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SURFACE SYSTEMS & INSTRUMENTS, INC. smoothroad.com

Custom Test Equipment • Mobile Technology Solutions • Inertial Profilers • ADA Compliance • FF/FL Testing

SurfPro Operation Manual

Floor Flatness and Floor Levelness Software and Equipment

Version 1.0.1.3.

The SurfPro software was created exclusively for use with CS-8800 WalkPro and CS-8900 Sidewalk profiling equipment.

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1.0 Overview

Surface Systems and Instruments' SurfPro software is used to collect Floor Flatness (F_F) and Floor Levelness (F_L) numbers for surfaces. The SurfPro software has many features that expedite the process of calculation. The Visual Editor lets the operator simply draw out a section while it also displays the desired test run formation and location, compass direction, and an overview of all created surfaces. Yet it is not necessary for the user to enable the Visual Editor; the operator can perform pre-profiling profiling calculations manually. For this reason it is recommended that the operator of the software is knowledgeable in both aspects of the Visual Editor functions and manually preparing the surface properties for profiling, along with all the other useful features of the software.

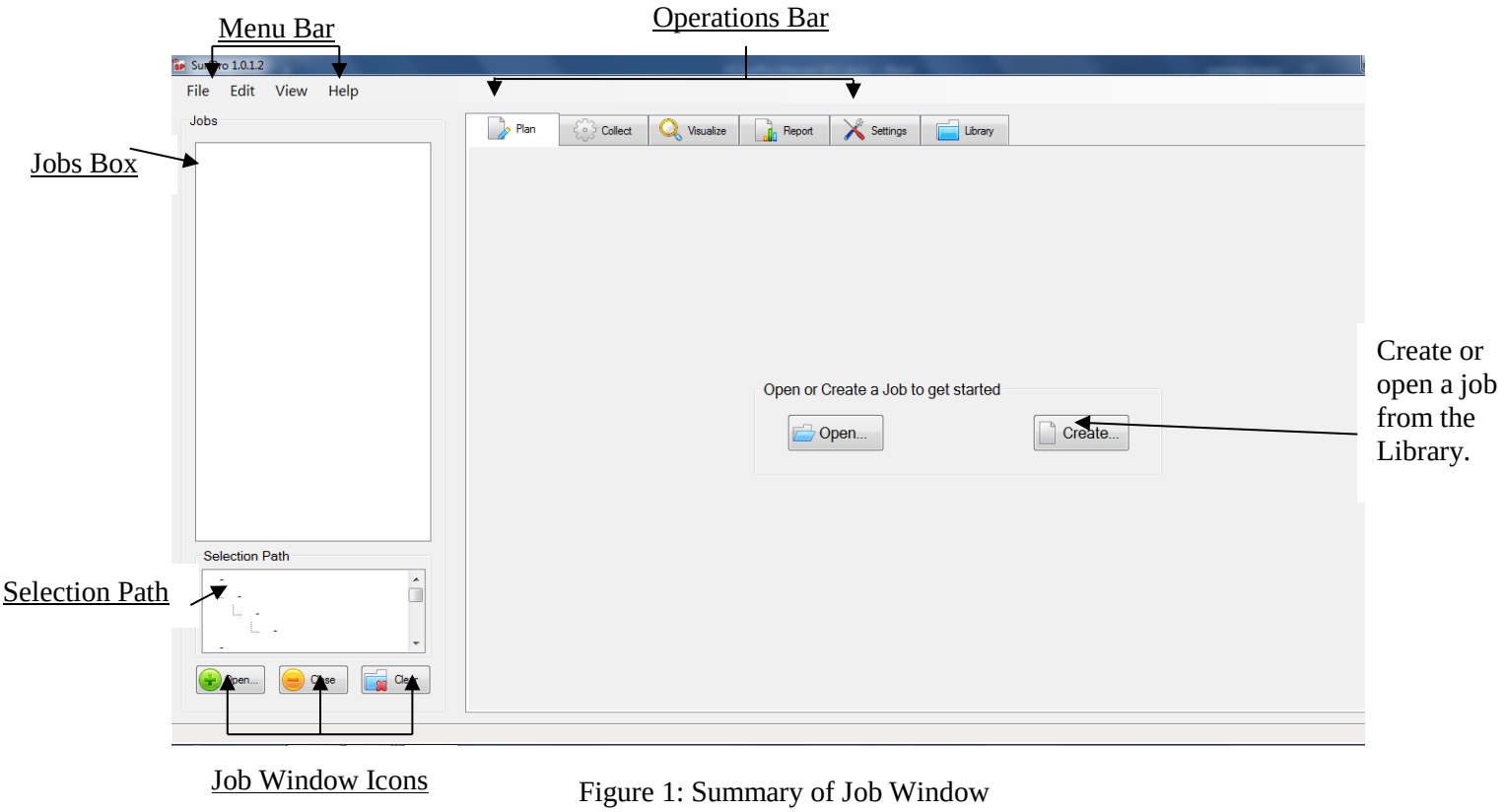


Figure 1: Summary of Job Window

1.1– Jobs Box

The Jobs box always displays the job title of current job files. If a surface has been created for the job file, a double-left click of the job title will force the surface title to appear. This routine is also the same for sections and runs. Double-left click to hide or show a level of a job file. Another option to hide or show levels is to click on the plus (+) or minus (-) sign to the left of the above levels title.

1.1.1. – Right Clicking on a Job Within Jobs Box

When the user right clicks on a file within the Jobs Box, three options appear in the window: Rename, Delete, and Properties. The command only applies to the Job, Surface, Section, or run that was right clicked upon. When right clicking over the Jobs and Runs of the file, choosing Properties is not an option.

Rename

To rename the level that was selected and right-clicked upon, type the new title into the window that appears after selecting the rename option. To save the change, click "OK".

Delete

To delete the level selected and everything beneath said level, select delete after right clicking the level title.

If a file is deleted unintentionally, do not save the changes and clear the Jobs Box or delete the job file from the Job Box by the right click option. When prompted to save the changes to the job select "No." Once the job is not shown in the Jobs Box, import the job file again. The job file will be loaded according to the last save action of the file.

Properties

Right Click for properties. Within the properties option the user may change:

- The name,
- Flatness and levelness specs,
- The name and dimensions of a section.
- The construction date

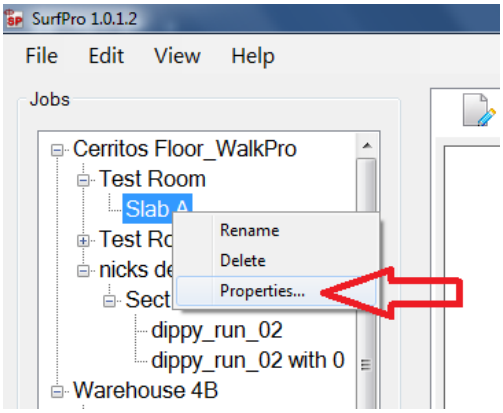


Figure 2: Right click for properties Window.

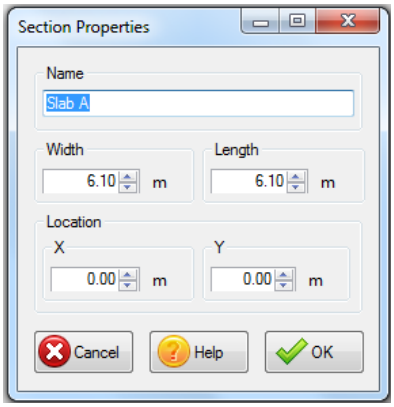


Figure 4: The Section Properties Window.

Note that the properties of the Job and the run cannot be accessed. Only properties of sections and surfaces can be accessed.

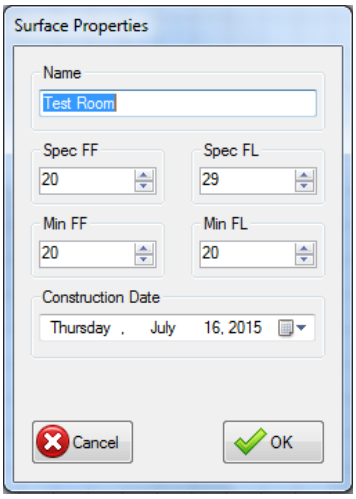


Figure 3: The Surface Properties Window with the Visual Editor option selected.

Visual Editor Related to Surface Properties

If a job file contains a surface without sections, the properties of being a Visual Surface can change. If the surface has sections associated with it, the option to make the surface a visual surface will not be available. To determine if a surface is visual or not, select the job and navigate to the plan tab. Within the Created Surfaces Box, select the surface in question. If the surface is a visual surface, the visual surface box will be checked. Also, if the surface is a visual surface, when the surface is selected in the Jobs Box, the Plan Tab (in the Operation Bar) will show the visual editor (S.S.I. compass and Grid).

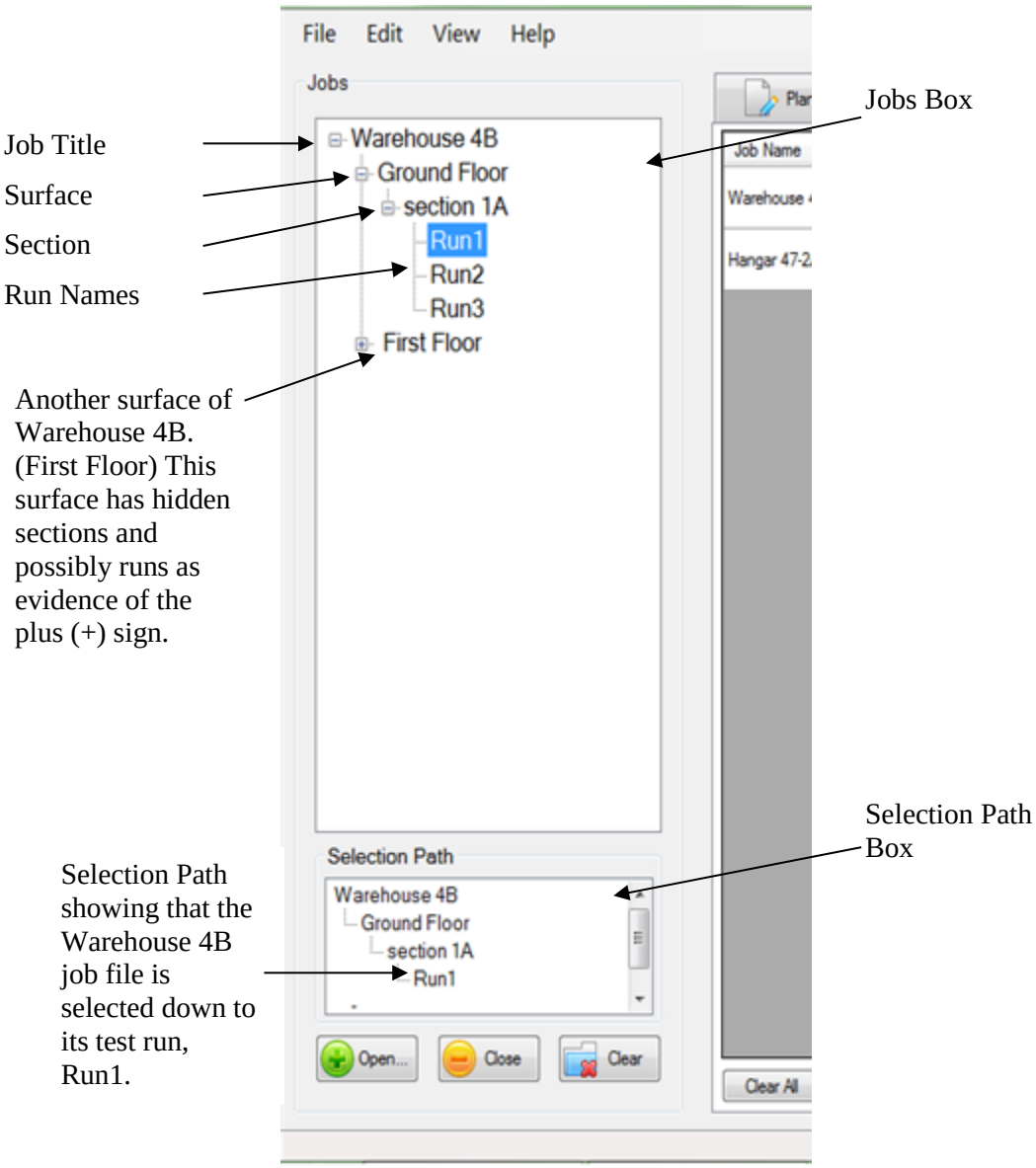


Figure 5: Jobs Box Coordination

1.2 – Selection Path

The Selection Path Box shows the current job file, surface, section, and run displayed within the main window. This feature is useful when collecting and reviewing the data visually so that the operator is aware of the file location. If only the job name is shown in the selection path box, double-left click on the job title to display the areas for the surface, section and run name. The key to understanding the SurfPro layout is to remember the order of the Jobs Box and Selection Path. This order is Job→ Surface→ Section→ Runs.

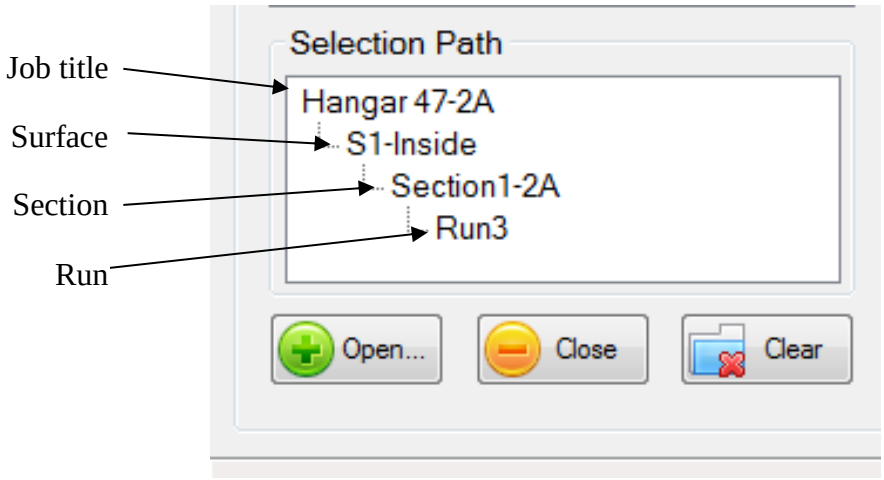


Figure 6: Selection Path Box Layout

1.3 – Jobs Box Icons

1.3.1. – Open

Selecting open loads floor flatness files into the Jobs Box. After selecting open, a windows explorer window opens and allows the operator to navigate to the location of the floor flatness file (.ffl). After selecting the file, the operator must click open to load the file. Files can also be imported by using the File Tab through Open Existing File and by selecting open from the original SurfPro window when there are not current job files in the Jobs Box.

1.3.2. – Close

By selecting close, the currently selected job file is closed and removed from the Jobs Box. If the job file to be closed is unsaved, the program will inquire if the file is desired to be saved.

1.3.3. – Clear

Choosing the Clear icon the Jobs Box is cleared of all job files. If any or all of the job files have unsaved changes, the software asks the operator if the changes would like to be saved.

1.4. – Created Surfaces/Sections Box

Created Surfaces Box is shown when the job title is selected and the user is in the Plan Tab of the Operations Bar. When a surface is selected from the Created Surfaces Box, below the box shows the information of how many sections are in the selected surface and if the surface is a visual surface.

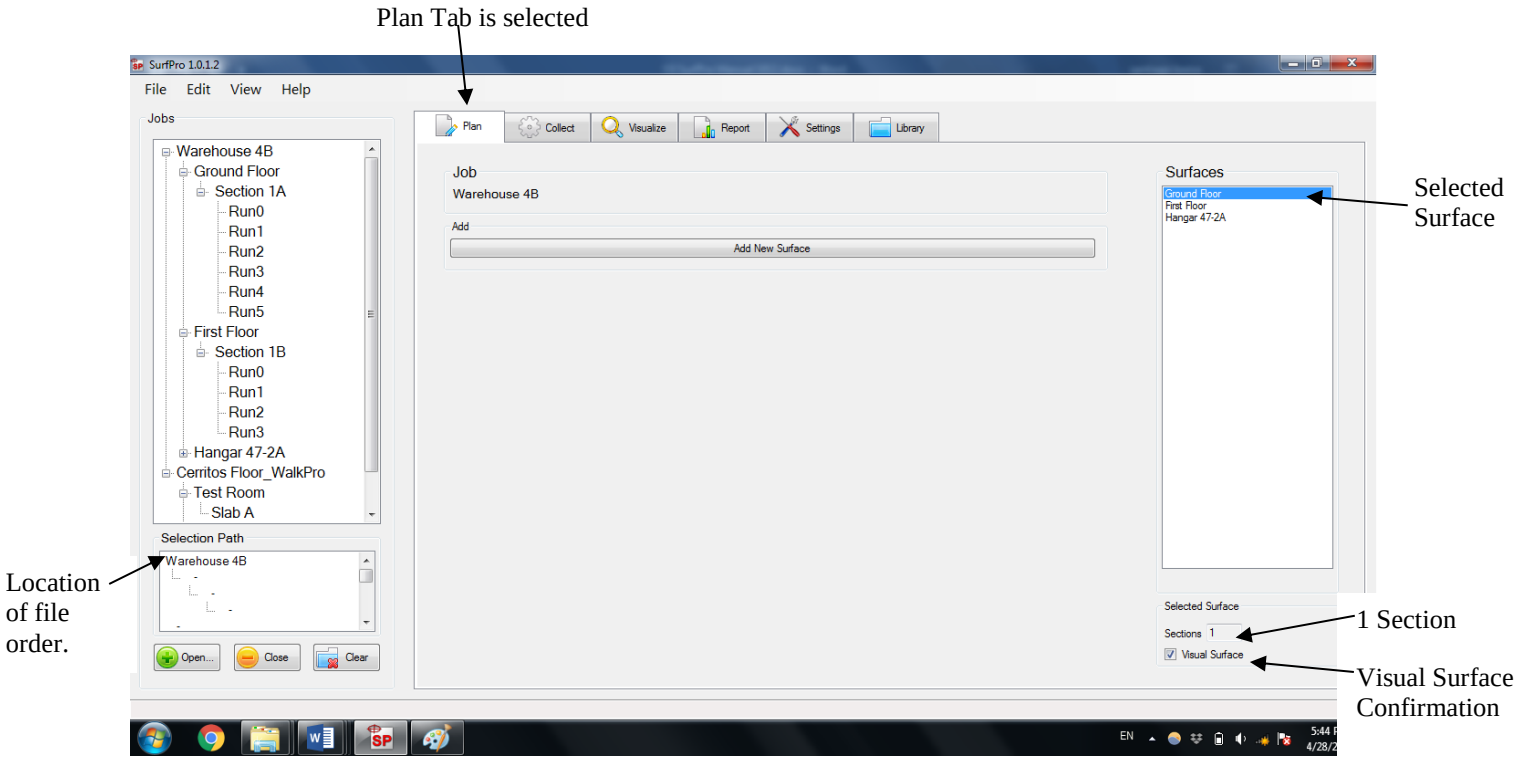


Figure 7: The main Plan Tab window.

Figure 7: The main Plan Tab displays the Warehouse 4B Plan Tab. The selected surface is 'First Floor.' The selected surface has one section within it and it is a visual surface based on the check mark in the selected surface box.

The Created Sections Box is shown when the surface title is selected and the Plan Tab is chosen from the Operations Bar. The Created Sections Box and window that contains the box only appears if the surface containing the section is not a visual surface. The number below displays how many runs are contained in the selected section.

When a job is selected in the Jobs Box, the Plan tab shows the options to create a new surface, and to view the created surfaces. When the created surfaces are selected in the Surfaces Box to the right, below the box displays how many sections are in the surface and whether the surface is a visual surface or not.

When a surface is selected in the Jobs Box, the plan tab displays options to add new sections or see the created sections. If a section is selected in the Sections Box, the number below displays how many runs are contained within that section. The properties of the surface can also be changed at this time.

When a section in selected in the Jobs Box, the options to add new runs or add a batch of runs appear. The created runs will be on the right side of the window in a box titled 'Runs.' At this time the operator may change the properties of the section.

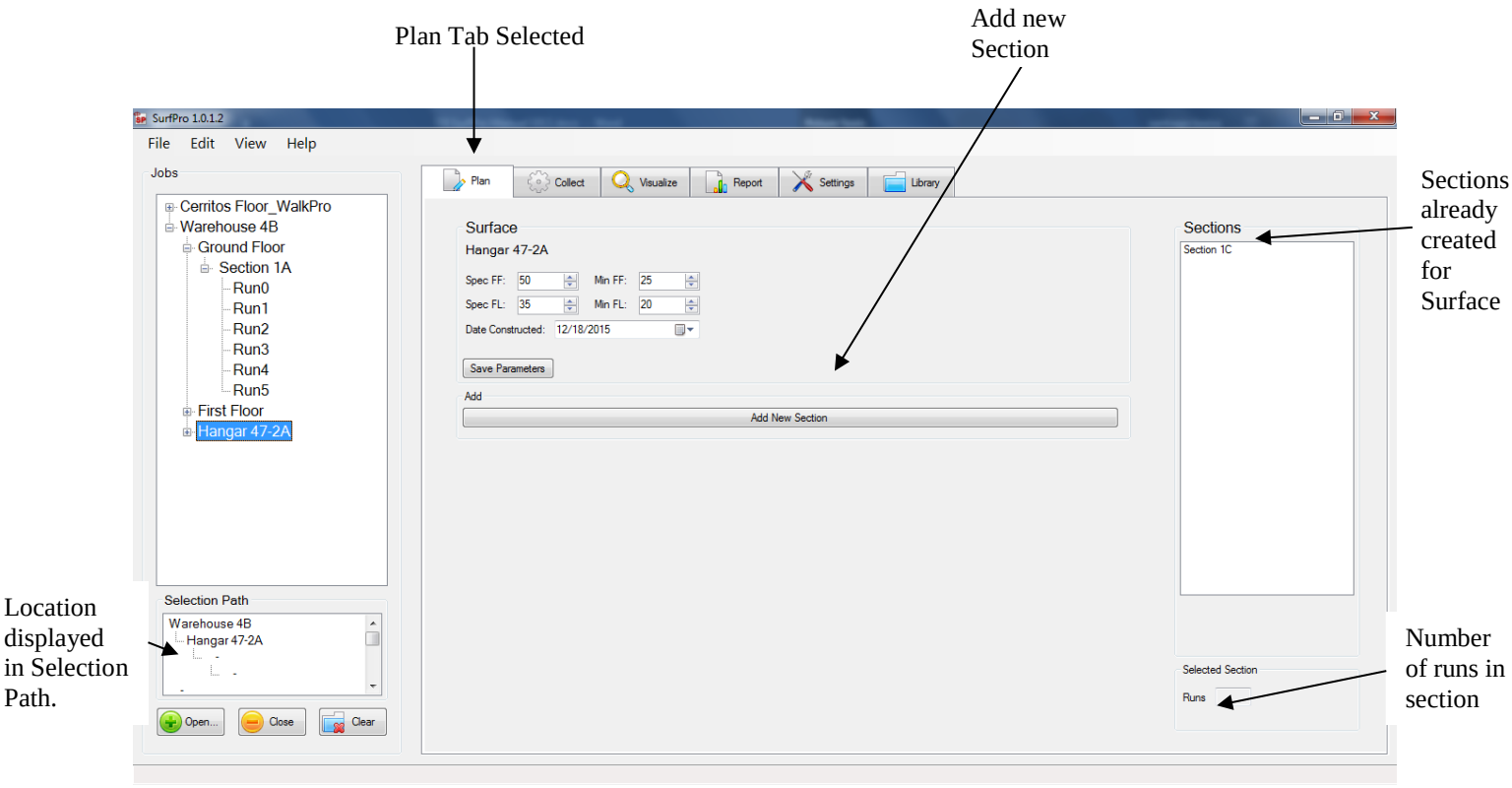


Figure 8: Non-Visual Collection sections

The Created Sections Box is shown for a non-visual surface (Ground Floor) in Figure 8: Non-Visual Collection sections. The properties are shown and the user can create new sections by selecting the 'Add New Section' icon. To see how many runs are in the section, select the section from the 'Sections' box and the number of runs will appear below.

1.5 - Concepts of Floor Flatness and Floor Levelness

Flatness

Flatness is described as the curvature between points that are separated by 24 inches (0.6096 meters). The profiler collects Q-values after every 12 inches (0.3048 meters) of travel. To find the number of Q-values in a test run, the equation is:

Number of Q-values= (Test Run length in feet) -1*

Note: *The distance traveled in the test run is rounded down to the nearest whole number.*

Flatness profiling compares adjacent slopes. If the slopes are identical then the profile is perfectly flat. The Q-value is the difference between consecutive elevation readings.

Levelness

Levelness is calculated by collecting elevation data at points spaced ten feet apart. The first Z-value is collected after ten feet is collected and a new Z-value is found for each successive foot traveled. The total number of Z-value for each test run is:

Number of Z-values= (Test Run length in feet) – 9

Note: *The distance traveled in the Test Run is rounded down to the nearest whole number.*

If two points spaced ten feet apart have the same elevation then it is said that the line joining the two points is level.

Q-Values

Q-values are related to flatness and are calculated every 12 inches after the first 24 inches are traveled. This means that the total amount of Q-values in a data run is:

Q-values= (Test run length in feet) – 1

The test run length in rounded down to the nearest whole number in feet.

Z-Values

Z-values are related to levelness and are calculated every 12 inches after the first ten feet is traveled. This is translated to the number of Z-values in a test run is:

Z-values= (Test run length in feet) – 9

The test run length is rounded down to the nearest whole number in feet. The number of z-values is crucial in the collection of data and length of profiled lines for a test section. For a test section with a characteristic area, it has a minimum number of z-values that are required to be collected. N_{min} is the minimum number of z-values required and is calculated from the total area of the test section. If the total area of the test section is between 320 square feet and 1600 square feet ($360 \leq A_{total} \leq 1600$), then $N_{min} = 2\sqrt{A_{total}}$. If the total area of the test section is greater than 1600 ft^2, then $N_{min} = A/30$.

Note: *If the test section is less than 360 square feet the test surface is too small to be profiled.*

N_{min}

N_{min} is the minimum number of z-values required to profile a test section. There are only two ways to calculate N_{min} and they are:

If $360ft^2 \leq A_{total} \leq 1600ft^2$	$Then$	$N_{min} = 2\sqrt{A_{total}}$
If $A_{total} > 1600ft^2$	$Then$	$N_{min} = A_{total}/30$

Note: *If the test section is less than 360 square feet the test surface is too small to be profiled.*

Working Area

The working area is the area of the test section that is to be profiled. The working area can be equal to the total area of the section or it can be the section with the two foot buffer. The 2 foot buffer is enacted to avoid inconsistencies near the construction joints. In order to properly use the 2 foot buffer, the omitted sections of surface must be less than 25% of the total area of the surface.

The SurfPro software implements a three foot buffer when possible due to the size of the WalkPro profiler.

Parallel and Perpendicular Method

The parallel and perpendicular method is a procedure to create test paths within a test section. The guidelines for the parallel and perpendicular method are:

1) That the lengths of the test paths must meet the minimum z-values (N_{min}),
2) That each section has an equal number of test runs in each direction,
3) Each section has the same length of runs in each direction.
4) The paths must be parallel and perpendicular to each other
5) The adjacent lines cannot be within 4 feet (1.2192 meters) of one another

For an example procedure using the parallel and perpendicular method see "Example Section."

45˚ Method

The 45 degree method uses 45 degree profiling paths with respect to the width of the test section is the region of surface to be profiled, or tested for floor flatness and floor levelness.

The 45 degree method is usually more efficient than the parallel and perpendicular method by having to walk less and profile the least amount of runs. The 45 degree method also does not have to have an equal amount of paths in each direction. The paths created for the 45 degree method must still meet the minimum Z-values or N_{min} number.

Total Area

The total area is the area of the test section using the construction joints or a travel boundary as a barrier. The area is found by multiplying the length time the width of the section.

$$A_{total} = Length \times Width$$

Test Section

The test section is the region of the surface that will be profiled. There can be many sections on a surface, and sections can be different sizes and have different run path coordination.

2 Foot Buffer

The two foot buffer is placed inside the border of the construction joints following the ASTM E1155 test method. The two foot buffer is enacted to avoid inconsistencies near the construction joints. In order to properly use the 2 foot buffer, the omitted sections of surface must be less than 25% of the total area of the surface.

The SurfPro software implements a three foot buffer when possible due to the size of the WalkPro profiler.

Example:

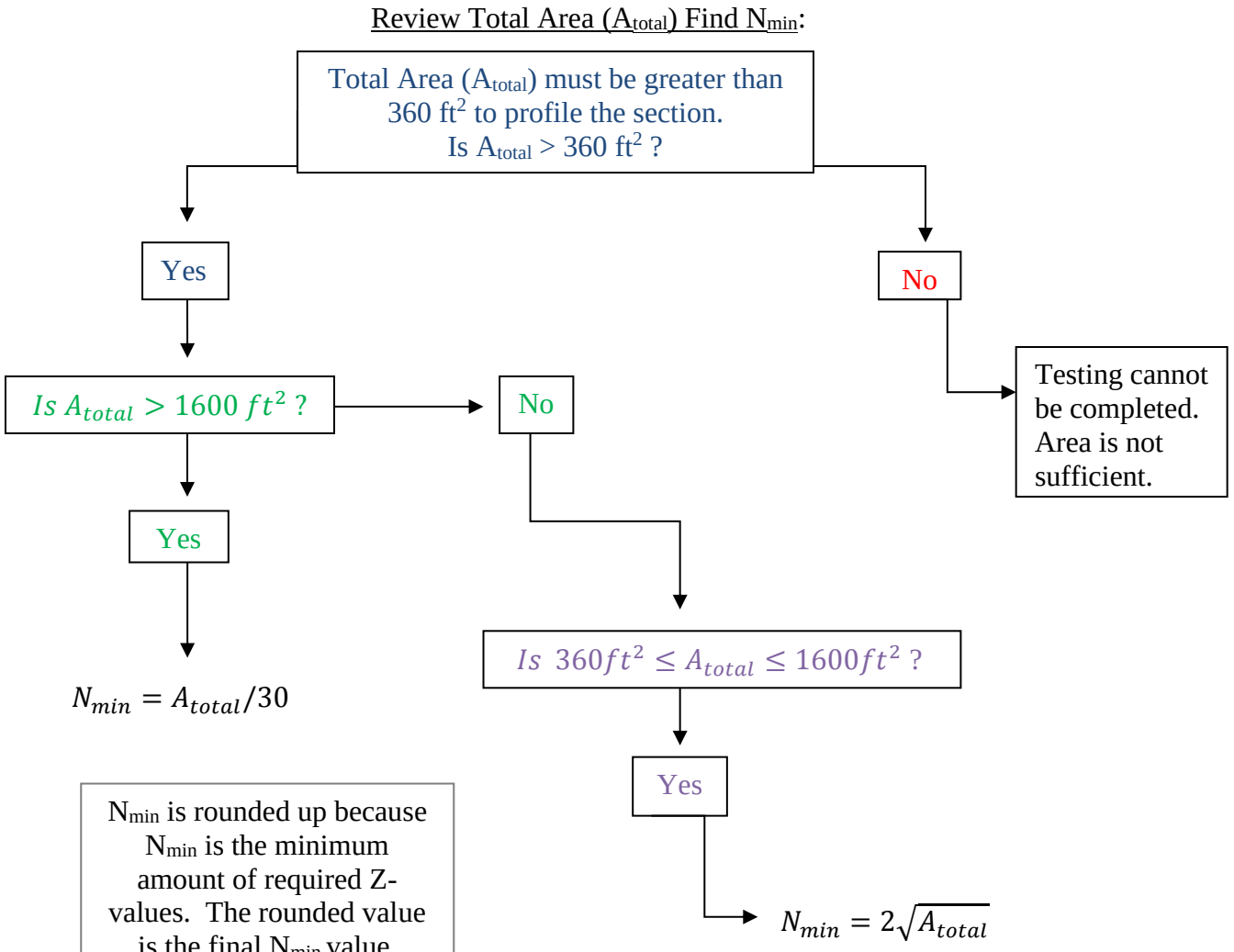
Total Area= 275 feet^2
Working Area= 230 feet^2
Omitted Area = 275-230=45 ft^2
Can 2 foot buffer be used?
Yes. 45/230=0.19 or 19%

19% is less than 25% so the 2 foot buffer can be used.

Process of Pre-Profiling

The process before profiling the surface is to find the minimum Z-values (N_{min}), determine the line direction method to be used, and calculate the length of the profiling path. The steps below outline the process stated above.

1) Find the barriers of the test section.
2) Find the total area of the test section (A_{total}).
3) Find the working area of the test section.
4) Find N_{min}.



N_{min} is rounded up because N_{min} is the minimum amount of required Z-values. The rounded value is the final N_{min} value.

Example)

N_{min} = 3.19 = **4**

5) Choose the Parallel and Perpendicular or 45˚ Method

Parallel and Perpendicular Method

A) Find the Longest line possible in the section's working area, which is the length of the shortest dimension in the working area.

B) Find the number of Z-values within one line path. Use the equation: Z-values= (line distance in feet) – 9.

C) Divide the total amount of z-values needed (N_{min}) by the number of Z-values in each run.

D) Round the number found in step C up to the nearest even number. This is how many runs need to be performed on the test section using the Parallel and Perpendicular Method.

E) Choose the paths to take, keeping all lines parallel and perpendicular and over 4 feet apart.

45˚ Method

A) Find and calculate the longest line. So, take the shortest dimension of the section and multiply by $\sqrt{2}$.

B) Find the total Z-count for the line found in step 1. Use the equation: Z-values= (line distance in feet) – 9.

C) Divide the total amount of z-values needed (N_{min}) by the number of z-values in each run.

D) Round the number found in step C up to the nearest whole number. This is how many runs need to be performed on the test section.

E) Choose the paths to profile keeping the lines 45 degrees. With this method the lines can zig-zag and there does not have to be an equal number of lines and distance going in both directions.

Dissimilar Traits between Methods

1) The 45˚ Method does not have to have equal lines in both directions.
2) The 45˚ Method is more efficient because it has longer paths, resulting in less run paths.
3) Round the run numbers for the Parallel and Perpendicular Method up to the nearest even whole number.
4) Round the 45˚ Method up to the nearest whole number.

Test Example 1

$$A_{total} = 44ft \times 52ft = 2288ft^2$$

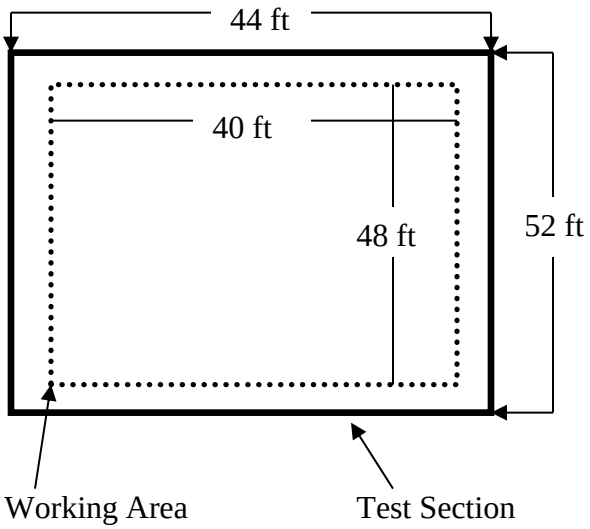
$$Area_{Working} = 40ft \times 48ft = 1920ft^2$$

$N_{min} \Rightarrow A_{total} > 1600ft^2$

$so\ N_{min} = A_{total}/30$

$N_{min} = 2288/30 = 76.266$

When rounded up, $N_{min} = 77$



Parallel and Perpendicular Method

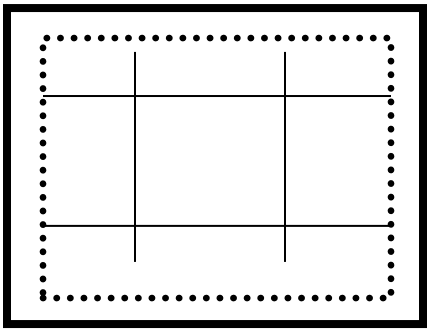
Longest line can be 40 feet. To find Z-values for a 40 foot line:

Z-values = 40-9 = 31 Z's for one run.

Total number of 40 foot runs needed:

$77/31 = 2.48$

2.48 runs is 4 runs total when using Parallel and Perpendicular Method. This means two runs up, two runs down as shown below.



Parallel and Perpendicular Statistics
124 Z's collected.
Walked distance = 160 feet.

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45 Degree Method

Same N_{min} as above, $N_{min} = 77$.

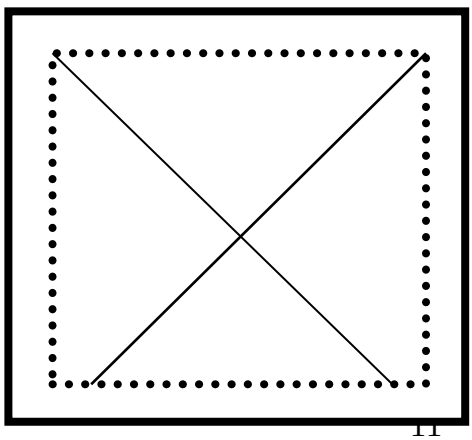
Longest line is 40 feet. $40\sqrt{2} = 56.508$.

56.508 feet is maximum length, so we will use 56 feet.

Number of Z-values is: 56 feet – 9 = 47 feet.

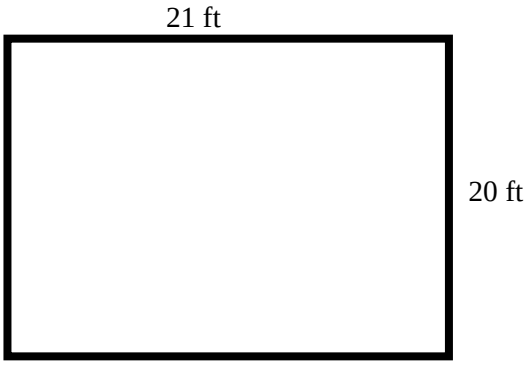
Number of runs needed is: $77/47 = 1.638$ or 2 runs.

2 runs at 56 feet is 94 Z's collected and walking 112 feet, which is more efficient than the Parallel and Perpendicular Method.



Test Example 2

This example shows when to use the two foot buffer.

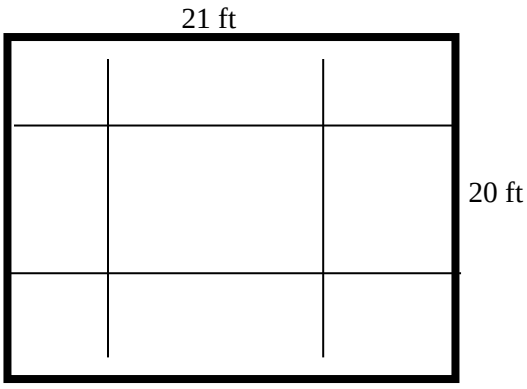


Total Area = 420 ft^2

Working Area (with 2 ft buffer) = 17 ft x 16 ft = 272 ft^2

$$272\ ft^2/420\ ft^2 = .6476 = 64.76\%$$

The two foot rule is not used because the profiled area of the section is less than 75% of the total area. The full dimensions of 20 ft x 21 ft will be profiled. (*This procedure is the inverse of the Example in the 2 Foot Buffer section above.*)



<u>Parallel and Perpendicular Method</u>
Longest line is 20 feet.

N_{min}=40.98~41

Z-values for each line is 20-9 = 11 z's per run.

To find the number of test runs needed, $41/11 = 3.7$

In the Parallel and Perpendicular Method, 3.7 is 4 runs total. Two runs up and two runs down, all runs are twenty feet long.

2.0 – Menu Bar

The menu bar has functions to: open previous .ffl files, save projects, create projects, clear the Jobs Box, change system settings, display the summary report, access the library and support. The menu bar is located at the top left corner of the SurfPro window.

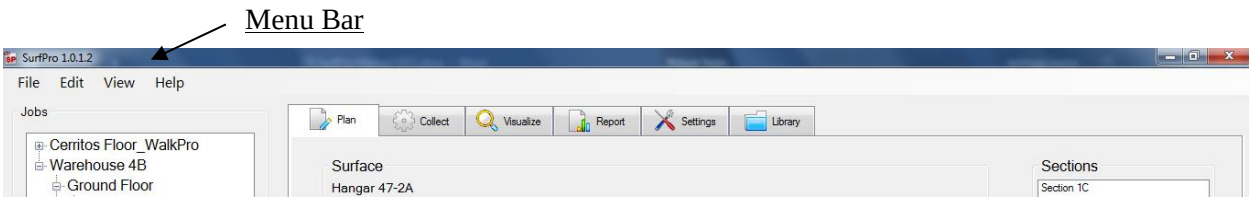


Figure 9: The Menu Bar.

2.1 – File Tab

2.1.1. – Create New Job

To create a new job, select the 'Create new job' option on the original window of SurfPro when there are no files within the jobs box or by selecting the option through the file tab. After choosing either option, type the name and specify if the job is in English or Metric units.

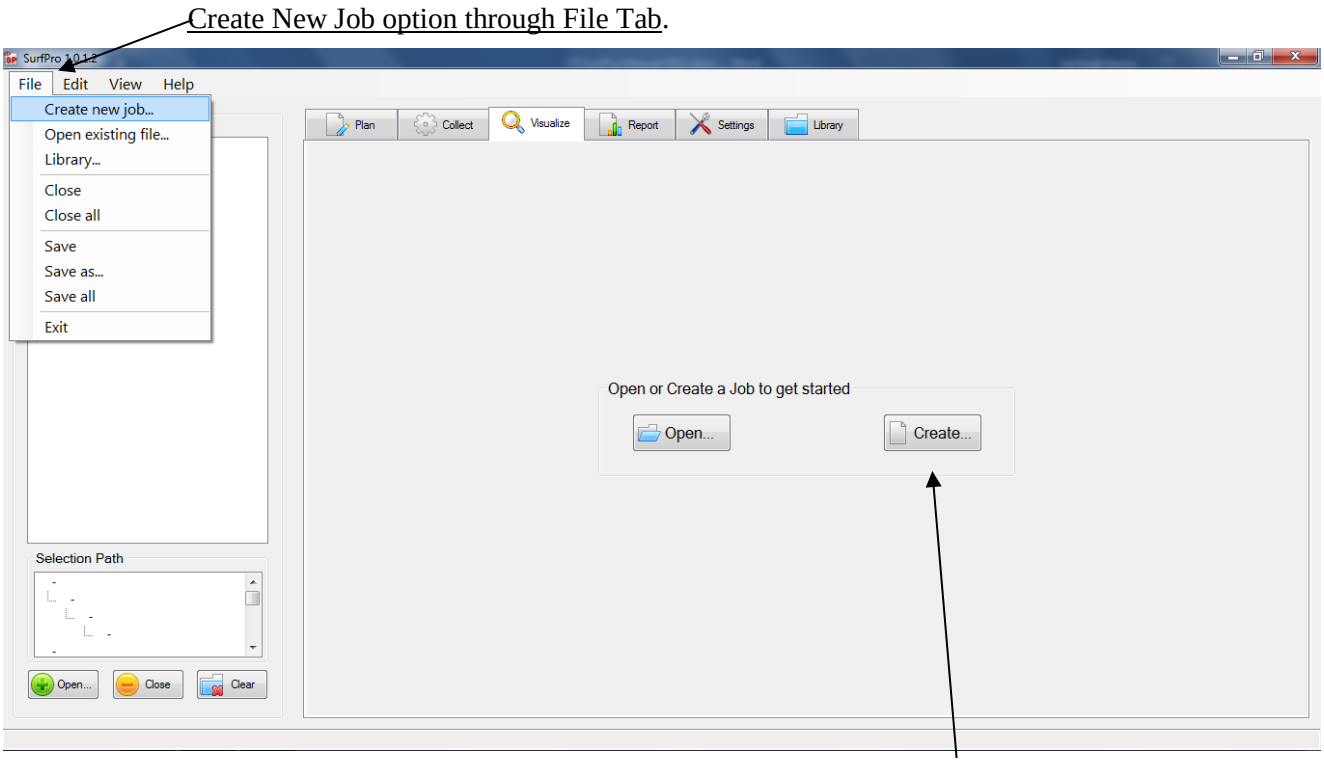


Figure 10: Create New Job Options.

2.1.2. – Open Existing File

This option opens previously saved floor flatness files (.ffl) on the user's hard drive or external device. This option can be found on the original SurfPro Window when there are not open jobs in the Jobs Box and in the File Tab. To import the files into the SurfPro software, navigate to the files within the 'Open Project' window. When the desired files are selected, left click open to import the files into the Jobs Box.

If the desired files have been opened on the same device before, SurfPro has kept the location of the job file and the file can also be opened through the library. The library tab is found at the end of the Operations Bar or in the File Tab in the Menu Bar. If the file is available the Load/unavailable icon will display load. After selecting load, the job file will be imported into the Jobs Box.

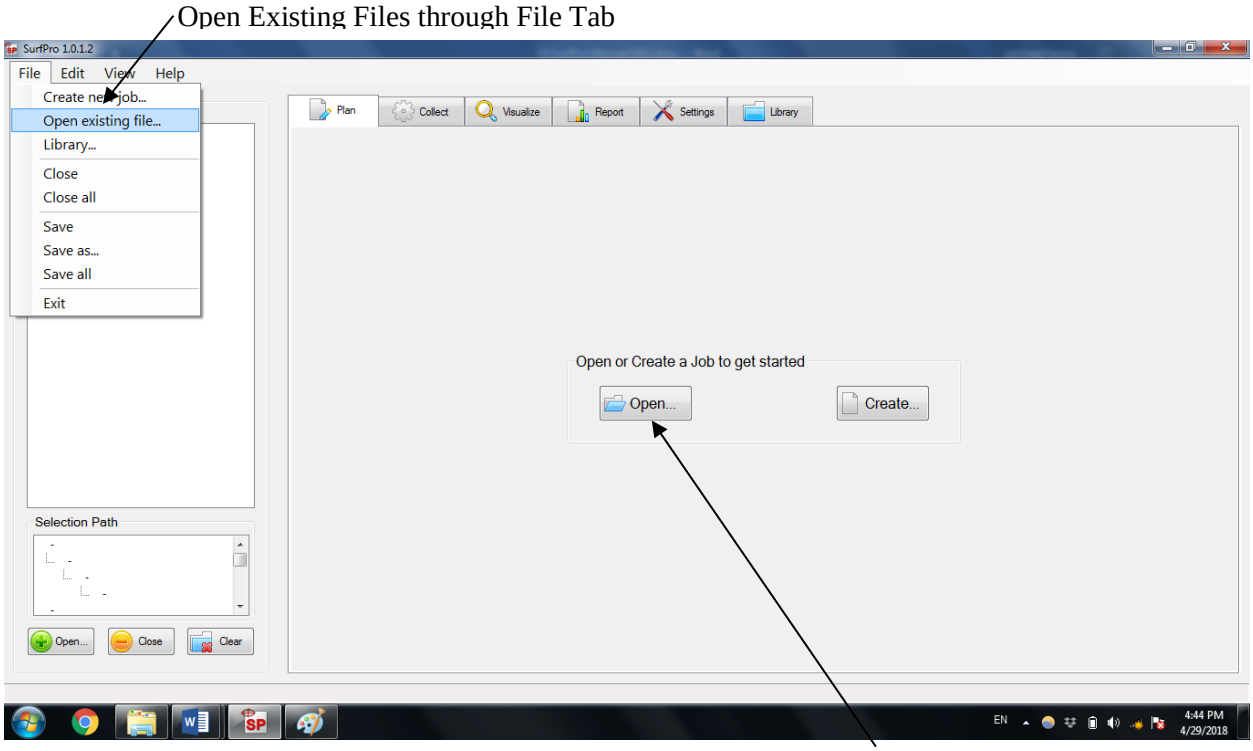


Figure 11: Open File Options

2.1.3. – Close

The 'Close' feature closes the currently selected job file in the Jobs Box. To be certain that a job file is selected, the current file will appear as the lowest level in the selection path.

2.1.4. – Library

See section 7.0 for Library information.

2.1.5. – Close All

The close all option clears the Jobs Box of all open job files. A secondary option to clear the Jobs Box is to select the Jobs Box Icon of 'Clear.'

2.1.6. – Save
Select the save feature to save the job file as a floor flatness file (.ffl) to the user's computer or external device.

2.1.7. – Save As
Select the save as feature to save job files that are currently saved on the local hard drive. This option allows job files to be saved in multiple locations.

2.1.8. – Save All
Save all allows the operator to save all job files open in the Jobs Box to the user's computer or external device.

2.1.9. – Exit
Choosing exit closes the SurfPro software. Before closing the software asks the user if the unsaved jobs are to be saved. The operator can then save the job files before the software closes.

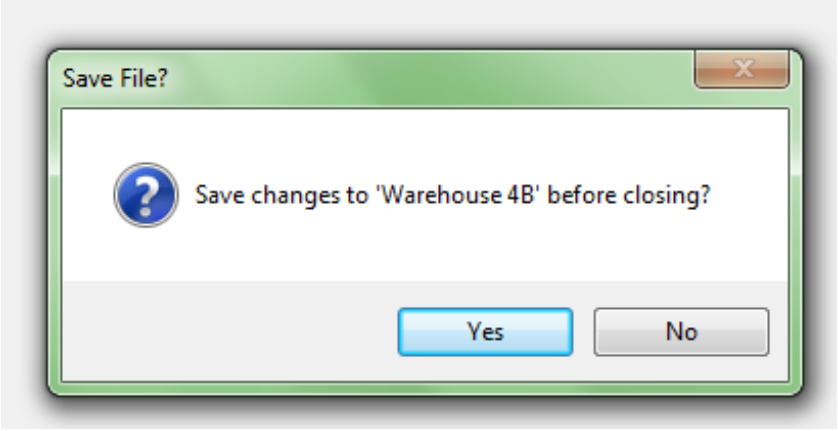


Figure 12: The Exit window if unsaved changes have been made to a job file.

2.2. – View

2.3.1. – Summary Report
The summary report is used to display the results of the floor flatness and floor levelness tests.

2.3.2. – Device Settings
The settings of the SurfPro software allow the user to set the device used to collect the data. For all practical purposes of using the system chose SSI CS8800. The other option, "Simulated", is used more internal research and development or when an SSI engineer is troubleshooting the systems.

3.0 - Calibration

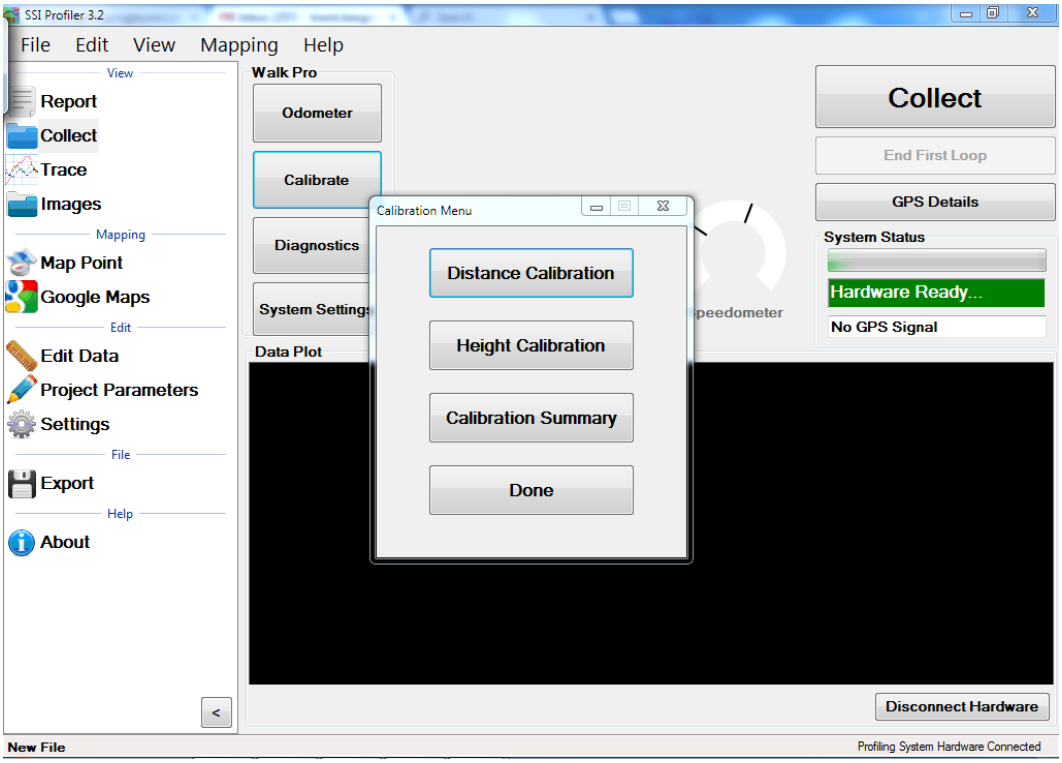


Figure 13: The calibration menu after "Calibrate" button is selected

3.1 - Absolute Encoder Calibration

Calibrate the absolute encoder by tilting the profiler upright on the rear wheels. This action should have the lever arm motion limiter contact the profiler body (The arm should be at the minimum of its downward range). Then insert a small allen wrench or blunt shaft into the hole of the rubber stopper. Push the tool into the base of the hole and apply pressure until the light turns red.

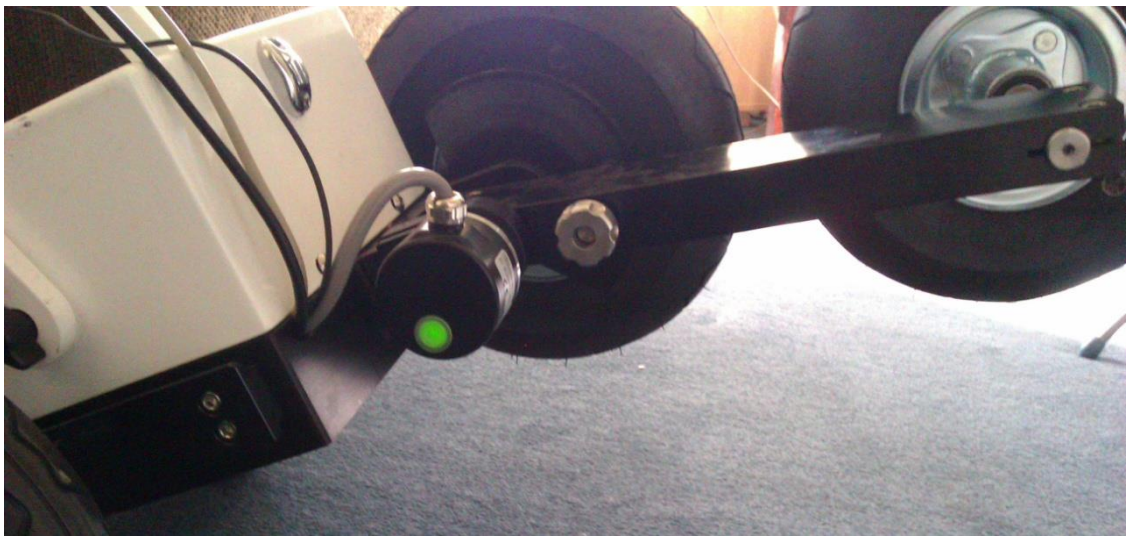


Figure 14: The absolute encoder of the walking profiler ready to calibrate.

The light is green in the rubber plug. The arm motion limiter is touching the bottom of the walker body.

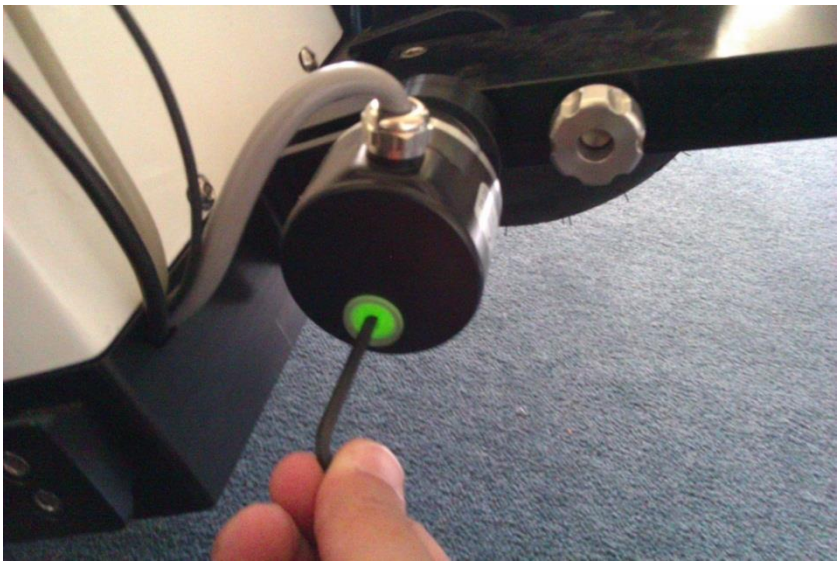


Figure 15: Applying pressure with an allen wrench

Apply pressure into the rubber plug's hole. It is green at this moment. It takes 2-3 seconds for the light to change from green to red.

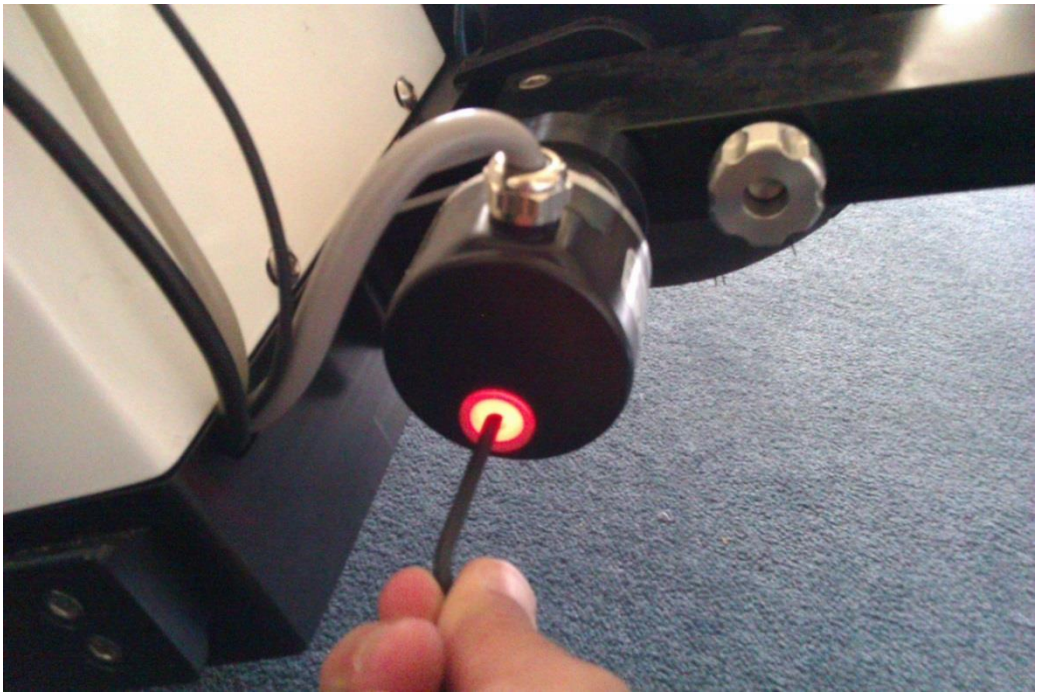


Figure 16: The calibration of the absolute encoder is complete when the light turns red, as seen above.

3.2 - Distance Calibration

Calibrate the distance readings of the walking profiler by measuring out 528 ft (160 meters) with a rolling wheel measuring device. Once the test track is prepared, start the calibration procedures through the Calibrate icon in the Collect window. Select Distance Calibration and follow the steps precisely to complete a successful calibration.

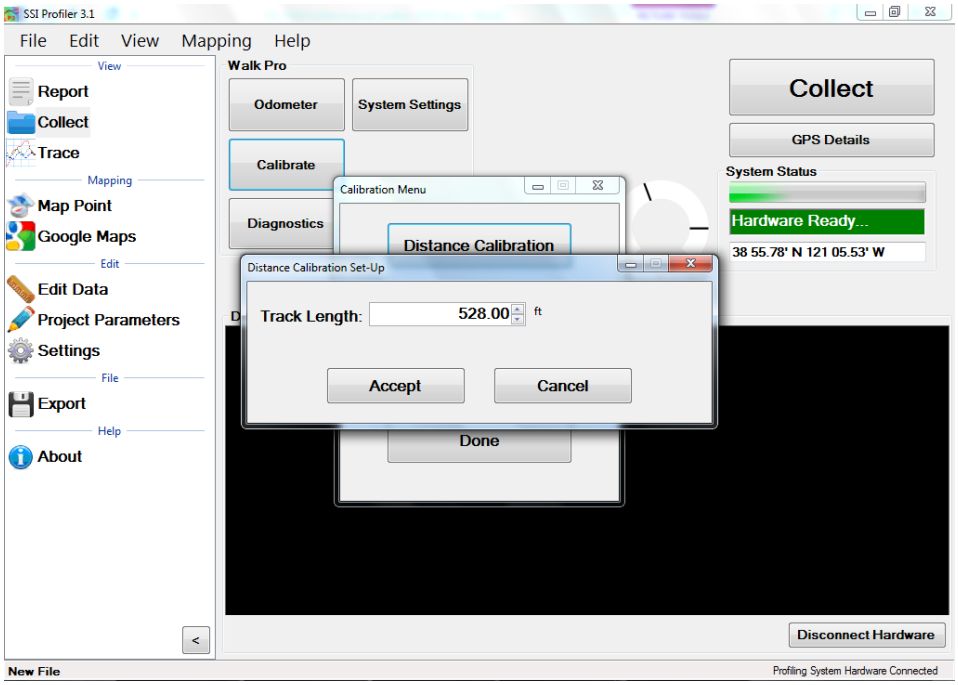


Figure 17: The initial window of the distance calibration.

This is the window where the operator enters how long the calibration track is. The units can be changed by clicking on the feet (ft) and choosing the appropriate units. After the length of the track has been entered, select accept.

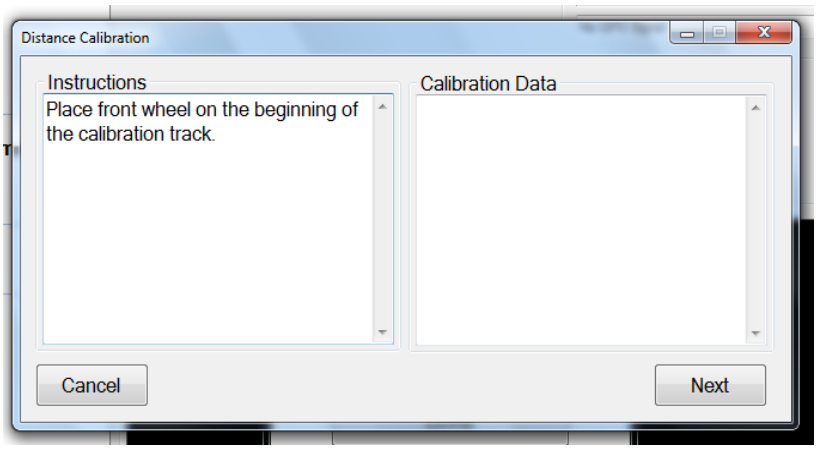


Figure 18: The instructions for the distance calibration are shown above.

Once the walking profiler's front wheel is on the beginning of the track, select next.

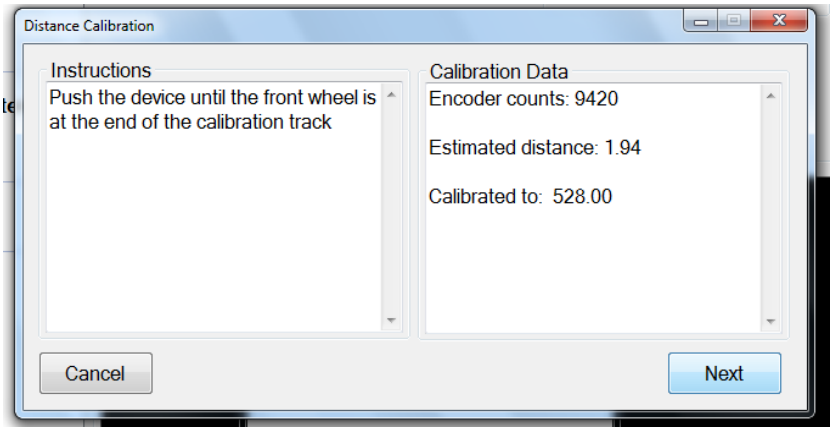


Figure 19**:** Distance Calibration Summary

This window shows the number of encoder counts, the length of the track that was entered in the previous window and the estimated distance traveled based on the last calibration. If the estimated distance does not match

3.3 - Height Calibration

Before performing the height calibration make sure the inclinometer sensitivity is set up correctly under System Settings. Enter the same number in Channel 0 and Channel 1. You can find your inclinometer sensitivity from documentation from your SSI Representative. The inclinometer sensitivity is based on the scaling factor of the inclinometer.

To perform a height calibration, the walking profiler needs to be placed on a level surface. Mark the locations of the main wheels on the ground and begin the calibration process. Once the first step is complete, rotate the walking profiler 180 degrees so that the wheels switch positions and resume the calibrations. These two steps are listed in the procedures while performing the height calibration.

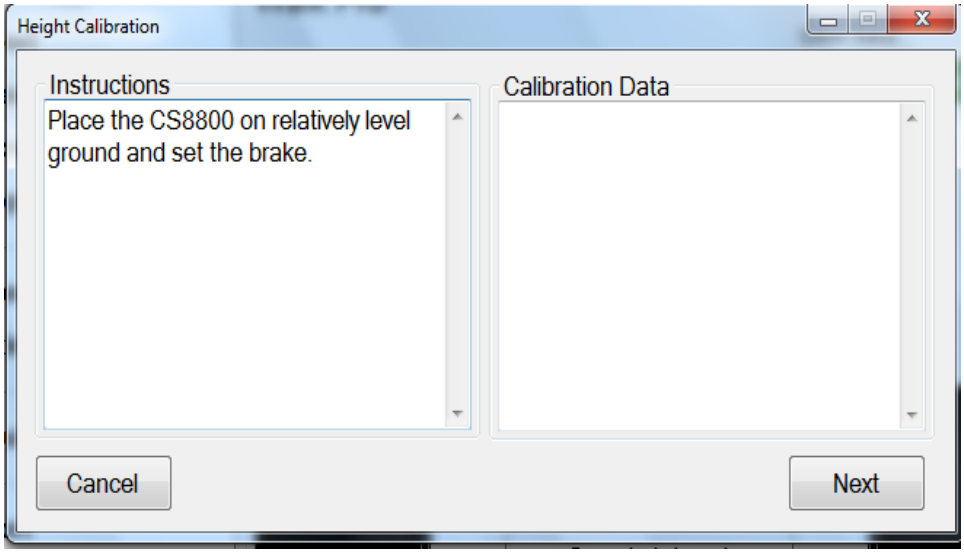


Figure 20: The first window of the height calibration

This window instructs the operator to place the walking profiler on level ground with the brake applied.

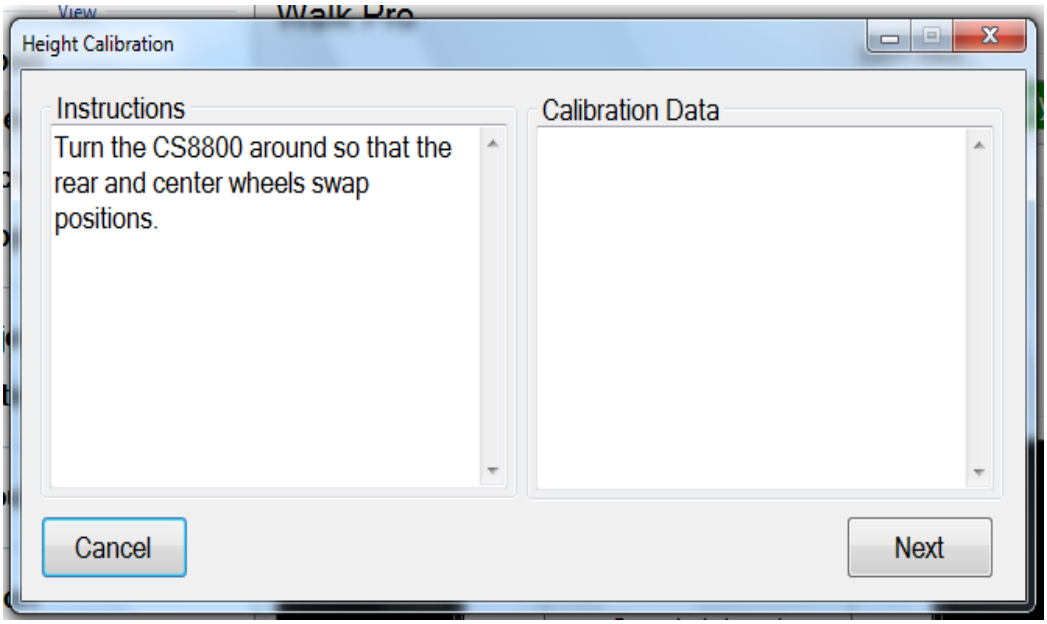


Figure 21: Height Calibration Steps.

After the first phase of the height calibration, the walking profiler must be turned around 180 degrees and have its left rear wheel switch positions with the left front wheel. When the walking profiler is in position, select next.

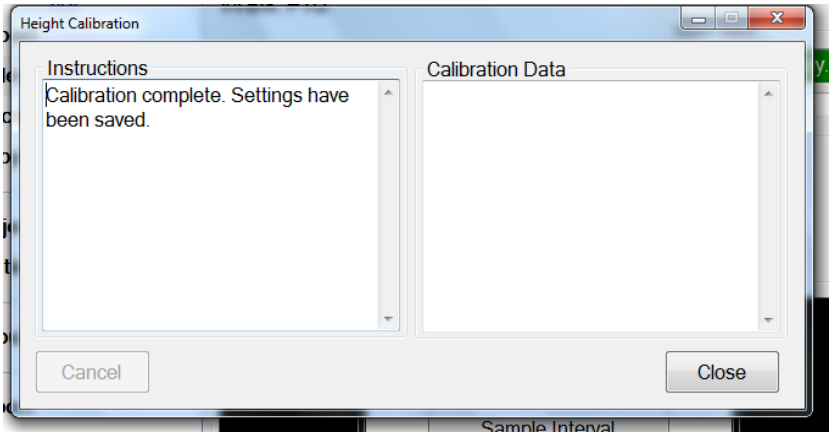


Figure 22: After a successful calibration, the settings will be saved. Select close to proceed with collecting data.

Figure 23: To begin the height calibration, the surface must be level.

The position of the wheels must be marked in a manner similar to the way shown above.

Figure 24: Initiate the height calibration.

Follow the directions of the program. To begin the calibration, find a level surface and mark the location of the wheels on the left side of the machine. These wheels do not move along the body of the walking profiler, so they are a good reference point. While the inclinometer is calibrating, do not touch or move the walking profiler.

After the first phase of the calibration, rotate the walking profiler 180 degrees so that it is facing the other direction. Line up the wheels with the same marks that were made in phase one; the back wheel has switched positions with the front wheel. Finish the calibration procedures given by the program.

Figure 25: Height Calibration.

4.0 – Operation Bar

4.1 – Plan Tab (Creating a Job)

The Plan Tab is located on the Operations Bar. The Plan Tab is used to organize and coordinate a plan of action before profiling. There are two possible organizations of the Plan Tab depending whether the operator chose the surface to be a visual surface. If the surface was chosen to be a visual surface, the interactive visual editor automates the layout procedure. Alternatively, a non-visual surface allows superior control over the collection parameters.

Note that when it is said "job, surface, section, or run title is selected in the header of the following sections", it means that the noted title is selected in the Jobs Box. To determine if the correct item is selected, review the selection path window and confirm that the lowest branch of the selection window is the desired level of the Job file.

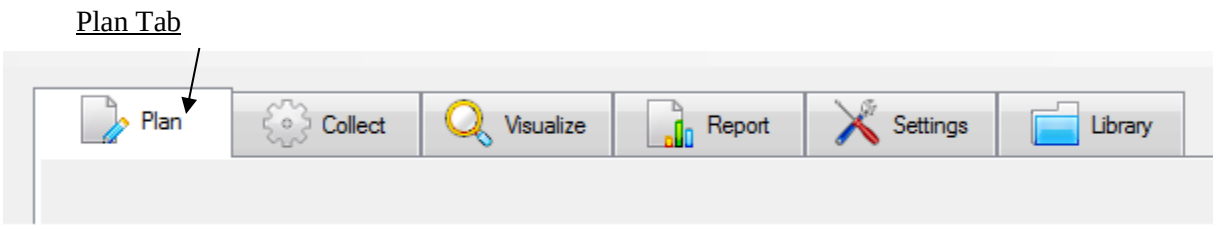


Figure 26: The Plan Tab is selected within the Operations Bar.

Creating a New Job

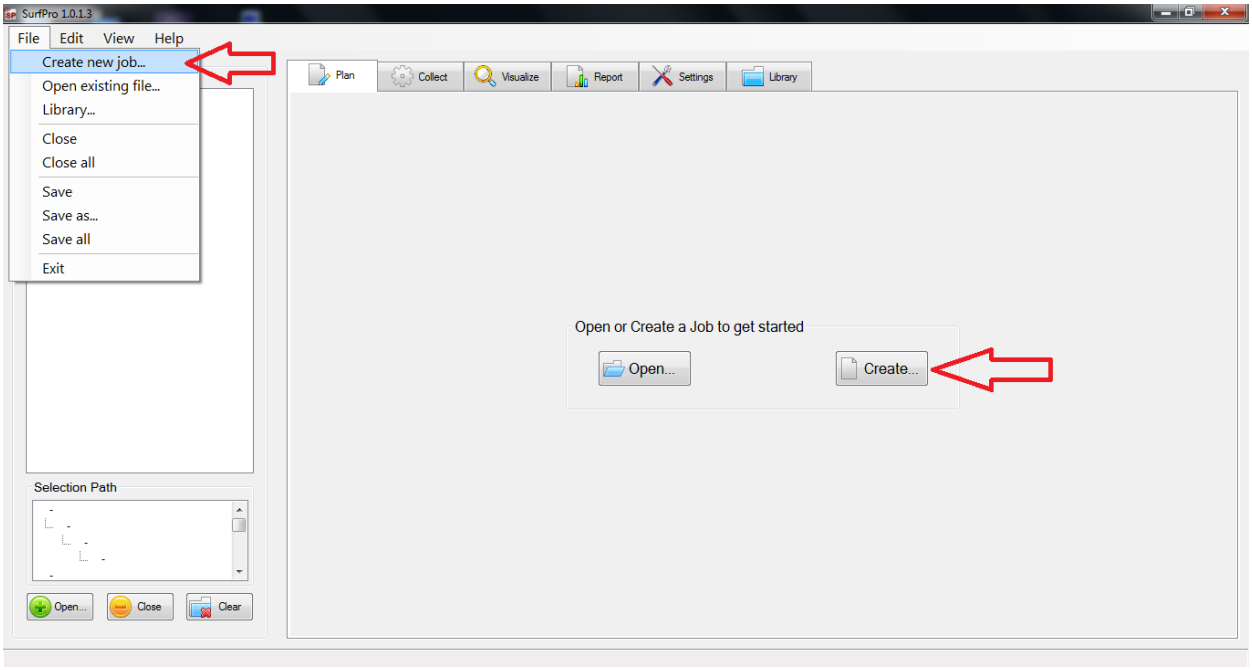


Figure 27: The two ways of creating a new job

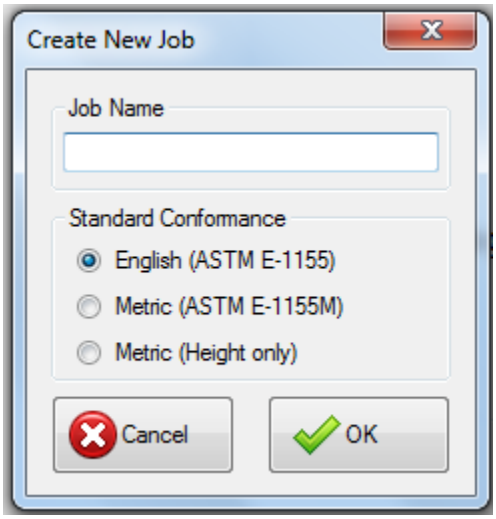
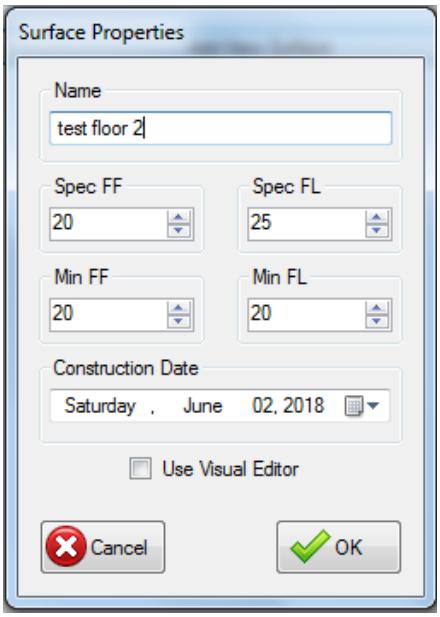


Figure 28: Chose Job Name and the Standard Conformance to be used.

Figure 29: The Surface Properties window.



Note: For Standard Conformance of English (ASTM E-1155) and Metric (ASTM E-1155) the FF/FL specs will the activated in the next Surface Properties window. If Metric (Height Only) is selected, the FF/FL specs will be deactivated. See pics below.

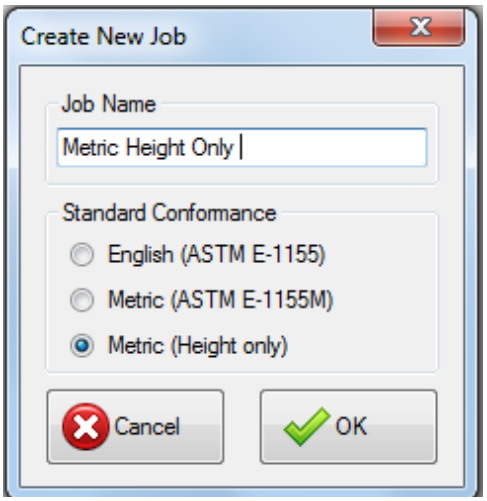


Figure 30: Chose Job Name window with Metric (height only) as Standard Conformance.

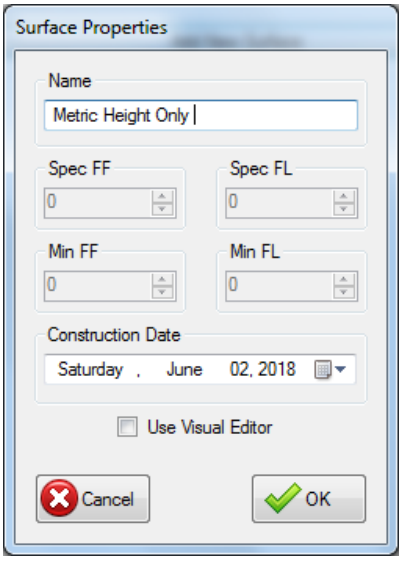


Figure 31: Surface Properties window for Metric (Height only) with the FF/FL specs deactivated.

The defined surface under the Surface Properties window has the sections that will contain the actual data collections. ***Note: To use the visual editor, check the "Use Visual Editor" Box. All areas must have non-zero entries to select "OK." An error message will popup if this condition isn't satisfied.*** If visual editor is enabled the user can draw the section for the collection creating a visual representation of the section as well as allows the ability to auto-generate runs. If visual editor is disabled, then the user must manually define and create each run in the collection / import the runs from a file. It is recommended to select "Use Visual Editor" when creating sections.

4.1.1. – Plan Tab without Visual Editor

In order to create a surface that is not a visual surface, do not select the "Use Visual Editor" option at the bottom of the Surface Properties window. The preference of using the visual editor can be changed if the surface in question does not have sections associated with it. If the surface is a visual surface and the user wishes that it not be, delete all sections from the surface. When all sections are absent or deleted from the surface, right click on the surface title, select properties, and deselect the "Use Visual Editor" box to not use the visual editor.

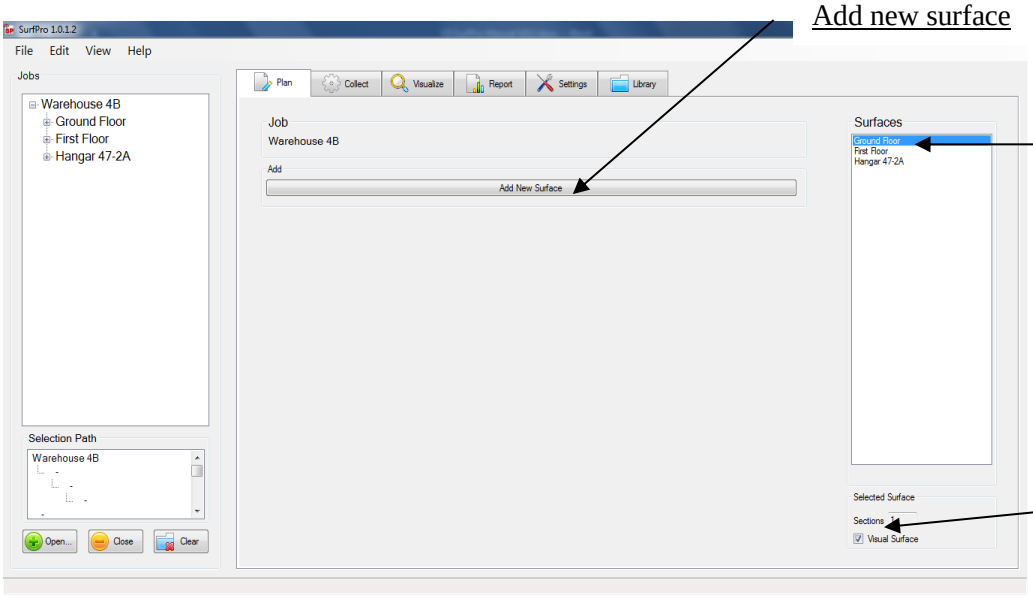


Figure 32: Shown above is the Plan Tab with a job title selected.

Figure 32 above window is the same whether or not the surfaces contained in the job are visual surfaces. To create new surfaces, select the "Add New Surface" icon. To tell if created surfaces are visual surfaces, select the surface in the Created Surfaces Box and if the Visual Surface box is checked below, then the surface is a visual surface. The first-floor surface shown selected is a visual surface.

4.1.2. – Plan Tab with Job Title Selected (With or without Visual Editor)

Under the Plan Tab when the Job title is selected the layout is the same whether or not the job is associated with visual surfaces. This is because the Job title is the level above surfaces in the jobs box. This window is important for creating new surfaces that may or may not be visual surfaces depending on the preference of the user. To create a new surface, select the "Add New Surface" icon. After selected, the Surface Properties window will appear. This window will ask for the flatness and levelness specifications and the operator will be able to make the surface a visual surface by checking the "Use Visual Editor" box. To change the date of construction, left click the calendar to the right of the displayed date and select the correct day and year, or input the date by entering the date in MM/DD/YYYY format. Before continuing, all areas must have entries (Except for Metric Height Only jobs where FF/FL is deactivated).

4.1.3. – Plan Tab with Surface Selected (No Visual Editor)

When not using the Visual Editor, all calculations for segment length, minimum counts, and areas are to be done by the operator. See the overview for step by step instructions on this process. The Plan tab with non-visual surfaces selected shows the flatness and levelness specifications entered when the surface was created, an icon to create sections, the Created Sections Box, and the selection section information.

Create Section

To create a new section select the "Add New Section" icon and input the section name and dimensions in the units specified when the job was created. When all fields are completed, select "OK."

Change Specifications

If the specifications for floor flatness or levelness need to be changed for the surface, select the "Save Parameters" icon after changing the specifications to the correct values. If saving is not performed, the report will display incorrect specifications.

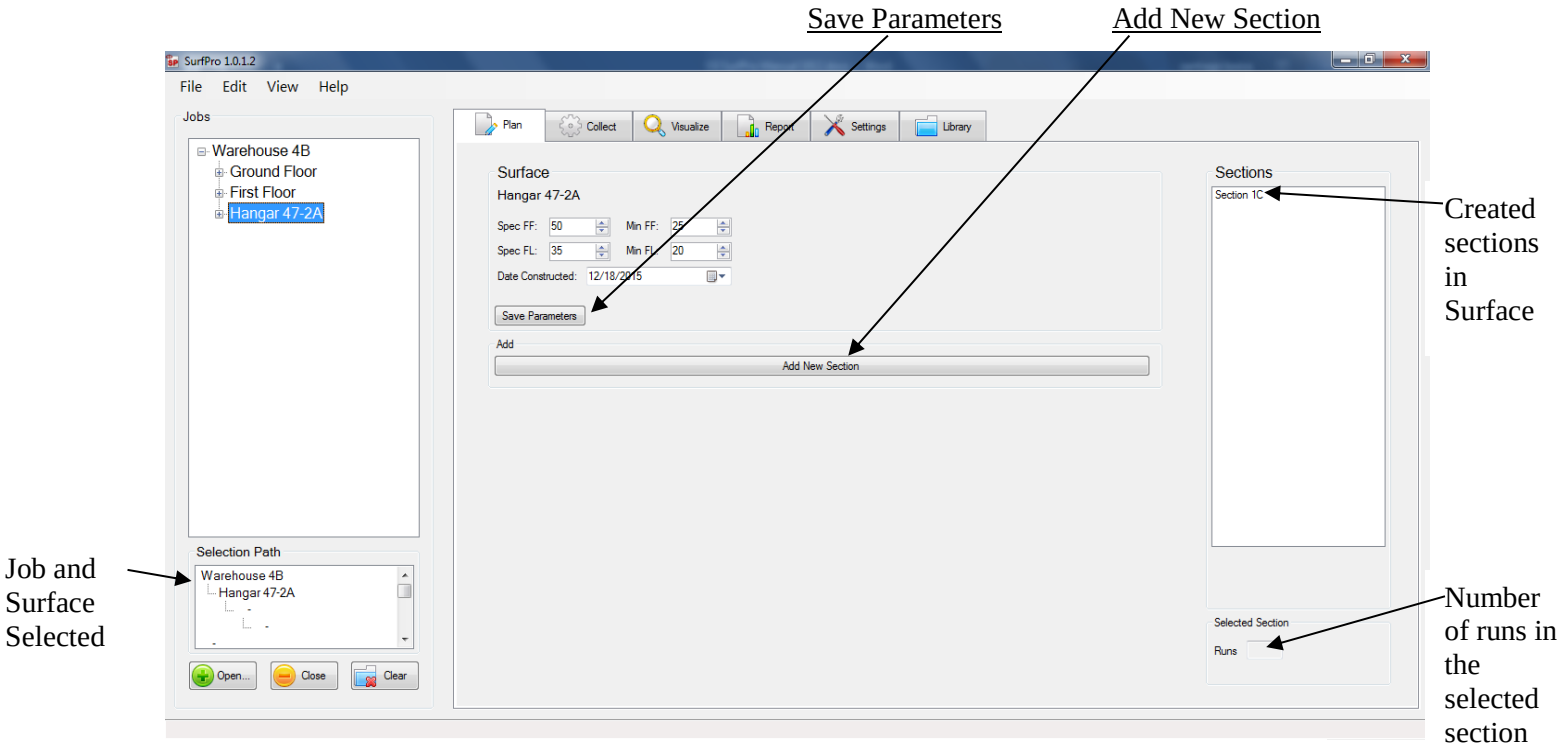


Figure 33: The "Add New Section" icon, the Created Sections Box and the information area

4.1.4. – Plan Tab with Section or Run Selected (No Visual Editor)

When not using the Visual Editor and a run or section is selected under the Plan Tab, the window shown in figure 34 allows the user to adapt the dimensions of the section. Press the "Add New Section" button in figure 33

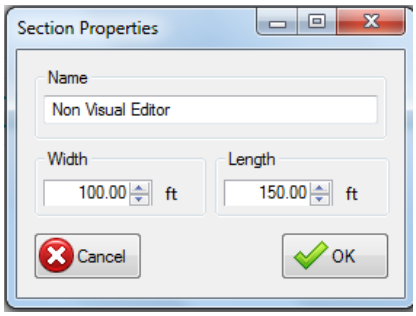


Figure 274: The numerical entry window

Changing Specifications

If the specifications for dimensions need to be changed for the section, select the "Save Parameters" icon after changing the specifications to the correct values. If saving is not performed, the report will display incorrect dimensions and the entire test may have been performed to the incorrect number of minimum counts.

Add Runs

To add new or additional runs to the section, the operator can add runs individually or through a batch process. Through "Add New Run," it is possible to add individual runs with the name that is typed into the Name Bar above the Add New Run icon.

Batched Runs

Adding batched runs just requires a prefix of the future runs such as "Run" and the number, or count of runs needed to be generated. Following the prefix the software will add numbers starting with zero. Using the example prefix of "Run" and a count of four (4), the runs created become Run0, Run1, Run2, Run3.

Import File

Import file can be used to import a raw elevation file of known sampling interval to be used as a run within a section.

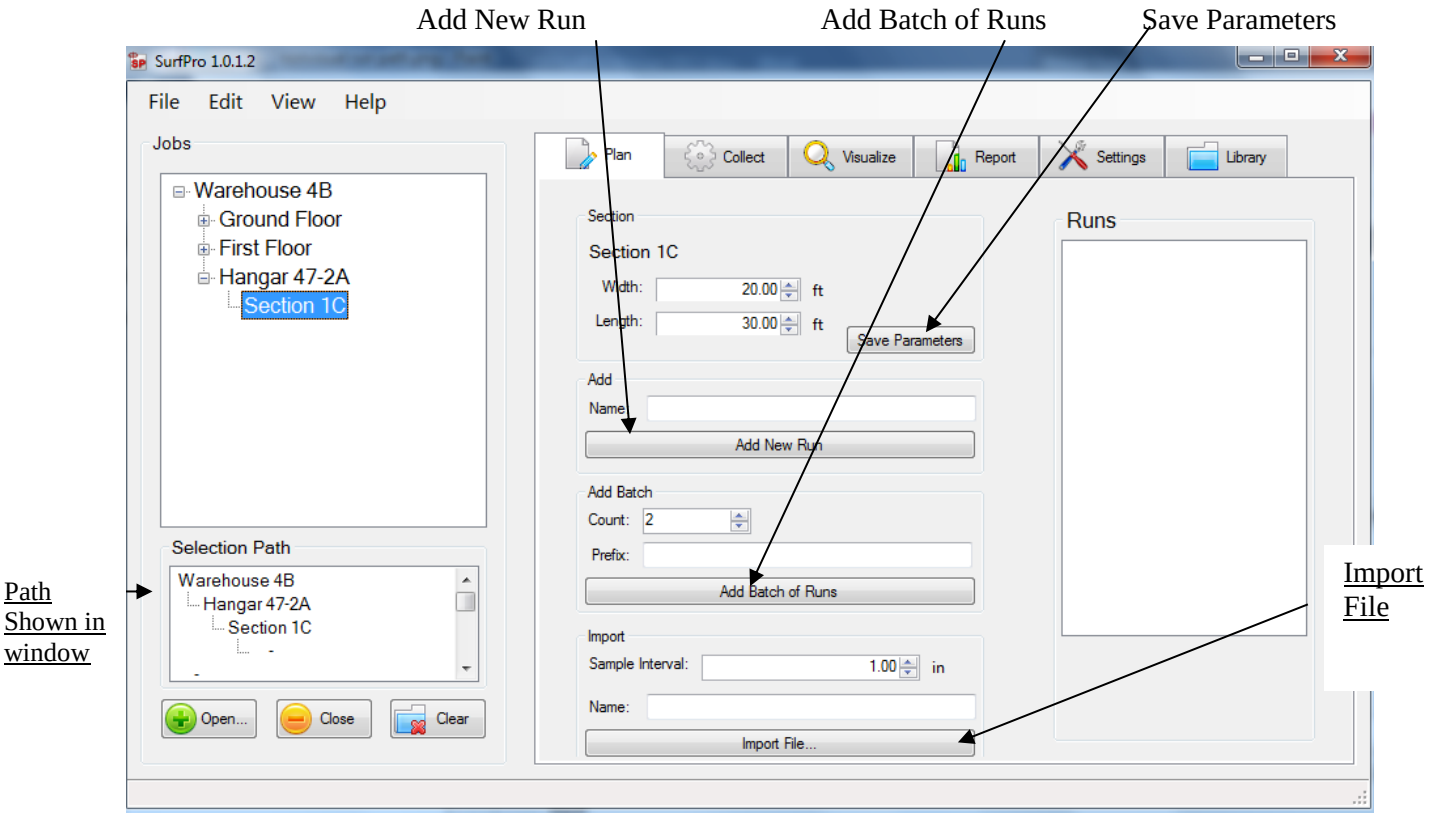


Figure 285: Non-Visual run Plan tab

4.2. – Visual Editor

The visual editor is the feature of the SurfPro software that can display the profiled surfaces as a spatial analysis, generate runs automatically, displays the parallel and perpendicular method and the 45 degree method for comparison, and aids profiling by displaying a compass. The visual editor is used by selecting the "Use Visual Editor" box when creating a surface when a job title is selected (see figures 29 and 31). If there exists a created surface that is not a visual surface and the operator desires to change it to a visual surface, there must not be any sections associated with the surface. If there are sections associated with the surface then those sections must be deleted in order to view the surface in the visual editor.

If profiling is desired to be completed by the user calculating number of runs, minimum counts, etc. without computer aid, the visual editor is not the advised setting. If the operator does not need computer assistance in finding run lengths or coordination, do not use the visual editor or visual surfaces during profiling.

4.2.1. – Plan Tab with Surface Selected (Visual Editor)

When the visual editor is used with a surface, the window shown is a grid format. Above the grid are tools for the grids operation and for creating sections. The overview box displays the larger area of grid that may be hidden and contain other sections. Using visual editor allows user to define the region using a drawing tool. To begin select the desired section that was created on the left-

hand side of the screen. Then select the pin tool that is highlighted in the picture below (In between pointer and hand icons). See figure 37 for details. The pen icon is labeled ‘Draw Mode’.

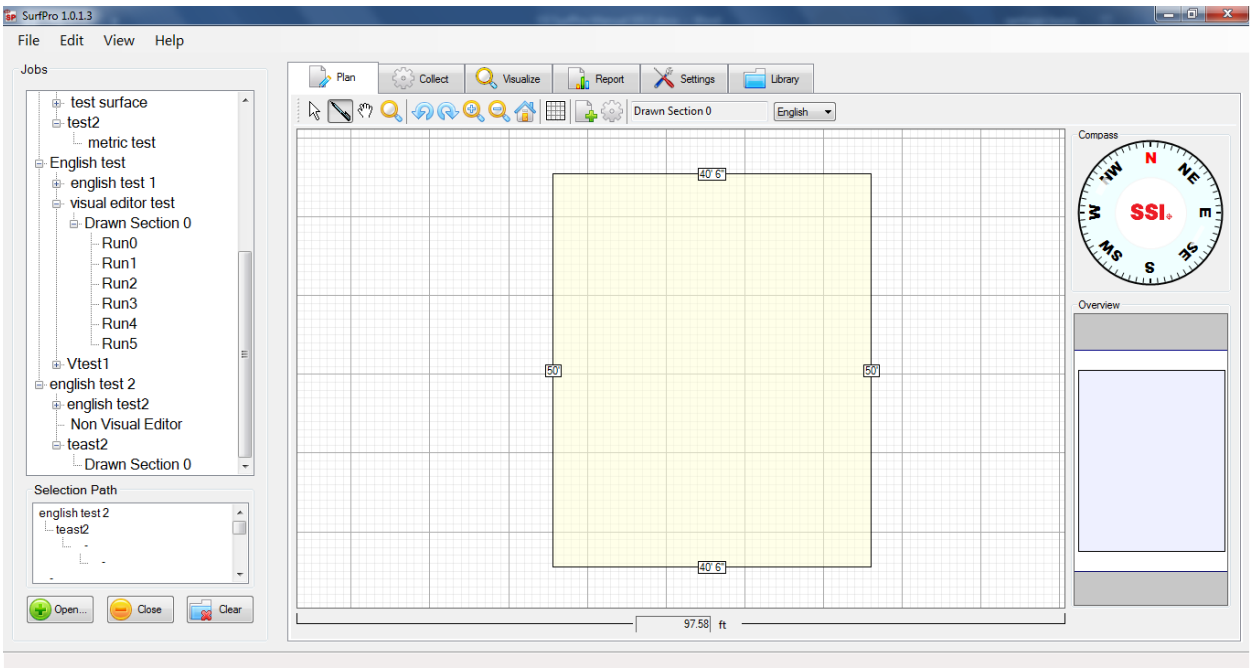


Figure 296: Visual run Plan tab

If the user selected the numerical entry button, the user will be prompted to enter the exact size of the surface and can alter its coordinates on the grid. See figure 37 where it says ‘Numerical Entry’

Compass

The software compass must be manually aligned to match the orientation of the surface within the Visual Editor. The compass is only found on visual surfaces and is stationary everywhere in the SurfPro software except for the visual editor when a surface is selected. This tool aids with profiling when the exact direct of the profiling path is not discernable. The compass direction can be changed only in the visual editor when a surface is selected. It is recommended that the user align the compass with respect to a cardinal direction. To set the compass, determine directions while looking at the section how it is set up in the visual editor. When collecting data, the compass will point north only if the user aligned the compass correctly under the surface visual editor.

To change the direction of the compass in the visual editor when a surface is selected in the Jobs Box, left-click and hold upon the compass and drag the mouse up or down with respect to the screen. When the direction of the compass is correct, release the mouse to save the compass direction.

Tool Bar

The names of the tools ca Figure 305: Visual run Plan tab on for 2 seconds. The tool bar in the visual editor includes the tools:

Edit Layout
Allows the user to select surfaces to edit with other tools.

Draw Mode
Allows the operator to draw sections by hand.
Pan Mode
Pan Mode allows the user to navigate over the surface without adjusting the viewing settings of the zoom options.
Zoom Mode
Enlarges the area of view that the user left-click and drags the mouse over.

Rotate Counter-Clockwise
Rotates the view of the surface counter-clockwise.
Rotate Clockwise
Rotates the view of the surface clockwise.

Zoom in
Enlarges the view of the surface.
Zoom out
Allows the user to view a larger amount of area of the surface.

View All
Acts as a fit to view of the entire surface. The zooming and panning actions will be reset and the screen will be set to the default view.

Toggle Grid
Turns the grid lines on and off.

Numerical Entry
Allows the user to create a surface using absolute dimensions. This process is more accurate than the draw tool.

Surface Properties
Permits the operator to change the properties of the surface such as flatness and levelness specifications, name, construction date and whether or not the surface is a visual surface.

Creating Sections
A section is created within this window using the numerical entry or draw mode. The created section is then selected in the Jobs Box to be viewed within the visual editor. The newly created section can now have runs created on top of it.

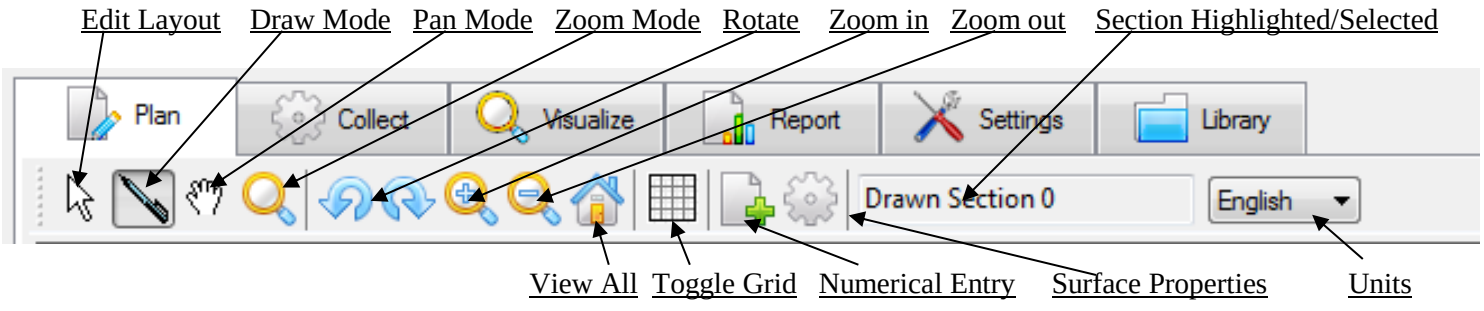


Figure 327: Visual Editor Tools

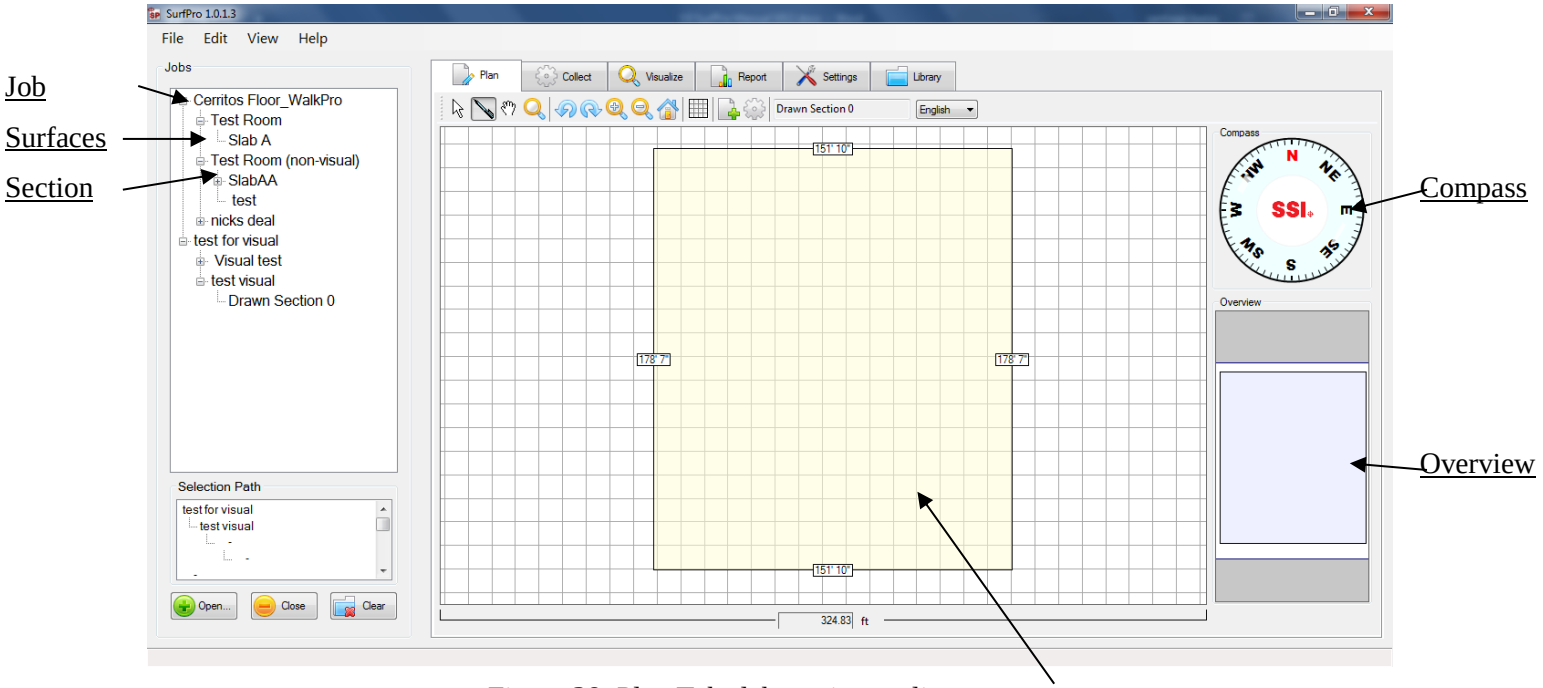


Figure 38: Plan Tab slab section outline.

4.2.2. – Plan Tab with Section Selected (Visual Surface)

The Plan Tab with section data selected displays the caliber of profiling simplicity with the SurfPro software. Within this window the user may create runs automatically to meet ASTM E-1155 floor flatness and levelness regulations.

After runs are created through 'Generate Runs' the Plan Tab window is the same whether a run or the section is selected in the Job Box.

Auto Generate Runs

After the section is created the user can will be given an option to automatically generate runs. The generate runs feature allows the user to choose the coordination of test runs and the method used to collect data. The software automatically uses the dimensions of the section to find the efficiency, minimum counts, and test run lengths by each method of parallel and perpendicular or 45 degree. The operator may then choose which method to use and begin collecting runs. (With **Metric Height Only**, runs will be created at one-meter intervals with two offset runs created normal to those runs at either ends of the collection.)

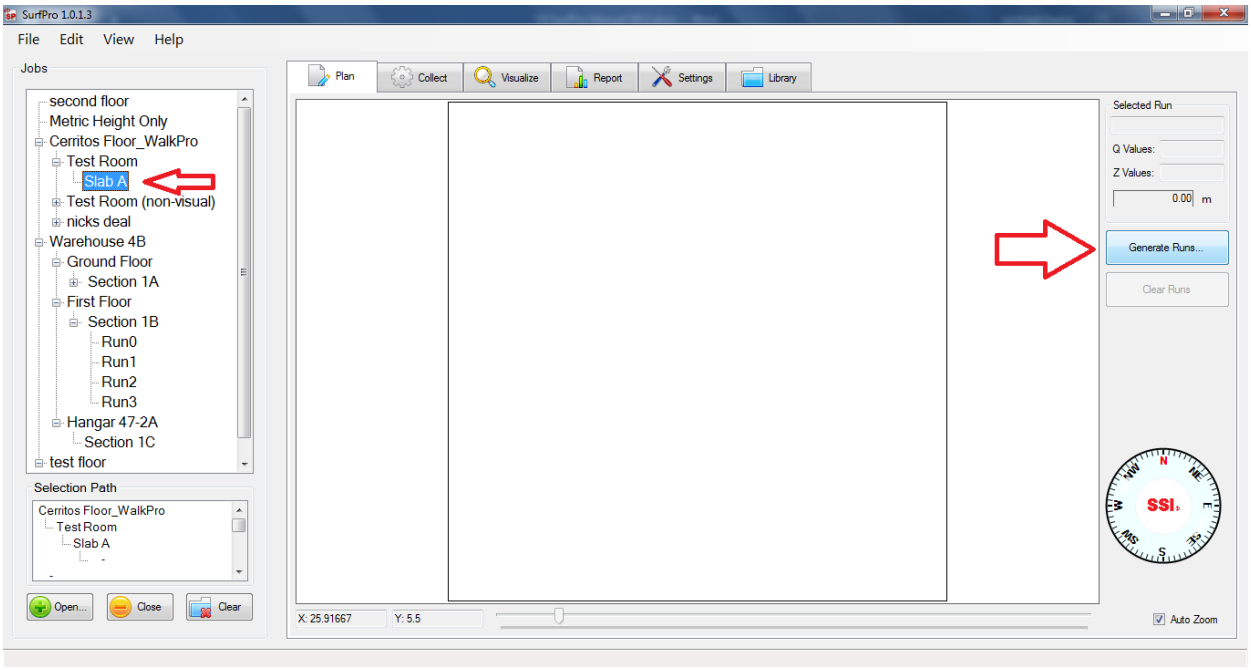


Figure 39: With the surface selected on the left, press the Generate Runs button on the right

Run Name Prefix

The run generator allows the user to choose the prefix of the run name. The default is set to run. This means, with a run coordination of 4 the names of the runs will be Run0, Run1, Run2, and Run3.

Change Method of Layout

To change the method or layout of the runs from perpendicular and parallel to 45 degrees, change the selector of the Layout Box in the Run Generator window. The method is to be chosen by the operator, there is no single way to profile a section. Frequently, the 45 degree method is more efficient, however the run paths are more difficult to find and follow during profiling.

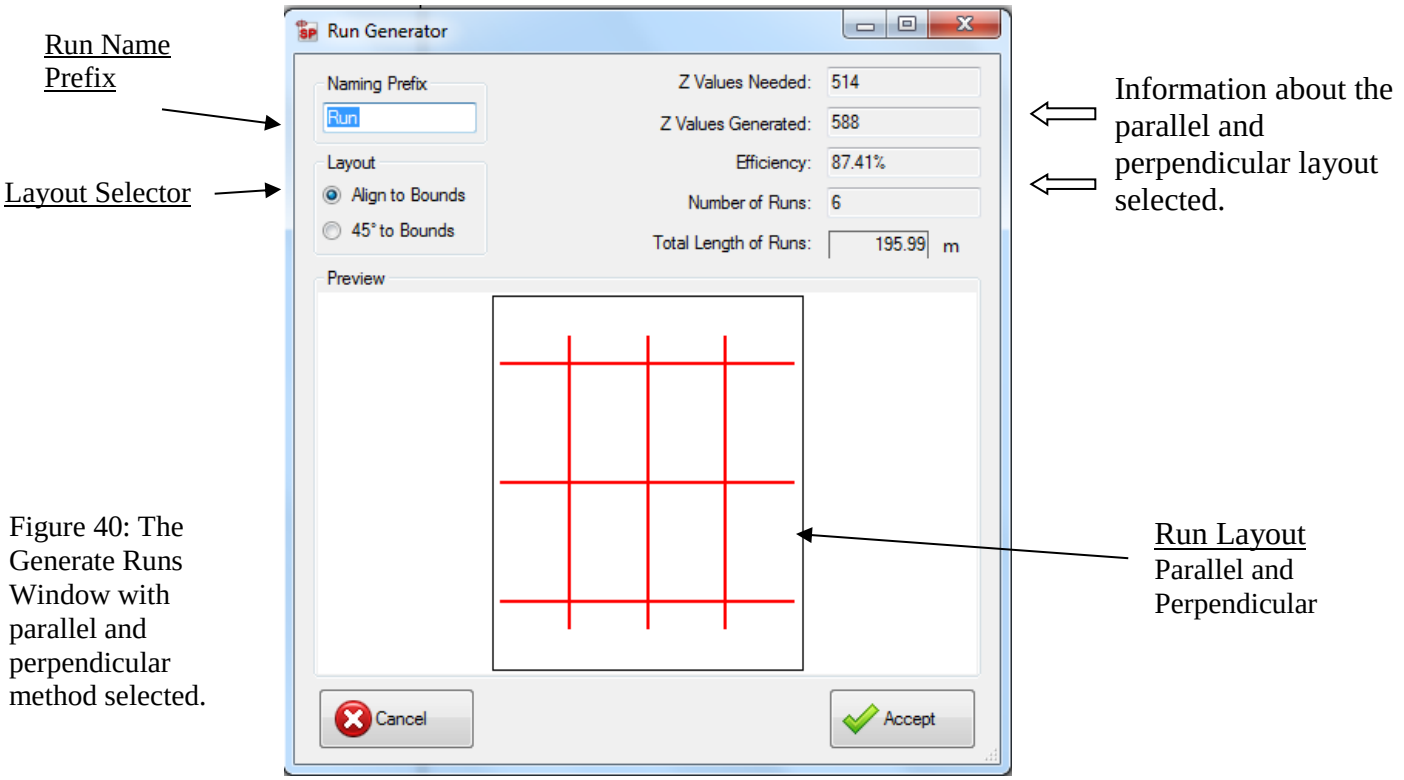


Figure 40: The Generate Runs Window with parallel and perpendicular method selected.

Run Path Order

To determine the location of each run number on the section, the user may move the mouse over the run path. When the mouse is scrolled over a run, the run is highlighted blue, and the run information can be found in the Selected Run region. Another way to find the location of a run path is to select a run from the Jobs Box. When the run turns blue the information about the runs, such as the Name, Q-values, Z-values, and total length all appear in the information area in the right corner of the window under 'Selected Run'.

Collection can be started by selecting the Collect Tab in the Operations Bar and then selecting the run path to be collected by left-clicking. After left-clicking upon the highlighted blue run, the collection window will appear. Or select the run to collect data on by selecting a run title in the Jobs Box or left-clicking a run in the visual editor after it turns blue. Selecting a run will open the collection window, where the operator may commence profiling.

Another sample of the automatically generated runs is provided to the right for a **Metric Height Only** surface. The offset runs are located at the top and bottom of this example. The first run (located on the left) and the two offset runs play a vital role for collection. Runs are generated automatically to minimize the number of runs needed while maintaining a 1 meter spacing between each run. Offset runs are added perpendicular to the other runs to stitch all the other runs together so that the first run becomes the reference point for all other runs. After hitting accept the runs will be created and added to the section.

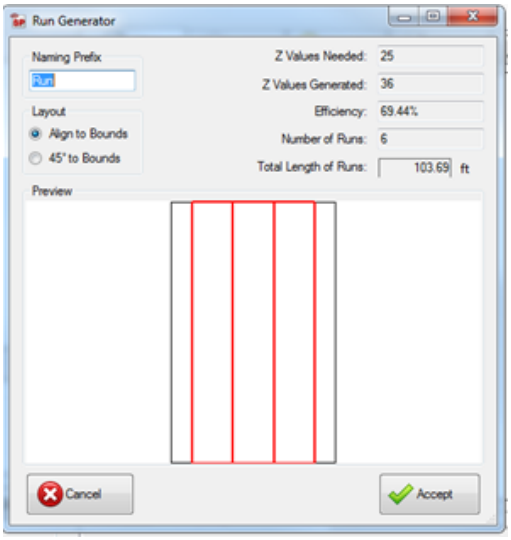


Figure 41: The Run Generator Window for metric height only.

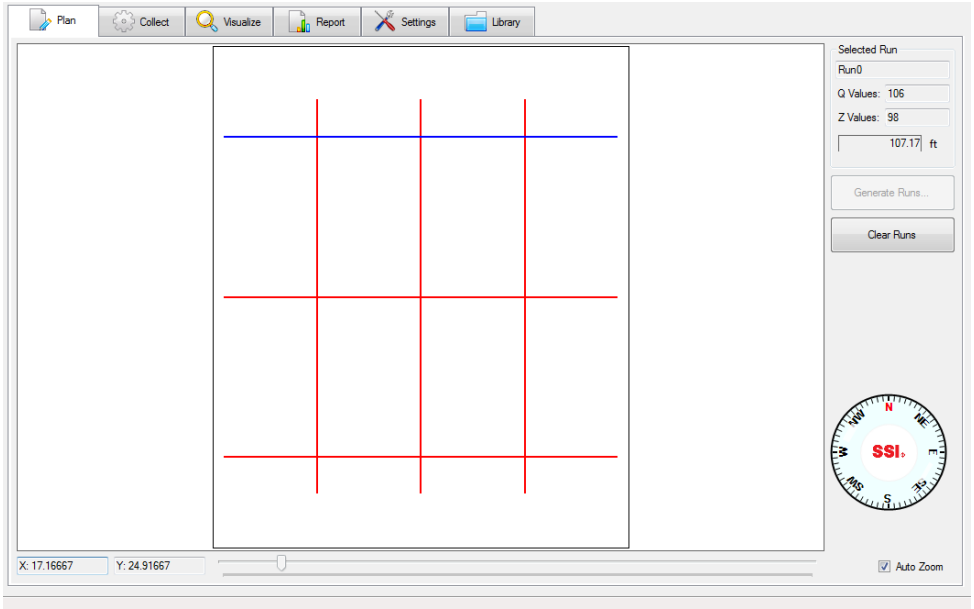


Figure 42: Selecting runs for collections. The blue run is selected

Starting Locations For Each Run

When the operator is ready to begin collecting data, the starting and ending locations will need to be found on the section. To do this in the visual editor, run the mouse over an end of a run path until the end of the path shows a green square. Once the green square appears, left click. A window will appear that shows the distances from each side of the section where the start (or end) of the run is located. The large green arrow in the window points in the forward profiling direction. After the profiler is at the starting location, selecting 'OK' in the window will open the Collect Tab to begin collecting data on the run path.

Green Square. Click on this square to find the distances from the sides of the section to start or end profiling.

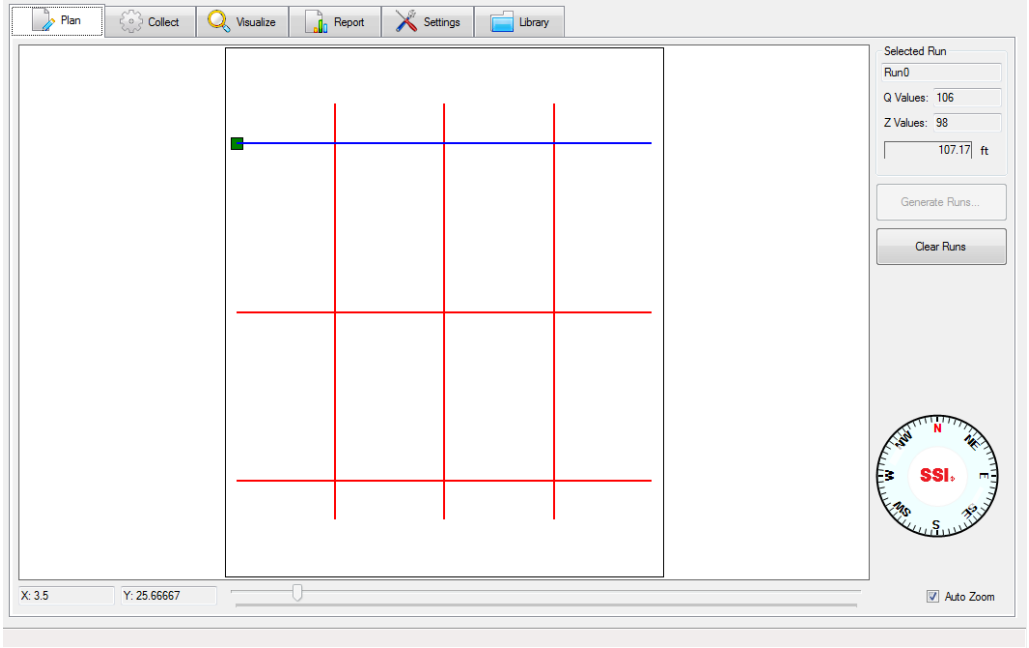


Figure 43: The Green Square to show distances of endpoints.

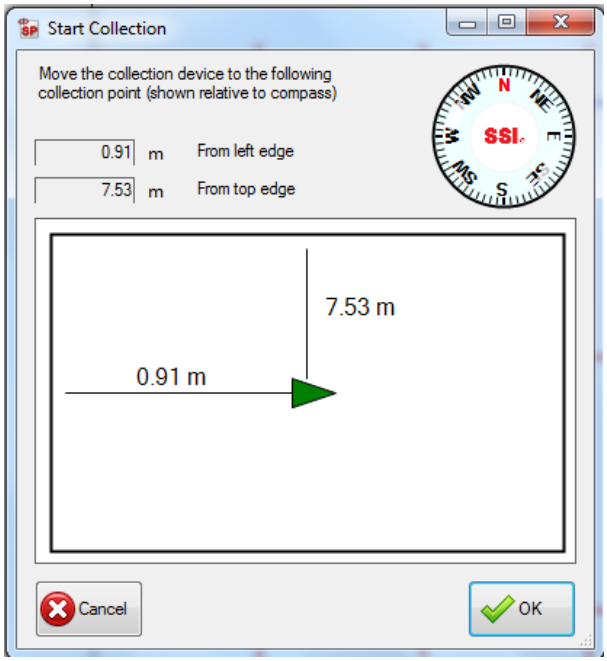


Figure 42: The window that appears when the green square is selected.

Selecting 'OK' will open the Collect Tab to allow collection of data for this run. The arrow points in the direction of motion during profiling.

Auto-Zoom

The auto-zoom feature keeps the section and surface in view. To disable the auto-zoom, uncheck the box and use the bar below to choose the aspect ratio desired.

5.0. – Collect Tab

The Collect Tab can be accessed through the Operations Bar or by selecting 'OK' on the endpoint locations window. Once the Collect Tab is open, the visual editor can be accessed to select a run path by left-clicking. This will also open the Collecting Window.

If no run is selected or a section is not selected for visual surfaces, the collection window will display, "Select a Run to Collect." To collect data under a visual surface, either a section or run needs to be selected. For non-visual surfaces, only runs can be selected. A surface can be determined visual or not by selecting the Job title in the Jobs Box and selecting the surface in question in the Created Surfaces Box. Below the Created Surfaces Box is the information on the surface which states if the surface selected is visual or not.

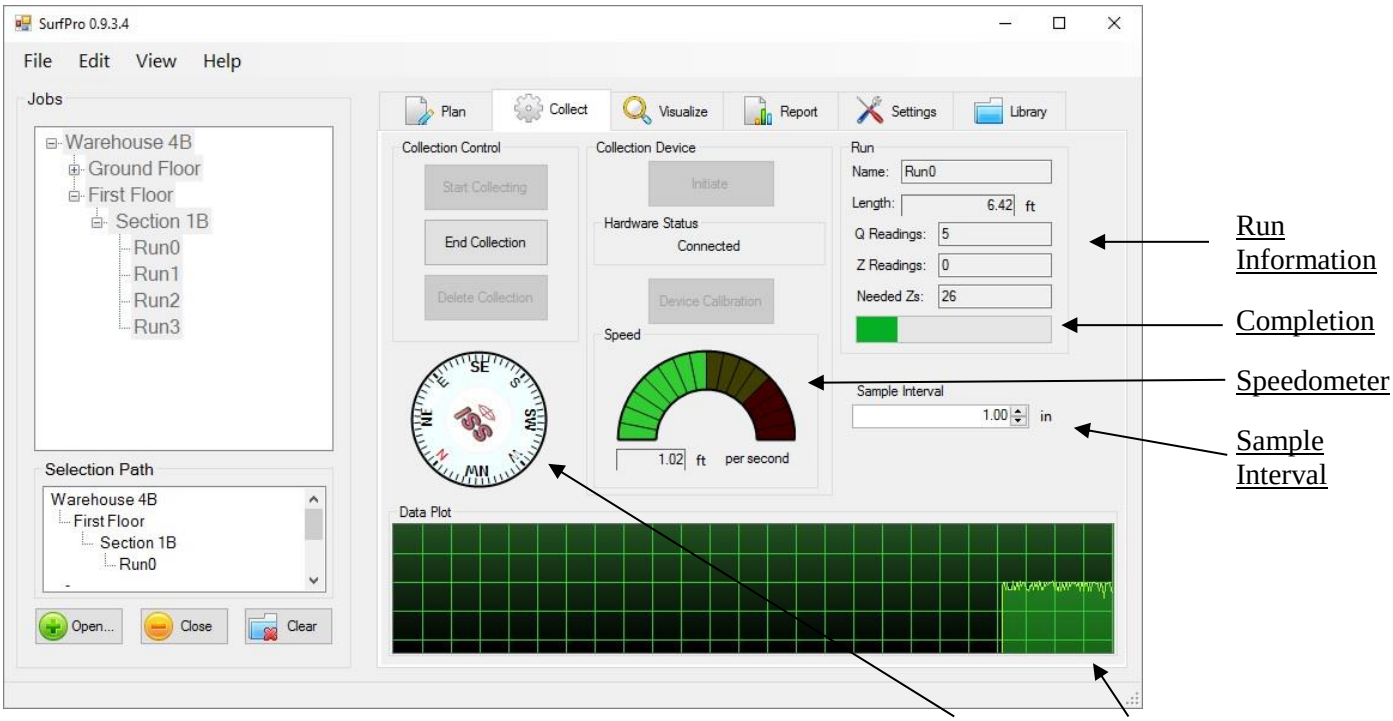


Figure 43: The Visual Surface Collect Tab. Notice the Compass.

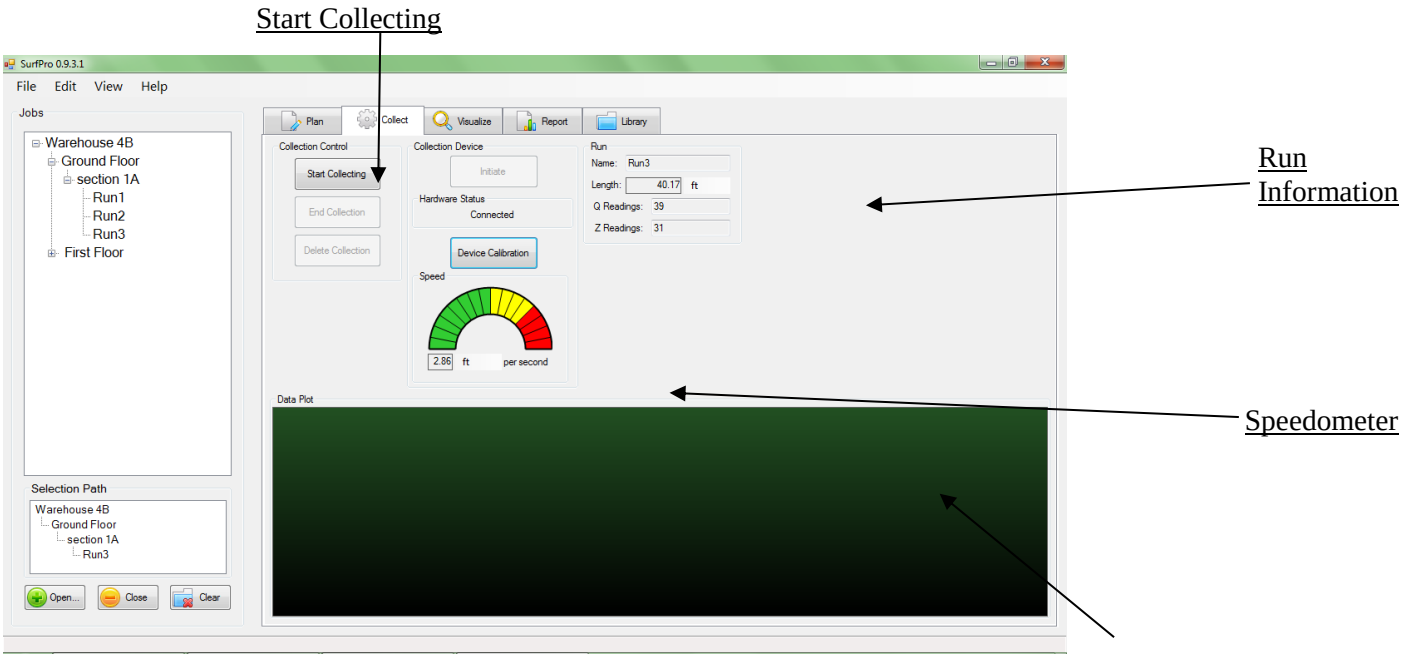


Figure 44: The Collect Tab for non-visual surfaces. Notice there is not a compass.

5.1.1. – Start Collection Button

Start collection begins collecting data tied to the run path listed under the 'Run' region of the window. Start collection can only be used after the hardware has been found. To set the device to be connected, set the settings window to the correct preferences (SSI CS8800) and then click on the "Initiate" Button to connect to the hardware. The settings window is located under the view tab in the Menu Bar. It is recommended that the device be calibrated prior to collecting profile data. The device will go through a "loading filter" status before it is connected. There is a sampling interval option that allows you to change the interval the data is collected at. The FF-numbers are calculated at 12inches regardless of the sample interval.

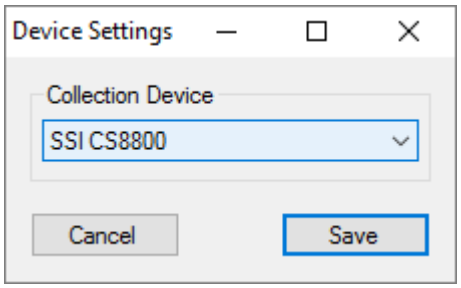


Figure 45: Select collection device

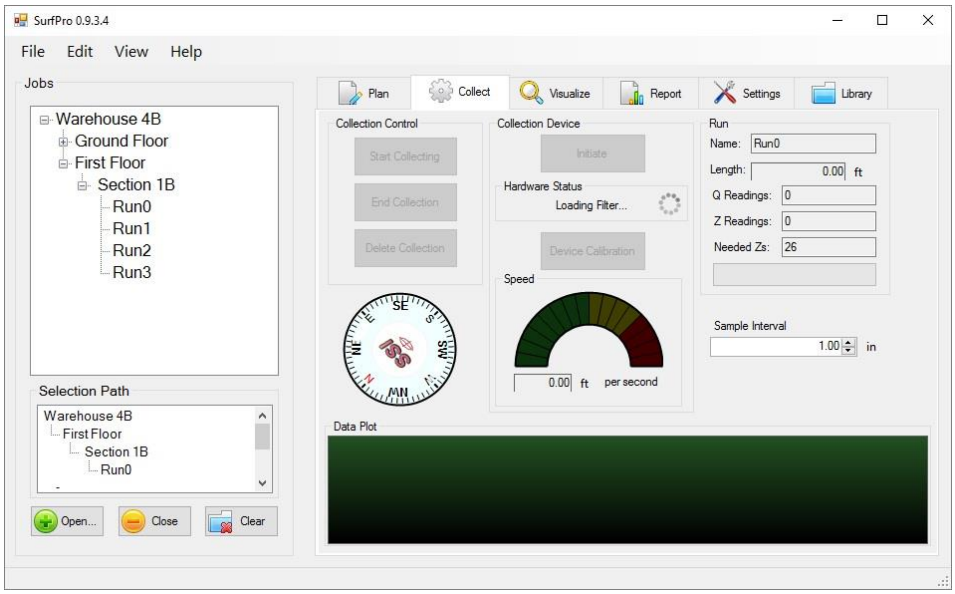


Figure 46: Initiate Collection Device

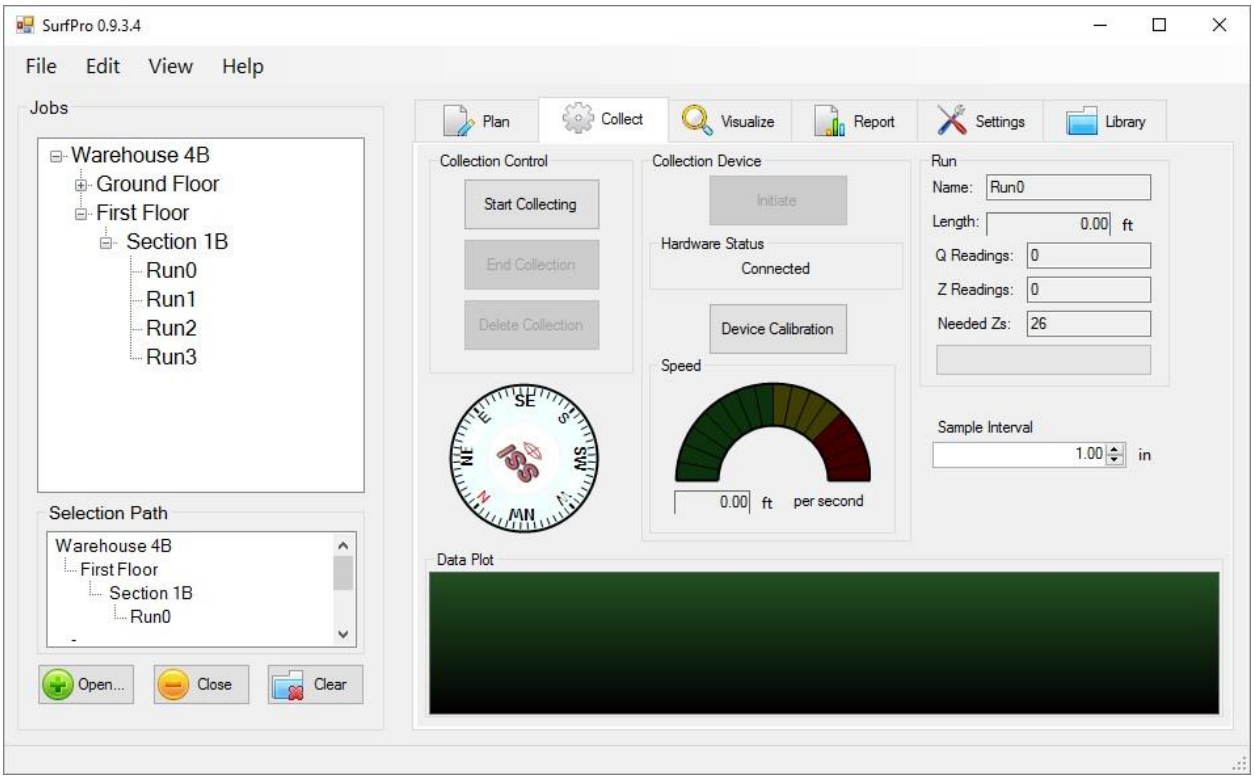


Figure 48: Ready to begin collection with the Start Collection button activated.

Before clicking "Start Collecting", make sure the front wheel of the WalkPro is on the starting point. After hitting the button, you can start pushing the device and you will notice it starts at -1.50 ft. This is to allow for 1.5ft of run-up data before collecting the needed profile data for FF-numbers.

Figure 49 shows the window immediately right after pressing the "Start Collection" button.

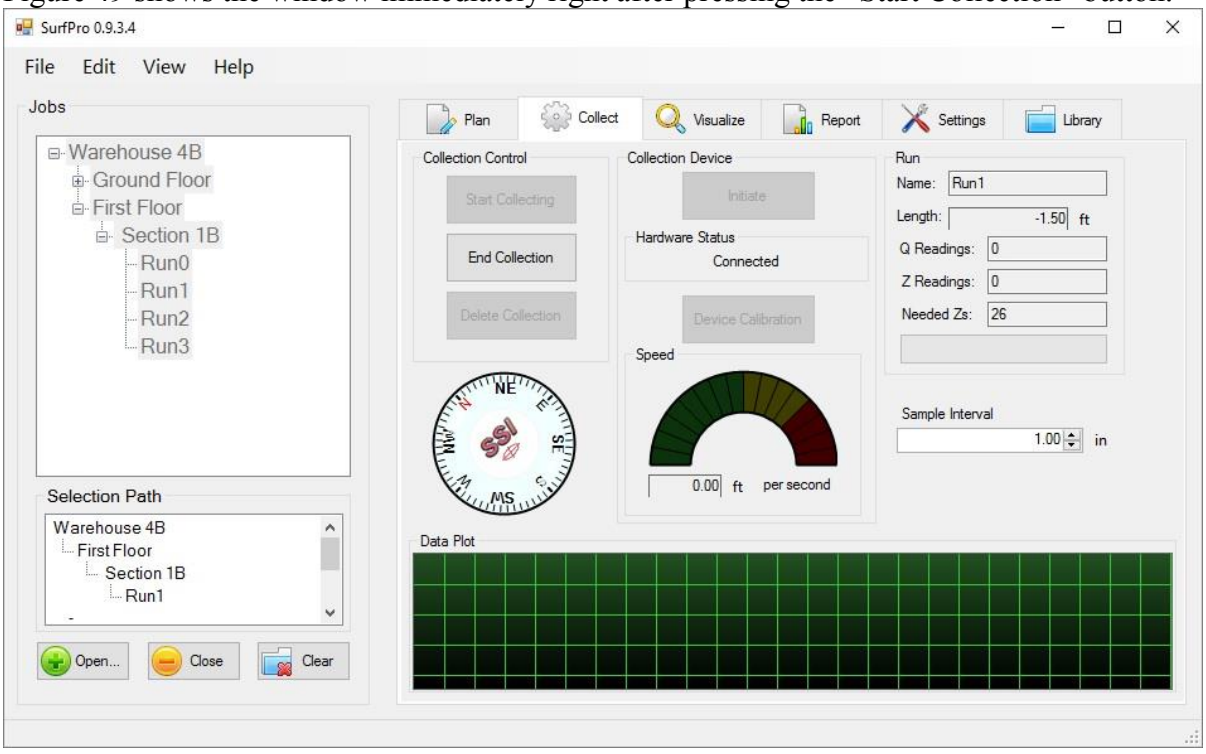


Figure 49: After collection began

5.1.2 Collection (Metric height only example)

For best results for a **Metric Height Only** job, it's recommended to do a closed loop collection on the first run and offset runs 1 and 2. The other runs do not have to be closed loop. In the example below, that would be 3 total closed loops runs and 3 total normal runs.

If these runs, the reference run and two offset runs, are not collected as close loop (one collection in on direction, then a second collection in the other direction) the data will be skewed and incorrect, so great deal of care must be taken to insure accurate values.

The sample collection below uses the Metric Height Only surface in Figure 41:

Start and end relative to run 0, the reference run.

Run 0 – Collected in the Up-Station direction, and closed loop bringing us back to the start.

Run 1 – Collected in the Up-Station direction, bringing us to the other end.

Run 2 – Collected in the Down Station direction, bringing us back to the start.

Run 3 – Collected in the Up-Station direction, bringing us to the other end.

Run 4 – Offset 1 – Collected in the Up-station direction starting at the start of the reference run ending at the start of the Run 3.

Run 5 – Offset 2 – Collected in the Up-Station direction starting at the end of the reference run to the end of the Run 3.

An illustration is provided.

Direction of collection can be changed at time of collection, they do not have to directly match those in the example. Up station is generally shown to be downwards in the software. This is indicated by a visual guide that can be enabled/disabled.

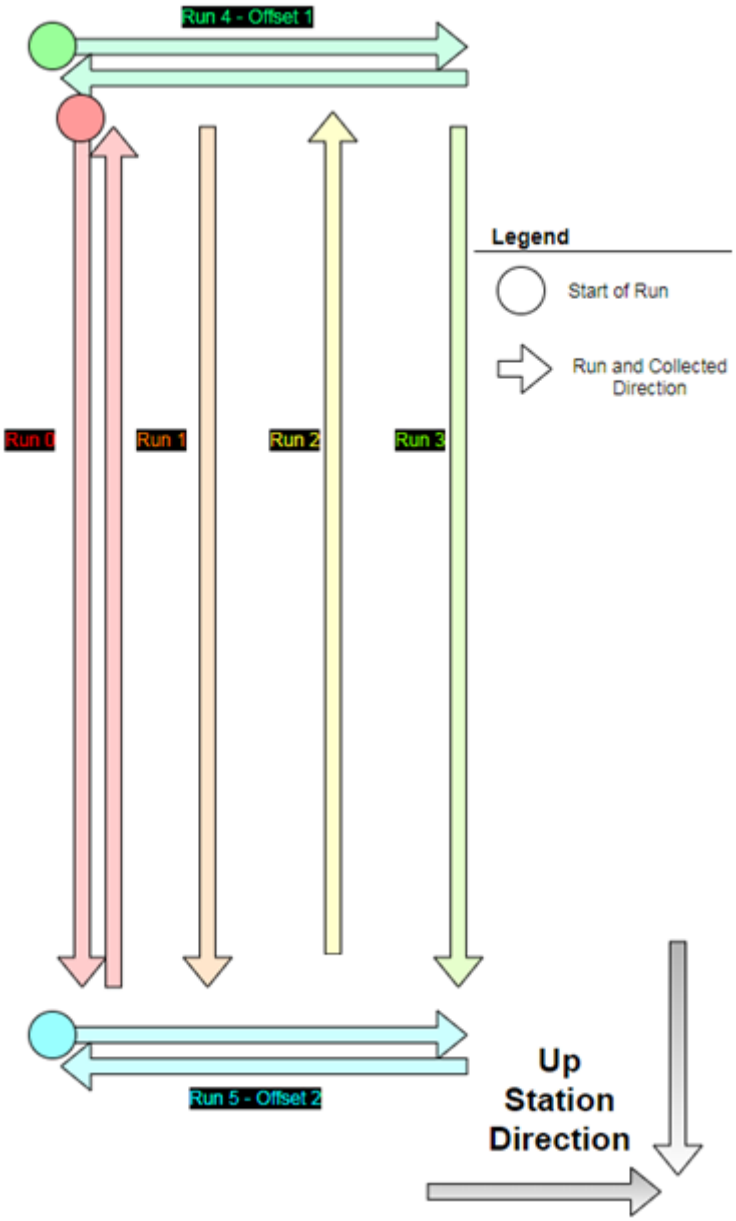


Figure 50: Collection procedure run layout.

5.1.3. – End Collection

The End Collection button ceases the collection of data to the run path. If the run paths were created through the generate runs routine while part of a visual surface, then the software will terminate each run when the length and Z-counts are met for the current path. If the operator is not using a visual surface, the termination must be manually enacted by the operator.

5.1.4. – Delete Collection

Delete collection is only available after a collection has ended. If the run was made in error, it can be deleted and profiled again. Deleting a run can be enacted at any time and only deletes the data associated with the run name.

5.1.5. – Collection Device

The collection device has the initiate button which connects and prepares the hardware for data collection. Once the hardware is initiated, the icon is available.

5.1.6. – Hardware Status

Under the Hardware Status region are the calibration routines. The calibration icon covers the height and distance calibration.

5.1.7. – Speed

The speed region contains the speedometer that measures the rate the operator is traveling. Fast paces or abrupt changes in pace can result in inaccurate profile data. It is advised to keep the speedometer out of the red region.

5.1.8. – Run Information

For non-visual surfaces, the run information has the run name, length of the run traveled, and the amount of Z-readings and Q-readings collected.

For visual surfaces, the run information zone displays the run name, length traveled, Q-readings and Z-readings collected and the amount of Z-readings needed. When the amount of Z-readings needed is met the collection is automatically terminated.

5.1.9. – Data Plot

The data plot is a visual height representation of the collected data in real time.

5.1.10. – Completion Bar

The completion bar shows the approximate percentage of the data run that has been completed. This feature is only available for visual surfaces.

5.1.11. – Compass

The compass shows the direction that the physical compass mounted on the device should show when pointed in the correct direction. The compass appears in the Collect Tab only when the visual surface option is implemented.

6.0. – Visualize Tab

The visualize tab allows the user to see spatial analysis of the profiled sections when using visual surfaces.

Show Runs

The show runs feature superimposes the run paths onto the spatial analysis plot.

Change Units

The units of the spatial analysis plot can be changed by left-clicking on the current unit preference and left-clinking again to signify the desired units.

Non-Visual Surfaces and Sections Selected

When non-visual surfaces and sections are selected the 'Visualize Tab' displays "You can only visualize visual surfaces."

To create a visual surface, select Add New Surface under the Plan Tab when a job title is selected in the Jobs Box, or right click on a surface title in the Jobs Box and select 'Properties.' When the surface properties window opens, the Use Visual Editor option will appear only if the surface does not have sections associated with it. If the surface has attached sections, the operator must delete these sections and revisit the Surface Properties Window and select Use Visual Editor. To determine if a surface is a visual surface, use the Surfaces Box (far right) under the Plan Tab when a Job is selected in the Jobs Box. When a surface is selected in the Surfaces Box, the information below will inform the user if the surface has any attached sections and if the surface is visual or not (lower right hand corner).

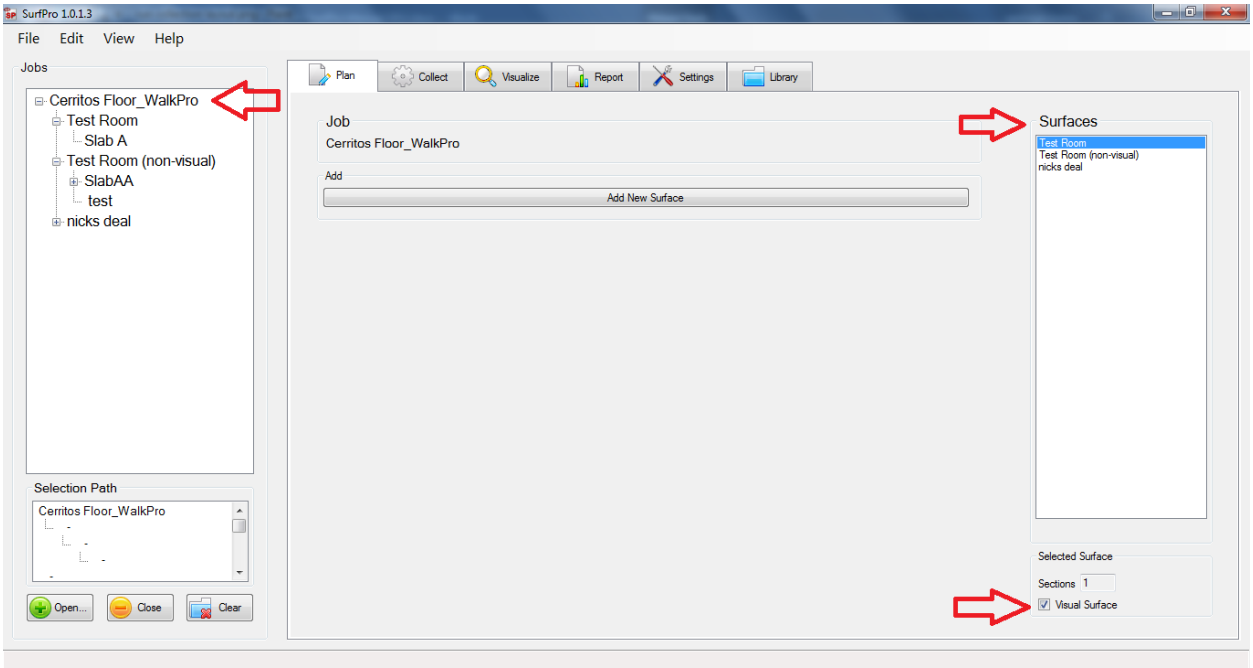


Figure51: Plan tab showing Surfaced box Visual/NonVisual status of surface

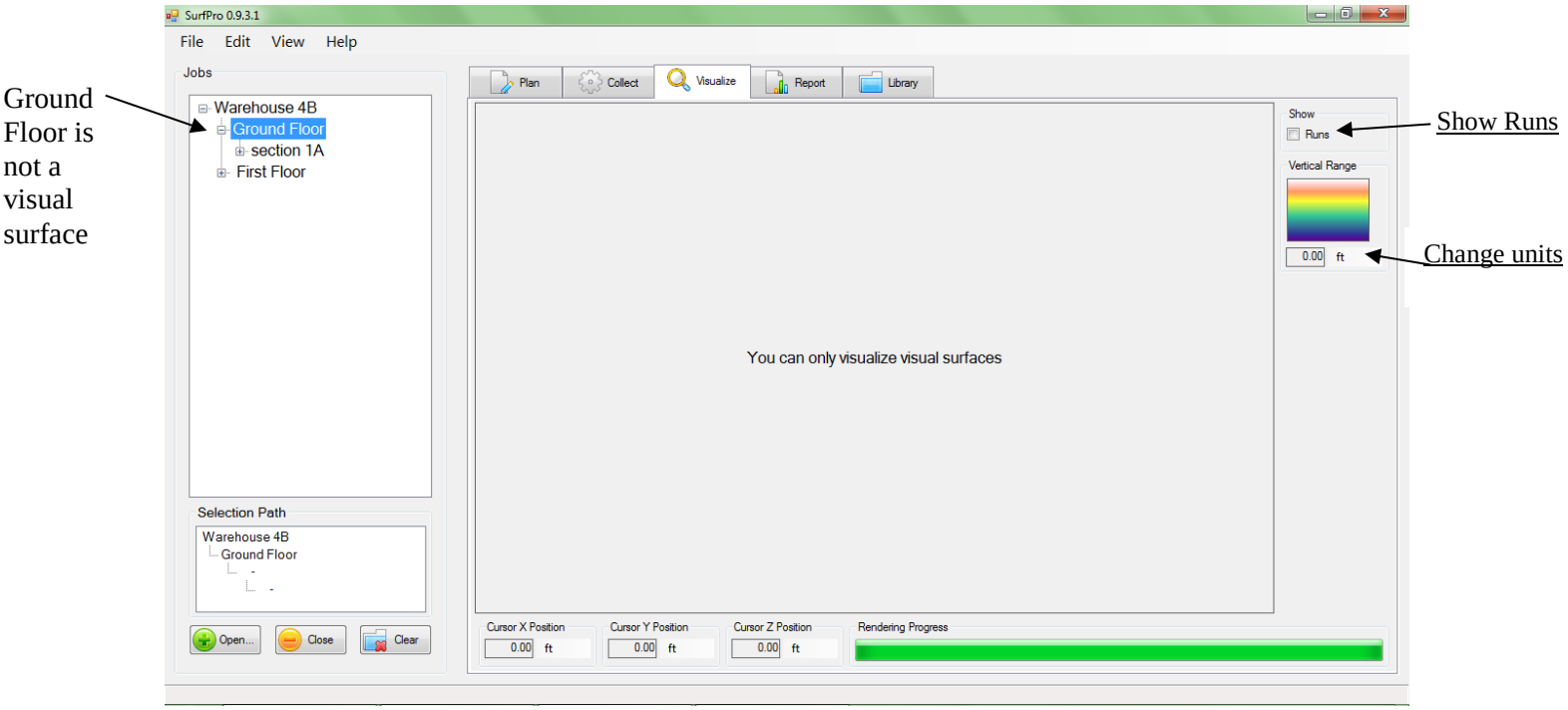


Figure52: Visualize Tab

Figure52: above displays the window of the Visualize Tab when a non-visual surface or section is selected. A surface is selected because the selection path window shows a surface as the lowest level.

Non-Visual Runs Selected

When a non-visual run is selected in the Visualize Tab the plot from the Collect Tab's Data Plot graph appears in larger form.

Non-visual runs originate from non-visual surfaces and sections. A non-visual run cannot be converted to a visual run.

The units of the cursor location shown in X and Y coordinates can be changed by selecting the current units with a left-click and selecting the desired units with a left-click. The origin of the axis is at the middle of the vertical range and at the left of the window, or at the beginning of the profile data.

There is also an "export" button that allows you to export the raw data of any run selected. This will export to a csv file that just has the elevation points spaced at whatever interval the sampling interval was set to during collection.

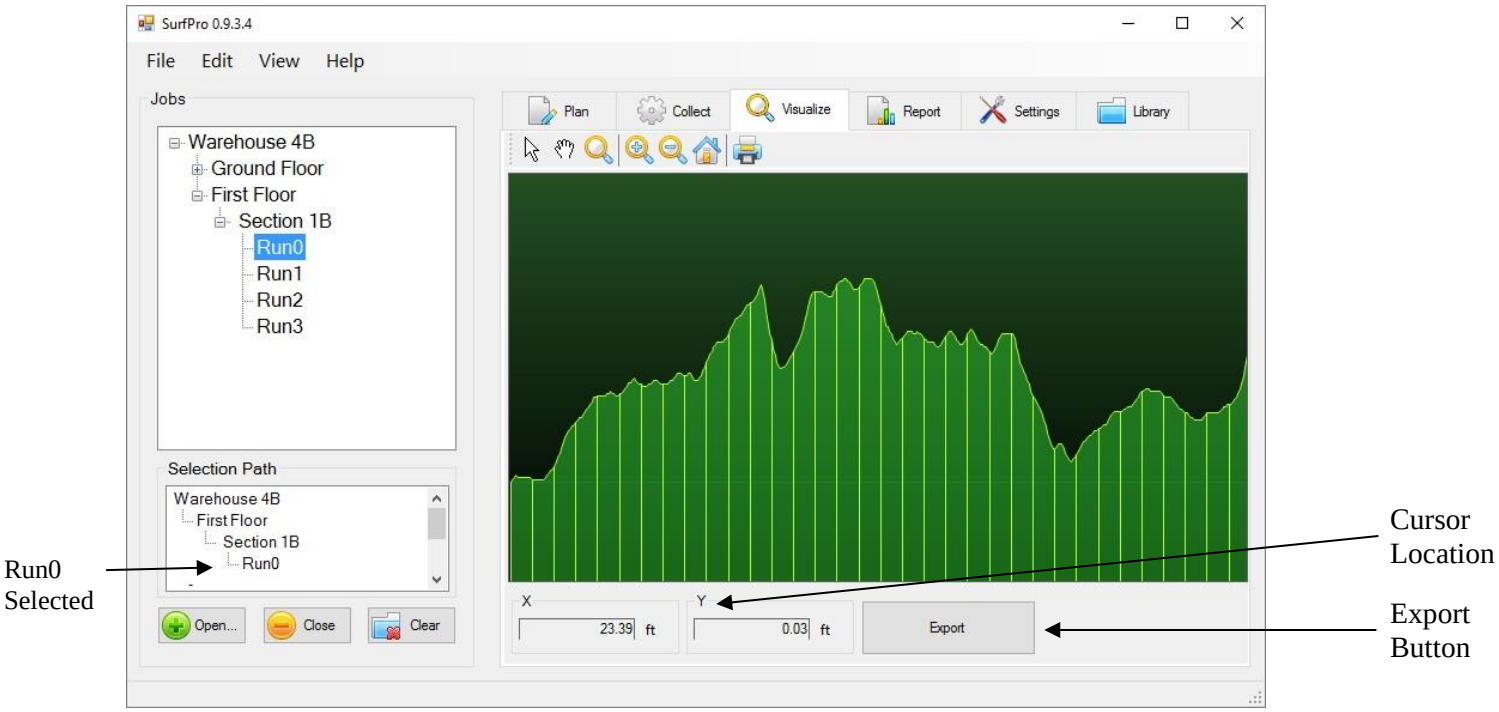


Figure 53: Profile data plot

Figure 53: above shows the window when a run is selected under a non-visual surface. The plot can be used to find the height of the profile characteristics by pointing the cursor over the plot area and reviewing the cursor location.

Visual Surfaces or Sections Selected

When a visual surface or section is selected in the Jobs Box while under the Visualize Tab, the result is a spatial depiction of the profiled surface. The view of the plot is looking down in the section from above.

The color representations of height in this analysis are indicated in the legend. The top of the legend is the maximum height, or maximum range of the plot. The numerical result for the maximum range is located under the legend.

The cursor location can be viewed at the bottom of the window with respect to the X, Y, and Z axes. The X-axis the left to right, the Y-axis is up and down, and the Z-axis is the height of the profile. The units of the cursor location can be changed by left-clicking upon the current units and selecting the desired units with another left-click.

The operator has the option to show the runs on the analysis to indicate the paths of the profiling. This can be done through checking the box labeled Runs in the show region. See figure 54 below.

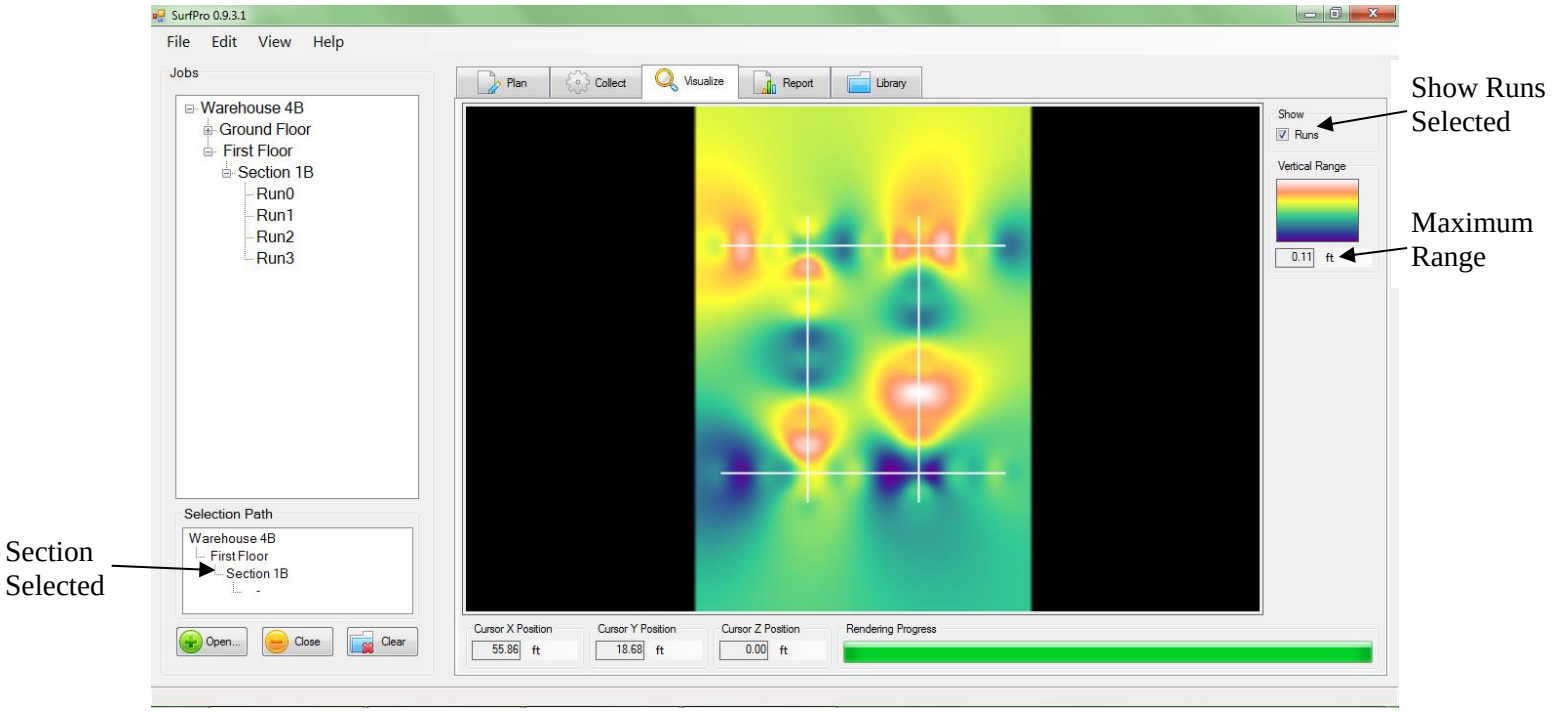


Figure 54: Spatial analysis of a visual section.

Visual Surface with Runs Selected

When an individual run is selected in the Jobs Box while under the Visualize Bar, the following window appears displaying the same graph as the Collect Tab's Data Plot. The only difference between the two plots is that that Visualize Tab's graph covers a larger portion of the screen. The operator can find the height and distance between profiled characteristics by using the cursor and the location distances shown in the lower area of the window.

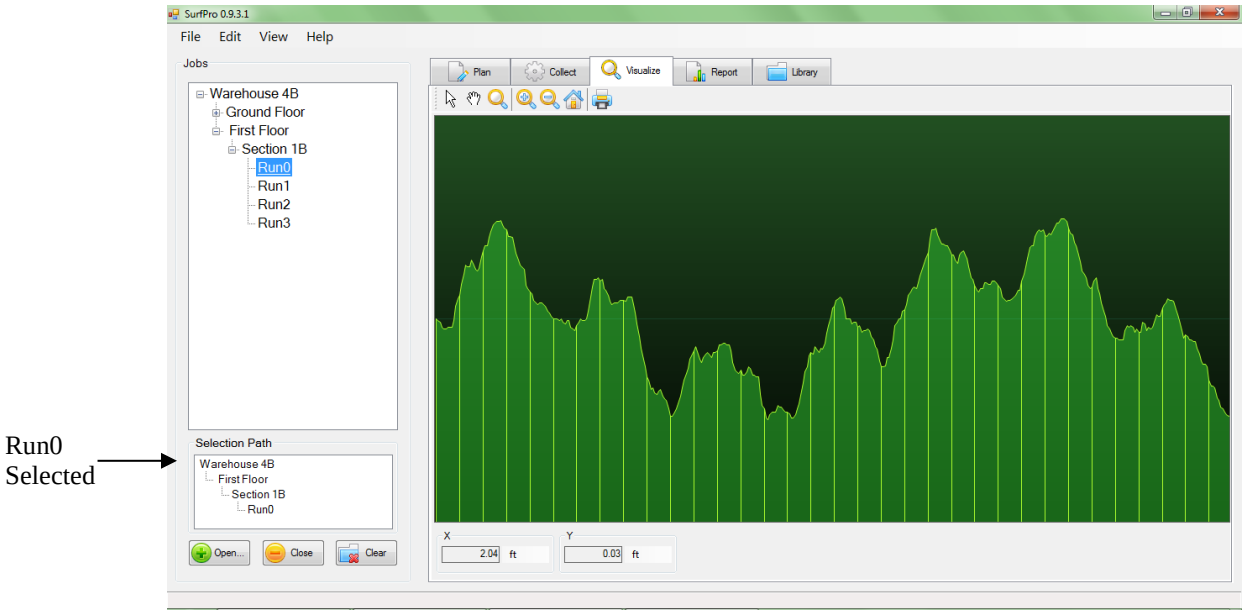


Figure 55: Visual surface run selected under the Visualize Tab.

7. Settings Tab

Make sure the units set are the same as the units in the Job specs. The “Traffic Type” is by default set to ‘Random’ where it must not be changed to ‘Defined’ unless explicitly mentioned in the specs. The operator can also choose to ‘Ignore FL Values’ and or ‘Show Waviness Index’ under “Report Opcions”.

New settings are added specifically for use with the **Metric Height Only** specification that allows customization of the excel report. Users are now able to highlight values above and below a threshold and offset all the height values by a constant value, useful if you’d like to make all values reference a different point as zero.

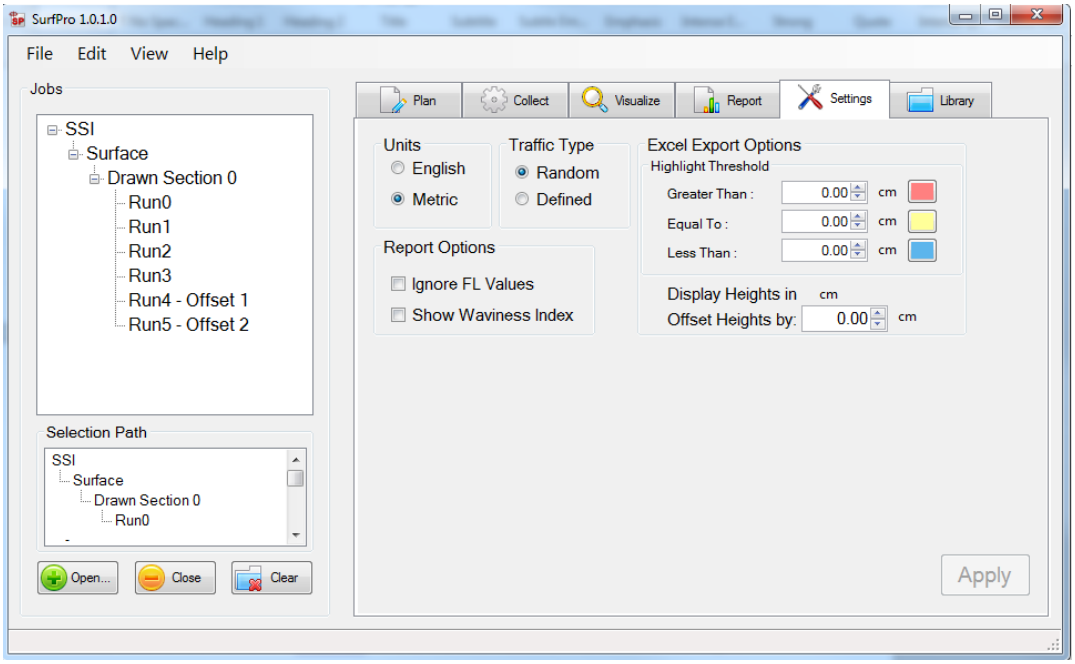


Figure 56: The setting tab window

8.0 – Report Tab

The Report Tab of the Operation Bar shows the results of the floor flatness and floor levelness tests according to the surface selected in the Jobs Box. When the surface changes, the report changes to show the correct specification and test results.

The report shows the results in a spreadsheet format with the topics of the flatness and levelness numbers measured and the specified. Each surface report then shows each run with its own levelness and flatness results along with the respective Z-counts and Q-counts. The Z-count and Q-counts can be added up to make it certain that the minimum number of count were met during profiling.

The report tab shows nothing while a Job Title is selected in the Jobs Box. The report is surface based since surfaces are the highest level of the Jobs Box that can have different flatness and levelness specifications. When surfaces, sections, and runs are selected in the Jobs Box while under the Report Tab, the report window will be the same.

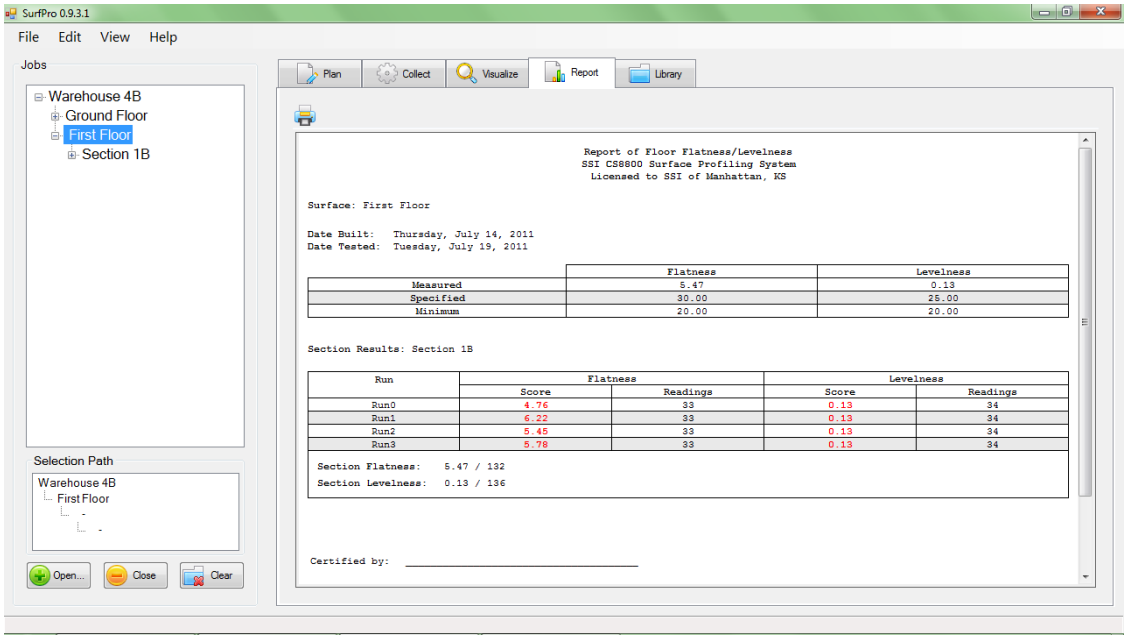


Figure 57: The screen shot above shows the report of the surface “First Floor.”

Metric Excel Reporting

After collection, navigate to the report tab and select the excel export button. This button will prompt the user for a save location for the file, once selected will begin exporting the report.

An example of the report is provided to the right.

The report displays the x and y positions, in meters, the data collected, or in other words the position the data was collected. The values are in units shown above in the header of the report as well as date collected, offset, and section name.

1		Surface:			lot	
2		Section:			by the shoppe	
3		Date Tested:			Wednesday, April 18, 2018	
4		Units:			cm	
5		Offset:			0cm	
6	**Position (M)**	**0.00**	**1.00**	**2.00**	**3.00**	
7	**0.00**	0.00	-0.93	-2.08	-2.79	**0.00**
8	**1.00**	-0.21	-1.11	-2.04	-2.86	**1.00**
9	**2.00**	-0.35	-1.02	-1.96	-2.69	**2.00**
10	**3.00**	-0.28	-1.03	-1.47	-2.50	**3.00**
11	**4.00**	-0.34	-1.05	-1.51	-2.39	**4.00**
12	**5.00**	-0.27	-0.89	-1.41	-2.20	**5.00**
13	**6.00**	-0.31	-1.12	-1.10	-2.26	**6.00**
14	**7.00**	-0.29	-0.83	-1.25	-2.05	**7.00**
15	**8.00**	-0.17	-0.69	-1.35	-1.91	**8.00**
16	**9.00**	-0.17	-0.76	-1.27	-2.02	**9.00**
17	**10.00**	-0.22	-0.76	-1.32	-1.92	**10.00**
18	**11.00**	-0.26	-0.68	-1.20	-1.78	**11.00**
19	**12.00**	0.21	-0.35	-1.34	-1.76	**12.00**

Figure 58: The excel export template for Metric Height Only collections.

9. Printing

Printing of the report can be started by selecting the printer icon in the top left corner of the report tab. Once selected the page layout window will appear. This window offers options of paper size, headers, footers, margins, and font. To select the correct combination of these options, left click on the current setting and select the desired setting from the drop down menu. Once the page setup window is close, either by selecting okay or cancel, the print window appears. Within the print window the operator can choose the printer used and set additional printer settings.

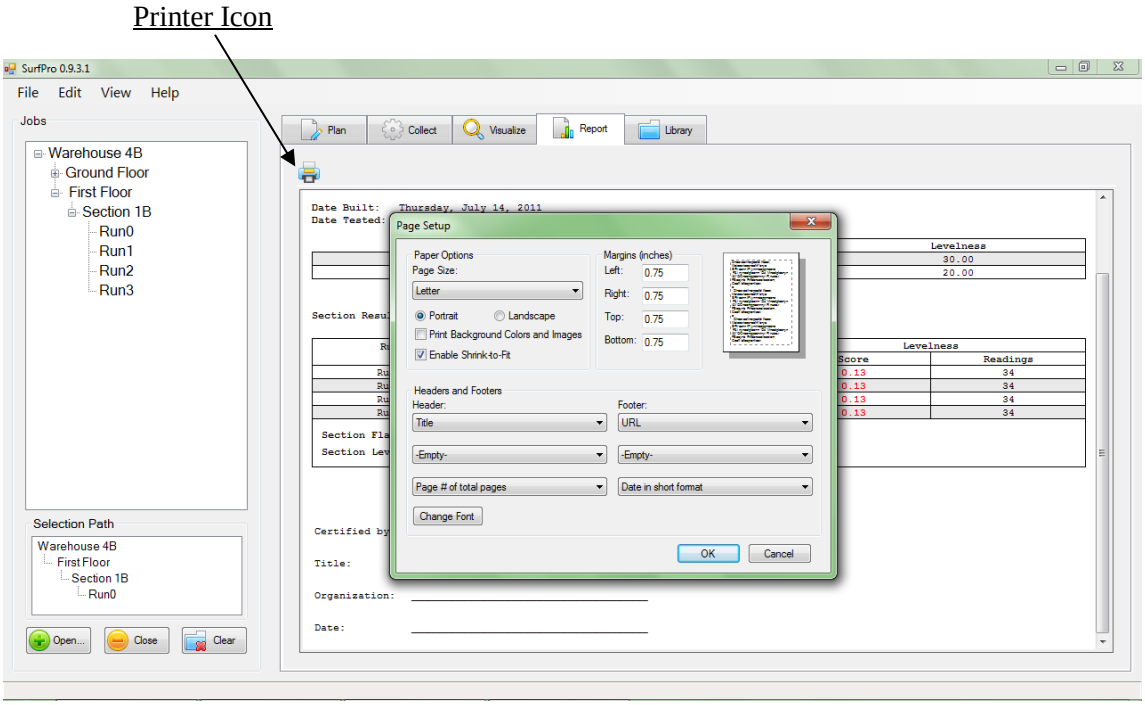


Figure 59: Printing Reports

10. – Library

The library feature of the SurfPro software maintains a record of the past job files that have been opened on the user's computer. To open a job file saved on the user's computer or external device quickly and efficiently, select the load icon to import the job file to the Jobs Box. If the library lists the job file as unavailable, please connect the external memory that contains the job file. After connection of the external device, the library will be able to import the job file into the SurfPro software.

The library can be accessed through the File Tab or through the operations bar. It is also possible to import and open job files under the File Tab through Open Existing File.

Clear All

The Clear All option found on the bottom of the library clears all library memory of file locations. Although the files are absent from the library, the job files are not deleted from the user's hard drive.

Remove Missing Files

The Remove Missing Files feature deletes the job files that are unavailable at the time of selecting 'Remove Missing Files.' Although the files are absent from the library, the job files are not deleted from the user's hard drive.

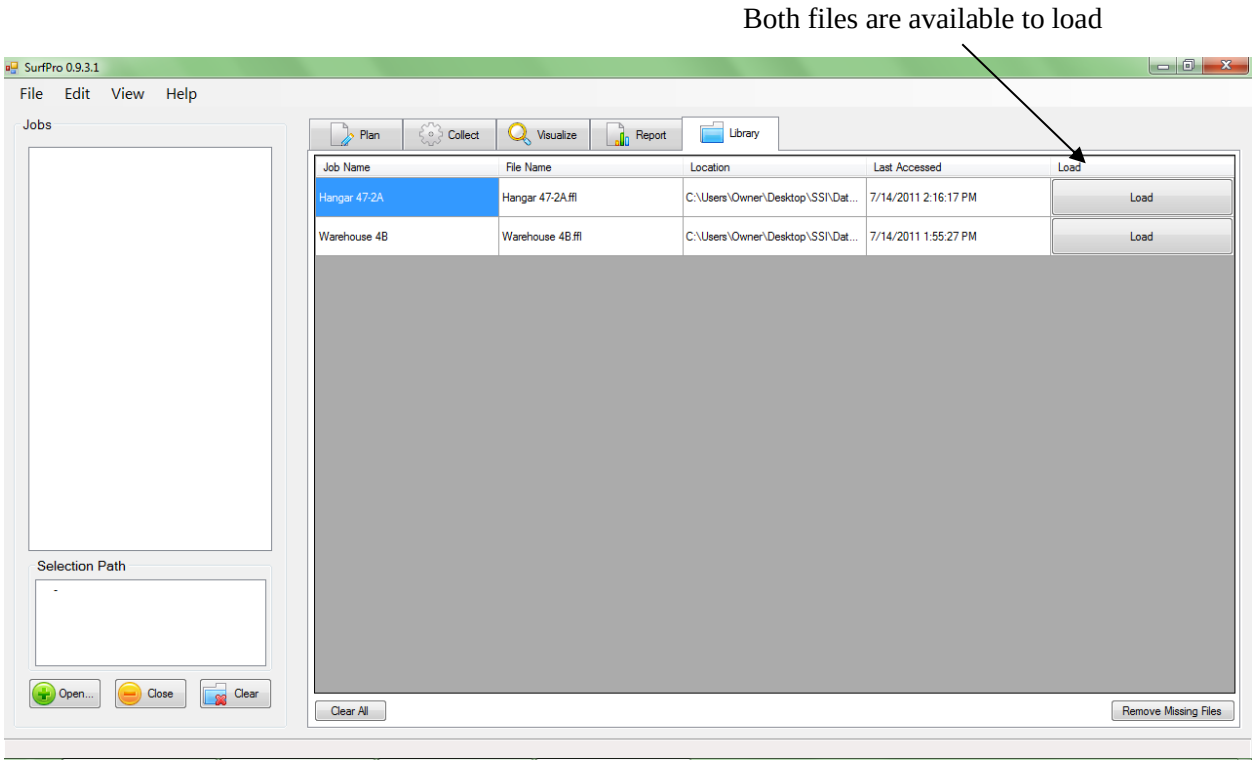


Figure 60: Library opened with two job files available.