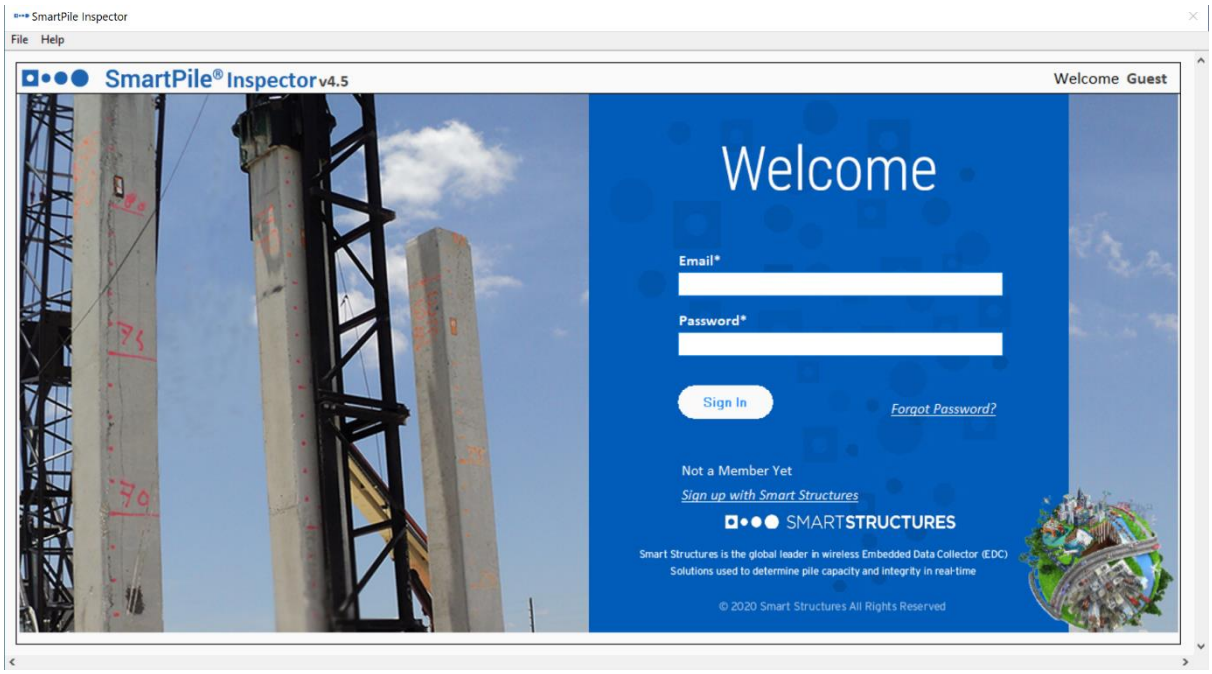
SMARTSTRUCTURES

INFRASTRUCTURE CONNECTED

SmartPile® Inspector

Handbook



Note: This handbook is intended to provide a high-level overview about SmartPile® Inspector application offered by Smart Structures. For more details on the product or updates, please refer to the latest SmartPile® Inspector User Manual.

SMART STRUCTURES

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1. Introduction

SmartPile® Inspector is an IoT-based, versatile, machine-learning application that is bound to change the way you experience any pile driving activity. It is a single platform for acquiring, recording, reporting, and connecting information.

- Data Driven Decisions
  - Driving Criteria based alerts in real time on the screen.
- Data Quality
  - AI/ML based advanced blow detection algorithms.
- Data Storage
  - Real-time recording, analysis, and backup of the operation data.
- Data Integrity
  - Completely automated FDOT-compliant pile driving logs, eliminating paperwork hassle and manual errors.

2. Operation

a. SmartPile Audio Sensor:

i. SmartPile® Audio Sensor is required to connect to the workstation prior to opening the application.

ii. Please note that the "Data Acquisition" tab under SmartPile Inspector application cannot be started until the SmartPile® Audio Sensor is connected and detected by the tablet/laptop/workstation.

b. SmartPile Inspector (SPI) Application:

i. Ensure that SPI application is installed, and the user is logged in prior to going to the job site.

ii. It is always recommended that workstation/tablet/laptop used for SPI is fully charged.

3. Project Information

a. Project Details:

i. Inspector can create a new project under project information section by clicking ---Add New--- or can select an existing project from the dropdown.

b. Structure Details:

i. Under that project tab, once Project is selected corresponding Structures are populated in Structure's dropdown, user can either select one or create a new Structure by clicking –Add New—in Structure's dropdown

c. Substructure Details:

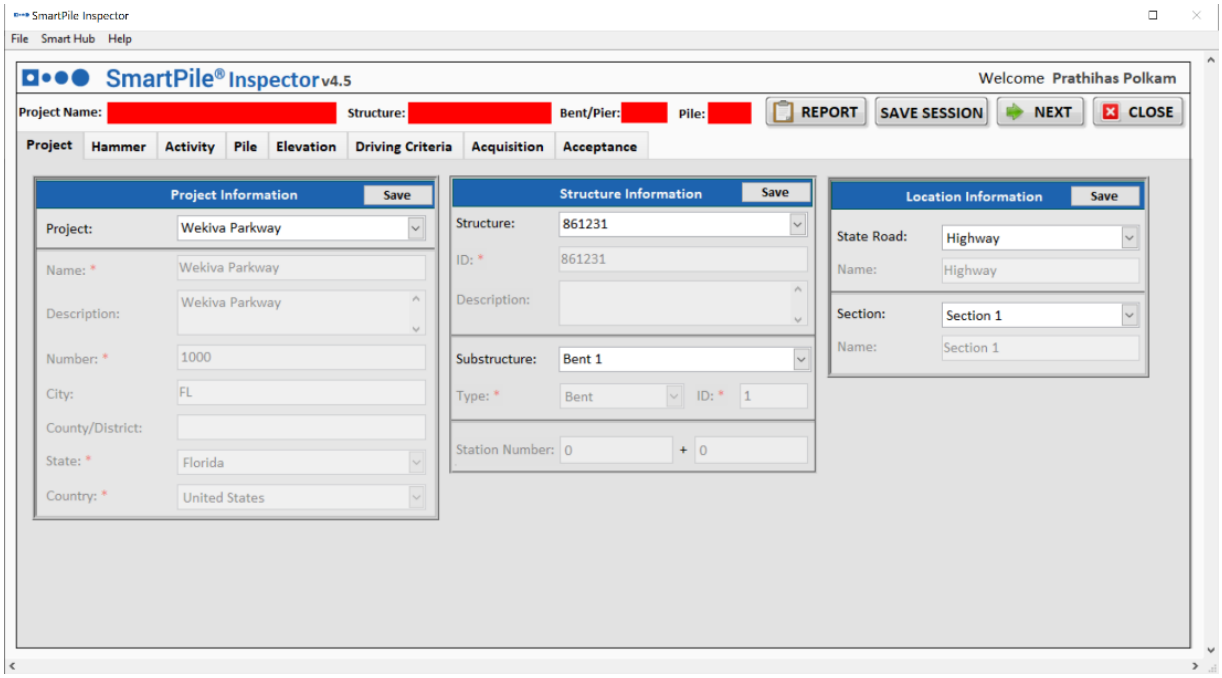
i. Once Project and Structure is selected corresponding Substructures are populated in Substructure's dropdown, user can either select one or create a new Substructure by clicking –Add New—in Substructure's dropdown

d. State Road:

i. Under Project Tab, once Project is selected corresponding State-Roads gets populated, user can either select one or create a new State Road by clicking –Add New—in State-Road dropdown

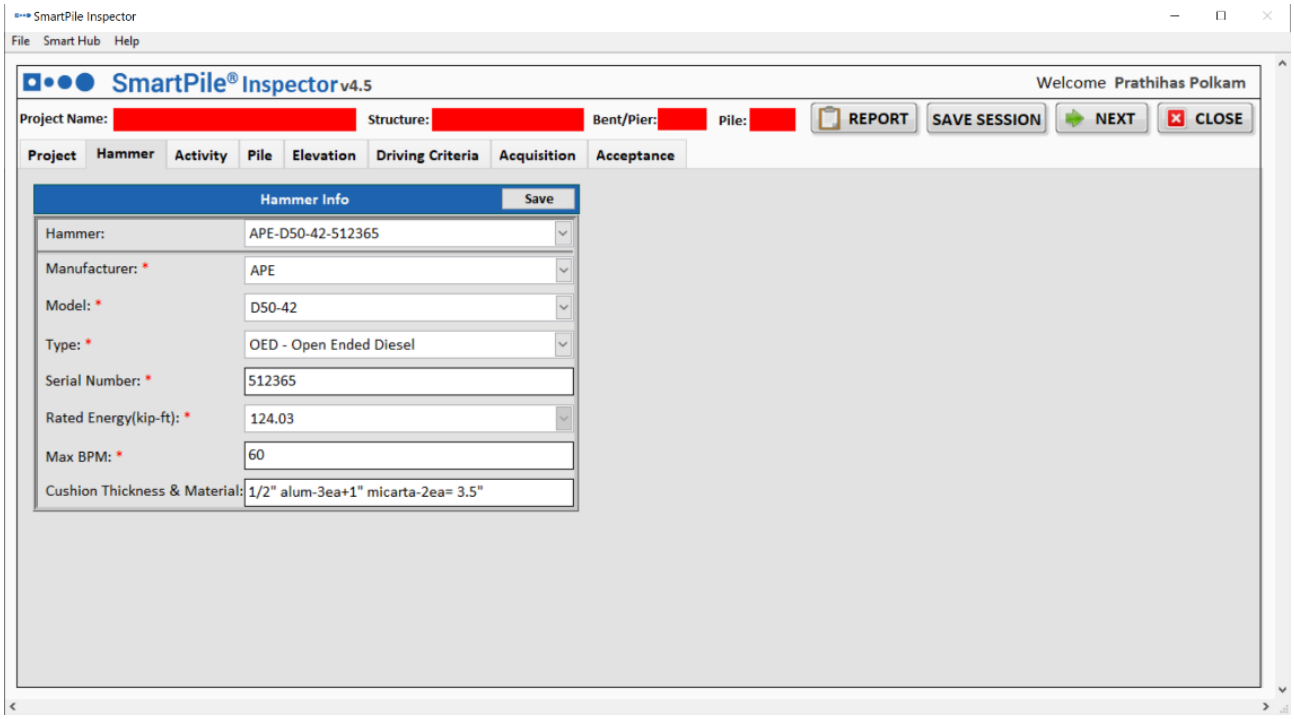
e. Section:

i. Once Project and State Road is selected corresponding Sections are populated in Section's dropdown, user can either select one or create a new Section by clicking –Add New—in Section dropdown



4. Hammer Information

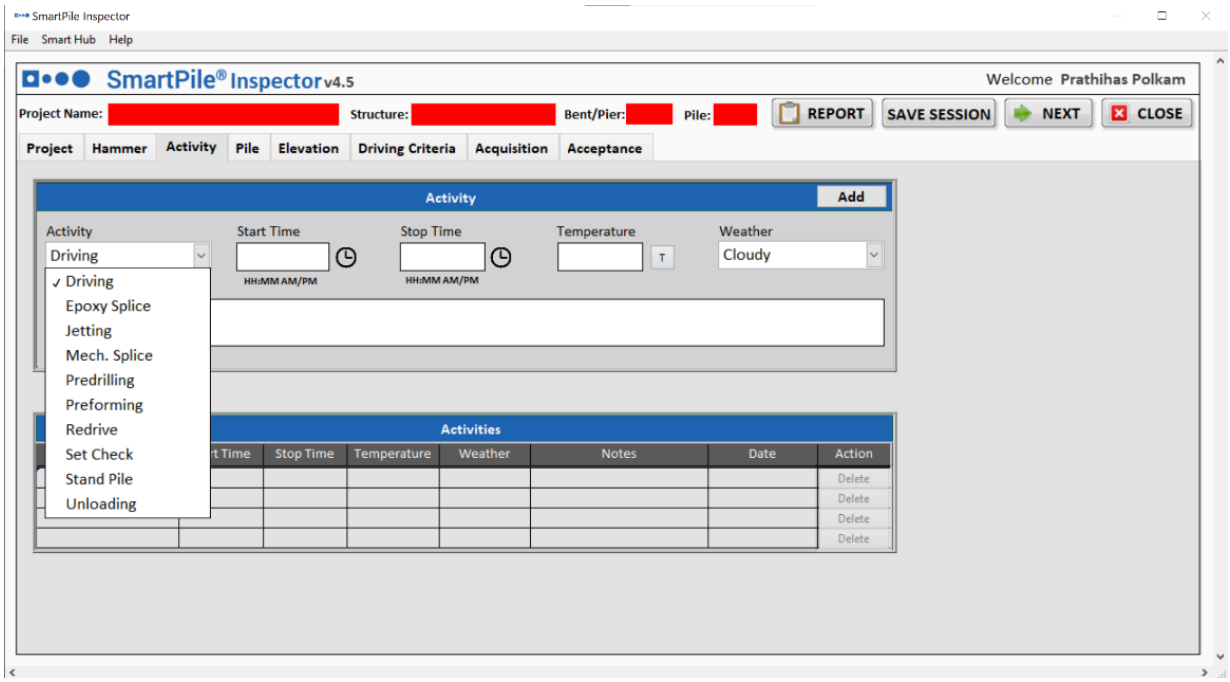
a. Under Hammer Tab, select –Add New Hammer—, pick a Manufacturer from the drop-down, corresponding Models with that Manufacturer will be listed in Model dropdown. Select a desired model, that will auto-populate related energy, Max BPM (which can edit it if needed)
b. Enter Serial Number
c. For non-OED Hammers, select corresponding Input Value, which will be entering manually during Pile Driving.
d. Enter optional Cushion-thickness and material as needed.
e. The above steps are typically done one time at the beginning of the project. Once the hammer is setup in the local device, user can directly choose it from the Hammer drop down and corresponding details will be displayed in the below fields.



5. Pile Activity Information

a. Under Pile Activity tab, Select Activity from the drop down and enter the Start Time, Stop Time, Temperature, Weather and Notes, then hit **Add**. Newly added activity will appear in the Activities Table below.

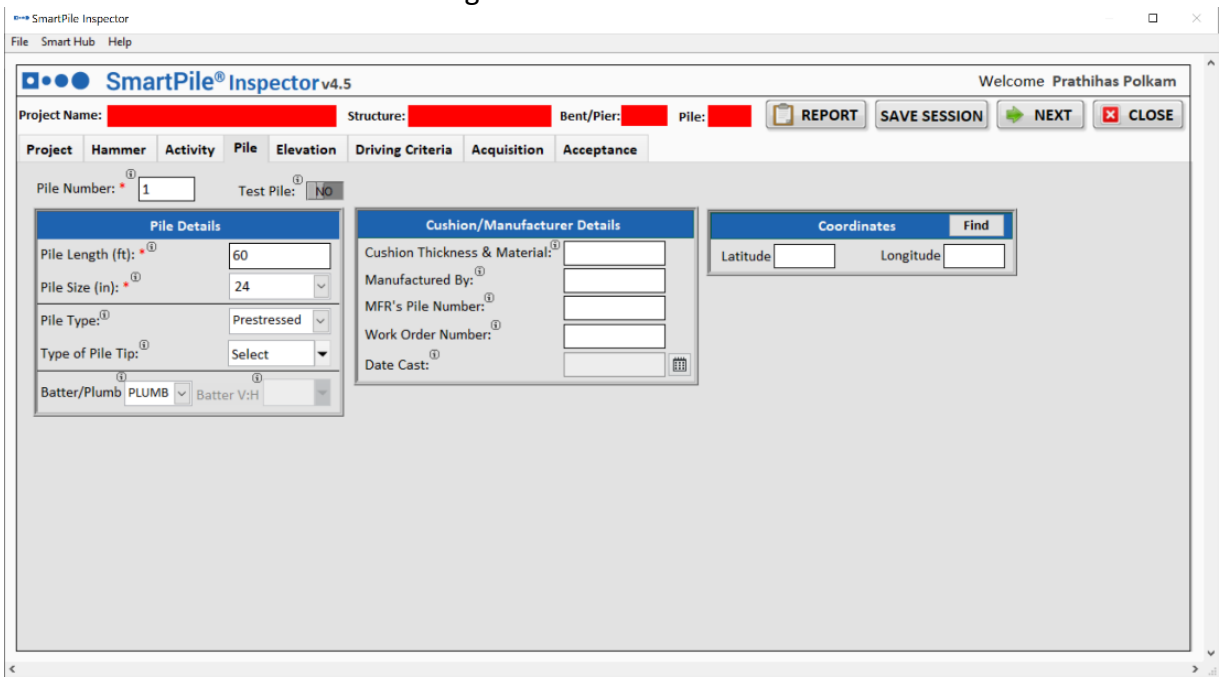
b. When the device is connected to internet user can get the Temperature automatically populated by clicking on the (T) button next to the Temperature field. User can also enter the Temperature manually if needed.



6. Pile Information

a. Enter Pile Information (from Pile Installation Plan and/or markings on the pile)
   i. Pile Number (e.g., Pile 3)
   ii. Length (ft) – actual/authorized pile length (including any splice) (e.g., 76 ft)
   iii. Pile Size (e.g., 24”)
   iv. Pile Type (e.g., SQ PCP)
   v. Manufactured By
   vi. MFR’s Pile Number (e.g., MK-10)
   vii. Date Cast
   viii. Work Order Number
   ix. Pile Cushion Thickness & Material
   x. Batter/plumb

b. When the device is connected to internet user can get the Pile Location automatically by clicking on **Find** button or else Inspector can manually enter the Latitude and Longitude fields.



7. Elevation Information

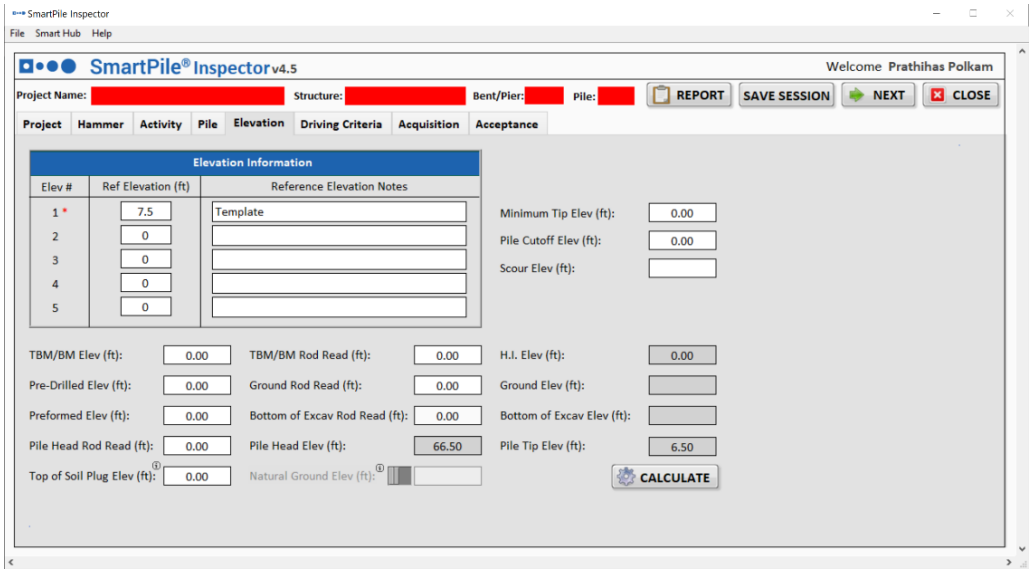
a. SPI handles multiple reference elevations (up to 5). However, at least one reference elevation information needs to be entered at minimum to continue with data collection/acquisition.
   i. Reference Elevation(ft) (obtain from contractor or surveyor)
   ii. Reference Elevation Notes (e.g., “Template” or “String line”)

b. Elevations from the plans:
   i. Minimum Tip Elevation(ft)
   ii. Pile Cut-off Elevation(ft)
   iii. Scour Elevation(ft)

c. Other Elevation information:
   i. TBM/BM Elevation(ft)
   ii. TBM/BM Rod Read Elevation (ft)
   iii. Pre-Drilled Elevation(ft)
   iv. Ground Rod Read Elevation(ft)
   v. Preformed Elevation(ft)
   vi. Bottom of Excav Rod Read Elevation(ft)
   vii. Pile Head Rod Read Elevation(ft)
   viii. Top of Soil Plug Elevation(ft)
   ix. Natural Ground Elevation(ft)

d. Calculated Elevations, when you hit on Calculate button these will be calculated based on Pile Length and other Elevation information entered. If needed, Inspector can overwrite Calculated values.
   i. H.I. Elevation(ft)
   ii. Ground Elevation(ft)
   iii. Bottom of Excav Elevation(ft)
   iv. Pile Head Elevation(ft)
   v. Pile Tip Elevation(ft)

e. After **the pile driving is completed,** the calculated elevations will be automatically updated based on Final Tip Elevation.



8. Driving Criteria

a. Toggle **Driving Criteria ON/OFF** as deemed necessary.

i. Driving Criteria Information

1. Configure Stroke Range, such that SPI alerts inspector during Pile Driving if Calculated Stroke is not within range.
2. Add Driving Criteria Note.

ii. **Cushion Change**

1. Configure the number of blows after which the Pile cushion needs to be changed, application will give an alert after configured blows are recorded.

iii. Cut-Off Elevation

1. Enter Cut-off Warning Range - value for how many feet the pile head can be above cut-off before issuing an alert or warning.

iv. Bearing Resistance

1. If applicable, select Bearing Method and enter Bearing Resistance required. SPI will calculate the Bearing Resistance during Pile Driving.

v. Practical Refusal

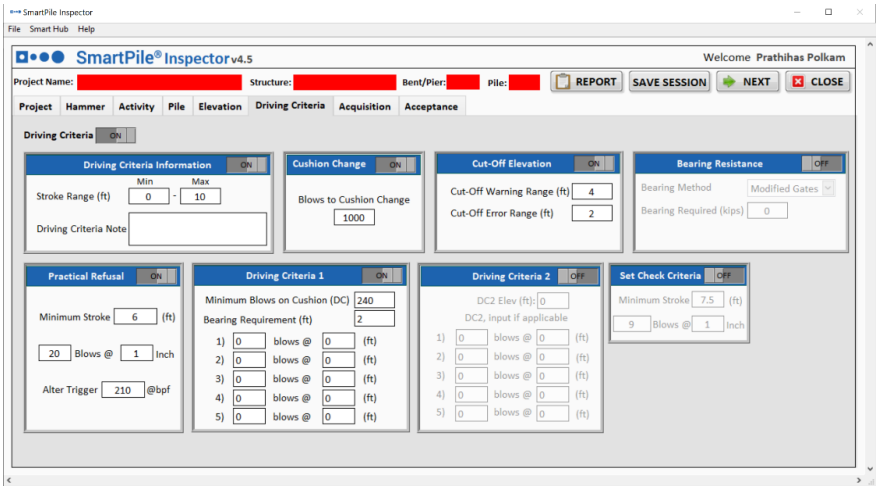
1. Minimum stroke for practical refusal.
2. Alert Trigger: Blows per foot value, it will alert user accordingly during drive with 1 foot increment.
3. Acceptance Criteria: Number of blows per inch, it will alert user accordingly during Set check drive per inch.

vi. Driving Criteria

1. Enter Driving Criteria 1 information such as number of blows at specified stroke as mentioned in the Driving Criteria Letter, such that system can alert the Inspector during pile driving if the criteria is met.
2. In extremely rare case, when there are two Driving Criteria's specified in the Geotech report based on the pile tip elevation "Driving Criteria 2" option can be enabled and used.

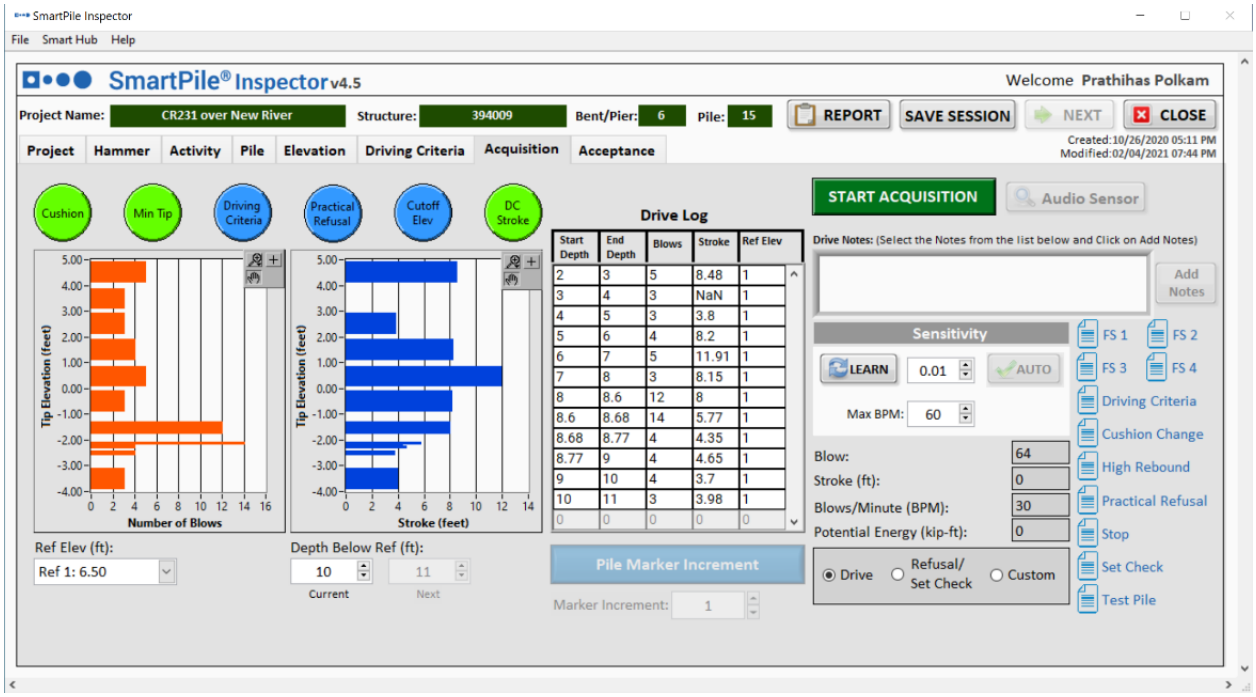
vii. Set Check Criteria

1. Based on Minimum Stroke configured, and blows required per inch it will alert inspector during Pile Driving if the set check criteria are met.



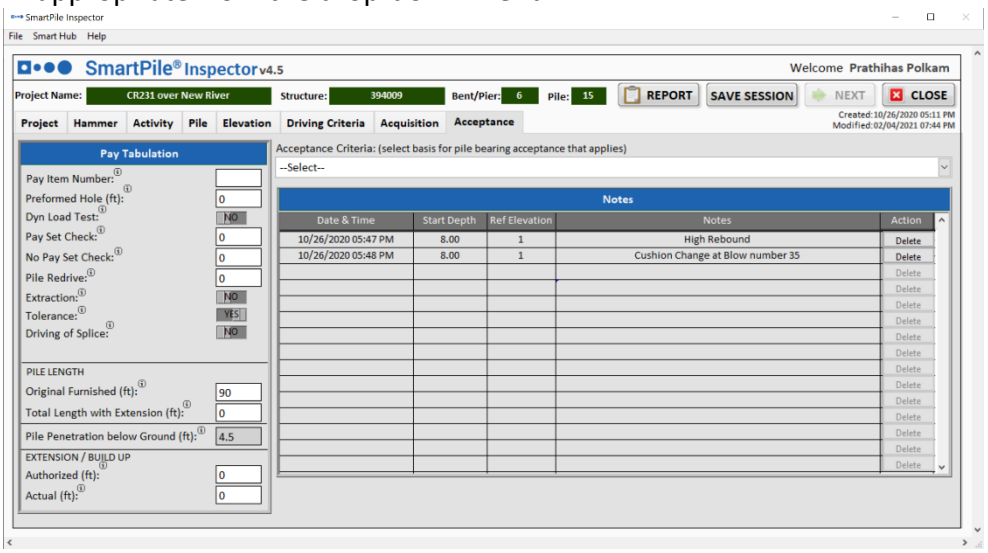
9. Acquisition

a. Select Reference Elevation from drop-down menu if necessary. By default, Reference Elevation 1 from the Elevations tab is applied.
b. Enter Depth Below Reference for Current.
c. By default, the **Drive** mode is selected for pile marker increment which defaults the pile marker increment to 1 foot. When mode is changed to **Set Check** the pile marker increment updates to 1 inch increment.
d. When ready to start, Hit Start Acquisition.
e. Start Acquisition button will be disabled if user does not enter the Project Name, Structure Number, Bent/Pier Number and Pile Number as these are the Mandatory requirements to start the Acquisition.
f. Hit Learn when hammer hits pile to set trigger value.
g. If Auto button is enabled, the Sensitivity gets updated based on the blow's detection.
h. After each blow, data is saved automatically.
i. During pile driving at each increment, Hit Pile Marker Increment.
j. Drive notes When appropriate, click on button for F1 Fuel Setting, F2 Fuel Setting, F3 Fuel Setting, F4 Fuel Setting, Driving Criteria, Cushion Change, High Rebound, Practical Refusal, Stop, Set Check, Test Pile. Inspector can manually enter the notes in free form text and click on **Add Notes** button, it will be added to that depth
k. Change Marker Increment Value if necessary. This is usually necessary when pile driving is started at foot marker which is not a whole number (example, 19.18 ft. So, setting the marker increment at 0.82 would represent penetration 19.18 ft. – 20 ft.)



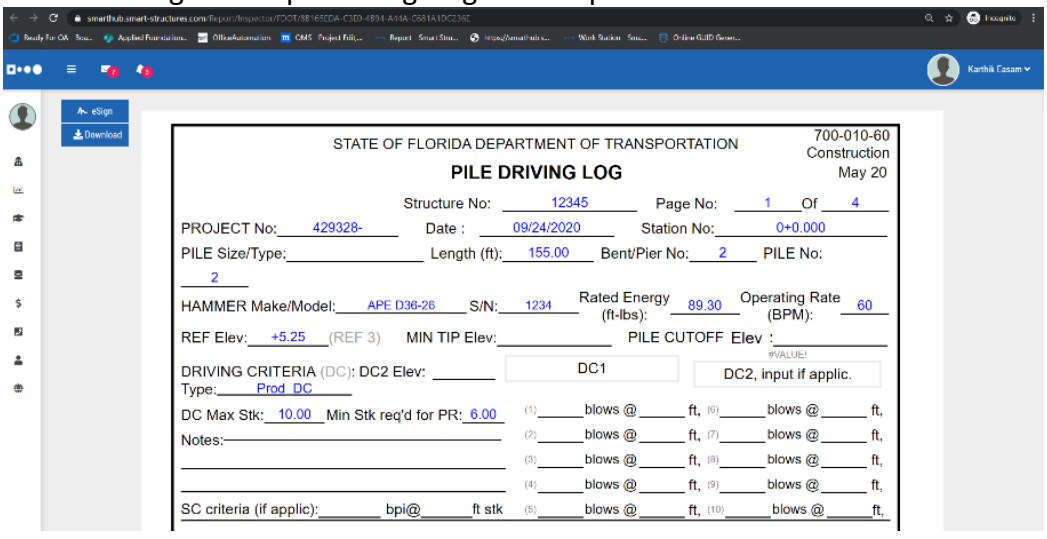
10. Notes

a. Check the date-time and start-depth of each drive note and edit the notes if deemed necessary.
b. User can add Manually by entering all input, Date Time, Start Depth, Ref Elevation, Notes.
c. When pile driving is completed for pile, Select/Type Acceptance Criteria as appropriate from the drop-down menu.



11. Generate Report

a. Click on Report button on top right of the Application.
    - Please make sure you are connected to internet before you click on Report Button.
b. On click Download, a PDF report will be generated and downloaded to local.
c. User can e-sign the report using eSignature option.



Smart Structures Support

For any other Software or Hardware related issues, you can reach out directly to Smart Structures Support by phone at 561.988.0070 or by email at: **support@smart-structures.com**