InstroTek® Inc.

innovators in instrumentation technology

Smart_SCB Jig

Breaking Head
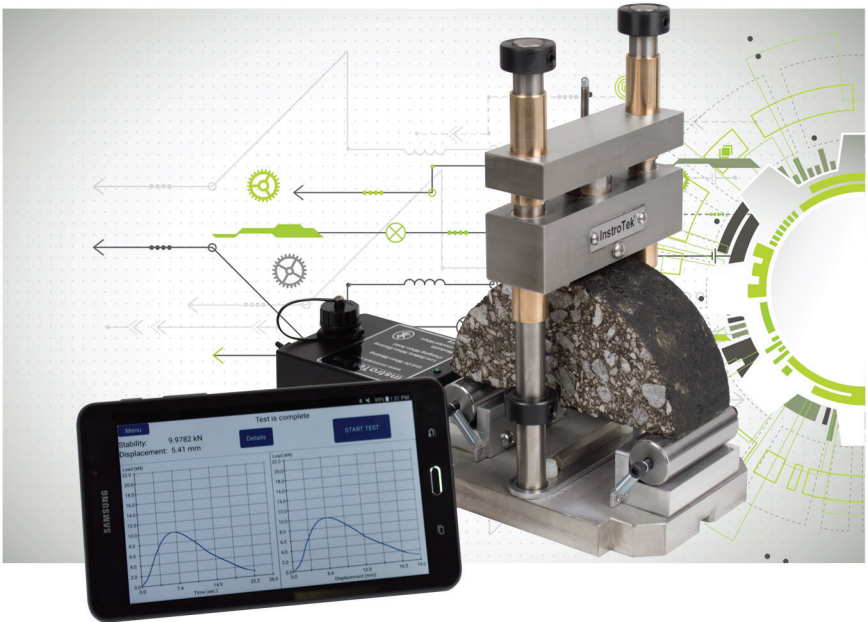
OPERATING MANUAL

www.InstroTek.com

Important

PRECAUTIONS WHEN USING THE Smart-SCB

1. **The Smart-SCB is rated to measure loads up at 10 kN (2,200 lbs.). Exceeding this load could damage the load cell and void the warranty.**

2. **Users must be properly trained to use the load frame supplying the load. Always use your internal laboratory safety procedures when working with and around this unit to avoid any crush hazards.**

Table of Contents

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1. Introduction

Smart-SCB is the first semi-circular bend (SCB) breaking head that is designed to independently collect data for each tensile strength test performed in the lab. The Smart-SCB's integrated high-precision load cell collects data at a rate of 100 Hz. Graph paper, graphing pens or printers are no longer required. Simply place the Smart-SCB breaking head into your existing load frame and add your sample. Start the app and connect to the Smart-SCB. Once the test starts, all the data is transferred via Bluetooth to any connected Windows or Android device. The Smart-SCB application collects, plots, prints, and stores the data directly on your PC, tablet or smart phone. The results can be easily emailed directly from the application. The Smart-SCB app displays accurate peak tensile load and strength information, eliminating the potential for errors from manual determination. The Smart-SCB satisfies the requirements of testing jigs for AASTHO TP 124 (I-FIT) and ASTM D8044 (LSU Method) for determining the SCB strength of asphalt mixtures.

Smart-SCB is wireless and powered by a rechargeable battery, which ensures quick and easy loading and unloading of specimens and safe storage.


Specifications

- Load Capacity: 10 kN (2,200 lbs)
- Power: 110/220VAC charger to convert to 12 VDC
- Battery: Rechargeable NiMH batteries (8-hour battery life)
- Data Collection Rate: 100 Hz (data points/second)
- Report Formats: PDF and CSV
- Software Platforms: Windows Operating System or Android Operating System

Field Calibration

Instrotek offers a reusable metal beam and a calibration instruction guide to calibrate the Smart-SCB in the field. Calibration will require a calibrated 10 kN loadcell and a load frame capable of reaching 10 kN and holding a load.

2. Windows Application User Guide

When the application starts you will be presented with the SmartLoader Splash Screen below:
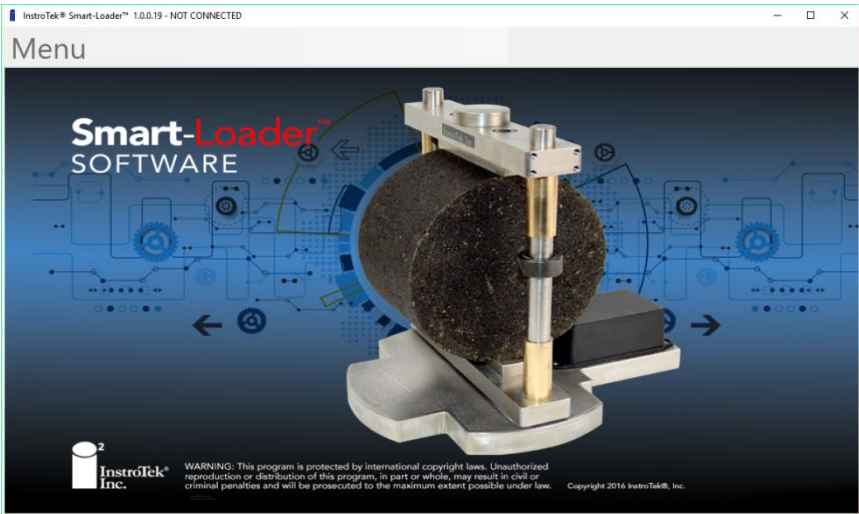
Connecting to the Smart Loader

The Smart-Loader software can connect to the Smart-SCB fixture in two ways:

1. Bluetooth Connection
2. USB cable (backup if batteries are discharged or Bluetooth is not enable on your Windows PC)

The computer software will attempt to connect with the Smart-SCB automatically. If it is successful, the following screen will appear:
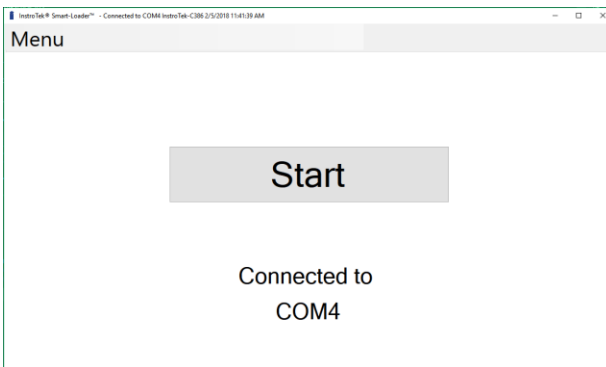

If the software cannot connect, the following screen will appear.
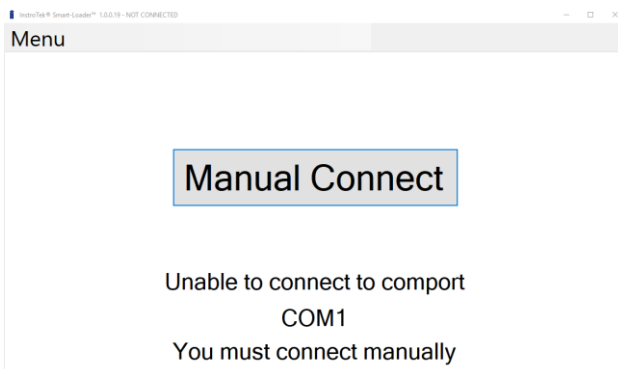
Make sure the Smart-SCB is turned on. The GREEN LED on the device will flash. Press the 'Manual Connect' to search for all paired and wired COM ports (connections).

**NOTE**: Bluetooth devices must first be paired through the Window settings. General instructions for pairing a Bluetooth device in Windows in provided in a later section.
If using a USB cable, it must be plugged for the Smart Loader software to find appropriate COM port.

After the search is completed, COM ports found will be displayed in a dropdown box used to select the device you wish to connect to.
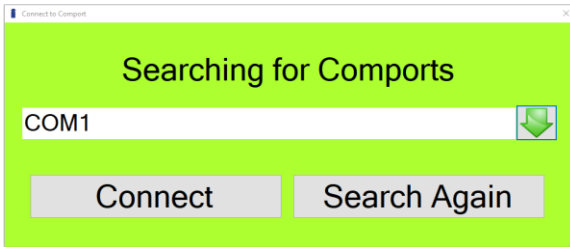
Wired devices show up as COM ports (i.e., COMxx). Bluetooth devices show up as InstroTek devices (i.e., COM InstXXX).

Select the COM port you wish to connect to and press the "Connect" button. If the software does not connect with the Smart-SCB, select a different COM port.
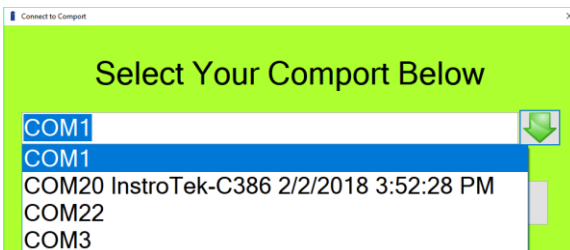
After the device has connected successfully, pressing the "Start" button will enable the Smart-SCB to start acquiring data.

Charging the Batteries

The batteries must be charged with the supplied 12 VDC wall charger.

Plug the wall charger cord into the charging port. Then, plug the wall charger into the 120 VAC wall outlet. The Red LED will turn on to signify it is charging. If the Red LED turns off with the power converter plugged in, the battery is fully charged.

NOTE: The batteries cannot be charged with a USB cord.

Meaning of LEDS

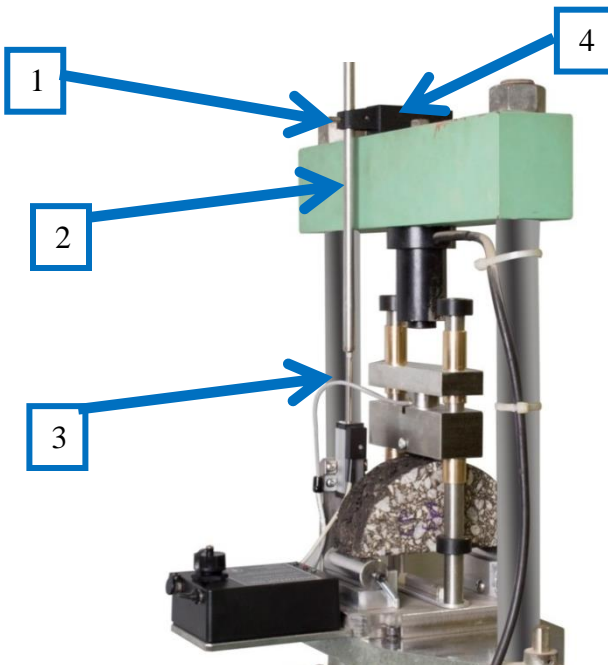Green LED
- Blinking - unit is turned ON

Red LED
- Blinking – Low battery
- Solid – Battery Charging

Blue LED
1. Blinking – Bluetooth connection established

Setting up a Test

1. Before running a SCB test, the unit should be setup in the load frame according to the diagram below.

2. Align the jig in the load frame centered under the load point.
3. Use the magnetic base (item 4) to align the metal rod (item 2) with the LVDT (item 3).
4. Loosen the bolt (item 1) on the magnetic base and move the rod down until the LVDT (item 3) makes contact with the metal rod (item 2) and is compressed by at least an eighth of an inch. Then tighten the bolt (item 1) firmly.

Running a Test

1. Before each test, grease guide rods and bushings to ensure smooth operation.
2. Press *Start Test* to run a test.
3. Before running a test, the *Settings* page will appear.
4. (*Optional*) Enter the following information:

   NOTE: The specimen dimensions must be entered before testing for an accurate calculation of the indirect tensile strength.

   a. Specimen dimensions
   b. Specimen Project and Specimen IDs
   c. Start and Stop Loads
      i. Start Load – minimum required load to start recording data
      ii. Stop Reduction – load to stop recording after reaching the peak load AASHTO T 124 requires stopping at 0.1 kN
      iii. Stop on Percentage – changes Stop Reduction to percentage decrease from peak load (for example – 90% requirement would stop at 1.0 kN after a peak of 10 kN)
      ASTM D 8044 requires stopping at 25% reduction
   d. Select desired units (SI or English).

e. For the SCB test "Use Height Sensor" must be pressed.

5. Press *Finished* button to save the changes to the settings.
6. Before starting the load frame, press the "Start Test" button in Smart Loader software to start recording data. The software will automatically stop recording when the "Stop Reduction" setting is reached.

WARNING
The Smart Loader software does not control your load frame. You must follow your manufacturer's manual for the proper setup and use of the load frame!

7. Set the load frame to apply the correct displacement rate and then start the load frame.
   a. AASHTO TP 124 (I-FIT) - 50 mm/minute
   b. ASTM D8044 (LSU) – 0.5 mm/minute.

8. Stop the loading frame when the test has finished or the specimen has cracked through the whole specimen.

9. When the test has finished, the Peak Load and Peak Displacement will be shown along with the graphs of the results. The results are automatically saved as a ".csv" file and a PDF in the folder "Documents\InstroTek".
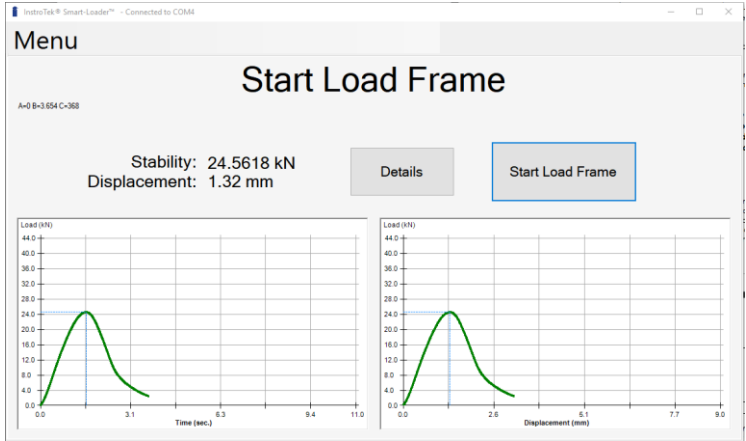

10. Press *Details* to show results calculated from the test data.
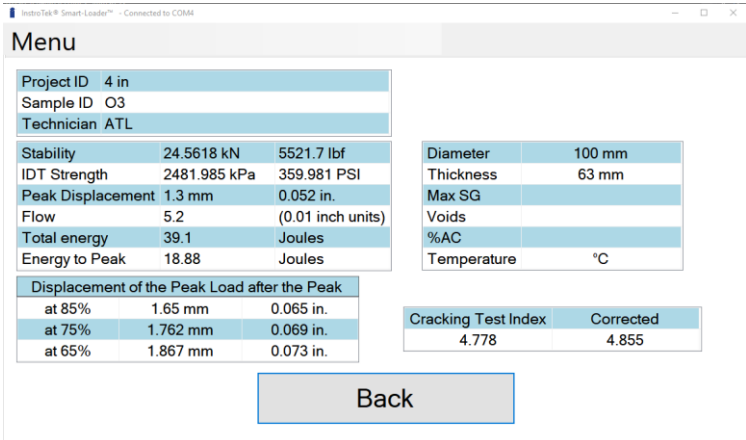
Menu

1. *Connect/Disconnect* – Connect or Disconnect from a COM port.

2. *Save Results* – Save data to a different location and/or name. You can save as PDF, CSV, or XLS (if Excel is installed on the tablet/PC).

3. *Open Saved Files* – Open previous test to view the data and graphs. Up to 4 CSV or XLS files may be opened and compared at one time.
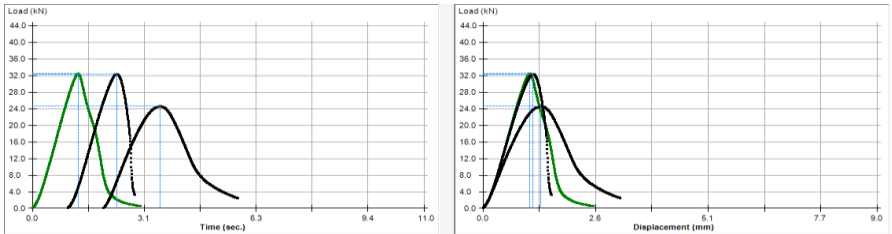
4. *Calibration Values* – Display raw ADC values used for calibrating the device.

5. *Company* – Load company logo to be displayed on the PDF report. The logo must be a bitmap file and it will be scaled to 131 by 71 pixels.

6. *Software / Firmware Update* – Update firmware by connecting to server on Internet. The updates are not automated, and must be checked periodically by clicking the buttons to check for an update.

3. Windows Software Installation

- Download the Smart Loader software from the InstroTek's website at:

  https://www.instrotek.com/pages/downloads#software

- Save the msi file to the desktop of your computer.
- Run the msi file and file follow the on screen instructions.

4. Windows Troubleshooting

1. Smart-SCB does not show in the list of COM ports.
    a. If you have not paired with the device
        i. Pair with it (see section below).
    b. If you have paired with it.
        i. Unpair from the device through you system settings. (see section below)
        ii. Pair with the device again
2. Cannot connect with the Smart Loader
    a. Bluetooth
        i. Make sure you have paired with the device.
        ii. Turn off the device, wait 30 seconds, turn it back on.
        iii. Unpair from the device (Smart-SCB) through you system settings. Pair with the device again.
        iv. Make sure you are within 20 feet of the device.
    b. Wired
        i. Check that you are connecting with the correct COM port.
        ii. Turn off the device, wait 30 seconds, turn it back on.
3. Device says connected but no values received.
    a. The pairing information may have become corrupt.
        i. Unpair from the device through you system settings, Pair with the device again.

Finding the correct COM port:

1. Open Device Manager.
   a. Press the "Start" Button.
   b. Type "Device Manager" in the search bar.
   c. Click on "Device Manager"
2. Click on the arrow for "Ports (COM & LPT)".
3. Find the COM port listed for "USB Serial Port". The correct COM port is COM63 in the figure below.
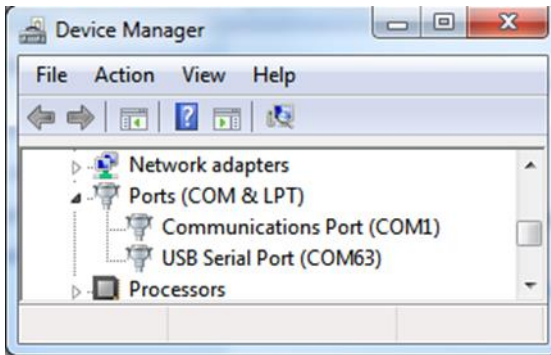
5. Android Application User Guide

Using the Application

When the application starts you will be presented with the SmartLoader Splash Screen below:
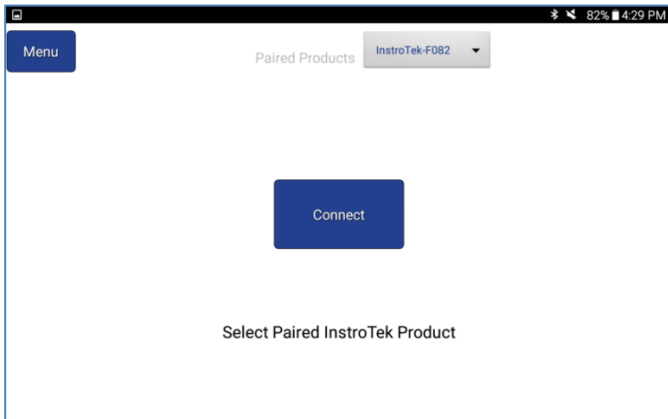
Connecting to the Smart Loader

The Smart-Loader software can connect to the Smart-SCB fixture using Bluetooth or Android devices.

The Android software will attempt to connect with the Smart-SCB automatically. If it is successful, the following screen will appear:
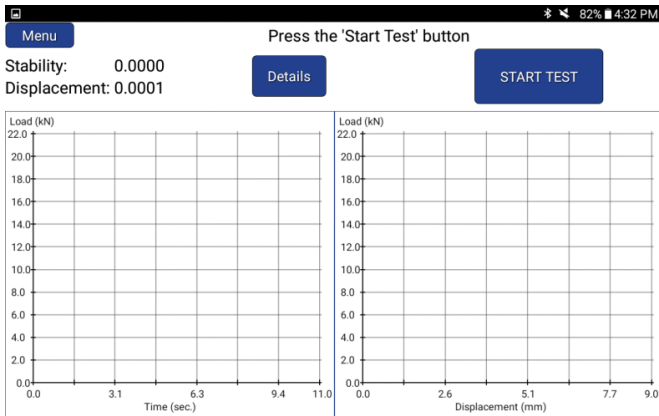
If the software cannot connect, the following screen will appear:

Make sure the Smart-SCB is turned on. The GREEN LED on the device will flash. At the top of the screen is a box with a list of products that you have paired with the tablet, such as "InstroTek-F082" in the picture above. Tap the arrow to list and choose the one you wish to connect to. Press the 'Connect' to pair to the device. A successful pairing will result in the BLUE LED flashing and the software advancing to the test screen above with a "Start Test" button.

NOTE: Bluetooth devices must be paired through the Android's system settings. General instructions for pairing a Bluetooth device in an Android tablet are provided in a later section.

Charging the Batteries

The batteries must be charged with the supplied 12 VDC wall charger.

Plug the wall charger cord into the charger port. Then, plug the wall charger into the 120 VAC wall outlet. The Red LED will turn on to signify it is charging. If the Red LED turns off with the power converter plugged in, the battery is fully charged.

NOTE: The batteries cannot be charged with a USB cord.

Meaning of LEDS

Green LED
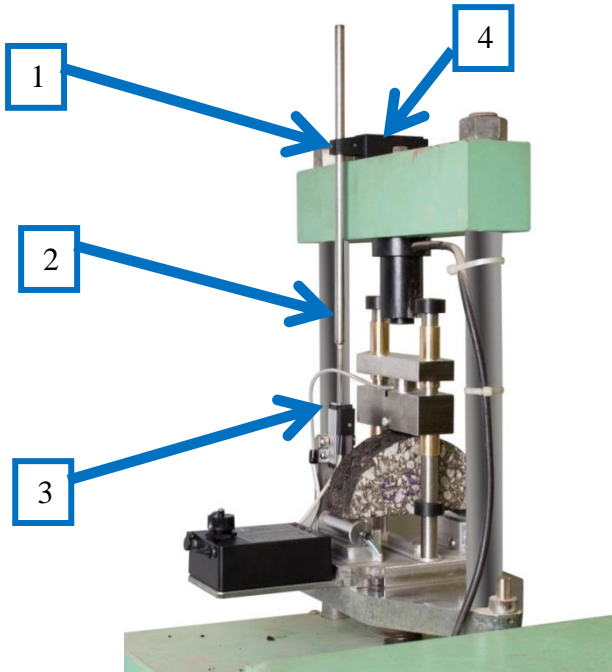- Blinking - unit is turned ON

Red LED
- Blinking – Low battery
- Solid – Battery Charging

Blue LED
- Blinking – Bluetooth connection established

Setting up a Test

1. Before running a SCB test the unit should be setup in the load frame according to the diagram below.

2. Align the jig in the load frame centered under the load point.
3. Use the magnetic base (item 4) to align the metal rod (item 2) with the LVDT (item 3).
4. Loosen the bolt (item 1) on the magnetic base. Then move the rod down until the LVDT (item 3) makes contact with the metal rod (item 2). Do this until it is compressed by at least an eighth of an inch. Then tighten the bolt (item 1) firmly.

Running a Test

1. Before each test guide rods and bushings should greased to ensure smooth operation.
2. Press *Start* to run a test.
3. Before running a test, the *Settings* page will appear.
4. (*Optional*) Enter the following information:
   a. Specimen dimensions
   b. Specimen Project and Specimen IDs
   c. Start and Stop Loads
      i. Start Load – minimum required load to start recording data
      ii. Stop Reduction – load to stop recording after reaching the peak load   AASHTO T 124 requires stopping at 0.1 kN
      iii. Stop on Percentage – changes Stop Reduction to percentage decrease from peak load (for example – 90% requirement would stop at 1.0 kN
   d. Check that the desired units (SI or English) are selected

NOTE: The specimen dimensions must be entered before testing for an accurate calculation of the SCB strength.

5. Press the *Finished* to accept the settings. The Smart Loader software will start recording data after the "Start Load" button is pressed and will stop recording when the "Stop Load" settings is reached.
6. Set the load frame to apply the correct displacement rate and then start the load frame.
   a. AASHTO TP 124 (I-FIT) - 50 mm/minute
   b. ASTM D8044 (LSU) – 0.5 mm/minute.

WARNING
The Smart Loader software does not control your load frame. You must follow your manufacturer's manual for the proper setup and use of the load frame!

7. Stop the loading when the test has finished or the specimen has cracked completely through the specimen.
8. When the test has finished, the Peak Load and Peak Displacement will be shown along with the graphs of the results. The results are automatically saved as a ".csv" file and a PDF in the folder "Downloads".
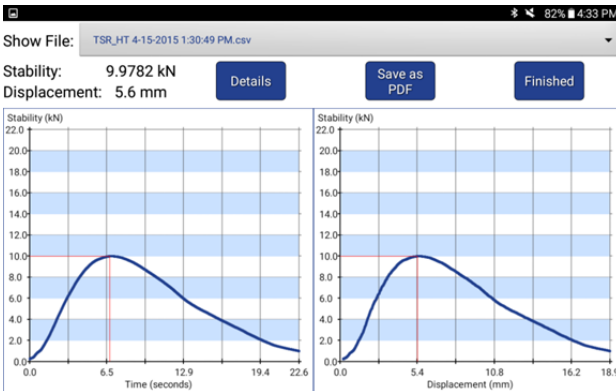
9. Press Details to show results calculated from the test data.

Stability	9.9782 kN		2243.19 lbf		Diameter	150 mm
IDT Strength	705.814 kPa		102.37 PSI		Thickness	60 mm
Peak Displacement	5.4 mm		0.213 in.		Max SG	
Flow	22.05		0.01 in. units		Voids	
Total Energy	100.44		Joules		% AC	
Energy to Peak	30.88		Joules		Temperature	21

Displacement of the Peak Load after the Peak			Cracking Test Index	Corrected
at 85%	8.14 mm	0.32 in.	703.03	680.351
at 75%	9.239 mm	0.364 in.		
at 65%	10.184 mm	0.401 in.		

Back

10. CVS and PDF files can be emailed directly from the tablet if a Wi-Fi network is available. Additionally, the files can be transferred to a Windows PC by using the included USB cable and navigating to the "Download" folder of the tablet in Windows Explorer.

Menu

Connect/Disconnect – Connect or Disconnect from a COM port.

Settings – Enter specimen and mixture data.

Calibration Values – Display raw ADC values used for calibrating the device.

Company – Load company logo to be displayed on the PDF report. The logo must be a bitmap file and it will be scaled to 131 by 71 pixels.

Open Saved File – Open previous test to view the data and graphs. Up to 4 CSV or XLS files may be opened and compared at one time.
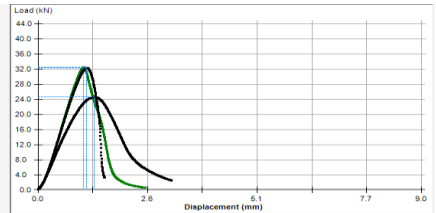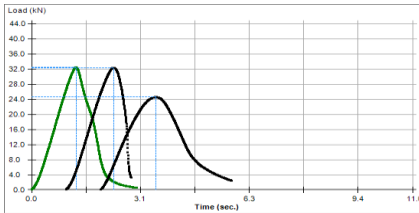
6. Android Software Installation

Download the Android software by searching "Smart Loader" or "Instrotek" on the Google Play store on most Android devices. The application can run on either a tablet or a phone, but a tablet is recommended.

7. Android Troubleshooting

1. Smart-SCB does not show in the list of COM ports.
    a. If you have not paired with the device
        i. Pair with it (see section below).
    b. If you have paired with it.
        i. Unpair from the device through you system settings. (see section below)
        ii. Pair with the device again
2. Cannot connect with the Smart Loader
    a. Bluetooth
        i. Make sure you have paired with the device.
        ii. Turn off the device, wait 30 seconds, turn it back on.
        iii. Unpair from the device (Smart-SCB) through you system settings. Pair with the device again.
        iv. Make sure you are within 20 feet of the device.
    b. Wired
        i. Check that you are connecting with the correct COM port.
        ii. Turn off the device; wait 30 seconds, turn it back on.
3. Device says connected but no values received.
    a. The pairing information may have become corrupt.
        i. Unpair from the device through your system settings. Pair with the device again.

Pairing with Bluetooth Devices

1. Turn on the Smart-SCB.
2. Enable Bluetooth on your Android device.
3. Search for available Bluetooth devices.
   a. Open the settings screen and tap the "Bluetooth" option under Wireless & Networks.
4. Select the device that starts with "InstroTek-"
5. Accept the given key and let your system finish pairing with the device.

Unpairing with Bluetooth Devices

1. Open your Bluetooth Settings.
   a. Open the settings screen and tap the "Bluetooth" option under Wireless & Networks.
2. Tap the device you wish to remove.
3. Select "Remove Device".

8. Example Files

CVS File:

```
InstroTek® SCB Smart Loader®,,
,,
Project ID:,A-22,
Sample ID:,1,
Technician:,ATL ,
Date:,1/15/2018 12:37,
Max Specific Gravity:,,
Voids:,3,
AC:,4,
Temperature:,22°C,
Frequency:,200 Hz,
Rate:,sensor,
Start Load:,0.1,
Stop Reduction:,'90%,
Thickness:,50.1,
Diameter:,150,
Ligament:,58.9,
Time (Seconds),Load (kN),Deformation [mm]
0.025,0.02681,0
0.05,0.02651,-0.00001
0.075,0.02651,-0.00001
```

```
7.9,0.10146,6.43276
7.925,0.10055,6.45267
7.95,0.09902,6.47524
AB9112EB,,
```
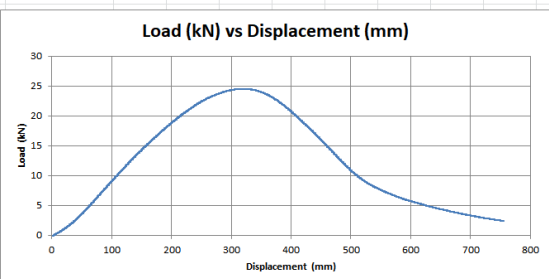
XLS File:

InstroTek® TSR Smart Loader©

Project ID:	4 in
Sample ID:	O3
Technician:	ATL
Date:	/2018 9:58:43 AM
Max Specific Gravity:	50
%Voids:	3
AC:	10
Temperature:	22 °C
Frequency:	200 Hz
Rate:	50 mm/min
Start Load:	0.1
Stop Reduction:	'90%
Thickness:	63
Diameter:	100

Load (kN) vs Time (seconds)

Load (kN) vs Displacement (mm)
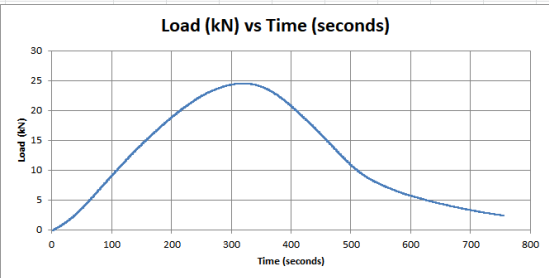
Time (Seconds)	Load (kN)	Constant Rate (mm
0	0.1352322	17.45416625
0.005	0.1823067	0.004166667
0.01	0.2302371	0.008333333
0.015	0.2781675	0.0125
0.02	0.3278097	0.016666666
0.025	0.3774519	0.020833333
0.03	0.4288059	0.024999999
0.035	0.4810158	0.029166666
0.04	0.5340816	0.033333333
0.045	0.5897151	0.037499999
0.05	0.6453486	0.041666666
0.055	0.7035498	0.045833332
0.06	0.7626069	0.049999999
0.065	0.8242317	0.054166665
0.07	0.8892801	0.058333332
0.075	0.9534726	0.062499999
0.08	1.0219446	0.066666665
0.085	1.0913725	0.070833332

InstroTek

9. Index

10. Warranty

InstroTek, Inc. extends a 1-year warranty on the Smart-SCB™ to the original purchaser of this equipment. This warranty covers defects in material, workmanship, and operation under the conditions of normal use and proper maintenance.

This WARRANTY DOES NOT cover the replacement of the parts due to improper setup.

InstroTek will replace, free of charge, any part found to be defective within the warranty period.

This warranty is void if inspection shows evidence of abuse, misuse or unauthorized repair.

This warranty covers replacement of defective materials and workmanship only. It does not cover shipping charges, duties or taxes in the transport to and from the factory or authorized service center.

InstroTek's liability is in all cases limited to the replacement price of its products. InstroTek shall not be liable for any other damages, whether consequential, indirect, or incidental arising from use of its product.

If return of the product is necessary, please include return shipping directions, contact name, phone & fax number and a description of the action needed.

Call InstroTek, Inc. for shipping details at (919) 875-8371. If return of the product is necessary, please include return shipping directions, contact name, phone & fax number and a description of the action needed.

Contact Information

InstroTek® Inc.

Contact us for top quality, best value and superior service!
email: **sales@instrotek.com** ✦ visit: **InstroTek.com**