

SOWiL Limited
INNOVATIVE SOLUTIONS, ADDING VALUE

CiMMS 3D

Network Survey Vehicle





Agenda

- Overview
- Network Survey Vehicle Overview
- Road Inventory Data Acquisition
- Pavement Condition Data Acquisition
- Data Processing System
 - Road Inventory Analysis Module
 - Pavement Condition Analysis Module
- Report Viewer System





CiMMS 3D - Network Survey Vehicle

an overview

SOWiL Limited has pioneered the development of a patented Network Survey System that encompasses automatic data acquisition, a automatic data processing system, and an automatic report generation system.

Network Survey Vehicle is based on the latest survey techniques utilizing Differential Global Positioning System (DGPS), 3d Laser cum-Camera system and High Quality Video cameras. The Survey Vehicle is used for collection of road inventory and pavement condition related data required for Pavement Maintenance Management System and Road Safety Audit Related Studies and Road Asset Management. Our High Quality cameras capture videos of 180 and 360 degree view.





CiMMS 3D - Network Survey Vehicle

Patent Certificate

INTELLECTUAL PROPERTY INDIA

पेटेंट कार्यालय भारत सरकार | The Patent Office, Government Of India

पेटेंट प्रमाण पत्र | Patent Certificate

(पेटेंट नियमावली का नियम 74) | (Rule 74 of The Patents Act, 1970)

पेटेंट सं. / Patent No. : 528734

आवेदन सं. / Application No. : 201821001541

सादत करने की तारीख / Date of Filing : 13/01/2018

पेटेटी / Patentee : SOWIL Limited

प्रमाणित किया जाता है कि पेटेटी को, उपरोक्त आवेदन में प्रयासकृत **SYSTEM AND METHOD FOR INVESTIGATION OF ROAD CONDITION AND INVENTORY BY A NETWORK SURVEY VEHICLE** नामक आविष्कार के लिए, पेटेंट अधिनियम, 1970 के उपबंधों के अनुसार आज तारीख जनवरी 2018 के तैरहवें दिन से बीस वर्ष की अवधि के लिए पेटेंट अनुदान किया गया है।

It is hereby certified that a patent has been granted to the patentee for an invention entitled **SYSTEM AND METHOD FOR INVESTIGATION OF ROAD CONDITION AND INVENTORY BY A NETWORK SURVEY VEHICLE** as disclosed in the above mentioned application for the term of 20 years from the 13th day of January 2018 in accordance with the provisions of the Patents Act, 1970.

अनुदान की तारीख : 18/03/2024

Date of Grant : 18/03/2024

नियम - इस पेटेंट के नवीकरण के लिए बीस, यह बीस वर्ष का जमा है, जल्द से जल्द 2020 के तैरहवें दिन से और उसके पचास प्रतिशत वर्ष में इसे फिर से लेनी होगी।

Note - The fees for renewal of this patent, if it is to be maintained, will fall / has fallen due on 13th day of January 2020 and on the same day in every year thereafter.



CiMMS 3D - Network Survey Vehicle

List of Hardware

- 180 and 360 -Degree GPS Enabled Camera.
- Rear GPS Enabled Camera.
- PG₄
 1. 3D Laser Cum Camera
 2. DGPS
 3. Distance Measuring Instrument (DMI)
 4. Encoder
 5. Inertial Measurement Unit (IMU) with GPS
 6. Computer System for Data Collection
- LPSP IRI Systems with DGPS
- Vehicle Tracking Device
- Analysis Computer System





CiMMS 3D - Network Survey Vehicle

List of Software

- CiMMS File Uploader
- CiMMS Inventory Collector
- CiMMS IRI Collector and Analyzer
- Kurabo CiMMS Pavement Analyzer
- CiMMS Integrator
- CiMMS Report Maker
- CiMMS Viewer





CiMMS 3D - Network Survey Vehicle

Front View

GPS Enabled 360 Degree Camera

GPS Enabled 180 Degree Camera





CiMMS 3D - Network Survey Vehicle

180 and 360 degrees Camera Technical Details

- Resolution:
 - The camera resolutions supports up to 5.7K.
- Video Format:
 - The H.264 codec is a widely used video compression format, ensuring efficient storage and playback compatibility with most devices and editing software.
- Memory:
 - The MicroSD card slot for storage. This enables you to record a significant amount of high-resolution video without constantly swapping cards.
- Connectivity:
 - Wi-Fi connectivity enables seamless pairing with your smartphone for real-time monitoring.
- GPS:
 - Inbuilt GPS





CiMMS 3D - Network Survey Vehicle

Back Side View



→ DGPS

→ GPS Enabled 2D Digital Camera

→ 3D Laser-cum-Camera





CiMMS 3D - Network Survey Vehicle

DGPS Technical Details

Features:

- Receiver Type: Multi-frequency, Multi-GNSS RTK
- Signals Received: GPS, GLONASS, BeiDou, and Atlas
- Channels: 572 / 488
- GPS Sensitivity: -142 dBm
- SBAS Tracking: 3-channel, parallel tracking
- Update Rate: 10 Hz standard





CiMMS 3D - Network Survey Vehicle

2D Camera Technical Details

Resolution:

- The camera resolutions supports up to 4K.

Video Format:

- The H.264 codec is a widely used video compression format, ensuring efficient storage and playback compatibility with most devices and editing software.

Memory:

- The MicroSD card slot for storage. This enables you to record a significant amount of high-resolution video without constantly swapping cards.

Connectivity:

- Wi-Fi connectivity enables seamless pairing with your smartphone for real-time monitoring.

GPS:

- Inbuilt GPS.





3D Laser-cum-Camera - PG4

Camera Technical Details



Effortless Data Acquisition: Easily gather 3D data and inspect roads by simply attaching the unit to your vehicle.

High-Definition Imagery: Utilize high-definition images to identify cracks and rutting with precision.

Detailed Inspection Reports: Generate comprehensive inspection reports based on the acquired data.

High-Speed Crack Detection: The system can capture crack inspection data with a 4mm pitch while traveling at 100 km/h, all without the need to close lanes.

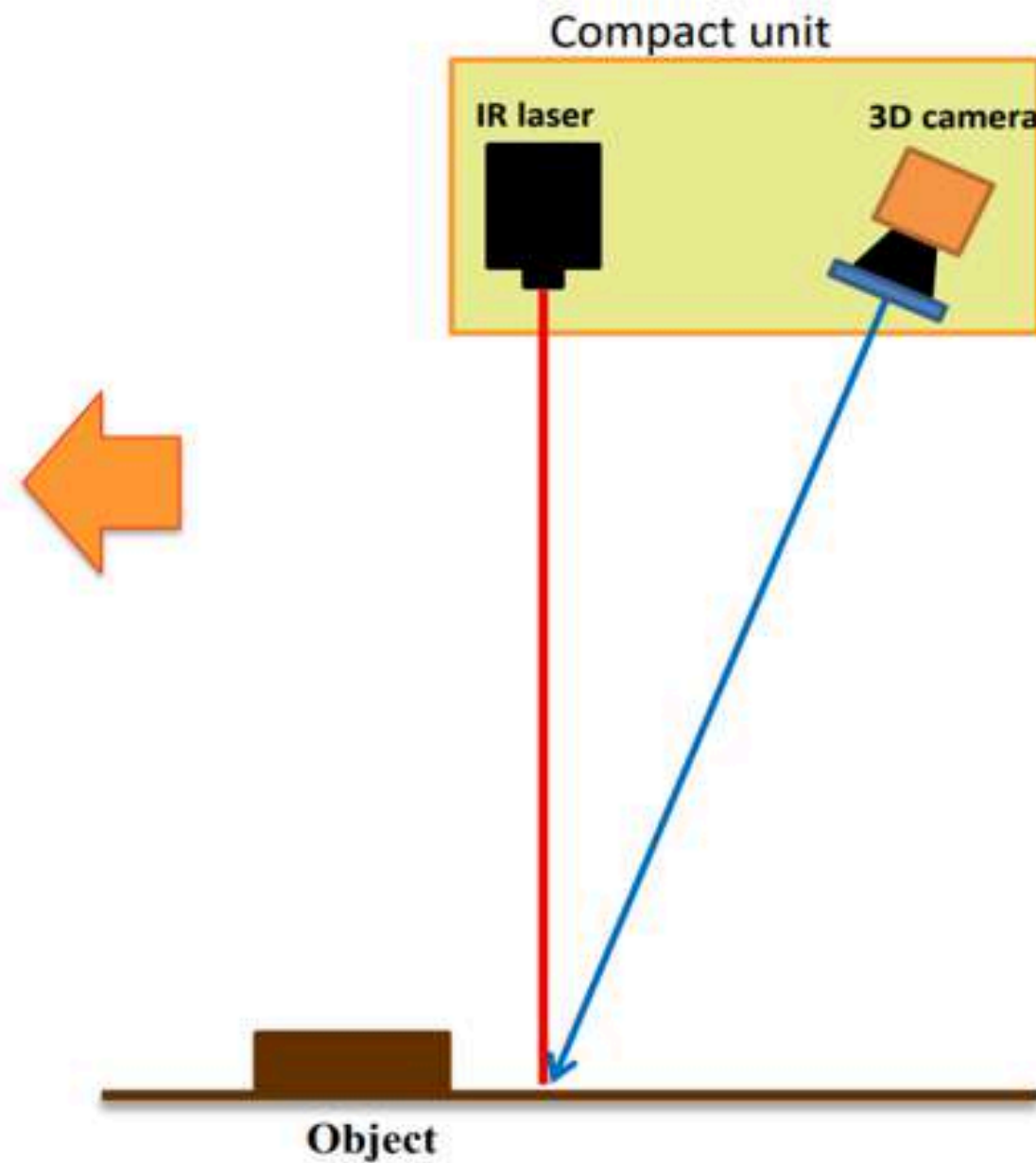




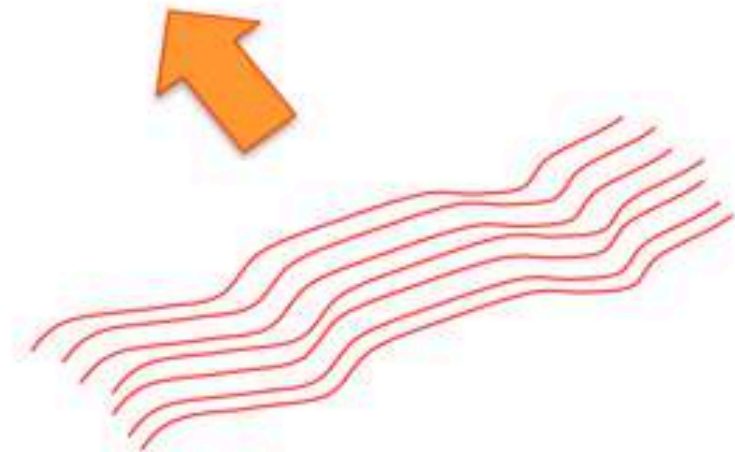
3D Laser-cum-Camera - PG₄

Acquisition Principle

*** Side**



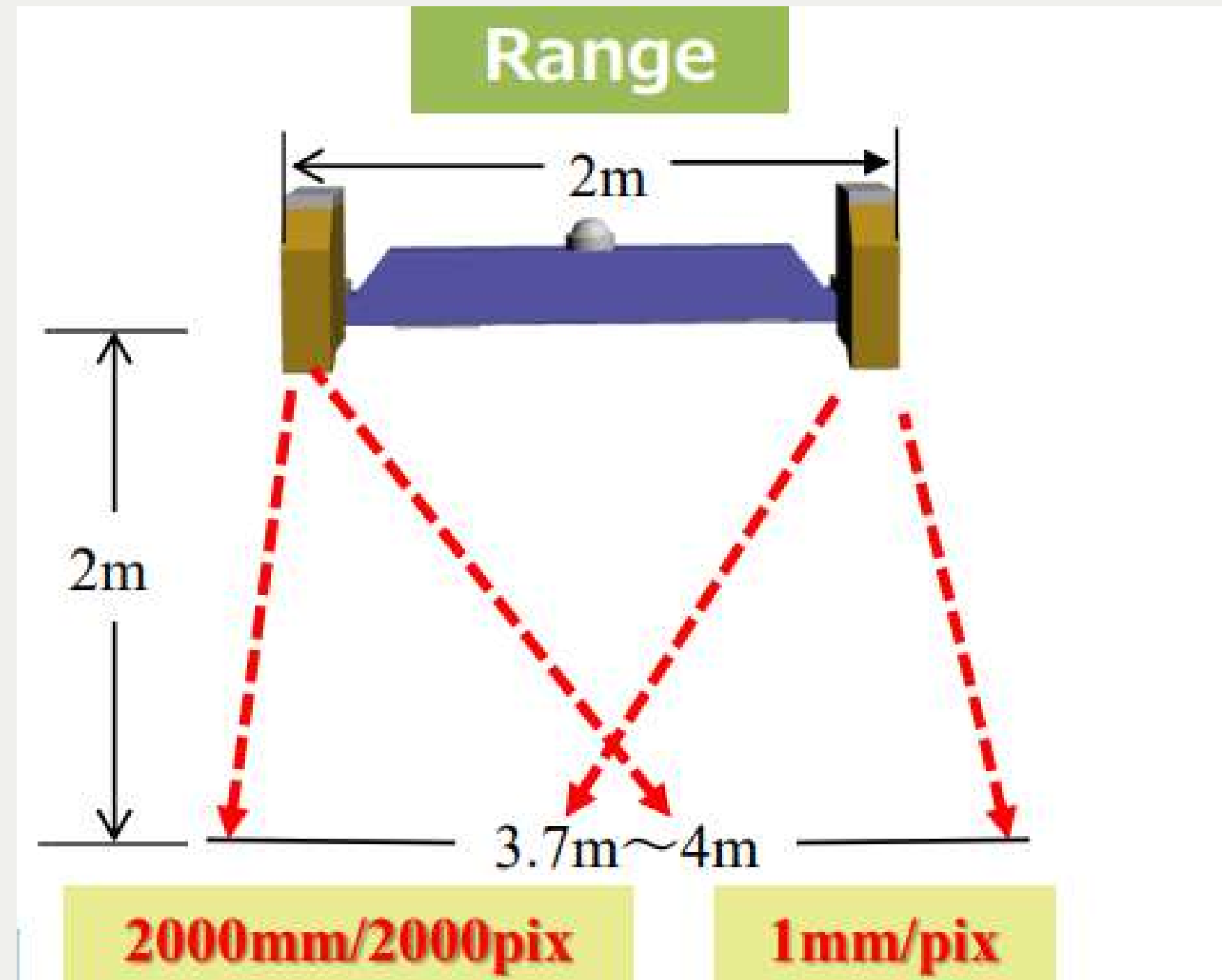
3D Camera





3D Laser-cum-Camera - PG₄

Unit spec





3D Laser-cum-Camera - PG₄

Technical Details

- **Survey Speed:** Up to 100 km/h.
- **Transversal Resolution:** 1 mm/pixel.
- **Height Resolution:** 0.5 mm.
- **Longitudinal Resolution:** 1 mm to 4 mm.
- **Software Functions:** Includes lane mark detection, 2D/3D viewing, 3D camera data integration, GPS linking, mesh processing, auto/manual rut analysis, auto/manual crack and pothole analysis. It also outputs reports in suitable formats.
- **Data Handling:** Capable of processing raw data for result evidence.
- **Maintenance:** Open source hardware facilitates easier local maintenance





Distance Measuring Instrument (DMI)





Distance Measuring Instrument (DMI)

FEATURES:

- Uses non-contact measurement system which makes high accurate measurement without any slip, idling and abrasion of wheels.
- With the fluctuation range of measurement distance with in ± 80 mm, which makes accurate measurement even if in rain or bumpy track on road.
- Makes accurate measurement of velocity and travel distance from a stop point.
- The accuracy of measurement is unaffected by measurement place or environment change.





Distance Measuring Instrument (DMI)

TECHNICAL DETAILS:

- **Measurement Technology:** Utilizes laser Doppler technology for speed measurement.
- **Velocity Range:** -250~+250km/h or -5~+500km/h
- **Distance (focus):** 500mm±80mm or more
- **Accuracy:** Typically offers an accuracy of +/- 1% of the measured speed.
- **Speed Range:** Capable of measuring speeds from 0 km/h to over 300 km/h.
- **Laser Type:** Often uses an infrared laser, Class 3B, with a specific wavelength (e.g., 780 nm).
- **Beam Divergence:** The laser beam divergence is generally small, around 3 milliradians, to ensure focused targeting.
- **Environmental Resistance:** Typically designed to be weather-resistant, capable of operating in diverse environmental conditions.





Inertial Measurement Unit (IMU)



IMU fitted
in the vehicle

IMU Integration: IMU integrates data from accelerometers and gyroscopes to determine vehicle position and orientation.





Inertial Measurement Unit (IMU)

FEATURES:

- **High Precision:** The IMU is known for its high precision in measuring motion and orientation, making it suitable for applications in robotics, unmanned vehicles, and other demanding industries.
- **Versatile Application:** This IMU is designed for a wide range of applications, including aerospace, industrial automation, automotive testing, and more, where accurate motion and orientation data are crucial.
- **Compact Design:** Its miniature size and lightweight design make it easy to integrate into various systems without adding significant weight or bulk.
- **Temperature Compensation:** The IMU often includes temperature compensation algorithms to ensure accurate measurements across different operating temperatures.





Inertial Measurement Unit (IMU)

FEATURES:

- **Customization:** IMU Sensing Systems typically provides options for customization to meet specific application needs, including data output formats and communication protocols.
- **Data Fusion:** It may incorporate sensor fusion algorithms to combine data from accelerometers, gyros, and magnetometers to provide accurate and stable orientation information, even in dynamic environments.
- **Robust Construction:** IMU allows them to withstand challenging environmental conditions.





Inertial Measurement Unit (IMU)

TECHNICAL DETAILS:

- **IMU Type:** An Inertial Measurement Unit, which combines multiple sensors to measure acceleration, angular velocity, and magnetic field data.
- **Sensors:** It is equipped with a combination of accelerometers, gyroscope, and magnetometers to provide accurate motion and orientation measurements.
- **Measurement Range:**
 1. Accelerometer: Typically ± 16 g (adjustable range)
 2. Gyroscope: Typically ± 2000 deg/s (adjustable range)
 3. Magnetometer: Typically ± 8 gauss (adjustable range)
- **Output Data Rate:** The IMU can provide sensor data at different rates, often adjustable to suit specific application requirements. Typical rates range from a few Hz to several hundred Hz.
- **Communication Interface:** It typically supports multiple communication interfaces such as RS-232, RS-485, and USB for data output and configuration.
- **Power Supply:** The unit operates on a low voltage power supply, often in the range of 5V to 24V DC.
- **Accuracy:** High accuracy in motion and orientation measurements, which makes it suitable for applications requiring precise positioning and attitude determination.





Network Survey Vehicle

INSIDE VEHICLE



Display Monitor



Laser Power

Power Box

Encoder Box

Control PC





LPS-P Laser Profiler



Distance Sensor

Laser Sensor

Dual longitudinal profiler enables measurement of international roughness index (IRI), Standard Deviation, and Riding Quality Index (RQI) along both wheel-paths.



LPS-P Laser Profiler

- **Versatile Laser Profiler:** The Laser Roughness Meter is a versatile tool suitable for various applications.
- **Impressive Speed:** Operates at speeds from 25 km/h to 120 km/h.
- **Real-time Data Processing:** Offers efficient and immediate data processing and output.
- **Vehicle-Mounted:** Designed as a response-type vehicle-carried instrument.
- **High Precision:** Provides accurate measurements, including IRI, standard deviation, and RQI.
- **Automation:** Automatically processes and outputs data every 100 meters or 1 kilometer.





LPS-P Laser Profiler

- **Laser sensor:**
 - Sampling frequency: 8 K
 - Measuring range: 500 mm
 - Stand off: 125 mm
 - Resolution: 0.01% FSO (digit output)
 - Linearity: $\pm 0.05\%$ FSO
- **Acceleration sensor:**
 - Measuring range: ± 30 g
 - Accuracy: 1 mg
 - Resolution: 1 μ g
 - Response frequency: ≥ 300 Hz
- **Distance sensor:**
 - Resolution: 2048 pulse/round
 - IP Code: IP50
 - Distance accuracy: $< 0.1\%$
- **DAQ system:**
 - DAQ card: NI-USB 6210
 - Data transfer mode: USB
- **Ambient condition:**
 - Operating temperature: $-5^{\circ}\text{C} \sim 40^{\circ}\text{C}$
 - Storage temperature: $-10^{\circ}\text{C} \sim 65^{\circ}\text{C}$
 - Relative humidity: $\leq 85\%$





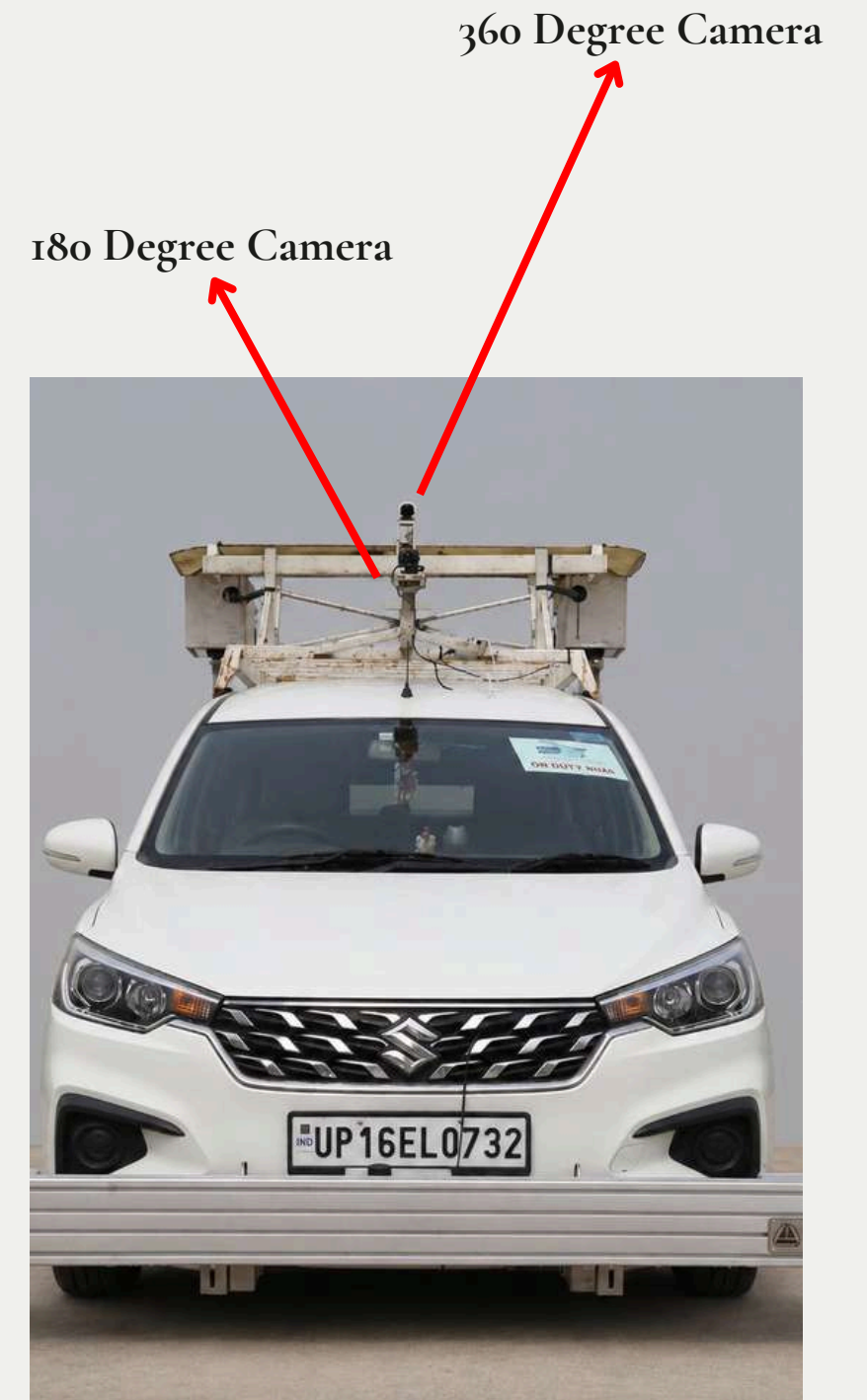
Road Inventory Data Acquisition





Road Inventory Data Acquisition

- The innovative use of front and middle cameras for the intricate video imaging of roadside furniture and road assets epitomizes a strategic blend of technology and infrastructure management. The embedded GPS functionality ensures that each piece of captured video is accurately geo-tagged, providing precise locational data that is indispensable for spatial analysis, asset management, and future planning initiatives.
- In addition to providing spatial coordinates, the system embeds a date-time stamp, road track, and elevation data into the imagery, ensuring a comprehensive data set for each recorded video frame. This robust amalgamation of visual and locational data facilitates a nuanced understanding of the road conditions, surrounding environment, and asset health, presenting an invaluable resource for traffic management, road maintenance, and infrastructural development. Thus, the technology acts not only as a tool for documentation but also as a crucial asset in enhancing and streamlining road network management and development.

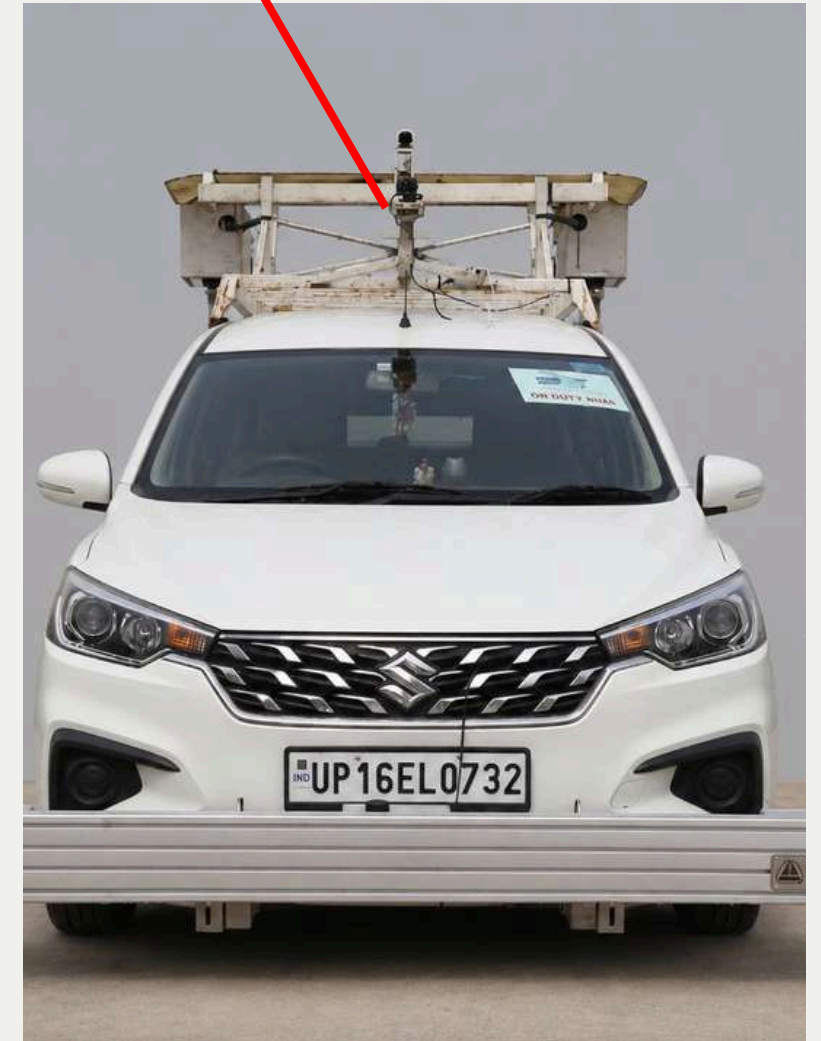




Road Inventory Data Acquisition

- Our GPS-enabled 180 and 360-degree cameras, meticulously designed for Network Survey Vehicles. Navigate, capture, and analyze every detail with precise geolocation, ensuring comprehensive data collection and accurate, efficient road mapping for smarter infrastructural development.
- The incorporation of a 180-degree camera in a Network Survey Vehicle (NSV) can bring numerous advantages by providing a comprehensive view of the roadways, surrounding infrastructure. A 180-degree camera enables wide-field monitoring by capturing a hemispherical view around its installation point.
- 360-degree camera capture every angle around them, providing comprehensive imagery of road conditions, assets, and surroundings.

180 Degree Camera





Road Inventory Data Acquisition

GPS-enabled digital camera, with its intricate video imaging and accurate data-embedding capabilities, epitomizes an exemplary integration of technology and infrastructure management, presenting a pivotal asset in modern road network management and development.

Innovative Imaging:

1. Utilizes front camera with 180-degree and a central camera with 360-degree video capturing.
2. Enables intricate imaging of roadside furniture and other road assets.

Precise Geo-Tagging:

1. Embeds GPS functionality to assure each video frame is accurately geo-tagged.
2. Facilitates precise location data essential for spatial analysis and asset management.

Comprehensive Data Embedding:

1. Ingrains a date-time stamp, road track into every piece of imagery.
2. Ensures robust and detailed data is available for each recorded frame.

360 Degree Camera





Pavement Condition Data Acquisition





Pavement Data Acquisition

Introducing our state-of-the-art 3D camera system, seamlessly integrated with Differential Global Positioning System (DGPS), engineered to elevate the standards of road surface evaluation. This avant-garde technology not only provides high-definition, high-speed image capturing capabilities but also ensures uninterrupted full-time inspection, courtesy of its proficient infrared laser. The Pavement Condition Analysis module enables to produce output and report such as DGPS-based Pavement Images Feed, Rutting (RUT), Cross Slope, Crack Detection and Depth, Potholes, and Sensor Measured Texture Depth, International Roughness Index (IRI) amalgamating them into a singular, coherent dataset. This integration enables an astute, automated, and comprehensive analysis of pavement conditions, propelling infrastructural maintenance into a new era of precision and efficiency.





Pavement Data Acquisition

In the realm of pavement management and road safety, precise data collection and analysis across various parameters are crucial. This enables an efficient maintenance schedule, safeguards road users, and ensures compliance with industry standards, such as AASHTO.

- Transverse Profile: Assess the cross-sectional shape of the road's surface.
- Rut Depth: Accurately measure and analyze rutting.
- Crack Metrics: Quantify and categorize pavement cracking.
- Sealed Crack Assessment: Examine the state and durability of sealed cracks.
- Ravelling Analysis: Identify and measure the degree of surface aggregate loss.
- Patch Condition: Inspect and evaluate pavement patch areas.
- Pothole Examination: Record characteristics and locations of potholes.
- Edge Break Investigation: Analyze degradation along pavement edges.
- Concrete Condition: Assess the integrity and stability of concrete sections.





Pavement Data Acquisition

- Road Geometry: Measure road features like slope and curvature.
- Texture: Investigate pavement texture for both macro and micro scales.
- Lane Marking: Validate clarity and adherence of road markings.
- Depth Evaluation: Ensure defect depth measurements are accurate.
- Macro Texture: A crucial aspect of road safety, is commonly assessed using Mean Profile Depth (MPD) and Mean Texture Depth (MTD), ensuring surfaces across the 5 AASHTO bands provide adequate skid resistance. Rigorously evaluating these parameters ensures optimized frictional properties, subsequently enhancing vehicular control and minimizing hydroplaning risks across varying pavement conditions
- Geometry: Conduct detailed geometric assessments of road profiles.
- Roughness: Measure and categorize lane roughness.
- Rutting Analysis: Document rut dimensions.

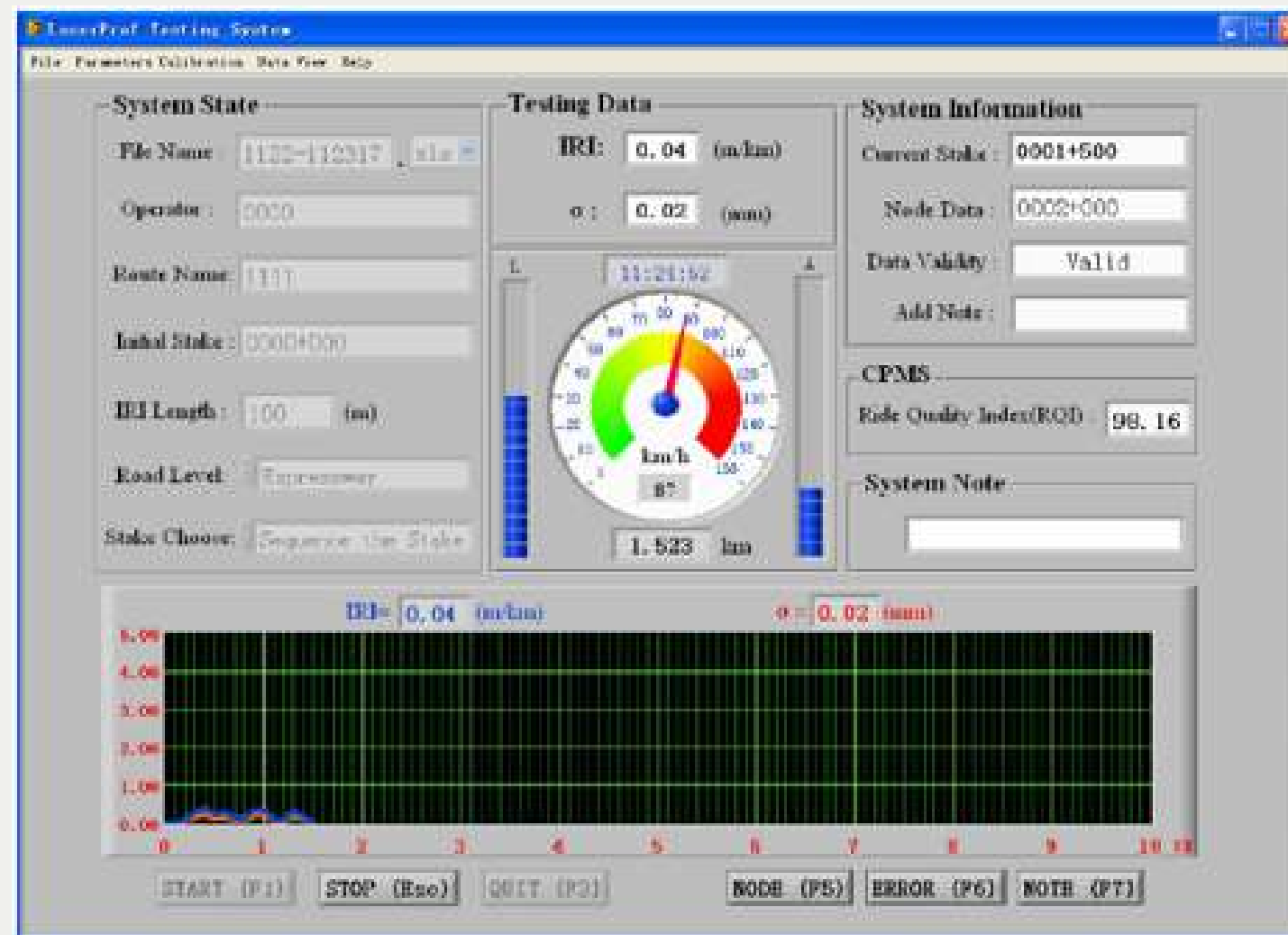




Pavement Data Acquisition

The LPS-P Laser Profiler stands out as a technologically advanced tool designed meticulously for assessing and managing road and construction site surface conditions. Encompassing an array of applications, this tool ensures thorough and precise measurement, from highway roughness to construction site control, aligning not only with global standards but also enhancing the overall quality and safety of the infrastructural developments.

CiMMS IRI Collector and Analyzer



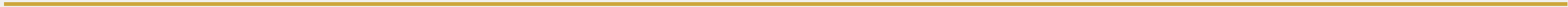


Pavement Data Acquisition

Key Points:

- **Multifaceted Applications:** It serves varied applications including measuring highway roughness, validating road surface roughness through acceptance measurements.
- **Precision and Speed:** It gives better measurement precision and speed in data gathering and analysis.
- **Real-time Data Processing:** Equipped with superior real-time data processing and output capabilities, ensuring timely and accurate data availability.
- **Comprehensive Metrics Display:** Offers real-time display of vital metrics such as the International Roughness Index (IRI), standard deviation and Riding Quality Index (RQI) providing a granular insight into road surface conditions.
- **User-Friendly:** User-centric design facilitates easy operation and interpretation of results, making it an indispensable tool for professionals in road construction and maintenance.





Data Processing System





Data Uploader

CiMMS File Uploader

The CiMMS File Uploader facilitates the uploading of Inventory and Pavement data collected from survey sites. It operates efficiently even in low Internet connectivity by continuously uploading data in small segments. If Internet connection is lost, it resumes uploading from where it left off once the connection is restored.

This system provides the advantage of allowing the Analysis team to receive data without waiting for the survey vehicle to return or for data to be delivered via portable HDD, thereby saving transportation time.





Data Uploader

CiMMS Inventory Collector

The CiMMS Inventory Collector facilitates the collection of Inventory using Artificial Intelligence. It automates object detection, marking, and interpretation processes. This ensures quick, accurate, and consistent recognition of diverse assets without the need for manual intervention.





CiMMS Integrator

The CiMMS Integrator acts like a bridge, bringing together data from various software tools such as FWD, IRI, RUT, SMTD, and MTD. It's designed to make it easier for analysts and engineers to work with data collected from these different sources. By integrating these outputs, it simplifies the process of understanding and using the information, ultimately helping teams make more informed decisions based on a comprehensive view of the data. This integration ensures smoother workflows and improves the accuracy of the insights gained from the combined data sets.

The screenshot displays the CiMMS Integrator web interface with three tabs: 'Fit To CSV', 'Configuration', and 'Data for Inventory'. The 'Fit To CSV' tab is active, showing several functional areas:

- Import Raw File into CSV:** Contains buttons for 'Import FWD File to CSV', 'Import Laser Profile File to CSV', and 'Import RUT Profiler Data'.
- Add GPS Data:** Includes a 'Browse Folder' button, a text input field, and a 'Join' button.
- Transfer CSV into Database:** Features a text input field with a 'Browse File' button, and buttons for 'Transfer FWD CSV to Database', 'Transfer Laser Profile CSV to Database', and 'Transfer RUT CSV to Database'.
- Entry Type:** Includes a checkbox for 'NHA Format'.
- Sync Data:** Contains a button labeled 'Sync FWD, RUT, LPS and Inventory Data'.
- Merge Inv GPS:** A button at the bottom right.





Road Inventory Analysis Module

System captures Roadside Assets along with Time, GPS Information, Inventory Type and Name automatically.

CIMMS

Fit To CSV | Configuration | Data for Inventory

Save Type: CSV
Save Save As

Latitude
Longitude
Speed - 0 Buffer 0

DATE: 3/2/2020 N26° 37' 51.5" E93° 43' 38.2" TIME: 1:41:55 PM

Time: 13:41:55 Side: [icon] Inventory Type: 1-Road Side Utilities Name: 1-Electric Pole Count: 1 Add + Measure Frame No. 19

	SN	Time	Latitude	Longitude	Distance	Type	Name	Count	Side	Length	Width	Height	FRNO	ID
▶	1	13:45:05	26.63038	93.72755	0	Waysi...	Bus Stand	1	1				1912	
	2	13:43:24	26.63087	93.72723	0	At Gra...	Village ...	1	1	0	0	0	901	
	3	13:43:24	26.63087	93.72723	0	Land U...	Commer...	1	1	0	0	0	901	
	4	13:43:24	26.63087	93.72723	0	Pavem...	Bitumin...	1	1	0	0	0	901	

	SN	Time	Latitude	Longitude	Distance	Type	Name	Count	Side	Length	Width	Height	FRNO	ID
▶	1	13:45:05	26.63038	93.72755	0	Waysi...	Bus Stand	1	1				1912	
	2	13:43:24	26.63087	93.72723	0	At Gra...	Village ...	1	1	0	0	0	901	
	3	13:43:24	26.63087	93.72723	0	Land U...	Commer...	1	1	0	0	0	901	
	4	13:43:24	26.63087	93.72723	0	Pavem...	Bitumin...	1	1	0	0	0	901	





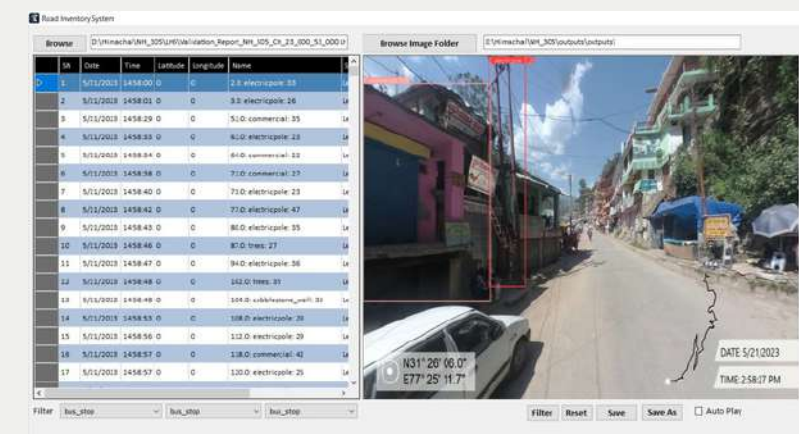
Road Inventory Analysis Module

Advanced System: A state-of-the-art system pivotal in the digital transformation of infrastructure. It not only identifies but also categorizes road-side assets with a high degree of precision, providing a comprehensive view of urban and suburban landscapes.

AI-powered Video Processing: Harnessing cutting-edge AI technology, the CiMMS Inventory Collector automates object detection, marking, and interpretation processes. This ensures quick, accurate, and consistent recognition of diverse assets without the need for manual intervention, even in complex environments. This capability streamlines data collection and enhances efficiency across various scenarios.

Data Collection: Concurrently capturing vital parameters such as the exact time of detection and accurate GPS coordinates. This feature guarantees that each asset is geo-tagged with pinpoint precision, facilitating better mapping and spatial analysis.

Integration: Embodies a harmonious fusion of the latest artificial intelligence algorithms with advanced geographic information systems. This integration not only augments the reliability of the captured data but also ensures that the repository is easily navigable, interactive, and primed for future technological advancements.





Road Inventory Analysis Module

List of Inventory Types and Sub Types

- Road Side Utilities
 - Electric Pole
 - Telegraphic Pole
 - HT Line
 - HT Tower
 - Well
 - Hand Pump
 - Gas-Pipeline
 - Water Pipeline
 - Other Cables
 - LT Line
 - High Mast Light
 - CCTV Poll
- Land Use
 - Residential
 - Agricultural
 - Commercial
 - Forest
 - Barren
 - Religious Place
 - Institutional Bodies
 - Government Office
- Trees
 - Trees
 - Bushes
 - Shrubs
 - Other Plantations
- Wayside Amenities
 - Bus Stand
 - Lay Bys
 - Rest Area
 - Petrol Pump
 - Hotel
 - Motel
 - Restaurant
 - Vehicle Service Point
- At Grade Junctions or Grade separated Junctions or Intersections
 - Right angle Junctions
 - Oblique Junctions
 - T-Junctions
 - Y-Junctions
 - RA-Junctions
 - Flyover
 - VUP(vehicular under pass)
 - PUP
 - Cattle Pass
 - Single Trumpet
 - Double Trumpet
 - Clover Leaf
 - Hairpin Bend
 - Four Arm Junction
 - Village Road
 -





Road Inventory Analysis Module

List of Inventory Types and Sub Types

- R6-CD Works (Culverts or Bridge or Barrage or Canal Crossing)
 - HP Culvert
 - Armco Culvert
 - Box Culvert
 - Slab Culvert
 - Minor Bridge-Single Span
 - Minor Bridge-Multi Span
 - Major Bridge- Multi Span
 - Major Bridge- Single Span
- Water Bodies
 - Pond
 - Lake
 - Canal
 - River
 - Streams
 - Tubewell
- Shoulder Condition
 - Shoulder Cuts
 - Shoulder Drop/
 - Broken Shoulders
 - Uneven Shoulders
- Pavement Type
 - Bituminous
 - Gravel
 - Earthen
 - Concrete
 - Divided Road
- Pavement Condition
 - Detailed Cracking
 - Raveling
 - Potholes
 - Rutting
 - Damaged
- Shoulder Type
 - Paved
 - Unpaved
- Signages
 - OH Gantry Sign Board
 - Road Side Sign Board
 - Road Side Notice Board
 - Milestone
- Slope
 - Left Hill Side
 - Left Vally Side
 - Right Hill side
 - Right Vally Side
 - Incline
 - Decline
 - Left Vally Side with Retaining Wall
 - Left Hill Side with Brest Wall
 - Right Vally Side with Retaining Wall
 - Right Hill Side with Brest Wall
- Toll Gate
 - Toll Gate





Road Inventory Analysis Module

System captures various Types of Inventory

CIMMS

Fit To CSV | Configuration | Data for Inventory



DATE: 3/2/2020

N26° 37' 40.2"
E93° 43' 43.5"

TIME: 1:45:48 PM

Time: 13:45:41 | Side: 1 | Inventory Type: 1-Road Side Utilities | Name: 1-Electric Pole | Count: 1 | Add + Measure | Frame No. 2343

	SN	Inventory Type	Latitude	Distance	Type	Name	Count	Side	Length	Width	Height
1	1	1-Road Side Utilities	2755	0	Wayside	Bus Stand	1	1			
2	2	2-Land Use	2727	0	Land U...	Agricult...	1	3	0	0	0
3	3	3-Trees	2723	0	At Gra...	Village ...	1	1	0	0	0
4	4	4-Wayside Amenities	2723	0	Land U...	Commer...	1	1	0	0	0

Inventory Type dropdown menu:

- 1-Road Side Utilities
- 2-Land Use
- 3-Trees
- 4-Wayside Amenities
- 5-At Grade Junctions or Grade
- 6-CD Works (Culverts or Bridge
- 7-Water Bodies
- 8-Shoulder Type
- 9-Shoulder Condition
- 10-Pavement Type
- 11-Pavement Condition
- 12-Terrain
- 13-Signages
- 14-Slope
- 15-Toll Gate



Road Inventory Analysis Module

Saving inventories under define hierarchy.

Configuration

Data for Inventory



DATE: 3/2/2020

N26° 37' 40.2"
E93° 43' 43.5"

TIME: 1:45:48 PM

Save Type: CSV

Save

Save As

Latitude: 26°37'40"N

Longitude: 93°43'44"E

Speed: 9

Buffer: 0

Side: 1

Inventory Type: 1-Road Side Utilities

Name: 1-Electric Pole

Count: 1

Add + Measure

Frame No. 2343

N	Time	Latitude	Longitude	Name	Count	Side	Length	Width	Height	Frame No.	ID
570	15:26:34	26.63061	93.72718	2-Telegraphic Pole	1	2	0	0	0	62902	
571	15:26:44	26.63111	93.72662	3-HT Line	1	2	0	0	0	62903	
572	15:26:50	26.63112	93.72624	4-HT Tower	1	2	0	0	0	62903	
574	15:45:48	26.62787	93.72879	5-Well	1	1	0	0	6	2343	





Road Inventory Analysis Module

Marking of an inventory and measurement.

Configuration

Data for Inventory

Add Inventory

FR.No.

2343

Inventory Type

1-Road Side Utilities

Name

1-Electric Pole

Side

1

Count

Remarks

	SN	FRNO	Ownership
▶	1	2343	0

\$Filename2343.jpg (75%)

1620x1080 pixels, RGB, 7.9MB



DATE: 3/2/2020

N26° 37' 40.2"

E93° 43' 43.5"

TIME: 1:45:48 PM

0

Road S...

Electric

1

1

0

0

6

2343

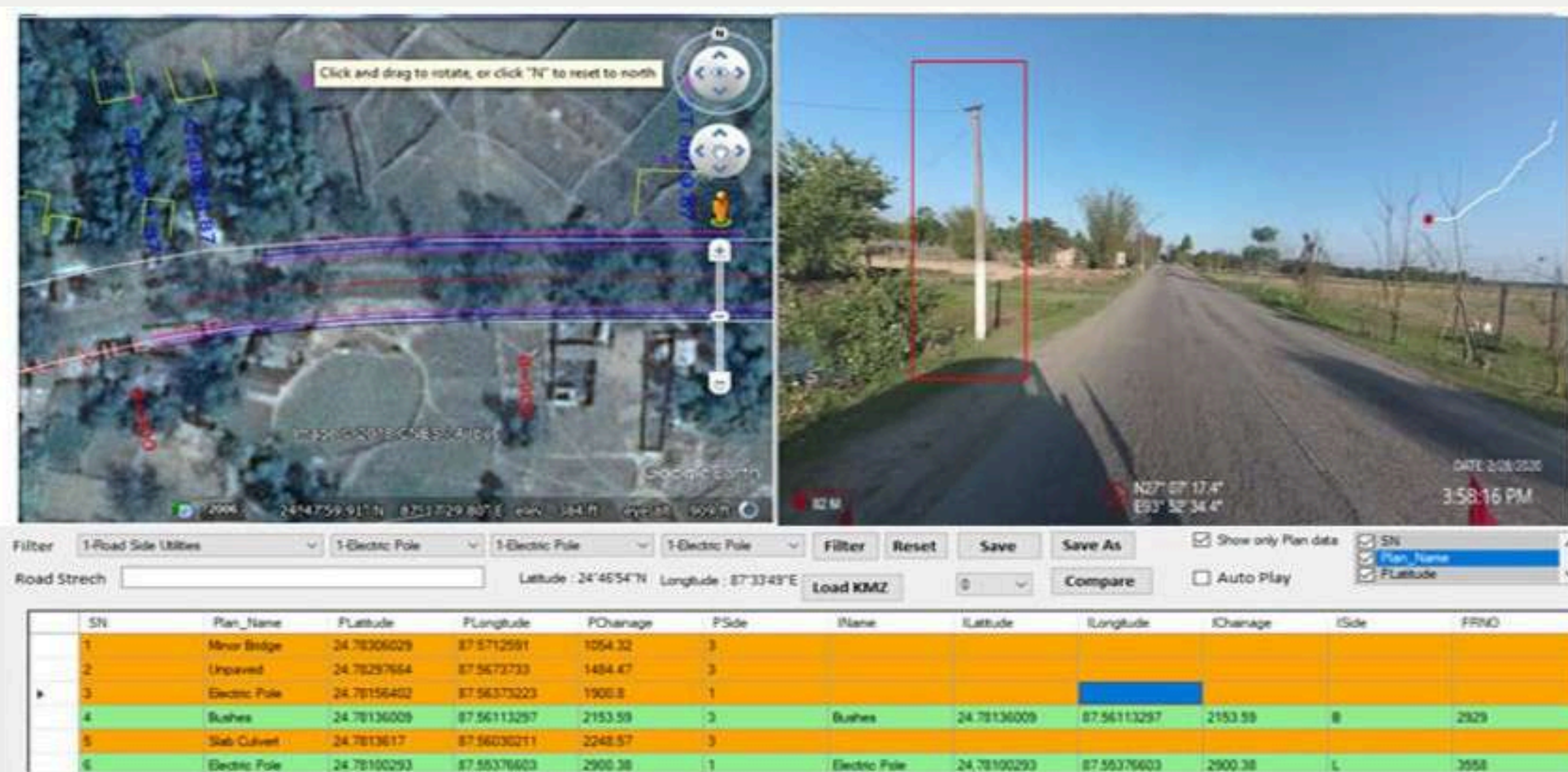




Road Inventory Analysis Module

As Built Audit

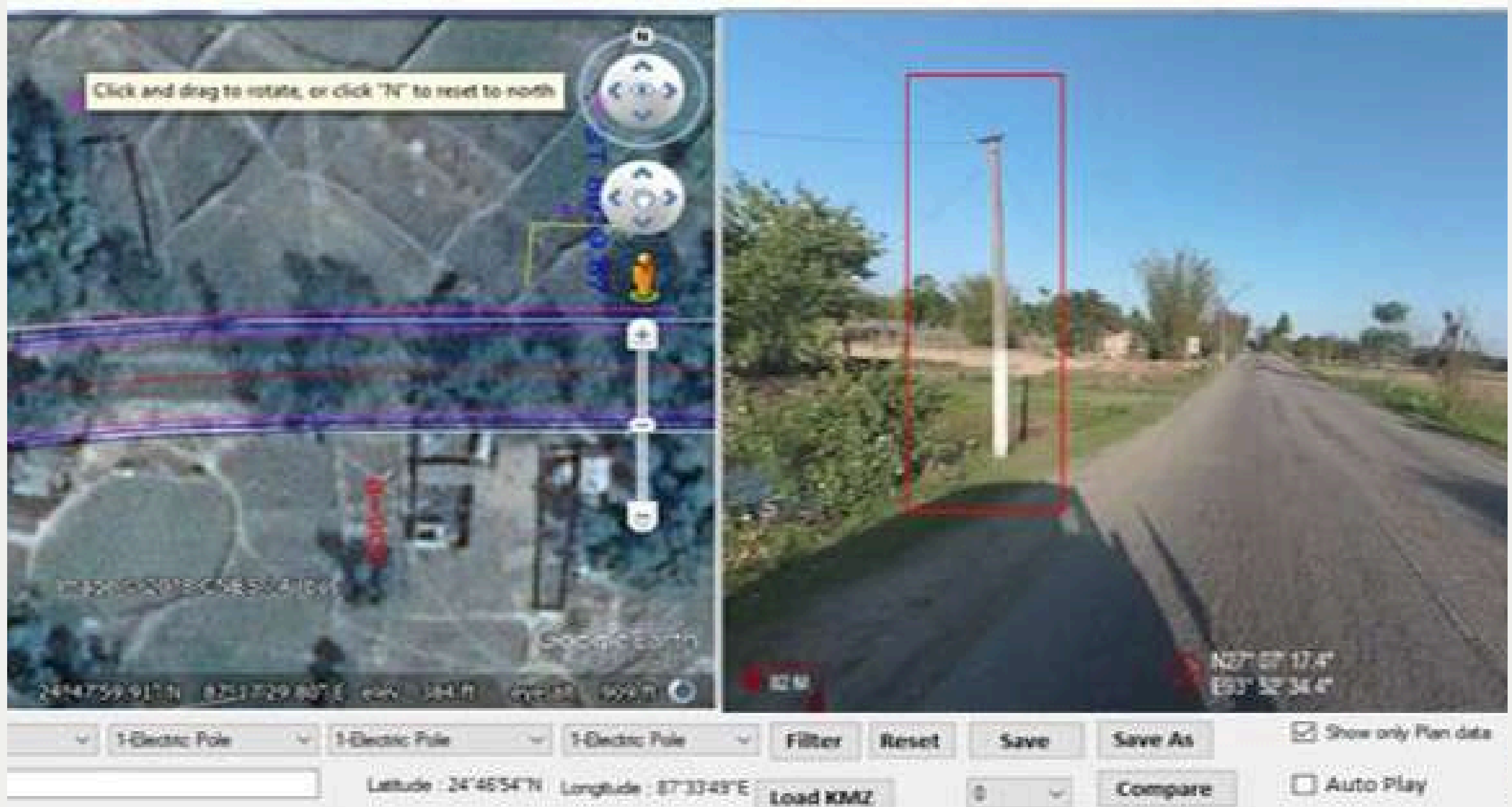
In the image, on Right Panel the image Road Inventory is shown, on left panel Plan Profile is showing the position of the inventory. In Grid Green Coloured Row showing matched data and in Orange color displaying unmatched data with Plan Profile Above the bottom grid, there are four dropdown of Filter options are available. The Auto Play check box enables you to go through every data one by one automatically.





Road Inventory Analysis Module

Detailed design drawing





Pavement Condition Analysis Module





Pavement Condition Analysis Module

This module takes input like DGPS based 3D Pavement Crack Data, Pavement Video Feed, RUT Profiler data includes Cross Slope, International Roughness Index, Sensor Measured Texture Depth, FWD output data synced and integrated these data automatically.





Pavement Condition Analysis Module

List of Types and Sub Types

Pavement Type

- Flexible
- Rigid

Pavement Condition

- Crack measurement
- Sealed Crack area
- Raveling
- Patch area
- Pothole
- Edge Break
- Concrete
- Road Geometry
- Texture
- Roughness
- Rutting
- Lane Marking
- Depth measurement
- Transverse Profile

Surface Type

- Bituminous
- Brick
- Concrete
- Cobblestone
- Asphalt

Crack Type

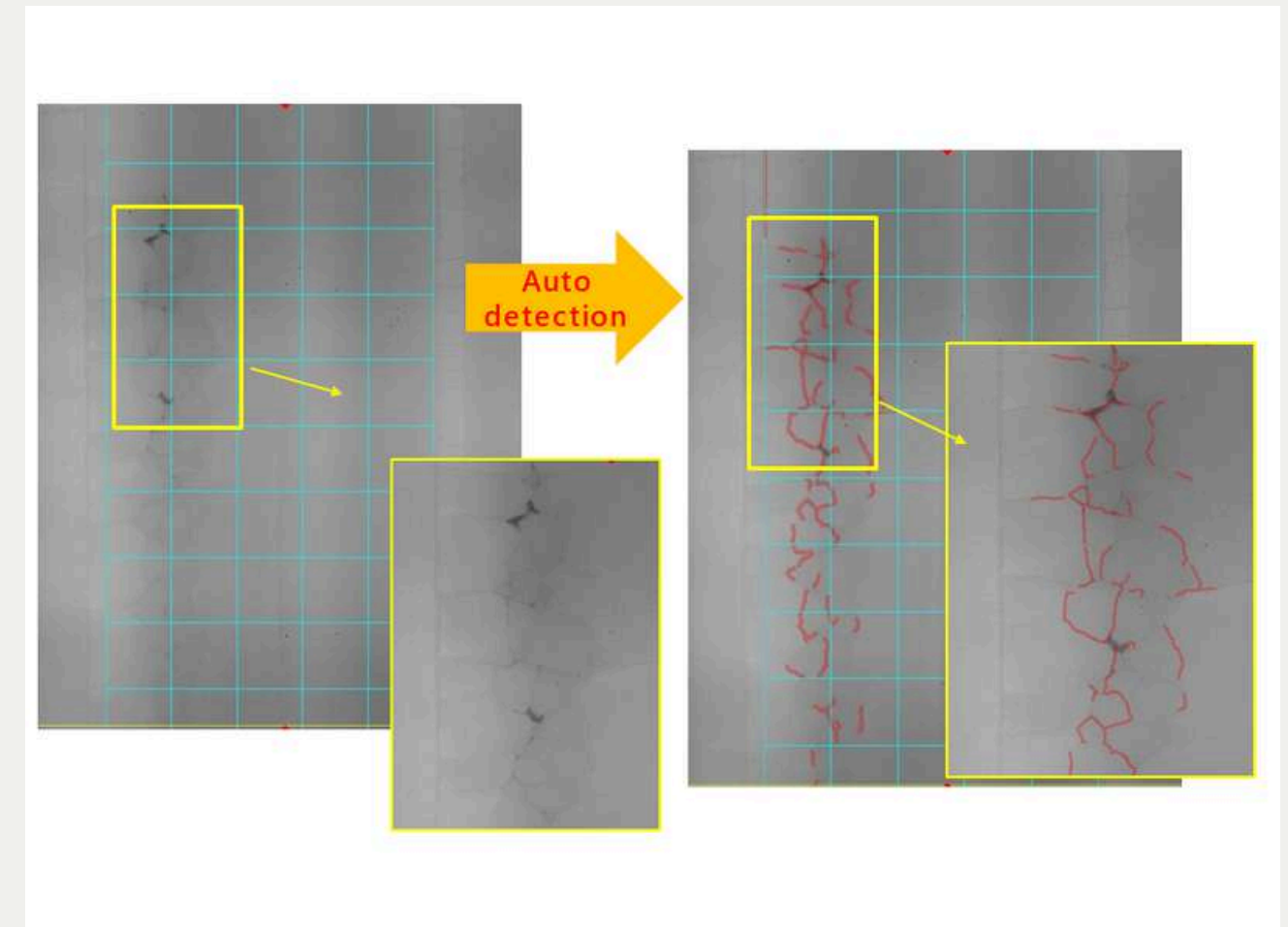
- Alligator
- Longitudinal
- Transverse





Pavement Condition Analysis Module

Automatic 3D crack detection and measurement represents a crucial advancement in ensuring structural integrity and safety across various fields such as civil engineering. Leveraging technologies like laser scanning, machine learning, and computer vision, this methodology enables precise detection, analysis, and measurement of cracks in three-dimensional space. Automated systems capture high-resolution images or scans of the material or structure, after which algorithms process this data to identify and delineate cracks. Subsequently, they analyze the length, width, and depth of the cracks, providing a comprehensive mapping that is crucial for understanding the severity and progression of structural damage. The intricate depth measurement, often achieved through techniques like 3D laser profiling or stereo vision, allows engineers to assess the criticality of a crack, paving the way for timely interventions and maintenance. This automated approach not only enhances accuracy and consistency in crack detection but also significantly reduces the risks and limitations associated with manual inspections.

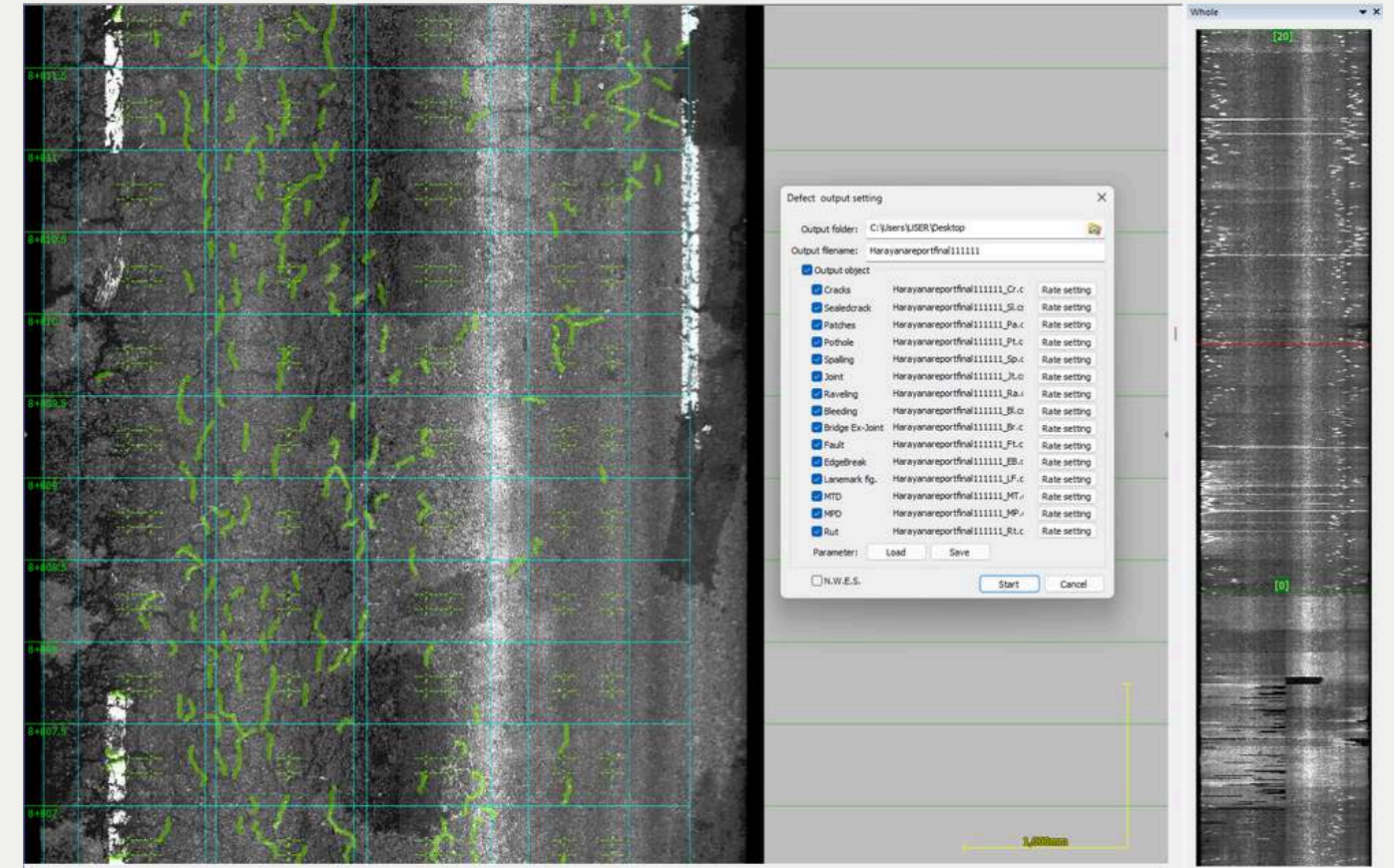




Pavement Condition Analysis Module

Our Analysis Software able to automatically detect and analyze following items:

- **Crack Measurement:** Ensuring a thorough evaluation of cracks, which includes detecting and measuring their length, width and depth, is essential for maintaining structural integrity.
- **Sealed Crack Area:** Assessing the sealed cracks ensures that the repair works have been done effectively and are holding up against wear and tear.
- **Raveling:** Identifying areas where the aggregate is loosening and separating from the binder can help prevent further surface disintegration.
- **Patch Area:** Monitoring patched areas for durability and effectiveness against the recurrence of damage.
- **Pothole:** Active detection of potholes and recording their dimensions and depths to prioritize repair schedules.
- **Edge Break:** Evaluating the edge of the road for breakdowns to prevent structural failures and maintain alignment.

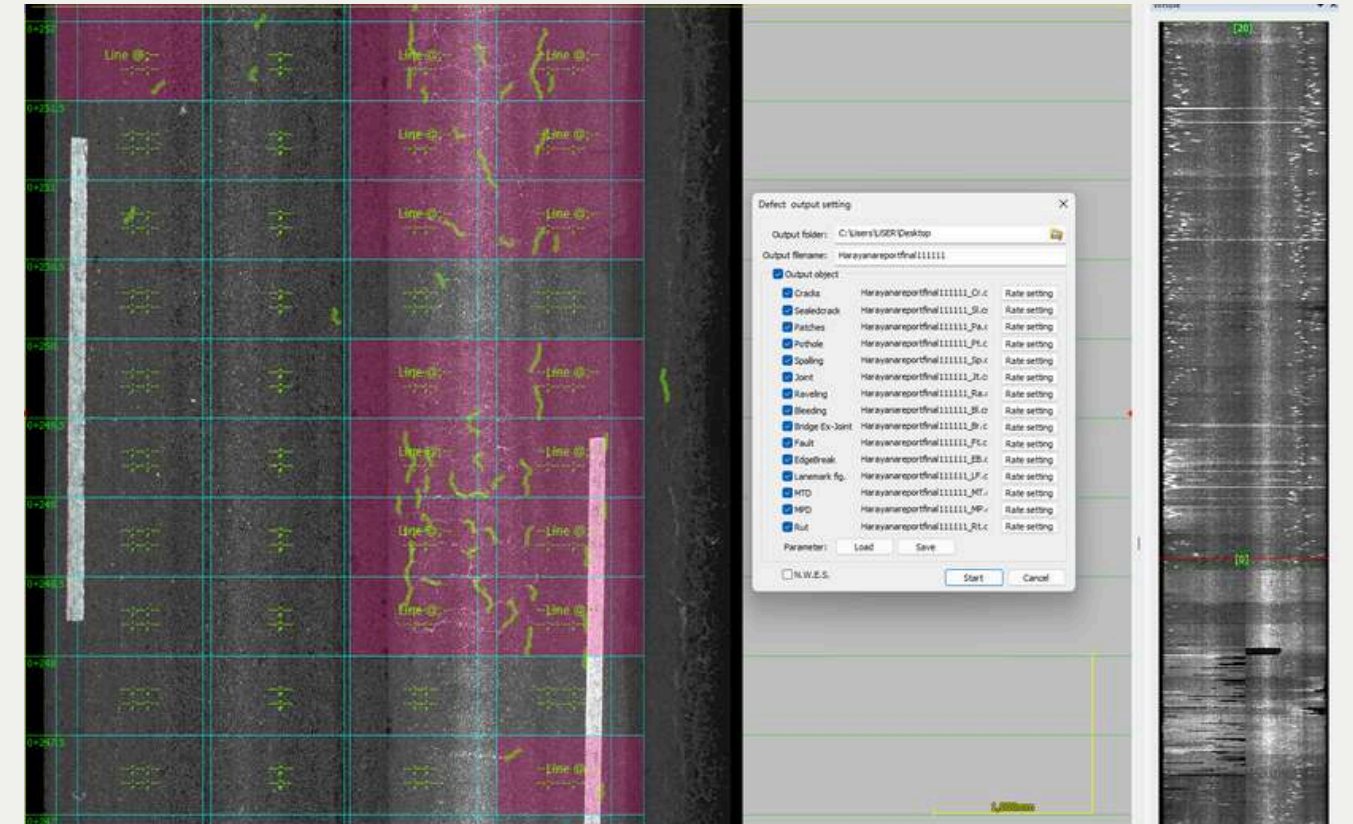




Pavement Condition Analysis Module

Our Analysis Software able to automatically detect and analyze following items:

- Concrete: Regular checkups for concrete consistency, cracks, and structural integrity to ensure robustness.
- Road Geometry: Keeping tabs on the road's curvature, slope, and alignment to safeguard against design flaws and ensure smooth vehicular flow.
- Texture: Analyzing the road's texture to guarantee skid-resistance and optimal friction between the tires and the surface.
- Roughness: Measurement of road roughness is vital for understanding its condition and for predicting the comfort and safety level of the vehicular motion.
- Rutting: Identifying and measuring wheel path depressions to mitigate risks of hydroplaning and maintain smooth vehicle travel.
- Lane Marking: Ensuring the visibility and accuracy of lane markings for effective vehicular guidance and to prevent on-road confusions.

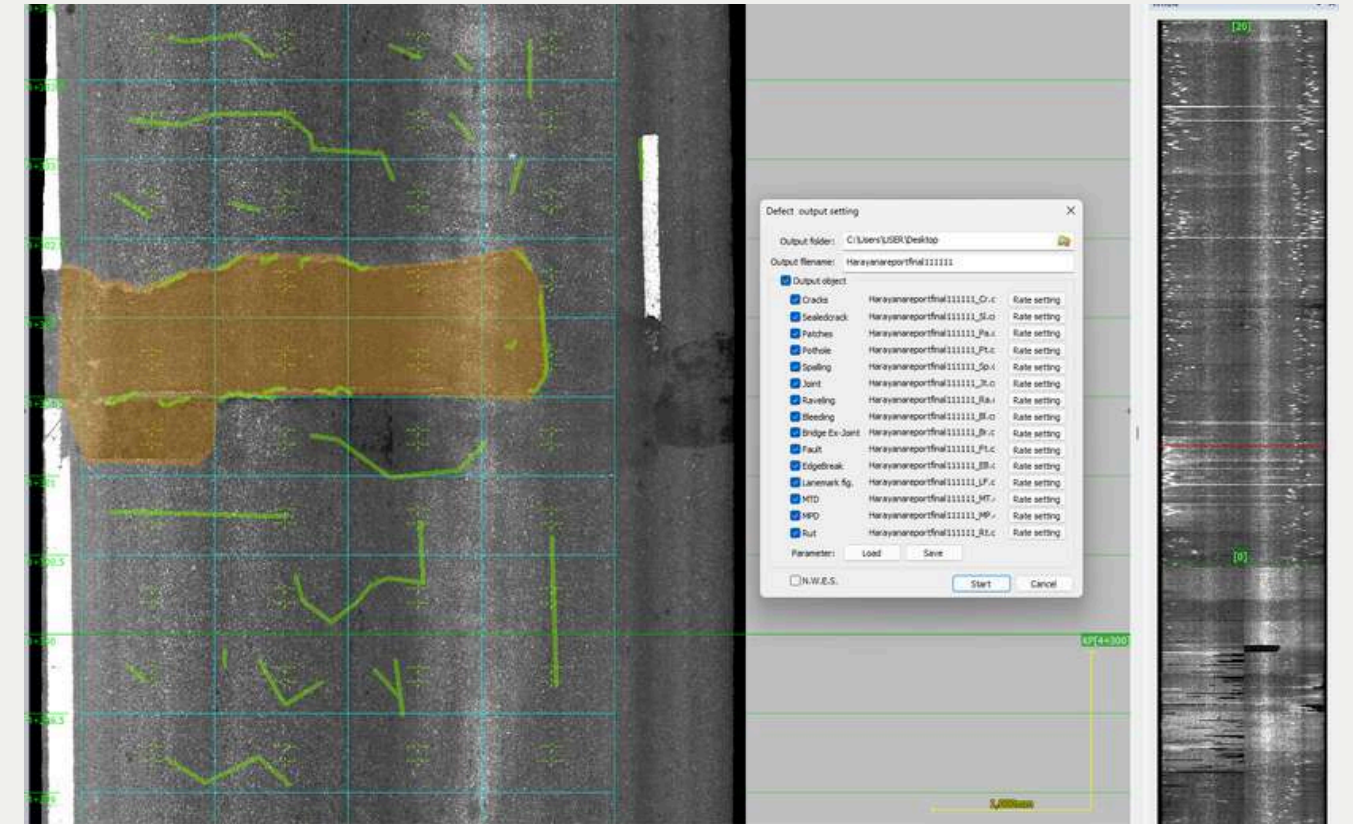




Pavement Condition Analysis Module

Our Analysis Software able to automatically detect and analyze following items:

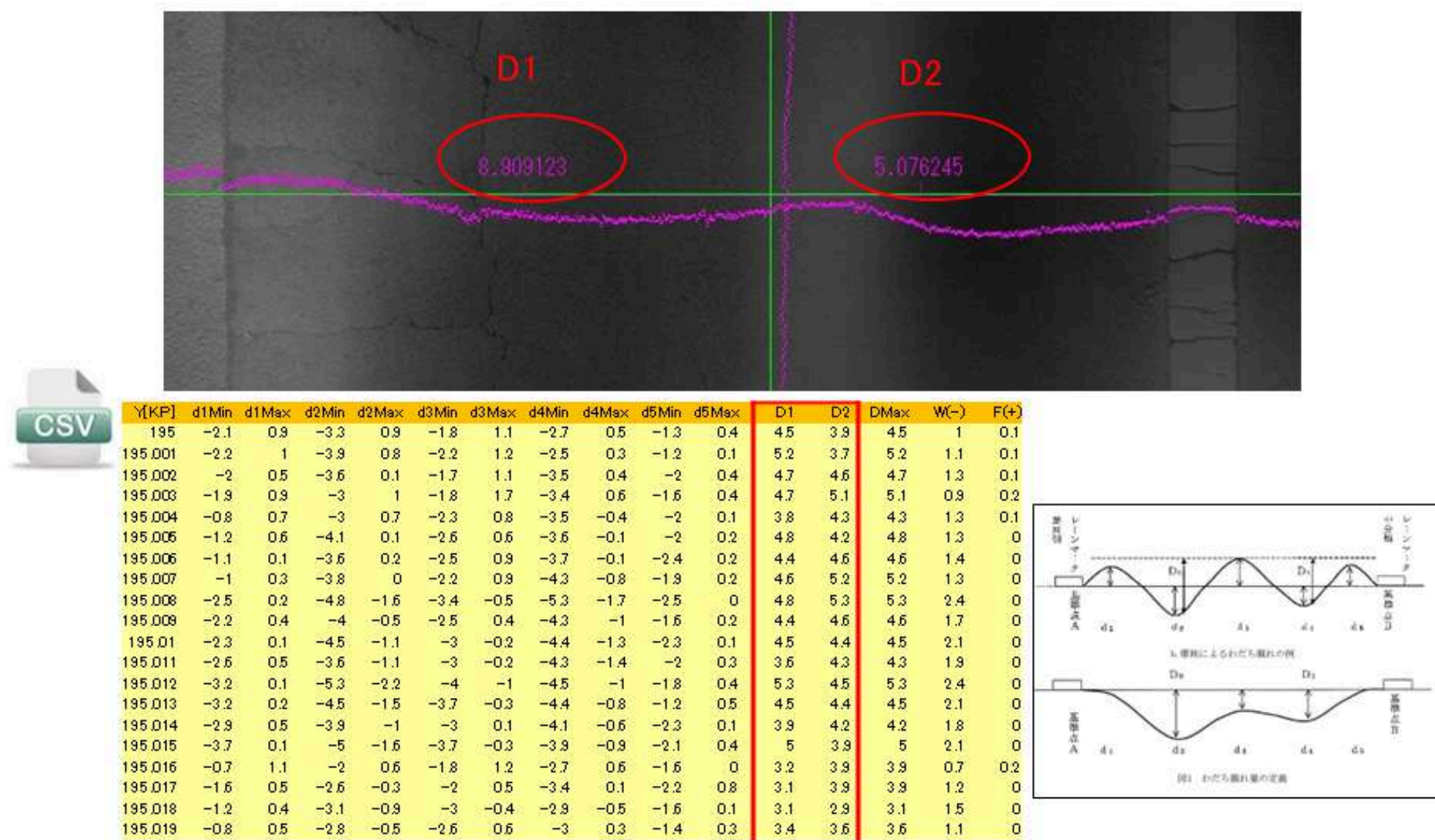
- Depth Measurement: Gauging the depth of damages or applications (like pavement layers) to ensure compliance with safety standards.
- Transverse Profile: Evaluating the cross-sectional profile of the road to identify any irregularities and ensure adequate water drainage.





Pavement Condition Analysis Module

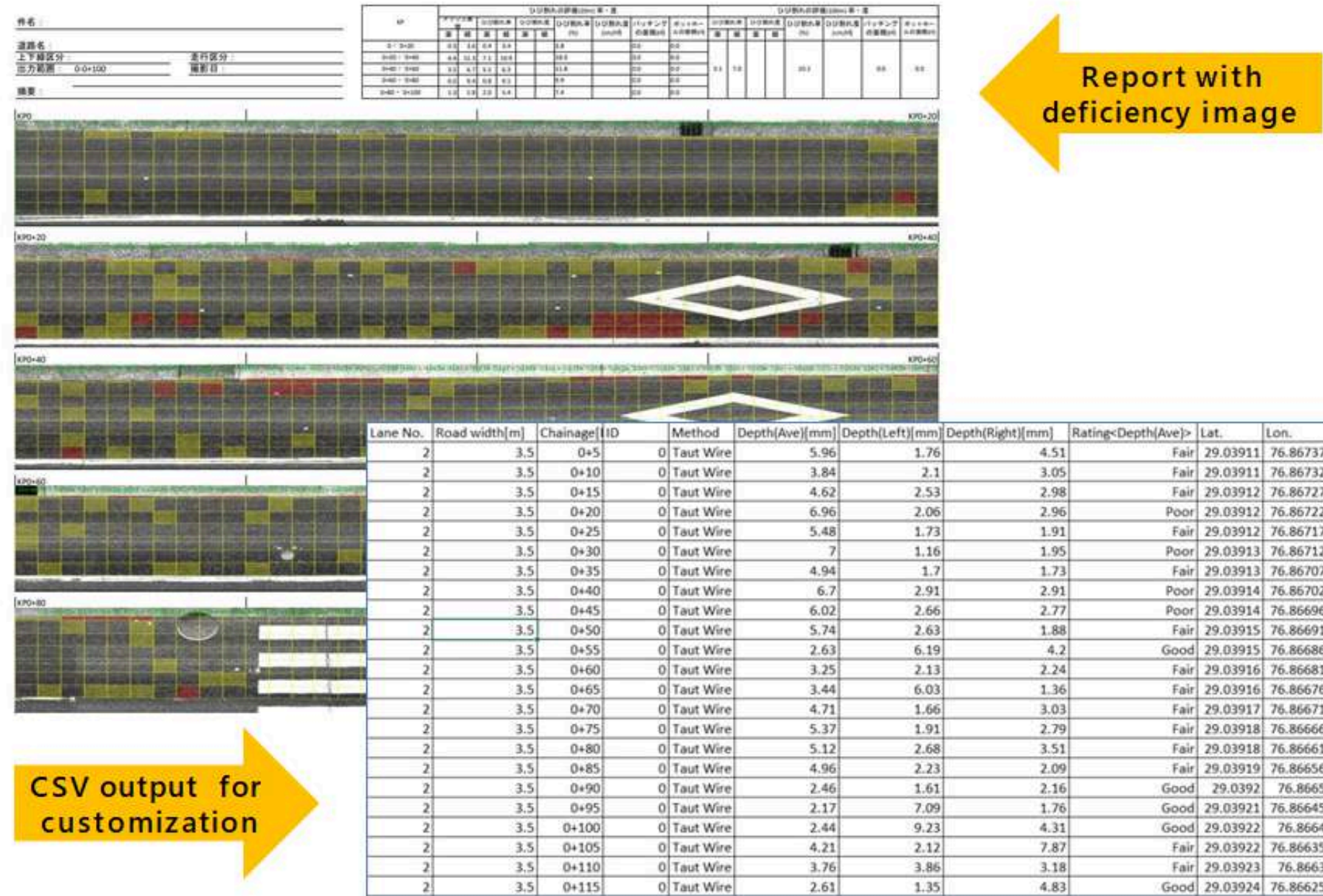
The system accurately captures rut data, systematically processing the left-side wheel path rut (designated D1) and the right-side wheel path rut (denoted D2).





Pavement Condition Analysis Module

System captures various Types of Pavement Details





Pavement Condition Analysis Module

System captures Pavement conditions Video along with Time, GPS Information, Type and Name.

CIMMS

Configuration | Data for Pavement

36 M

N26° 05' 15.0"
E91° 34' 59.3"

03/06/2020
10:17:54

Save Type: CSV

Save

Latitude

Longitude

Speed

Time: 12:17:55 | Slide: 1 | Inventory Type: 1-Pavement Type | Name: 1-Flexible | Count: 1

Add + Measure

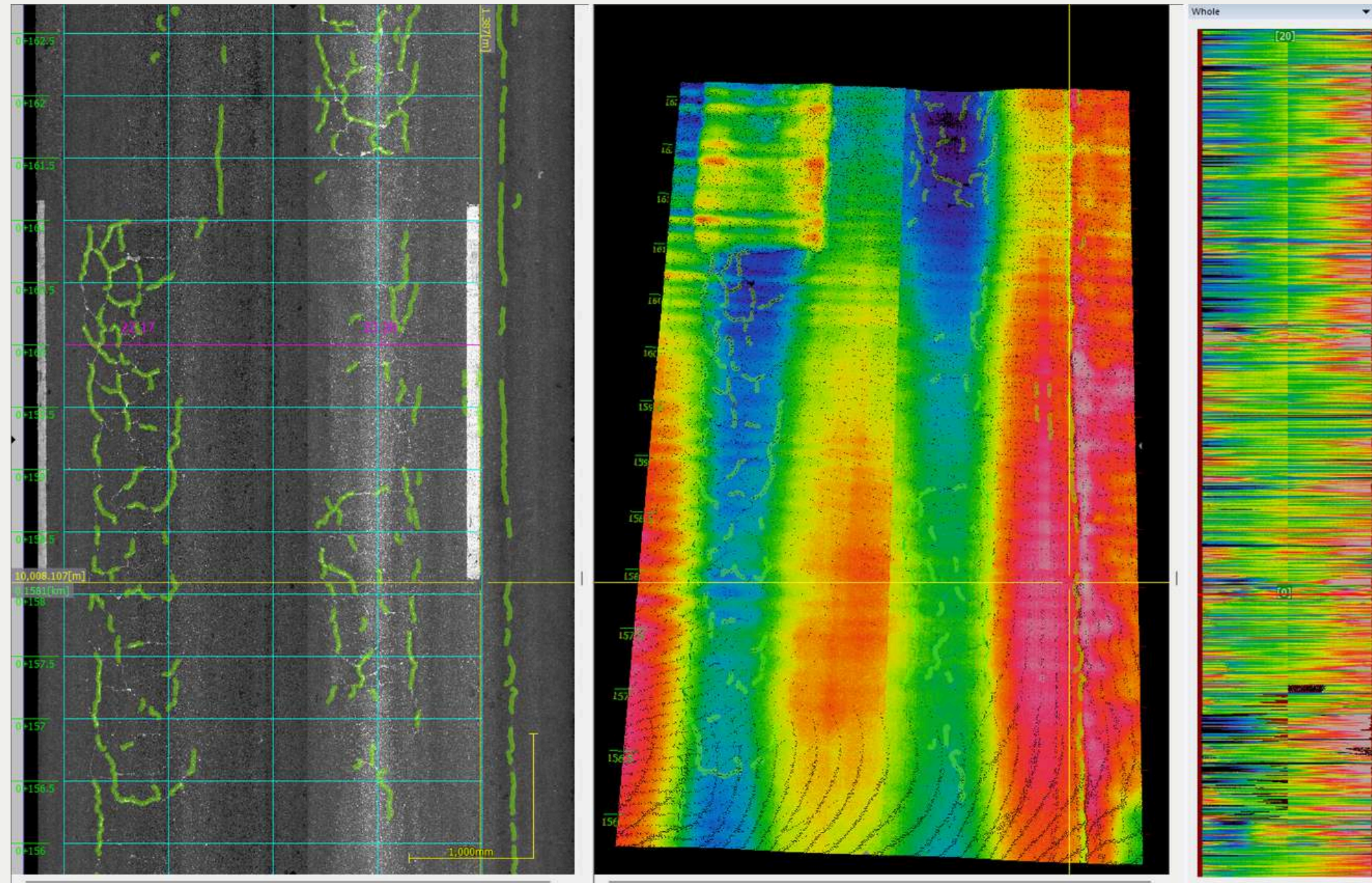
Frame No.: 3071

	SN	Time	Latitude	Longitude	Distance	Type	Name	Length	Width	Height	Area	FRNO	ID
D	1	14:28:51	27.91551	95.76641	0	Pavem...	Potholes	0	0	0	30724	37333	
	2	14:29:11	27.91717	95.76612	0	Pavem...	Potholes	0	0	0	105807	37337	
	3	11:23:56	27.6436	95.56013	0	Pavem...	Detail...	0	0	0	235379	495	
	4	11:23:58	27.64364	95.56014	0	Pavem...	Ravelling	0	0	0	227488	517	



Pavement Condition Analysis Module

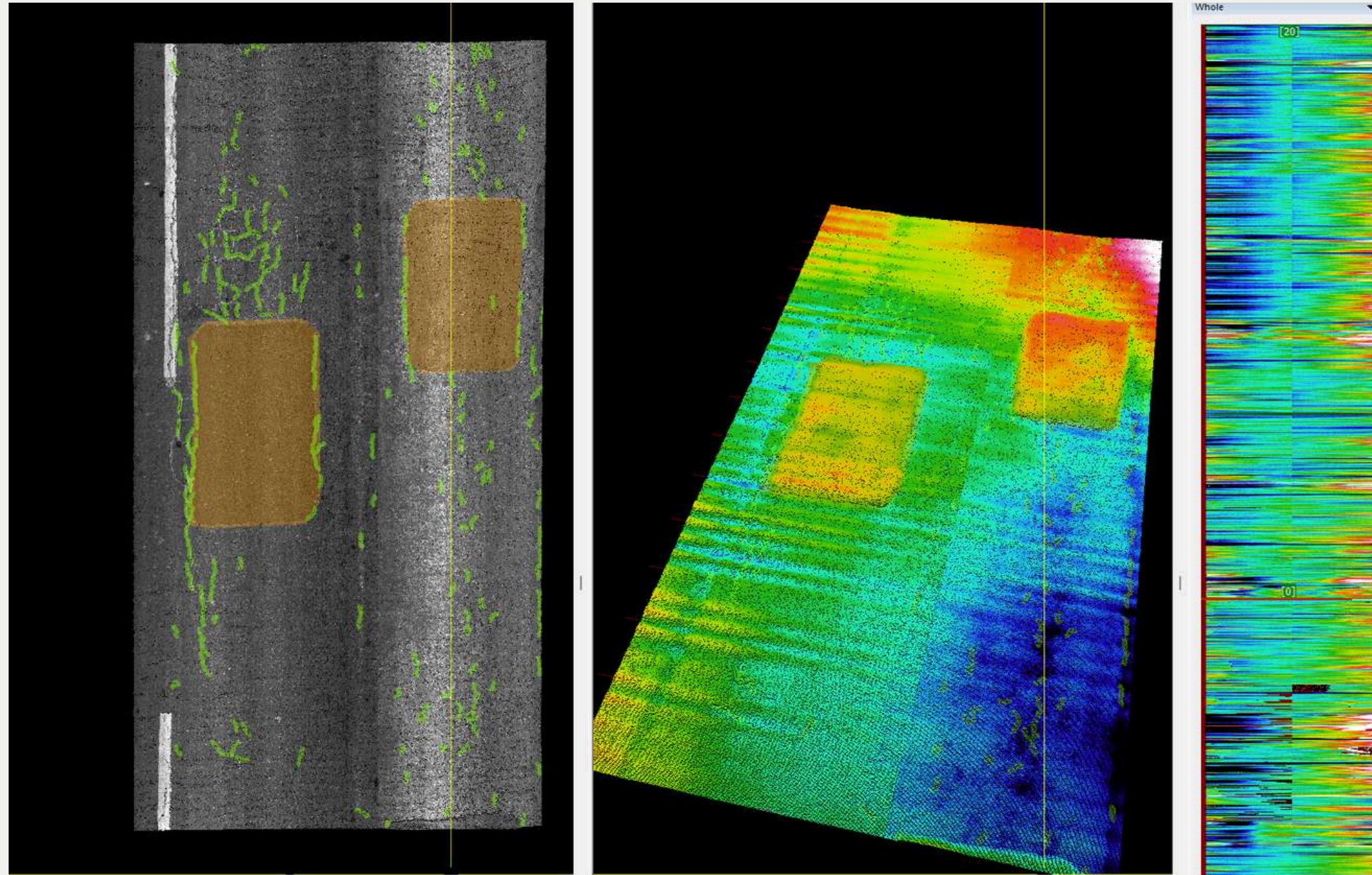
2D & 3D View of Crack





Pavement Condition Analysis Module

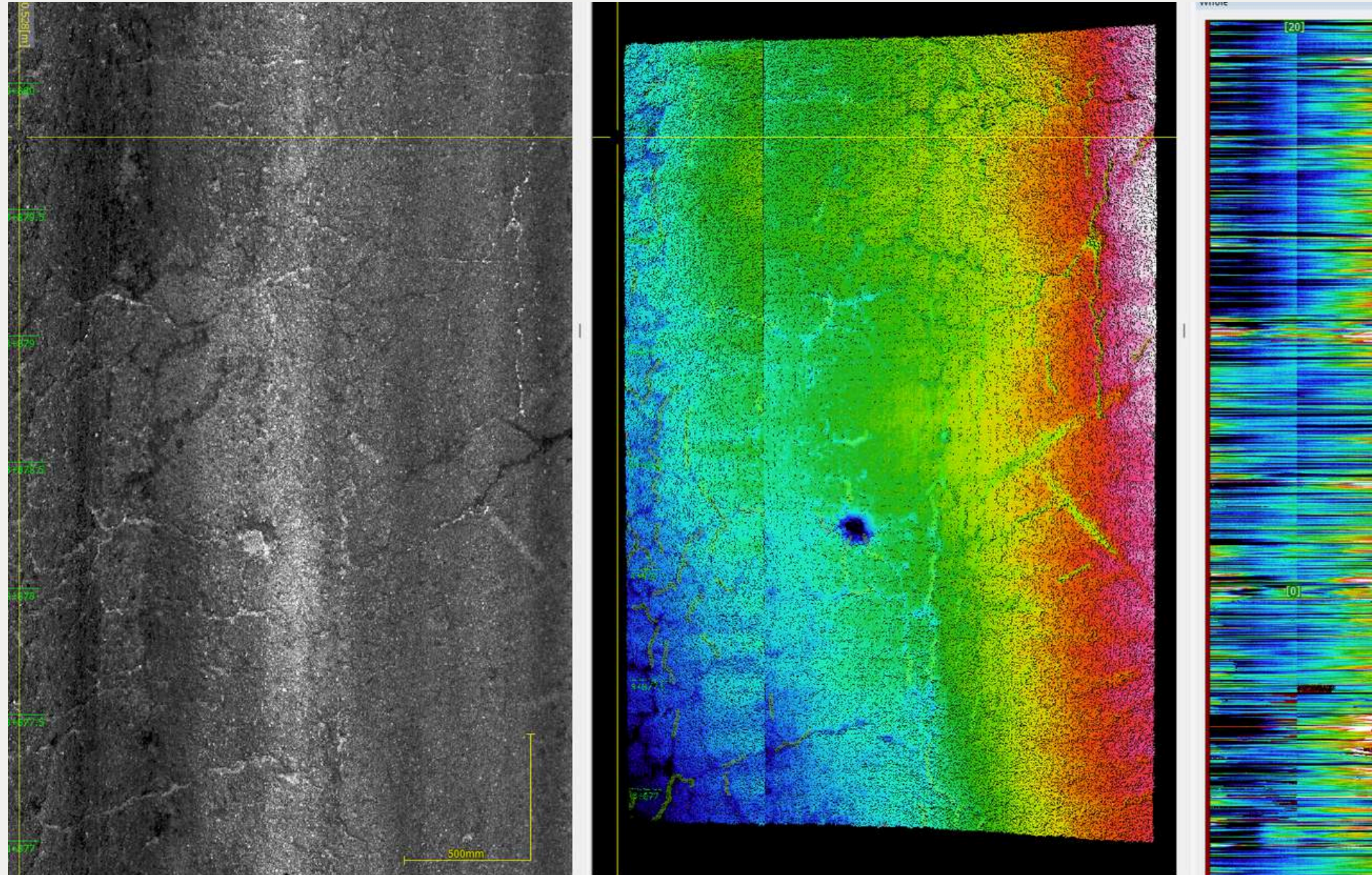
2D & 3D View of Crack





Pavement Condition Analysis Module

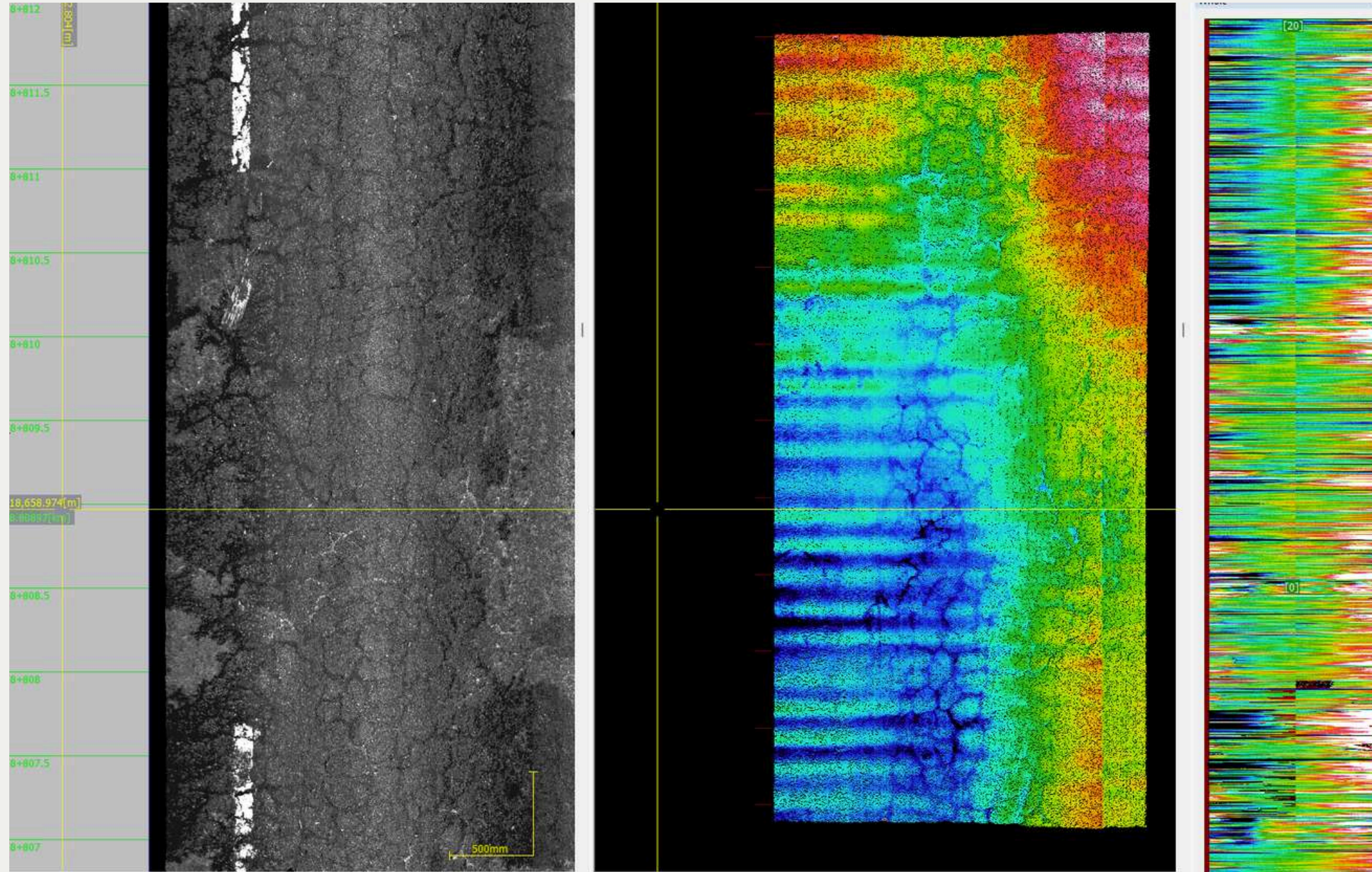
2D & 3D View of Crack





Pavement Condition Analysis Module

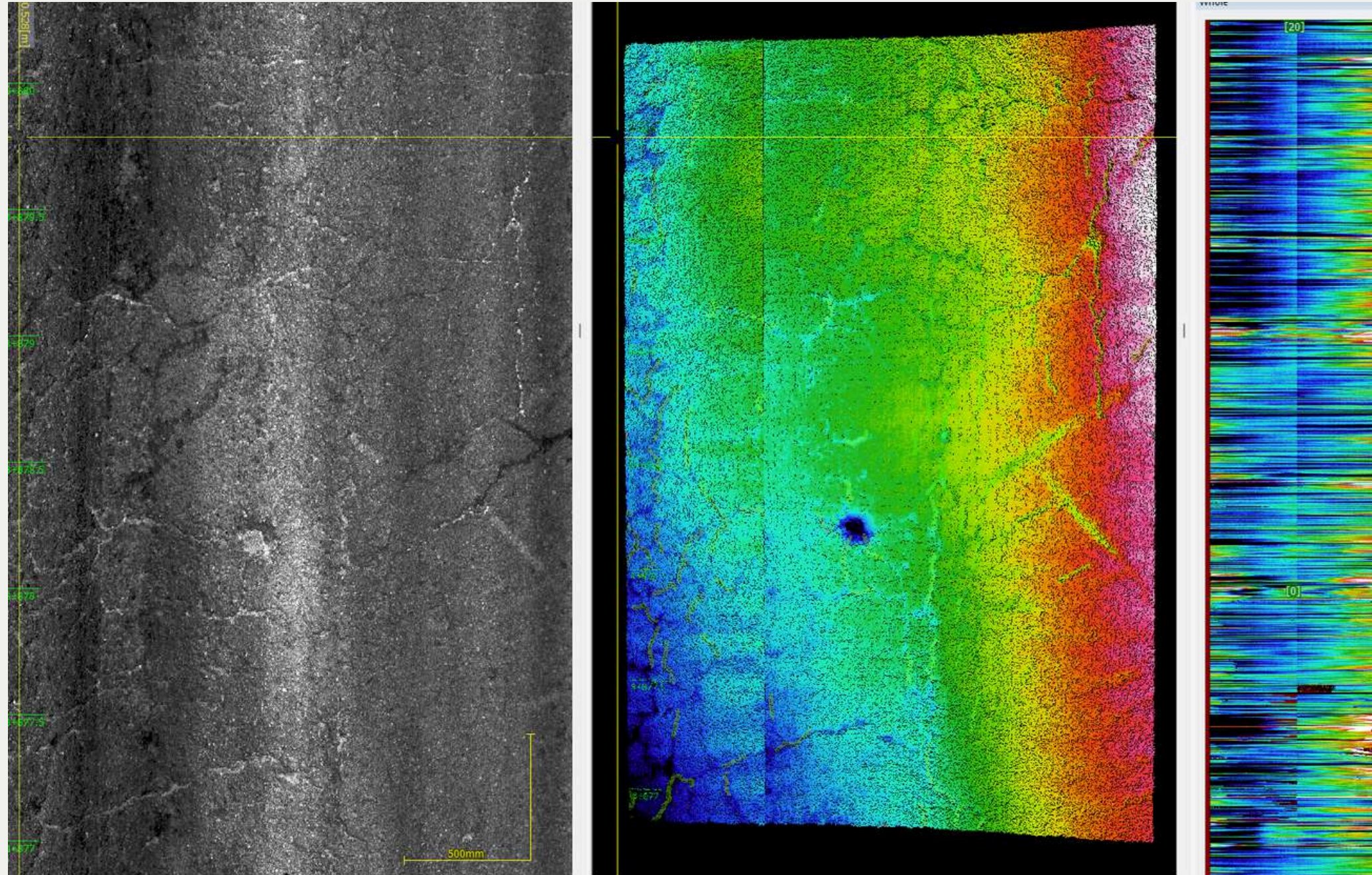
2D & 3D View of Potholes





Pavement Condition Analysis Module

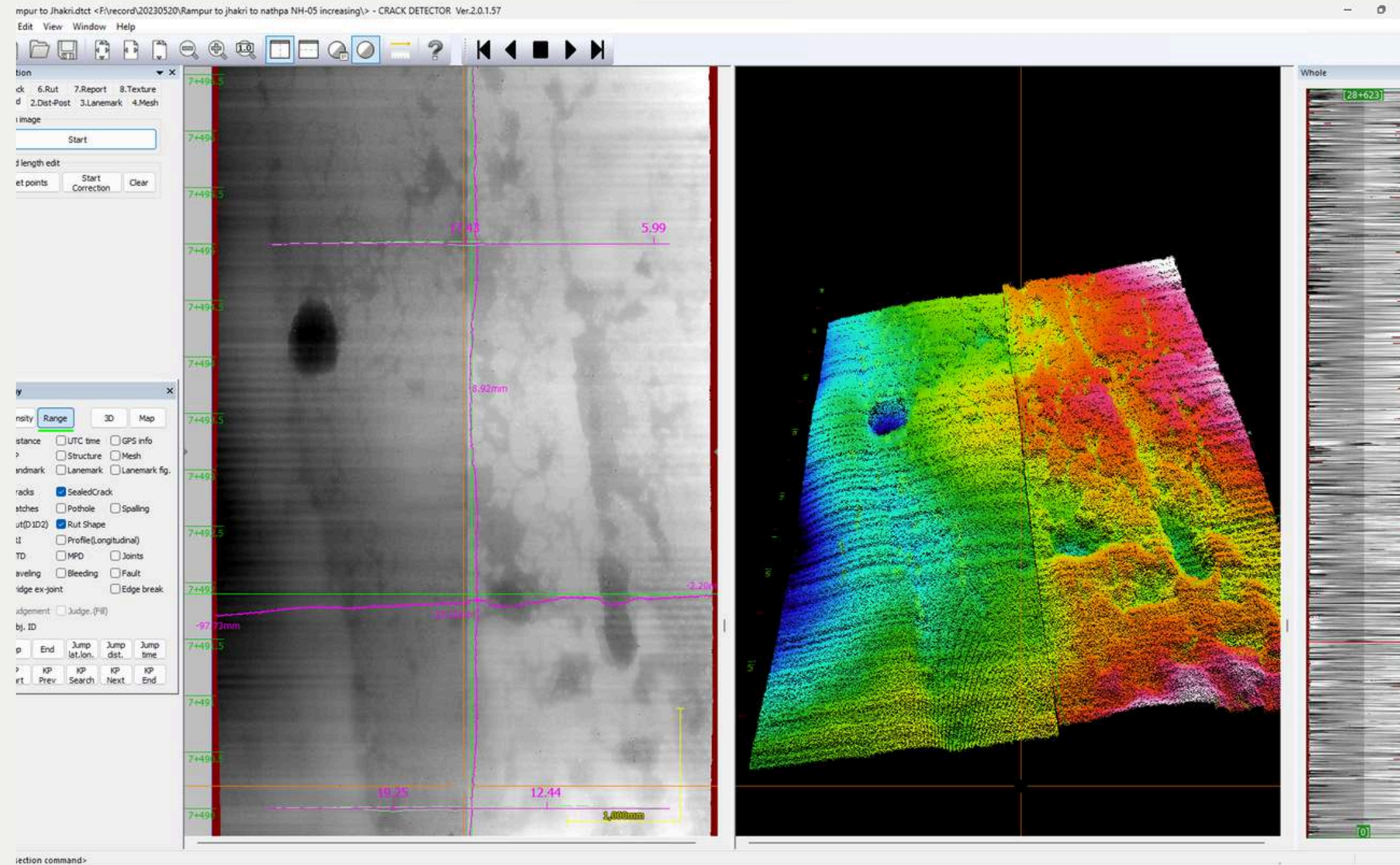
2D & 3D View of Potholes in Range Mode





Data Processing System

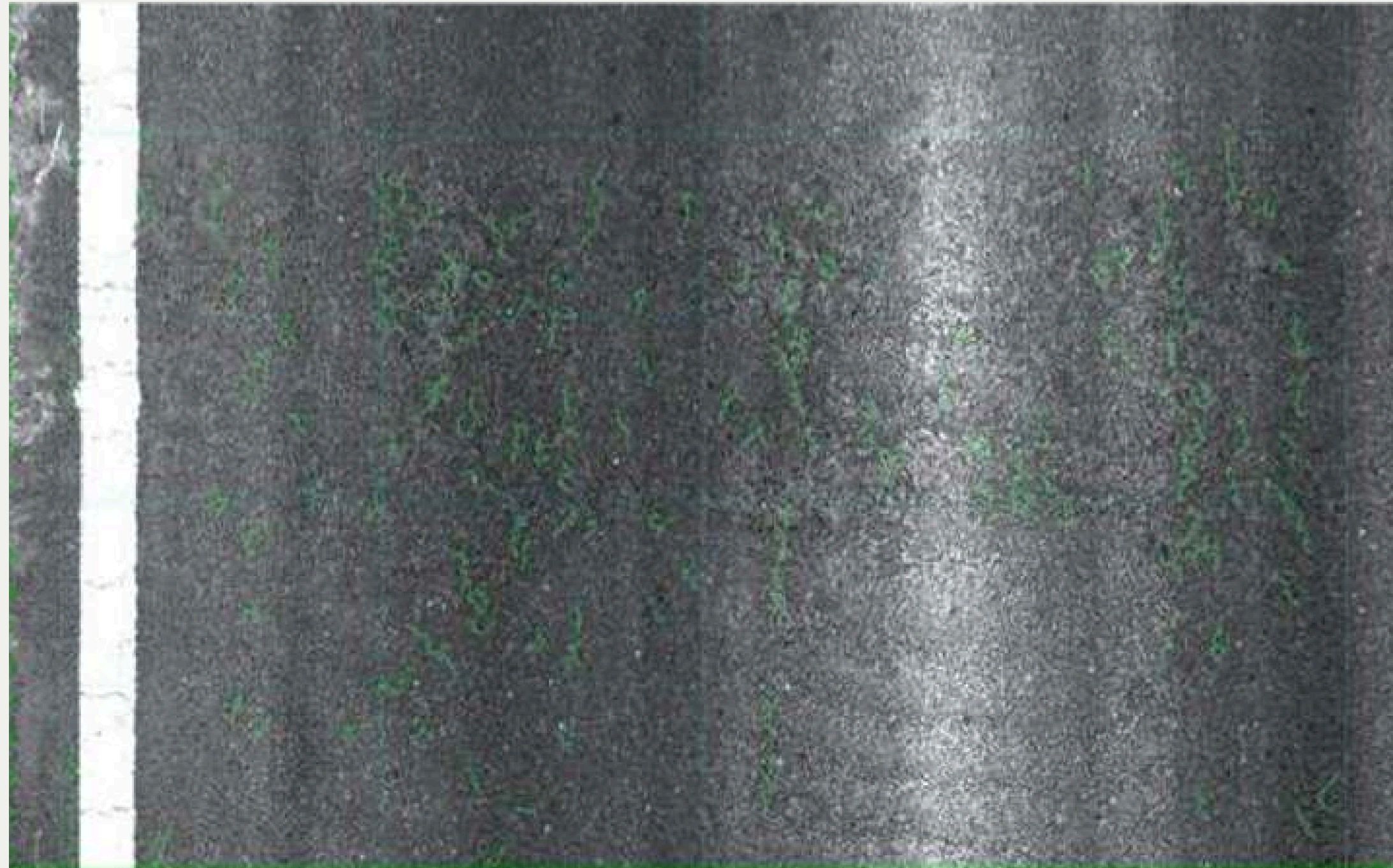
2D & 3D View of Rut





Pavement Condition Analysis Module

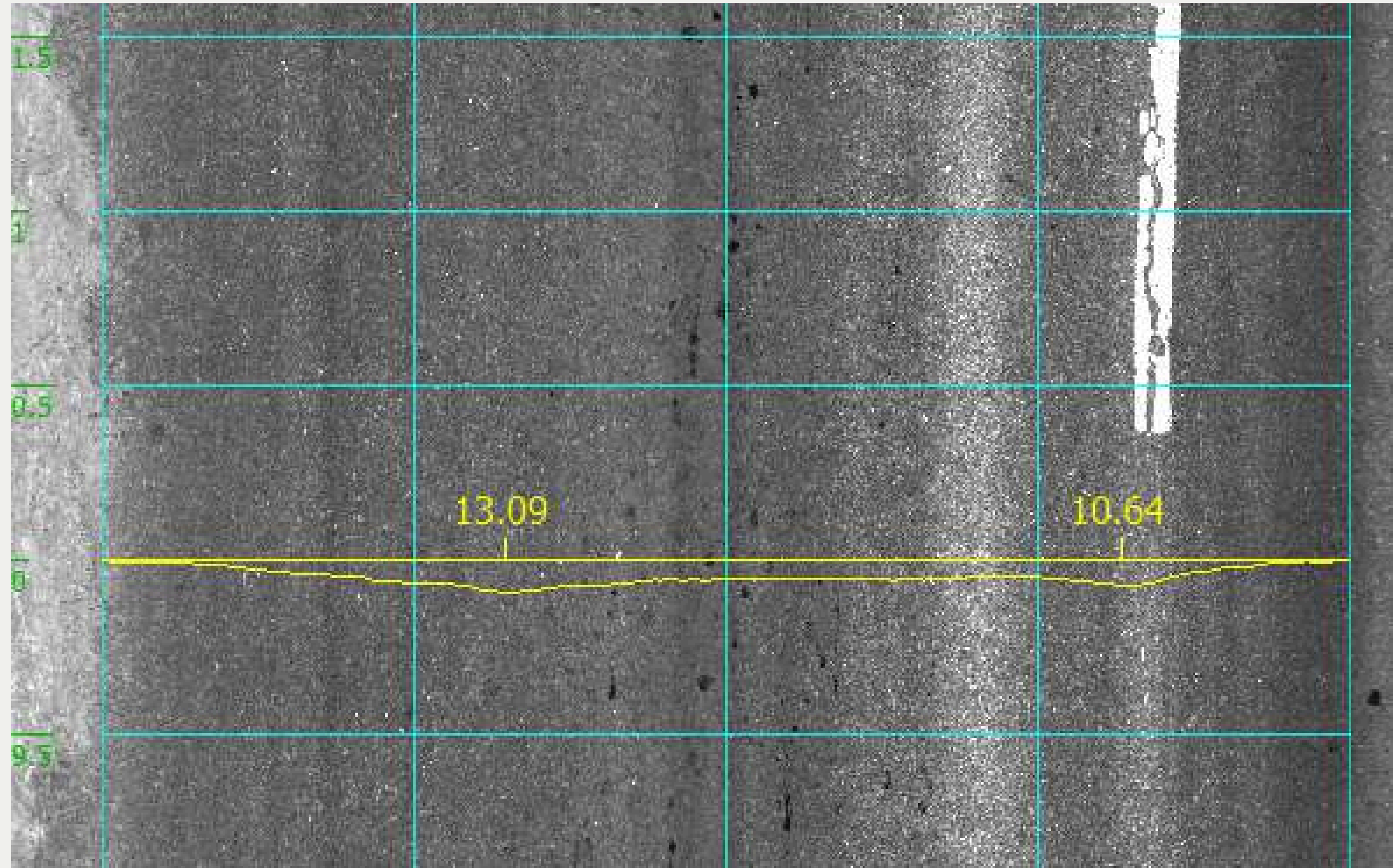
Our Analysis Software able to automatically detect and analyze cracks

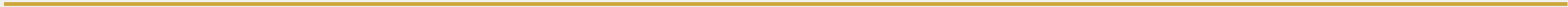




Pavement Condition Analysis Module

Automatic RUT Detection





Report Viewer System



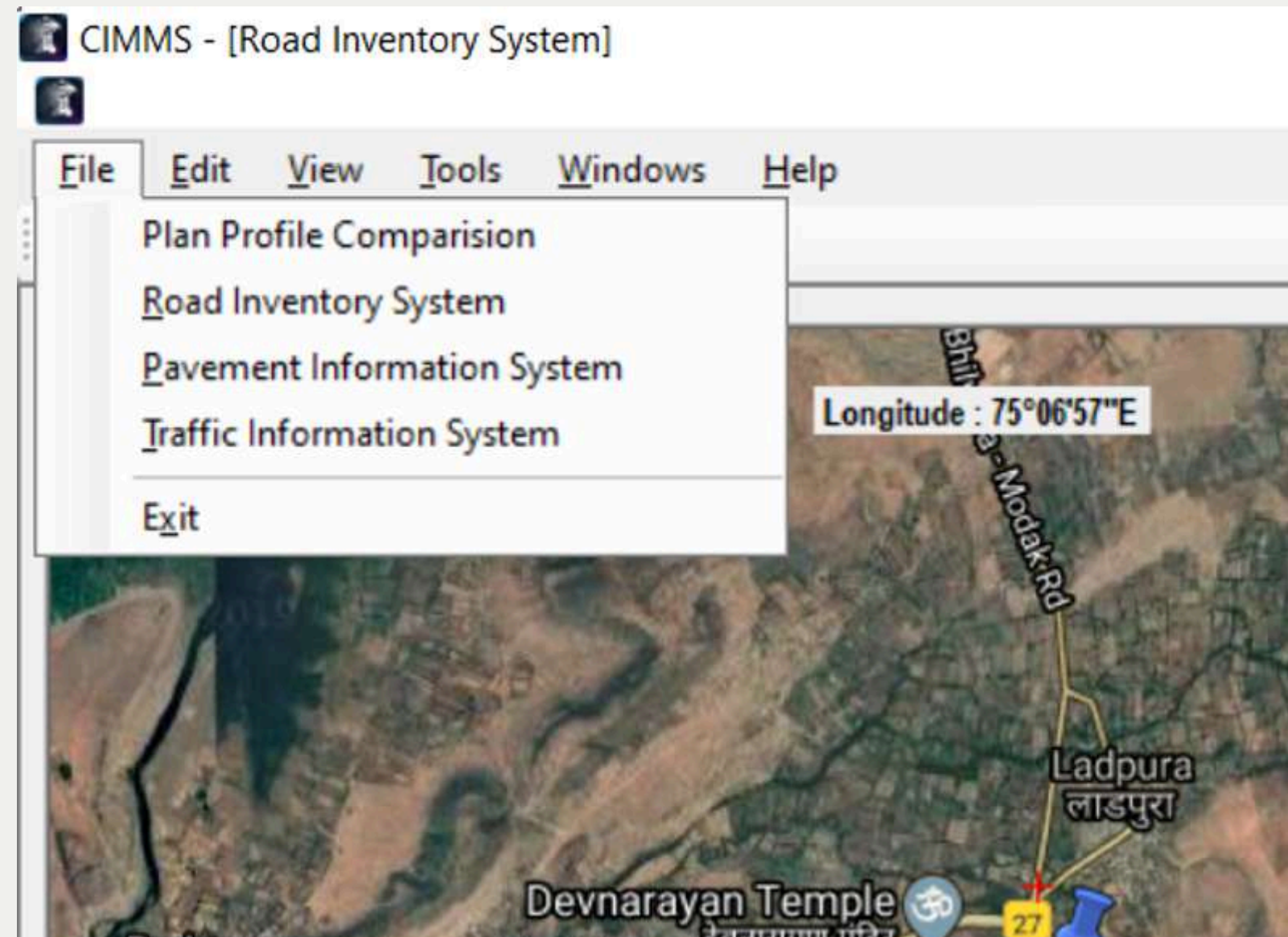


Report Viewer System

CiMMS Viewer

The Report Viewer Dashboard comprises of modules like:

- Plan Profile Comparison
- Road Inventory System
- Pavement Information System
- Traffic Information System





Report Viewer System

System displays captured inventory data along with image in sync with Google Map navigation

In the below image, on Right Panel the height of the electrical pole is shown as 7.5 m, on left panel in Google Map (+) sign in red color is showing the position of the pole. Above the bottom grid, there are four dropdown of Filter options by which you can filter the data by Inventory Name. The Auto Play check box enables you to go through every data one by one automatically. This system allows you to filter captured inventory data as per your requirement.

Road Inventory System

Latitude: 25°09'00"N Longitude: 75°06'59"E

Map Satellite

Jai Hanuman Radios
Barang tea stall
Shree Dev Sweet & Restaurant
Devnarayan Temple

Ladpura
Princ Tailor
BRKGB

DATE: 17-09-2019 ELEVATION: 382 M

7.5 m

TIME: 14:02:47 N25° 09' 00.2" E75° 06' 57.2"

Filter 1-Road Side Utilities 1-Electric Pole 1-Electric Pole 1-Electric Pole Filter Reset Save Save As Buffer 0 Auto Play View Video

Road Stretch: Ladopura-Bhilwada Chainage: Km 0.0-Km 67.8

	SN	Date	Time	Latitude	Longitude	Inventory Type	Inventory Name	Side	Inventory Count	Width (m)	Remarks	IRI(L_B)	BI(L_B)	Cont
	8	17-Sep-19	14:02:42	25.14942	75.11646	Road Side Utilities	HT Line	1	1	0		3.99	2970.64	Avera
	9	17-Sep-19	14:02:44	25.14964	75.11649	Road Side Utilities	HT Line	2	1	0		3.99	2970.64	Avera
	10	17-Sep-19	14:02:47	25.15002	75.11649	Road Side Utilities	Electric Pole	2	1	0		3.99	2970.64	Avera
	11	17-Sep-19	14:02:47	25.15002	75.11649	Road Side Utilities	HT Line	2	1	0		3.99	2970.64	Avera
	12	17-Sep-19	14:02:49	25.15026	75.11651	Road Side Utilities	HT Line	1	1	0		3.99	2970.64	Avera
	13	17-Sep-19	14:02:49	25.15026	75.11651	Wayside Amenities	Vehicle Service Point	3	2	0		3.99	2970.64	Avera

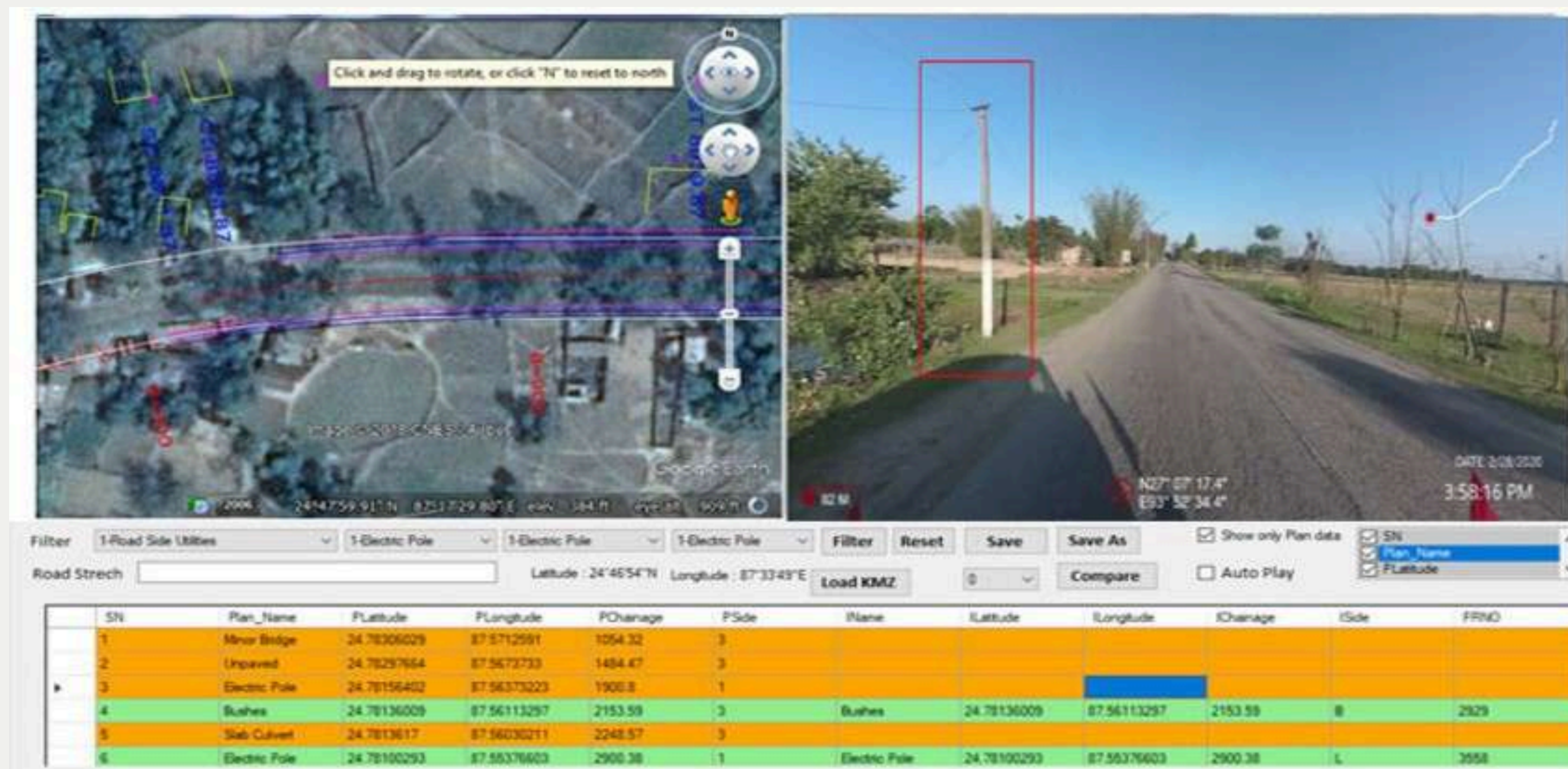




Report Viewer System

CiMMS Viewer is user Friendly Graphic User Interface system gives you facility to evaluate between the proposed plan and the current condition of Road Assets

In the image, on Right Panel the image Road Inventory is shown, on left panel Plan Profile is showing the position of the inventory. In Grid Green Colored Row showing matched data and in Orange color displaying unmatched data with Plan Profile Above the bottom grid, there are four dropdown of Filter options are available. The Auto Play check box enables you to go through every data one by one automatically.



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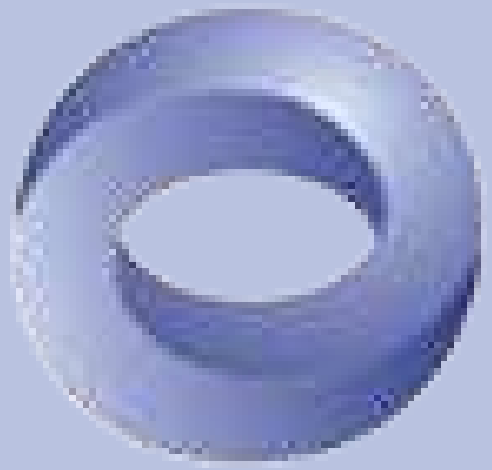
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