

I. TECHNOLOGY TRANSFER

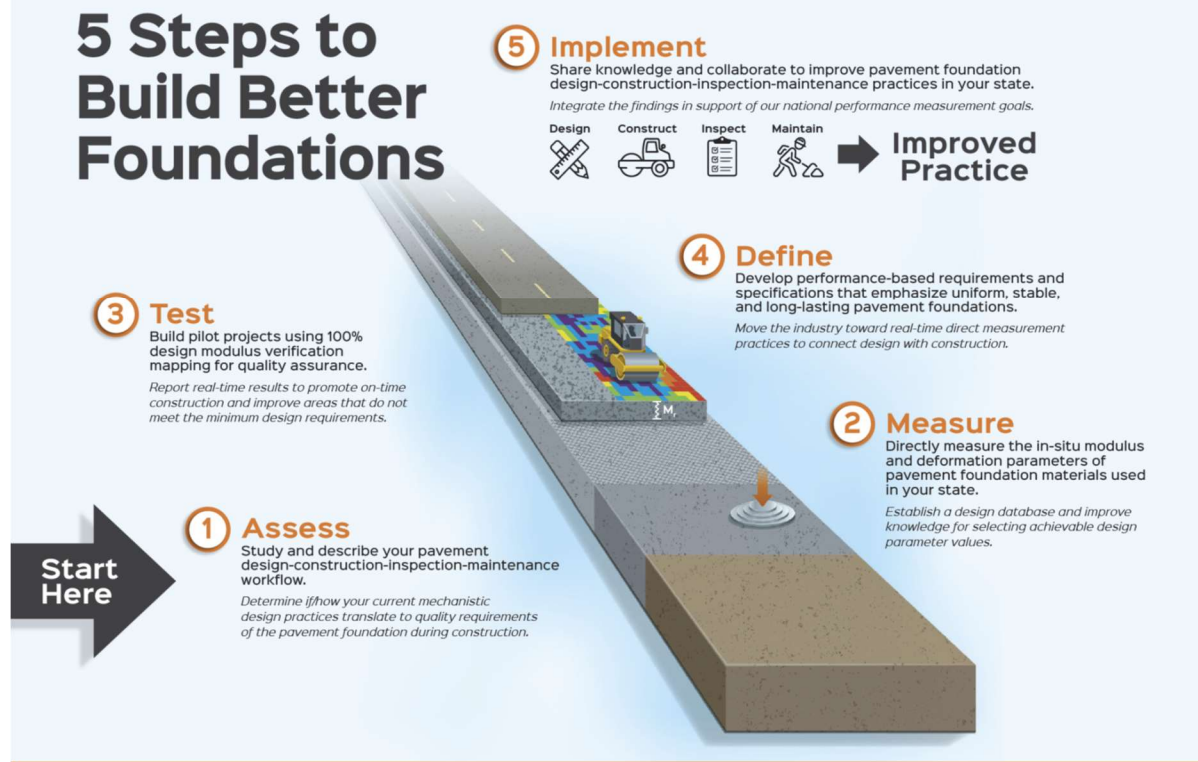
Technology Brief

Roadmap for Long-Life Pavements

Sustainable Pavements are only possible by starting with quality foundations.

Our nation needs pavements that will last longer. The key to improving pavement performance is building quality foundations and ensuring that they meet the design requirements at the time of initial construction. Integrating direct measurement of critical pavement design inputs into the pavement construction workflow reduces the owner's risk and eliminates unnecessary repairs in the future.

5 Steps to Build Better Foundations



Critical Needs

A disconnect exists between the inputs used in modern pavement design and the quality acceptance requirements during construction.ⁱ It is critically important to link these requirements. **97% of state DOTs want more effective quality acceptance (QA) technologies** for pavement foundations,ⁱⁱ and there is broad national interest in modernizing pavement foundation specifications and construction practices.ⁱⁱⁱ

ⁱ White, D.J., P. Vennapusa, and B. Cetin. Improving the Foundation Layers for Concrete Pavements: Lessons Learned and a Framework for Mechanistic Assessment of Pavement Foundations. National Concrete Pavement Technology Center and Center for Earthworks Engineering Research, Institute for Transportation, Ames, IA.

ⁱⁱ National DOT Survey Findings and Results: Accelerated Innovation Deployment (AID) Demonstration Project: Increasing Pavement Performance through Pavement Foundation Design Modulus Verification and Construction Quality Monitoring Interim Report February 26, 2021.

ⁱⁱⁱ FHWA. Accelerated Implementation and Deployment of Pavement Technologies 2019–2020 Annual Report. Federal Highway Administration, Washington, D.C.

About Ingios

Ingios partners with state agencies and academic collaborators to improve engineering and construction solutions by bringing state-of-the-art into practice. Learn more about our capabilities and projects at www.ingios.com



COMP-Score RT Operator Training

The following slides presentation was presented to the Engineers and Contractors on the specific activities for modulus mapping with the instrumented roller.



COMP-Score® RT Operator Training

Kera Gieselman
Ingios Geotechnics, Inc.
kera.gieselman@ingios.com
319-238-3825

Colby Van Nimwegen
Ingios Geotechnics, Inc.
colby.vannimwegen@ingios.com
515-230-7580

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AGENDA

- Objectives
- COMP-Score® RT
 - ✓ Hardware & Components
 - ✓ Settings & Operator Interface
 - ✓ Performing a CRT Map
 - ✓ Rolling Patterns
- Using RT for Modulus Verification

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OBJECTIVES

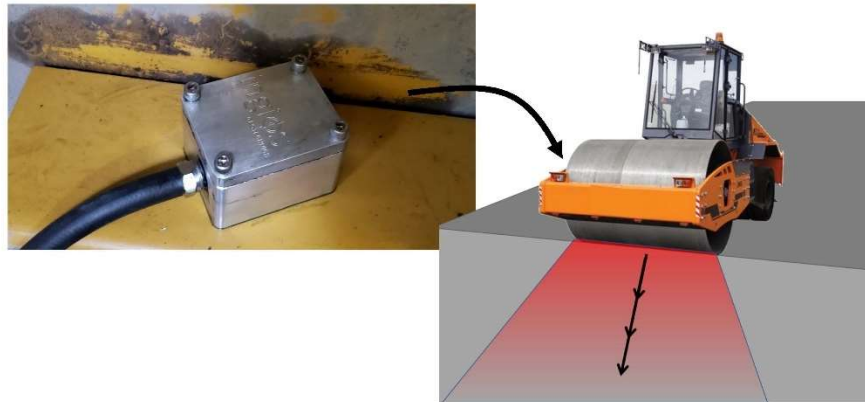
1. Learn about RT technology and how to perform mapping operations
2. Gain knowledge to perform maps to satisfy the special provision.
3. ****Demonstrate basic knowledge with completing RT workshop activity****

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The RT Hardware Kit:

Vibration sensor mounted on the drum is used to measure compaction quality



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The RT Hardware Kit:

RTK compatible GPS antennas to measure vertical and horizontal position within about 1 inch.



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The RT Hardware Kit:

Onboard computer and interactive monitor to provide real-time display of compaction quality on an aerial map.



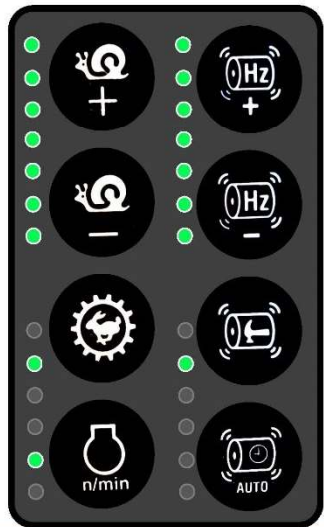
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Step 1: Turn on Roller and allow it to warm up for 1-2 minutes BEFORE booting up computer.



Step 2: Verify correct roller vibration and speed settings. Data will NOT be recorded if the system is not within the correct tolerances!!!



The control panel consists of two columns of buttons. The left column has four buttons: a plus sign with a spring icon, a minus sign with a spring icon, a gear icon, and a speedometer icon labeled 'n/min'. The right column has four buttons: a plus sign with a vibration icon and 'Hz', a minus sign with a vibration icon and 'Hz', a vibration icon with a double-headed arrow, and a vibration icon with a plus sign and 'AUTO'. Green indicator lights are present next to the top three buttons in both columns.

HIGH frequency

LOW amplitude

Autovibration = OFF

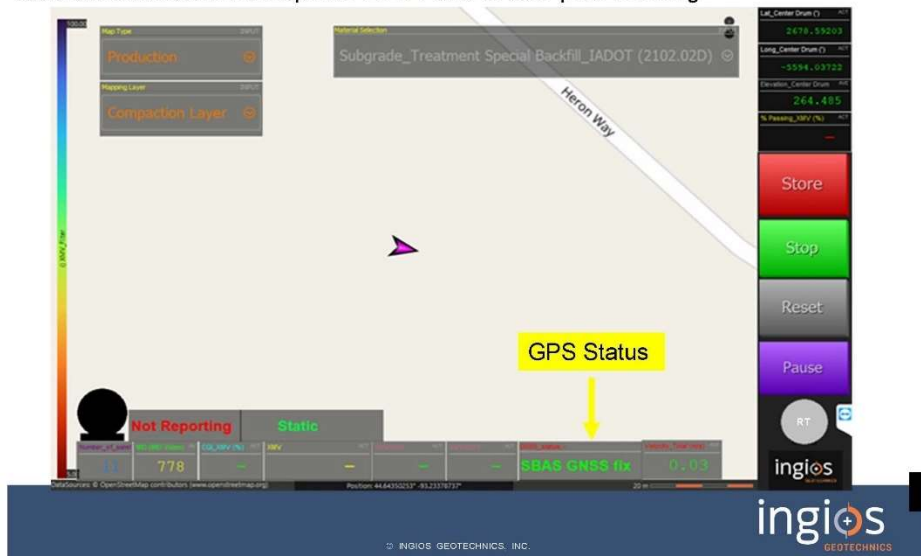
Step 3: Boot up CRT computer. The system will take approximately 1 minute to load to mapping screen.



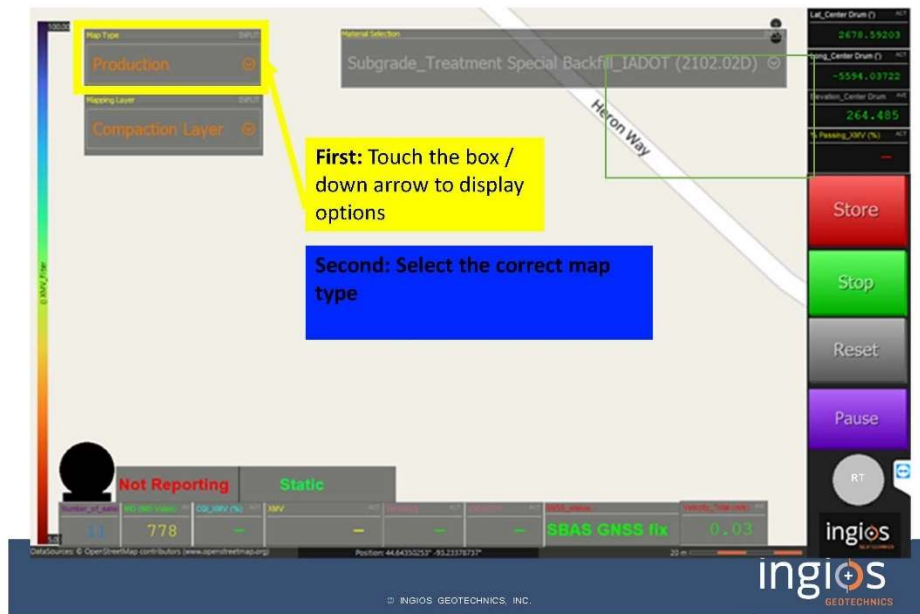
Startup Splash Screen:



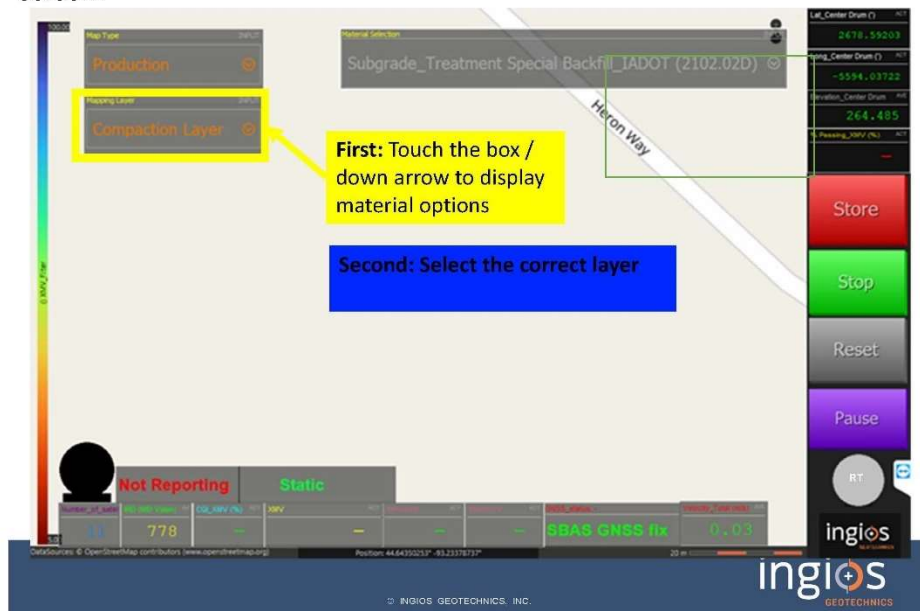
Step 4: The system will automatically open to the map view screen. Verify that the system has acquired accurate GPS fix before proceeding. Do not proceed if GPS status displays "No GNSS fix" or "Standalone". **NOTE:** It can take over 15 minutes to acquire satellites and obtain the required "RTK Fixed GNSS" prior to rolling.



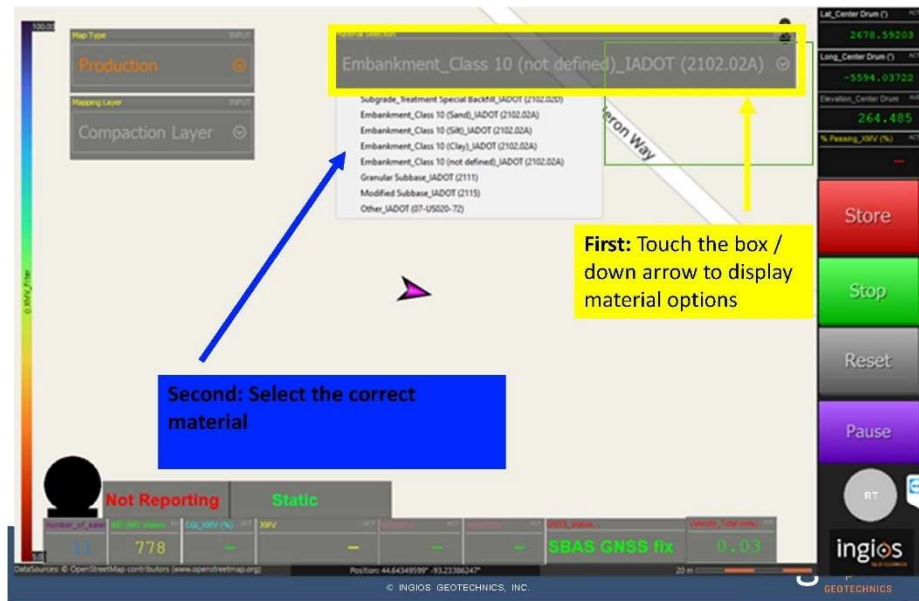
Step 1: Select **Map Type** from the drop-down box in the top left of the screen.



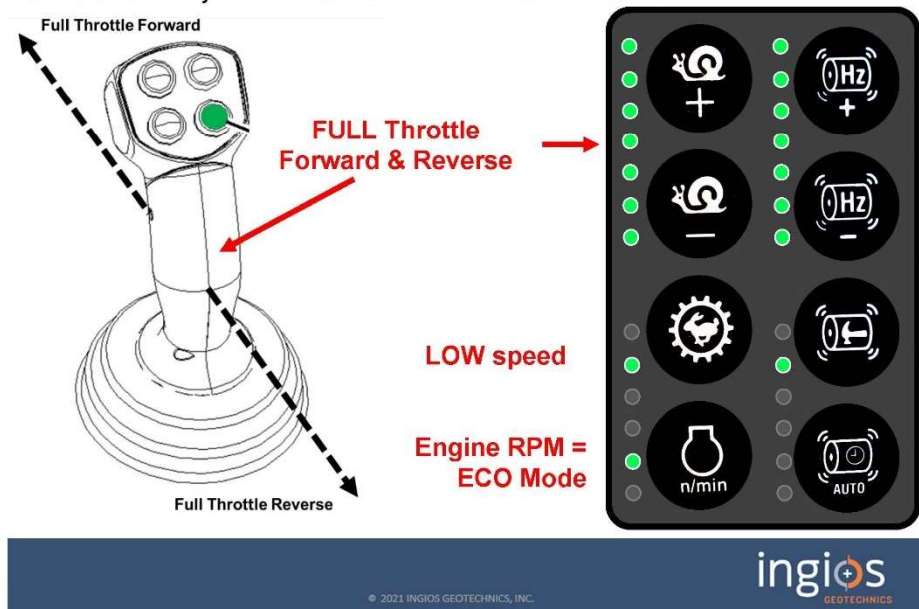
Step 2: Select **Mapping Layer** from the drop-down box in the top left of the screen.



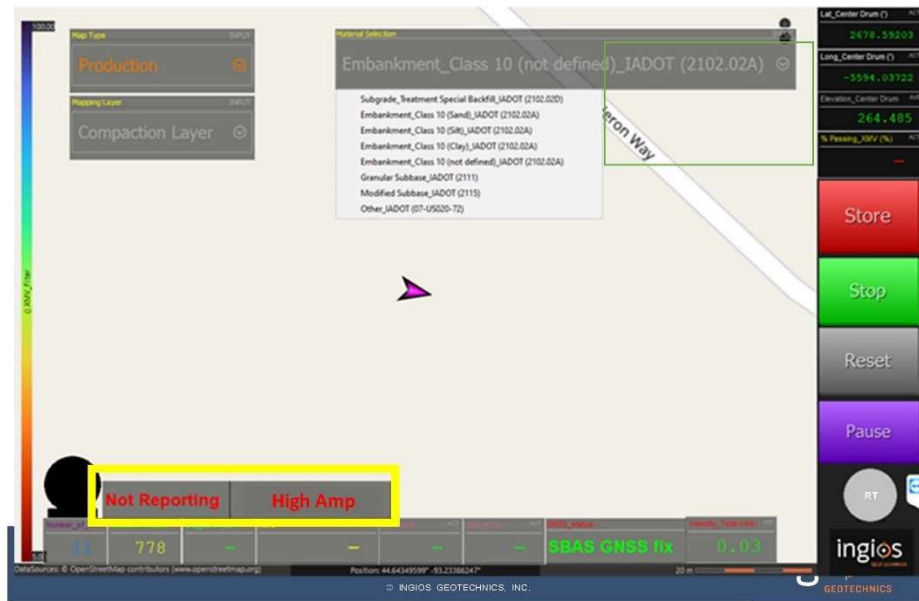
Step 3: Select **Material Type** from the drop-down box in the top right of the screen.



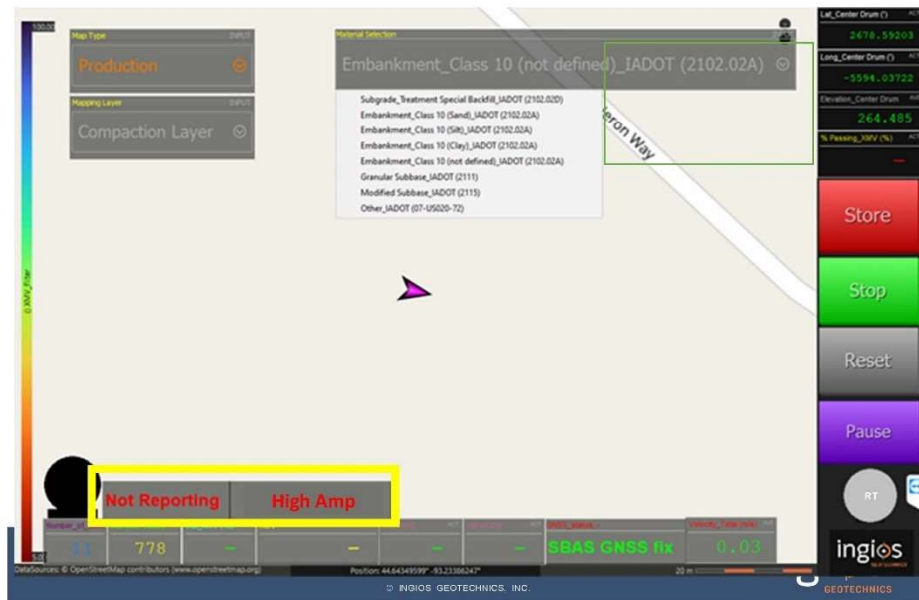
Step 4: Verify correct roller vibration and speed settings. Data will NOT be recorded if the system is not within the correct tolerances!!!



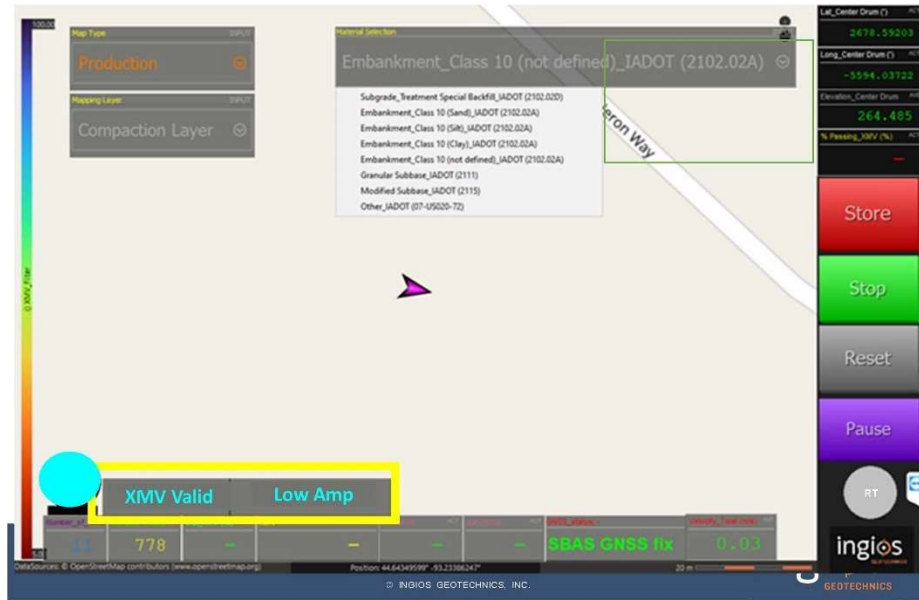
Step 4 cont: Verify correct roller vibration and speed settings. **Roller is not vibrating.** Data will NOT be recorded!!!



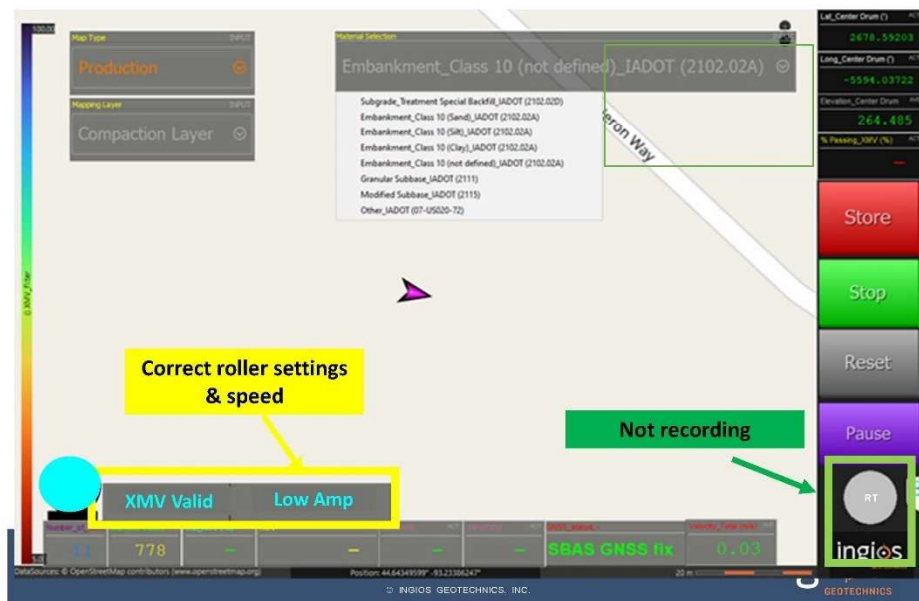
Step 4 cont: Verify correct roller vibration and speed settings. **Roller is currently set to High Amplitude Vibration.** Data will NOT be recorded!!!



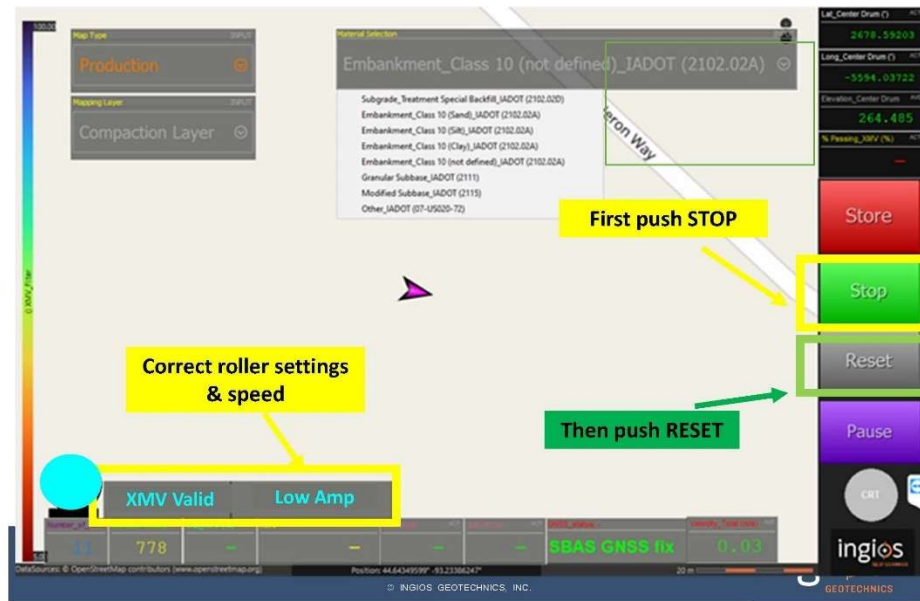
Step 4 cont: Verify correct roller vibration and speed settings. **Roller settings are correct and vibrating in low amplitude.**



Step 4 cont: Roller can now be used for production work or to beginning mapping. Example of production work / rolling.



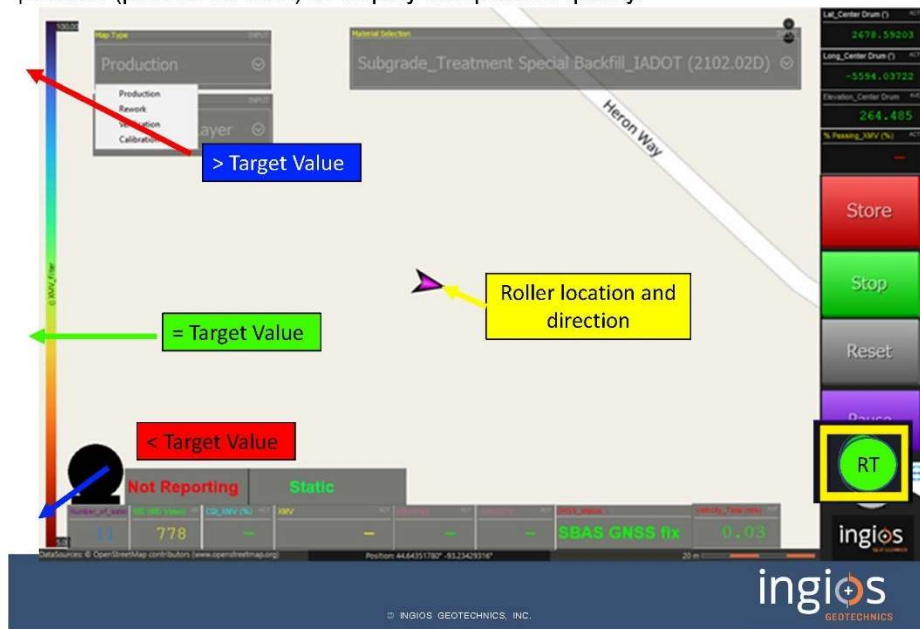
Step 4 cont: Display can be cleared of production rolling by stopping the roller then pushing the **Stop** button followed by pushing the **Reset** button.



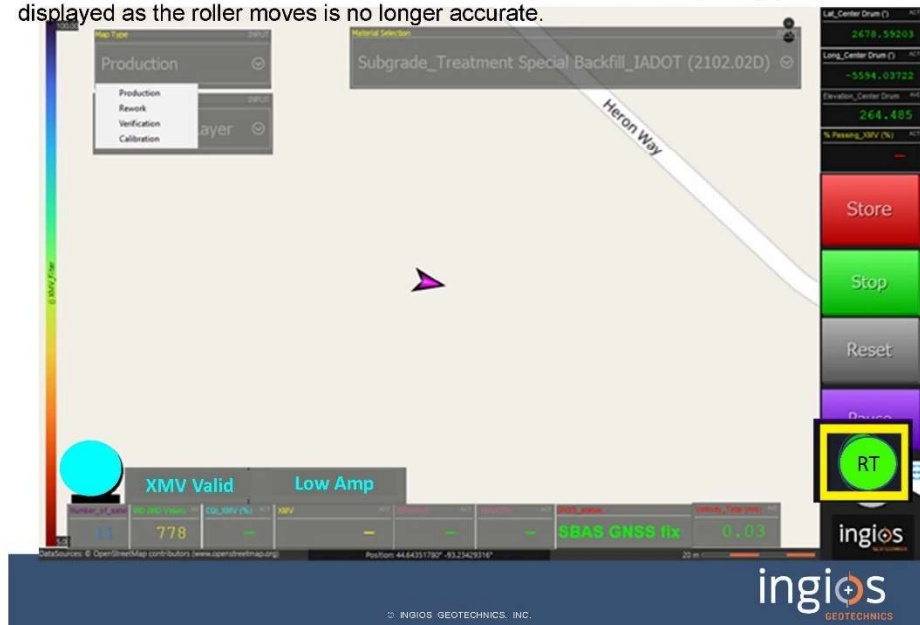
Step 7: Initiate a map using the RED Store button on the touch screen.



Step 8: Start rolling. Colorized tracking lines will appear behind the roller position (pink arrow icon) to display compaction quality.



Step 9: "XMV Valid Low Amp" will be displayed with a blue circle, only if roller is at the correct speed and settings. The circle will be black, shows "Not Reporting", and the color displayed as the roller moves is no longer accurate.



Step 10: Stop the map once the full mapping area has been covered by hitting the green stop button.

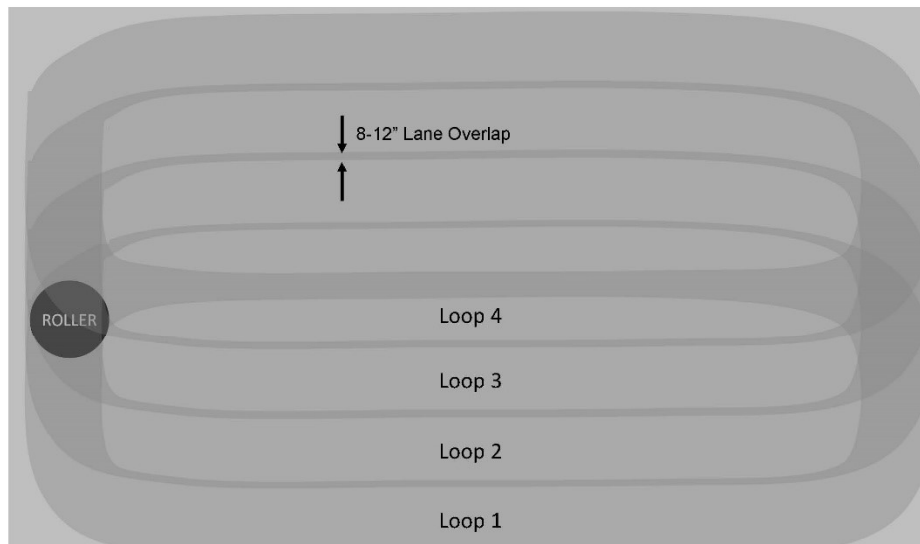


Step 10 cont: Wait for the map file to successfully upload to the cloud. Once the "Run File is Uploading" notification disappears, the file has been successfully uploaded.



Map the area using this recommended rolling pattern:

The rolling pattern is a series of forward moving offset loops to cover a large area efficiently.



Training Agenda

- Objectives
- Comp-Score Real Time
 - Hardware & Components
 - Roller Settings & Operator Interface
 - Performing a RT Map
 - Rolling Patterns

➤ Using RT for Modulus Verification-Project Specific

Compaction 101

4 main process control elements that affect compaction quality:

1. Moisture Content
2. Compaction Energy
3. Lift Thickness
4. Soft Underlying Layer

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