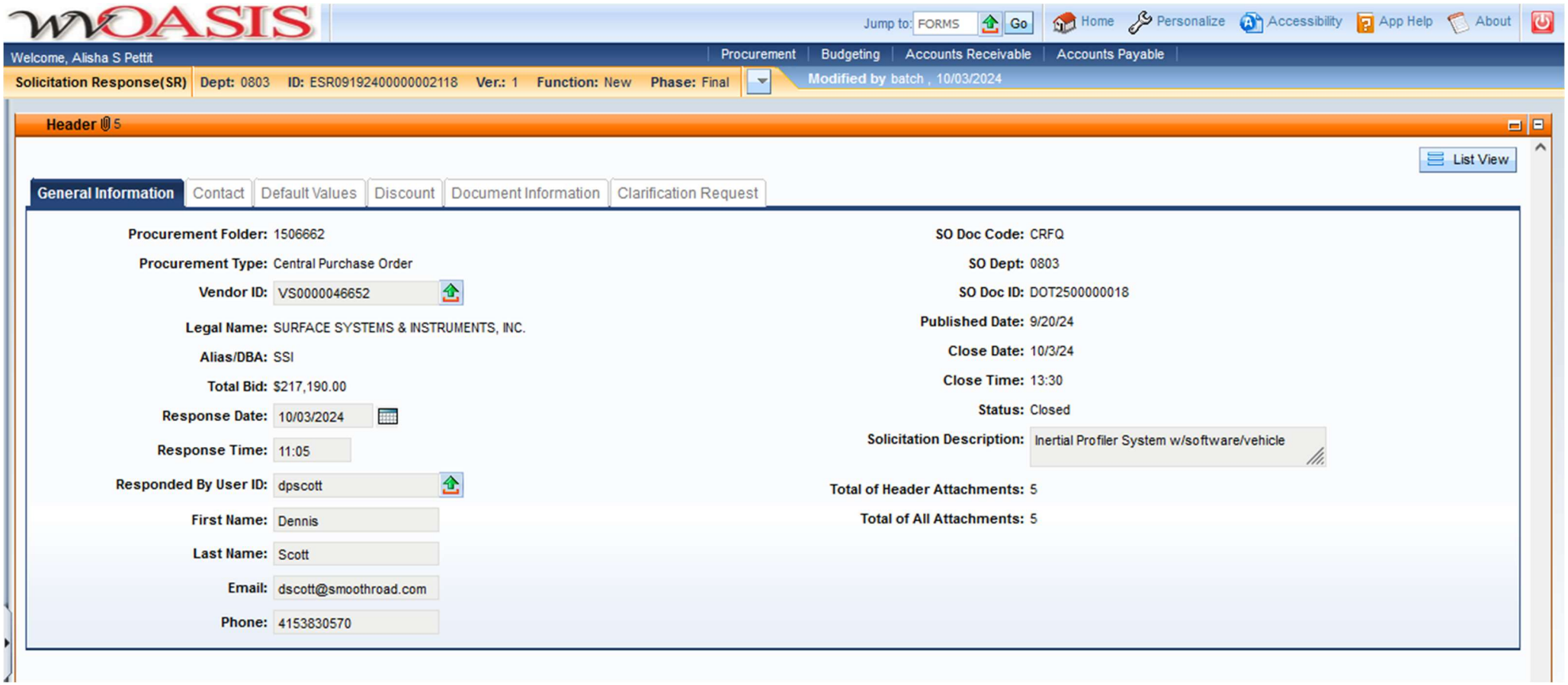
The following documentation is an electronically-submitted vendor response to an advertised solicitation from the *West Virginia Purchasing Bulletin* within the Vendor Self-Service portal at ***wvOASIS.gov***. As part of the State of West Virginia's procurement process, and to maintain the transparency of the bid-opening process, this documentation submitted online is publicly posted by the West Virginia Purchasing Division at ***WVPurchasing.gov*** with any other vendor responses to this solicitation submitted to the Purchasing Division in hard copy format.


wvOASIS
Jump to: FORMS Go
Home
Personalize
Accessibility
App Help
About
Welcome, Alisha S Pettit
Procurement
Budgeting
Accounts Receivable
Accounts Payable
Solicitation Response(SR) Dept: 0803 ID: ESR09192400000002118 Ver.: 1 Function: New Phase: Final
Modified by batch , 10/03/2024
Header 5
List View
General Information
Contact
Default Values
Discount
Document Information
Clarification Request
Procurement Folder: 1506662
Procurement Type: Central Purchase Order
Vendor ID: VS0000046652
Legal Name: SURFACE SYSTEMS & INSTRUMENTS, INC.
Alias/DBA: SSI
Total Bid: $217,190.00
Response Date: 10/03/2024
Response Time: 11:05
Responded By User ID: dpscott
First Name: Dennis
Last Name: Scott
Email: dscott@smoothroad.com
Phone: 4153830570
SO Doc Code: CRFQ
SO Dept: 0803
SO Doc ID: DOT2500000018
Published Date: 9/20/24
Close Date: 10/3/24
Close Time: 13:30
Status: Closed
Solicitation Description: Inertial Profiler System w/software/vehicle
Total of Header Attachments: 5
Total of All Attachments: 5

Department of Administration
Purchasing Division
2019 Washington Street East
Post Office Box 50130
Charleston, WV 25305-0130

State of West Virginia
Solicitation Response

Proc Folder:	1506662
Solicitation Description:	Inertial Profiler System w/software/vehicle
Proc Type:	Central Purchase Order

Solicitation Closes	Solicitation Response	Version
2024-10-03 13:30	SR 0803 ESR09192400000002118	1

VENDOR

VS0000046652
SURFACE SYSTEMS & INSTRUMENTS, INC.

Solicitation Number: CRFQ 0803 DOT2500000018

Total Bid: 217190 **Response Date:** 2024-10-03 **Response Time:** 11:05:16

Comments: We are a certified small business in California (# 1765609). If available, we request reciprocal small business status/ preference in West Virginia, pursuant to applicable laws, including W. Va. CSR§ 148-22-9.

FOR INFORMATION CONTACT THE BUYER
John W Estep
304-558-2566
john.w.estep@wv.gov

Vendor
Signature X **FEIN#** **DATE**

All offers subject to all terms and conditions contained in this solicitation

Line	Comm Ln Desc	Qty	Unit Issue	Unit Price	Ln Total Or Contract Amount
1	Smoothness Tester w/Host Vehicle	1.00000	EA	217190.000000	217190.00

Comm Code	Manufacturer	Specification	Model #
25100000			

Commodity Line Comments: Guaranteed compliance with requirements specified in the Solicitation.

Extended Description:

High Speed Inertial Profiler System w/software/ and Host vehicle (Smoothness Tester) 7024E029

High speed inertial profiler system with software and host vehicle

Item No.	Description:	Model & Part Number Being Bid	Estimated Unit Quantity	Unit Price	Item Total Cost
1	**High speed inertial profiler system with software and host vehicle**	**CS9300 CS9300IP/F150**	1	**$217,190.00**	**$217,190.00**
2					
	Total Bid Cost				**$217,190.00**

Bid Will Be Awarded To The Lowest Overall Bid Total For All Items

Vendor Information

Company Name: SURFACE SYSTEMS & INSTRUMENTS, INC.

Contact Manager: Dennis Scott

Address: 307 Plymate Ln, Manhattan, Kansas 66502

Phone: (415)235-9035

Fax: (415)358-4340

E-mail: dscott@smoothroad.com; info@smoothroad.com

Signature:

ADDENDUM ACKNOWLEDGEMENT FORM
SOLICITATION NO.: CRFQ DOT2500000018

Instructions: Please acknowledge receipt of all addenda issued with this solicitation by completing this addendum acknowledgment form. Check the box next to each addendum received and sign below. Failure to acknowledge addenda may result in bid disqualification.

Acknowledgment: I hereby acknowledge receipt of the following addenda and have made the necessary revisions to my proposal, plans and/or specification, etc.

Addendum Numbers Received:
(Check the box next to each addendum received)

[X]	*Addendum No. 1*	[ ]	*Addendum No. 6*
[X]	Addendum No. 2	[ ]	Addendum No. 7
[X]	Addendum No. 3	[ ]	Addendum No. 8
[X]	Addendum No. 4	[ ]	Addendum No. 9
[ ]	Addendum No. 5	[ ]	Addendum No. 10

I understand that failure to confirm the receipt of addenda may be cause for rejection of this bid. I further understand that that any verbal representation made or assumed to be made during any oral discussion held between Vendor's representatives and any state personnel is not binding. Only the information issued in writing and added to the specifications by an official addendum is binding.

SURFACE SYSTEMS & INSTRUMENTS, INC.
Company

Dennis P. Scott
Authorized Signature

10/2/2024
Date

NOTE: This addendum acknowledgement should be submitted with the bid to expedite document processing.

California	Kansas
1845 Industrial Drive	307 Plymate Lane
Auburn, California 95603	Manhattan, Kansas 66502
Telephone: (415) 383-0570	Telephone: (785) 539-6305
Facsimile: (415) 358-4340	info@smoothroad.com

SURFACE SYSTEMS & INSTRUMENTS, INC. smoothroad.com

Custom Test Equipment • Mobile Technology Solutions

PROPOSAL IN RESPONSE TO RFP CRFQ DOT25000000018
West Virginia Department of Highways

1. INTRODUCTION

Surface Systems & Instruments, Inc. ("SSI") submits this Proposal in support of the West Virginia Department of Highways (WVDOH) Request for Quotation for "High Speed Inertial Profiler System." SSI is a manufacturer of road surface test equipment with facilities in Manhattan, Kansas and Auburn, California. SSI proposes to supply an SSI model CS9300 Five Point Profiler with the Zero-Speed upgrade to WVDOH. SSI submits the details below, in addition to the CS9300 data sheet and technical specifications also included within SSI's response to the RFQ.

A. Bidder/Manufacturer's Contact Information

Bidder/Manufacturer Information:

Manufacturer:	Surface Systems & Instruments, Inc.
Mailing/Remittance Address:	P. O. Box 790, Larkspur, California 95603
Fabrication Shop:	1845 Industrial Drive, Auburn, California 95603
Engineering Office:	307 Plymate, Manhattan, Kansas 66502
Contact:	Mr. Dennis P. Scott
Telephone:	(415) 383-0570
Facsimile:	(415) 358-4340
E-mail:	dscott@smoothroad.com
SSI Internet URL:	http://www.smoothroad.com
Business Size:	Small Business
U.S. Federal Tax I.D.	39-1850182
Dunn & Bradstreet Number:	133759766
CCR Registration:	39JDEQ
Trading Partner Id.	69341140
CAGE Code:	3RVG0

B. SSI's Background and Experience

SSI is a manufacturer of custom test equipment, including high speed and lightweight inertial surface profiling systems, walking profilers, computerized profilographs, and other specialty material test equipment. Among SSI's most recognizable products are the CS8500 profilograph, used worldwide for many years, the CS8800 walking profiler, and the CS8700/CS9100/CS9300/CS9500 models of inertial profiling systems. SSI has produced test equipment since 1995, and SSI's engineering team has successfully designed a full line of surface profile test equipment devices that are in common usage by transportation agencies, professional engineers, and construction contractors throughout the U.S. and worldwide.

SSI's surface profiling systems have passed every equipment certification test that they have been subjected to, including the stringent requirements of the AASHTO R56 and R57 standards, the Texas Department of Transportation Test 1001-S and NCAT certification. In addition to being a vendor of surface profiling systems, SSI also provides profiling project services. SSI has performed extensive data collection projects for construction contractors, vehicle manufacturers, vehicle proving grounds, airports, and racing industry firms. Further information on the commercial products offered by SSI is available online at **www.smoothroad.com**.

2. BACKGROUND ON SSI'S CS9300 HIGH-SPEED INERTIAL PROFILING SYSTEM

SSI has attached product literature and technical specifications that demonstrate the compliance of SSI's CS9300 high speed profiling system with current ASTM E950, AASHTO (M328, R056/R057) and DOT requirements. SSI's CS9300 high-speed profiling system meets, and in many respects exceeds the technical requirements stated in this RFP. Below is a picture of the SSI CS9300 Inertial Profiler with Five Point Rutting in the standard installation.

Figure 1: SSI CS9300 High Speed Inertial Profiling System with Five Point Rutting Sensors

SSI inertial profiling systems collect data at true 1" (25 mm) sampling intervals and can operate between 0 and 100 mph (0-160 kph) with the Zero-Speed upgrade. SSI zero-speed inertial profilers can also come to a

complete stop at traffic signals without losing any of the data collected. The ability of SSI profiling systems to operate at lower speeds allows more pavement to be collected, no matter whether it is a remote forest road or in congested traffic. Without the Zero-Speed upgrade the collection speed range is 5 to 74 mph. SSI's systems generate all commonly used roughness indices (including IRI, MRI, HRI, RN and PRI/PI). SSI's CS9300 generates on-screen displays of profile traces and instantaneous test results. The data is easily downloaded to a USB external drive or emailed to agency personnel. IRI data is generated simultaneously, and averaged (MRI), for both left, right and center wheelpaths, as shown in Figure 2 below:

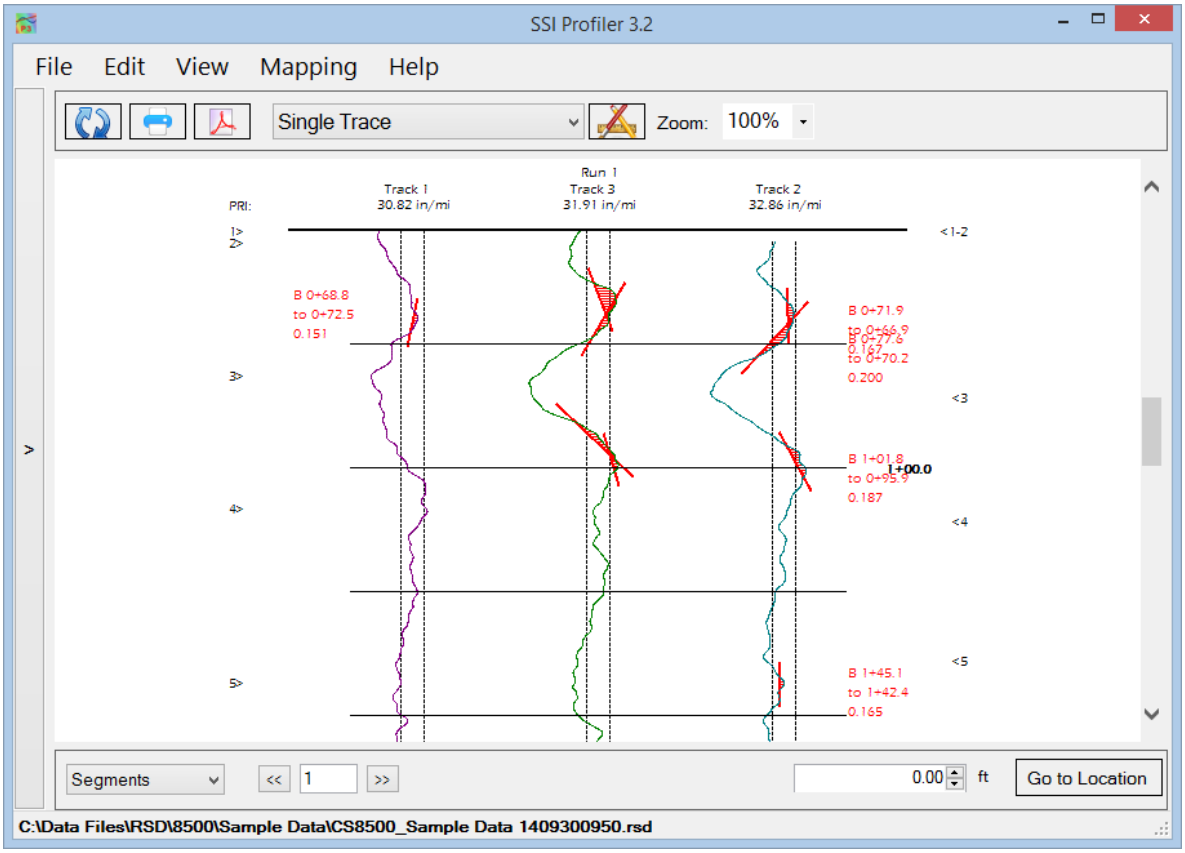


Figure 2: Sample View of SSI Trace View with Ride Quality and Localized Roughness Reporting

The hardware supplied for mounting the CS9300 core components onto the host vehicle is modular and robust. The profiling system modules (lasers and accelerometers) are installed on dove-tail hardware to allow fast and easy adjustment of the sensors into the correct configuration. The core components of the profiling system are "plug and play"—meaning that the component is easily installed in the field by plugging into the profiling system electronics. After any replacement component is installed in the field, the system is immediately ready for testing. The modular design supports field installation of additional sensors, such as high-resolution GPS, ROW camera, cross-slope and specialty laser for texture measurement.

SSI inertial profiling systems are operated from the cab of the host vehicle through a pedestal mounted computer workstation supplied by SSI. Most SSI systems can be safely operated by one person. Two-person operation is easily accommodated. The computer is mounted on a docking station and powered by the vehicle's standard 12VDC power supply or auxiliary battery. These power connections can be augmented with a 120VAC converter for in-shop use. The computer supplied is a Panasonic Toughbook rugged notebook tested in compliance with military specifications for durability. The Toughbook computer will meet the requirements of this RFQ stated below.

3. MINIMUM REQUIREMENTS UNDER THE WEST VIRGINIA DEPARTMENT OF HIGHWAYS RFQ

FIVE POINT HIGH SPEED INERTIAL PROFILER GENERAL REQUIREMENTS (RFQ 3.0)

The proposed CS9300 system meets the requirements of the RFP, including:

- CS9300 with two *line laser* wheel path sensor modules with a center and two outside point lasers for rutting measurement.
- Five-point rut depth measurement (AASHTO r48 compliant).
- Report IRI, MRI, HRI, PRI, and RN within the SSI Profiler software program (meets 0-300 in/mile range at 0.1-mile interval, minimum)
- Units can be adjusted to metric or English at any time.
- SSI systems can collect at temperatures between 35 to 100 degrees Fahrenheit.
- Meets the minimum collection speed range of the RFQ of 15 to 70 mph.
- AASHTO m328, r56 and r57 between 5 and 74 mph (0 and 100 mph with Zero-Speed option).
- Manual triggering and automatic triggering through GPS or photoelectric eye
- Collection reports distance traveled, GPS coordinates, speed, and stationing (or mileposts)
- ASTM E950 as a Class I Profiler.
- LMI Technologies, Inc. “Gocator” wide footprint lasers in wheelpaths
- Both a wheel encoder distance measurement interface (DMI) and GPS-DMI supplied.
- Single software program for calibration, collection, analysis, editing, viewing, reporting, and exporting.
- Real time display of profile traces, stationing, GPS coordinates, speed, and past segment IRI values.
- Adjustable thresholds for IRI ALR.
- Outputs include PDF images, ProVal PPF/ERD and CSV/Excel.
- Includes items required for calibration and verifications (laser height blocks).
- Removable hardware and quick-disconnect signal cabling.
- Durable storage case for laser modules when not in use.
- Battery backup that can power equipment for two hours.
- SSI training conducted at a WVDOH facility. SSI will furnish at least eight copies of training materials.

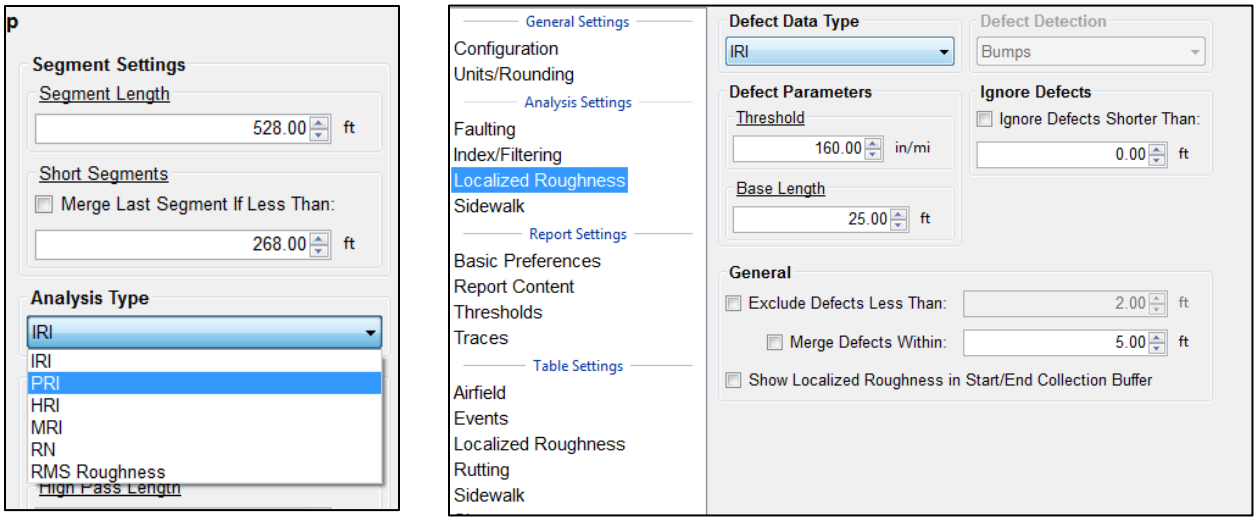


Figure 3: SSI Profiler Adjustable Ride Value and IRI ALR Thresholds

ADDITIONAL EQUIPMENT, FEATURES AND ACCESSORIES

- Computer accessible to driver or passenger with daylight readable touchscreen and backlit keyboard.
- A switched, 120VAC inverter will be provided, but is not necessary for computer charger.
    - Toughbook computer and profiling system is powered from 12VDC vehicle supply.

    - Wall charger will be supplied for Toughbook for 120VAC supply.
    - Wall power 120VAC connection to power system for powering system in garage
- Electronics are simplified to two connections to limit power consumption.
- Main electronics are protected with at least two fuses; shielded signal cabling.
- Core electronics produced in ISO9001 compliant facility.
- Laser modules can be removed to avoid damage or theft. Entire system can be removed with 4 bolts.

PROFILER MEASURING SYSTEM

- This bid will include all hardware, software, and components required for profile data collection.
- Profile data will be collected along three longitudinal paths; one in each wheel path and one in the vehicle center.
- CS9300 system will be composed of two 100mm line lasers in the wheelpaths and additional three lasers for five-point rutting measurement.
- The CS9300 default sampling interval is 1-inch at the same position for each sensor.
- Data collection between 5-74 mph is standard on all systems.
- Collection speeds of 0-100 mph with the SSI Zero-Speed patent pending technology
- SSI inertial profilers are capable of wavelength measurement of 0.25-feet to 8,000-feet.
- Electronics components do not contain spinning parts susceptible to shock.
    - Lasers are rated for 15 g, half sine wave, 11 ms, positive and negative in X, Y and Z directions.
    - No damage to SSI systems due to shock has ever been reported.
- Most sensitive electronic components rated for ambient operating temperatures from 32F to 122F.
- Most sensitive electronic components rated for ambient temperature storage from -22F to 158F.
- CS9300 will perform unaffected under non-condensing humidity conditions.
- Cross-slope data can be reported under the applicable standard for a five-point rutting system.

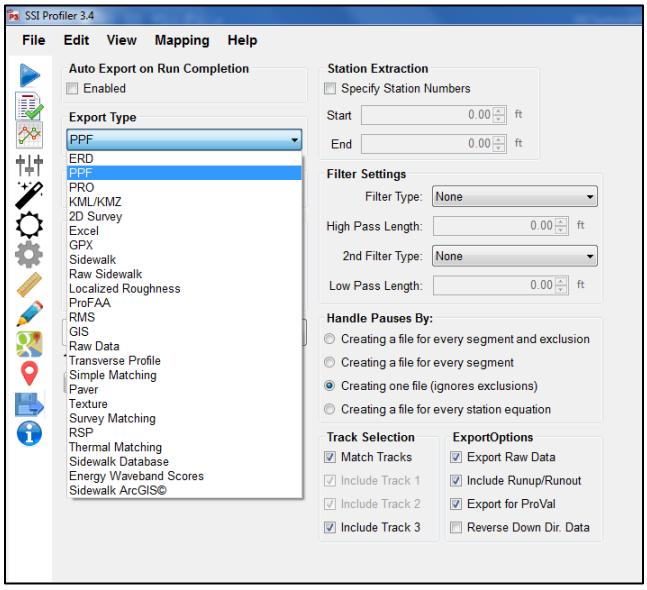


Figure 4: SSI Profiler Export Options: Excel, ERD, PPF (and more)

DISTANCE MEASUREMENT INSTRUMENT (DMI) (RFQ 3.1.6.)

- The distance measurement error for SSI systems is less than 0.05-percent for wheel mounted DMI's and GPS-DMI systems, as proven by State DOT equipment certifications.
- Distance, stationing and speed are displayed prominently on the collection screen.

- Both GPS-DMI and the wheel encoder comply with the 0.15 percent error requirement of the RFQ.

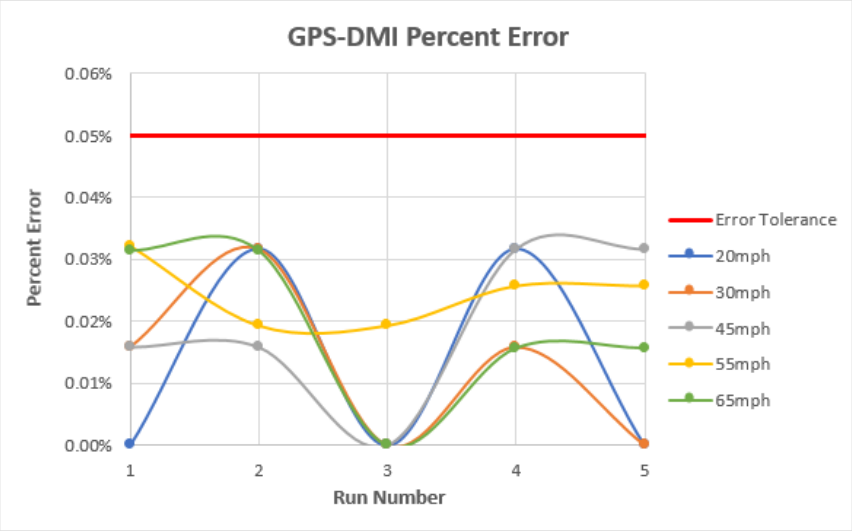


Figure 5: SSI GPS-DMI Accuracy at Varying Speeds Over 0.1-mile

GLOBAL POSITIONING SYSTEM (RFQ 3.1.7.)

- GPS streaming receiver is standard on each SSI inertial profiler.
- GPS receiver will have sub-meter accuracy with satellite-based corrections.
- GPS is received in NMEA format. Conversion to DMS or decimal degrees within SSI Profiler.
- GPS is streamed at least 10 times per second (10Hz) and is saved to each 1-inch sample.
- The GPS system will have access to WAAS/SBAS corrections, accurate to under 1-meter horizontally.

System Operating System (RFQ 3.1.10)

- Automatic SSI software upgrades are available when connected to the internet.
- Real time status of GPS, distance, speed, laser data can be observed in the SSI software.
- User configurable inputs into the software are saved to each data file. These user settings are saved to the computer for future use. These include county, route, project number, lane, traffic direction, start station, end station, etc.
- Events or 'flags' can be entered into the data during collection or post-processing.

COMPUTER SYSTEM (RFQ 3.13)

The CS9300 complies with the requirements for the operator interface. All of the program functions are within the SSI Profiler software.

- Panasonic Toughbook with at least: i7 8665U/1.9 GHz processor, 32GB RAM, 1 TB SSD, UHD Graphics 620, Wi-Fi, Bluetooth, Windows 11 Pro 64-bit or newer.
- Adobe Acrobat Pro, Microsoft Office (Excel, Word, Outlook), ProVal software installed.
- Four USB ports (including docking station).
- Daylight readable 14" touchscreen (1920 x 1080 Full HD) and backlit keyboard.
- Pedestal-mounted docking station with port-expansion and driver/passenger swivel for safer system operation.
- SSI will install or supply the SSI Profiler program and all utilities, drivers and needed configurations.
- Software license and installer for SSI Profiler on office desktop computer.
- SSI recommends a Panasonic Toughbook for all inertial profiler, in-vehicle systems.

- SSI software requires administrator privileges.

Figure 6: Panasonic Toughbook with docking station

SSI's Profiler 3 data analysis software has evolved since 1995 based on DOT and contractor input; as such the program is robust, stable, and rich in features. SSI's profiling systems use Windows 11 Professional (Windows 7+ compatible) based user interface programs to collect and analyze the profile data. As a result, all raw profile data, summary reports, and field logs can be transferred to electronic storage media and transferred immediately after the data is collected. The SSI Profiler data analysis software program allows extensive on-screen data analysis and viewing capabilities. Users can infinitely re-write raw data files after making changes to the data fields and analysis parameters. For example, operators can specify numerous changes to filtering and other data reduction parameters, such as choosing between units of measurement (several IRI indices, simulated profilograph index, etc.), filter lengths and types, English or metric units, variable segment length (e.g. 528 feet, 25 feet, 100 meters, etc.), inserting blanking bands or localized roughness ("must-grind or dip") templates. Localized roughness can be reported by traditional templates (e.g., 0.4" in 25 feet or simulated straightedge) or IRI based areas of localized roughness (e.g. identify areas exceeding a user entered IRI threshold using a configurable moving average filter; for example, areas exceeding 160 in/mile using a 25 ft. moving average filter).

The SSI Profiler software is installed through a zip folder and a dedicated license file made for the end user. The SSI Profiler program can be installed on any computer with a Window 10 operating system with administrator access. Updates are released to all SSI Profiler users with an internet connection. Software operators can send feedback to SSI staff through the program and view the embedded software manual. After sending feedback through SSI Profiler, each SSI support representative receives an email with the main contact information of the profiling system to continue software support.

SSI does not follow the industry practice of charging subscription fees to upgrade real-time or offline software or to annually calibrate the profiling system. Hundreds of SSI profiling systems run without interaction with SSI technicians.

Figure 7: SSI Profiler Software Manual, Update and Feedback Options

The SSI Profiler data files are saved in their raw binary form in .RSD format. The proprietary format contains all collected profile elevations, GPS, and metadata for reporting the profile data.

SSI's inertial profiling systems include software routines to convert the raw profile data into numerous formats, such as ERD/PPF (ASTM E2560) for ProVal, PDF, Excel, CSV, elevation profile.

The SSI Profiler program is the only software required to collect, view, report, edit and export profile data from SSI inertial profiling systems. The advanced tools and trace view windows within the software give the user options to view ROW images and the transverse profile traces for rutting profiles.

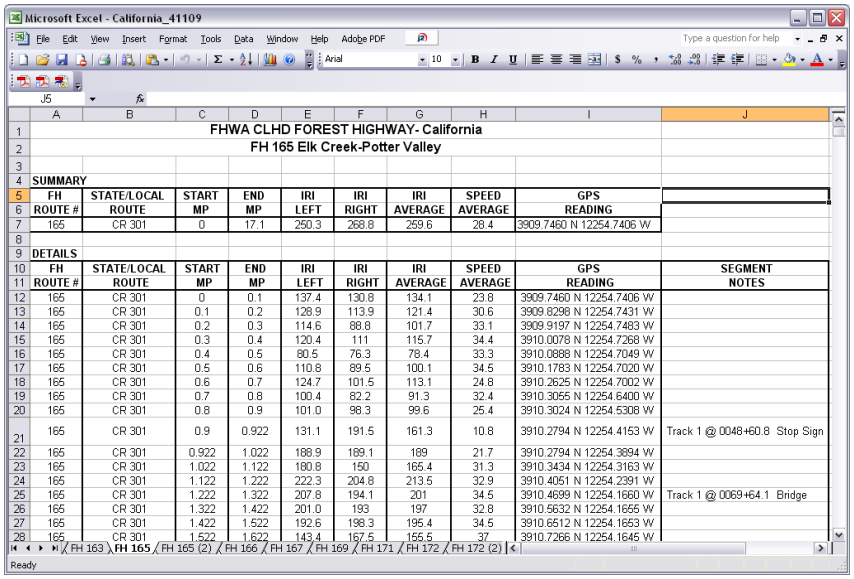


Figure 8: Example of Excel Data Export of Profile Data with IRI Results

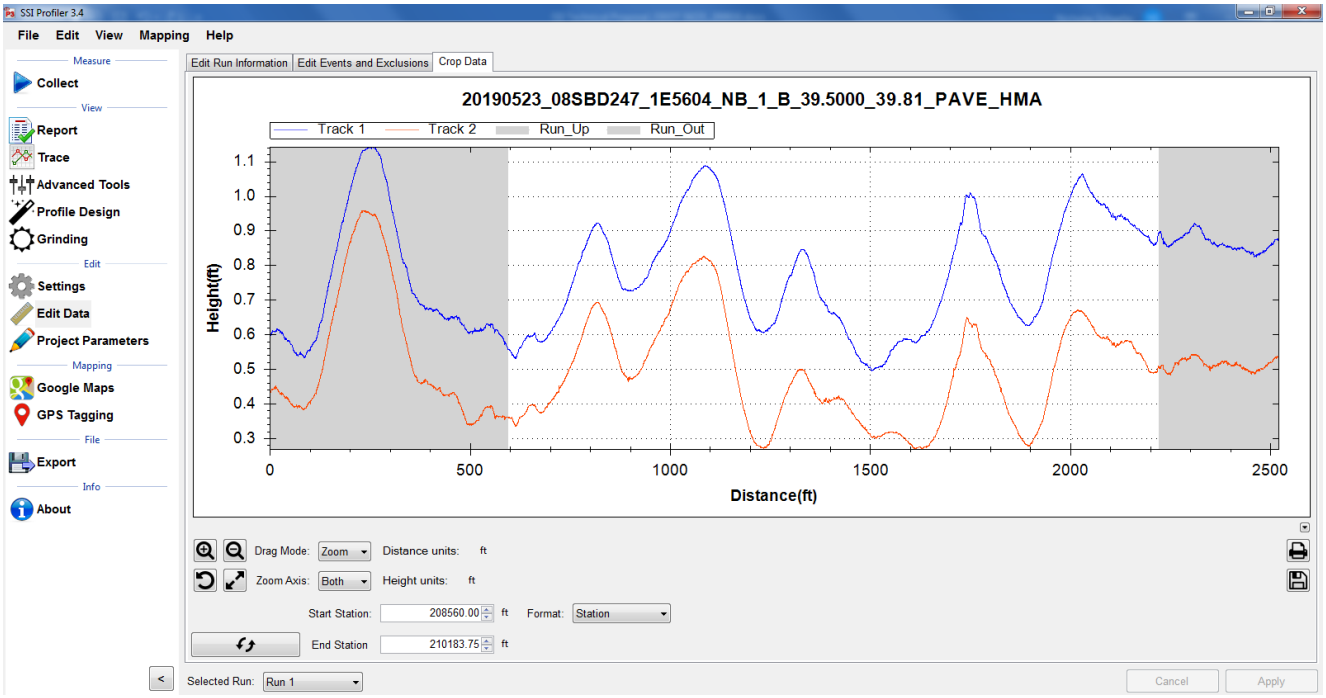


Figure 9: SSI Profiler Edit Data Window with Run Information, Events & Pauses, and Crop Data (shown)

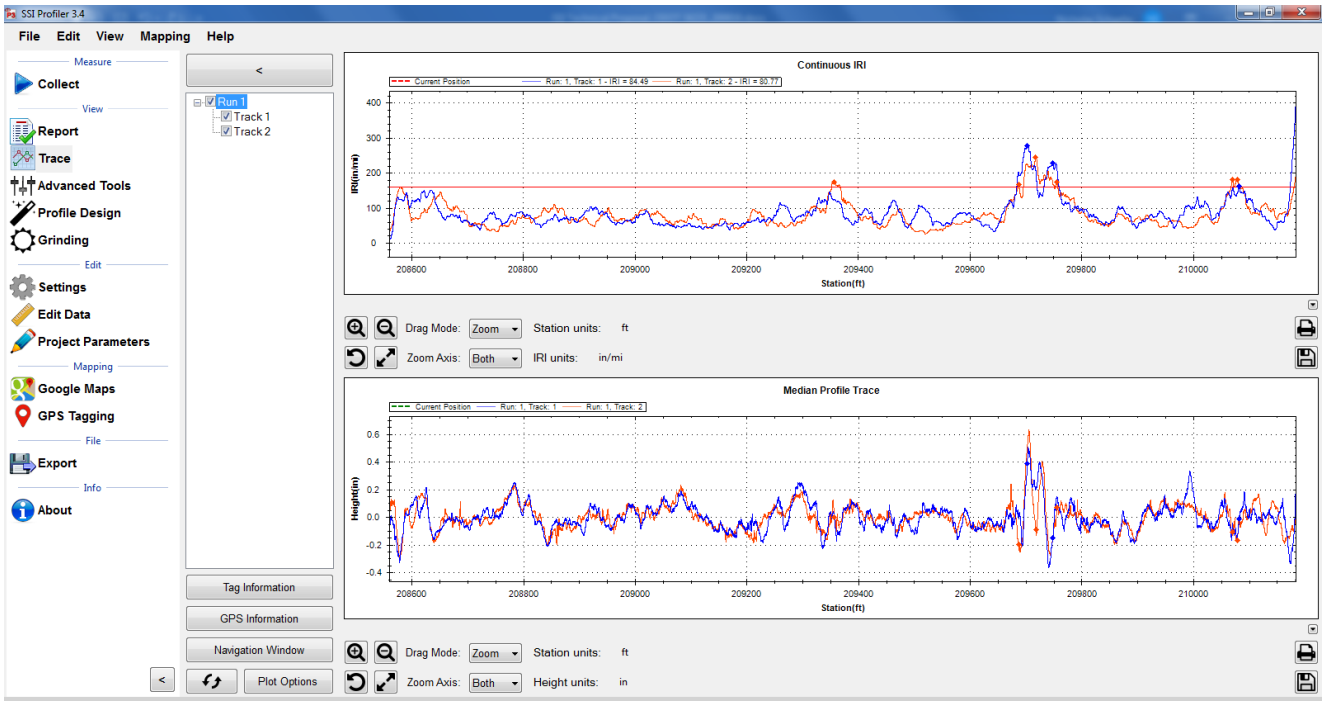


Figure 10: SSI Profiler Trace View Window with IRI ALR and Elevation Displayed (User configurable)

SSI SAMPLE TRAINING VIDEOS

SSI offers a variety of operator training and customer support online videos. Below are several examples.

SSI Sample YouTube Links		
Laser Height Verification	Distance Calibration	Advanced Tools Image Slideshow Clip
Accelerometer Calibration	GPS Navigation Clip	Edit Data Tutorial

OPTIONAL FEATURES WITH SSI EQUIPMENT

SSI is proposing the CS9300 Inertial Profiler with pricing to include the Zero-Speed upgrade. This will expand the collection speed range from 5-74 mph to 0-100 mph, including stoppages (and without any need to collect lead-in or run-out sections). Cross-slope measurement and reporting comes standard with this upgrade. The Zero-Speed inertial profiler upgrade has been proven by The Texas Transportation Institute (TTI), Caltrans and NDOT on their AASHTO r56 inertial profiler certification tracks. A research report issued by TTI on "stop-and-go" profilers is accessible here: TTI Report. The SSI zero-speed is System C in the TTI Report.

DIGITAL CAMERA SYSTEM (OPTIONAL UPGRADE)

- SSI incorporates high-definition USB cameras which integrate into the profile data.
- The small footprint of the camera does not obstruct the sight-lines of the driver.
- SSI Profiler software allows image viewing as a slideshow with information such as ride values, defects, speed, cross-slope, GPS, and rut values.
- YouTube example of image slideshow: https://youtu.be/NkoyqHaC_3o

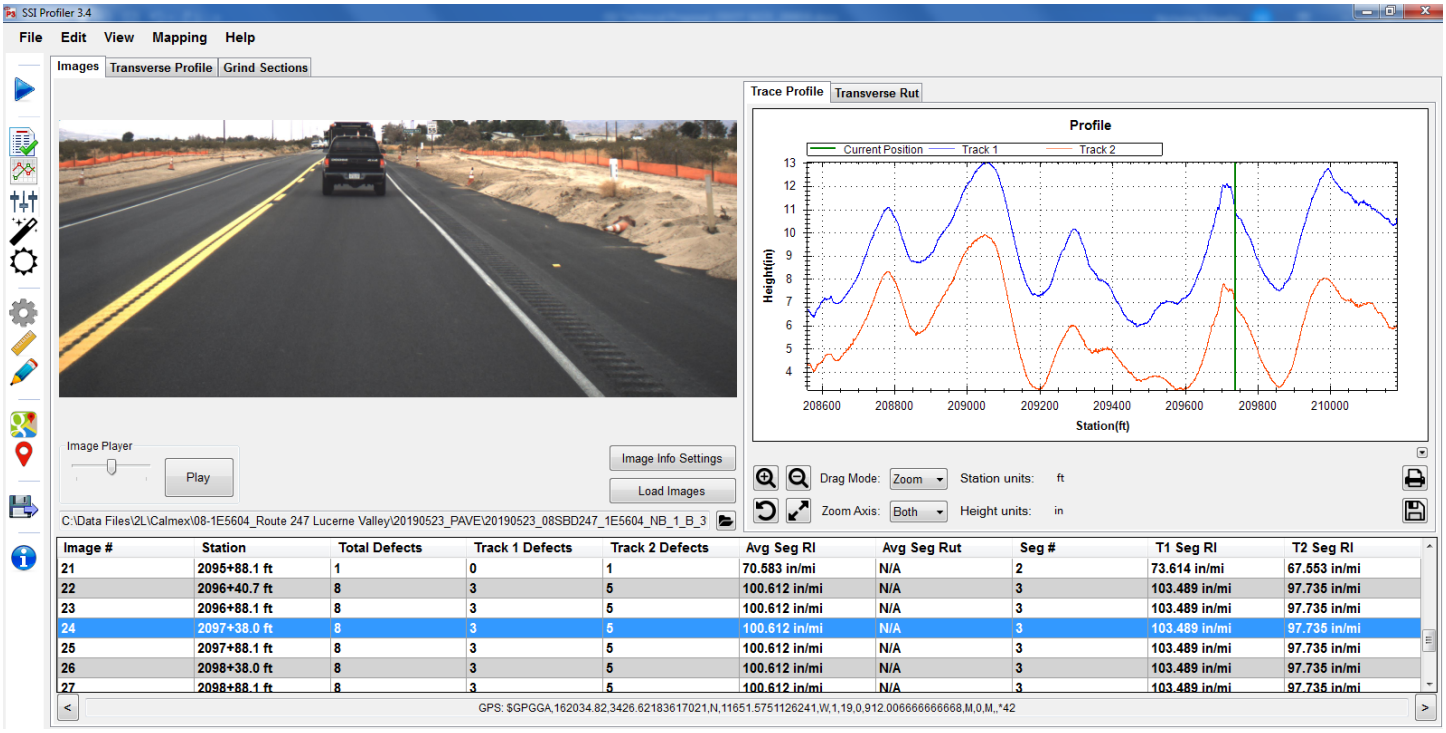


Figure 11: Example of Advanced Tools Window with ROW Image

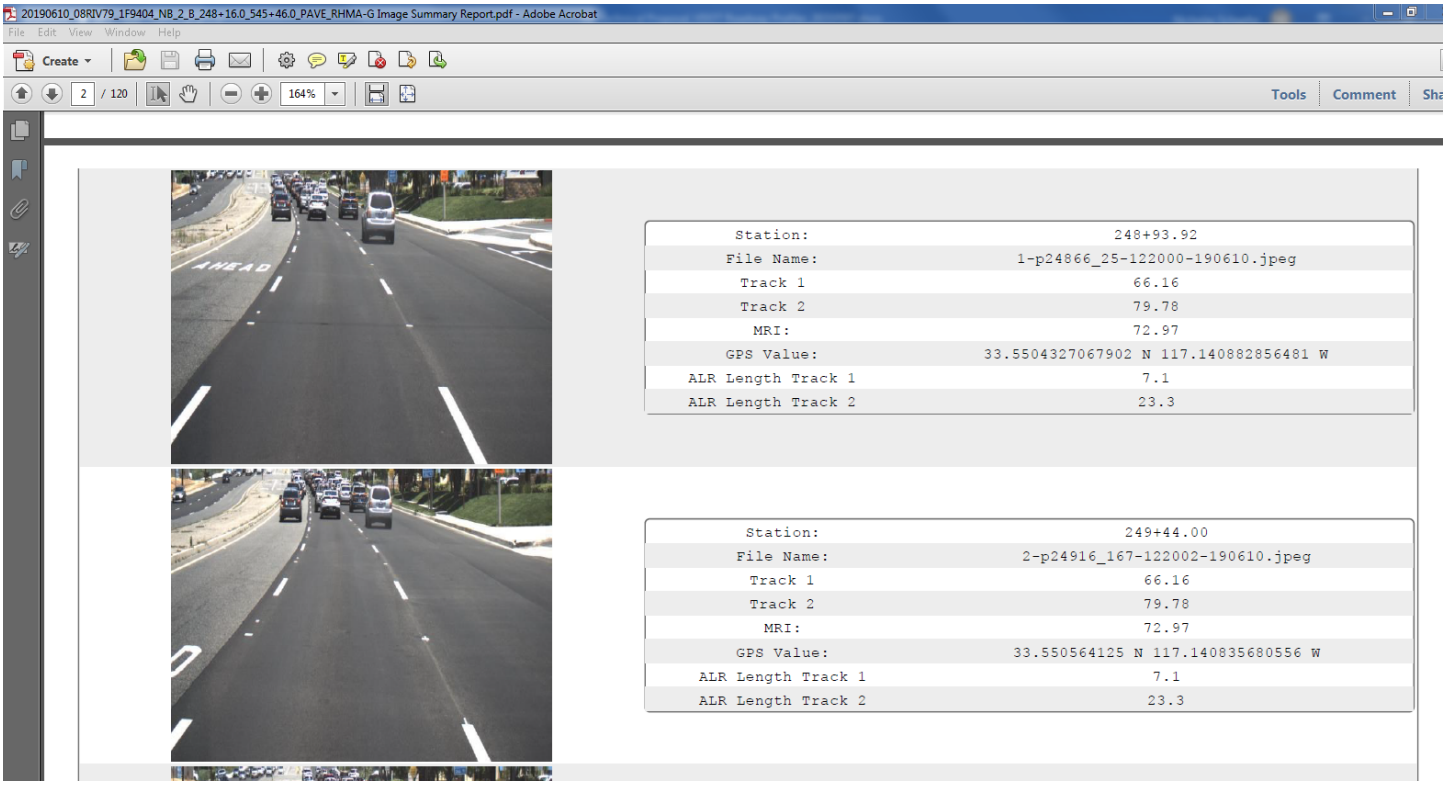


Figure 12: SSI Profiler PDF Image Report from ROW Camera

Figure 13: CS9300 Inertial Profiler in Shipping/Storage Case

4. SUPPORT

Multiple SSI support staff are accessible by telephone or email through our offices in Auburn, CA and Manhattan, KS. Customers have multiple cell phone and email contacts for technicians across North America. SSI also has full time staff across the western United States in Vancouver, WA, Carson City, NV and Spartanburg, SC. All of the SSI staff is available by cell phone as problems are encountered. Each regional staff member has been working for SSI for at least 10 years. Most of our team members have been with SSI for more than 10 years.

Team Member	Education	Years with SSI	SSI Office	Duties
Brent Bergman	Kansas State University	14	Manhattan, KS	R&D and Technical Support
Bryant Umscheid	Kansas State University	14	Manhattan, KS	R&D and Technical Support
Adam Kohake	Kansas State University	6	Manhattan, KS	R&D and Technical Support
Ethan Grother	Kansas State University	10	Manhattan, KS	Programming
Travis Glenn	Kansas State University	4	Manhattan, KS	Programming
Ahren Verigin	-	9	Auburn, CA	Hardware & Support
Nicholas Schaefer, PE	University of California, Davis	14	Spartanburg, SC	Field Services and Support
Flint Hixon	Kansas State University	19	Carson City, NV	Hardware Fabrication & Support
Anthony Henderson	Washington State University	21	Vancouver, WA	Hardware Fabrication & Support
Dennis Scott	University of Wisconsin-Madison	Founder, 29	Larkspur, CA	Administration & Support

Figure 14: SSI Support Staff

SSI has a warranty period on equipment and hardware, but support hours are not charged to customers. Typical repairs are completed by shipping replacement parts from our Auburn, CA or Manhattan, KS offices. Overnight shipping is typically available on all parts. On-loan sensors are provided at no cost.

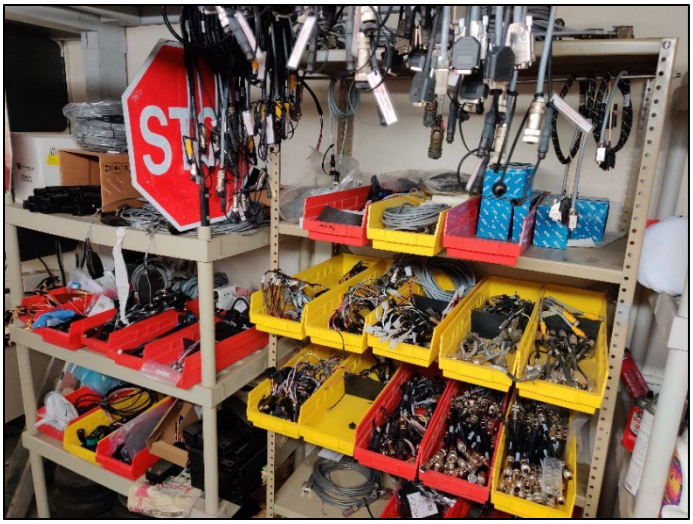


Figure 15: Replacement Parts Stocked in SSI's Auburn, CA Office

5. PRODUCT UTILIZATION

Below is a sample of users in the United States and Canada. This is a partial list. The total number of systems in operation throughout the USA and Canada exceeds 120.

Organization	Contact	Number	Email	System Model	Delivery Date
Arizona DOT	Kevin Robertson	(602)531-8112	KRobertson2@azdot.gov	CS9300	10/2018
Caltrans	Gary Kenyon	(916)837-5633	gary.kenyon@dot.ca.gov	CS9500	2018
Caltrans	Frank Chavez Arnold Truong (D7) John Warrick (D7) Pete Spector	(916)227-7011 (714)548-1742 (213)798-6076 (916)227-7306	frank.chavez@dot.ca.gov arnold.truong@dot.ca.gov john.warrick@dot.ca.gov pete.spector@dot.ca.gov	CS9100 (QTY 12)	5/2019
Nevada DOT	Steven Hale	(775)888-7226	SHale@dot.nv.gov	CS9100 (QTY 2)	2017
Montana DOT	Matt Needham	(406)444-7260	maneedham@mt.gov	CS9100 (QTY 5)	5/2020
Idaho DOT	Craig Wielenga	(208)334-4415	Craig.Wielenga@itd.idaho.gov	CS8700	6/2020
Iowa State University	Kelly Freel	(515)294-9918	kmfreel@iastate.edu	CS9300	3/2019
New Mexico DOT	Alfonso Lopez	(505)285-3261	Alfonso.Lopez@state.nm.us	CS9100	6/2019
Maryland DOT	Ralph Smith	(410)952-8625	RSmith3@mdot.maryland.gov	CS9100	8/2019
Illinois DOT	LaDonna Rowden	(217)782-8582	ladonna.Rowden@illinois.gov	CS9300 (QTY 16)	11/2016
City of Oklahoma City	Daniel Witthuhn	(405)316-5511	daniel.witthuhn@okc.gov	CS9300	9/2016
Pavement Recycling Systems	Ryan Zenahlik	(951)790-7950	RZenahlik@pavementrecycling.com	CS9100 & CS9500	2016, 2018
Sam Rhodes, Inc.	Cameron Martin	(530)906-9777	cameron@samrhodesinc.com	CS9100 (QTY 4)	2015-2020
Inertial Profiling Services, Inc.	Thomas Reickard	(231)580-9401	treickard@inertialprofiling.com	CS9100 (QTY 2)	2017, 2019
Clark County Public Works	Rickey Shepard	(702)281-2311	rickey.shepard@clarkcountynv.gov	CS9500	2016
Ellis Profiling, LLC	Robert Ellis	(801)380-7832	ellisprofiling@msn.com	CS9100zs	4/2020

6. WARRANTY AND SERVICE

The proposed CS9300 system will be supplied with a five-year warranty against defects in workmanship or materials is supplied, effective from the date the CS9300 system is placed into service. Technical support assistance will be steadily available from SSI's shop facilities in Kansas and California. WVDOH will have numerous cell phone support contacts from SSI.

The CS9300 profiling system requires little maintenance. The mount hardware should be inspected periodically for loose set-screws or and firmly tightened hardware. The hardware should be kept in a clean condition. The lenses of the lasers should be cleaned periodically. Cables should be periodically inspected for wear and adequate strain relief. The software should be updated at least annually. Software version updates are available: (i) by internet automatic updating; simply open the SSI software on a web connected computer and follow the prompts to install updates, or (ii) by downloading new software from SSI's customer support website: https://www.smoothroad.com/support. SSI recommends installing the Microsoft Windows operating system updates on the operator interface computer every 1-2 months.

7. CONCLUSION

The CS9300 High-Speed Inertial Profiling System proposed by SSI as a most capable solution that meets and exceeds the requirements set forth in the WVDOH RFQ. SSI hopes to supply West Virginia Department of Highways with a CS9300 High-Speed Inertial Profiling System.

SURFACE SYSTEMS & INSTRUMENTS, INC.

By_____
Dennis P. Scott, President

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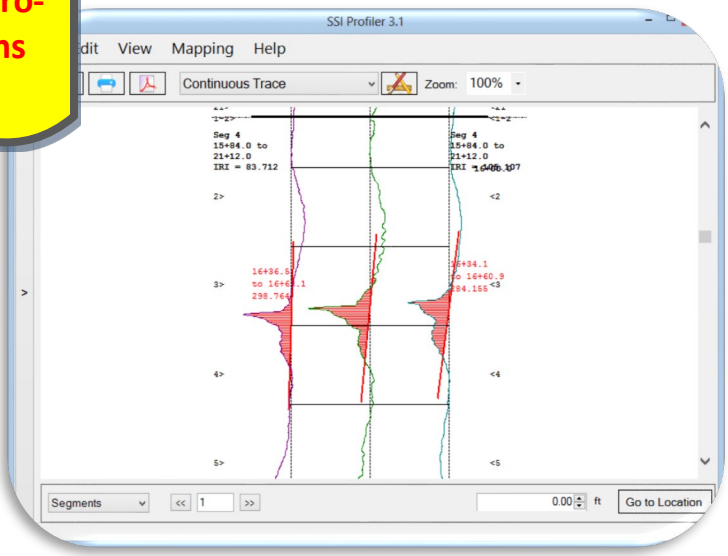
Inertial Profiler

▲CS9300 Inertial Profiler▲

▲CS9100 Mid-Mount Inertial Profiler▲

GPS-DMI & Zero-Speed Options

▲GPS Tracking Thru Profile Data in SSI Profiler 3, Google Earth/Maps▲



▲IRI and Localized Roughness Displayed by Individual Track▲

Precise Surface Profile Measurement at Highway Speeds

DOT Compliant QA/QC Testing on All Pavement Types

Meets ASTM/AASHTO Standards ⊕ Easy Collection & Analysis Software ⊕ Productive & Reliable (=Quick ROI)

CS9100/CS9300 Inertial Profiling Systems

Profiling System Specifications

- Collect data 5 to >100 mph (8-160 kph).
- Meets E950, M328, R054, R056-057
- Meets or exceeds all Class I requirements of **ASTM E950**.
- *Zero-Speed Option*: collect certifiable data through vehicle stoppages and at ***ANY*** speed: **0-100 mph**.
- Gocator 5 kHz ***wide beam lasers*** for best results on textured asphalt and concrete pavements.
- ±10g accelerometers with 0.0001g resolution.
- Record profile wavelengths of ~0.25 feet (7.62mm) to at least 8000 feet (2438 meters).
- Collection system removable for use on other vehicles.

Compliance and Equipment

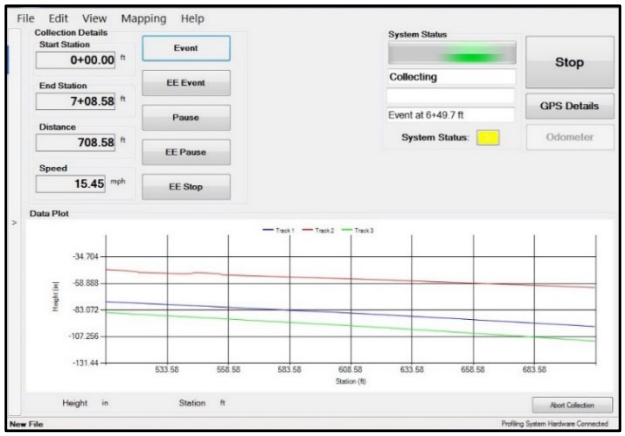
- Complies with all commonly used agency specifications.
- Equipped with industrial grade sensors and connectors.
- Core electronics manufactured in an ISO 9001 facility.
- TOUGHBOOK rugged computer on all systems.
- Docked computer accessible by driver or passenger.
- Connects to host vehicle's 12-volt power supply.

Operation, Training & Support

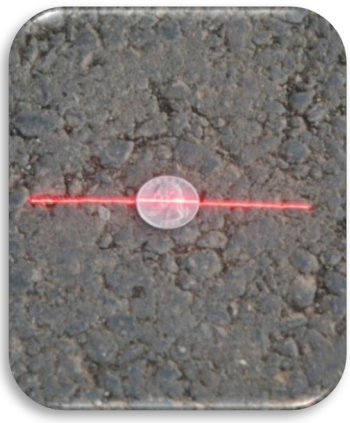
- Designed for safe one-person operation.
- Speed range: 1-inch sampling at 5-70 mph (8-113 kph).
- Operating temperature: 32°-115°F (0°-46°C).
- Waterproof core components.
- Automatic software updates with SSI Profiler 3
- In-field replacement of portable, modular components.
- ***Warranty*** and rapid response ***customer support*** on all profiling system hardware and software components.
- ***Options***: GPS-DMI, survey GPS with CAD output, HD camera, rut measurement, texture and more.
- Worldwide multi-lingual operator training available.

Best-In-Class Profiling System Software

- Windows 10/11 Professional software programs.
- Easy calibration instructions for bounce test, laser verification, accelerometer and distance calibrations.
- On screen visual aids and fast reporting of profile results.
- Support for Google Earth, Google Maps.
- Navigate to locations within profile data using real time GPS Tracker and navigational/mapping capabilities.
- User selectable parameters for English and Metric units.
- Real time display of profile traces, position and speed.
- Electric Eye data triggers on each side of system function at 30+ feet (10+ meters).
- User programmable keyboard shortcuts.
- Continuous Collection function tracks vehicle position below 5 mph and resumes inertial data at 5 mph or more.
- Pause areas integrated into collection. View paused areas separately or exclude.
- Multiple Profile Indexes: IRI (International Roughness Index, Mean IRI (**MRI**), Half Car Ride Index (HRI), Profile Ride Index (**PRI,** ASTM E1274), Ride Number (RN).
- Multiple outputs for **Areas of Localized Roughness**: IRI based roughness with configurable thresholds; Rolling Straightedge, Profilograph must-grind bumps, Texas 1001-S localized roughness, Boeing Bump reporting.
- Raw data is rewritable: change parameters at any time.
- User defined filtering values for high and low pass filters.
- View system diagnostics and raw sensor data for monitoring performance and identifying support issues.
- Export data into PROVAL (PPF, ERD), PDF, Excel, CSV, PRO, GPS/GIS, CAD/LAS (survey systems).
- Encrypted data for compact file size and security.



▲Computer Instructed Calibration and Data Collection Routines▲



▲Gocator Wide Footprint Laser▲

▲In-Cab Touchscreen Computer▲

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SSI INERTIAL PROFILING SYSTEMS
Technical Specifications

▲ CS9300 Front/Rear Mount ▲

▲ CS9100 Mid-Mount ▲

▲ CS9400 Portable Mount ▲

Overall System Highlights

- Portable Profiling Options Available
- All Components are Modular
- Class I Profiler under ASTM E950
- Simple, User Friendly Software
- No Annual Factory Calibration Required
- Guaranteed Compliance with Smoothness Specifications
- Zero-Speed Upgrade for 0-113 mph Collections, Through Stoppages
- GPS-DMI Accurate Within 0.05%
- GPS Features Allow for One-Person Operation
- All-in-One Software
- Components are Interchangeable Between Systems
    - Typical with a CS9100/CS9300 and a secondary CS8700 Lightweight Profiler

▲ CS9300 Front Mount Zero-Speed ▲

▲ CS8700 Lightweight Profiler ▲

Profiling System and Sensors Specifications:

Device Compliance	ASTM E950 AASHTO M328, R54, R56, R57 Any Applicable DOT Test Method
Collection Surface Type	Concrete, Asphalt, Gravel, Soil
Sampling Interval	1-inch (25.4mm) at all collection speeds 0-100 mph (0-160 kph), default User configurable option in SSI Software
DMI Options (Accuracy)	Encoder DMI (0.1%) GPS-DMI or INS-DMI (<0.05%)
Collection Speed	5-113 mph (8-182 kph) 0-113 mph with ***Zero-Speed Upgrade,*** *through stoppages* (0-182 kph)
Height Sensor Options	Dot Laser, single point Line Laser: 4-6 inches (100-150mm) Wide Scan Line Laser: 2.3-feet (0.7-meters) Sonic Sensor
Height Sensor Sampling Speeds	Dot Laser: up to 32kHz Line Laser: up 5kHz Wide Scan Line Laser: 5 kHz Sonic Sensor: 200 Hz
Laser Resolution	Compliant with AASHTO r56 (0.01-inch) Typical accuracy is 0.002-0.005-inches (0.05-0.1mm)
Accelerometer	±5 to ±10g with 0.0001g resolution
Laser Rating	Type 3B/IIIB ***Warning***: Do not look directly into the laser housing. Laser is **UNSAFE** for eye exposure. Wear proper protection when working around laser beam.
INS Pitch/Roll Accuracy	0.02 degrees
INS Heading Accuracy	0.01 degrees
GPS Accuracy, Horizontal	~0.75-meters with SBAS GPS constellation 4cm with subscription based corrections 10mm with RTK

Profiling System Data Accuracy:

Profile Features and Preservation	SSI Inertial Profilers able to measure and preserve profile wavelengths from ~0.25-feet to ~8,000-feet (76.2mm to 2,438 meters). With optional survey subsystem long wavelengths can be preserved to theoretically infinite length.
Repeatability and Accuracy	Guaranteed compliance with industry standards. Including ASTM E950, AASHTO M328, R56, and Texas 1001-S.
Specification Compliance	Guaranteed compliance with all commonly used agency specifications and test methods regarding use of inertial profiling systems for quality control or quality assurance

Profiling System Electronics and Computer Hardware:

SSI Electronics Rating	ISO 9001
Core Electronics Housing Size	Portable: 15” x 16” x 8” (38 x 41 x 20 cm)
Electronics Power Input	10-16 VDC; Power regulation components available
Electronics Power Draw	2.4 amps per laser
Power Source/Connection	Vehicle Cigarette, Vehicle 7-pin Trailer, Vehicle battery
Cabling and Connector Rating	IP67 minimum, including quick disconnect
Operating Computer	Mil-Spec Panasonic Toughbook CF-33 or CF-55
Operating Computer Typical Specs	Intel i5 processor, Win10 Pro, 8GB RAM, 512 GB SSD, Gigabit Ethernet LAN, wireless 802.11 a/b/g/n, Bluetooth, 14.1” HD display – Daylight Readable, Lithium-ion internal battery. *Additional options available.*
In-Vehicle Workstation	Pedestal Mount system and docking station for operating computer and power supply. Adjustable computer position between driver and passenger for safe one-person operation.

Professionally Engineered Profiling System Mount Hardware:

CS9300 Front Mount Vehicle Connection	Connection to, or replacement of tow hooks. Horizontal rigid bar mount for three points of contact to profiling system. Bolt connection.
CS9300/CS9400 Rear Mount Vehicle Connection	Rear mounted system can connect to any 2-inch Class III receiver. Connected and clamped to hitch with SSI hardware. Core front mount and rear mount systems are interchangeable.
CS9100 Mid-Mount Vehicle Connection (Same as CS8700 LWP)	Connection to vehicle chassis. Dovetail hardware and cabling remains on vehicle. Sensors are removed when not in use.
Laser Standoff Height	Lasers typically stand 12-inches off ground (30.5cm)
Distance DMI Hardware	Optical encoder mounted on wheel or use of GPS-DMI
Sensor Adjustment	Dovetail hardware supplied for horizontal and vertical adjustment of sensor modules
Custom Vehicle Mounting	Options available for custom vehicle mounting

Profiling System Software:

SSI Profiler Software	All-in-one software for calibration, collection, analysis, editing, reporting, and exporting.
Software Operating System	Windows 7, 10+
Calibration Routines	Distance, accelerometer, inclinometer (if equipped)
Verification Routines	Bounce Test, Laser Height Verification
Diagnostic Routines	Real-time monitoring of sensor data and sensor status
Software Analysis Units	English or Metric
Ride Value Reporting	IRI, MRI, HRI, PRI, RN, RMS
Localized Roughness Reporting	Profilograph, IRI short continuous ALR, MRI, HRI, Rolling Straightedge, Relative Height, Texas 1001-S.
Real Time Display	Displays vehicle position and raw elevations during collections
Data Collection and Event Triggers	(i) Reverse Direction, (ii) Electric-Eye Photocell, (iii) On-the-Fly Hot Key, (iv) GPS Coordinates

Event/Exclusion Input Methods	(i) On-the-Fly Hot Key, (ii) Electric-Eye Photocell, (iii) GPS Coordinates, (iv) Post-Collection System GPS, (v) Post-Collection Stationing
Urban Area Collections	Zero-Speed option allows collection speeds at 0-100 mph, including through stoppages. Without Zero-Speed option, continuous collection software suspends data collection below 5mph. Collection resumes with a vehicle speed above 5mph.
Re-Writeable Data	Data can be reanalyzed infinitely to review multiple parameters
Configurable Filtering	Low pass, high pass and band pass for Butterworth or Moving Average type filters
Multiple Trace Reporting	Patented multiple profile trace data acquisition and reporting.
Export Types	ERD, PPF, PRO, ASCII, CSV, Excel, PDF, GIS shapefiles, Google Earth KML/KMZ, configurable text (PNEZD, raw sensor, speed, elevations, etc.)
Software Licenses	License for each specific user. One perpetual license for SSI Profiler included with each system.
Feedback and Errors	All software errors and feedback is sent to SSI developers
Software Updates	Automatic software updates supplied to each user as available
Data Encryption	Encrypted raw data files for data integrity security

Operational & Physical Attributes:

One Person Operation	Operation can be hands free with GPS assistance
Collection Speed	All collections may be made at highway speed without leaving vehicle
Operation Ambient Temperature	~30˚ to 128˚F (~0˚ to 53˚C)
Storage Temperature	-22˚ to 158˚F (-30˚to 70˚C)
Humidity	<90% (non-condensing)
Wet Pavement or Raining Condition	Pavement must be drier than saturated surface dry. No spraying water from tires of standing water or ponding on the surface.
CS9300 Dimensions	60” x 8” x 24” (152 x 20.3 x 61 cm)
CS9300 Weight	~75 lbs (34 kg)
CS9100 Dimensions	Laser cover: 10” x 7” x 6” (25 x 18 x 15 cm)
CS9100 Weight	35 lbs (16 kg)
CS9400 Dimensions	20” x 8” x 24” (51 x 20.3 x 61 cm)
CS9400 Weight	35 lbs (16 kg)

Options & Accessories:

GPS Upgrades and Accuracy	Constellation Upgrades: GPS, Glonass, Beidou, Galileo (~35+ satellites) RTK Post-Processing – 10mm horizontal, 20-25mm vertical NTRIP, data or subscription based corrections (4cm accuracy)
Wide Footprint Lasers	Common – typical for high textured pavement: concrete, grooved or coarse pavement with high voids
Rut Depth Measurement	Available in: 3-point 5-point (AASHTO PP38) Full transverse (AASHTO R87 and R88)
Texture	Macrotexture measurement reporting MPD (ASTM E1845), ETD, RMS

	One or multiple track texture measurement
Cross-Slope	INS-GNSS instrumentation. Reports within 0.1% of smart level
ROW Camera	5MP, 12MP or 24MP camera for ROW images. Camera images merged with profile data and embedded with GPS. May add up to two cameras
Down Facing Camera for Pavement Condition	Continuous, full lane width images for pavement distresses. Distance-based triggering of images for accurate location measurement and timing.
Mobile Surveying	2D or 3D point cloud survey scanning with additional hardware. Available with PPK post-processing. SSI software allows to merge correction points for 95% of point cloud within vertical accuracy of 6mm. Full lane or half-lane with collections. Typical 2” x 0.5” grid collected at 55 mph (50mm x 12mm at 88 kph) LAS, PNEZD or DXF export formats.
Terrain Profiling	Collect offroad data with accelerometer only or sonic sensor. Ideal for IRI or RMS assessments of unpaved roads or trails. Option to export survey grade profiles with PPK processing. Kvalue export for vertical curve monitoring and assessment
Multiple System Integration	Support available to integrate other systems for distress and pavement management (LCMS/LRMS, GPS, GPS/GIS, etc.
Printer	Optional on-board thermal printer

Support:

Operator Training	Worldwide multi-lingual on-site operator training available
Real Time Diagnostics	In-software diagnostics of components, sensors and data streams
Software Updates	Automatic updates sent over internet connection. Manual updates can be easily installed with executable file from SSI staff.
In-Field Component Replacement	All collection system components are portable, modular and can be replaced in-field
Warranty	Industry standard limited warranty on all profiling system components and accessories.
Customer Support	Customer assistance available worldwide by telephonic, e-mail and on-site assistance (24x7 support available as requested or needed).

Patented Technology:

SSI profiling systems include technology within the scope of patents granted by (or filed with) the U.S. Patent and Trademark Office. Contact SSI for further patent or other technical information.