



# Optimizing the Use of Limestone, Dolomite, and Crushed Gravel Aggregates in Stone-matrix Asphalt (SMA)

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**Illinois Bituminous Paving**  
**Conference**



# Objective and Scope

## Enable the use of aggregates meeting lesser quality requirements in SMA

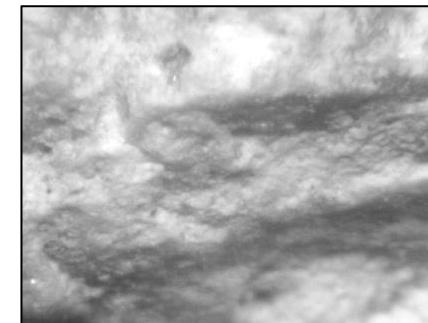
- Design SMAs and perform lab and full-scale performance evaluations
  - Evaluate SMA with local aggregates (breakage level?)
  - Evaluate effect of gyration number reduction
  - Quantify the benefits of using local aggregates



# Aggregate Characterization



- LA Abrasion
- Micro-Deval
- Deleterious/ Residue
- Flat/ Elongated Ratio
- Aggregate Imaging System (AIMS)



# SMA Design Requirements

- **Volumetric Design: Minimum Voids in Mineral Aggregate (VMA)**
  - 4% Air Void Content (AV)
  - SBS PG76-28
  - Cellulose fibers: 0.3% by total weight
  - Two coarse stockpiles; no RAP/RAS
  - Same FM20 for all
  - Same mineral filler (MF)

| NMAS (mm) | Target VMA (%) |
|-----------|----------------|
| 9.5       | 17.5 ± 0.3     |
| 12.5      | 16.5 ± 0.3     |

# Laboratory Evaluation



**I-FIT: Cracking Potential**

**TSR: Moisture Damage Potential**



**HWTT: Rut Potential**

# Aggregate Breakage Measurements



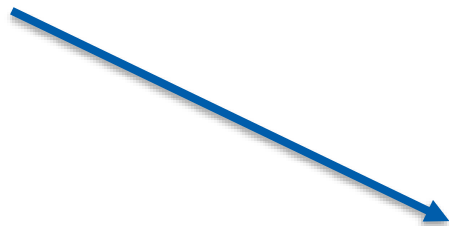
Loose SMA



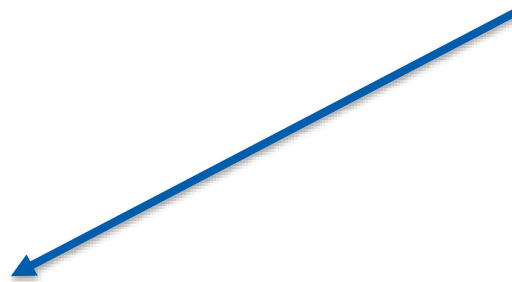
Compacted SMA



HWTT



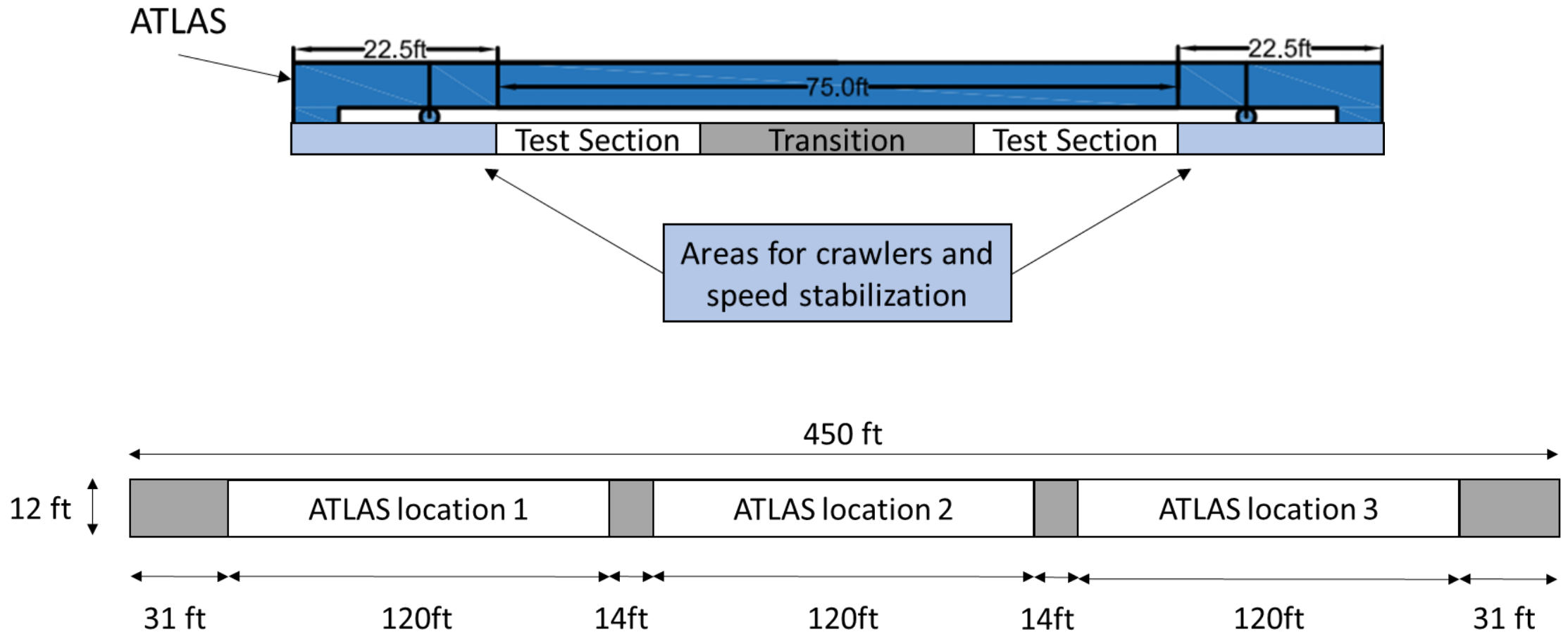
Extraction



# Accelerated Transportation Loading System (ATLAS)

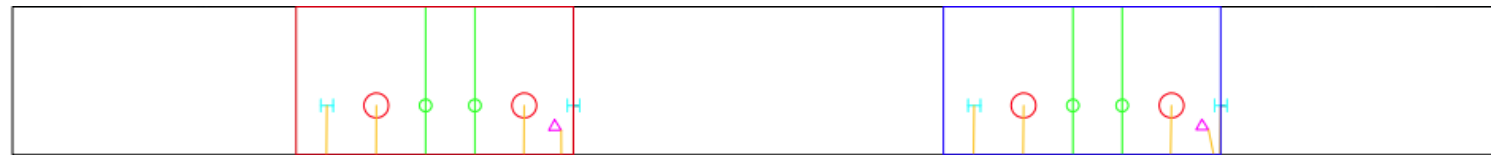


# 1 APT Lane – 6 Sections – 3 Experiments





# Instrumentation at the bottom of SMA



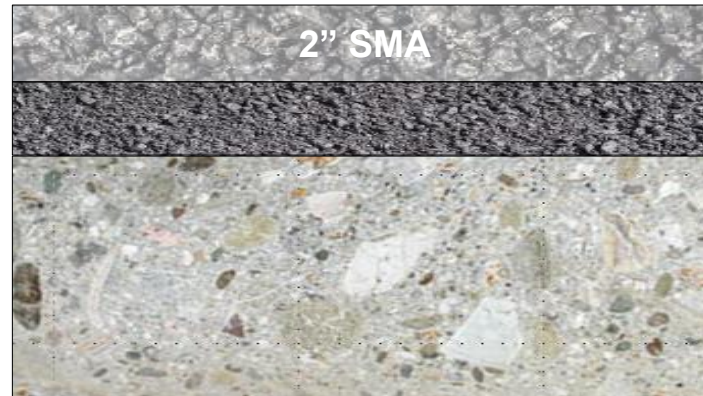
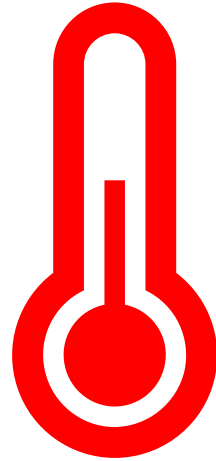
**Rutting Profile  
Measurement  
Locations**

Datalogger

# Base Construction

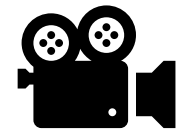


# Instrumentation



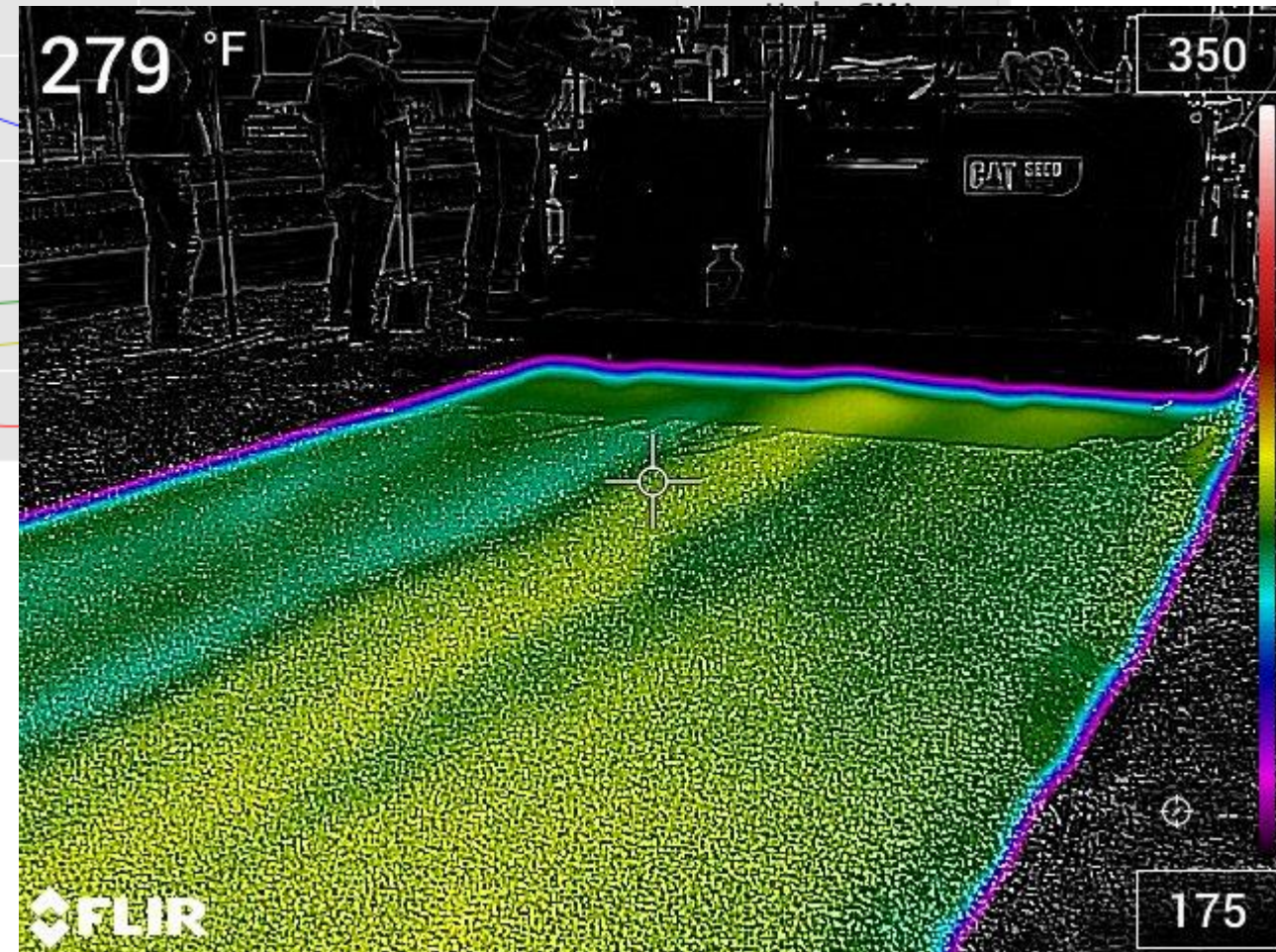
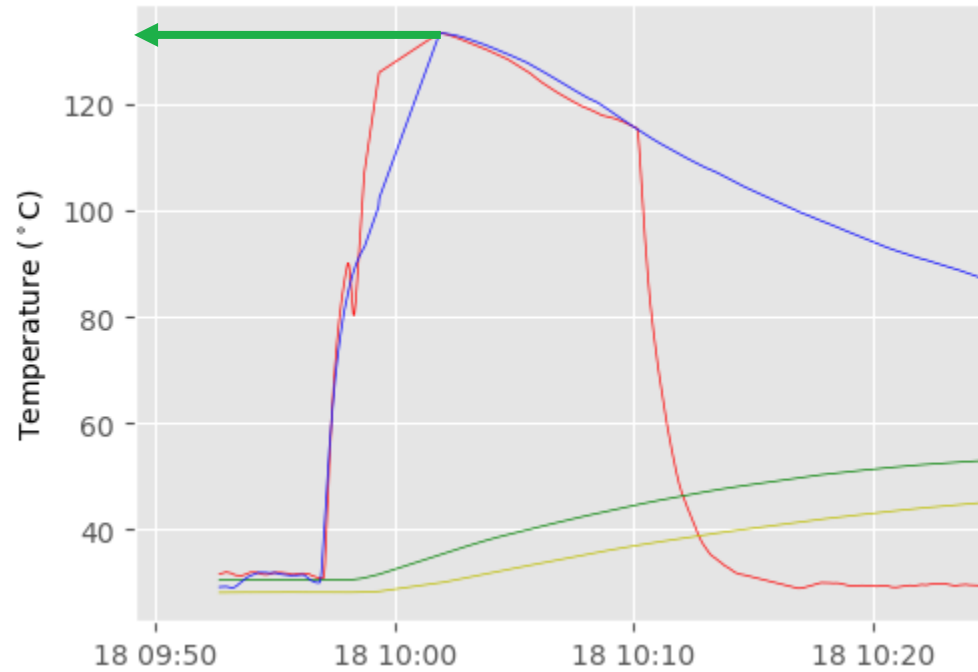


# SMA Construction

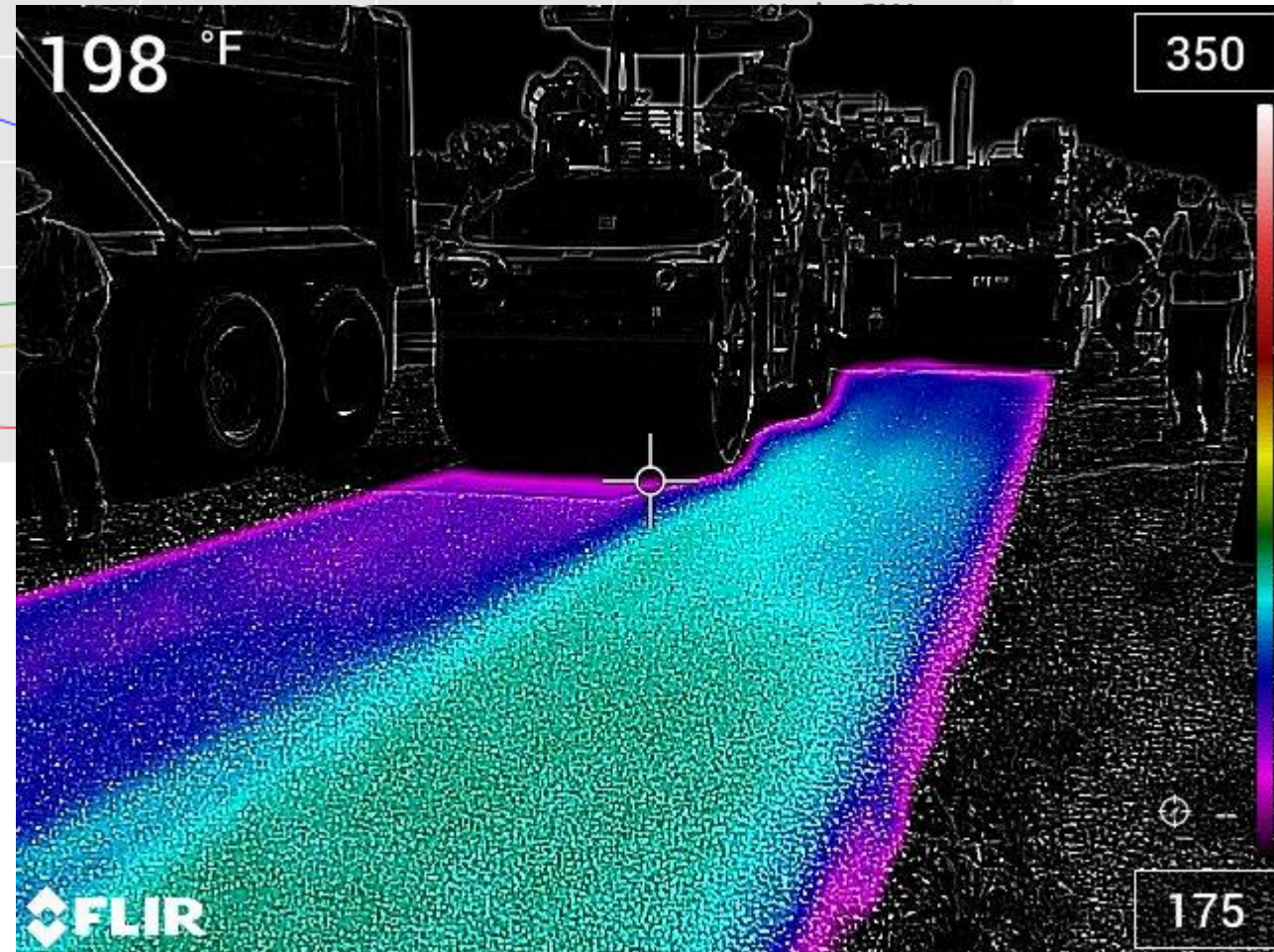
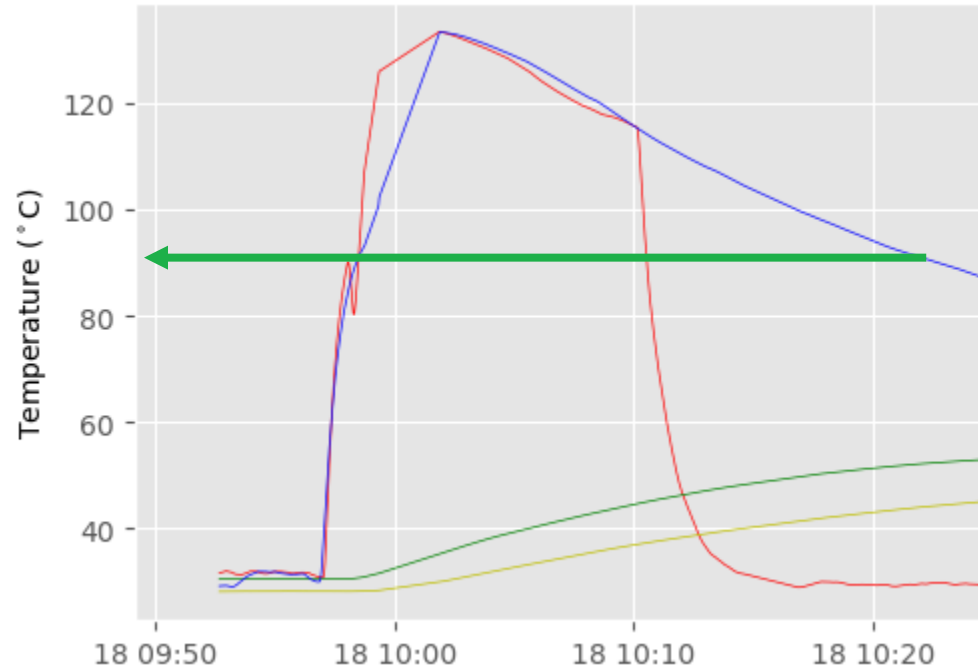


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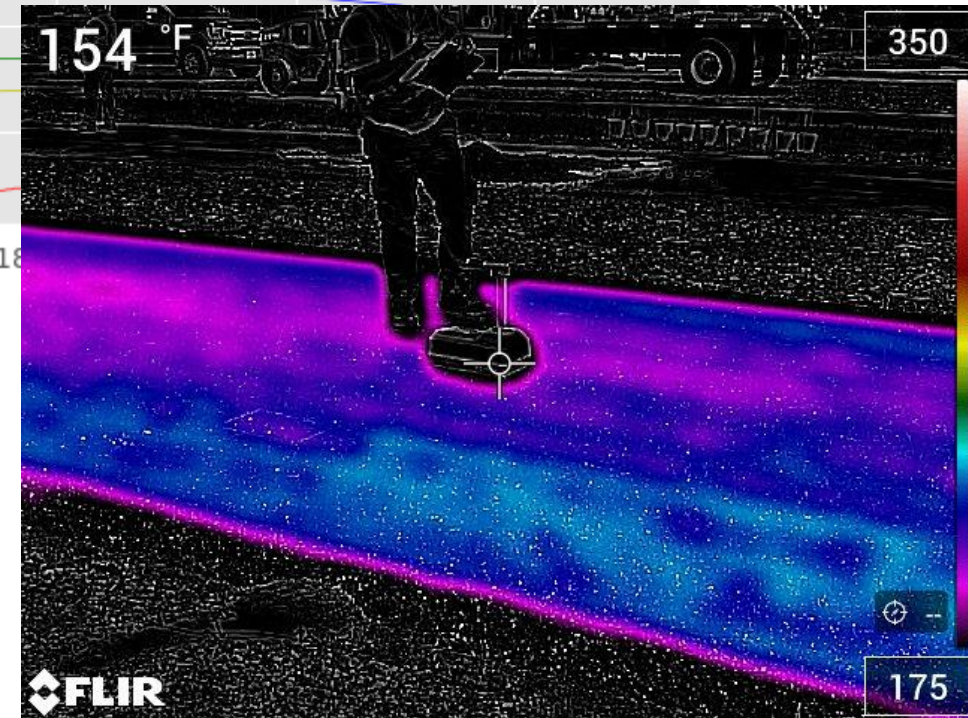
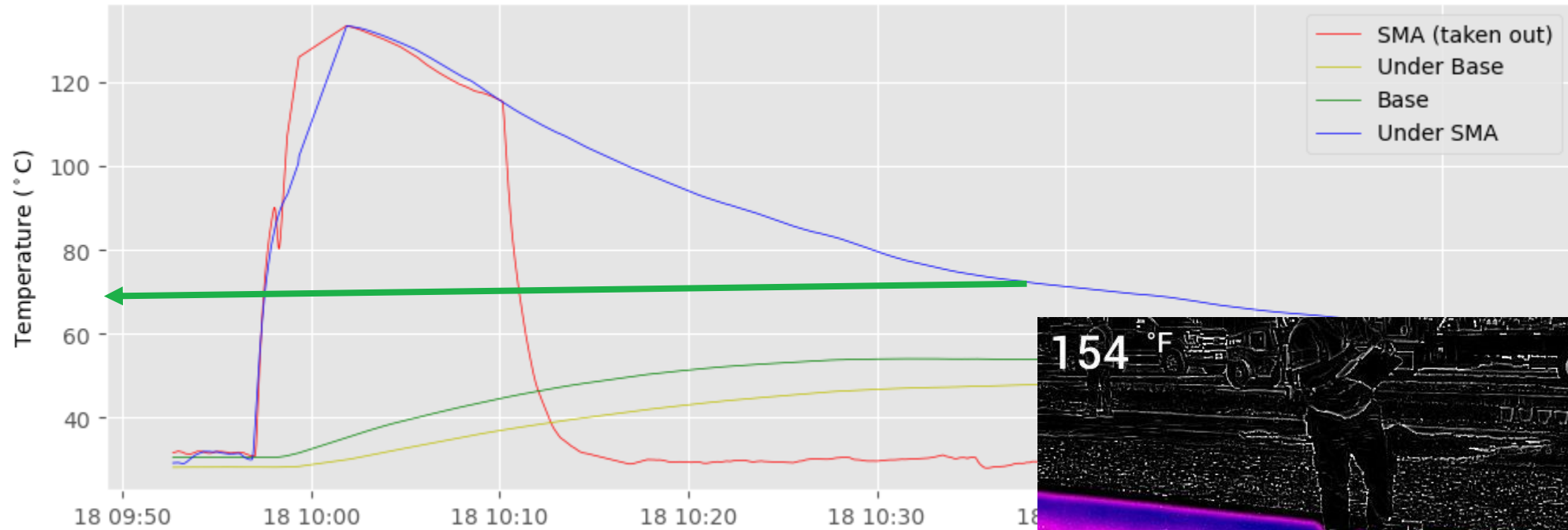
# Temperature during Construction (1/3)



# Temperature during Construction (2/3)



# Temperature during Construction (3/3)







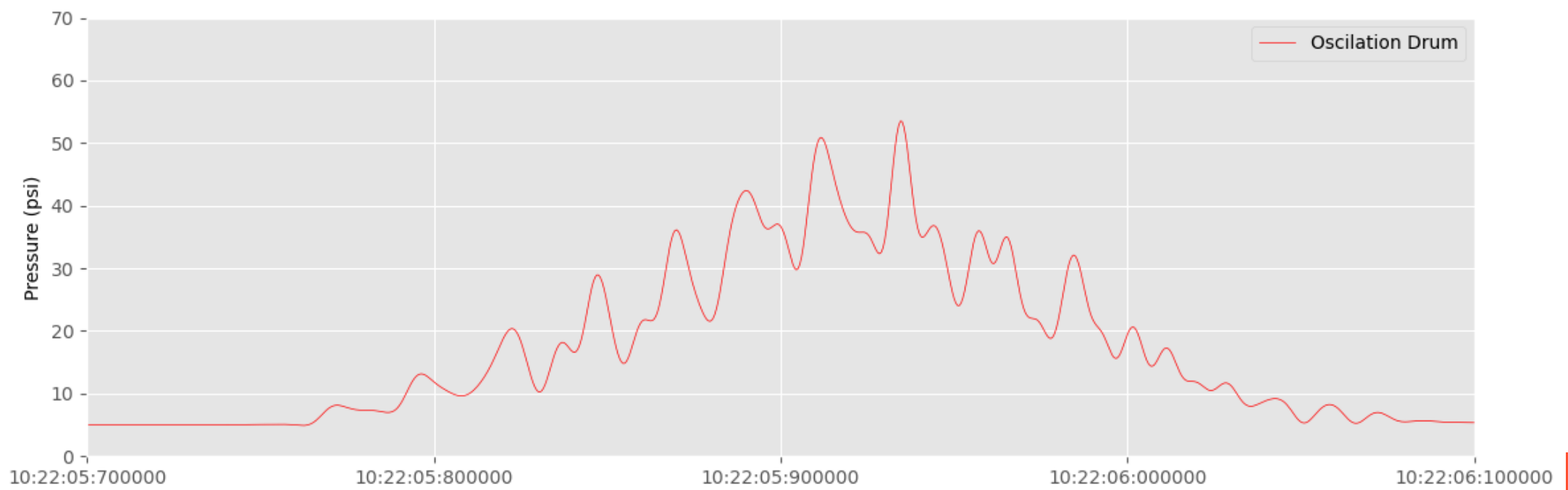
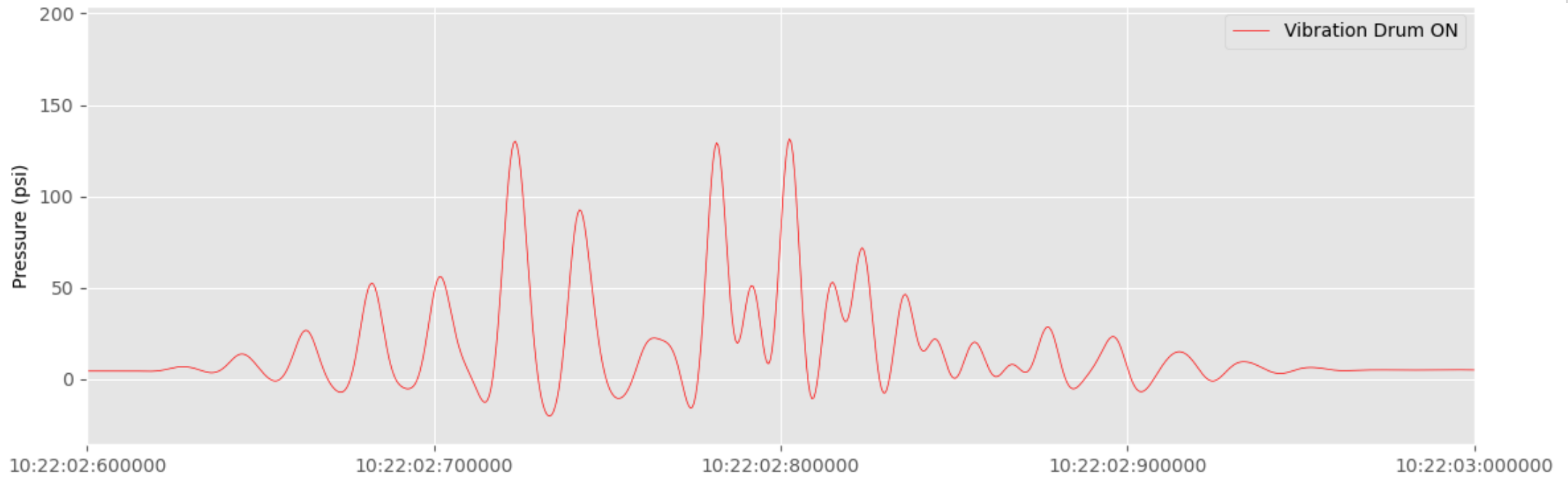
# Hamm HD+ 110 VO Compactor



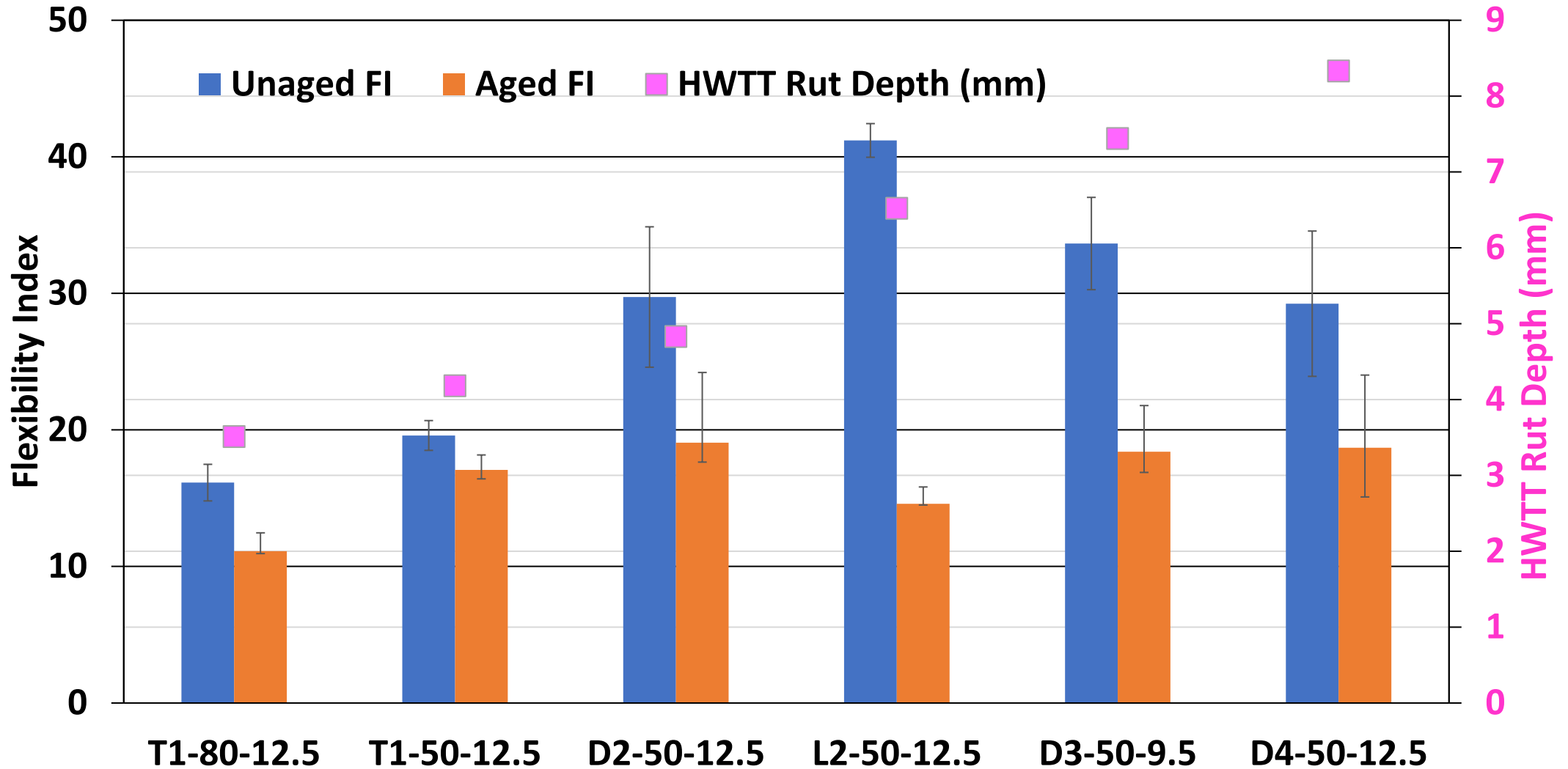
**Vibration Drum**

**Oscillation Drum**

# T1-50-12.5-0 SMA Compaction



# SMA Performance Potential Quality Assurance



# APT Loading Plan

- **May-September 2024**
- **Unidirectional w/o wander**
- **9kip load**
- **Wide-base tire (100psi)**
- **Constant 5mph speed (No traction and acceleration)**
- **Constant temperature @1” depth**
- **40000 passes**

# APT Monitoring Plan

- **2 rutting profile locations per section**
- **Moduli using light-weight deflectometer**
- **Frequency:**
  - Every 100passes until 1000
  - Every 1000passes until 10000
  - Every 5000passes until 40000
- **Every pass: pavement responses from strain gauges and pressure cells**
- **Final coring and trenching for ground truth**



**THANK YOU**  
*Questions?*

Illinois Center for Transportation

