Pavement Analysis and Related Services for Burnet County, Texas

Date: July 13, 2026

Submitted to:

Burnet County
220 S. Pierce Street
Burnet, TX 78611

Submitted by:

Fugro USA Land, Inc.
11211 Taylor Draper Lane, Suite 320
Austin, TX 78759

Table of Contents

List of Figures

List of Tables

Fugro USA Land, Inc.
11211 Taylor Draper Lane, Suite 320
Austin, TX 78759

July 13, 2026

Megan Schumann
Assistant Auditor
Burnet County
220 S. Pierce Street
Burnet, TX 78611

Subject: Proposal for Pavement Analysis and Related Services for Burnet County, Texas

Dear Ms. Schumann,

Fugro USA Land, Inc. (Fugro) is pleased to submit our proposal to provide pavement analysis and related services for Burnet County (County). Fugro has over 75 years of experience in pavement and asset data collection, implementing and updating pavement management systems (PMS), and geotechnical and pavement engineering. Fugro understands that maintaining valuable assets, such as roadway infrastructure, has never been more critical and complex due to budget constraints and the growing usage of the infrastructure system.

We appreciate the opportunity to discuss our services with you and the County. We have had the privilege of providing asset data collection and condition assessment services to North Central Texas Council of Governments (NCTCOG) participating agencies for over 20 years, and this offers us a unique understanding of the needs and expectations of the County.

The following proposal is based on other similarly sized projects and discusses our team's experience and qualifications, our proposed methodology and approach, as well as the tools and equipment necessary to carry out the scope of work.

Please do not hesitate to contact me at 512-977-1851 or by e-mail at salavi@fugro.com if you have questions or need additional information.

Best Regards,

Sirous Alavi, Ph.D., P.E., PTOE
Director of Pavement Engineering & Infrastructure Management, Americas

Section A provides general descriptions of Fugro services. Section B describes the proposed scope of work. Section C provides our pricing proposal.

Section A: Description of Services

A.1 Introduction

Fugro USA Land, Inc. (Fugro) has over 75 years of experience with pavement and roadway asset data collection and offers a strong record of successfully providing services. Fugro provides services for all aspects of pavement management and evaluation, planning and oversight, developing maintenance and rehabilitation strategies, and optimizing network conditions within available budgets. Our services deliver value by planning, accurately diagnosing, and prioritizing maintenance and rehabilitation activities. The following provides a high level overview of the services.

A.1.1 Pavement Data Collection and Processing

Fugro operates a fleet of Automatic Road Analyzer (ARAN) vehicles that automatically and continuously measure over 15 different data types simultaneously on arterial, collector, and local streets with various surfaces. Typical data types collected include:

- Roughness, smoothness, ride, and International Roughness Index (IRI)
- Rutting and Transverse Profile
- Pavement Distress
- Pavement and Right-of-Way (ROW) Images
- Faulting

Fugro has developed our Vision software for the processing and analysis of pavement condition data. Vision is a customized digital condition rating system that can be configured for user defined severity/extent based upon pavement distresses and pertinent roadway attributes. Data can be exported to a pavement management system (PMS) or an asset management system (AMS), and it can be easily customized for industry standard reporting.

A.1.2 Data Viewing and Managed Hosting

Fugro's iVision is a web-based software that offers the ability to review the collected data and images. The County will benefit from the functionality of Fugro's iVision software completely free of charge for one year. With over 1 Petabyte (1 billion Megabytes) of data storage, we currently provide such managed services for numerous State and municipal agencies within the U.S.

A.1.3 Pavement Management System (PMS) Services

Fugro is experienced with a variety of pavement management software packages such as OpenGov's Cartegraph, StreetSaver, Trimble's AgileAssets, and PAVER. Our experience with these software packages includes developing condition listings, condition maps, work plans, budget optimization, and maintenance and rehabilitation alternatives for agencies. Fugro can provide tailored pavement management solutions to NCTCOG Participants based upon their specific

requirements. Fugro has provided pavement management services for all different sized agencies with a wide variety of needs:

- Data migration from legacy systems
- Loading of Pavement Management Data
- Pavement Management Implementation
- Pavement Management Update
- Geographic Information System services
- Work plans, budget analysis, and network condition reporting
- Performance Modeling
- Computer Hardware and PMS/Asset Software
- Presentations to County Councils and Commissioners Courts

A.1.4 Training

Fugro's certified professionals have years of experience providing clients and engineering professionals with a variety of training and continuing education courses pertaining to pavement design, materials, pavement management, and pavement preservation.

A.1.5 Asset Inventory

Fugro has extensive experience collecting roadway assets and has extracted and delivered over 70 different asset types totaling 5.1 million unique assets over 216,000 miles of road for municipal and State agencies since 2008. Fugro's Surveyor software uses the calibrated geo-referenced images collected by the ARAN to capture, extract, measure, and store data on client's visible roadside assets. Surveyor can be used for asset data extraction for sidewalks (location, length, width and condition), curb ramps (location, configuration, presence of truncated domes or other detectable warning features, condition), and roadway signs (type, location). Assets can be provided via geodatabases for incorporation into the County's GIS system.

A.2 Overview of Automated Equipment

Developed in 1977, our ARAN was the first automated data collection vehicle available in the market and continued to evolve with the latest technology and equipment. Figure 1 shows our current sixth generation ARAN. The ARAN includes cutting-edge gyroscopes, sensors, cameras, computers, software, and related equipment, all designed to withstand the rigors of collecting seven days a week, 365 days a year in all landscapes and climates. Fugro's experience and industry knowledge have allowed us to be innovative and responsive to the changing economic conditions facing transportation agencies, balancing reduced budgets, and staffing with the demands for maintaining a safe, reliable, and efficient transportation network.

Currently, we are working with over half the North American DOTs and many municipalities providing a full range of innovative custom roadway management solutions including data collection, PMS services, and M&R work plan development. Client satisfaction and trust are top priorities for us. We have developed many long-standing clients with this sound approach. We are currently working with over twenty (20) States/Provinces in North America.

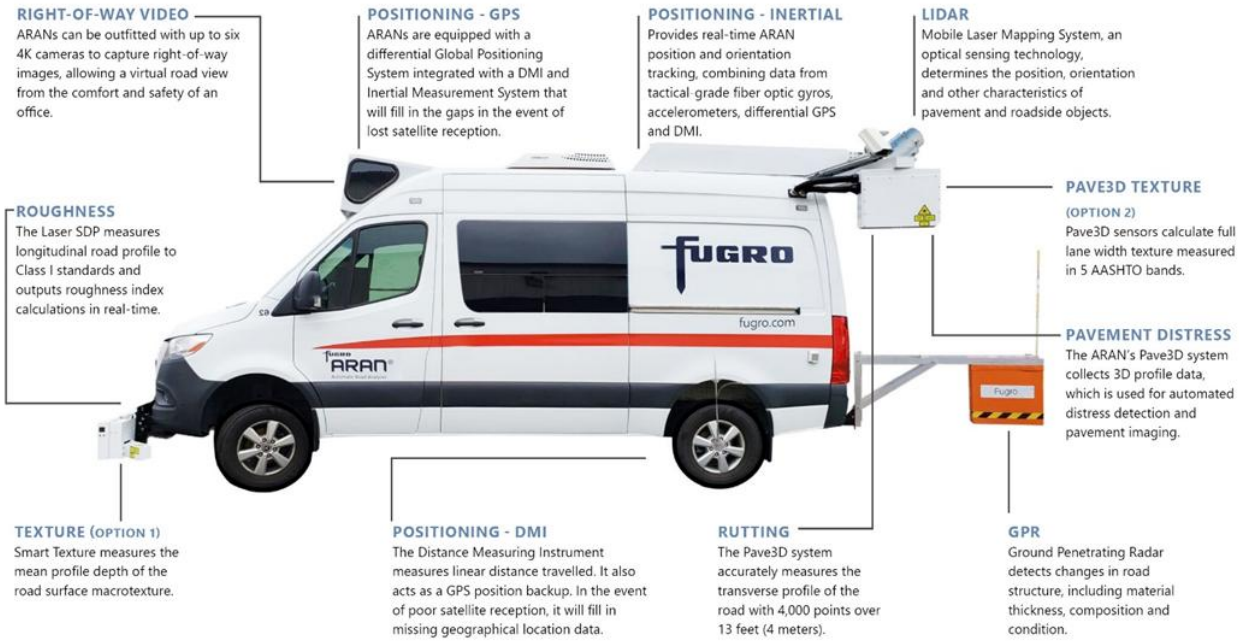

Figure 1: Automatic Road Analyzer (ARAN)

The following describes some of the specific ARAN subsystems that are pertinent to the project.

A.2.1 Locational Referencing and Positioning

The ARAN is equipped with a Distance Measuring Instrument (DMI) mounted on the driver's-side rear wheel as shown in Figure 2. The DMI is used to provide distance based triggers to the ARAN subsystems and translate wheel revolutions into measurements of velocity and linear distance traveled. The DMI meets the Class 1 requirements per ASTM E950, Standard Test Method for Measuring the Longitudinal Profile of Traveled Surfaces with an Accelerometer Established Inertial Profiling Reference.

Figure 2: Distance Measuring Instrument (DMI)

The ARAN also incorporates a Differential Global Positioning System (DGPS) using Applanix's POS LV 220. The POS LV is Global Navigation Satellite System (GNSS)-aided inertial technology that mitigates the real-world effects of GPS outage.

The POS LV 220 tracks and reports the position (latitude, longitude, and elevation) and orientation (heading) of the ARAN in real-time using complementary locating technologies. The GPS corrects any drift evident in the inertial sensor over time, while the inertial sensor ensures that accurate positioning will be continuously available, even during periods of GPS outage due to tree canopy, mountainous terrain, tunnels, or urban canyons. Figure 3 is an image of the Applanix POS LV system.

Figure 3: Applanix POS LV

A.2.2 Downward Pavement Image Collection

Fugro's Pave3D uses downward-facing high-speed cameras, custom optics, and laser line projectors to output range and intensity data, which derive a 3D image of the pavement surface as seen in Figure 4. These capabilities improve performance of post-processing techniques resulting in superior accuracy for identifying pavement crack severity. These images facilitate automated and manual crack identification methods.

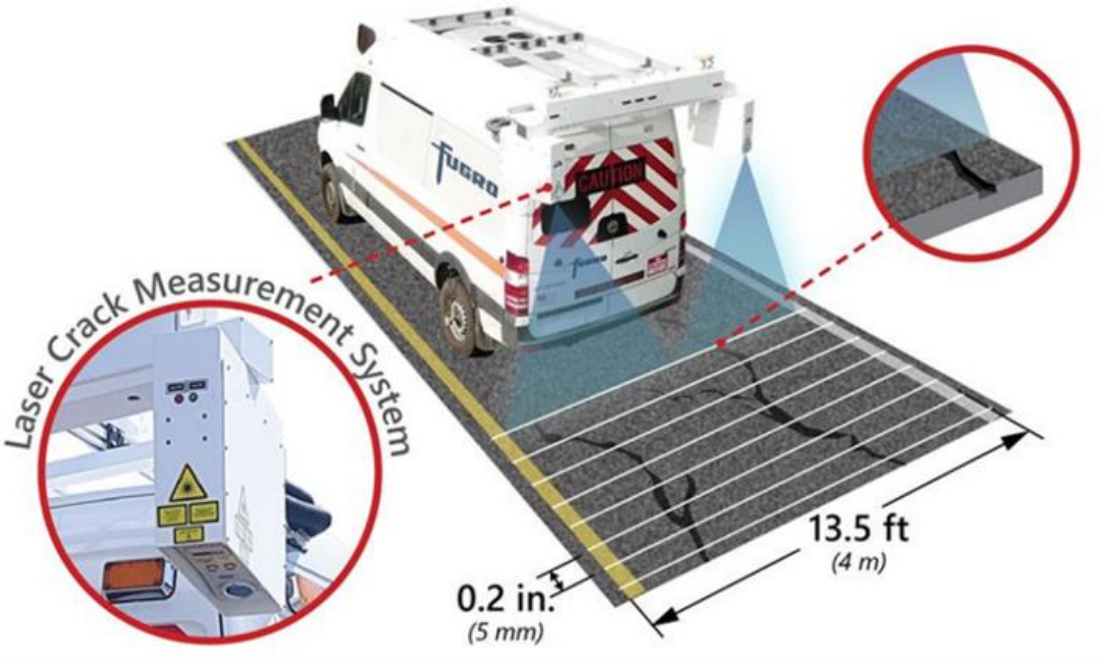

Figure 4: Downward Scanning Capabilities

Figure 5 depicts the range, intensity, and 3D views captured by Fugro's Pave3D system. The range image represents depth in grayscale; lower elevations due to defects like cracks, potholes, corner breaks, etc., appear dark. A range image means only actual pavement distress is detected and no

other artifacts on the road like oil, skid marks, or dampness in hairline cracks. The intensity image is a more "traditional" camera image showing the surface as the human eye would see it. An intensity image is essential for the visual verification of non-crack-related distresses like raveling. The 3D view combines the Range and Intensity images to provide an enhanced image of the roadway that is ideal for visual rating and quality control of the cracking detected by the automated distress tool. Using both range and intensity information matched pixel for pixel, we can better determine the exact locations of cracks based on width, depth, texture, color, and other surrounding features.

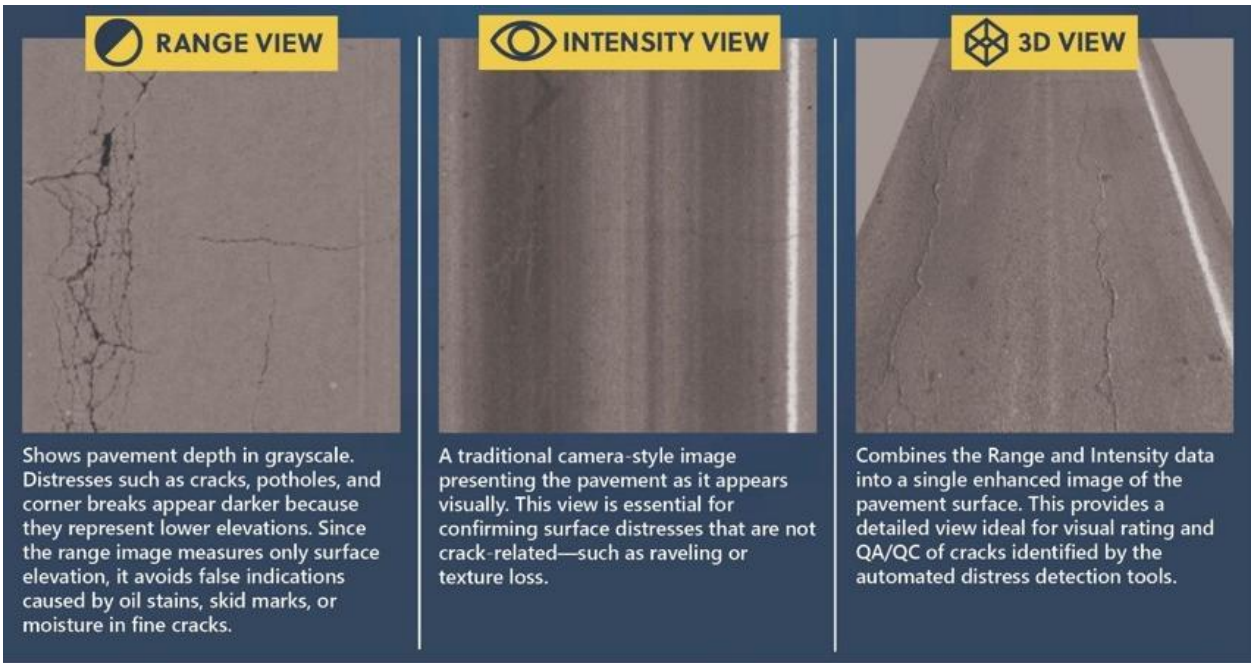

Figure 5: Range View (left), Intensity View (middle), and 3D View (right)

Some of the advantages of using the Pave3D system over conventional pavement images include:

- Uninterrupted operation in all lighting conditions during the day and at night without the need for artificial pavement illumination.
    - Sun and shadows and various pavement types ranging from dark asphalt to light-colored concrete can be measured at highway survey speeds and on roads reaching 14 feet in width and still achieve the 0.19 inches longitudinal resolution.

- Continuous collection of pavement images along the roadway's length with no interruptions.
    - This feature allows the user to select their desired reproduction interval length of generated pavement images, which align with predetermined right-of-way image intervals. The high-definition images are processed for various condition and distress ratings within Fugro's Vision software.

A.2.3 Laser SDP (South Dakota Profiler)

Fugro's Laser SDP (South Dakota Profiler) system shown in Figure 6 is a non-contact Class 1 inertial profiler (per ASTM E950) that uses lasers and accelerometers mounted at the front of the vehicle over each wheel path. The system measures the longitudinal profile for 100% of all lane miles to calculate International Roughness Index (IRI) and Ride Condition Index (RCI) for maximum accuracy. The equipment conforms with AASHTO R 57 "Standard Practice for Operating Inertial Profiling System".

The ARAN saves raw longitudinal profile data for every one (1) inch of pavement in both wheel paths along with the standard deviations of each. The result is computed IRI values (in inches/mile) for each segment for both the left and right wheel paths. Highlights of Fugro's Laser SDP system for IRI data collection include:

- Equipped with GoCator dispersion lasers providing a full 100mm (4-inch) line of data across the road surface (like that of a tire footprint). This offers improved consistency, repeatability, and accuracy in the collection of the longitudinal profile.
- Ability to collect at variable testing speeds while maintaining a bias of less than 5%.
- Allowance for testing at low speed and "Stop and Go" conditions.
- High accuracy; measurements within ± 5% of all popular manual profiling techniques.
- High repeatability with standard deviation for repeat runs within ± 5% of the mean. GoCator sensors' use further improves on this consistency, regardless of the testing surface type or condition.
- Real-Time IRI reporting for immediate operator identification of system issues.
- Two standard conformance tests, one static, and the other dynamic, ensure that both the laser and accelerometer components of the system are operating as intended.
- Multiple parameters reported, including mean and max IRI and standard deviation by segment.

Figure 6: ARAN Laser SDP

Fugro has developed reliable, speed-sensitive algorithms to improve the accuracy of the longitudinal profile calculated in low speed zones. These algorithms reduce the impact of the unwanted frequencies in the accelerometer signal that affect profile and IRI calculations. Since the low-speed algorithms are non-casual, meaning that they incorporate future data into the calculation, the low speed roughness feature recalculates the longitudinal profile and IRI during the processing stage for maximum accuracy and repeatability.

A.2.4 Right-of-Way (ROW) Images

With our long history of working with States, Counties, and municipalities, we understand the value that transportation agencies receive from high quality digital images that offer a clear, focused view of the roadway and surrounding area. We have taken great care to source, calibrate, and maintain the best cameras in the industry. The image collection for this project will include both continuous ROW and downward facing pavement imaging. Collection will be performed on dry pavement and when weather and light do not inhibit visibility of pavement and ROW.

ROW cameras will capture the lane of travel and ROW. These images shall be captured at a minimum interval (e.g., 25 feet), at typical speeds, and will provide 100% and continuous coverage of the ROW in full-frame with a high pixel resolution. The ARAN will collect ROW images utilizing Sony FX9 HD cameras that offer a resolution up to 3840 x 2160 pixels at 16:9 aspect ratio. Figure 7 provides an example of Fugro's superior ROW image quality collected for one of our current clients. Each image is tied to a GPS location as well as a linear reference, which allows all images to be tied back to each other. All images can then be used to extract visible assets now or in the future.

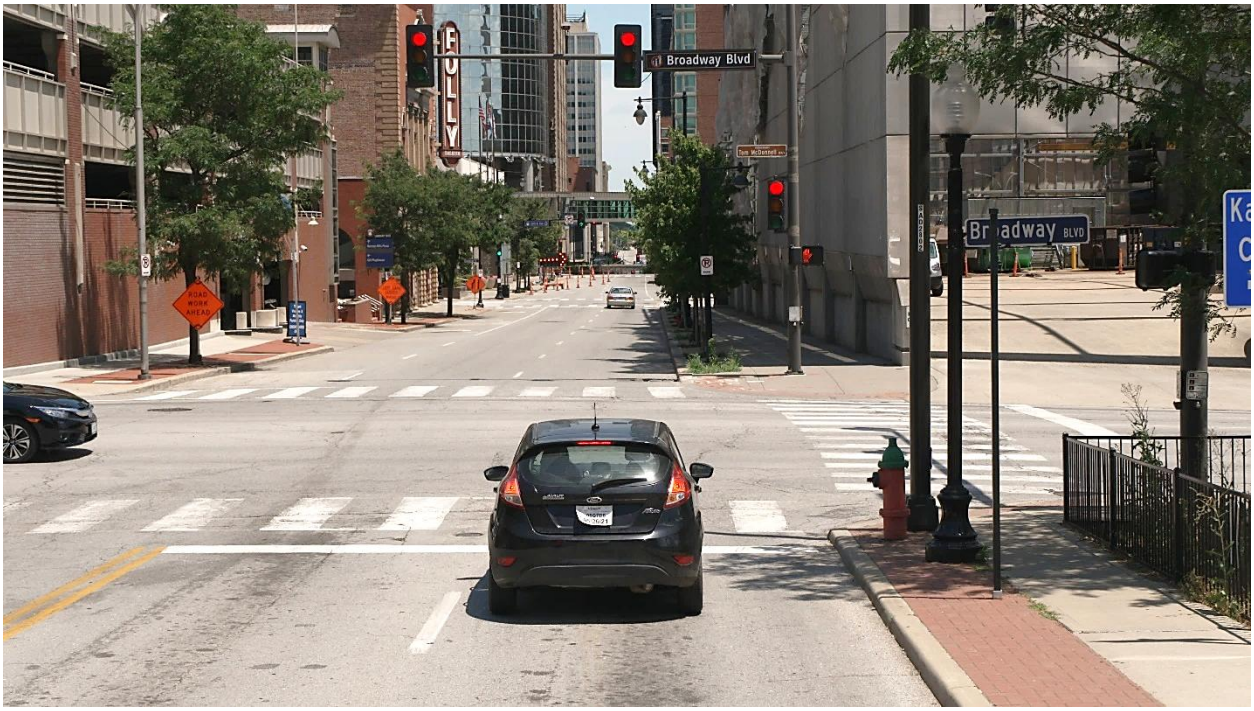

Figure 7: Example of Fugro's Superior ROW Image Quality

Section B: Scope of Work

B.1 Overview

The County has provided a list of roadways totaling approximately 118 centerline miles for data collection. Table 1 lists County Roads provided to us by the County. The County has confirmed that only a single direction of travel is required to be collected for each roadway.

Table 1: Selected Country Roads

Precinct	County Road	Other Name	From	To	Estimated Centerline Miles
1	CR 103	Dobyville Cemetery Road			6.6
1	CR 101	Lampasas Burnet Road			8.0
1	CR 108	San Saba Road			15.7
1	CR 122	Slaughter Mountain Road			4.0
2	CR 200	Shady Grove Road	FM 963	FM 1174	8.0
2	CR 207	Old Austin Road	FM 963	County Line	14.0
2	CR 220		FM 2657	County Line	2.5
2	CR 219		FM 2657	County Line	3.8
3	CR 330	Old Bertram Road / Westfall Street			8.5
3	CR 340	Mormon Mill Road			13.0
3	CR 341				4.4
3	CR 322	Old Hwy 29			2.9
4	CR 404	Double Horn Road / CF Wall Lane / Spicewood Road / Mike Wall Lane			12.0
4	CR 413	Gregg Drive			1.0
4	CR 401 (N&S)	Shovel Mountain Road			6.2
4	CR 403	Flat Rock Road			2.7
4	CR 410	Eagle Bluff Road			4.4
				Total Miles	**117.6**

B.2 Right-of-Way (ROW) and Pavement Images

ROW and pavement images will be collected for each lane surveyed using the ARAN. ROW images will be collected at an interval of 25 feet, and pavement images will be collected continuously along the surveyed lane. All images will be delivered to the County on external hard drives. Images will also be available to the County for one year via Fugro's iVision viewing software.

B.3 Pavement Data Collection

The following data will be collected and reported to the County for each lane surveyed using the ARAN:

- Street Name
- Segment ID
- Inventory Date
- Pavement Type
- Functional Class (if available)
- Pavement Condition Score
- Rutting
- International Roughness Index (IRI)
- Surface Distress

B.3.1 Distress Standards & Pavement Condition Index (PCI)

The images provide a visual representation of various cracking types, surface defects, patches, and other distresses along the roadway. Fugro will identify the distresses as defined in American Society for Testing and Materials (ASTM) D6433, Standard Practice for Roads and Parking Lots Pavement Condition Index Survey. The ASTM D6433 standard is used by many municipalities worldwide to calculate PCI for their roadway networks. PCI uses a scale from 0 to 100, where 0 represents a completely failed pavement and 100 represents a pavement in perfect condition. PCI is calculated based on the type, severity, and extent of surface distresses. Each distress type includes a severity level (i.e., low, medium, and high) and has a different impact or "deduct" value for pavement condition depending on its quantity (i.e., extent). Since each distress type has a different impact on pavement performance, deduct values are specific to individual distresses in accordance with the ASTM D6433 standard. High severity distresses and/or high distress quantities result in more reductions in PCI scores. In general, deduct values for fatigue cracking are higher than deduct values of other types of cracking. Presence of load related fatigue cracking results in lower PCI scores, when compared with similar severities and extents for cracking associated with environmental conditions such as transverse cracking. Table 2 and Table 3 present the asphalt and concrete pavement distresses and their classifications.

Table 2: Asphalt Concrete Pavement Distresses and Classification

ID #	Load Related	ID#	Climate/Durability Related	ID#	Other Related
1	Alligator Cracking	**3**	Block Cracking	**2**	Bleeding
7	Edge Cracking	**8**	Joint Reflection Cracking	**4**	Bumps & Sags
13	Pothole	**10**	Longitudinal/Transverse Cracking	**5**	Corrugation
15	Rutting	**19**	Raveling	**6**	Depression
		20	Weathering	**9**	Lane/Shoulder Drop Off
				11	Patch/Utility Cut
				12	Polished Aggregate
				14	Railroad Crossing
				16	Shoving
				17	Slippage Cracking
				18	Swell

Table 3: Concrete Pavement Distresses and Classifications

ID #	Load Related	ID#	Climate/Durability Related	ID#	Other Related
22	Corner Break	**21**	Blow Up	**25**	Faulting
23	Divided Slab	**24**	Durability Cracking	**27**	Lane/Shoulder Drop Off
28	Linear Cracking	**26**	Joint Seal Damage	**29**	Large Patch/Utility Cut
34	Punchout	**37**	Shrinkage Cracking	**30**	Small Patch
		38	Corner Spalling	**31**	Polished Aggregate
		39	Joint Spalling	**32**	Popouts
				33	Pumping
				35	Railroad Crossing
				36	Scaling

B.3.2 Data Processing Software – Vision

Fugro's Vision software with automated and semi-automated algorithms for pavement distress detection, classification, and rating per ASTM D6433 is used to accurately process the ARAN data. Vision's Report Generator module facilitates the creation of custom reports and data deliveries using post-processed collection of all pavement performance parameters. This module allows Fugro staff to modify and apply reporting templates to ensure that data conforms to client requirements.

B.4 PCI Calculation

Fugro will utilize a Fugro licensed PMS software or proprietary coding to determine the PCI scores for every street segment identified in the data collection program. The PCI scores will be provided to the County in electronic format (i.e., MS Excel format) and also GIS shapefile for upload to the County's GIS database.

B.5 Data Viewing Software – iVision5

Fugro's iVision5 viewing software provides the agency with a powerful tool to review collected images and asset data in a synchronized GIS-based environment. iVision5 is hosted by Fugro and available on any device with access to the internet. Fugro will upload all raw images and data to our Vision processing software, data will be processed by our team, and post processed data will be synchronized with iVision5. Figure 8 provides an example of one display option for iVision5's rich dashboard layout. All displayed data is played in a synchronized view as the user navigates along the roadway on the GIS-based map. The agency will then be provided with multiple licenses to use the software for one year at no additional cost. After one year, licenses can be renewed annually for an additional cost.

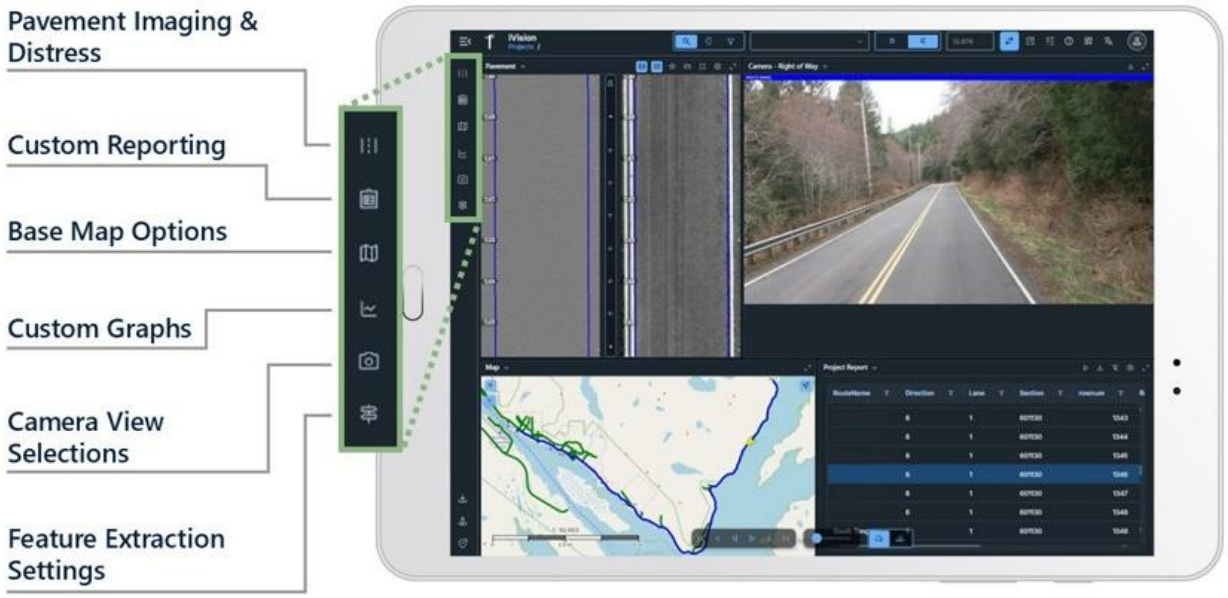

Figure 8: iVision5 Dashboard Example

B.6 Deliverables

Fugro will provide the following deliverables:

- **Geodatabase Delivery –** Fugro will deliver an ESRI compatible geodatabase with distress data, PCI, IRI, and other attribute data.
- **Data Delivery Files –** Fugro will provide electronic files (e.g., Excel or CSV) with segment information.
- **Image Delivery –** Fugro will deliver all the collected images (i.e., pavement and ROW) to the County on a hard drive.
- **iVision5 access –** Images will be available on Fugro's iVision5 dashboard.
- **Final Report –** Fugro will prepare a comprehensive final report for the County. The report will include the pavement network inventory with PCI scores.

Section C: Pricing Proposal

Table 4 represent Fugro's proposed fee for this project, which includes 118 centerline miles of pavement data collection. This fee is compliant with the NCTCOG North Texas SHARE contract for pavement analysis services. The fee does not include the assessment, purchase or implementation price of a PMS software for the County. Due to the proximity of Burnet County to Fugro's Austin operations, we are providing a 30% discount from our usual pricing for a total of $34,601.

Table 4: Price Proposal

Activity #	Activity Description	Provide Price Per Tiered Group		A	B	C=AxB	30% Discount Cost
		Unit	Unit Base Cost ($)	Total Units	Agreed Upon Cost ($)/Unit	Total Agreed Upon Cost ($)	
1	Automatically and continuously measure pavement cracking, texture, rutting and geometrics. Equipment used for rut measurement shall be capable of measuring both wheel track ruts simultaneously.	Lane Mile [1]		118	$130	**$15,340**	**$10,738**
2	Collect pavement surface distress and structural condition information through automated means for all Participant-owned roadways.	Lane Mile [1]		118	$78	**$9,204**	**$6,443**
3	Provide a customized digital condition rating system to collect user defined severity/extent based pavement distresses and pertinent roadway attributes to accommodate a standardized approach to collecting data	Lump Sum	$2,600	1	$2,600	**$2,600**	**$1,820**
4	Collect dual-wheel path roughness data to International Roughness Index standards.	Lane Mile [1]		118	$13	**$1,534**	**$1,074**
5	Collect pavement performance information that includes rutting using a minimum of seven (7) sensors (include pricing for nine (9) sensors as well), fatigue cracking, transverse cracking using a minimum of four (4) sensors, and longitudinal cracking	Lane Mile [1]		118	$26	**$3,068**	**$2,148**
21	Calculate the International Roughness Index (IRI)for each road segment in accordance with ASTM E1926. Provide results compatible with the Participant's GIS database, if applicable.	Lane Mile [1]		118	$6.5	**$767**	**$537**
22	Calculate a Pavement Condition Index (PCI) score for each road segment using an approved pavement management system and in accordance with ASTM D6433 or ASTM E3303. Provide results compatible with the Participant's GIS database, if applicable.	Lane Mile [1]		118	$19.6	**$2,313**	**$1,619**
28	Roadway information that shall be collected and provided to the Participant at a minimum includes items a. through i. in Exhibit B	Lane Mile [1]		118	$26	**$3,068**	**$2,148**
29	Collect digital images at 25-foot intervals of the road surface condition and link to a geodatabase (minimum forward facing imagery).	Lane Mile [1]		118	$13	**$1,534**	**$1,074**
40	Full Written Final Report- Firm shall prepare and submit a written project report summarizing the work performed, dates of collection, methodology, and results.	Each Participant	$10,000	1	$10,000	**$10,000**	**$7,000**
					Total	**$49,428**	**$34,601**

[1]Lane mile is to be defined as a mile traveled as 1) A single pass on alleyways; 2) A centered single pass on residential streets; 3) the outside lane in each direction for collectors and arterials (2 total).