Early Loading to Deploy Overlay Joints: Does It Work?

Principal Investigator: Mike Wallace, MnDOT

Co- Principal Investigator: Tom Burnham, MnDOT

CPAM Annual Workshop

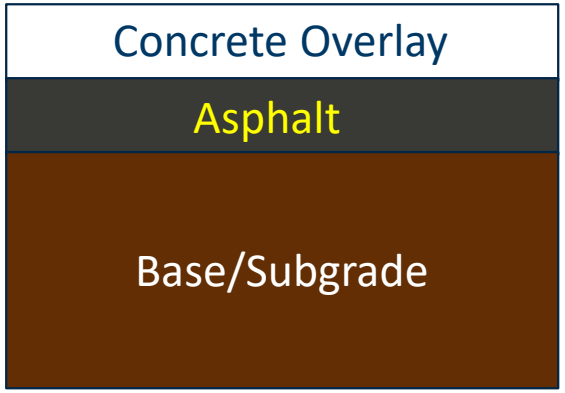
3/12/2026

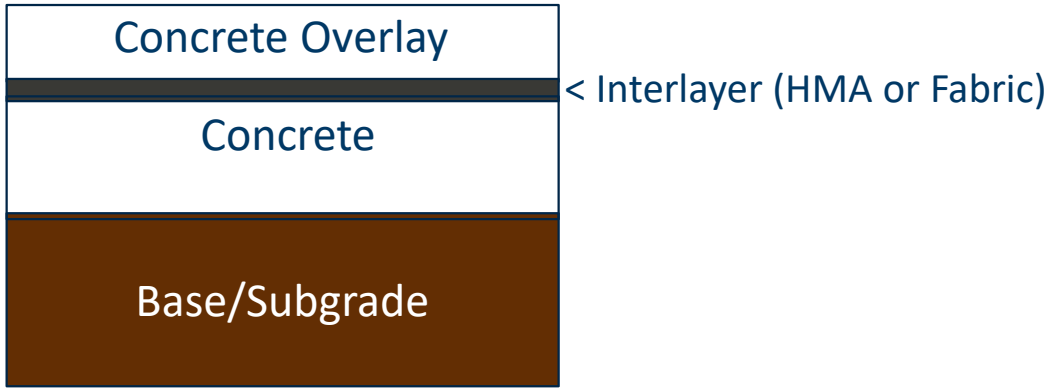
Outline

- **Background**
- **Case Histories**
- **MnROAD Test Sections**
- **Discussion**

Concrete Overlays

- **Concrete Overlay on Asphalt (COA)**
- **Concrete Overlay on Concrete (COC)**



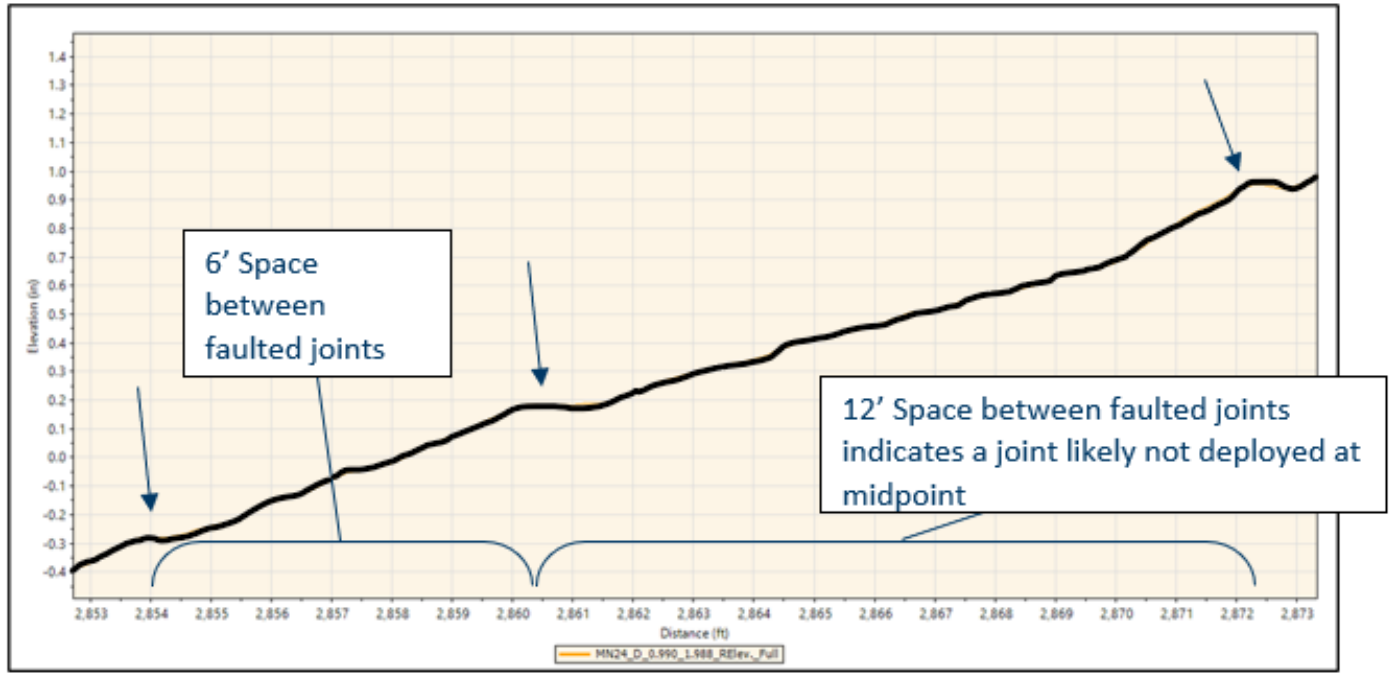


Benefit of Deployed Joints

- **COAs designed for small panels to reduce warp and curl**
- **More joints = smaller openings after shrinkage = increased aggregate interlock**
- **Minimize transverse cracks in panels**
- **Better long-term performance**

Non-Uniform Joint Deployment in COAs

- **Higher and inconsistent levels of faulting**
- **Increased potential for buckled panels**
- **Bumps from sealant in dominant joints**



Thin Concrete Overlays on Asphalt

- **Cause for joints not to deploy:**
  - **Surface of underlying asphalt layer is typically removed using diamond grinding**
  - **Diamond grinding leaves a rough surface that the concrete bonds extremely well to**
  - **Due to restrained shrinkage of the concrete by the underlying asphalt, many joints are prevented from deploying**

Joint Deployment through Early Loading

- **Recent research has shown that concrete pavements can be loaded without damage much earlier than in the past**
- **Apply heavier loads earlier to encourage joint deployment**
  - **Must be careful not to damage pavement**

Early Loading Criteria

- **Timing of load application**
  - **Mitigate pavement damage**
  - **Minimum time after saw cutting?**
- **Loading configuration**
  - **Vehicle weight**
  - **Vehicle speed**
  - **Number of passes**
  - **Axle spacing and configuration**
- **Site conditions affect rate of slab shrinkage**
  - **Windy weather**
  - **Extreme changes in temperature**

Research Study

Document deployment of loaded and unloaded joints

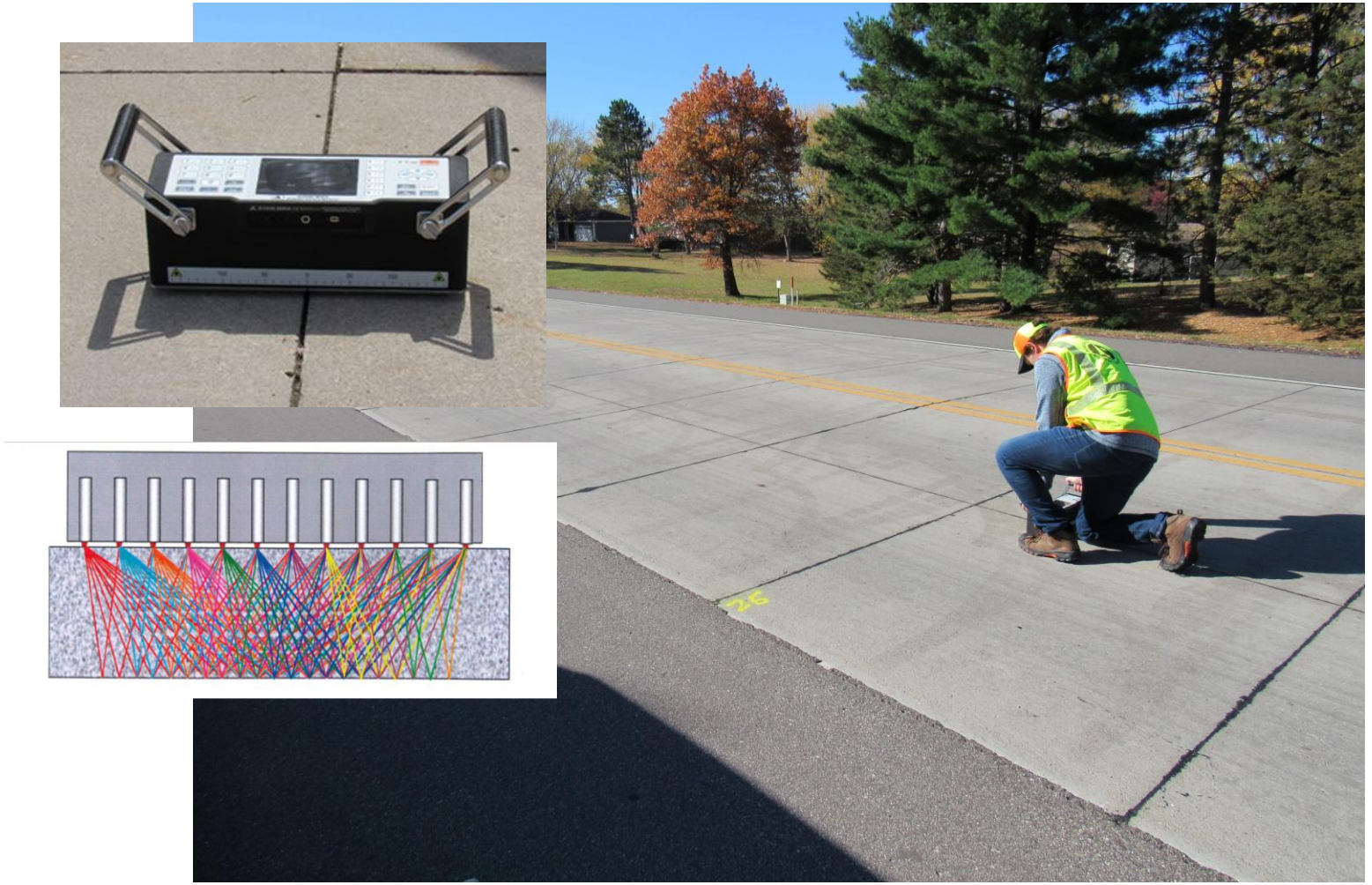
- **Shortly after early loading**
- **Periodically to determine rate of deployment**

- **CSAH 1 (Fillmore County, MN)**
- **CSAH 21 (Fillmore County, MN)**
- **TH 63 (Zumbro Falls, MN)**
- **CSAH 15 (McLeod County, MN)**

Methods

Visual surveys

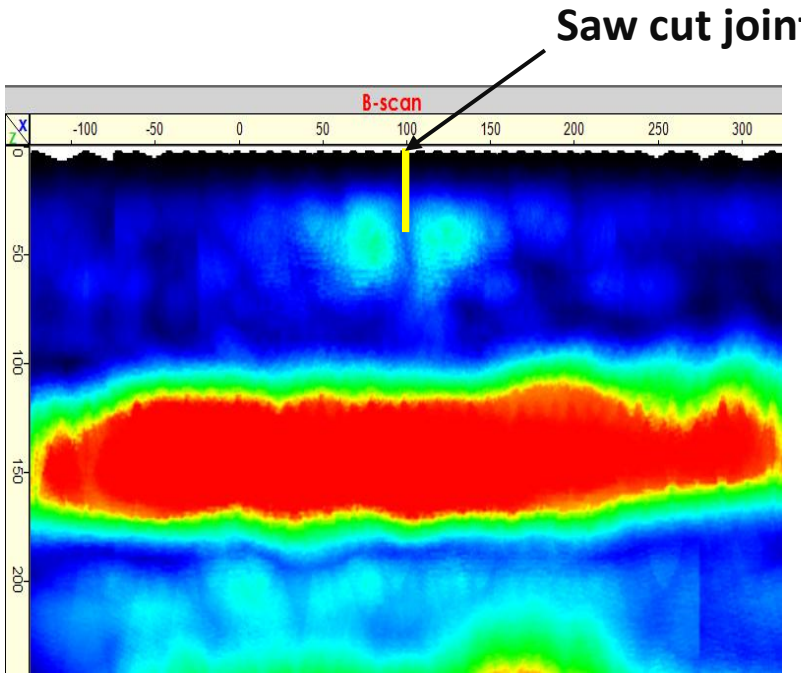
Methods



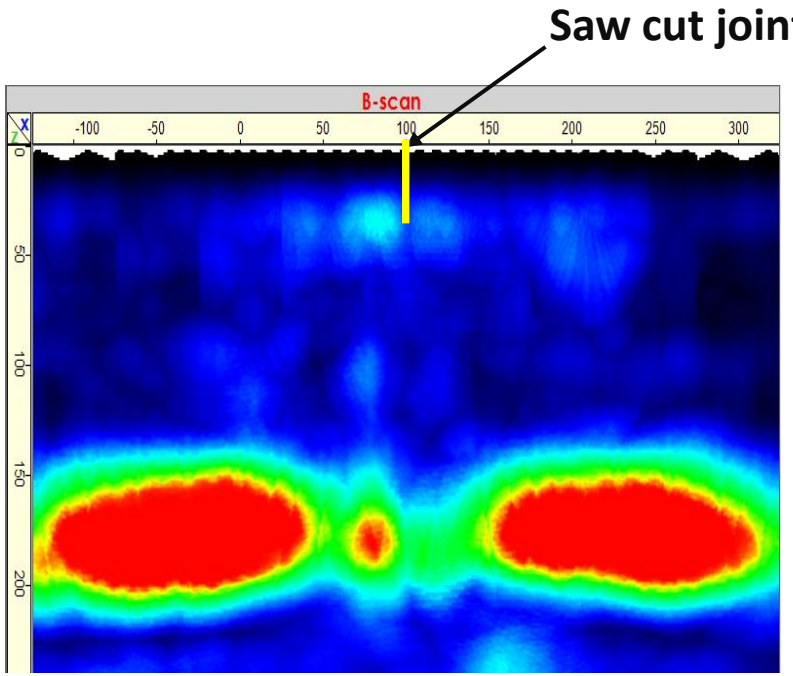
Ultrasonic tomography (MIRA device)

Ultrasonic Tomography

Profile views



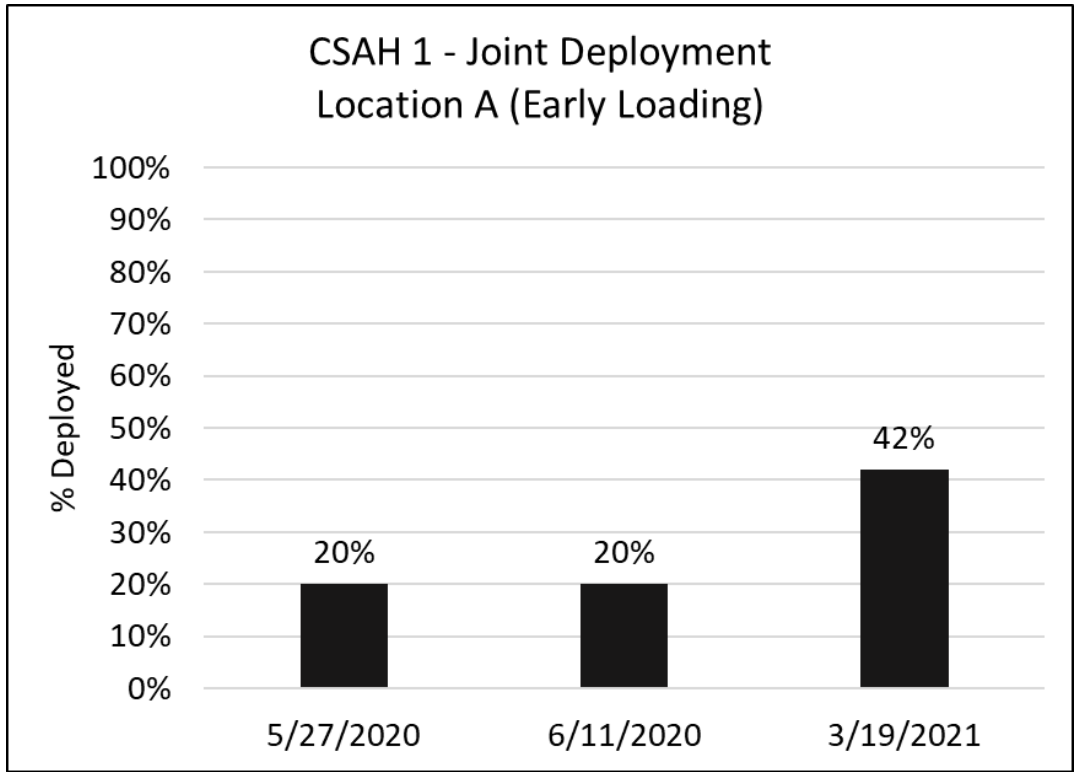
Joint not deployed



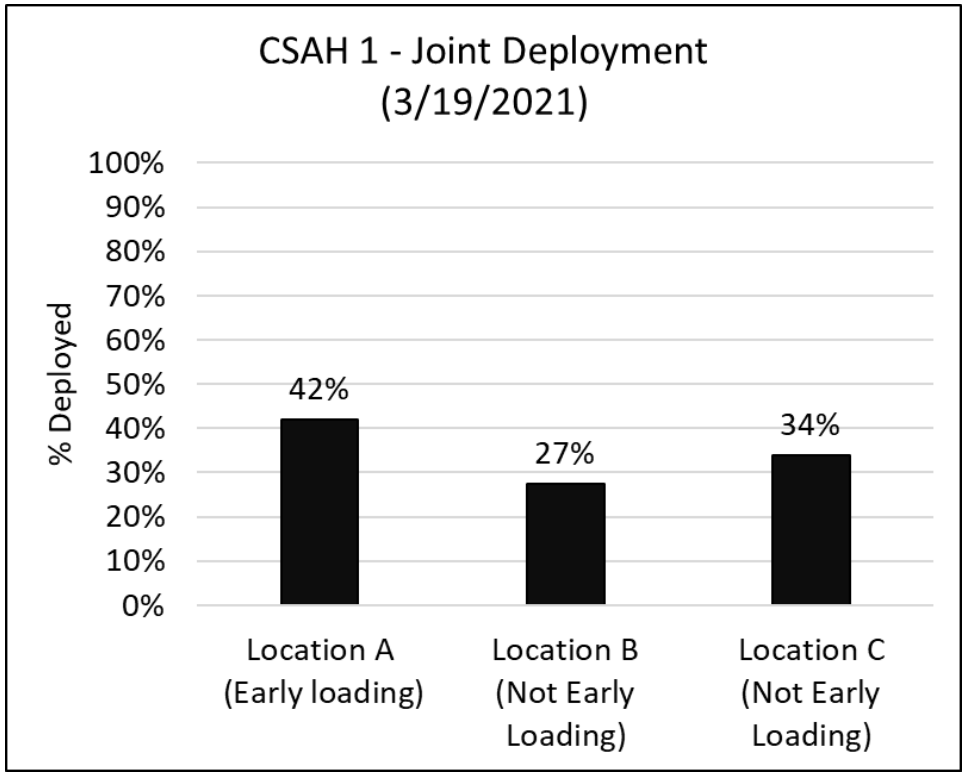
Joint deployed

Case Study Results

CSAH 1 – Fillmore County: 5” concrete on 6.5-7” remaining asphalt, loaded 19-25 hours after paving (Paving date: 5/26/2020)



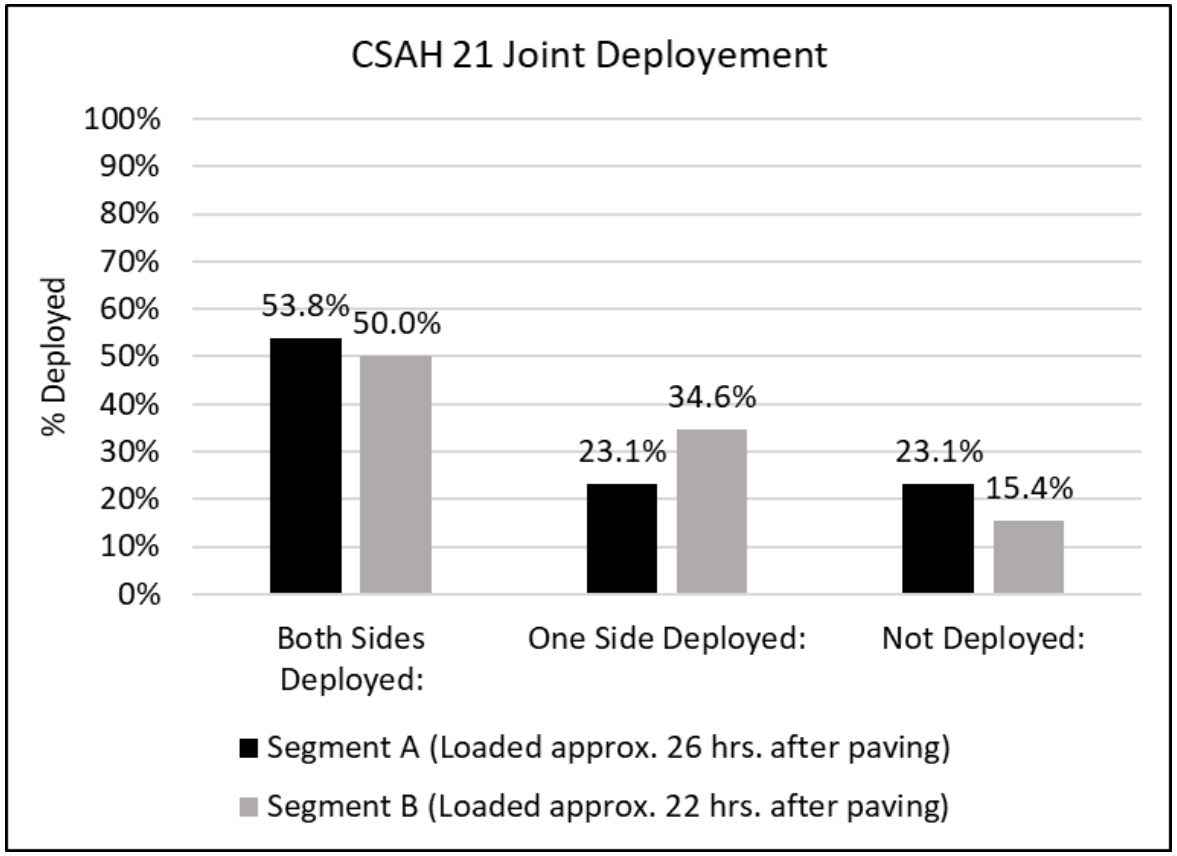
Day 2 Day 16 9 months



After 9 months

Case Study Results

CSAH 21 – Fillmore County: 5” concrete on variable thickness asphalt layer, three segments loaded @ 13, 22, and 26 hours after paving



Day 6

Case Study Results

MnDOT District 6, TH 63: 5” concrete on 8-11” remaining asphalt, two segments loaded 24 and 17 hours after paving

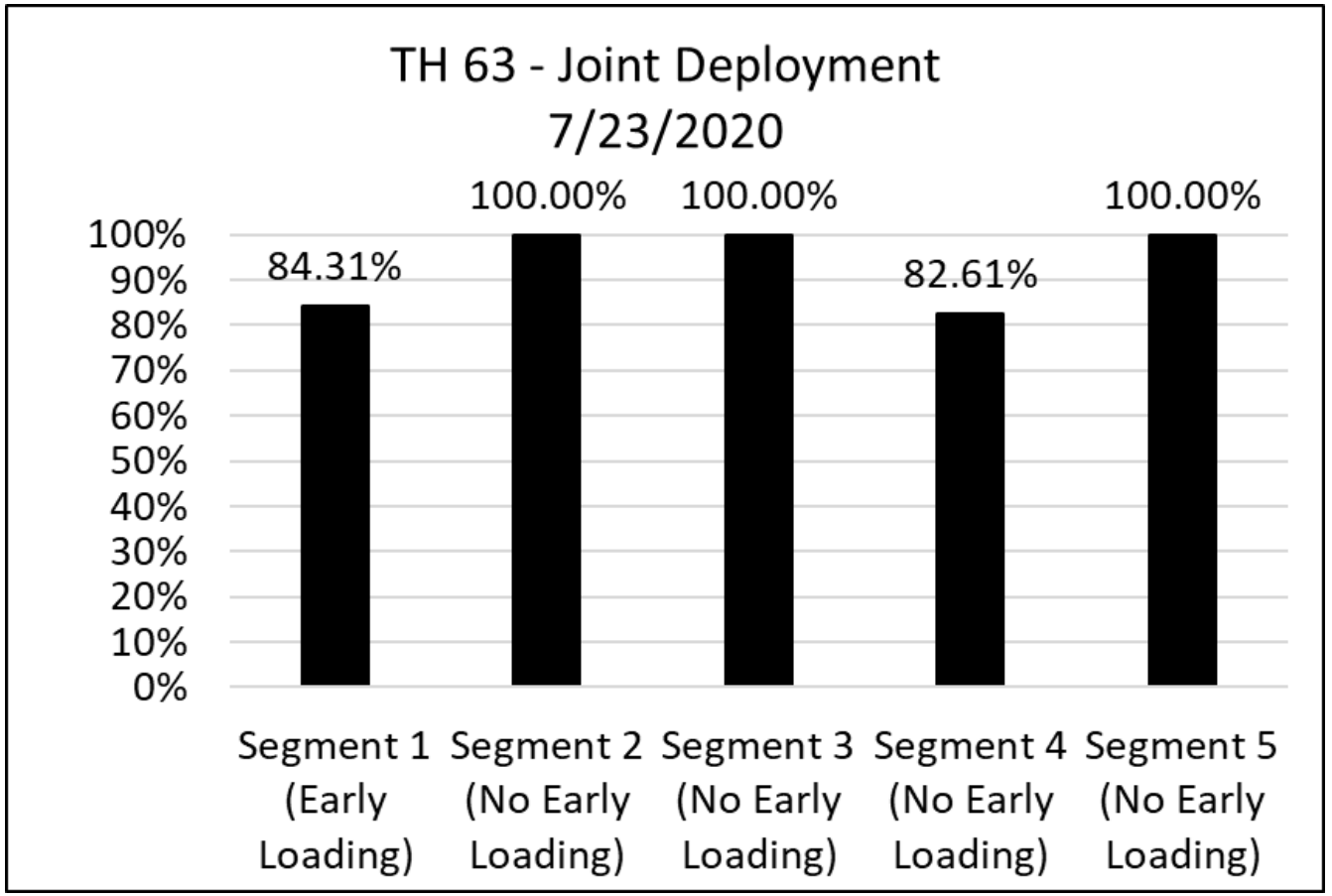
Segment	
1	Standard mix, 6’x6’ panels
2	Standard mix, 12’Lx6’W panels
3	Standard mix, 12’Lx6’W panels
4	FRC mix 1, 6’x6’ panels
5	FRC mix 2, 6’x6’ panels

- First round of early loading 24 hours after paving resulted in 4% deployed joints (checked shortly after loading)
- Second round of early loading 17 hours after paving resulted in 10% deployed joints (checked shortly after loading)

Crack near undeployed joint (aligning with major reflective crack)

Case Study Results

MnDOT District 6, TH 63: 5” concrete on 8-11” remaining asphalt

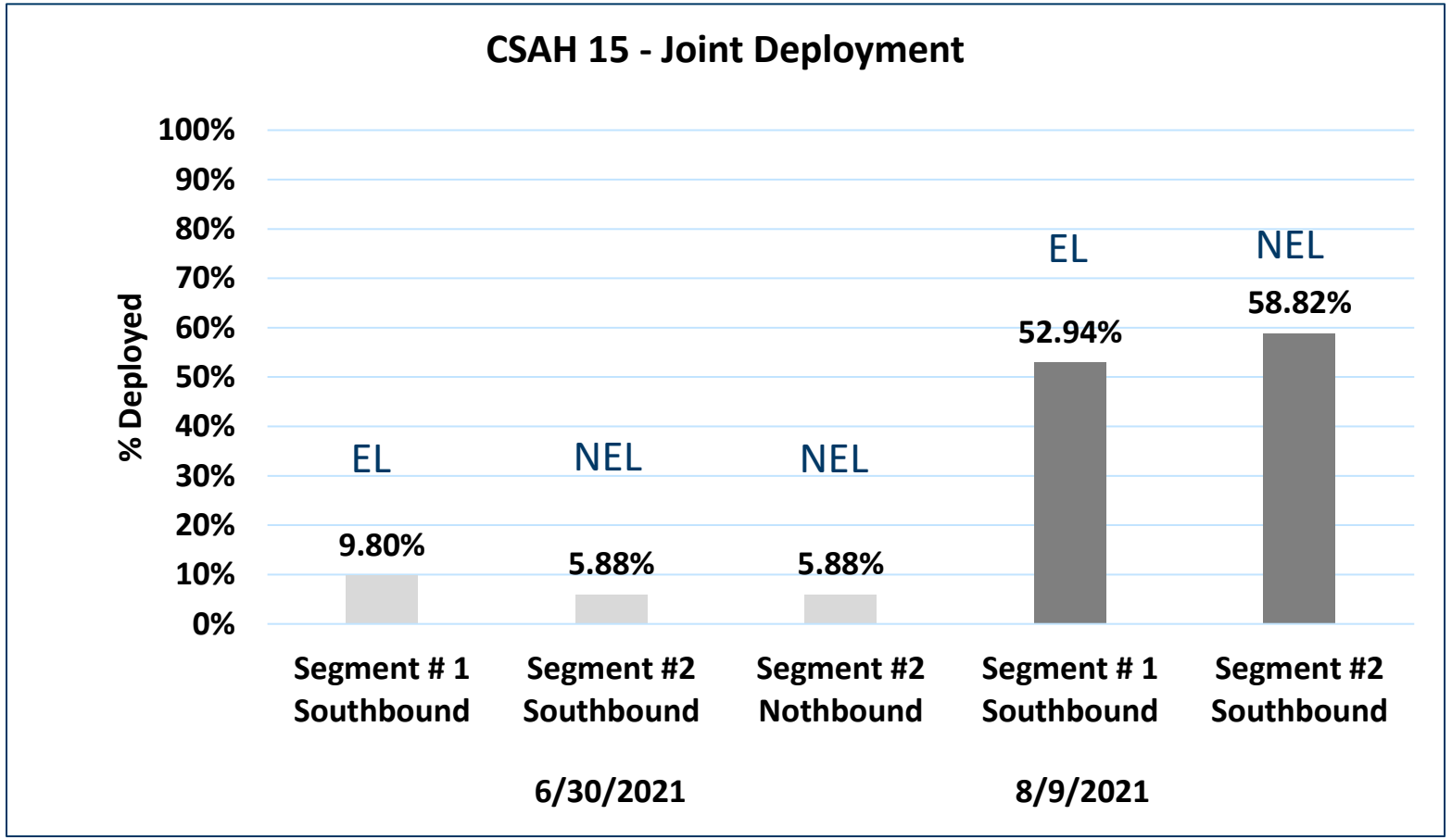


Segment	
1	Standard mix, 6’x6’ panels
2	Standard mix, 12’Lx6’W panels
3	Standard mix, 12’Lx6’W panels
4	FRC mix 1, 6’x6’ panels
5	FRC mix 2, 6’x6’ panels

Two years after paving

Case Study Results

CSAH 15 – McLeod County: 6” concrete on variable thickness asphalt layer, loaded 24 hours after paving

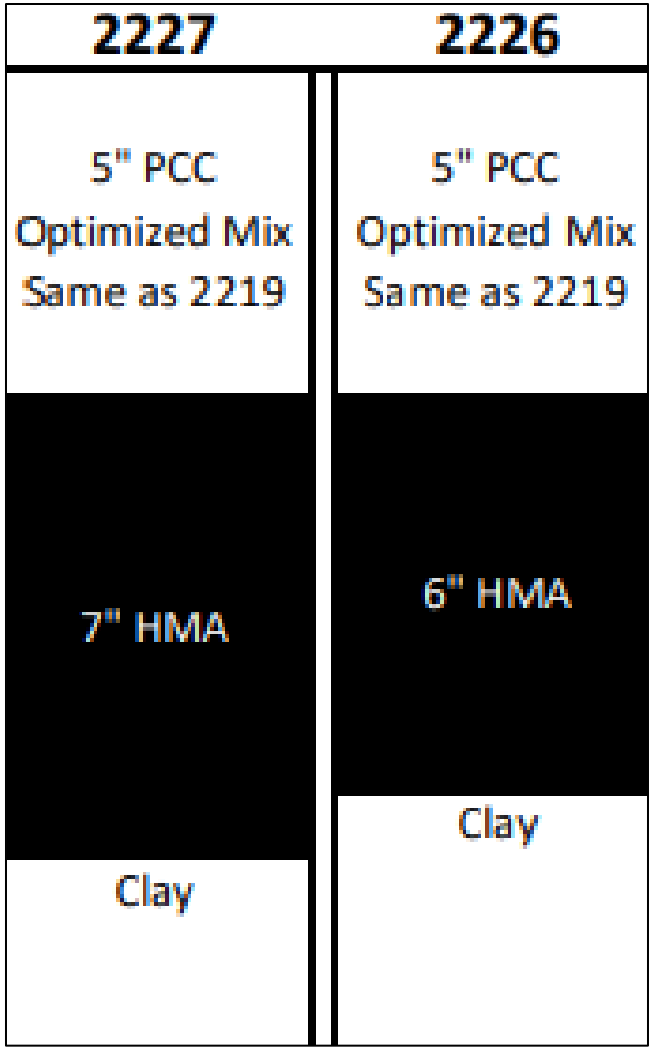


EL=Early loaded
NEL= Not early loaded

Case Study Summary

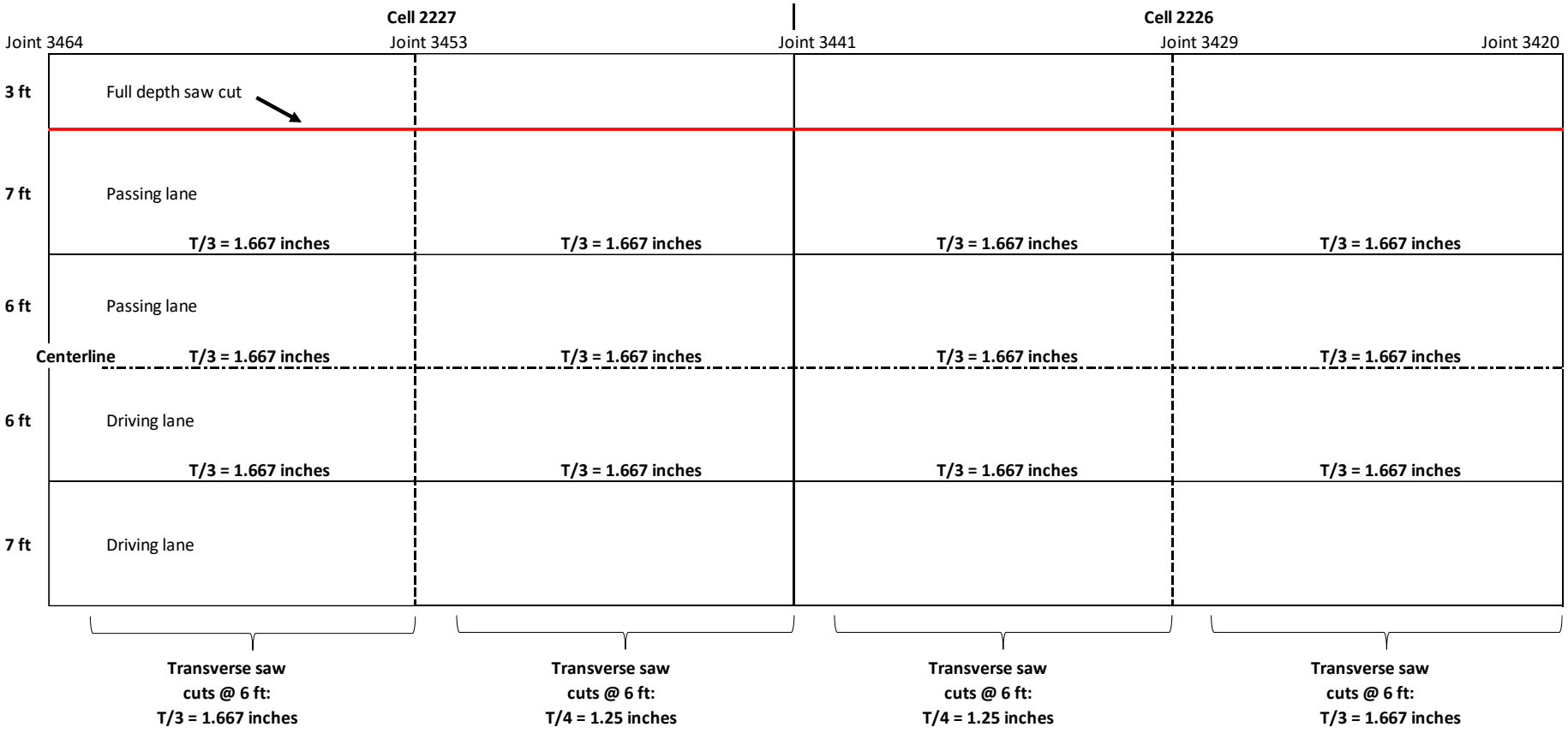
- **Early deployment not consistent or significantly increased by early loading**
- **Considered “unsuccessful” overall**
- **No damage to the pavement from early loading was observed**

MnROAD Test Sections



- **Constructed in August 2022**
- **5-inch thick concrete on 6” to 7” of asphalt**
- **135 feet long**
- **Driving and passing lanes divided into 6-foot-long by 7-foot-wide panels.**
- **Existing asphalt layer, paved in 1993, was milled 1 inch before the overlay was placed**
- **CPTech optimized MnDOT concrete mix**

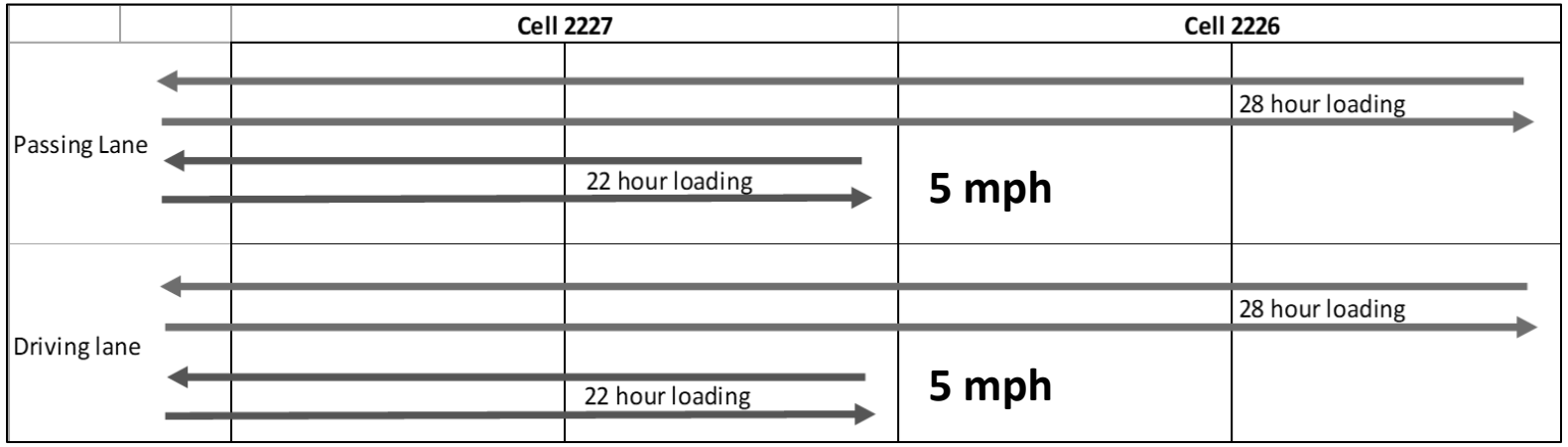
MnROAD Test Sections Saw Cut Details



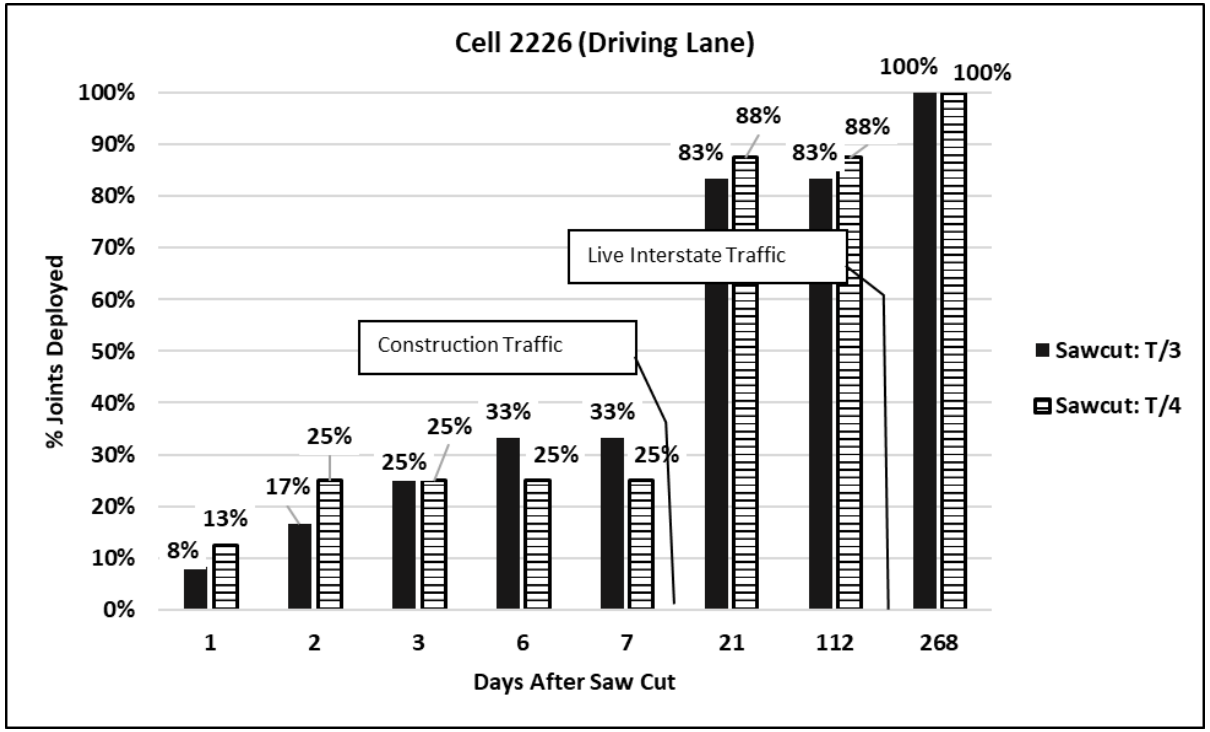
- Testing theory that saw-cut depth might have effect on increasing early joint deployment

Early Loading of MnROAD Test Sections

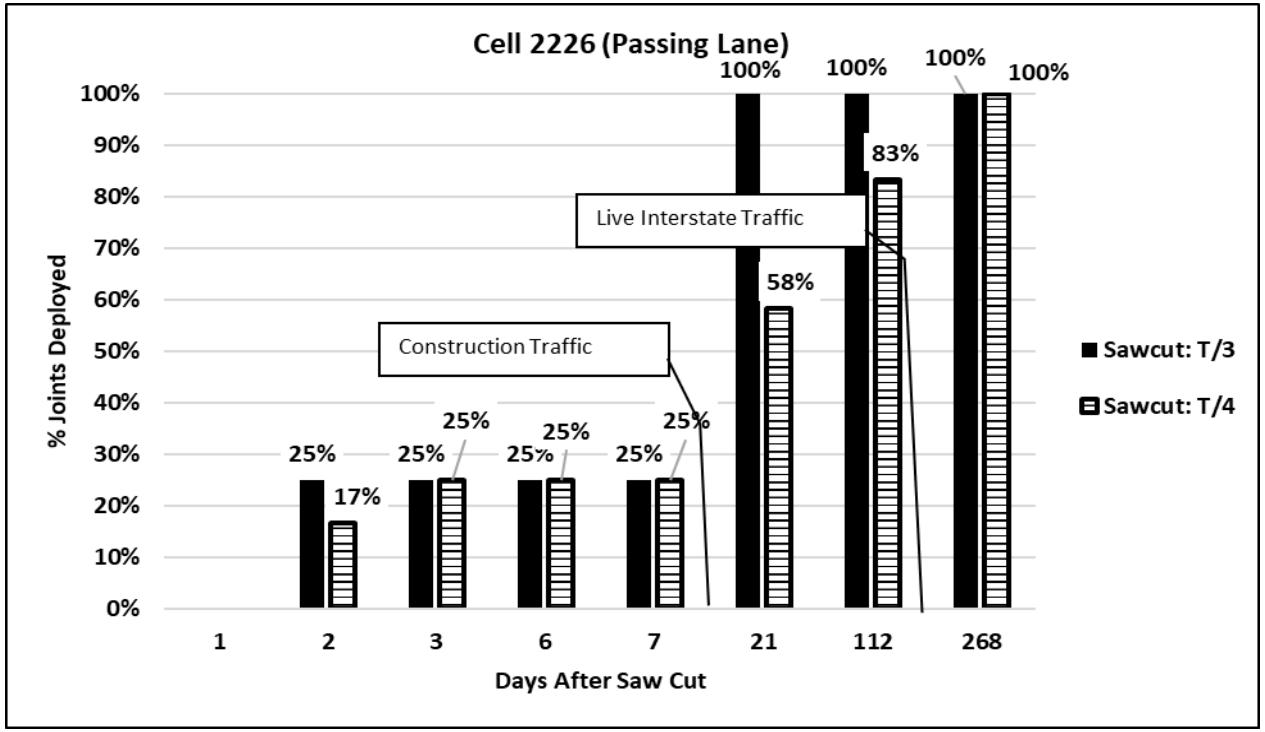
- **52,000-pound tandem axle dump truck**
- **22 hours after paving**
  - **5 slow (5 mph) passes on driving/passing lane of test section 2227 only**
- **28 hours after paving**
  - **5 slow (5 mph) passes were made on driving lane of both test sections**
  - **5 fast (30 mph) passes were made on passing lane of both test sections**



MnROAD Test Sections - Joint Deployment

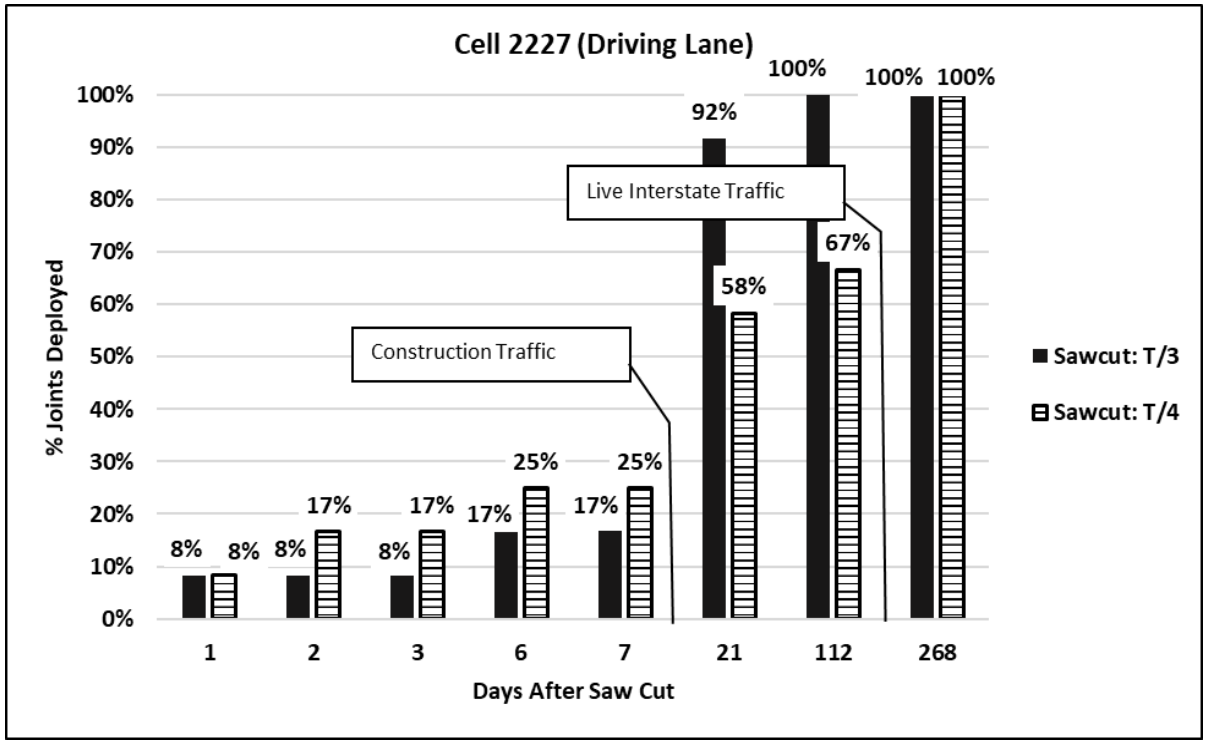


Loading @ 28 hours, 5 mph

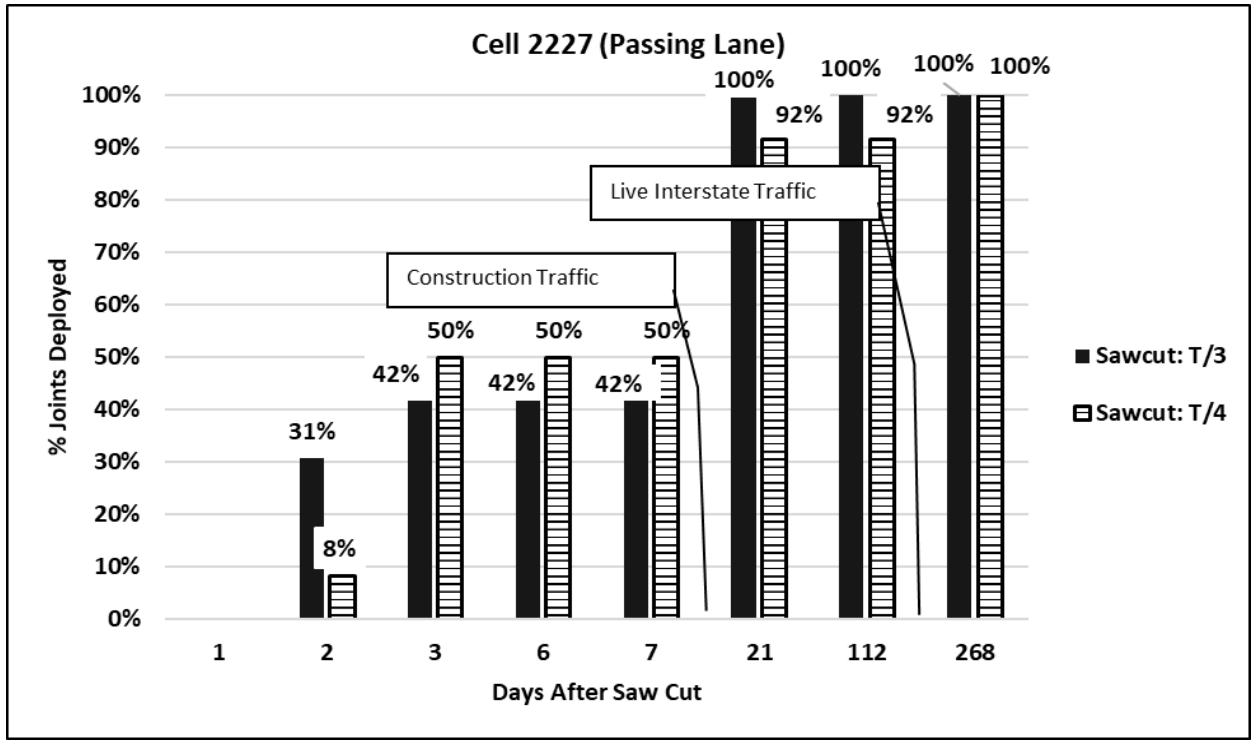


Loading @ 28 hours, 30 mph

MnROAD Test Sections - Joint Deployment

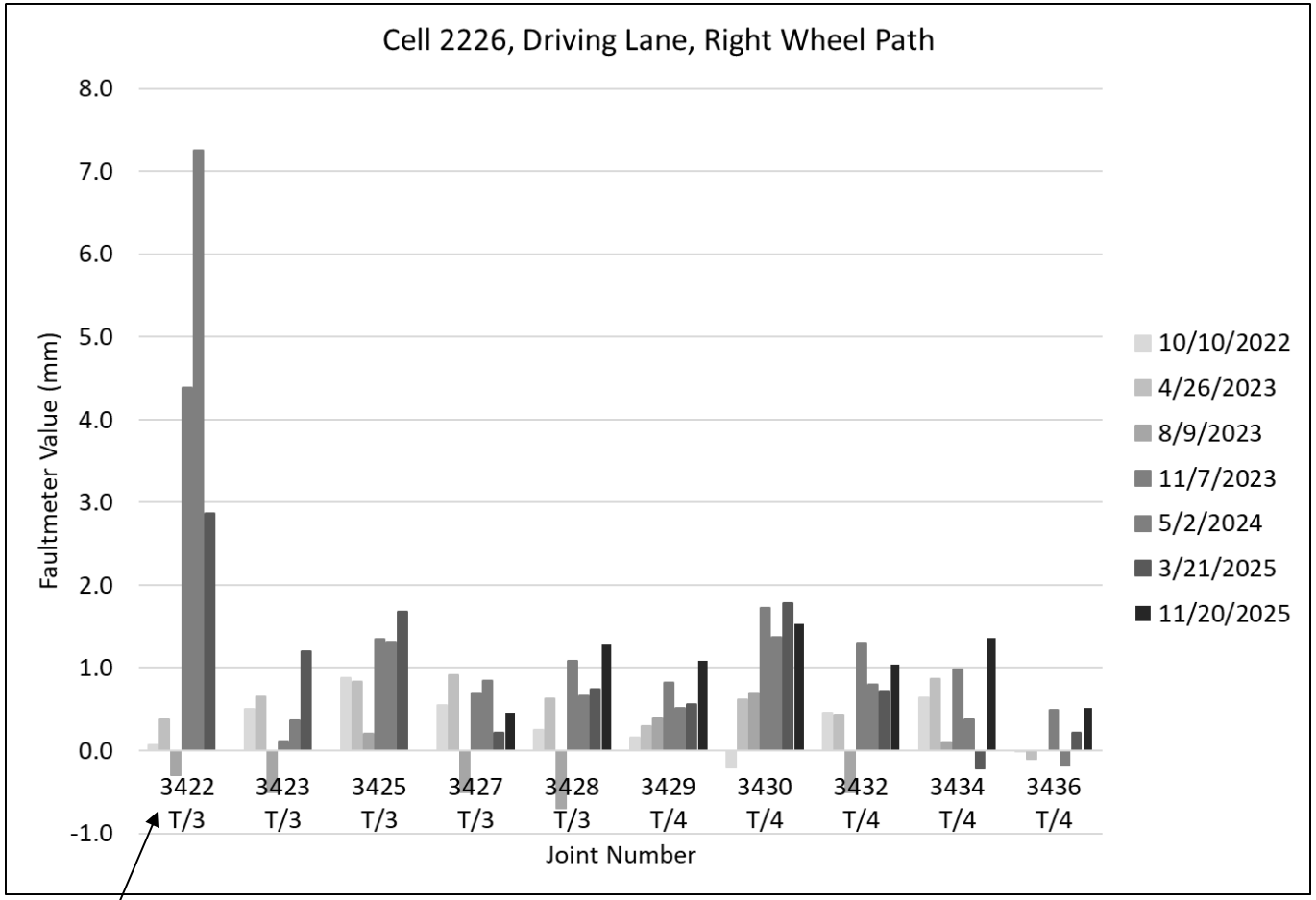


Loading @ 22 and 28 hours, 5 mph



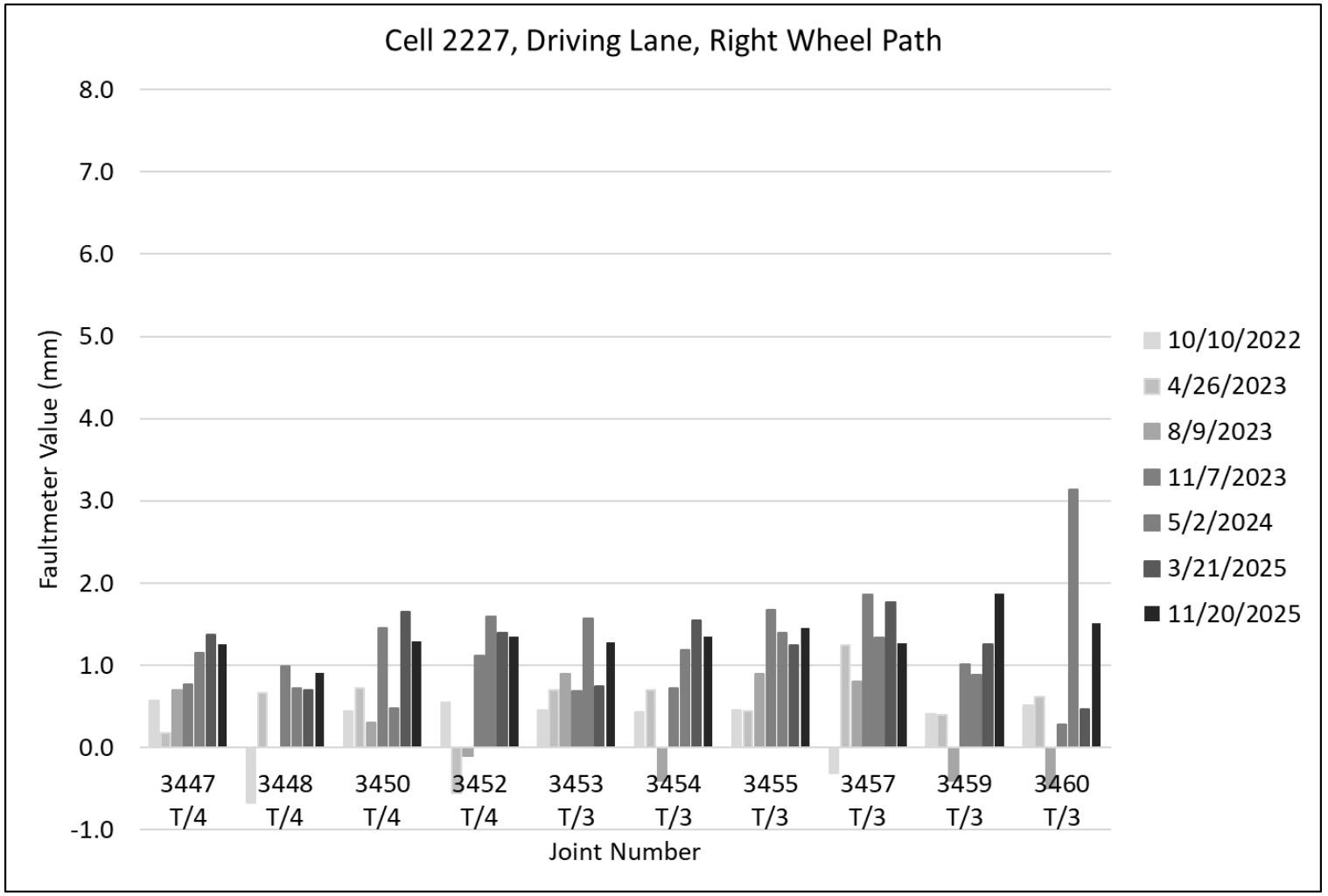
Loading @ 22 and 28 hours, 5 and 30 mph

MnROAD Test Sections - Faulting

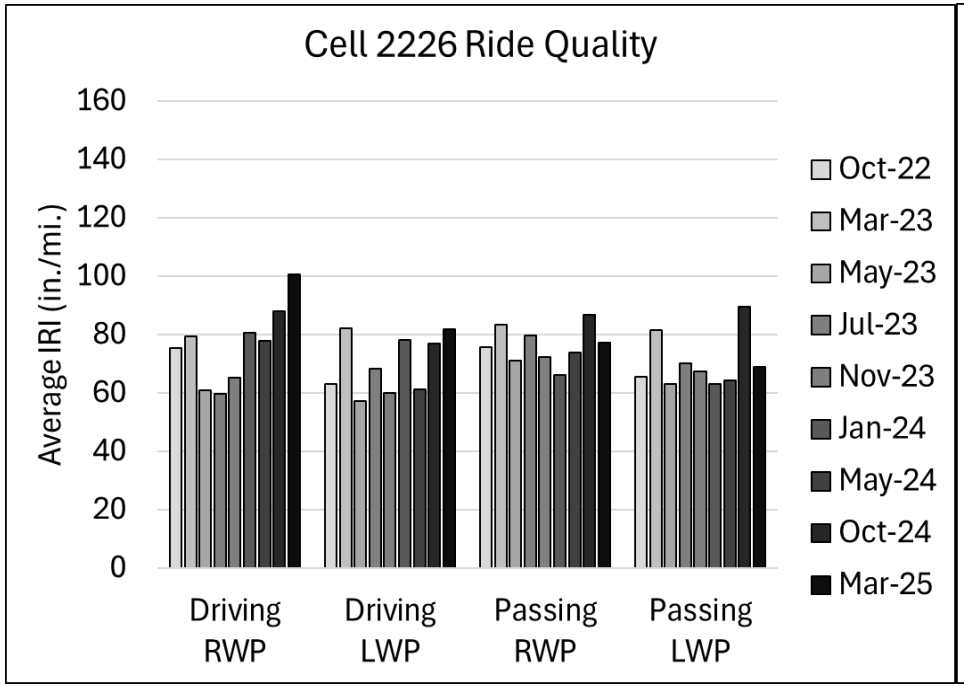


Distressed Panel

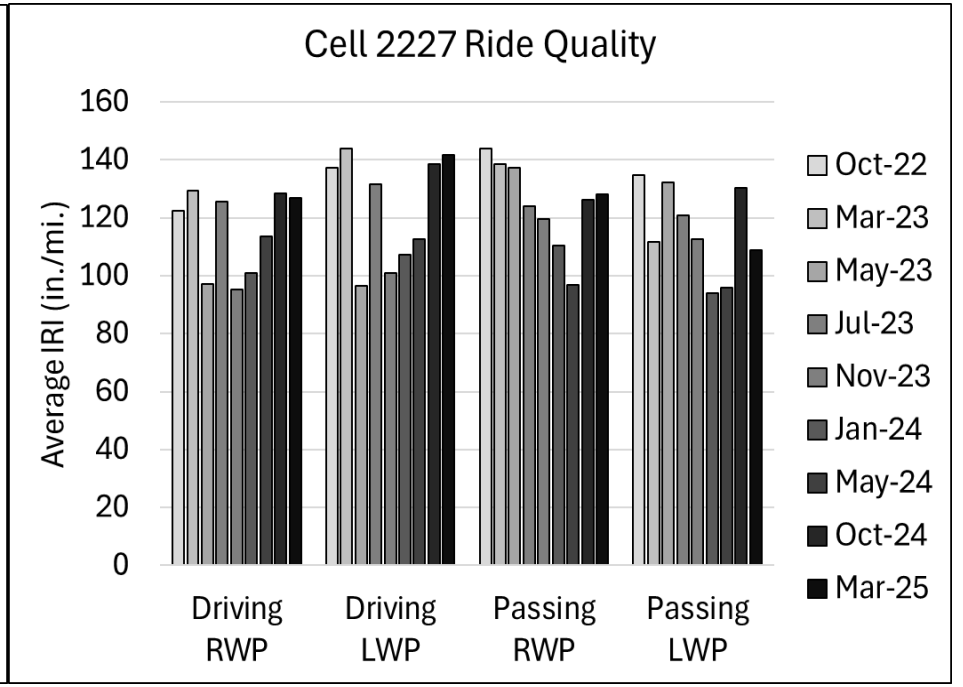
MnROAD Test Sections - Faulting



MnROAD Test Sections – Ride Quality (LISA)

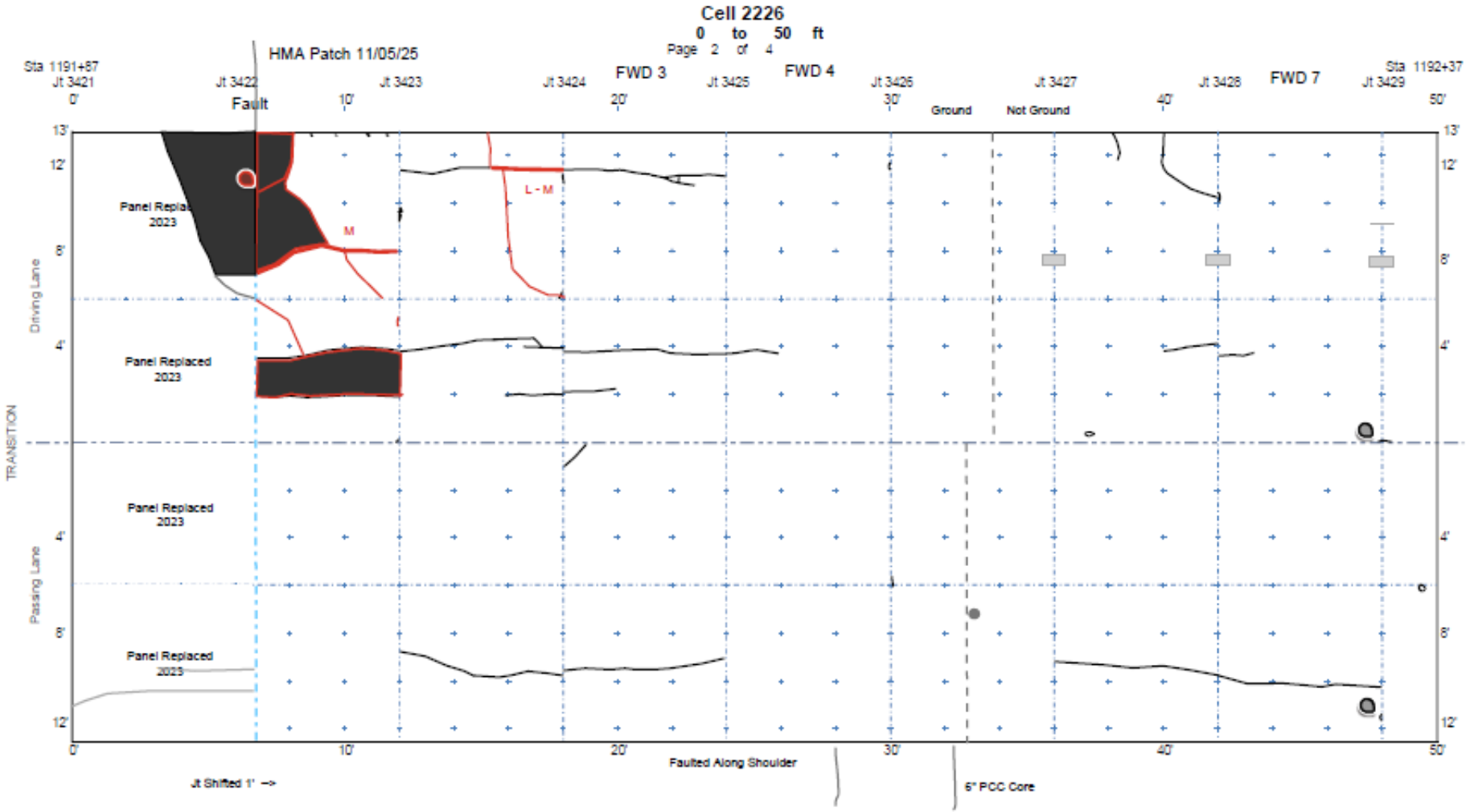


1 pass of early loadings



2 passes of early loadings

MnROAD Test Sections – Distress Survey



Cracked panels requiring repairs near west end of cell 2226

(November 2025)

Discussion

Early loading of COA to increase deployment of joints:

- **Results have not been consistent**
- **Small differences between loaded and unloaded at early age**
- **No noticeable damage caused by current loading methods**
- **No clearly defined definition of success**
- **Is it worth it?**

❖ **Final report will be coming out this summer**

Thank you!

Mike Wallace

michael.wallace@state.mn.us

Tom Burnham

tom.burnham@state.mn.us