# Thick Lift Asphalt Paving

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# Background – Multi Lift Paving

# Background – Thick Lift Paving

- Asphalt pavements typically built in lifts
  - Usually <3” thick
  - Tack between layers
  - Different mixes in each layer
  - Long work zones with traffic on intermediate layers and uneven lanes

- Traffic demands and work zone scheduling, SCDOT has been moving toward single, thick lift paving (5+ inches)

# Thick Lift Paving Advantages

http://www.worldhighways.com/_resources/assets/inline/custom/73/100641.jpg

- Shorter work zones
  - Both time and distance
- No lift interfaces
  - Prevents interface shear failure
- No uneven lanes
- Open new pavement to traffic almost immediately
- Can be accomplished on any schedule
  - Off peak
- SCDOT aiming for greater depths (7+ inches)

# Key Questions

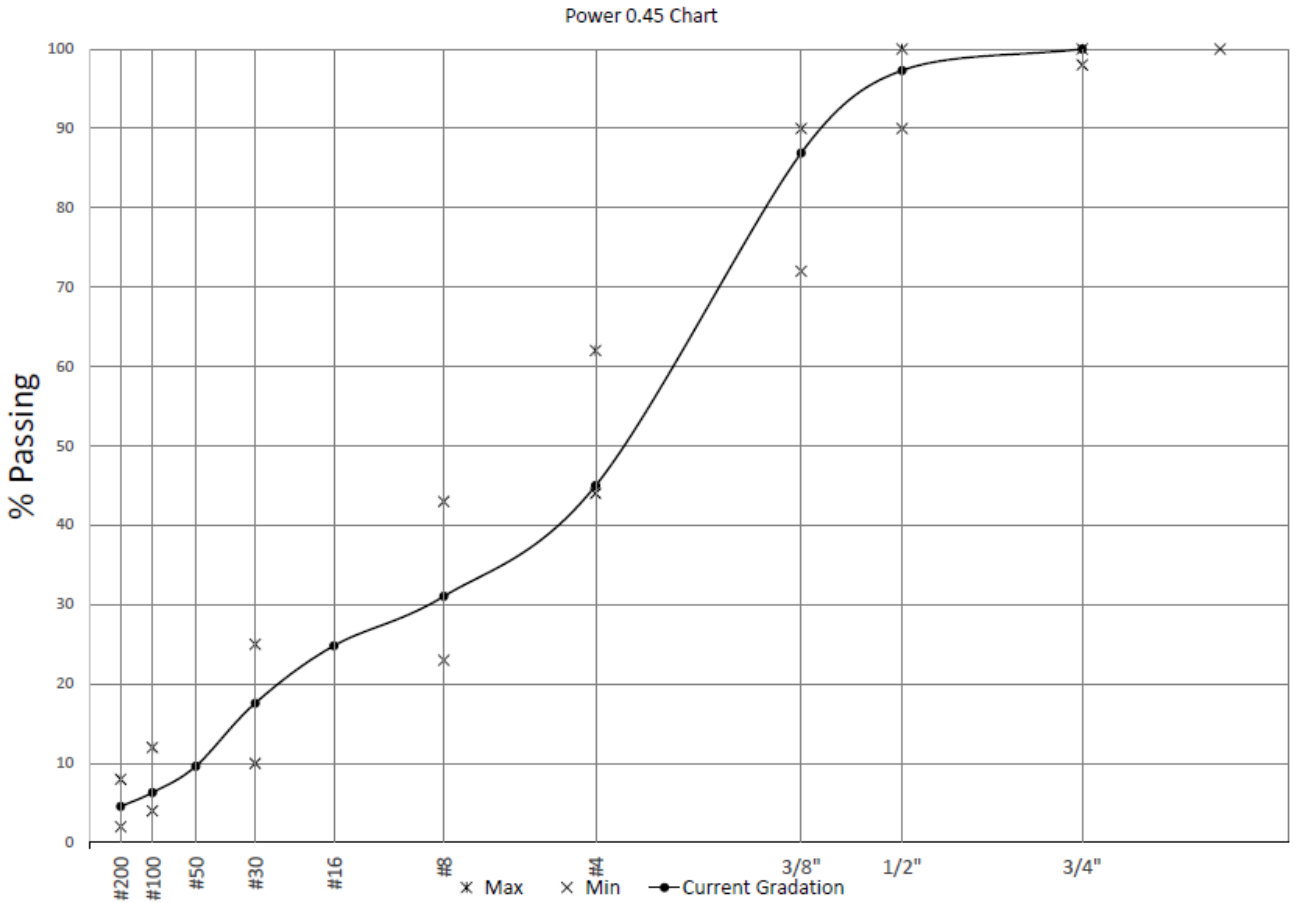
- Cooling
  - How long will it take thick mat to cool before opening it to traffic?
- Compaction
  - Can density be achieved throughout pavement depth?
- Structural Response
  - Thick lift pavement relative to conventional multi-lift pavements?
- Performance
  - How does a thick lift pavement perform relative to conventional multi-lift pavements?

# NCAT Test Track

# Section S9 – 8” AC over Granular Base

# S9 - Asphalt Mix Design

- "Type B Intermediate Special"
  - Rehabilitation Repairs, Interstates, High Volume Primary Routes
- 12.5 NMAS
- PG 64-22 with 25% RAP
- WMA (Evotherm M1 @ 0.5%)
  - Mixing @ 275-280F
  - Compaction @ 245-250F
- Design Air Voids = 2.5%
- $N_{des}$ = 75
- Asphalt Content = 5.75%
  - 4.37% Virgin
  - 1.38% RAP

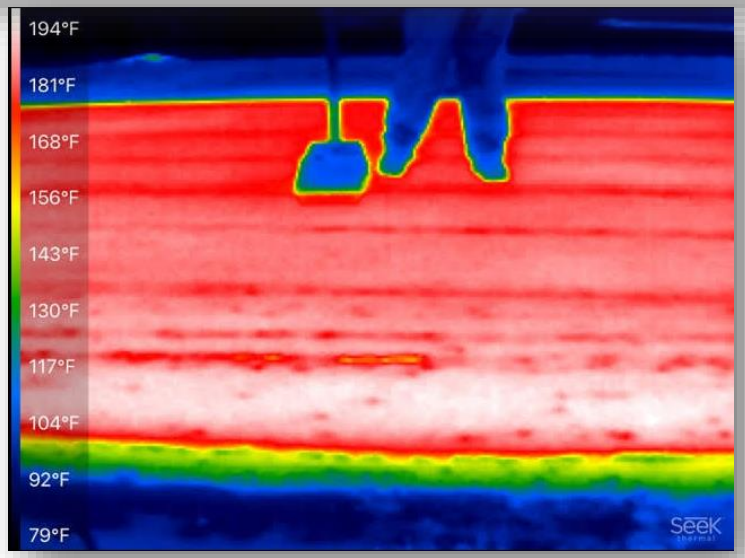


# Construction

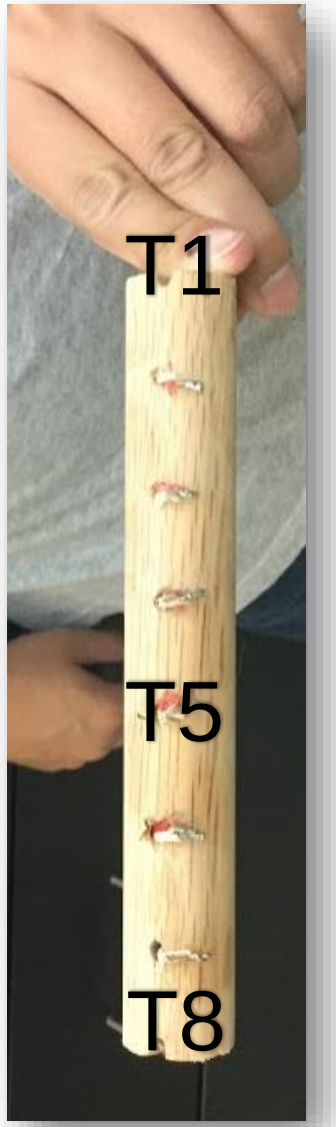
# Construction

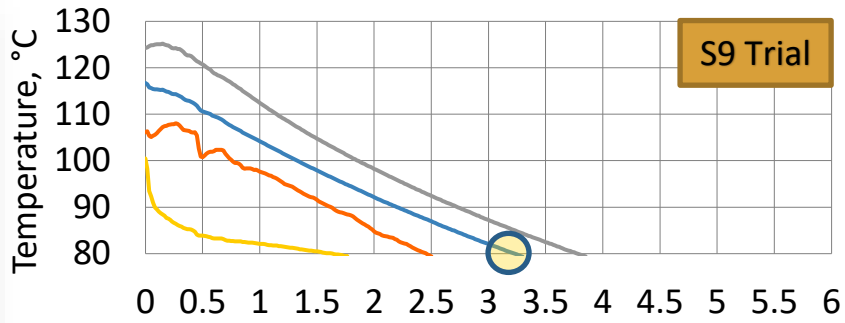
# Embedded Temp Probe During Paving

# Temperature Monitoring

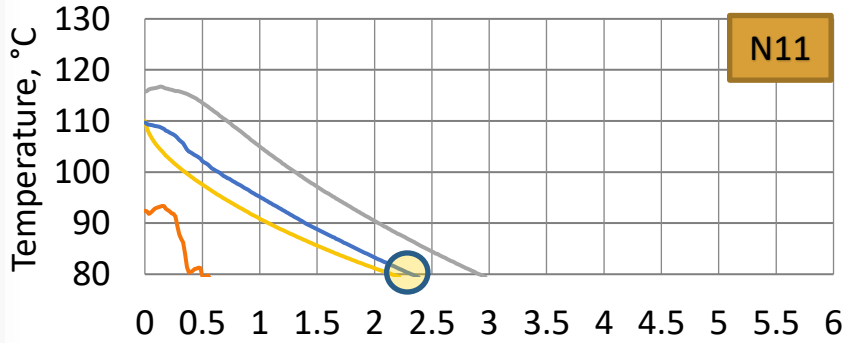



# In Situ Cooling Curves




*8/22/2018*
*3:02 PM*
*Tair = 86F*

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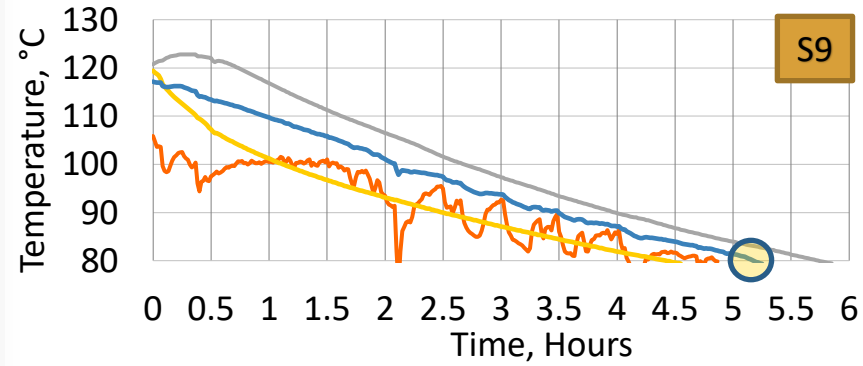
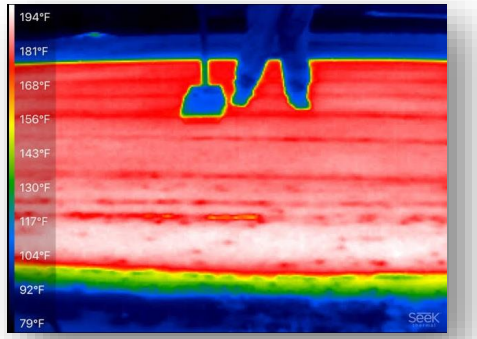
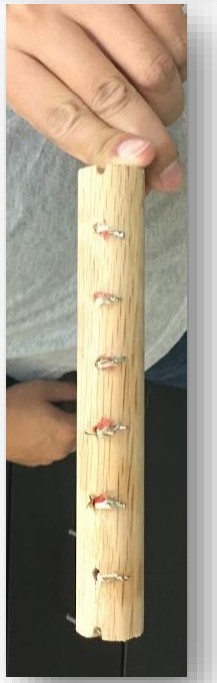
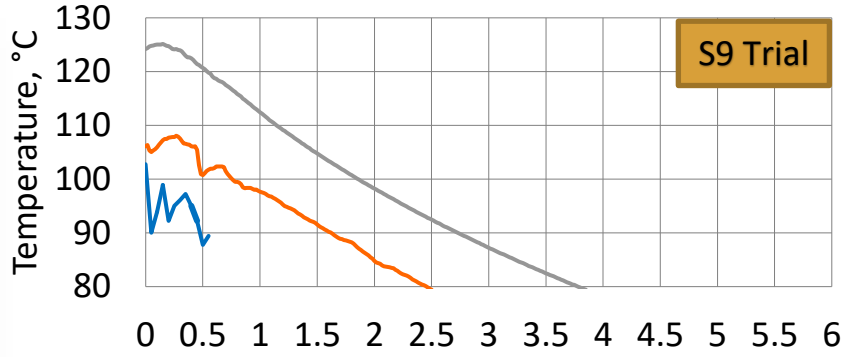



*8/24/2018*
*10:28 AM*
*Tair = 86F*

# Surface vs In Situ Monitoring



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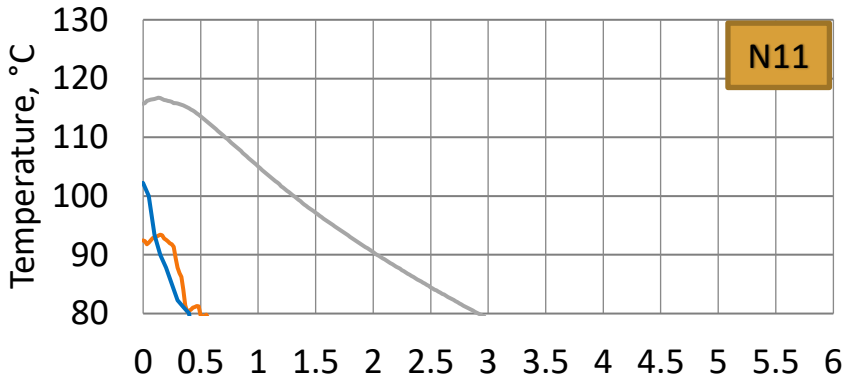


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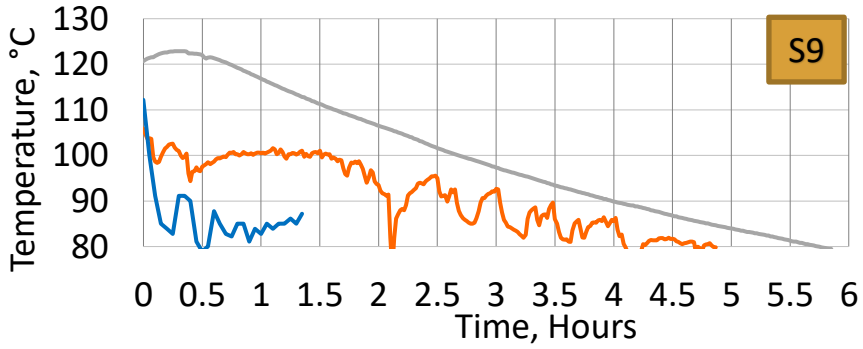


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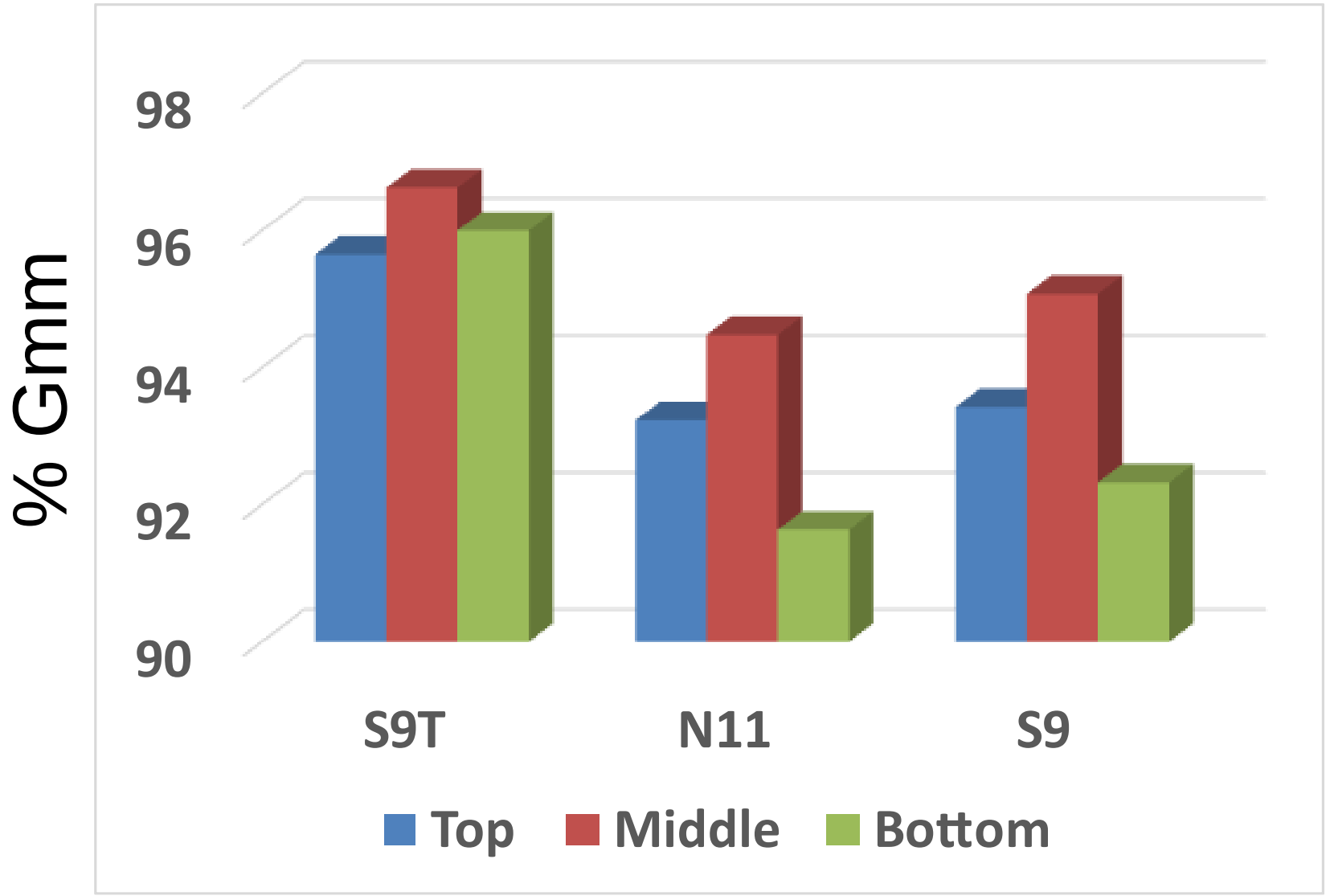
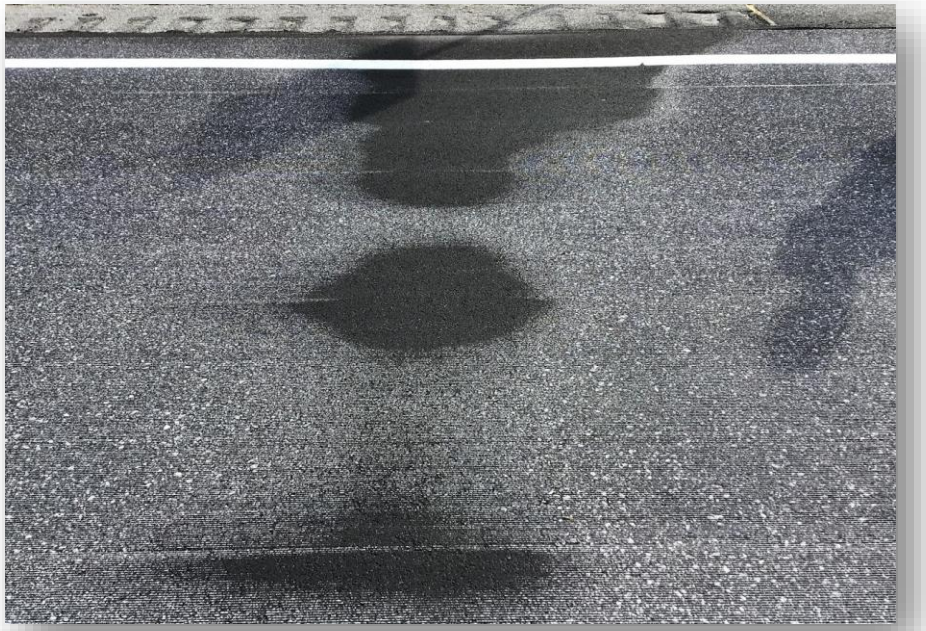
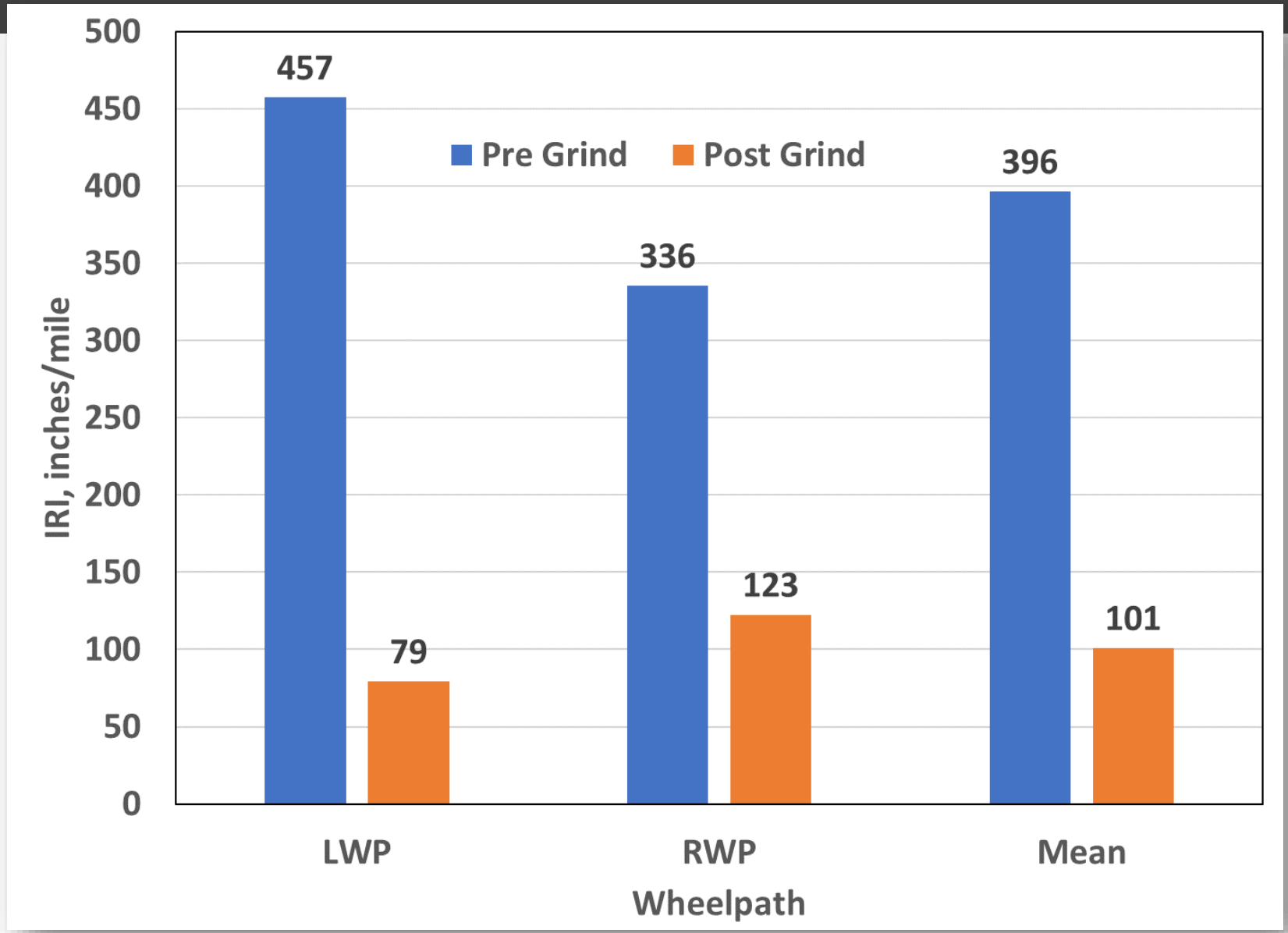
# In-Place Density



# S9 Post-Construction Grinding



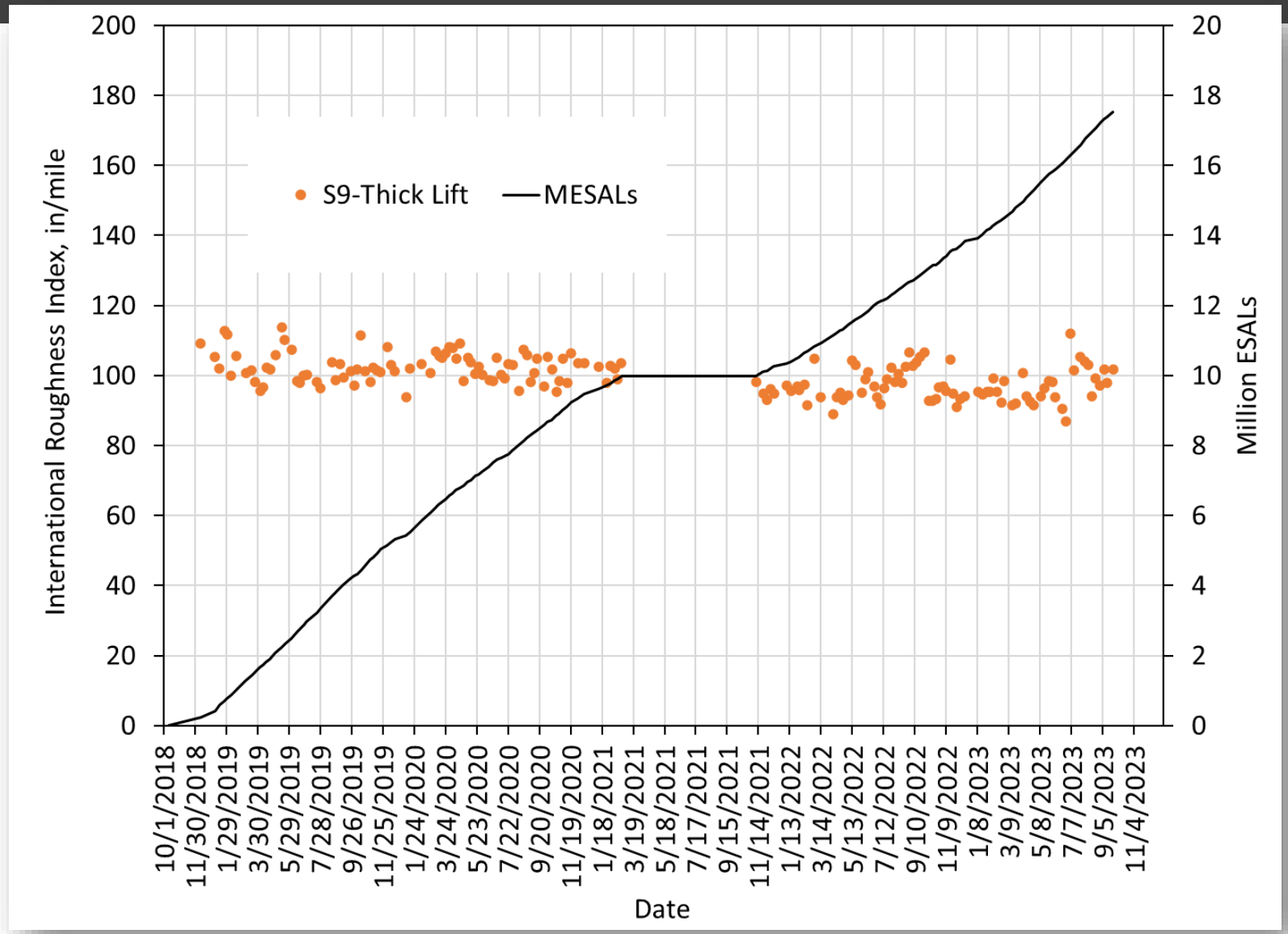
# Post Construction – Ride Quality



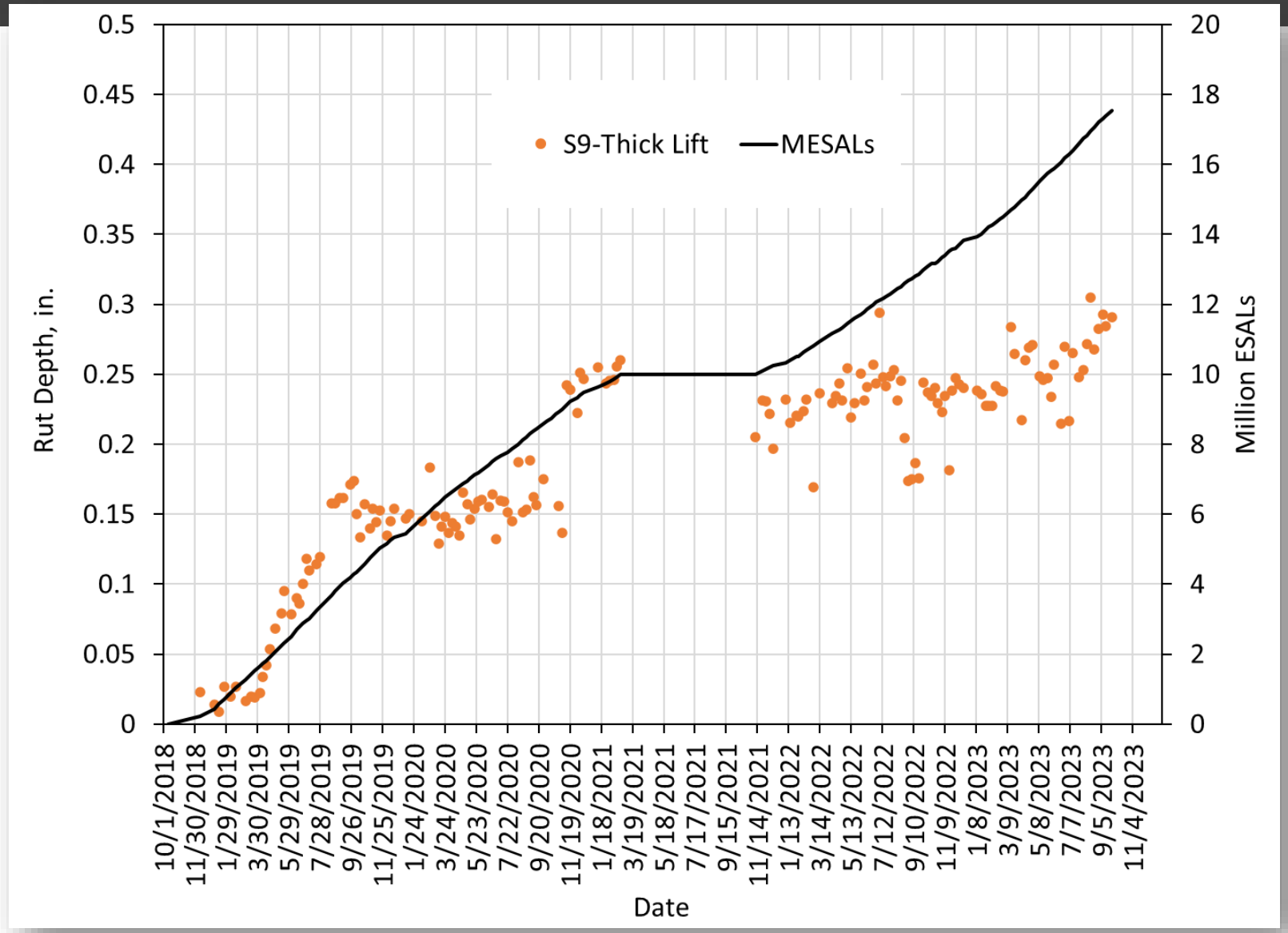
# Performance

**S9 @ 17.8 MESALs**

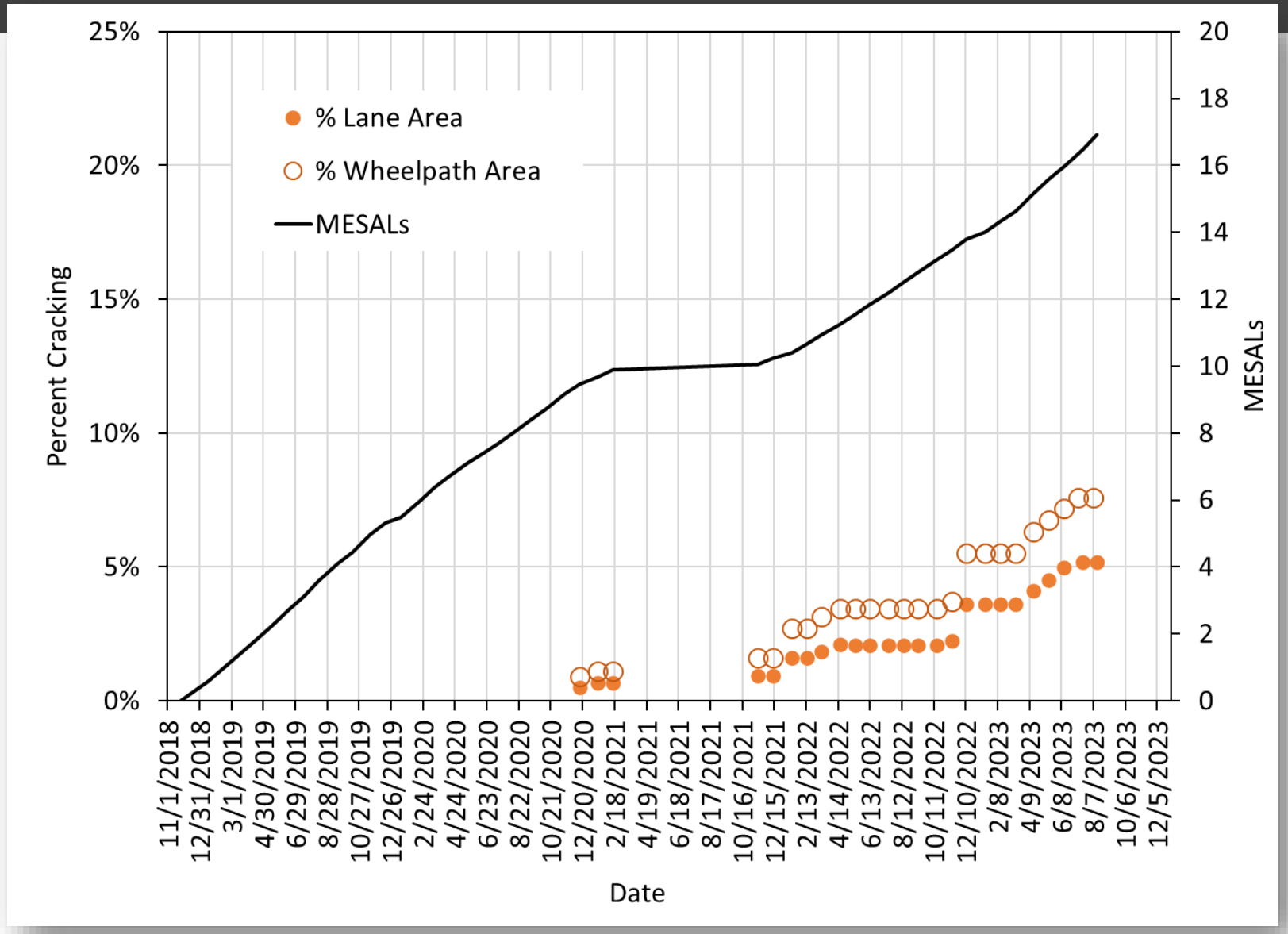
# Ride Quality (IRI)



# Rutting


S9-Thick Lift
MESALs
Rut Depth, in.
Million ESALs
Date
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
0.5
0
2
4
6
8
10
12
14
16
18
20
10/1/2018
11/30/2018
1/29/2019
3/30/2019
5/29/2019
7/28/2019
9/26/2019
11/25/2019
1/24/2020
3/24/2020
5/23/2020
7/22/2020
9/20/2020
11/19/2020
1/18/2021
3/19/2021
5/18/2021
7/17/2021
9/15/2021
11/14/2021
1/13/2022
3/14/2022
5/13/2022
7/12/2022
9/10/2022
11/9/2022
1/8/2023
3/9/2023
5/8/2023
7/7/2023
9/5/2023
11/4/2023

# Cracking


% Lane Area
% Wheelpath Area
MESALs
Percent Cracking
MESALs
Date
25%
20%
15%
10%
5%
0%
20
18
16
14
12
10
8
6
4
2
0
11/1/2018
12/31/2018
3/1/2019
4/30/2019
6/29/2019
8/28/2019
10/27/2019
12/26/2019
2/24/2020
4/24/2020
6/23/2020
8/22/2020
10/21/2020
12/20/2020
2/18/2021
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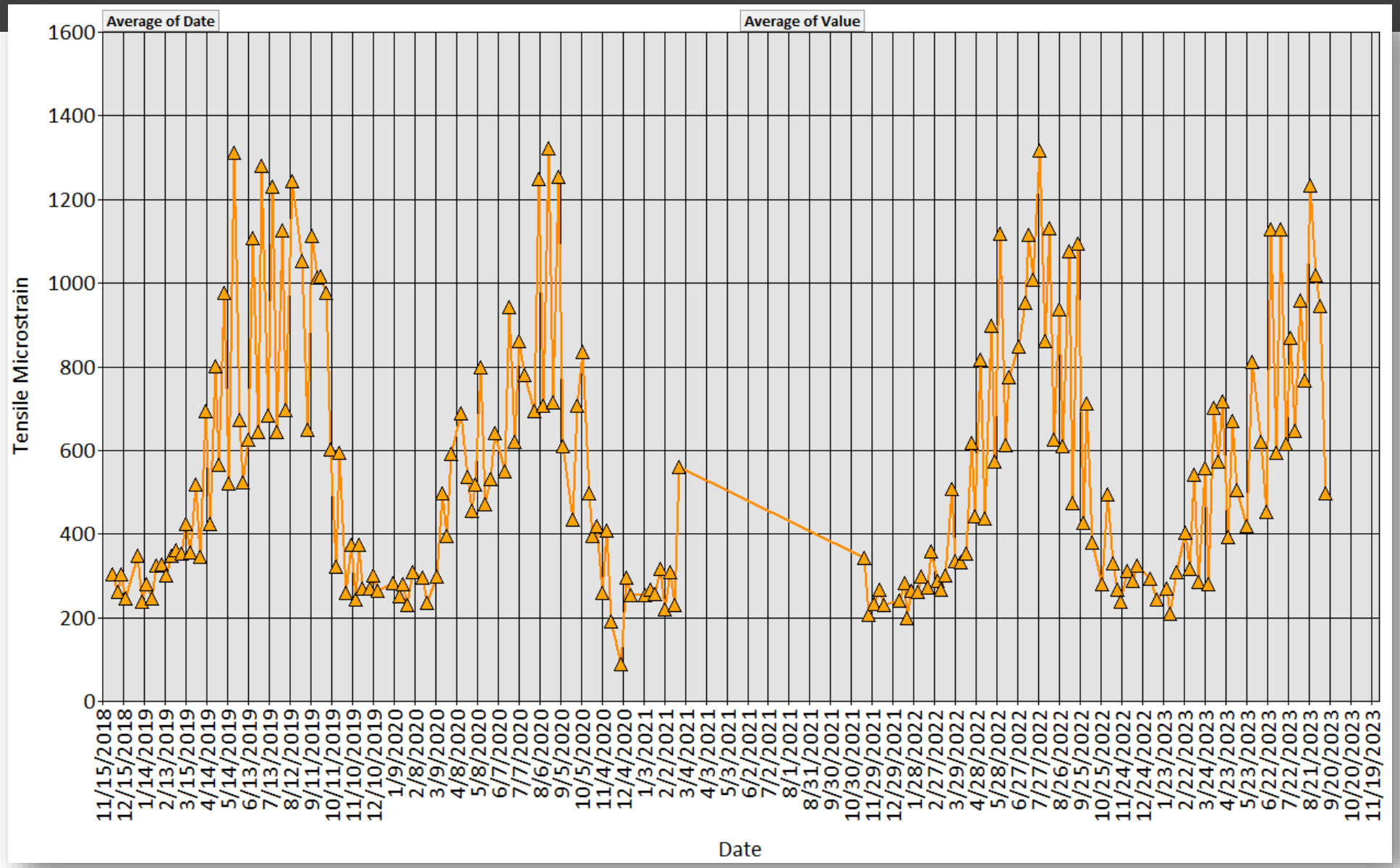
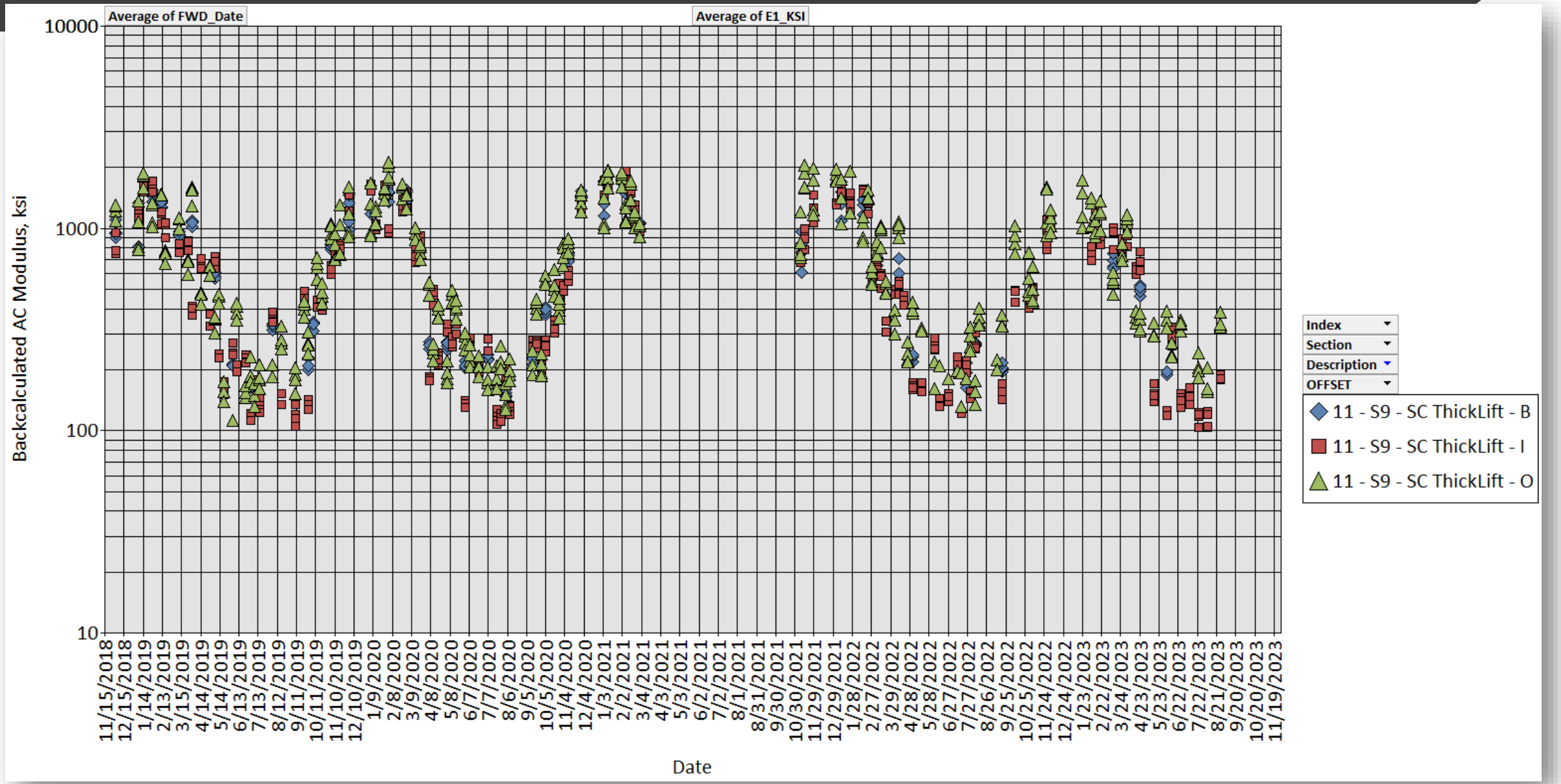
12/5/2023

# Tensile Strain Measurements



# Backcalculated AC Modulus



# Key Findings

- Time of day has strong influence on cooling rate
- MultiCool is most accurate over short durations & needs some improvement
- Cooling may be significantly longer than measured at surface
  - Recommend thermocouple probe inserted at mid-depth to monitor in real-time
- Adequate in-place density was achieved
- Precision grinding needed to achieve acceptable IRI at Track (SCDOT reporting 50 in/mile achievable)
- Good performance
  - IRI decreasing over time
  - Rutting < 0.3” @ 17.5 MESALs
  - Limited cracking
  - Strain and backcalculated modulus indicate healthy section
- Behaves like conventional multi-lift section, without lift interfaces
- Continue monitoring into next test cycle


# Questions?

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