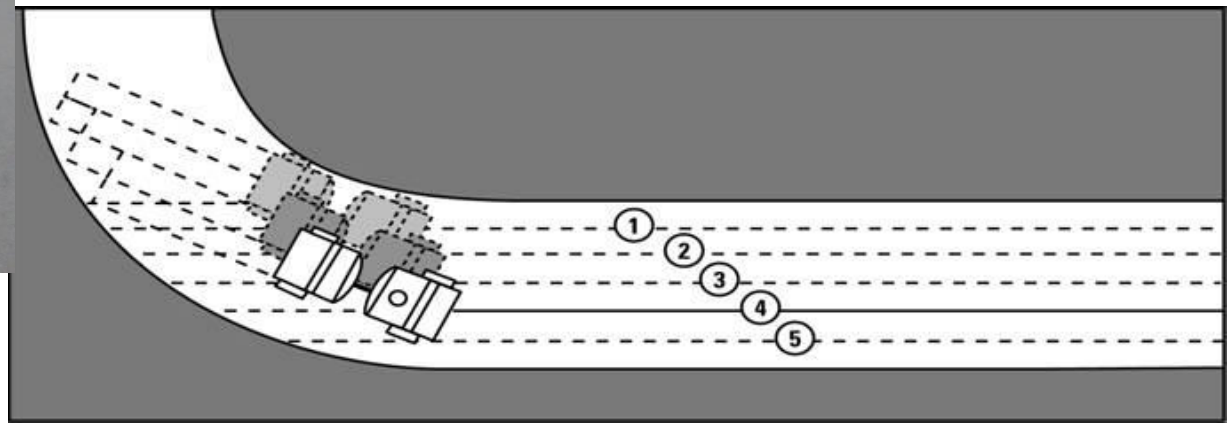
# Bends, Tight Radius Compaction

- Pattern takes more passes but leaves smooth tight mat



# Bends, Tight Radius Compaction

- Roller operator trained to roll straight into radius





# Roller types that could help...



Split-drum roller



Combination roller

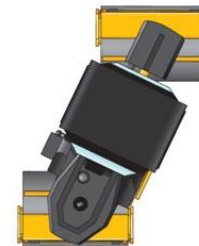


Offset drum roller

Articulated pneumatic roller



Drum steer roller





# Rolling around tie-in areas



- Do not roll onto hot mainline
- Severe roughness
- Another reason to pave tie-ins first, then mill the edge to get a solid joint

# QUESTIONS?

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