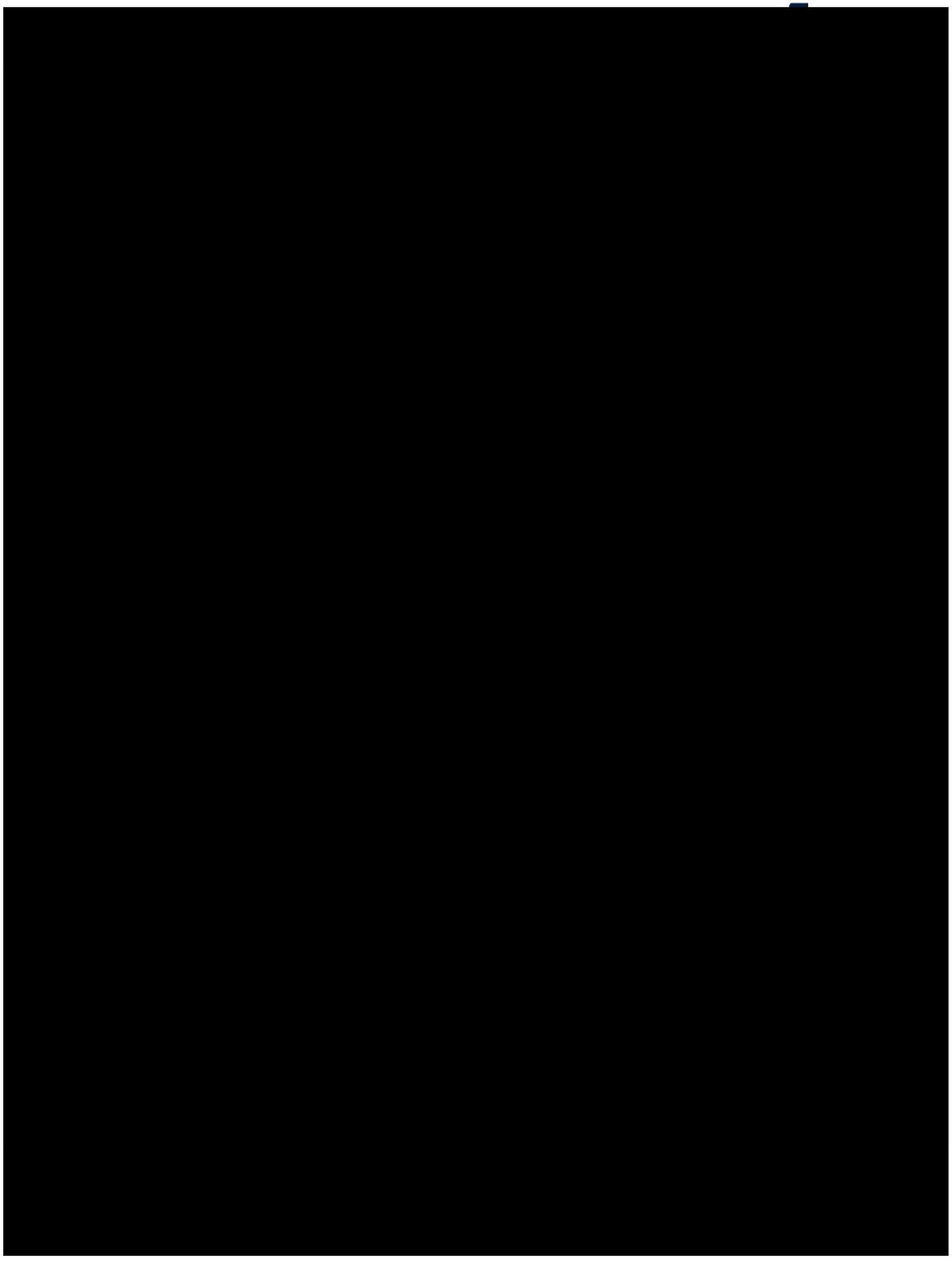
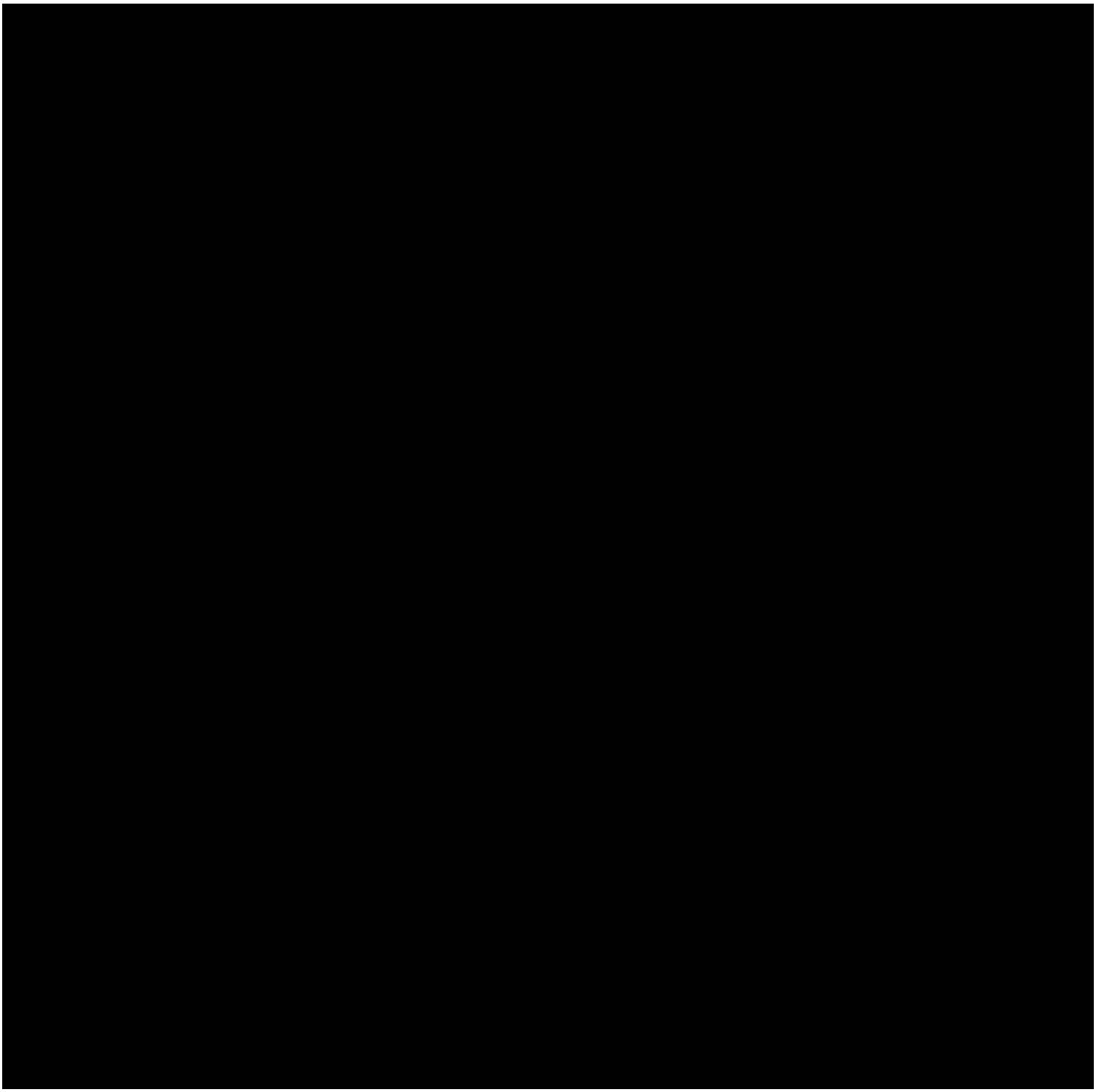

# Contract 4400025193 Pavement Distress Data Collection (Statewide)

13 October 2022

**Prepared for: Louisiana Department of Transportation and Development Section 21, Management Systems and Data Collection**

DOTD
LOUISIANA DEPARTMENT OF TRANSPORTATION & DEVELOPMENT





# Table of Contents

# 4400025193 Pavement Distress Data Collection 24-102 DOTD FORM

# DOTD FORM: 24-102

(4400025193 September, 2022)

**PROPOSAL TO PROVIDE CONSULTANT SERVICES**

Prime consultant shall complete the DOTD Form 24-102 without altering the Form's text; however, the instruction and/or guidance for Sections 12 through 23 can be removed but do not remove Section title and number.

ANY CONSULTANT FAILING TO SUBMIT ANY OF THE INFORMATION REQUIRED ON THE DOTD FORM 24-102, OR PROVIDING INACCURATE INFORMATION ON THE DOTD FORM 24-102, MAY BE CONSIDERED NON-RESPONSIVE.

Prime consultant should enter the firm name in the footer at the bottom of this page. (It will carry over to subsequent pages.)

| | |
|---|---|
| 1.Contract title as shown in the advertisement | **Pavement Distress Data Collection** |
| 2.Contract number(s) as shown in the advertisement | **4400025193** |
| 3.State Project Number(s), if shown in the advertisement | |
| 4.Prime consultant name (as registered with the Louisiana Secretary of State where such registration is required by law) | Fugro Canada Corp.<br>2505 Meadowvale Blvd<br>Mississauga, Ontario, L5N 5S2 |
| 5.Prime consultant license number (as registered with the Louisiana Professional Engineering and Land Surveying Board (LAPELS) if registration is required under Louisiana law) | N/A |
| 6.Prime consultant mailing address | 2505 Meadowvale Blvd<br>Mississauga, Ontario, L5N 5S2 |
| 7.Prime consultant physical address (existing or to be established, if location is used as an evaluation criteria) | 2505 Meadowvale Blvd<br>Mississauga, Ontario, L5N 5S2 |
| 8.Name, title, phone number, and email address of prime consultant's contract point of contact | Cory Hackbart, Senior Project Manager<br>Tel: 1-905-567-2876 \| Mobile: 1-519-757-9952<br>E-mail: info@fugro.com |
| 9.Name, title, phone number, and email address of the official with signing authority for this proposal | Denis Charland, Service Line Director<br>Tel: 1 905 567 2067 \| Mobile: 647-233-2083<br>E-mail: dcharland@fugro.com |

| | |
|---|---|
| 10.This is to certify that all information contained herein is accurate and true, and that the team presently has sufficient staff to perform these services within the designated time frame. By submitting this proposal, proposer certifies that it is not engaged in a boycott of Israel and it will, for the duration of its contract obligations, refrain from a boycott of Israel. Proposer also certifies and agrees that the following information is correct: In preparing its response, the proposer has considered all proposals submitted from qualified, potential subcontractors and suppliers, and has not, in the solicitation, selection, or commercial treatment of any subcontractor or supplier, refused to transact or terminated business activities, or taken other actions intended to limit commercial relations, with a person or entity that is engaging in commercial transactions in Israel or Israeli-controlled territories, with the specific intent to accomplish a boycott or divestment of Israel. The proposer also has not retaliated against any person or other entity for reporting such refusal, termination, or commercially limiting actions. DOTD reserves the right to reject the response of the bidder or proposer if this certification is subsequently determined to be false, and to terminate any contract awarded based on such a false response. | Signature (shall be the same person as #9):  <br>Date: 10/13/2022 |

Fugro

| | | |
|---|---|---|
| 11. If a Disadvantaged Business Enterprise (DBE) goal has been set for this advertisement, indicate which firm(s) will be used to meet the DBE goal and each firm(s)' percentage. | Firm(s): | Firm(s)' %: |
| | Acacia Industries, LLC | 0.5% |
| | A&A Enterprises, inc. | 1% |
| | Accel Talent and Development | 2% |
| | J Star Enterprises, inc. | 1% |
| | Traffic Commander, LLC | 0.5% |

Fugro

**12. Past Performance Evaluation Discipline Table:**

As indicated in the advertisement, insert the completed table here. The percentages for the prime and sub-consultants must total 100% for **each past performance evaluation discipline**, as well as the overall total percent of the contract.

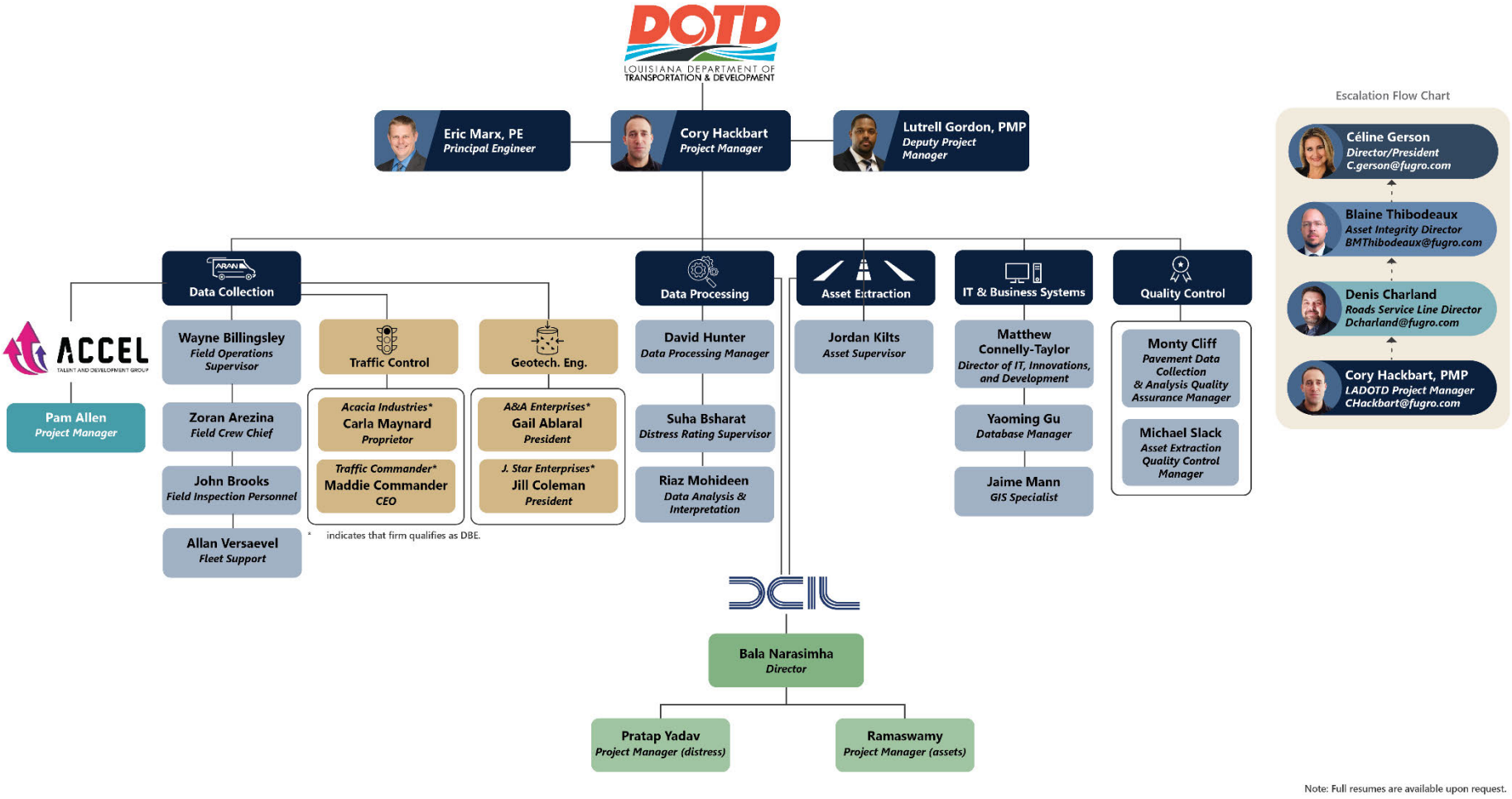
| Sub-consultants are allowed to be used for this proposal. Fill in the table by identifying only those evaluation disciplines consistent with the approach and methodology proposed in Section 18 of the DOTD Form 24-102*, the name of each firm that is part of the proposal, and the percentage of work in each past performance evaluation discipline to be performed by that firm. The percentage estimated for each evaluation discipline is for evaluation purposes only and will not control the actual performance or payment of the work. The percentages for the prime and sub-consultants must total 100% for each past performance evaluation discipline, as well as the overall total percent of the contract. | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Evaluation Discipline (s) | % of Overall Contract | Prime (Fugro) | Firm B (Acacia Industries, LLC) | Firm C (Traffic Commander, LLC) | Firm D (A&A Enterprises, inc.) | Firm E (J.Star Enterprises, inc.) | Firm F (Accel) | Firm G (DCIL) | Each Discipline must total to 100% |
| Data Collection | 97% | 91% | 0 | 0 | 0 | 0 | 2% | 7% | 100% |
| Geotech | 2% | 0% | 0 | 0 | 50% | 50% | 0 | 0 | 100% |
| Traffic | 1% | 0% | 50% | 50% | 0 | 0 | 0 | 0 | 100% |
| Identify the percentage of work for the overall contract to be performed by the prime consultant and each sub-consultant. | | | | | | | | | |
| Percent of Contract | 100% | 88% | 0.5% | 0.5% | 1% | 1% | 2% | 7% | 100% |

For all firms that are part of this team, indicate the approximate number of personnel to be committed to this contract, by DOTD Job Classification and the total number of personnel within the firm that could provide support, if needed. If a specialized job classification is required and not included on the DOTD job classification list, specify "Other (xxxx)" and include the classification title inside the parentheses. The DOTD Job Classification(s) to be used can be found at the following link: http://wwwsp.dotd.la.gov/Inside_LaDOTD/Divisions/Engineering/CCS/Job_Qualification/Job%20Classifications%20with%20Descriptions.pdf

| Firm name | DOTD Job Classification | Number of personnel committed to this contract | Total number of personnel available in this DOTD Job Classification (if needed) |
|---|---|---|---|
| Fugro | Administrative | 1 | 14 |
| Fugro | Engineer | 2 | 39 |
| Fugro | Engineering-Aide | 0 | 0 |
| Fugro | Engineer Intern | 0 | 0 |
| Fugro | Engineer-Other | 0 | 5 |
| Fugro | GIS Analyst | 3 | 10 |
| Fugro | Professional | 8 | 61 |
| Acacia Industries, LLC | Professional | 4 | 12 |
| A&A Enterprises, inc | Professional | 3 | 15 |
| DCIL | Professional | 12 | 40 |
| J.Star Enterprises, inc | Professional | 8 | 20 |
| Traffic Commander, LLC | Professional | 12 | 60 |
| DCIL | Principal | 1 | 4 |
| Fugro | Principal | 3 | 10 |
| Fugro | Supervisor- Eng | 1 | 11 |
| Fugro | Supervisor- Other | 4 | 12 |
| DCIL | Supervisor- Other | 1 | 4 |
| Fugro | Surveyor | 6 | 19 |
| DCIL | Technician | 50 | 250 |
| Accel | Technician | 8 | 20 |
| Fugro | Technician | 20 | 62 |

## 14. Organizational Chart:

Provide an organizational chart showing ALL **relevant** prime consultant and sub-consultant (if applicable) personnel assigned to the contract, area of project responsibility for each, and reporting lines for the purposes of this contract. An individual's role does not necessarily have to match their DOTD job classification identified in Section 13.



**15. Minimum Personnel Requirements:**

Use the table below to identify both prime consultant and sub-consultant staff designated to work on this contract meeting the Minimum Personnel Requirements (MPRs) specified in the advertisement. Ensure the résumé reflects the required experience stated in the MPR.

| MPR No.<br>Do not insert wording from ad | Personnel being used to meet the MPR<br>(Individual(s) may not satisfy more than one MPR unless specifically allowed by Attachment B of the advertisement) | Firm employed by | Type of license / certification & number | State of license | License / certification expiration date |
|---|---|---|---|---|---|
| 1)At least one (1) principal of the prime consultant shall be professionally competent in pavement data collection methods (visual, automated methods, road profilers, etc.) and in pavement data collection, analysis, and quality control and assurance. | Lutrell Gordon | Fugro | Project Management Professional (PMP) | VA 1893032 | 01/07/2025 |
| 2)At least one (1) principal or responsible member of the prime consultant shall have a minimum of five (5) years of experience in responsible charge of pavement data collection and quality assurance. | Denis Charland | Fugro | Project Management Professional (PMP) | Canada 1334299 | N/A |
| 3) At least one (1) Pavement Data Collection and Analysis Quality Assurance Manager who has five (5) years of experience in pavement data | Cory Hackbart | Fugro | Certified Engineering Technologist (C.E.T)<br><br>Project Management Professional (PMP) | N/A | N/A |

| | | | | | |
|---|---|---|---|---|---|
| collection and quality assurance. | | | | | |
| 4)At least one (1) GIS Analyst shall have a minimum of five (5) years of GIS experience. | Riaz Mohideen | Fugro | Advanced Certification in Geographic Information Systems (GIS) | N/A | N/A |
| 4)At least one (1) GIS Analyst shall have a minimum of five (5) years of GIS experience. | Eric Marx, PE | Fugro | Professional Engineer, No. 31479 | LA | 3/31/2023 |

(Add rows as needed)

## 16. Staff Experience:

<table>
<tr><td colspan="6">Firm employed by Fugro</td></tr>
<tr><td>Name</td><td colspan="2">Zoran Arezina</td><td colspan="2">Years of relevant experience with this employer</td><td>19</td></tr>
<tr><td>Title</td><td colspan="2">Field Operations Crew Chief</td><td colspan="2">Years of relevant experience with other employer(s)</td><td>4</td></tr>
<tr><td colspan="3">Degree(s) / Years / Specialization</td><td colspan="3">B.Sc., Electrical Engineering, Technology of Telecommunication, University of Sarajevo, 1984<br><br>Applications Piezoelectric Sensors in Transducers Technology Certificate, University of Sarajevo, 1985<br><br>It Specialist Diploma, Alpha Logic Career College, 1999</td></tr>
<tr><td colspan="3">Active registration number / state / expiration date</td><td colspan="3"></td></tr>
<tr><td>Year registered</td><td></td><td>Discipline</td><td colspan="3"></td></tr>
<tr><td colspan="3">Contract role(s) / brief description of responsibilities</td><td colspan="3">As the Field Operations Crew Chief, Mr. Arezina will be overseeing Fugro’s Automatic Road Analyzer (ARAN) field operators; responding to any concerns or issues raised. He will work alongside the team with supervisory duties, running pavement data collection and reviewing daily reports for quality assurance and control.</td></tr>
<tr><td>Experience dates (mm/yy–mm/yy)</td><td colspan="5">Experience and qualifications relevant to the proposed contract; i.e., “designed drainage”, “designed girders”, “designed intersection”, etc. Experience dates should cover the time specified in the applicable MPR(s).</td></tr>
<tr><td></td><td colspan="5">Safeguards Fugro’s ARAN pavement data collection vehicles ARAN data collection quality by reviewing daily data collection reports, flagging down any issues and resolving them immediately to keep projects on track. Maintains an active inventory of all spare parts, hardware, and software on the trucks as part of a strategy for risk migration.<br><br>Zoran serves/served as the Field Operations Crew Chief for the following Fugro projects:</td></tr>
</table>

| | |
|---|---|
| 12/2004-Present | Louisiana Department of Transportation and Development (LADOTD) – Pavement Distress Data Collection Statewide – 2004- 2022. Annual collection, processing and delivery of roadway condition data including longitudinal profile and IRI, rutting, surface distress, texture, geometrics, pavement and HD ROW images, Global Positioning System (GPS) and elevation data for 36,000 miles of highway network. Contract also includes GPR data and analysis, coring, friction (skid) testing, and asset inventory for 35,000 miles including Highway Performance Monitoring System (HPMS) data items. Additionally, Fugro collected ROW images, GPS and roadside assets for 120,000 miles of local roads throughout the State of Louisiana. Fugro provides iVision5 hosting for access to the data and images. |
| 01/2017-Present | Vermont Agency of Transportation (Vtrans) – Transportation Consulting, Geospatial Roadway Data Collection and Inventory – 2017 – Present. Annual collection, processing and delivery of roadway condition data including IRI, rutting, surface distress, texture, pavement and HD ROW images for 7,100 lane miles of highway network. Fugro's provides iVision5 hosting services for access to the data and images. |
| 01/2017-12/2022 | Arizona Department of Transportation (ADOT) – Transportation Consulting, Geospatial Roadway Data Collection and Inventory – 2017-2022 – Annual collection, processing and delivery of roadway condition data including roughness, transverse profile and rutting, faulting, surface distress, pavement and HD ROW images, and Global Positioning System (GPS) data for 15,000 miles of highway network. Project also includes the collection of roadway assets and lidar data. Fugro's provides iVision5 hosting services for access to the data and images. |
| 02/2019-Present | Pennsylvania Department of Transportation (PennDOT) – Automated Data Collection, Inventory, and Analysis of Pavement Distress – 2019-Present – Annual collection, processing and delivery of roadway condition data including roughness, rutting, surface distress, geometrics, pavement and High Definition (HD) right-of-way (ROW) images for 28, 500 miles of highway network, and 1,950 miles of local roads. Fugro has also provided project-level Ground Penetrating Radar (GPR) when requested. Fugro provides iVision hosting services for access to the data and images. |
| 01/2017- Present | New York State Department of Transportation (NYSDOT) – Pavement Condition Data Collection Services – 2017 - Present - Annual collection, processing and delivery of roadway condition data including IRI, rutting, faulting, geometrics, HD ROW images for 26,500 miles of highway network. Project also includes 19,800 miles of asset inventory; over five million assets inventoried. Fugro's provides iVision hosting services for access to the data and images. NYSDOT also has their own ARAN used for quality review of the data and images received from Fugro, and for project-level testing. |

| | | | |
|---|---|---|---|
| Firm employed by Fugro | | | |
| Name | Blaine Thibodeaux | Years of relevant experience with this employer | 12 |
| Title | Asset Integrity Director | Years of relevant experience with other employer(s) | 14 |

| | | | |
|---|---|---|---|
| Degree(s) / Years / Specialization | | | BS Degree of Civil Engineering, 1997<br>University of Louisiana at Lafayette (ULL)<br>LSU Executive Management Program (MBA equivalent)– Graduated 2011 |
| Active registration number / state / expiration date | | | Registered VA Surveyor & Photogrammetrist License #000039<br>Registered E.I.T. T-17920 |
| Year registered | | Discipline | Data Collection |
| Contract role(s) / brief description of responsibilities | | | Mr. Thibodeaux is Fugro's Regional Business Line Director of the Land Asset Integrity Business in the Americas.. |

| Experience dates (mm/yy–mm/yy) | Experience and qualifications relevant to the proposed contract; *i.e.*, "designed drainage", "designed girders", "designed intersection", etc. Experience dates should cover the time specified in the applicable MPR(s). |
|---|---|
| April 1st 2018 – to Present | Regional Business Line Director FUSALI |
| January 1st 2017 to December 31st 2017 | Managing Director FUSAMI |
| January 1st 2015 to December 31st 2016 | President, Fugro Chance Inc. |

| | |
|---|---|
| April 1st 2014 to December 31st 2014 | COO & Vice President, Fugro Chance Inc. |
| April 1st, 2010 – March 31st, 2014 | Vice President, Fugro Chance Inc. |
| August 2008 – March 31st, 2010 | Vice President, Airborne Sensing & Mapping Division |
| July 2000 – July 2008 | Division Manager, Corridor Mapping Division |
| 1996-June 2000 | Project Engineer, Corridor Mapping Division |

| | | | | |
|---|---|---|---|---|
| Firm employed by Data Collection Infotech (India) Private Limited | | | | |
| Name | Bala Narsimha | | Years of relevant experience with this employer | 19 |
| Title | Director<br>Data Collection Infotech (India) Private Limited | | Years of relevant experience with other employer(s) | 5 |
| Degree(s) / Years / Specialization | | | BE, MTech<br>Trained in HDM4, UKPMS, ASTM Road Standards | |
| Active registration number / state / expiration date | | | | |
| Year registered | | Discipline | | |
| Contract role(s) / brief description of responsibilities | | | Advanced Technical Skills and Knowledge Areas:<br>Knowledge of ESRI Suite Software and MapInfo Suite of GIS Software<br>Vast Knowledge on Road Condition and Data Analysis<br>Knowledge on various database and softwares<br>Project Management Skills | |

| Experience dates (mm/yy–mm/yy) | Experience and qualifications relevant to the proposed contract; *i.e.*, "designed drainage", "designed girders", "designed intersection", etc. Experience dates should cover the time specified in the applicable MPR(s). |
|---|---|
| 01/2003-Present | Narasimhan performs Project Management of highway data analysis road data parameters & features for road condition data for UK, Australia & North America.<br>**Narasimhan provided project Management for Road Asset Extractions from video and lidar data for the following Fugro projects:** |
| 12/2004-Present | Louisiana Department of Transportation and Development (LADOTD) – Pavement Distress Data Collection Statewide – 2004- 2022. Annual collection, processing and delivery of roadway condition data including longitudinal profile and IRI, |

| | |
|---|---|
| | rutting, surface distress, texture, geometrics, pavement and HD ROW images, Global Positioning System (GPS) and elevation data for 36,000 miles of highway network. Contract also includes GPR data and analysis, coring, friction (skid) testing, and asset inventory for 35,000 miles including Highway Performance Monitoring System (HPMS) data items. Additionally, Fugro collected ROW images, GPS and roadside assets for 120,000 miles of local roads throughout the State of Louisiana. Fugro provides iVision5 hosting for access to the data and images. |
| 01/2017-Present | Alaska Department of Transportation & Public Facilities (ADOT & PF) – Highway Data Collection – 2017-Present – Annual collection, processing and delivery of roadway condition data including IRI, rutting, surface distress, geometry, pavement and HD ROW images for 5,600 miles of road network. Fugro developed and built a 4 x 4 Automatic Road Analyzer (ARAN) in order to meet the demands of performing data collection over Alaska's very diverse, challenging terrain. Optional items for the project include asset inventory, pavement engineering, friction testing, Falling Weight Deflectometer (FWD), coring and GPR. |
| 01/2017-12/2022 | Arizona Department of Transportation (ADOT) – Transportation Consulting, Geospatial Roadway Data Collection and Inventory – 2017-2022 – Annual collection, processing and delivery of roadway condition data including roughness, transverse profile and rutting, faulting, surface distress, pavement and HD ROW images, and Global Positioning System (GPS) data for 15,000 miles of highway network. Project also includes the collection of roadway assets and lidar data. Fugro's provides iVision5 hosting services for access to the data and images. |
| 01/2020-Present | California Department of Transportation (Caltrans) – Automated Pavement Condition Survey – 2009-2011, 2020– Present. Annual collection, processing and delivery of global referencing data, longitudinal profile and IRI, rutting, surface distress, pavement and HD ROW images, and asset extraction for approximately 120,000 miles. During the project, Fugro worked with Caltrans to develop a new project-specific distress manual, and in the transition to the use of 3D technology for surface distress. Data was formatted for use within Caltrans' PaveM Pavement Management System (PMS), and PaveM was integrated with Fugro's web-based iVision5 software. |
| 01/2018-Present | New Mexico Department of Transportation (NMDOT) – Pavement Condition Data Collection – 2018-Present - Annual collection, processing and delivery of roadway condition data including roughness, rutting, surface distress, faulting, GPS and Linear Referencing System (LRS), pavement and HD ROW images for 12,700 miles of highway network. |
| 01/1998-12/2002 | IT Project Management<br><br>Management of IT projects using large databases |

| | | | | |
|---|---|---|---|---|
| Firm employed by Data Collection Infotech (India) Private Limited | | | | |
| Name | Pratap Ramkrishana Yadav | | Years of relevant experience with this employer | 17 |
| Title | Project Manager | | Years of relevant experience with other employer(s) | 3 |
| Degree(s) / Years / Specialization | | | B.E (Mechanical Engineering) | |
| Active registration number / state / expiration date | | | | |
| Year registered | | Discipline | | |
| Contract role(s) / brief description of responsibilities | | | Advanced Technical Skills and Knowledge Areas:<br>Good Knowledge of ESRI Suite Software and MapInfo Suite of GIS Software<br>12+ years experience in Automated Distress analysis and Highway defect management.<br>5+ years experience people management QA,QC process, with various methods.<br>2+ years experience in SQL Server database administration. | |

| Experience dates (mm/yy–mm/yy) | Experience and qualifications relevant to the proposed contract; *i.e.*, "designed drainage", "designed girders", "designed intersection", etc. Experience dates should cover the time specified in the applicable MPR(s). |
|---|---|
| 01/2006-Present | As a Project Manager Pratap worked on prestigious highway Distress management projects like Virginia, Louisiana, British Columbia, Mississippi, FHWA & Abu Dhabi Road This included defect collection and analysis of various surface types and event collection. Pratap worked on ASTM standards for Defect capture and analysis.<br>**Pratap provided project Management for the following Fugro projects:** |
| 12/2004-Present | Louisiana Department of Transportation and Development (LADOTD) – Pavement Distress Data Collection Statewide – 2004- 2022. Annual collection, processing and delivery of roadway condition data including longitudinal profile and IRI, rutting, surface distress, texture, geometrics, pavement and HD ROW images, Global Positioning System (GPS) and elevation data for 36,000 miles of highway network. Contract also includes GPR data and analysis, coring, friction (skid) |

| | |
|---|---|
| | testing, and asset inventory for 35,000 miles including Highway Performance Monitoring System (HPMS) data items. Additionally, Fugro collected ROW images, GPS and roadside assets for 120,000 miles of local roads throughout the State of Louisiana. Fugro provides iVision5 hosting for access to the data and images. |
| 03/2012-Present | Virginia Department of Transportation (VDOT) – Pavement Data & Evaluation Services – 2012-Present – Annual collection, processing and delivery of roadway condition data including longitudinal profile and International Roughness Index (IRI), transverse profile and rutting, faulting, surface distress, pavement and High Definition (HD) right-of-way (ROW) images for 29,000 miles of highway network. Fugro also delivered 1.2 million roadway assets, as well as Ground Penetrating Radar (GPR) data and analysis. Fugro provides iVision hosting services for the data and images, and successfully migrated over 25 TB of historical data from VDOT's servers. Also, Fugro supported VDOT in the transition to the use of 3D technology by conducting several pilot projects to ensure historical data integrity. |
| 02/2019-Present | Pennsylvania Department of Transportation (PennDOT) – Automated Data Collection, Inventory, and Analysis of Pavement Distress – 2019-Present – Annual collection, processing and delivery of roadway condition data including roughness, rutting, surface distress, geometrics, pavement and High Definition (HD) right-of-way (ROW) images for 28, 500 miles of highway network, and 1,950 miles of local roads. Fugro has also provided project-level Ground Penetrating Radar (GPR) when requested. Fugro provides iVision hosting services for access to the data and images. |
| 01/2017- Present | New York State Department of Transportation (NYSDOT) – Pavement Condition Data Collection Services – 2017 - Present - Annual collection, processing and delivery of roadway condition data including IRI, rutting, faulting, geometrics, HD ROW images for 26,500 miles of highway network. Project also includes 19,800 miles of asset inventory; over five million assets inventoried. Fugro's provides iVision hosting services for access to the data and images. NYSDOT also has their own ARAN used for quality review of the data and images received from Fugro, and for project-level testing. |
| 01/2008-12/2017 | Federal Highway Administration (FHWA) - LTPP Project – 2008-2017 - FHWA LTPP Project consists of pavement performance monitoring and data collection along selected sites across US for pavement research. Fugro provided the data collection, quality control, and data management of the test sites in the southern region (12 states) under this contract. |

<table>
<tr><td colspan="6">Firm employed by Data Collection Infotech (India) Private Limited</td></tr>
<tr><td>Name</td><td colspan="2">Ramaswamy</td><td colspan="2">Years of relevant experience with this employer</td><td>3</td></tr>
<tr><td>Title</td><td colspan="2">Asset Project Manager</td><td colspan="2">Years of relevant experience with other employer(s)</td><td>19</td></tr>
<tr><td colspan="3">Degree(s) / Years / Specialization</td><td colspan="3">B.E</td></tr>
<tr><td colspan="3">Active registration number / state / expiration date</td><td colspan="3"></td></tr>
<tr><td>Year registered</td><td></td><td>Discipline</td><td colspan="3"></td></tr>
<tr><td colspan="3">Contract role(s) / brief description of responsibilities</td><td colspan="3">Advanced Technical Skills and Knowledge Areas:<br>Knowledge of ESRI Suite Software and MapInfo Suite of GIS Software<br>20+ years experience in Photogrammetric mapping, GIS, Lidar Technologies<br>10+ years experience in managing databases based projects<br>7+ years experience in Project Professional Management.</td></tr>
<tr><td>Experience dates (mm/yy–mm/yy)</td><td colspan="5">Experience and qualifications relevant to the proposed contract; i.e., “designed drainage”, “designed girders”, “designed intersection”, etc. Experience dates should cover the time specified in the applicable MPR(s).</td></tr>
<tr><td></td><td colspan="5">Ramaswamy works on state DOT asset extraction projects for Fugro performing project management of various lidar projects for feature extraction, classification and mobile mapping and project Management of Roames Powerline projects<br>Ramaswamy provided project Management for the following Fugro projects:</td></tr>
<tr><td>12/2004-Present</td><td colspan="5">Louisiana Department of Transportation and Development (LADOTD) – Pavement Distress Data Collection Statewide – 2004- 2022. Annual collection, processing and delivery of roadway condition data including longitudinal profile and IRI, rutting, surface distress, texture, geometrics, pavement and HD ROW images, Global Positioning System (GPS) and elevation data for 36,000 miles of highway network. Contract also includes GPR data and analysis, coring, friction (skid) testing, and asset inventory for 35,000 miles including Highway Performance Monitoring System (HPMS) data items.</td></tr>
</table>

| | |
|---|---|
| | Additionally, Fugro collected ROW images, GPS and roadside assets for 120,000 miles of local roads throughout the State of Louisiana. Fugro provides iVision5 hosting for access to the data and images. |
| 01/2017- Present | New York State Department of Transportation (NYSDOT) – Pavement Condition Data Collection Services – 2017 - Present - Annual collection, processing and delivery of roadway condition data including IRI, rutting, faulting, geometrics, HD ROW images for 26,500 miles of highway network. Project also includes 22,000 miles of GPR collection and analysis, and 22,000 miles of asset inventory; over five million assets inventoried. Fugro's provides iVision hosting services for access to the data and images. NYSDOT also has their own ARAN used for quality review of the data and images received from Fugro, and for project-level testing. |
| 01/2017-Present | Vermont Agency of Transportation (Vtrans) – Transportation Consulting, Geospatial Roadway Data Collection and Inventory – 2017 – Present. Annual collection, processing and delivery of roadway condition data including IRI, rutting, surface distress, texture, pavement and HD ROW images for 7,100 lane miles of highway network. Fugro's provides iVision hosting services for access to the data and images. |
| 01/2017-12/2022 | Arizona Department of Transportation (ADOT) – Transportation Consulting, Geospatial Roadway Data Collection and Inventory – 2017-2022 – Annual collection, processing and delivery of roadway condition data including roughness, transverse profile and rutting, faulting, surface distress, pavement and HD ROW images, and Global Positioning System (GPS) data for 15,000 miles of highway network. Project also includes the collection of roadway assets and lidar data. Fugro's provides iVision5 hosting services for access to the data and images. |
| 01/2020-Present | California Department of Transportation (Caltrans) – Automated Pavement Condition Survey – 2009-2011, 2020– Present. Annual collection, processing and delivery of global referencing data, longitudinal profile and IRI, rutting, surface distress, pavement and HD ROW images, and asset extraction for approximately 120,000 miles. During the project, Fugro worked with Caltrans to develop a new project-specific distress manual, and in the transition to the use of 3D technology for surface distress. Data was formatted for use within Caltrans' PaveM Pavement Management System (PMS), and PaveM was integrated with Fugro's web-based iVision5 software. |
| 01/2018-Present | New Mexico Department of Transportation (NMDOT) – Pavement Condition Data Collection – 2018-Present - Annual collection, processing and delivery of roadway condition data including roughness, rutting, surface distress, faulting, GPS and Linear Referencing System (LRS), pavement and HD ROW images for 12,700 miles of highway network. |

| | | | | |
|---|---|---|---|---|
| Firm employed by Fugro | | | | |
| Name | Eric Marx | | Years of relevant experience with this employer | 21 |
| Title | Principal Engineer, Vice President, Louisiana General Manager | | Years of relevant experience with other employer(s) | 3 |
| Degree(s) / Years / Specialization | | | MS / 2001 / Civil Engineering<br>BS / 1999 / Civil Engineering | |
| Active registration number / state / expiration date | | | Professional Engineer, LA, No. 31479, 3/31/2023 | |
| Year registered | | Discipline | | |
| Contract role(s) / brief description of responsibilities | | | Mr. Marx will provide engineering review and oversite of the program tasks. | |

| Experience dates (mm/yy–mm/yy) | Experience and qualifications relevant to the proposed contract; *i.e.*, "designed drainage", "designed girders", "designed intersection", etc. Experience dates should cover the time specified in the applicable MPR(s). |
|---|---|
| 05/01 – current | Principal-in-Charge, Fugro Louisiana General Manager. Eric Marx has provided geotechnical services on transportation, government, industrial, commercial and coastal infrastructure projects since joining Fugro in 2001. He has been both engineer and engineer-of-record on some of Louisiana's high-profile transportation projects over the last 20 years, including the I-10 Twin Span Replacement Project, John J. Audubon Bridge, and numerous task orders, as part of previous retainer contracts. Eric's role has involved managing and executing task orders, developing and overseeing field programs, achieving and maintaining laboratory certifications and performing and reviewing geotechnical engineering analyses. Many of the projects have required access in difficult site conditions and required advanced engineering evaluation. |
| 01/10 – 03/17<br>08/20 - Current | LADOTD Statewide Geotechnical Retainer Contract, Louisiana. Mr. Marx served as principal-in charge for this program which included performing over 20 task orders for bridge structures across Louisiana with a total program cost of over $4M. The scope of work included soil borings (on land and in water), cone penetration test (CPT), laboratory testing, engineering analysis, and design recommendations. Fugro was also retained to install geotechnical instrumentation. Mr. Marx was Principal-in-Charge, negotiated and oversaw completion of task orders, and worked with DOTD to ensure client satisfaction on deliverables. |

| | |
|---|---|
| 04/04 – 04/19 | Bridge Scour Analysis, Statewide Louisiana. Mr. Marx served as project engineer, project manager and is currently principal-in-charge for the project. Fugro was selected by the Louisiana Department of Transportation and Development (LADOTD), with the assistance of selected Design Consultants, in evaluating the stability of critical bridge structures across the state regarding scour susceptibility. Since 2004, Mr. Marx has supervised evaluations on over 300 bridges across Louisiana including coordination of geotechnical field investigations, laboratory testing, and Electric Cone Penetrometer Test (ECPT) soundings. Geotechnical engineering analyses included deep foundation evaluations on driven piles, drilled shafts and caissons for varying scour events and development of soil parameters. |
| 09/17 – 04/21 | Kansas Lane, Garrett Road Connector. Mr. Marx was Principal-In-Charge for Fugro and provided contract oversight for the project. Work included conducting geotechnical field investigations and geotechnical analyses for the roadway project with significant interaction with the local airport and businesses. Mr. Marx reviewed results of field and laboratory analyses and performed QA checks on deep foundation calculations, embankment settlement calculations of driven and drilled foundations and MSE Wall recommendations. |
| 04/13 – current | Ambassador Caffery Interchange. Mr. Marx was Principal-In-Charge for Fugro and provided contract oversight for the project. Work included conducting geotechnical field investigations and geotechnical analyses for the roadway project. Mr. Marx reviewed results of field and laboratory analyses and performed QA checks on deep foundation calculations, embankment settlement calculations of driven and drilled foundations and MSE Wall recommendations. |
| 03/15-08/19 | Livingston Parish Road Improvement Program, Livingston Parish, LA Mr. Marx Served as Principal-In-Charge. Livingston Parish funded this project to rehabilitate approximately 40 roads across the parish each year. Fugro's work included soil borings and collection of bulk samples, laboratory testing for classification and bench scale testing for cement treatment, engineering recommendations for pavement thickness and subgrade preparation, and construction materials testing observations to document compliance with plans and specifications Mr. Marx oversaw the field operations and engineering analyses. |
| 04/05-02/08 | Twin Spans Replacement Project, Orleans and St. Tammany Parishes, Louisiana. Mr. Marx was a Project Engineer on the project to replace the Twin Spans bridge damaged during Hurricane Katrina. Mr. Marx coordinated the field program which consisted of 30 soil borings and over 260 CPT's to depths between 100 and 190 feet in 15 feet of water. Mr. Marx helped develop the pile load testing program and performed axial and lateral pile capacity calculations using LRFD methodology. |

<table>
<tr><td colspan="5">Firm employed by Fugro</td></tr>
<tr><td>Name</td><td colspan="2">Cory Hackbart</td><td>Years of relevant experience with this employer</td><td>28</td></tr>
<tr><td>Title</td><td colspan="2">Project Manager</td><td>Years of relevant experience with other employer(s)</td><td>5</td></tr>
<tr><td colspan="3">Degree(s) / Years / Specialization</td><td colspan="2">Microsoft Project Management Training & Applied Project Management Certification Training | 20/20 Business Insight Ltd | 2014<br>Project Management: Applied Tools & Techniques | Fugro Academy | 2010<br>Civil Engineering Technology Program | University of Waterloo | 2001<br>Project Management Institute | Conestoga College | 1993</td></tr>
<tr><td colspan="3">Active registration number / state / expiration date</td><td colspan="2"></td></tr>
<tr><td>Year registered</td><td></td><td>Discipline</td><td colspan="2"></td></tr>
<tr><td colspan="3">Contract role(s) / brief description of responsibilities</td><td colspan="2">As the Project Manager, Mr. Hackbart will plan, set up and manage the Louisiana project from beginning to end. Through all phases of the project, he will serve as the primary point of contact, and will be responsible for communication and coordination for all parties. He will be monitoring the project costs and schedule, and will responsible for developing the project charter and detailed management plans. Mr. Hackbart will also be responsible for ensuring that Fugro’s Quality Management System is fully implemented for the project.</td></tr>
<tr><td>Experience dates (mm/yy–mm/yy)</td><td colspan="4">Experience and qualifications relevant to the proposed contract; i.e., “designed drainage”, “designed girders”, “designed intersection”, etc. Experience dates should cover the time specified in the applicable MPR(s).</td></tr>
<tr><td>05/1994-Present</td><td colspan="4">Mr. Hackbart is a Senior Project Manager and currently leads State and local data collection projects including the Louisiana, New York State, Vermont Agency, Region of Peel, and Region of Waterloo.. He directs project teams to meet expectations for costs, quality and on-time deliveries. Furthermore, he ensures that project management practices are adhered to and adopted throughout the company, including assisting with developing Project Standards, Methodologies, and Procedures. He brings a wealth of experience in managing high-level projects and has the ability to translate between user needs and technical solutions and vice versa.<br>Mr. Hackbart has performed these tasks for the following Fugro Projects:</td></tr>
</table>

| | |
|---|---|
| 12/2004-Present | Louisiana Department of Transportation and Development (LADOTD) – Pavement Distress Data Collection Statewide – 2004- 2022. Annual collection, processing and delivery of roadway condition data including longitudinal profile and IRI, rutting, surface distress, texture, geometrics, pavement and HD ROW images, Global Positioning System (GPS) and elevation data for 36,000 miles of highway network. Contract also includes GPR data and analysis, coring, friction (skid) testing, and asset inventory for 35,000 miles including Highway Performance Monitoring System (HPMS) data items. Additionally, Fugro collected ROW images, GPS and roadside assets for 120,000 miles of local roads throughout the State of Louisiana. Fugro provides iVision5 hosting for access to the data and images. |
| 01/2017-Present | Vermont Agency of Transportation (Vtrans) – Transportation Consulting, Geospatial Roadway Data Collection and Inventory – 2017 – Present. Annual collection, processing and delivery of roadway condition data including IRI, rutting, surface distress, texture, pavement and HD ROW images for 7,100 lane miles of highway network. Fugro's provides iVision hosting services for access to the data and images. |
| 02/2019-Present | Pennsylvania Department of Transportation (PennDOT) – Automated Data Collection, Inventory, and Analysis of Pavement Distress – 2019-Present – Annual collection, processing and delivery of roadway condition data including roughness, rutting, surface distress, geometrics, pavement and High Definition (HD) right-of-way (ROW) images for 28, 500 miles of highway network, and 1,950 miles of local roads. Fugro has also provided project-level Ground Penetrating Radar (GPR) when requested. Fugro provides iVision hosting services for access to the data and images. |
| 01/2017- Present | New York State Department of Transportation (NYSDOT) – Pavement Condition Data Collection Services – 2017 - Present - Annual collection, processing and delivery of roadway condition data including IRI, rutting, faulting, geometrics, HD ROW images for 26,500 miles of highway network. Project also includes 19,800 miles of asset inventory; over five million assets inventoried. Fugro's provides iVision hosting services for access to the data and images. NYSDOT also has their own ARAN used for quality review of the data and images received from Fugro, and for project-level testing. |

| | | | | |
|---|---|---|---|---|
| Firm employed by Fugro | | | | |
| Name | Lutrell Gordon | | Years of relevant experience with this employer | 10 |
| Title | Deputy Project Manager | | Years of relevant experience with other employer(s) | 5 |
| Degree(s) / Years / Specialization | | | 2011 – 2013 MBA, Project Management, Strayer University<br>2003 – 2007 B.Sc., Mechanical Design Engineering Technology, Norfolk State University | |
| Active registration number / state / expiration date | | | | |
| Year registered | | Discipline | | |
| Contract role(s) / brief description of responsibilities | | | In his current role as Director of Project Management & Operations, Mr. Gordon manages Fugro's team of Project Managers, and Operations Department including field data collection and processing. He continues to strengthen and improve the company's framework for managing data collection projects. Additionally, he works to standardize and streamline processes and procedures for data processing, analysis, quality, and delivery to clients. | |

| Experience dates (mm/yy–mm/yy) | Experience and qualifications relevant to the proposed contract; *i.e.*, "designed drainage", "designed girders", "designed intersection", etc. Experience dates should cover the time specified in the applicable MPR(s). |
|---|---|
| 01/2012-Present | Mr. Gordon offers a long history of successfully managing roadway condition data projects for state transportation agencies and municipalities.<br>**Mr. Gordon has performed these tasks for the following Fugro Projects:** |
| 12/2004-Present | Louisiana Department of Transportation and Development (LADOTD) – Pavement Distress Data Collection Statewide – 2004- 2022. Annual collection, processing and delivery of roadway condition data including longitudinal profile and IRI, rutting, surface distress, texture, geometrics, pavement and HD ROW images, Global Positioning System (GPS) and elevation data for 36,000 miles of highway network. Contract also includes GPR data and analysis, coring, friction (skid) testing, and asset inventory for 35,000 miles including Highway Performance Monitoring System (HPMS) data items. |

| | |
|---|---|
| | Additionally, Fugro collected ROW images, GPS and roadside assets for 120,000 miles of local roads throughout the State of Louisiana. Fugro provides iVision5 hosting for access to the data and images. |
| 03/2012-12/2018 | Michigan Department of Transportation (MDOT) – Network Level Semi-Automated Pavement Surface Condition Surveys – 2012 - 2018– Collection, processing and delivery of roadway condition data including IRI, rutting, faulting, surface distress, texture, geometrics, pavement and HD ROW images for 11,000 lane miles. Project also included the delivery of pavement marking retroreflectivity and asset inventory for all roadway signs. Fugro provided iVision hosting services. Mr. Gordon served as Project Manager and then Deputy Project Manager. He was responsible for coordination and management of project-related activities. As Deputy Project Manager, he provided guidance and advice to ensure that the project was managed according to Fugro's professional project management methodology. |
| 03/2012-Present | Virginia Department of Transportation (VDOT) – Pavement Data & Evaluation Services – 2012-Present – Annual collection, processing and delivery of roadway condition data including longitudinal profile and International Roughness Index (IRI), transverse profile and rutting, faulting, surface distress, pavement and High Definition (HD) right-of-way (ROW) images for 29,000 miles of highway network. Fugro also delivered 1.2 million roadway assets, as well as Ground Penetrating Radar (GPR) data and analysis. Fugro provides iVision hosting services for the data and images, and successfully migrated over 25 TB of historical data from VDOT's servers. Also, Fugro supported VDOT in the transition to the use of 3D technology by conducting several pilot projects to ensure historical data integrity. |
| 02/2019-Present | Pennsylvania Department of Transportation (PennDOT) – Automated Data Collection, Inventory, and Analysis of Pavement Distress – 2019-Present – Annual collection, processing and delivery of roadway condition data including roughness, rutting, surface distress, geometrics, pavement and High Definition (HD) right-of-way (ROW) images for 28, 500 miles of highway network, and 1,950 miles of local roads. Fugro has also provided project-level Ground Penetrating Radar (GPR) when requested. Fugro provides iVision hosting services for access to the data and images. |
| 01/2017-Present | Vermont Agency of Transportation (Vtrans) – Transportation Consulting, Geospatial Roadway Data Collection and Inventory – 2017 – Present. Annual collection, processing and delivery of roadway condition data including IRI, rutting, surface distress, texture, pavement and HD ROW images for 7,100 lane miles of highway network. Fugro's provides iVision hosting services for access to the data and images. |

| | | | |
|---|---|---|---|
| Firm employed by Fugro | | | |
| Name | Wayne Billingsley | Years of relevant experience with this employer | 9 |
| Title | Field Operations Supervisor | Years of relevant experience with other employer(s) | 25 |

| | | | |
|---|---|---|---|
| Degree(s) / Years / Specialization | | | Certifications in Break Concrete Cylinders, Hot Mix Paving Inspection, and Laser Safety Officer. Training on sub grade and base, storm water protection and environmental issues for construction projects. Project Management training as well. |
| Active registration number / state / expiration date | | | |
| Year registered | | Discipline | |
| Contract role(s) / brief description of responsibilities | | | Field data collection coordination and management; specifically for skid (friction) testing. |

| Experience dates (mm/yy–mm/yy) | Experience and qualifications relevant to the proposed contract; *i.e.*, "designed drainage", "designed girders", "designed intersection", etc. Experience dates should cover the time specified in the applicable MPR(s). |
|---|---|
| 02/2013-Present | Mr. Billingsley is an Operations Manager for Fugro in Austin, Texas. Mr. Billingsley has provided significant support for the collection of friction testing and coring data for the previous Louisiana contract. He inspects field operation projects for completeness, quality, and compliance with mandated standards. He also ensures safety standards and procedures are implemented and adhered to. He is currently managing all field operations for the Southern Region Support Contract of the FHWA Long-Term Pavement Performance (LTPP) program. His current duties include the following:<br>Oversee data collection activities and personnel<br>Oversee the maintenance and calibration of all field related equipment and vehicles<br>Assist engineers and staff as needed<br>Operates pavement surface friction measurement equipment (skid trailer)<br>Operates automated distress vehicles to collect pavement surface distress, texture, longitudinal and transverse profile<br>Collects pavement elevation measurements to determine layer thickness and subsurface material properties<br>Serves as drillers helper |

| | |
|---|---|
| | Operates pavement coring rig and shallow Geotech<br><br>**Mr. Billingsley has performed these tasks for the following Fugro Projects:** |
| 12/2004-Present | Louisiana Department of Transportation and Development (LADOTD) – Pavement Distress Data Collection Statewide – 2004- 2022. Annual collection, processing and delivery of roadway condition data including longitudinal profile and IRI, rutting, surface distress, texture, geometrics, pavement and HD ROW images, Global Positioning System (GPS) and elevation data for 36,000 miles of highway network. Contract also includes GPR data and analysis, coring, friction (skid) testing, and asset inventory for 35,000 miles including Highway Performance Monitoring System (HPMS) data items. Additionally, Fugro collected ROW images, GPS and roadside assets for 120,000 miles of local roads throughout the State of Louisiana. Fugro provides iVision5 hosting for access to the data and images. |
| 03/2012-Present | Virginia Department of Transportation (VDOT) – Pavement Data & Evaluation Services – 2012-Present – Annual collection, processing and delivery of roadway condition data including longitudinal profile and International Roughness Index (IRI), transverse profile and rutting, faulting, surface distress, pavement and High Definition (HD) right-of-way (ROW) images for 29,000 miles of highway network. Fugro also delivered 1.2 million roadway assets, as well as Ground Penetrating Radar (GPR) data and analysis. Fugro provides iVision hosting services for the data and images, and successfully migrated over 25 TB of historical data from VDOT's servers. Also, Fugro supported VDOT in the transition to the use of 3D technology by conducting several pilot projects to ensure historical data integrity. |
| 02/2019-Present | Pennsylvania Department of Transportation (PennDOT) – Automated Data Collection, Inventory, and Analysis of Pavement Distress – 2019-Present – Annual collection, processing and delivery of roadway condition data including roughness, rutting, surface distress, geometrics, pavement and High Definition (HD) right-of-way (ROW) images for 28, 500 miles of highway network, and 1,950 miles of local roads. Fugro has also provided project-level Ground Penetrating Radar (GPR) when requested. Fugro provides iVision hosting services for access to the data and images. |
| 01/2017- Present | New York State Department of Transportation (NYSDOT) – Pavement Condition Data Collection Services – 2017 - Present - Annual collection, processing and delivery of roadway condition data including IRI, rutting, faulting, geometrics, HD ROW images for 26,500 miles of highway network. Project also includes 19,800 miles of asset inventory; over five million assets inventoried. Fugro's provides iVision hosting services for access to the data and images. NYSDOT also has their own ARAN used for quality review of the data and images received from Fugro, and for project-level testing. |

| | | | | |
|---|---|---|---|---|
| Firm employed by Fugro | | | | |
| Name | John Brooks | | Years of relevant experience with this employer | 11 |
| Title | Field Inspection Personnel | | Years of relevant experience with other employer(s) | 6 |
| Degree(s) / Years / Specialization | | | 2004 – J. Sergeant Reynolds Community College, Computer Networking Hardware Studies<br>1982 – James Monroe High School, General Equivalency Degree (GED) | |
| Active registration number / state / expiration date | | | | |
| Year registered | | Discipline | | |
| Contract role(s) / brief description of responsibilities | | | Mr. John Brooks has the critical knowledge to efficiently navigate any challenges of road networks. Mr. John Brooks started at Fugro in 2011 as a Field Supervisor. He offers a strong technical skillset, punctuated by the ability to quickly remedy issues contributing to ARAN performance including the daily quality checks, calibrations, and diagnostics ensuring that data collection adheres to Fugro's quality standards and the client's quality standards. | |
| Experience dates (mm/yy–mm/yy) | Experience and qualifications relevant to the proposed contract; *i.e.*, "designed drainage", "designed girders", "designed intersection", etc. Experience dates should cover the time specified in the applicable MPR(s). | | | |
| | A skilled supervisor to the ARAN operation crew, he manages many statewide pavement data collection projects across North America. Along with this, he also manages ARAN performance checks including the daily quality assurance measures, calibrations, and diagnostics.<br><br>**Mr. Brooks has performed the tasks associated with field personnel management and quality control for the following Fugro Projects:** | | | |
| 12/2004-Present | Louisiana Department of Transportation and Development (LADOTD) – Pavement Distress Data Collection Statewide – 2004- 2022. Annual collection, processing and delivery of roadway condition data including longitudinal profile and IRI, rutting, surface distress, texture, geometrics, pavement and HD ROW images, Global Positioning System (GPS) and elevation data for 36,000 miles of highway network. Contract also includes GPR data and analysis, coring, friction (skid) | | | |

| | |
|---|---|
| | testing, and asset inventory for 35,000 miles including Highway Performance Monitoring System (HPMS) data items. Additionally, Fugro collected ROW images, GPS and roadside assets for 120,000 miles of local roads throughout the State of Louisiana. Fugro provides iVision5 hosting for access to the data and images. |
| 01/2017-Present | Vermont Agency of Transportation (Vtrans) – Transportation Consulting, Geospatial Roadway Data Collection and Inventory – 2017 – Present. Annual collection, processing and delivery of roadway condition data including IRI, rutting, surface distress, texture, pavement and HD ROW images for 7,100 lane miles of highway network. Fugro's provides iVision hosting services for access to the data and images. |
| 01/2017-12/2022 | Arizona Department of Transportation (ADOT) – Transportation Consulting, Geospatial Roadway Data Collection and Inventory – 2017-2022 – Annual collection, processing and delivery of roadway condition data including roughness, transverse profile and rutting, faulting, surface distress, pavement and HD ROW images, and Global Positioning System (GPS) data for 15,000 miles of highway network. Project also includes the collection of roadway assets and lidar data. Fugro's provides iVision5 hosting services for access to the data and images. |
| 02/2019-Present | Pennsylvania Department of Transportation (PennDOT) – Automated Data Collection, Inventory, and Analysis of Pavement Distress – 2019-Present – Annual collection, processing and delivery of roadway condition data including roughness, rutting, surface distress, geometrics, pavement and High Definition (HD) right-of-way (ROW) images for 28, 500 miles of highway network, and 1,950 miles of local roads. Fugro has also provided project-level Ground Penetrating Radar (GPR) when requested. Fugro provides iVision hosting services for access to the data and images. |
| 01/2017- Present | New York State Department of Transportation (NYSDOT) – Pavement Condition Data Collection Services – 2017 - Present - Annual collection, processing and delivery of roadway condition data including IRI, rutting, faulting, geometrics, HD ROW images for 26,500 miles of highway network. Project also includes 19,800 miles of asset inventory; over five million assets inventoried. Fugro's provides iVision hosting services for access to the data and images. NYSDOT also has their own ARAN used for quality review of the data and images received from Fugro, and for project-level testing. |

| | | | | |
|---|---|---|---|---|
| Firm employed by Fugro | | | | |
| Name | Allan Versaevel | | Years of relevant experience with this employer | 17 |
| Title | Fleet Support | | Years of relevant experience with other employer(s) | 13 |
| Degree(s) / Years / Specialization | | | 1992 Network Engineer Diploma, triOS College of Information Technology with Major in MCSA and MCSE, and Minor in A+, Net+, MCP, CNA, UNIX and Cisco | |
| Active registration number / state / expiration date | | | | |
| Year registered | | Discipline | | |
| Contract role(s) / brief description of responsibilities | | | Mr. Versaevel has been successful in overseeing Fugro's Fleet Support Team. His vast skillset includes technical expertise on all facets of Fugro's Automatic Road Analyzer (ARAN), as well as intuitive relationship building strengths needed to continuously motivate and encourage staff. He also served in the role of a Field Operations Technician for over three (3) years; providing him with an in-depth understanding of roadway condition data collection and quality review. | |

| | |
|---|---|
| Experience dates (mm/yy–mm/yy) | Experience and qualifications relevant to the proposed contract; *i.e.*, "designed drainage", "designed girders", "designed intersection", etc. Experience dates should cover the time specified in the applicable MPR(s). |
| | Responsible for managing and developing the skills of Fugro's Fleet Support Team; leading, training, and mentoring the team. He manages the timelines for Fugro's data collection projects, and for the performance management including setting targets. Mr. Versaevel collaborates with Fugro's engineers and software developers to recommend changes to hardware/software to improve reliability and collection, provides email and telephone support to Operations staff, and helps repair and maintain field operations equipment inventory and spare parts. He also supports the introduction/development of new products and creates and maintains a database for handling ARAN preventative maintenance forecasting and fleet parts.<br><br>**Mr. Versaevel has performed these tasks for the following Fugro Projects:** |
| 12/2004-Present | Louisiana Department of Transportation and Development (LADOTD) – Pavement Distress Data Collection Statewide – 2004- 2022. Annual collection, processing and delivery of roadway condition data including longitudinal profile and IRI, |

| | |
|---|---|
| | rutting, surface distress, texture, geometrics, pavement and HD ROW images, Global Positioning System (GPS) and elevation data for 36,000 miles of highway network. Contract also includes GPR data and analysis, coring, friction (skid) testing, and asset inventory for 35,000 miles including Highway Performance Monitoring System (HPMS) data items. Additionally, Fugro collected ROW images, GPS and roadside assets for 120,000 miles of local roads throughout the State of Louisiana. Fugro provides iVision5 hosting for access to the data and images. |
| 03/2012-Present | Virginia Department of Transportation (VDOT) – Pavement Data & Evaluation Services – 2012-Present – Annual collection, processing and delivery of roadway condition data including longitudinal profile and International Roughness Index (IRI), transverse profile and rutting, faulting, surface distress, pavement and High Definition (HD) right-of-way (ROW) images for 29,000 miles of highway network. Fugro also delivered 1.2 million roadway assets, as well as Ground Penetrating Radar (GPR) data and analysis. Fugro provides iVision hosting services for the data and images, and successfully migrated over 25 TB of historical data from VDOT's servers. Also, Fugro supported VDOT in the transition to the use of 3D technology by conducting several pilot projects to ensure historical data integrity. |
| 02/2019-Present | Pennsylvania Department of Transportation (PennDOT) – Automated Data Collection, Inventory, and Analysis of Pavement Distress – 2019-Present – Annual collection, processing and delivery of roadway condition data including roughness, rutting, surface distress, geometrics, pavement and High Definition (HD) right-of-way (ROW) images for 28, 500 miles of highway network, and 1,950 miles of local roads. Fugro has also provided project-level Ground Penetrating Radar (GPR) when requested. Fugro provides iVision hosting services for access to the data and images. |
| 01/2017- Present | New York State Department of Transportation (NYSDOT) – Pavement Condition Data Collection Services – 2017 - Present - Annual collection, processing and delivery of roadway condition data including IRI, rutting, faulting, geometrics, HD ROW images for 26,500 miles of highway network. Project also includes 19,800 miles of asset inventory; over five million assets inventoried. Fugro's provides iVision hosting services for access to the data and images. NYSDOT also has their own ARAN used for quality review of the data and images received from Fugro, and for project-level testing. |

| | | | | |
|---|---|---|---|---|
| Firm employed by Fugro | | | | |
| Name | David Hunter | | Years of relevant experience with this employer | 12 |
| Title | Data Processing Manager | | Years of relevant experience with other employer(s) | 9 |
| Degree(s) / Years / Specialization | | | 2005 – 2009 Advanced Certification in Geographic Information Systems (GIS) MCMaster University | |
| Active registration number / state / expiration date | | | | |
| Year registered | | Discipline | | |
| Contract role(s) / brief description of responsibilities | | | Mr. David Hunter brings over 10 years of industry experience to our team offering an exceptionally diverse set of skills that are focused on the successful delivery of data. He possesses expert-level programming skills and is responsible for our quality assurance routines. David is very knowledgeable on setting in-place analysis, quality verification, and trend tools to ensure the delivered data will stand the reasonableness test. Combining his ten years of experience with data, he also has direct experience on the previous CRPC contract. | |

| | |
|---|---|
| Experience dates (mm/yy–mm/yy) | Experience and qualifications relevant to the proposed contract; *i.e.*, "designed drainage", "designed girders", "designed intersection", etc. Experience dates should cover the time specified in the applicable MPR(s). |
| | **Mr. Hunter has performed data processing tasks and provided management for the following Fugro Projects:** |
| 12/2004-Present | Louisiana Department of Transportation and Development (LADOTD) – Pavement Distress Data Collection Statewide – 2004- 2022. Annual collection, processing and delivery of roadway condition data including longitudinal profile and IRI, rutting, surface distress, texture, geometrics, pavement and HD ROW images, Global Positioning System (GPS) and elevation data for 36,000 miles of highway network. Contract also includes GPR data and analysis, coring, friction (skid) testing, and asset inventory for 35,000 miles including Highway Performance Monitoring System (HPMS) data items. Additionally, Fugro collected ROW images, GPS and roadside assets for 120,000 miles of local roads throughout the State of Louisiana. Fugro provides iVision5 hosting for access to the data and images. |

| | |
|---|---|
| 01/2017-Present | Alaska Department of Transportation & Public Facilities (ADOT & PF) – Highway Data Collection – 2017-Present – Annual collection, processing and delivery of roadway condition data including IRI, rutting, surface distress, geometry, pavement and HD ROW images for 5,600 miles of road network. Fugro developed and built a 4 x 4 Automatic Road Analyzer (ARAN) in order to meet the demands of performing data collection over Alaska's very diverse, challenging terrain. Optional items for the project include asset inventory, pavement engineering, friction testing, Falling Weight Deflectometer (FWD), coring and GPR. |
| 01/2017-12/2022 | Arizona Department of Transportation (ADOT) – Transportation Consulting, Geospatial Roadway Data Collection and Inventory – 2017-2022 – Annual collection, processing and delivery of roadway condition data including roughness, transverse profile and rutting, faulting, surface distress, pavement and HD ROW images, and Global Positioning System (GPS) data for 15,000 miles of highway network. Project also includes the collection of roadway assets and lidar data. Fugro's provides iVision5 hosting services for access to the data and images. |
| 01/2020-Present | California Department of Transportation (Caltrans) – Automated Pavement Condition Survey – 2009-2011, 2020– Present. Annual collection, processing and delivery of global referencing data, longitudinal profile and IRI, rutting, surface distress, pavement and HD ROW images, and asset extraction for approximately 120,000 miles. During the project, Fugro worked with Caltrans to develop a new project-specific distress manual, and in the transition to the use of 3D technology for surface distress. Data was formatted for use within Caltrans' PaveM Pavement Management System (PMS), and PaveM was integrated with Fugro's web-based iVision5 software. |
| 01/2018-Present | New Mexico Department of Transportation (NMDOT) – Pavement Condition Data Collection – 2018-Present - Annual collection, processing and delivery of roadway condition data including roughness, rutting, surface distress, faulting, GPS and Linear Referencing System (LRS), pavement and HD ROW images for 12,700 miles of highway network. |

<table>
<tr><td colspan="5">Firm employed by Fugro</td></tr>
<tr><td>Name</td><td colspan="2">Suha Bsharat</td><td colspan="2">Years of relevant experience with this employer</td><td>7</td></tr>
<tr><td>Title</td><td colspan="2">Distress Rating Supervisor</td><td colspan="2">Years of relevant experience with other employer(s)</td><td>10</td></tr>
<tr><td colspan="3">Degree(s) / Years / Specialization</td><td colspan="3">2005 Bachelor of Science, Computer Engineering, Al-Quds University</td></tr>
<tr><td colspan="3">Active registration number / state / expiration date</td><td colspan="3"></td></tr>
<tr><td>Year registered</td><td></td><td>Discipline</td><td colspan="3"></td></tr>
<tr><td colspan="3">Contract role(s) / brief description of responsibilities</td><td colspan="3">Ms. Suha Bsharat offers more 5 years of experience with data processing, data analysis, computer engineering and database management. She has extensive technical, software application and Information Technology (IT) skills including SQL Server and Oracle, MS Access, ArcGIS, UNIX, and web design (Dreamweaver, Flash, Adobe Photoshop 2000). Additionally, she has a proven ability with data and process modelling and resolving data integrity issues while analyzing data using multiple databases. Ms. Bsharat has excellent oral and written communication skills.</td></tr>
<tr><td>Experience dates (mm/yy–mm/yy)</td><td colspan="5">Experience and qualifications relevant to the proposed contract; i.e., “designed drainage”, “designed girders”, “designed intersection”, etc. Experience dates should cover the time specified in the applicable MPR(s).</td></tr>
<tr><td></td><td colspan="5">As a Data Analyst, Ms. Bharat is responsible for analyzing and processing roadway condition data including surface distress and sensor data, as well as pavement and roadway imagery. She well-versed in Fugro’s Vision data processing software, Vision batch processors and SQL scripts. She applies her problem-solving skills to overcome any project challenges, liaises with clients, identifies opportunities for process improvement, reviews and recommends for changes to existing workflows, and communicates client/project needs with Fugro’s software engineers. Ms. Bharat performs quality control on the data, and delivers data to clients in a variety of formats including Access databases, ArcGIS geodatabases and shapefiles, CVS files and Fugro’s iVision5 web-based software.<br><br>Ms. Bsharat has performed distress rating tasks and provided management for the following Fugro Projects:</td></tr>
</table>

| | |
|---|---|
| 12/2004-Present | Louisiana Department of Transportation and Development (LADOTD) – Pavement Distress Data Collection Statewide – 2004- 2022. Annual collection, processing and delivery of roadway condition data including longitudinal profile and IRI, rutting, surface distress, texture, geometrics, pavement and HD ROW images, Global Positioning System (GPS) and elevation data for 36,000 miles of highway network. Contract also includes GPR data and analysis, coring, friction (skid) testing, and asset inventory for 35,000 miles including Highway Performance Monitoring System (HPMS) data items. Additionally, Fugro collected ROW images, GPS and roadside assets for 120,000 miles of local roads throughout the State of Louisiana. Fugro provides iVision5 hosting for access to the data and images. |
| 01/2017-Present | Vermont Agency of Transportation (Vtrans) – Transportation Consulting, Geospatial Roadway Data Collection and Inventory – 2017 – Present. Annual collection, processing and delivery of roadway condition data including IRI, rutting, surface distress, texture, pavement and HD ROW images for 7,100 lane miles of highway network. Fugro's provides iVision hosting services for access to the data and images. |
| 01/2017-12/2022 | Arizona Department of Transportation (ADOT) – Transportation Consulting, Geospatial Roadway Data Collection and Inventory – 2017-2022 – Annual collection, processing and delivery of roadway condition data including roughness, transverse profile and rutting, faulting, surface distress, pavement and HD ROW images, and Global Positioning System (GPS) data for 15,000 miles of highway network. Project also includes the collection of roadway assets and lidar data. Fugro's provides iVision5 hosting services for access to the data and images. |
| 02/2019-Present | Pennsylvania Department of Transportation (PennDOT) – Automated Data Collection, Inventory, and Analysis of Pavement Distress – 2019-Present – Annual collection, processing and delivery of roadway condition data including roughness, rutting, surface distress, geometrics, pavement and High Definition (HD) right-of-way (ROW) images for 28, 500 miles of highway network, and 1,950 miles of local roads. Fugro has also provided project-level Ground Penetrating Radar (GPR) when requested. Fugro provides iVision hosting services for access to the data and images. |
| 01/2017- Present | New York State Department of Transportation (NYSDOT) – Pavement Condition Data Collection Services – 2017 - Present - Annual collection, processing and delivery of roadway condition data including IRI, rutting, faulting, geometrics, HD ROW images for 26,500 miles of highway network. Project also includes 19,800 miles of asset inventory; over five million assets inventoried. Fugro's provides iVision hosting services for access to the data and images. NYSDOT also has their own ARAN used for quality review of the data and images received from Fugro, and for project-level testing. |

| | | | | |
|---|---|---|---|---|
| Firm employed by Fugro | | | | |
| Name | Jaime Mann | | Years of relevant experience with this employer | 14 |
| Title | Data Analysis & Interpretation | | Years of relevant experience with other employer(s) | 3 |
| Degree(s) / Years / Specialization | | | 2003 – 2006 MA, Urban and Economic Geography, Wilfred Laurier University<br>2001 – 2003 Postgraduate, Geographic Information Systems (GIS), Niagara College<br>1999 – 2003 BA, Human Geography (Geomatics), Brock University | |
| Active registration number / state / expiration date | | | | |
| Year registered | | Discipline | | |
| Contract role(s) / brief description of responsibilities | | | As a Data Analyst, Ms. Mann is responsible for analysing and processing the collected data and images for delivery to clients; applying problem-solving skills to project challenges, liaising with clients, identifying opportunities for process improvement, recommending changes to existing workflows, and communicating with software engineering. She monitors incoming data for quality and consistency, performs data processing, and creates output formats and formatting for client delivery. She works with Fugro's Project Management and Data Services teams to contribute to project setup and execution. | |

| Experience dates (mm/yy–mm/yy) | Experience and qualifications relevant to the proposed contract; *i.e.*, "designed drainage", "designed girders", "designed intersection", etc. Experience dates should cover the time specified in the applicable MPR(s). |
|---|---|
| 04/2008-Present | **Ms. Mann has performed data analysis tasks and provided management for the following Fugro Projects:** |
| 12/2004-Present | Louisiana Department of Transportation and Development (LADOTD) – Pavement Distress Data Collection Statewide – 2004- 2022. Annual collection, processing and delivery of roadway condition data including longitudinal profile and IRI, rutting, surface distress, texture, geometrics, pavement and HD ROW images, Global Positioning System (GPS) and elevation data for 36,000 miles of highway network. Contract also includes GPR data and analysis, coring, friction (skid) testing, and asset inventory for 35,000 miles including Highway Performance Monitoring System (HPMS) data items. Additionally, Fugro collected ROW images, GPS and roadside assets for 120,000 miles of local roads throughout the State of Louisiana. Fugro provides iVision5 hosting for access to the data and images. |

| | |
|---|---|
| 02/2019-Present | Pennsylvania Turnpike Commission (PTC) – Automated Data Collection, Inventory, and Analysis of Pavement Distress – 2019-Present – Annual collection, processing and delivery of roadway condition data including roughness, rutting, surface distress, pavement and High Definition (HD) right-of-way (ROW) images for 1, 400 miles of highway network including 240 miles of ramps. Fugro provides iVision5 hosting services for access to the data and images. |
| 03/2012-Present | Virginia Department of Transportation (VDOT) – Pavement Data & Evaluation Services – 2012-Present – Annual collection, processing and delivery of roadway condition data including longitudinal profile and International Roughness Index (IRI), transverse profile and rutting, faulting, surface distress, pavement and High Definition (HD) right-of-way (ROW) images for 29,000 miles of highway network. Fugro also delivered 1.2 million roadway assets, as well as Ground Penetrating Radar (GPR) data and analysis. Fugro provides iVision hosting services for the data and images, and successfully migrated over 25 TB of historical data from VDOT's servers. Also, Fugro supported VDOT in the transition to the use of 3D technology by conducting several pilot projects to ensure historical data integrity. |
| 01/2017-Present | Alaska Department of Transportation & Public Facilities (ADOT & PF) – Highway Data Collection – 2017-Present – Annual collection, processing and delivery of roadway condition data including IRI, rutting, surface distress, geometry, pavement and HD ROW images for 5,600 miles of road network. Fugro developed and built a 4 x 4 Automatic Road Analyzer (ARAN) in order to meet the demands of performing data collection over Alaska's very diverse, challenging terrain. Optional items for the project include asset inventory, pavement engineering, friction testing, Falling Weight Deflectometer (FWD), coring and GPR. Mr. Cliff serves as the Project Manager responsible for all project-related activities, communication, quality and client deliverables. |
| 01/2017-12/2022 | Arizona Department of Transportation (ADOT) – Transportation Consulting, Geospatial Roadway Data Collection and Inventory – 2017-2022 – Annual collection, processing and delivery of roadway condition data including roughness, transverse profile and rutting, faulting, surface distress, pavement and HD ROW images, and Global Positioning System (GPS) data for 15,000 miles of highway network. Project also includes the collection of roadway assets and lidar data. Fugro's provides iVision hosting services for access to the data and images. |
| | |

| | | | | |
|---|---|---|---|---|
| Firm employed by Fugro | | | | |
| Name | Jordan Kilts | | Years of relevant experience with this employer | 11 |
| Title | Asset Supervisor | | Years of relevant experience with other employer(s) | 3 |
| Degree(s) / Years / Specialization | | | 2004 – 2008 Geographic Analysis Degree, Ryerson University | |
| Active registration number / state / expiration date | | | | |
| Year registered | | Discipline | | |
| Contract role(s) / brief description of responsibilities | | | Mr. Kilts works avidly to keep his team's focus on network level asset inventories; quickly, safely, and on-time with high quality output. He has been responsible for delivering over 6.7 million assets from over 70 unique asset types. He is involved in on-going research and development, as well as testing of the Fugro's Surveyor software, and is responsible for overseeing his team's resources. | |

| Experience dates (mm/yy–mm/yy) | Experience and qualifications relevant to the proposed contract; *i.e.*, "designed drainage", "designed girders", "designed intersection", etc. Experience dates should cover the time specified in the applicable MPR(s). |
|---|---|
| 2011-present | **Mr. Kilts has performed asset extraction and quality assurance tasks for the following Fugro Projects:** |
| 12/2004-Present | Louisiana Department of Transportation and Development (LADOTD) – Pavement Distress Data Collection Statewide – 2004- 2022. Annual collection, processing and delivery of roadway condition data including longitudinal profile and IRI, rutting, surface distress, texture, geometrics, pavement and HD ROW images, Global Positioning System (GPS) and elevation data for 36,000 miles of highway network. Contract also includes GPR data and analysis, coring, friction (skid) testing, and asset inventory for 35,000 miles including Highway Performance Monitoring System (HPMS) data items. Additionally, Fugro collected ROW images, GPS and roadside assets for 120,000 miles of local roads throughout the State of Louisiana. Fugro provides iVision5 hosting for access to the data and images. |
| 01/2017-Present | Alaska Department of Transportation & Public Facilities (ADOT & PF) – Highway Data Collection – 2017-Present – Annual collection, processing and delivery of roadway condition data including IRI, rutting, surface distress, geometry, pavement and HD ROW images for 5,600 miles of road network. Fugro developed and built a 4 x 4 Automatic Road Analyzer (ARAN) in order to meet the demands of performing data collection over Alaska's very diverse, challenging terrain. Optional items |

| | |
|---|---|
| | for the project include asset inventory, pavement engineering, friction testing, Falling Weight Deflectometer (FWD), coring and GPR. |
| 01/2017-12/2022 | Arizona Department of Transportation (ADOT) – Transportation Consulting, Geospatial Roadway Data Collection and Inventory – 2017-2022 – Annual collection, processing and delivery of roadway condition data including roughness, transverse profile and rutting, faulting, surface distress, pavement and HD ROW images, and Global Positioning System (GPS) data for 15,000 miles of highway network. Project also includes the collection of roadway assets and lidar data. Fugro's provides iVision5 hosting services for access to the data and images. |
| 01/2020-Present | California Department of Transportation (Caltrans) – Automated Pavement Condition Survey – 2009-2011, 2020– Present. Annual collection, processing and delivery of global referencing data, longitudinal profile and IRI, rutting, surface distress, pavement and HD ROW images, and asset extraction for approximately 120,000 miles. During the project, Fugro worked with Caltrans to develop a new project-specific distress manual, and in the transition to the use of 3D technology for surface distress. Data was formatted for use within Caltrans' PaveM Pavement Management System (PMS), and PaveM was integrated with Fugro's web-based iVision5 software. |
| 01/2018-Present | New Mexico Department of Transportation (NMDOT) – Pavement Condition Data Collection – 2018-Present - Annual collection, processing and delivery of roadway condition data including roughness, rutting, surface distress, faulting, GPS and Linear Referencing System (LRS), pavement and HD ROW images for 12,700 miles of highway network. |

| | | | | |
|---|---|---|---|---|
| Firm employed by Fugro | | | | |
| Name | Matthew Connelly-Taylor | | Years of relevant experience with this employer | 15 |
| Title | Director of IT, Innovations, and Development | | Years of relevant experience with other employer(s) | 5 |
| Degree(s) / Years / Specialization | | | 1999 – 2002 Bachelor of Science (Honors), University of Derby | |
| Active registration number / state / expiration date | | | | |
| Year registered | | Discipline | | |
| Contract role(s) / brief description of responsibilities | | | Mr. Connelly-Taylor currently manages a team of highly skilled subject matter experts in Business Systems, Innovation, Software Engineering/Development and IT. He provides strategic and technical direction to the company based upon industry trends and new technologies. His team supports the business by researching and developing new tools and products, hardware design and integration, database support, and testing. Mr. Connelly-Taylor has played an integral role in the development of Fugro's 3D technology, lidar collection system, iVision5 web-based analysis tool, and iVision Gateway integrations with Esri. | |

| Experience dates (mm/yy–mm/yy) | Experience and qualifications relevant to the proposed contract; *i.e.*, "designed drainage", "designed girders", "designed intersection", etc. Experience dates should cover the time specified in the applicable MPR(s). |
|---|---|
| 08/2007-Present | **Mr. Connely-Taylor has provided oversight and innovative solutions for the following Fugro Projects:** |
| 12/2004-Present | Louisiana Department of Transportation and Development (LADOTD) – Pavement Distress Data Collection Statewide – 2004- 2022. Annual collection, processing and delivery of roadway condition data including longitudinal profile and IRI, rutting, surface distress, texture, geometrics, pavement and HD ROW images, Global Positioning System (GPS) and elevation data for 36,000 miles of highway network. Contract also includes GPR data and analysis, coring, friction (skid) testing, and asset inventory for 35,000 miles including Highway Performance Monitoring System (HPMS) data items. Additionally, Fugro collected ROW images, GPS and roadside assets for 120,000 miles of local roads throughout the State of Louisiana. Fugro provides iVision5 hosting for access to the data and images. |

| | |
|---|---|
| 03/2012-12/2018 | Michigan Department of Transportation (MDOT) – Network Level Semi-Automated Pavement Surface Condition Surveys – 2012 - 2018– Collection, processing and delivery of roadway condition data including IRI, rutting, faulting, surface distress, texture, geometrics, pavement and HD ROW images for 11,000 lane miles. Project also included the delivery of pavement marking retroreflectivity and asset inventory for all roadway signs. Fugro provided iVision hosting services. Mr. Gordon served as Project Manager and then Deputy Project Manager. He was responsible for coordination and management of project-related activities. As Deputy Project Manager, he provided guidance and advice to ensure that the project was managed according to Fugro's professional project management methodology. |
| 03/2012-Present | Virginia Department of Transportation (VDOT) – Pavement Data & Evaluation Services – 2012-Present – Annual collection, processing and delivery of roadway condition data including longitudinal profile and International Roughness Index (IRI), transverse profile and rutting, faulting, surface distress, pavement and High Definition (HD) right-of-way (ROW) images for 29,000 miles of highway network. Fugro also delivered 1.2 million roadway assets, as well as Ground Penetrating Radar (GPR) data and analysis. Fugro provides iVision hosting services for the data and images, and successfully migrated over 25 TB of historical data from VDOT's servers. Also, Fugro supported VDOT in the transition to the use of 3D technology by conducting several pilot projects to ensure historical data integrity. |
| 02/2019-Present | Pennsylvania Department of Transportation (PennDOT) – Automated Data Collection, Inventory, and Analysis of Pavement Distress – 2019-Present – Annual collection, processing and delivery of roadway condition data including roughness, rutting, surface distress, geometrics, pavement and High Definition (HD) right-of-way (ROW) images for 28, 500 miles of highway network, and 1,950 miles of local roads. Fugro has also provided project-level Ground Penetrating Radar (GPR) when requested. Fugro provides iVision hosting services for access to the data and images. |
| 01/2017-Present | Vermont Agency of Transportation (Vtrans) – Transportation Consulting, Geospatial Roadway Data Collection and Inventory – 2017 – Present. Annual collection, processing and delivery of roadway condition data including IRI, rutting, surface distress, texture, pavement and HD ROW images for 7,100 lane miles of highway network. Fugro's provides iVision hosting services for access to the data and images. |

| | | | | |
|---|---|---|---|---|
| Firm employed by Fugro | | | | |
| Name | Yaoming Gu | | Years of relevant experience with this employer | 15 |
| Title | Database Manager | | Years of relevant experience with other employer(s) | 7 |
| Degree(s) / Years / Specialization | | | Bachelor of Medicine \| Shantou University Medical School, Shantou, China \| 1982<br>Ph.D., Neuroscience and Anatomy \| Sun Yat-Sen University of Medical Science, Guangzhou, China \| 1989 | |
| Active registration number / state / expiration date | | | | |
| Year registered | | Discipline | | |
| Contract role(s) / brief description of responsibilities | | | Mr. Gu is responsible for management of the database environments, and designs and implements redundant systems including<br>policies and procedures for disaster recovery and data archiving. He will be responsible for monitoring database systems as well<br>as performing complex database troubleshooting performance analysis. | |

| Experience dates (mm/yy–mm/yy) | Experience and qualifications relevant to the proposed contract; *i.e.*, "designed drainage", "designed girders", "designed intersection", etc. Experience dates should cover the time specified in the applicable MPR(s). |
|---|---|
| 03/2007-Present | Mr. Gu ensures the monitoring, performance tuning and maintenance of the production SQL database. He troubleshoots the complex database and provides root cause analysis for the ARAN, Vision and iVision SQL databases. He has developed several SQL scripts, store procedures, CRL store procedure to improve the data processing in the Mississippi and Louisiana VisiWeb and Wx2visi. Mr. Gu created a customized Vision SQL database to speed up LA 10 curve detection. He is the project lead in Iowa, Louisiana and Mississippi statewide projects as well as the City of Seattle and several other municipal projects. He developed an ArcMap Object application for Arc Map 9.0-9.2 to improve the clicking/routing procedure.<br>Mr. Gu has been working with databases for over 20 years, and currently manages more than 1000 databases for Fugro data collection projects including Louisiana.<br>**Mr. Gu has performed these tasks for the following Fugro Projects:** |
| 12/2004-Present | Louisiana Department of Transportation and Development (LADOTD) – Pavement Distress Data Collection Statewide – 2004- 2022. Annual collection, processing and delivery of roadway condition data including longitudinal profile and IRI, |

| | |
|---|---|
| | rutting, surface distress, texture, geometrics, pavement and HD ROW images, Global Positioning System (GPS) and elevation data for 36,000 miles of highway network. Contract also includes GPR data and analysis, coring, friction (skid) testing, and asset inventory for 35,000 miles including Highway Performance Monitoring System (HPMS) data items. Additionally, Fugro collected ROW images, GPS and roadside assets for 120,000 miles of local roads throughout the State of Louisiana. Fugro provides iVision5 hosting for access to the data and images. |
| 01/2017-Present | Vermont Agency of Transportation (Vtrans) – Transportation Consulting, Geospatial Roadway Data Collection and Inventory – 2017 – Present. Annual collection, processing and delivery of roadway condition data including IRI, rutting, surface distress, texture, pavement and HD ROW images for 7,100 lane miles of highway network. Fugro's provides iVision hosting services for access to the data and images. |
| 01/2017-12/2022 | Arizona Department of Transportation (ADOT) – Transportation Consulting, Geospatial Roadway Data Collection and Inventory – 2017-2022 – Annual collection, processing and delivery of roadway condition data including roughness, transverse profile and rutting, faulting, surface distress, pavement and HD ROW images, and Global Positioning System (GPS) data for 15,000 miles of highway network. Project also includes the collection of roadway assets and lidar data. Fugro's provides iVision5 hosting services for access to the data and images. |
| 02/2019-Present | Pennsylvania Department of Transportation (PennDOT) – Automated Data Collection, Inventory, and Analysis of Pavement Distress – 2019-Present – Annual collection, processing and delivery of roadway condition data including roughness, rutting, surface distress, geometrics, pavement and High Definition (HD) right-of-way (ROW) images for 28, 500 miles of highway network, and 1,950 miles of local roads. Fugro has also provided project-level Ground Penetrating Radar (GPR) when requested. Fugro provides iVision hosting services for access to the data and images. |
| 01/2017- Present | New York State Department of Transportation (NYSDOT) – Pavement Condition Data Collection Services – 2017 - Present - Annual collection, processing and delivery of roadway condition data including IRI, rutting, faulting, geometrics, HD ROW images for 26,500 miles of highway network. Project also includes 19,800 miles of asset inventory; over five million assets inventoried. Fugro's provides iVision hosting services for access to the data and images. NYSDOT also has their own ARAN used for quality review of the data and images received from Fugro, and for project-level testing. |

| | | | | |
|---|---|---|---|---|
| Firm employed by Fugro | | | | |
| Name | Riaz Mohideen | | Years of relevant experience with this employer | 11 |
| Title | GIS Specialist | | Years of relevant experience with other employer(s) | 0 |
| Degree(s) / Years / Specialization | | | B.Arch., Architecture \| University of Madras \| 1999<br>M.C.P Urban and Regional Planning \| IIT Kharagpur \| 2005<br>Advanced Certification in Geographic Information Systems (GIS) \| Ryerson University \| 2013 | |
| Active registration number / state / expiration date | | | | |
| Year registered | | Discipline | | |
| Contract role(s) / brief description of responsibilities | | | As the Lead Data Analyst for the Louisiana project, Mr. Mohideen will be responsible for the processing of the pavement<br>condition data using Fugro's Vision software. He will lead and support additional Fugro staff assigned to the Louisiana project,<br>and will provide any required training on the project specifications and requirements. | |

| Experience dates (mm/yy–mm/yy) | Experience and qualifications relevant to the proposed contract; *i.e.*, "designed drainage", "designed girders", "designed intersection", etc. Experience dates should cover the time specified in the applicable MPR(s). |
|---|---|
| 07/2001-Present | Mr. Mohideen has over five years of experience utilizing analytical and problem-solving skills to process pavement sensors and distress data collected by Fugro Roadware's Automatic Road Analyzing (ARAN) vehicle technology. He is detail-oriented and highly analytical with the ability to quickly assess data integrity to ensure that clients receive a quality product. He is a very knowledgeable team player who constantly strives to ensure that tasks are completed correctly the first time. Mr. Mohideen is able to offer technical acuity with proficiency with various industry software packages such as ArcGIS, SQL, FoxPro, and MS Office Suite in addition to Fugro Roadware's innovative Vision technologies. Additional experience and qualifications below:<br>Works closely with the project manager to provide exceptional service to clients and communicates with clients effectively on a regular basis for status updates and issue resolution<br>Monitors incoming data for quality and consistency including ARAN daily verifications, quality checks on data delivered |

| | |
|---|---|
| | from other Data Processing departments<br>Analyzes and process sensor data and digital images from the collection vehicles for delivery to clients using Vision,<br>Vision batch processors and SQL scripts<br>Analyzes pavement distress and asset data from other internal departments to provide feedback on quality and consistency<br><br>**Mr. Mohideen has performed these tasks for the following Fugro Projects:** |
| 12/2004-Present | Louisiana Department of Transportation and Development (LADOTD) – Pavement Distress Data Collection Statewide – 2004- 2022. Annual collection, processing and delivery of roadway condition data including longitudinal profile and IRI, rutting, surface distress, texture, geometrics, pavement and HD ROW images, Global Positioning System (GPS) and elevation data for 36,000 miles of highway network. Contract also includes GPR data and analysis, coring, friction (skid) testing, and asset inventory for 35,000 miles including Highway Performance Monitoring System (HPMS) data items. Additionally, Fugro collected ROW images, GPS and roadside assets for 120,000 miles of local roads throughout the State of Louisiana. Fugro provides iVision5 hosting for access to the data and images. |
| 01/2017-Present | Vermont Agency of Transportation (Vtrans) – Transportation Consulting, Geospatial Roadway Data Collection and Inventory – 2017 – Present. Annual collection, processing and delivery of roadway condition data including IRI, rutting, surface distress, texture, pavement and HD ROW images for 7,100 lane miles of highway network. Fugro's provides iVision hosting services for access to the data and images. |
| 01/2017-12/2021 | Arizona Department of Transportation (ADOT) – Transportation Consulting, Geospatial Roadway Data Collection and Inventory – 2017-2021 – Annual collection, processing and delivery of roadway condition data including roughness, transverse profile and rutting, faulting, surface distress, pavement and HD ROW images, and Global Positioning System (GPS) data for 15,000 miles of highway network. Project also includes the collection of roadway assets and lidar data. Fugro's provides iVision5 hosting services for access to the data and images. |
| 01/2020-Present | California Department of Transportation (Caltrans) – Automated Pavement Condition Survey – 2009-2011, 2020– Present. Annual collection, processing and delivery of global referencing data, longitudinal profile and IRI, rutting, surface distress, pavement and HD ROW images, and asset extraction for approximately 120,000 miles. During the project, Fugro worked with Caltrans to develop a new project-specific distress manual, and in the transition to the use of 3D technology for surface distress. Data was formatted for use within Caltrans' PaveM Pavement Management System (PMS), and PaveM was integrated with Fugro's web-based iVision5 software. |

| | | | | |
|---|---|---|---|---|
| Firm employed by Fugro | | | | |
| Name | Monty Cliff | | Years of relevant experience with this employer | 25 |
| Title | Pavement Data Collection & Analysis Quality Assurance Manager | | Years of relevant experience with other employer(s) | 0 |
| Degree(s) / Years / Specialization | | | 1996 – Bachelor of Science (B.Sc.), Civil Engineering, Queen's University | |
| Active registration number / state / expiration date | | | | |
| Year registered | | Discipline | | |
| Contract role(s) / brief description of responsibilities | | | Mr. Monty Cliff is a Professional Engineer with over 20 years of industry experience. He has been involved in many aspects of pavement data collection and evaluation including project management, data processing and analysis (e.g. transverse profile, rut calculation, roughness calculation, texture, geometric curve fitting), and SQL querying and maintenance. Mr. Cliff offers in-depth experience with commercial and in-house Pavement Management Systems (PMS) and Asset Management Systems (AMS) applications. He has been involved with software testing and quality control and review of the data, and training. | |

| Experience dates (mm/yy–mm/yy) | Experience and qualifications relevant to the proposed contract; *i.e.*, "designed drainage", "designed girders", "designed intersection", etc. Experience dates should cover the time specified in the applicable MPR(s). |
|---|---|
| | Mr. Cliff has an extensive understanding of client data and pavement engineering principles and guidelines. He offers a strong understanding of industry technical standards (ASTM, AASHTO, ISO), protocols and reporting. He has strong problem-solving skills, management judgement, and resourcefulness to identify and resolve complex problems while minimizing risk.<br><br>**Mr. Cliff has performed these tasks for the following Fugro Projects:** |
| 12/2004-Present | Louisiana Department of Transportation and Development (LADOTD) – Pavement Distress Data Collection Statewide – 2004- 2022. Annual collection, processing and delivery of roadway condition data including longitudinal profile and IRI, rutting, surface distress, texture, geometrics, pavement and HD ROW images, Global Positioning System (GPS) and |

| | |
|---|---|
| | elevation data for 36,000 miles of highway network. Contract also includes GPR data and analysis, coring, friction (skid) testing, and asset inventory for 35,000 miles including Highway Performance Monitoring System (HPMS) data items. Additionally, Fugro collected ROW images, GPS and roadside assets for 120,000 miles of local roads throughout the State of Louisiana. Fugro provides iVision5 hosting for access to the data and images. |
| 02/2019-Present | Pennsylvania Turnpike Commission (PTC) – Automated Data Collection, Inventory, and Analysis of Pavement Distress – 2019-Present – Annual collection, processing and delivery of roadway condition data including roughness, rutting, surface distress, pavement and High Definition (HD) right-of-way (ROW) images for 1, 400 miles of highway network including 240 miles of ramps. Fugro provides iVision5 hosting services for access to the data and images. |
| 03/2012-Present | Virginia Department of Transportation (VDOT) – Pavement Data & Evaluation Services – 2012-Present – Annual collection, processing and delivery of roadway condition data including longitudinal profile and International Roughness Index (IRI), transverse profile and rutting, faulting, surface distress, pavement and High Definition (HD) right-of-way (ROW) images for 29,000 miles of highway network. Fugro also delivered 1.2 million roadway assets, as well as Ground Penetrating Radar (GPR) data and analysis. Fugro provides iVision hosting services for the data and images, and successfully migrated over 25 TB of historical data from VDOT's servers. Also, Fugro supported VDOT in the transition to the use of 3D technology by conducting several pilot projects to ensure historical data integrity. |
| 01/2017-Present | Alaska Department of Transportation & Public Facilities (ADOT & PF) – Highway Data Collection – 2017-Present – Annual collection, processing and delivery of roadway condition data including IRI, rutting, surface distress, geometry, pavement and HD ROW images for 5,600 miles of road network. Fugro developed and built a 4 x 4 Automatic Road Analyzer (ARAN) in order to meet the demands of performing data collection over Alaska's very diverse, challenging terrain. Optional items for the project include asset inventory, pavement engineering, friction testing, Falling Weight Deflectometer (FWD), coring and GPR. Mr. Cliff serves as the Project Manager responsible for all project-related activities, communication, quality and client deliverables. |
| 01/2017-12/2022 | Arizona Department of Transportation (ADOT) – Transportation Consulting, Geospatial Roadway Data Collection and Inventory – 2017-2022 – Annual collection, processing and delivery of roadway condition data including roughness, transverse profile and rutting, faulting, surface distress, pavement and HD ROW images, and Global Positioning System (GPS) data for 15,000 miles of highway network. Project also includes the collection of roadway assets and lidar data. Fugro's provides iVision hosting services for access to the data and images. |

| | | | | |
|---|---|---|---|---|
| Firm employed by Fugro | | | | |
| Name | Michael Slack | | Years of relevant experience with this employer | 13 |
| Title | Asset Extraction Quality Control Manager | | Years of relevant experience with other employer(s) | 0 |
| Degree(s) / Years / Specialization | | | 2010 Microsoft SQL Certification<br>2004 – 2008 Bachelor of Science, University of Guelph | |
| Active registration number / state / expiration date | | | | |
| Year registered | | Discipline | | |
| Contract role(s) / brief description of responsibilities | | | Mr. Michael Slack offers more than 10 years of experience working with transportation agencies in the use of Fugro's data collection equipment, processing roadway condition data, and information technology (IT). He offers a thorough understanding of data and image processing, analysis and client delivery; helping to develop plans and procedures as necessary for each project. He has the ability to identify and resolve complex problems, conduct diagnostic investigations and troubleshoot software and database related issues. Additionally, he has in-depth knowledge and extensive hands-on experience with software setup, database permissions, query and analysis tools, and SQL and web services. | |
| Experience dates (mm/yy–mm/yy) | Experience and qualifications relevant to the proposed contract; *i.e.*, "designed drainage", "designed girders", "designed intersection", etc. Experience dates should cover the time specified in the applicable MPR(s). | | | |
| | Mr. Slack works with other Fugro Data Processing and Analysis teams to create customized data deliveries if needed, as well as Fugro's software engineers to make recommended changes to software processing tools as needed. He is responsible for analyzing client's business and technology needs, developing and conducting end-user training, creating training and learning materials, and attending client meetings as required.<br>**Mr. Slack has performed tasks associated with data processing and quality control for the following Fugro Projects:** | | | |
| 12/2004-Present | Louisiana Department of Transportation and Development (LADOTD) – Pavement Distress Data Collection Statewide – 2004- 2022. Annual collection, processing and delivery of roadway condition data including longitudinal profile and IRI, | | | |

| | |
|---|---|
| | rutting, surface distress, texture, geometrics, pavement and HD ROW images, Global Positioning System (GPS) and elevation data for 36,000 miles of highway network. Contract also includes GPR data and analysis, coring, friction (skid) testing, and asset inventory for 35,000 miles including Highway Performance Monitoring System (HPMS) data items. Additionally, Fugro collected ROW images, GPS and roadside assets for 120,000 miles of local roads throughout the State of Louisiana. Fugro provides iVision5 hosting for access to the data and images. |
| 02/2018-12/2019 | Infralab – Automatic Road Analyzer (ARAN) 9000 – 2018 – 2019 - Delivery of a new ARAN for measuring roadway condition. The ARAN is equipped with an on-board Global Positioning System (GPS) and inertial navigation system, Distance Measuring Instrument (DMI), Laser SDP, Pave3D, front-view camera and rear-view LabyBug camera for recording High Definition (HD) right-of-way (ROW) images. Fugro was able to reuse the cameras, GPS and the inertial navigation system from Infralab's existing ARAN vehicle. |
| 01/2017-12/2022 | Arizona Department of Transportation (ADOT) – Transportation Consulting, Geospatial Roadway Data Collection and Inventory – 2017-2022 – Annual collection, processing and delivery of roadway condition data including roughness, transverse profile and rutting, faulting, surface distress, pavement and HD ROW images, and Global Positioning System (GPS) data for 15,000 miles of highway network. Project also includes the collection of roadway assets and lidar data. Fugro's provides iVision5 hosting services for access to the data and images. |
| 02/2019-Present | Pennsylvania Department of Transportation (PennDOT) – Automated Data Collection, Inventory, and Analysis of Pavement Distress – 2019-Present – Annual collection, processing and delivery of roadway condition data including roughness, rutting, surface distress, geometrics, pavement and High Definition (HD) right-of-way (ROW) images for 28, 500 miles of highway network, and 1,950 miles of local roads. Fugro has also provided project-level Ground Penetrating Radar (GPR) when requested. Fugro provides iVision hosting services for access to the data and images. |
| 01/2017- Present | New York State Department of Transportation (NYSDOT) – Pavement Condition Data Collection Services – 2017 - Present - Annual collection, processing and delivery of roadway condition data including IRI, rutting, faulting, geometrics, HD ROW images for 26,500 miles of highway network. Project also includes 19,800 miles of asset inventory; over five million assets inventoried. Fugro's provides iVision hosting services for access to the data and images. NYSDOT also has their own ARAN used for quality review of the data and images received from Fugro, and for project-level testing. |

| | | | | |
|---|---|---|---|---|
| Firm employed by Fugro | | | | |
| Name | Denis Charland | | Years of relevant experience with this employer | 11 |
| Title | Roads Service Line Director | | Years of relevant experience with other employer(s) | 14 |
| Degree(s) / Years / Specialization | | | Bachelor of Science, Psychology \| University of Ottawa \| 2002<br>Cartography Diploma \| Collège de L'Outaouais \| 1997<br>Project Management Professional (PMP) \| 2010 | |
| Active registration number / state / expiration date | | | n/a | |
| Year registered | n/a | Discipline | n/a | |
| Contract role(s) / brief description of responsibilities | | | Roads Service Line (RSL) Director<br><br>As the RSL Director, Mr. Charland manages Fugro's Field Operations and Data Services teams and is responsible for standardizing the production processes for greater efficiency, establishing a current benchmark for production rating and monitoring for continuous improvements, and enhancing the production environment as well as establishing Key Performance Indicator (KPI's) for staff at all levels. Additionally, he offers the financial acumen necessary to administer and track project budgets to achieve profitability and operational efficiency objectives. | |

| Experience dates (mm/yy–mm/yy) | Experience and qualifications relevant to the proposed contract; *i.e.*, "designed drainage", "designed girders", "designed intersection", etc. Experience dates should cover the time specified in the applicable MPR(s). |
|---|---|
| 12/2004-Present | Louisiana Department of Transportation and Development (LADOTD) – Pavement Distress Data Collection Statewide – 2004- 2022. Annual collection, processing and delivery of roadway condition data including longitudinal profile and IRI, rutting, surface distress, texture, geometrics, pavement and HD ROW images, Global Positioning System (GPS) and elevation data for 36,000 miles of highway network. Contract also includes GPR data and analysis, coring, friction (skid) testing, and asset inventory for 35,000 miles including Highway Performance Monitoring System (HPMS) data items. Additionally, Fugro collected ROW images, GPS and roadside assets for 120,000 miles of local roads throughout the State of Louisiana. Fugro provides iVision5 hosting for access to the data and images. |

| | |
|---|---|
| 01/2017- Present | New York State Department of Transportation (NYSDOT) – Pavement Condition Data Collection Services – 2017 - Present - Annual collection, processing and delivery of roadway condition data including IRI, rutting, faulting, geometrics, HD ROW images for 26,500 miles of highway network. Project also includes 19,800 miles of asset inventory; over five million assets inventoried. Fugro's provides iVision hosting services for access to the data and images. NYSDOT also has their own ARAN used for quality review of the data and images received from Fugro, and for project-level testing. |
| 02/2019-Present | Pennsylvania Department of Transportation (PennDOT) – Automated Data Collection, Inventory, and Analysis of Pavement Distress – 2019-Present – Annual collection, processing and delivery of roadway condition data including roughness, rutting, surface distress, geometrics, pavement, and High Definition (HD) right-of-way (ROW) images for 28, 500 miles of highway network, and 1,950 miles of local roads. Fugro has also provided project-level Ground Penetrating Radar (GPR) when requested. Fugro provides iVision hosting services for access to the data and images. |

| | | | | |
|---|---|---|---|---|
| Firm employed by Accel Talent and Development | | | | |
| Name | Pam Allen | | Years of relevant experience with this employer | 9 |
| Title | CEO/Owner | | Years of relevant experience with other employer(s) | 15 |
| Degree(s) / Years / Specialization | | | B.A Business Administration/HR- AIU Georgia | |
| Active registration number / state / expiration date | | | DBE LA 2022 | |
| Year registered | 2019 | Discipline | Staffing, Human Resource Consultant, Training and Development, Administrative Services | |
| Contract role(s) / brief description of responsibilities | | | Ms. Allen provides staffing for ARAN operators. | |

| Experience dates (mm/yy–mm/yy) | Experience and qualifications relevant to the proposed contract; *i.e.*, "designed drainage", "designed girders", "designed intersection", etc. Experience dates should cover the time specified in the applicable MPR(s). |
|---|---|
| | Ms. Allen provides staffing for ARAN operators for the following Fugro projects: |
| 02/2019-Present | Pennsylvania Turnpike Commission (PTC) – Automated Data Collection, Inventory, and Analysis of Pavement Distress – 2019-Present – Annual collection, processing and delivery of roadway condition data including roughness, rutting, surface distress, pavement and High Definition (HD) right-of-way (ROW) images for 1, 400 miles of highway network including 240 miles of ramps. Fugro provides iVision5 hosting services for access to the data and images. |
| 03/2012-Present | Virginia Department of Transportation (VDOT) – Pavement Data & Evaluation Services – 2012-Present – Annual collection, processing and delivery of roadway condition data including longitudinal profile and International Roughness Index (IRI), transverse profile and rutting, faulting, surface distress, pavement and High Definition (HD) right-of-way (ROW) images for 29,000 miles of highway network. Fugro also delivered 1.2 million roadway assets, as well as Ground Penetrating Radar (GPR) data and analysis. Fugro provides iVision hosting services for the data and images, and successfully migrated over 25 TB of historical data from VDOT's servers. Also, Fugro supported VDOT in the transition to the use of 3D technology by conducting several pilot projects to ensure historical data integrity. |
| 02/2019-Present | Pennsylvania Department of Transportation (PennDOT) – Automated Data Collection, Inventory, and Analysis of Pavement Distress – 2019-Present – Annual collection, processing and delivery of roadway condition data including roughness, |

| | |
|---|---|
| | rutting, surface distress, geometrics, pavement and High Definition (HD) right-of-way (ROW) images for 28, 500 miles of highway network, and 1,950 miles of local roads. Fugro has also provided project-level Ground Penetrating Radar (GPR) when requested. Fugro provides iVision hosting services for access to the data and images. |

| | | | | |
|---|---|---|---|---|
| Firm employed by Traffic Commander | | | | |
| Name | Madeline Commander , E.I. | | Years of relevant experience with this employer | 2 |
| Title | Owner/Estimator/ Project Manager | | Years of relevant experience with other employer(s) | 4 |
| Degree(s) / Years / Specialization | | | B. S. Civil Engineering/ 5/ Transportation | |
| Active registration number / state / expiration date | | | EI.0032164/ LA/ 03/31/2023 | |
| Year registered | 2017 | Discipline | Traffic | |
| Contract role(s) / brief description of responsibilities | | | Estimator/PM– Estimate potential costs, implement operations at or below estimated costs | |

| Experience dates (mm/yy–mm/yy) | Experience and qualifications relevant to the proposed contract; *i.e.*, "designed drainage", "designed girders", "designed intersection", etc. Experience dates should cover the time specified in the applicable MPR(s). |
|---|---|
| 01/19 - Present | Estimate project costs and coordinate resources needed to provide any and all traffic control services such as advanced warning signage per LADOTD and MUTCD standards, job specific detour signage, lane closures, flagging operations, message boards, arrow boards, and TMAs. |
| 08/17-12/18 | Estimate project costs and coordinate resources needed to provide any and all traffic control services, permanent ground-mounted and overhead signage, and guardrail. Many long-term guardrail projects have T&M repairs throughout as the rails get hit prior to project completion. We had to mobilize to the site quickly to make the repair to keep the roadway users safe. |

| | | | | |
|---|---|---|---|---|
| Firm employed by A&A Enterprises, Inc. | | | | |
| Name | Gail Albaral | | Years of relevant experience with this employer | 30 |
| Title | President | | Years of relevant experience with other employer(s) | 5 |
| Degree(s) / Years / Specialization | | | | |
| Active registration number / state / expiration date | | | | |
| Year registered | | Discipline | Geotech | |
| Contract role(s) / brief description of responsibilities | | | Gail has provided staff to perform coring and cutting services since 1985. Her firm, A & A Enterprises, Inc. has been the most trusted concrete cutting & drilling service in Southern Louisiana providing dependable, safe, affordable and quality service. Her services include concrete cutting, drilling, scanning, decorative scoring, equipment repairs, sales and rentals. | |
| Experience dates (mm/yy–mm/yy) | Experience and qualifications relevant to the proposed contract; *i.e.*, "designed drainage", "designed girders", "designed intersection", etc. Experience dates should cover the time specified in the applicable MPR(s). | | | |
| | A & A Enterprises, Inc has been in business since 1985. For over 30 years we have had the distinct pleasure of working with some of the top contractors throughout Southeast Louisiana, and the Gulf Coast. We have built many long-term relationships based on our reputation of being reliable and honest and on our ability to tackle some of the most complex projects in some of the most demanding environments. | | | |
| | Project-specific details can be provided upon request. | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

| | | | | |
|---|---|---|---|---|
| Firm employed by J Star Enterprises, Inc. | | | | |
| Name | Jill Coleman | | Years of relevant experience with this employer | 3 |
| Title | President | | Years of relevant experience with other employer(s) | 15 |
| Degree(s) / Years / Specialization | | | | |
| Active registration number / state / expiration date | | | | |
| Year registered | | Discipline | Geotech | |
| Contract role(s) / brief description of responsibilities | | | Jill provides staff to perform coring and cutting services within Louisiana. | |

| Experience dates (mm/yy–mm/yy) | Experience and qualifications relevant to the proposed contract; *i.e.*, "designed drainage", "designed girders", "designed intersection", etc. Experience dates should cover the time specified in the applicable MPR(s). |
|---|---|
| 10/2010-6/2011 | Boh Brothers Construction Katerina Repairs, Highway drilling |
| | |
| | |
| | |
| | |
| | |

**16. Staff Experience: (AMMENDED)**

| | | | | |
|---|---|---|---|---|
| Firm employed by Fugro | | | | |
| Name | Celine Gerson | | Years of relevant experience with this employer | 1 |
| Title | President | | Years of relevant experience with other employer(s) | 25 |
| Degree(s) / Years / Specialization | | | Bachelors of Science, European University of Brussels<br>Juris Doctor from the University of Houston<br>Harvard Business School | |
| Active registration number / state / expiration date | | | | |
| Year registered | | Discipline | Data Collection | |
| Contract role(s) / brief description of responsibilities | | | Gerson is recognized for her unique blend of international business, M&A, trade and logistics, legal, global P&L management experience and her focus on crafting and implementing disruptive strategies. She currently sits on the boards of the Petroleum Technology Alliance Canada (PTAC) and the Canadian Society for Unconventional Resources (CSUR). She is a member of the Schulich Industry Advisory Council at the University of Calgary and is the Director of Marketing for the 69th Canadian Energy Executive Association. She regularly speaks at conferences. | |

| Experience dates (mm/yy–mm/yy) | Experience and qualifications relevant to the proposed contract; *i.e.*, "designed drainage", "designed girders", "designed intersection", etc. Experience dates should cover the time specified in the applicable MPR(s). |
|---|---|
| Jun 2020 - Jan 2022 | Vice President Global Account Director bp at Schlumberger responsible for the global oversight and growth of the bp and Schlumberger's strategic relationship. bp was a top strategic client. She was actively involved with connecting both companies' focus on sustainability, energy transition and digital transformations. |
| 2017 - Jun 2020 | Celine served as the President of Schlumberger Canada where she was responsible for all Schlumberger product lines, and was also member of the Project Management Office of Schlumberger Global Strategy. Ms. Gerson directed operations and steered strategic positioning and profitable growth of all product lines in Canada. She formulated global strategy and |

| | |
|---|---|
| | alignment with a key strategic client of Schlumberger. In this role she particularly focused on energy transition, sustainability, and digital transformation. |
| Sep 2014 - Nov 2017 | Celine was promoted to Executive at Cameron International, which was a Fortune 100 $100~ billion global service provider, manufacturer, and servicer of pressure control equipment for the oil and gas and process industries (Schlumberger acquired Cameron International--$14B—in 2016) .She led Measurement Systems, a global business that designs and manufactures leading edge measurement, quality, and control instrumentation and systems for the energy, nuclear and military applications. |
| 2008 - 2014 | VP and Chief Compliance Officer at Cameron International managing global logistics and trade compliance. Her key achievements in these roles include:<br>• Championed negotiation of settlement with the U.S. Department of Justice and Securities and Exchange Commission following disclosure of potential FCPA violations in Kazakhstan; provided oversight of internal/external investigations<br>• Transformed the company's compliance culture; designed and implemented first worldwide "Compliance Awareness Week" program—achieved 90% participation and "best-in-class" recognition by Corporate Executive Board<br>• Developed a company culture of high morale which encouraged employees to take ownership—leading to enhanced buy-in, accountability, and awareness of compliance risks<br>• Merged and lead the logistics function historically owned by business with over $500M+ spend and the trade compliance function<br>• Identified, devised, and recommended execution of strategic and tactical action plans to address emerging external/internal critical cyber security risks, allowing company vision to expand while balancing risk to make high-level, informed decisions |
| 2004 - 2008 | Ms. Gerson served as the Associate Attorney: Trade Compliance and Anti-corruption with Baker & Hostetler LLP |

| | | | | |
|---|---|---|---|---|
| Firm employed by Acacia Industries, LLC | | | | |
| Name | Carla Maynard | | Years of relevant experience with this employer | 12 |
| Title | Co-Founder/Director | | Years of relevant experience with other employer(s) | 14 |
| Degree(s) / Years / Specialization | | | Graduate, Caddo Magnet High School, 1992 with GPA of 4.5<br>Graduate, Louisiana Tech University, 1996, magna cum laude – degree in civil engineering<br>Masters in Systems Technology, LSUS, | |
| Active registration number / state / expiration date | | | Professional Engineer's Licenses in Civil Engineering from Louisiana<br>Professional Engineer's Licenses in Civil Engineering from Texas<br>Professional Engineer's Licenses in Civil Engineering from Arkansas<br>Contractor's License for Highway and Bridge Construction from Louisiana<br>Contractor's License for Highway and Bridge Construction from Arkansas<br>Specialty Contractor's License for all Traffic Control from Mississippi | |
| Year registered | | Discipline | Traffic | |
| Contract role(s) / brief description of responsibilities | | | Provider of Traffic Engineering, Traffic Maintenance, Lane closures and detours, Temporary Traffic Control, Advanced Warning Signage, Truck Mounted Attenuators, temporary crash attenuators and message boards.<br>Install permanent signs on highway construction projects<br>Industries Served: Roadway Construction, Commercial Construction, State & Local Government. | |
| Experience dates (mm/yy–mm/yy) | Experience and qualifications relevant to the proposed contract; *i.e.*, "designed drainage", "designed girders", "designed intersection", etc. Experience dates should cover the time specified in the applicable MPR(s). | | | |

| | |
|---|---|
| 2010-present | Carla co-founded Acacia Industries, LLC which is a firm that provides Traffic Engineering, Traffic Maintenance, Lane closures and detours, Temporary Traffic Control, Advanced Warning Signage, Truck Mounted Attenuators, temporary crash attenuators and message boards. |
| 2007-2010 | Carla was with the Louisiana Department of Transportation and Development, Bossier City, LA as a Construction Project Engineer. Her tasks included:<br>• Coordinated construction projects located in Desoto and Red River parishes as well as south Bossier and south Caddo Parish.<br>• Supervised a crew of 13 technicians and inspectors who worked daily with contractors on active construction projects.<br>• Managed all problems and funding issues related to those projects. Wrote plan changes when necessary to make improvements to each project. |
| 1996-2007 | Carla held the position of Traffic Engineer with the Louisiana Department of Transportation and Development, Bossier City, LA. In this role she:<br>• Responded to traffic requests from the general public making recommendations for improvements.<br>• Reviewed existing traffic control devices in local areas for proper effectiveness and recommended improvements or modifications when necessary. Reviewed temporary construction traffic control plans and permanent traffic control plans for conformance to the Department's standards.<br>• Supervised three technicians in the management and operation of the Traffic Management Center.<br>• Supervised two technicians in the collection of field traffic data to make appropriate recommendations.<br>• Assisted traffic secretary in organizing and maintaining the files and records of the traffic section.<br>• Designed and implemented the Motorist Assistance Patrol (MAP) program for the Shreveport/Bossier area assisting in the emergency operations pertaining to both Hurricanes Katrina and Rita in 2005. |

**17. Firm Experience:**

Identify the team's project experience **most relevant** to the scope in the advertisement. **The projects should be limited to a total of 20, with no more than 5 projects being represented by the prime consultant and with no more than 3 projects represented by each sub-consultant on the team. If more than 5 projects are identified for the prime consultant, all projects identified after the first 5 will not be evaluated. If more than 3 projects are identified for a single sub-consultant, all projects identified after the first 3 from that sub-consultant will not be evaluated.** Include no more than one page per project. Projects identified shall only include work performed by firms on the team. The projects identified do not necessarily need to have been DOTD projects.

| | | | | | |
|---|---|---|---|---|---|
| Firm name | Fugro. | | Past Performance Evaluation Discipline(s)* | | Data Collection |
| Project name | Pavement Distress<br>Data Collection Statewide | | Firm responsibility (prime or sub?) | | Prime |
| Project number | 736-99-1719 | Owner's name | Louisiana Department of Transportation and Development | | |
| Project location | Baton Rouge, LA<br>(State of Louisiana) | | Owner's Project Manager | Mr. Chris Fillastre | |
| Owner's address, phone, email | Address: 1201 Capital Access Rd, 4th Floor, Baton Rouge, LA 70802<br>Phone: 225-242-4577<br>Email: christophe.fillastre@la.gov | | | | |
| Services commenced by this firm (mm/yy) | 12/2017 | Total consultant contract cost ($1,000's) | | $19,173 | |
| Services completed by this firm (mm/yy) | 12/2022 | Cost of consultant services provided by this firm ($1,000's) | | $19,173 | |

Describe the project including the firm's role, members involved (highlight members to be utilized in this project submittal) and % of work performed in Louisiana.

Fugro has been providing pavement and asset data collection services for the Louisiana Department of Transportation and Development (LADOTD) since 1995. During the most recent contract, approximately 163,000 lane miles of data was collected using the Automatic Road Analyzer (ARAN) for the purpose of delivering pavement distress, longitudinal profile in each wheel path and calculated International Roughness Index (IRI), rutting, texture, roadway geometry, High Definition Right-of-way (ROW) including right-side, Global Positioning System (GPS) and elevation data. Contract also included 22,000 miles of GPR collection and processing with coring validation on every 7 miles of GPR collection, 17,000 miles of Skid testing. Asset inventory for approximately 35,000 miles including Highway Performance Monitoring System (HPMS) data items and Louisiana DOTD point feature locations. Fugro also collected 120,000 miles of ROW, asset inventory, and GPS and for all local roads within the State of Louisiana.

Fugro served as the prime on this project and key project members from this project to be utilized for the upcoming Louisiana project include:

Cory Hackbart-Senior Project Manager, Denis Charland- Director of Operations, Riaz Mohideen-Lead Data Analyst, Zoran Arezina- Field Operations Crew Chief, Yaoming Gu-Database Manager, Wayne Billingsley-Operations Manager, Riaz Mohideen-GIS Specialist, Allan Versaevel-Fleet Support, Monty Cliff- Pavement Data Collection & Analysis Quality Assurance Manager

52% of the work was performed in Louisiana.

| | | | | | |
|---|---|---|---|---|---|
| Firm name | Fugro | | Past Performance Evaluation Discipline(s)* | | Data Collection |
| Project name | Automated Data Collection, Inventory and Analysis of Pavement Distress | | Firm responsibility (prime or sub?) | | Prime |
| Project number | 3511R03 | Owner's name | Pennsylvania Department of Transportation | | |
| Project location | Harrisburg, PA<br>(State of Pennsylvania) | | Owner's Project Manager | Mr. John Van Sickle | |
| Owner's address, phone, email | Address: 907 Elmerton Ave., Harrisburg, PA 17110<br>Phone: 717-705-8920<br>Email: jvansickle@state.pa.us | | | | |
| Services commenced by this firm (mm/yy) | | 12/2019 | Total consultant contract cost ($1,000's) | | $10,000 |
| Services completed by this firm (mm/yy) | | 12/2024 | Cost of consultant services provided by this firm ($1,000's) | | $6,000 |

Describe the project including the firm's role and members involved. (Highlight staff to be used in this proposal.)

Fugro has been providing pavement and asset data collection for Pennsylvania Department of Transportation (PennDOT) since 1997. The current contract involves the collection of approximately one half of the total 54,000 lane miles each year in a two-year cycle (27,000 miles of data collection each year). Data deliverables include longitudinal profile and calculated IRI, transverse profile (rutting), digital ROW video, and ground penetrating radar data. Fugro's Vision software is used for pavement data processing and analysis. Vision provides the ability to customize any distress protocol and can classify data using a variety of techniques. Prior to data processing, Vision is calibrated to PennDOT specifications for Bituminous Pavement Conditions, and Jointed Concrete Pavement (JCP) Condition.

Fugro serves as the prime on this project and key project members from this project to be utilized for the upcoming Louisiana project include:

Cory Hackbart-Senior Project Manager, Denis Charland- Director of Operations, Riaz Mohideen-Lead Data Analyst, Zoran Arezina- Field Operations Crew Chief, Yaoming Gu-Database Manager, Wayne Billingsley-Operations Manager, Allan Versaevel-Fleet Support, Monty Cliff- Pavement Data Collection & Analysis Quality Assurance Manager, David Hunter-Data Processing Manager

0% of the work was performed in Louisiana.

| | | | | | |
|---|---|---|---|---|---|
| Firm name | Fugro | | Past Performance Evaluation Discipline(s)* | Data Collection | |
| Project name | Automated Data Collection, Inventory, and Analysis of Pavement Distress | | Firm responsibility (prime or sub?) | Prime | |
| Project number | | Owner's name | Virginia Department of Transportation | | |
| Project location | Virginia (Statewide) | | Owner's Project Manager | Raja Shekharan | |
| Owner's address, phone, email | Address: 1201 E. Broad St. Richmond, VA 23219<br>Phone: 804-786-0870<br>Email: raja.shekharan@vdot.virginia.gov | | | | |
| Services commenced by this firm (mm/yy) | | 12/2020 | Total consultant contract cost ($1,000's) | $12,800 | |
| Services completed by this firm (mm/yy) | | 12/2024 | Cost of consultant services provided by this firm ($1,000's) | $6,350 | |

Describe the project including the firm's role and members involved. (Highlight staff to be used in this proposal.)

The Virginia Department of Transportation (Virginia DOT) has been a Fugro client since 2005. Fugro is currently contracted to perform 29,000 miles of annual automated pavement condition collection on interstate and primary, and secondary roads. Deliverables include longitudinal profile and IRI, transverse profile and rutting, faulting, surface distress, and pavement and HD ROW images. Fugro also delivered over 1.2 million roadway assets (signs, highway lighting, drop inlets, curb, gutter, guardrails, ditches). Fugro has collected and processed 28,800 miles of pavement data annually and 1.1 million total miles to-date for the Virginia Department of Transportation. Fugro supported Virginia DOT in the transition from windshield to automated surveys, and more recently, to 3D technology by performing a series of pilot projects. We successfully migrated over 25 TBs of data from Virginia DOT's servers to Fugro's iVision5 hosting services. Fugro set-up and customized Virginia DOT's LRS with its unique relationship of Master Routes, Non-master Routes, overlapping routes, X-routes, District County and City boundaries, and its relation to the condition data on their network with the DOT's PMS.

Fugro serves as the prime on this project and key project members from this project to be utilized for the upcoming Louisiana project include:

Lutrell Gordon-Deputy Project Manager, Cory Hackbart- Project Manager, Denis Charland- Director of Operations, Riaz Mohideen-Lead Data Analyst, Zoran Arezina- Field Operations Crew Chief, Yaoming Gu-Database Manager, Wayne Billingsley-Operations Manager, Allan Versaevel-Fleet Support, Monty Cliff- Pavement Data Collection & Analysis Quality Assurance Manager

0% of the work was performed in Louisiana.

| | | | | | |
|---|---|---|---|---|---|
| Firm name | Fugro | | Past Performance Evaluation Discipline(s)* | Data Collection | |
| Project name | New York State Data Collection and Asset Inventory | | Firm responsibility (prime or sub?) | Prime | |
| Project number | | Owner's name | New York Department of Transportation | | |
| Project location | Albany, New York (State of New York) | | Owner's Project Manager | Mr. Michael Mariotti | |
| Owner's address, phone, email | Address: Office of Technical Services, Highway Data Services Bureau, 50 Wolf Road, Albany, NY 12232<br>Phone: 518-485-8960<br>Email: michal.mariotti@dot.ny.gov | | | | |
| Services commenced by this firm (mm/yy) | | 12/2017 | Total consultant contract cost ($1,000's) | | $19,400 |
| Services completed by this firm (mm/yy) | | 12/2024 | Cost of consultant services provided by this firm ($1,000's) | | $14,400 |

Describe the project including the firm's role and members involved. (Highlight staff to be used in this proposal.)

Fugro current contract with New York includes data collection and processing for approximately 19,000 – 23,000 miles per year. Deliverables include IRI, rutting, geometrics, horizontal curve, and ROW images calibrated for asset extraction.

Fugro performed a pilot data collection and surface distress processing for 464 HPMS sections. Fugro has supported the NYSDOT in the transition from windshield surveys to fully automated crack detection equipment 3D technology with our Vision software.

NYSDOT also purchased an ARAN to perform pavement and asset data collection in-house.

Fugro serves as the prime on this project and key project members from this project to be utilized for the upcoming Louisiana project include:

Cory Hackbart-Senior Project Manager, Denis Charland- Director of Operations, Riaz Mohideen-Lead Data Analyst, Zoran Arezina- Field Operations Crew Chief, Yaoming Gu-Database Manager, Wayne Billingsley-Operations Manager, Allan Versaevel-Fleet Support, Monty Cliff- Pavement Data Collection & Analysis Quality Assurance Manager, David Hunter-Data Processing Manage, Suha Bsharat- Distress Rating Supervisor, Michael Slack-Asset Extraction Quality Control Managerr

0% of the work was performed in Louisiana.

| | | | | | |
|---|---|---|---|---|---|
| Firm name | Fugro | | Past Performance Evaluation Discipline(s)* | Data Collection | |
| Project name | Pavement Condition Data Collection | | Firm responsibility (prime or sub?) | Prime | |
| Project number | 22-24 | Owner's name | New Mexico Department of Transportation | | |
| Project location | Santa Fe, NM (Statewide) | | Owner's Project Manager | Rais Rizvi | |
| Owner's address, phone, email | Address: 1120 Cerrillos Road Santa Fe, NM 87504-1149<br>Phone: 505-467-9243<br>Email: rais.rizvi@state.nm.us | | | | |
| Services commenced by this firm (mm/yy) | 03/2022 | Total consultant contract cost ($1,000's) | $8,000 | | |
| Services completed by this firm (mm/yy) | 12/2026 | Cost of consultant services provided by this firm ($1,000's) | $500 | | |

Describe the project including the firm's role and members involved. (Highlight staff to be used in this proposal.)

The New Mexico DOT required a robust solution to collect, process, and distribute highway performance data for 15,000 miles of State force-maintained roadways. Their requirements extended to providing an HPMS data set that was very different from the data required for the Pavement Management System. Of critical importance was using the Fugro iVision tool to distribute the data to their entire enterprise efficiently.

New Mexico determined the requirement to collect, process, and distribute data on time, delivered once, and formatted to meet the department's needs. Fugro developed a strategy to meet weekly, supply early data results, and provide transparent exception reporting when we found data anomalies. The DOT team responsible for the HPMS reporting successfully went from months of effort to a few weeks after successfully implementing the strategy. This report reduced staff time and efforts by 64% from previous years.

Fugro serves as the prime on this project and key project members from this project to be utilized for the upcoming Louisiana project include:

Denis Charland, Director of Operations, Riaz Mohideen, Lead Data Analyst, Zoran Arezina- Field Operations Crew Chief, Yaoming Gu-Database Manager, Wayne Billingsley-Operations Manager, Allan Versaevel-Fleet Support, Monty Cliff- Pavement Data Collection & Analysis Quality Assurance Manager, David Hunter-Data Processing Manager

0% of the work was performed in Louisiana.

| | | | | | |
|---|---|---|---|---|---|
| Firm name | Accel | | Past Performance Evaluation Discipline(s)* | | Data Collection |
| Project name | Statewide PMS Data Collection and Analysis | | | Firm responsibility (prime or sub?) | Sub |
| Project number | | Owner's name | Fugro- Virginia Department of Transportation | | |
| Project location | Virginia (Statewide) | | Owner's Project Manager | Raja Shekharan | |
| Owner's address, phone, email | Address: 1201 E. Broad St. Richmond, VA 23219<br>Phone: 804-786-0870<br>Email: raja.shekharan@vdot.virginia.gov | | | | |
| Services commenced by this firm (mm/yy) | | 09/2021 | Total consultant contract cost ($1,000's) | | $1,000 |
| Services completed by this firm (mm/yy) | | 12/2026 | Cost of consultant services provided by this firm ($1,000's) | | $400 |

Describe the project including the firm's role and members involved. (Highlight staff to be used in this proposal.)

Fugro was the prime contractor for the Virginia Department of Transportation (Virginia DOT). Accel served as the subcontractor providing ARAN operators. Fugro is currently contracted to perform 29,000 miles of annual automated pavement condition collection on interstate and primary, and secondary roads. Deliverables include longitudinal profile and IRI, transverse profile and rutting, faulting, surface distress, and pavement and HD ROW images. Fugro also delivered over 1.2 million roadway assets (signs, highway lighting, drop inlets, curb, gutter, guardrails, ditches). Fugro has collected and processed 28,800 miles of pavement data annually and 1.1 million total miles to-date for the Virginia Department of Transportation. Fugro supported Virginia DOT in the transition from windshield to automated surveys, and more recently, to 3D technology by performing a series of pilot projects. We successfully migrated over 25 TBs of data from Virginia DOT's servers to Fugro's iVision5 hosting services. Fugro set-up and customized Virginia DOT's LRS with its unique relationship of Master Routes, Non-master Routes, overlapping routes, X-routes, District County and City boundaries, and its relation to the condition data on their network with the DOT's PMS.

Accel serves as the subconsultant to Fugro on this project performing the function of providing data collection vehicle operators.

0% of the work was performed in Louisiana.

| | | | | | |
|---|---|---|---|---|---|
| Firm name | Data Collection Infotech(I) Pvt Ltd (DCIL) | | Past Performance Evaluation Discipline(s)* | | Data Collection |
| Project name | Pavement Distress<br>Data Collection Statewide | | | Firm responsibility (prime or sub?) | Sub |
| Project number | 736-99-1719 | Owner's name | Fugro- Louisiana Department of Transportation and Development | | |
| Project location | Baton Rouge, LA<br>(State of Louisiana) | | Owner's Project Manager | Mr. Chris Fillastre | |
| Owner's address, phone, email | Address: 1201 Capital Access Rd, 4th Floor, Baton Rouge, LA 70802<br>Phone: 225-242-4577<br>Email: christophe.fillastre@la.gov | | | | |
| Services commenced by this firm (mm/yy) | | 12/2016 | Total consultant contract cost ($1,000's) | | $1,800 |
| Services completed by this firm (mm/yy) | | 12/2022 | Cost of consultant services provided by this firm ($1,000's) | | $1,800 |

Describe the project including the firm's role, members involved (highlight members to be utilized in this project submittal) and % of work performed in Louisiana.

Fugro has served as the primary contractor utilizing DCIL as a subcontractor providing pavement and asset data collection services for the Louisiana Department of Transportation and Development (LADOTD) since 1995. During the most recent contract, approximately 163,000 lane miles of data was collected using the Automatic Road Analyzer (ARAN) for the purpose of delivering pavement distress, longitudinal profile in each wheel path and calculated International Roughness Index (IRI), rutting, texture, roadway geometry, High Definition Right-of-way (ROW) including right-side, Global Positioning System (GPS) and elevation data. Contract also included 22,000 miles of GPR collection and processing with coring validation on every 7 miles of GPR collection, 17,000 miles of Skid testing. Asset inventory for approximately 35,000 miles including Highway Performance Monitoring System (HPMS) data items and Louisiana DOTD point feature locations. Fugro also collected 120,000 miles of ROW, asset inventory, and GPS and for all local roads within the State of Louisiana.

DCIL served as the subconsultant to Fugro on this project providing distress data analysis for collected pavement data and key project members from this project to be utilized for the upcoming Louisiana project include:

Bala Narashimha; Director, Pratap Yadav; Distress Project Manager, Ramaswamy; Assets Project Manager

0% of the work was performed in Louisiana.

| | | | |
|---|---|---|---|
| Firm name | Traffic Commander | Past Performance Evaluation Discipline(s)* | Traffic |
| Project name | | Firm responsibility (prime or sub?) | |
| Project number | | Owner's name | |
| Project location | | Owner's Project Manager | |
| Owner's address, phone, email | | | |
| Services commenced by this firm (mm/yy) | | Total consultant contract cost ($1,000's) | |
| Services completed by this firm (mm/yy) | | Cost of consultant services provided by this firm ($1,000's) | |

Describe the project including the firm's role and members involved. (Highlight staff to be used in this proposal.)

**Fugro is planning to partner with this local DBE firm for the GPR item and can furnish past project experience upon request.**

| | | | |
|---|---|---|---|
| Firm name | Acacia Industries | Past Performance Evaluation Discipline(s)* | Traffic |
| Project name | | Firm responsibility (prime or sub?) | |
| Project number | | Owner's name | |
| Project location | | Owner's Project Manager | |
| Owner's address, phone, email | | | |
| Services commenced by this firm (mm/yy) | | Total consultant contract cost ($1,000's) | |
| Services completed by this firm (mm/yy) | | Cost of consultant services provided by this firm ($1,000's) | |

Describe the project including the firm's role and members involved. (Highlight staff to be used in this proposal.)

**Fugro is planning to partner with this local DBE firm for the GPR item and can furnish past project experience upon request.**

| | | | |
|---|---|---|---|
| Firm name | A&A Enterprises | Past Performance Evaluation Discipline(s)* | Geotech |
| Project name | | Firm responsibility (prime or sub?) | |
| Project number | | Owner's name | |
| Project location | | Owner's Project Manager | |
| Owner's address, phone, email | | | |
| Services commenced by this firm (mm/yy) | | Total consultant contract cost ($1,000's) | |
| Services completed by this firm (mm/yy) | | Cost of consultant services provided by this firm ($1,000's) | |

Describe the project including the firm's role and members involved. (Highlight staff to be used in this proposal.)

**Fugro is planning to partner with this local DBE firm for the GPR item and can furnish past project experience upon request.**

| | | | | | |
|---|---|---|---|---|---|
| Firm name | J. Star Enterprises | | Past Performance Evaluation Discipline(s)* | Geotech | |
| Project name | | | Firm responsibility (prime or sub?) | | |
| Project number | | Owner's name | | | |
| Project location | | | Owner's Project Manager | | |
| Owner's address, phone, email | | | | | |
| Services commenced by this firm (mm/yy) | | Total consultant contract cost ($1,000's) | | | |
| Services completed by this firm (mm/yy) | | Cost of consultant services provided by this firm ($1,000's) | | | |

Describe the project including the firm's role and members involved. (Highlight staff to be used in this proposal.)

**Fugro is planning to partner with this local DBE firm for the GPR item and can furnish past project experience upon request.**

* If there is more than one past performance evaluation discipline included in the proposal, then indicate which past performance evaluation discipline(s) this project is being used to represent.

PROPOSERS must demonstrate that they meet the following:

1. Must have successfully captured, delivered and completed a 3D project of this nature for at least 5,000 miles;
2. Must have successfully completed this 5,000 mile 3D project for a State DOT or large organization/agency;
3. Must have successfully completed this 5,000 mile 3D project for multiple cycles of data collection and anaylsis; and
4. Must have successfully captured and delivered all of the deliverables outlined in Attachment A for previous projects.

## 18. Approach and Methodology:

Provide a description of how the work will be performed and provide the proposed project schedule. Include any additional information or description of unique resources that are planned to be used to produce the deliverables. In addition, document existing Data Collection Vehicle Inventory (DCV) using the table provided below. Include any proprietary technologies, methods or approaches that will be used on this project to improve quality or efficiency. This section shall be limited to four pages. If more than four pages are included, all pages after the fourth page will not be evaluated.

(DCV) Data Collection Vehicle Inventory

(Vehicles listed below are not required to be used for this contract)

| Vehicle ID | Vehicle Configuration Details | Owned By | Make | Model | Year |
|---|---|---|---|---|---|
| ARAN 30a | Pave3D (LCMS), Laser SDP (Line Laser Roughness), 64 kHz Texture Laser, Two (2) HD | Fugro | Dodge | Sprinter 2500 | 2022 |
| ARAN 46 | Pave3D (LCMS), Laser SDP (Line Laser Roughness), 64 kHz Texture Laser, Two (2) HD Sony D320 1080P Cameras, DMI, GPS, POS LV | Fugro | Mercedes | Sprinter 2500 | 2011 |
| ARAN 47 | Pave3D (LCMS), Laser SDP (Line Laser Roughness), 64 kHz Texture Laser, Two (2) HD Sony D320 1080P Cameras, DMI, GPS, POS LV | Fugro | Mercedes | Sprinter 2500 | 2011 |
| ARAN 49 | Pave3D (LCMS), Laser SDP (Line Laser Roughness), 64 kHz Texture Laser, three (3) HD SonyFX9 4K Cameras, DMI, GPS, POS LV | Fugro | Mercedes | Sprinter 2500 | 2013 |
| ARAN 50 | Pave3D (LCMS), Laser SDP (Line Laser Roughness), 64 kHz Texture Laser, Two (2) HD Sony D320 1080P Cameras, DMI, GPS, POS LV | Fugro | Mercedes | Sprinter 2500 | 2013 |

| | | | | | |
|---|---|---|---|---|---|
| ARAN 51 | Pave3D (LCMS), Laser SDP (Line Laser Roughness), 64 kHz Texture Laser, Two (2) HD Sony D320 1080P Cameras, DMI, GPS, POS LV | Fugro | Mercedes | Sprinter 2500 | 2014 |
| ARAN 52 | Pave3D (LCMS), Laser SDP (Line Laser Roughness), 64 kHz Texture Laser, Two (2) HD Sony D320 1080P Cameras, DMI, GPS, POS LV | Fugro | Mercedes | Sprinter 2500 | 2016 |
| ARAN 54 | Pave3D (LCMS), Laser SDP (Line Laser Roughness), 64 kHz Texture Laser, Two (2) HD Sony D320 1080P Cameras, DMI, GPS, POS LV | Fugro | Mercedes | Sprinter 2500 | 2016 |
| ARAN 55 | Pave3D (LCMS), Laser SDP (Line Laser Roughness), 64 kHz Texture Laser, Two (2) HD Sony D320 1080P Cameras, DMI, GPS, POS LV | Fugro | Mercedes | Sprinter 2500 | 2016 |
| ARAN 56 | Pave3D (LCMS), Laser SDP (Line Laser Roughness), 64 kHz Texture Laser, three (3) HD SonyFX9 4K Cameras, DMI, GPS, POS LV | Fugro | Mercedes | Sprinter 2500 | 2017 |
| ARAN 57 | Pave3D (LCMS), Laser SDP (Line Laser Roughness), 64 kHz Texture Laser, Two (2) HD Sony D320 1080P Cameras, DMI, GPS, POS LV Pave3D (LCMS), Laser SDP (Line Laser | Fugro | Mercedes | Sprinter 2500 | 2017 |

| | | | | | |
|---|---|---|---|---|---|
| ARAN 59 | Pave3D (LCMS), Laser SDP (Line Laser Roughness), 64 kHz Texture Laser, Two (2) HD Sony D320 1080P Cameras, DMI, GPS, POS LV | Fugro | Mercedes | Sprinter 2500 | 2019 |
| ARAN 60 | Pave3D (LCMS), Laser SDP (Line Laser Roughness), 64 kHz Texture Laser, three (3) HD SonyFX9 4K Cameras, DMI, GPS, POS LV | Fugro | Mercedes | Sprinter 2500 | 2019 |
| ARAN 61 | Pave3D (LCMS), Laser SDP (Line Laser Roughness), 64 kHz Texture Laser, three (3) HD SonyFX9 4K Cameras, DMI, GPS, POS LV | Fugro | Mercedes | Sprinter 2500 | 2019 |
| ARAN 62 | Pave3D (LCMS), Laser SDP (Line Laser Roughness), 64 kHz Texture Laser, three (3) HD SonyFX9 4K Cameras, DMI, GPS, POS LV, MX50 Laser Scanner (2), Lidar Unit 3: Trimble MX50-Spherical Camera 30MP (6xMP), Trimble GNSS-Inertial System | Fugro | Mercedes | Sprinter 2500 | 2019 |
| ARAN 63 | Pave3D (LCMS), Laser SDP (Line Laser Roughness), 64 kHz Texture Laser, three (3) HD SonyFX9 4K Cameras, DMI, GPS, POS LV | Fugro | Mercedes | Sprinter 2500 | 2019 |

| | | | | | |
|---|---|---|---|---|---|
| ARAN 64 | Pave3D (LCMS), Laser SDP (Line Laser Roughness), 64 kHz Texture Laser, three (3) HD SonyFX9 4K Cameras, DMI, GPS, POS LV, MX50 Laser Scanner (2), Spherical Camera 30MP (6xMP), Trimble GNSS-Inertial System | Fugro | Mercedes | Sprinter 2500 | 2019 |
| ARAN 65 | Pave3D (LCMS), Laser SDP (Line Laser Roughness), 64 kHz Texture Laser, Two (2) HD Sony D320 1080P Cameras, DMI, GPS, POS LV | Fugro | Mercedes | Sprinter 2500 | 2020 |
| ARAN 66 | Pave3D (LCMS), Laser SDP (Line Laser Roughness), 64 kHz Texture Laser, three (3) HD SonyFX9 4K Cameras, DMI, GPS, POS LV | Fugro | Mercedes | Sprinter 2500 | 2018 |
| ARAN 67 | Pave3D (LCMS), Laser SDP (Line Laser Roughness), 64 kHz Texture Laser, three (3) HD SonyFX9 4K Cameras, DMI, GPS, POS LV | Fugro | Mercedes | Sprinter 2500 | 2020 |
| ARAN 68 | Pave3D (LCMS), Laser SDP (Line Laser Roughness), 64 kHz Texture Laser, three (3) HD SonyFX9 4K Cameras, DMI, GPS, POS LV | Fugro | Mercedes | Sprinter 2500 | 2020 |
| ARAN 69 | Pave3D (LCMS), Laser SDP (Line Laser Roughness), 64 kHz Texture Laser, three (3) HD SonyFX9 4K Cameras, DMI, GPS, POS LV | Fugro | Mercedes | Sprinter 2500 | 2020 |

**19. Workload: (AMMENDED)**

For all contracts where a firm on the team is a prime consultant or sub-consultant and where a) the consultant selection was made by DOTD, and b) a contract was executed by the consultant and the contracting entity by the date the advertisement for this proposal was posted, list all work meeting the following criteria:

1) one of the team's firms is responsible for the performance of the work;
2) authorization to perform the work has been provided, as provided in the contract between the consultant and the contracting entity;
3) the work has not yet been performed and invoiced; and
4) the work is not currently suspended for an indefinite period of time.

For indefinite delivery/indefinite quantity (IDIQ) contracts, list open Task Orders individually.
List only the portion of the fees attributable to firms on the team.

| Firm(s) | Past Performance Evaluation Discipline(s) * | State project number | Project name | Remaining Unpaid Balance** |
|---|---|---|---|---|
| Fugro | Data Collection | Contract 4400008804-Agreement 3-Louisiana DOTD Purchase order number 2000389394 | Pavement Distress Data Collection Statewide | $120,000 |
| Data Collection Infotech (India) Private Limited | Data Collection | N/A | N/A | N/A |

| | | | | |
|---|---|---|---|---|
| Acacia Industries, LLC | Traffic | N/A | N/A | N/A |
| A&A Enterprises, inc. | Geotech | N/A | N/A | N/A |
| Accel Talent and Development | Data Collection | N/A | N/A | N/A |
| J Star Enterprises, inc. | Geotech | N/A | N/A | N/A |

| | | | | |
|---|---|---|---|---|
| Traffic Commander, LLC | Traffic | N/A | N/A | N/A |

(Add rows as needed) DO NOT SUM

* The only past performance evaluation disciplines to be used are: Road, Bridge, Traffic, CE&I/OV, Geotech, Survey, Environmental, Data Collection, Planning, Right-of-Way, CPM, ITS, Appraiser and Other. If a firm has more than one past performance evaluation discipline for any single project, the firm can use multiple rows to express the remaining unpaid balance per evaluation discipline.

** Round to the nearest dollar. **Do not** round to the nearest thousands. If there are no active contracts with a remaining unpaid balance, place N/A in the Remaining Unpaid Balance column. LEAVING THE "REMAINING UNPAID BALANCE" COLUMN BLANK IS NOT ACCEPTABLE.

## Project Understanding

It is our understanding that for the upcoming contract; the DOTD is seeking pavement distress data collection services and video log for approximately:

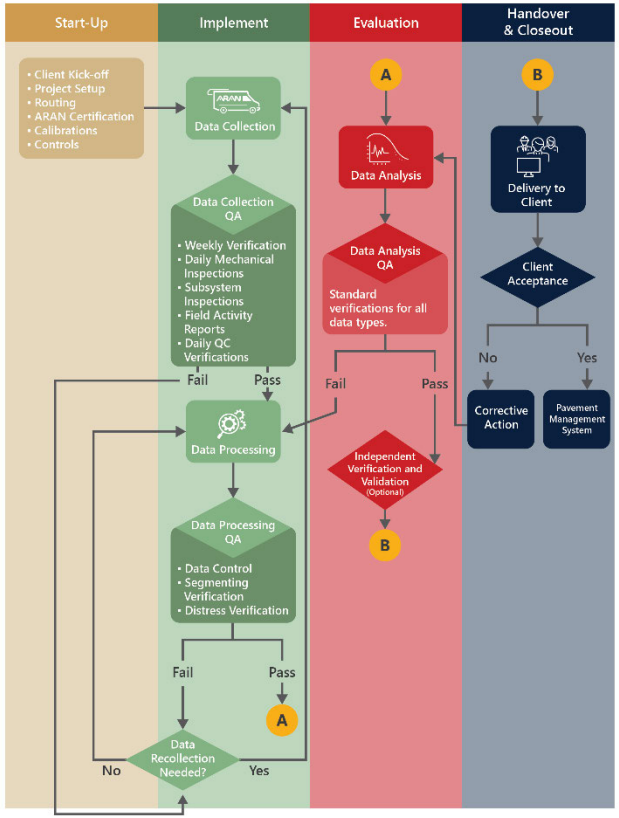
- Interstate Highway System – 1884 analysis lane miles annually
- Non-Interstate National Highway System (NHS) – 3280 analysis lane miles annually
- Local Nation Highway System (LNHS) – 210 analysis lane miles annually
- Highway Performance Monitoring System – 818 analysis lane miles annually
- State Systems – 13760 analysis lane miles bi-annually
- Ramps – 738 analysis lane miles bi-annually
- Frontage/Service Roads – 545 analysis lane miles bi-annually
- As the highway system in Louisiana is always changing, it is understood that additional miles may be added or discovered within a system. It is also understood that the DOTD expects Fugro to capture and deliver this additional mileage at no additional charge, so long as the total additional mileage does not exceed 0.5%, or one half of one percent, of the total analysis miles for the contract cycle.

In addition to the data and images, the DOTD is to be provided the following software:

- Software Viewing Tool
- Software Data Processing & Management Tool
- Software Asset Inventory Capture Tool

## Project Management Methodology

Data will continue to be collected by Fugro's Automatic Road Analyzer (ARAN) collection vehicle on dry pavement for the State's highway network. Our documentation and survey results provide a fully traceable account of the road network that will permit LaDOTD to audit our results and hold Fugro accountable for our work quality.



Fugro's ARAN vehicles will provide automated collection of pavement condition data with sufficient detail and accuracy to evaluate project-level pavement conditions, model pavement deterioration, and perform multi-year planning with a Pavement Management System (PMS). This data will be formatted for use in both network-level pavement management and project-level pavement evaluations.

### Sony D320 Right-of-Way (ROW) Camera

- 3CCD Broadcast Quality
- Recording up to 120 frames per second (fps)
- Each ARAN equipped with two (w) Sony 320 cameras
- Covers 180 degree field of view
- Image size of 1920 x 1080 pixel (16:9 aspect ratio)

### Or Sony PXW-FX9K

- 4K full-frame Exmor R CMOS sensor.
- Advanced image stabilization.
- Adjustable frame rate up to 120 frames per second (fps).
- Image size of 3840 x 2160 pixels.
- Superb image quality even in low-light conditions because of the high base sensitivity of the ISO 4000.
- Able to resolve 1.5-inch text at 100 feet

### Pave3D

*Pavement Images, Transverse Profiling & Rutting, Raveling, Failures, D-Cracking, and Transverse Joint Spalling.*


- 2 Laser Profilers
- Sampling rate: 28,000 profiles Hz scanning frequency.
- Can measure up to 14 feet (4.2672 meters) in width with a lateral resolution of 4,160 points.
- Provides a georeferenced 3-dimensional and 2-dimensional representation of the road surface across the full travelled lane to a width of up to 14 feet and can be linked the the client's linear referencing system (LRS).
- Down view image size is 2552 x 4739.
- Operates at highway speed in all lighting conditions and on all pavement types.
- Automated detection, classification and rating of transverse, longitudinal, alligator ( fatigue) cracking.
- Automated detection of pavement texture across the wheel path or according to AASHTO standards.
- Compliant with all AASHTO and ASTM industry standards.

### Laser SDP (South Dakota Profiler) with Gocator Sensors

- Continuously captures/measures the longitudinal profile along 100% of the driven lane in both wheel paths along the entire length of each section specified by the client.
- Longitudinal profile elevation point measurements shall be captured at a distance interval no larger than 1 in (38.1 mm) along the road.
- ASTM Class 1 profiler - Each GoCator laser sensor has a 4-inch (101.6-mm) scan width.
- Speed-sensitive algorithms to improve longitudinal profile during low speed zones (<15 mph), and "Stop and Go" conditions.
- Vertical Resolution: 0.0004 in (0.001 cm)
- Travelled Distance Accuracy: 0.02%
- Positional Referencing Accuracy: 0.02%

### Distance Measurement Instrument (DMI)

- Allows for validation of low speed IRI measurements.
- Meets requirements of ASTM E-950 Class 1 instrument.
- Accurate to +/-0.02%
- No minimum speed limitations, records 10,000 pulses per revolution
- Allows for all-weather operation

### Real-Time GPS with GNSS

- Trimble Differential Global Positioning System (DGPS) using Applanix's POS LV 220.
- Inertial Differential GPS lat/long values will be collected adhering to NAD83/NAVD88/GRS1980.
- Dual frequency NTRIP-capable GPS receiver to collect data.
- GPS coordinates measured will include longitude and latitude reported in decimal degrees to an accuracy of 6 digits, elevation data reported in feet to an accuracy of 0.1 ft (30.5 mm), as well as the Bearing at the beginning and end of each segment, reported in degrees from 0 (North) to an accuracy of one (1) digit.
- Accurate data collection at highway speeds

### Trimble MX50

*Lidar (Overhead Clearance)*

- Includes 2 laser scanners with a range up to 80m (appoximately 262 ft) each with a scan rate up to 500,000 pts/sec.
- Incorporate a Ladybug 5+ camera capable of collecting 360 degrees images.
- Range accuracy: 2 mm or 0.079 in.
- Computer controlled system
- Accurate data collection at highway speeds
- All data (imagery and LiDAR) are captured and processed in a robust and easy-to-use software.

### GripTester MK2

*Continuous Friction Testing*

- The single measuring wheel is braked by 15% and the load and drag on this wheel are continuously measured to determine the friction coefficient.
- Light towbar pull and low center of gravity ensure safe, stable operation on winter and summer roads.
- Automatic water delivery system that helps minimize water usage and safeguards the accuracy of results.
- Accurate data collection system

### Ground Penetrating Radar

- Ground Penetrating Radar (GPR) detects changes in road structure, including:
  - Material thickness
  - Composition
  - Condition



Prime consultant name**: Fugro**

Fugro will provide:

- Start-Up (Preliminary Activities & Initial Pilot- Task 1)
- Data and Imagery Collection- Tasks 2, 4, 8, 10, 12, 16, 18)
- Distress Data Analysis and Delivery (Tasks 3, 5, 9, 11, 13, 17, 19)
    a. Pavement Data Processing
- Image Collection and Image Delivery (Tasks 6, 7, 14, 15, 20, 21)
- Continuous Friction Testing (Task 22)
- Historical Data Conversion (Task 23)
- Final Documentation (Task 24)
- Pavement Viewing Interface Hosting State (Task 25)
- Ground Penetrating Radar (GPR) (Task 26)
- Additional Services: Road Asset Inventory Data Conversion (Task 27)

## Software

### *Pavement Data Processing Tool*

Fugro's Data Processing team will continue to utilize our Vision software for all distress processing. This software includes modules to quantify and categorize all pavement distresses required within this contract. Customizable distress parameters allow flexibility to meet the specific needs or each unique agency. All processed pavement condition data is then uploaded to the web-based iVision5 viewing tool.

### *Imagery and Pavement Data Viewing Tool*

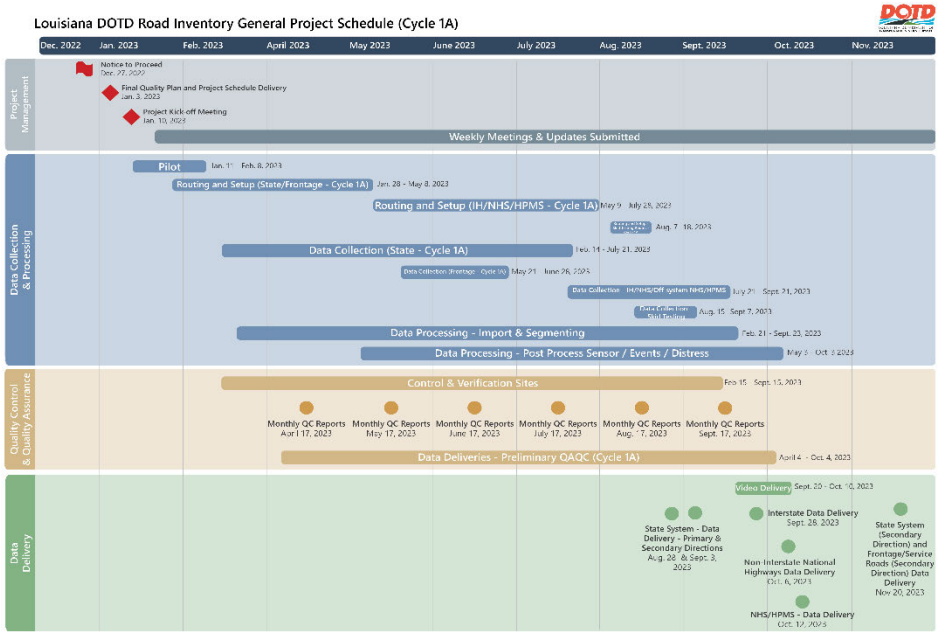
iVision5 offers open data schemas that enable customized data querying, extraction, and linking with other systems to provide maximum flexibility and data-synchronization capabilities.

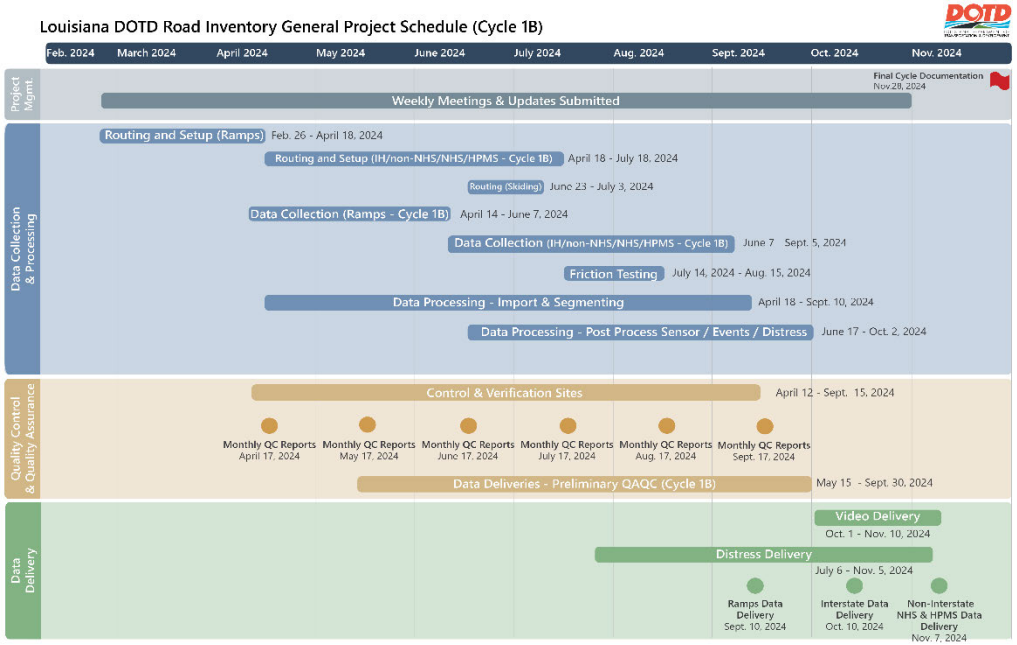
iVision5 seamlessly integrates the collected and processed data & imagery, GPS, and mapping layers into an intuitive, point-and-click user-friendly interface. The application can be operated on all major browsers and is compatible with mobile devices for review in the field. Additionally, iVision5 offers a playback speed of 900+ image per minute made possible using Fugro's sophisticated image compression and bandwidth optimization techniques.

## Proposed Project Schedule

The following page displays a detailed outline of our proposed project plan highlighting all collection and deliverable tasks. This schedule has been modeled after previous successful data collection projects for LaDOTD..

.




 Prime consultant name**: Fugro**

**19. Workload:**

For all contracts where a firm on the team is a prime consultant or sub-consultant and where a) the consultant selection was made by DOTD, and b) a contract was executed by the consultant and the contracting entity by the date the advertisement for this proposal was posted, list all work meeting the following criteria:

1) one of the team's firms is responsible for the performance of the work;
2) authorization to perform the work has been provided, as provided in the contract between the consultant and the contracting entity;
3) the work has not yet been performed and invoiced; and
4) the work is not currently suspended for an indefinite period of time.

For indefinite delivery/indefinite quantity (IDIQ) contracts, list open Task Orders individually.
List only the portion of the fees attributable to firms on the team.

| Firm(s) | Past Performance Evaluation Discipline(s) * | State project number | Project name | Remaining Unpaid Balance** |
|---|---|---|---|---|
| Fugro | Data Collection | Contract 4400008804-Agreement 3-Louisiana DOTD Purchase order number 2000389394 | Pavement Distress Data Collection Statewide | $120,000 |

(Add rows as needed) DO NOT SUM

* The only past performance evaluation disciplines to be used are: Road, Bridge, Traffic, CE&I/OV, Geotech, Survey, Environmental, Data Collection, Planning, Right-of-Way, CPM, ITS, Appraiser and Other. If a firm has more than one past performance evaluation discipline for any single project, the firm can use multiple rows to express the remaining unpaid balance per evaluation discipline.

** Round to the nearest dollar. **Do not** round to the nearest thousands. If there are no active contracts with a remaining unpaid balance, place N/A in the Remaining Unpaid Balance column. LEAVING THE "REMAINING UNPAID BALANCE" COLUMN BLANK IS NOT ACCEPTABLE.

**20. Certifications/Licenses:**

If the advertisement requires submission of licenses and/or certificates, include them here. Otherwise, leave this section blank.

**Copies of licenses and certificates are not required to be submitted with the proposal.**

## 21. QA/QC Plan and/or Work Plan:

# Work Plan

**FUGRO IS PLEASED TO PRESENT THIS PROPOSAL FOR PAVEMENT DISTRESS DATA COLLECTION STATEWIDE FOR THE LOUISIANA DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT (LADOTD).**

The following is Fugro's detailed Work Plan to perform the tasks and deliverables as outlined in the solicitation document for the DOTD project. The description of tasks and deliverables are outlined as per Section 2.4 titled" Deliverables" of the solicitation document. The supporting technical equipment details and additional information have been provided within section 18 of this form "Approach and Methodology" as well as within Appendix A:

The LaDOTD project will be managed according to our professional project management methodology, as seen within section 18 of this form "Approach and Methodology".. Fugro utilized the same concept in the past project to deliver all of the data to maintain consistency.

Given our long-standing partnership with LaDOTD, we understand the significant investment that has been made into your pavement management program. For this upcoming contract, we want to ensure that the LaDOTD receives the best value for this investment by delivering consistent, repeatable, accurate and timely data. Fugro wants to continue to support your team in the mission to deliver transportation and public works systems that enhance quality of life and facilitate economic growth. Some of Fugro's goals for this project are:

- Continually improve the performance of the LaDOTD.
- Deliver cost-effective products, projects, and services in a timely manner.
- Enhance the safety and well-being of the citizens, visitors, and staff.
- Improve customer service and public confidence.
- Effectively develop and manage the DOTD's human resources.
- Effectively manage the DOTD's financial resources.

The following Work Plan highlights Fugro's on-site resources, project team qualifications and experience, and equipment, software and technologies for this upcoming contract to ensure that the DOTD achieves the mission and goals as outlined in LaDOTD's 5-Year Strategic Plan.

## Work Plan Tasks

### Project Definition and Planning, and Initial Pilot (Task 1)

#### *Coordination/Communication*

Mr. Hackbart, as the Fugro Project Manager, will plan, set up, and manage the project from beginning to end. Through all phases of the project, he will continue to serve as the single point of contact for DOTD staff. He will be responsible for coordination and communication with all parties, and for the various internal project and processing related meetings that are held each week. The objectives of these meetings are as follows:

- Manage coordination between project components

- Ensure that schedules are met
- Monitor progress
- Ensure that adequate staffing levels are maintained on project teams to ensure project completion according to schedule.

*Project Control and Management*

Upon the receipt of the Notice to Proceed, Mr. Hackbart will work with DOTD staff to develop the project charter and detailed management plans including:

- Scope Management Plan
- Schedule Management Plan
- Resource Management Plan
- Communication Plan
- Risk Management Plan
- Quality Control Plan

Mr. Hackbart will provide LaDOTD with a more comprehensive Work Plan that will include well-defined milestones, a thorough description of the staffing and equipment plan, and will outline Fugro's approach to planning, monitoring, submitting and implementing the project activities on time. This document will also include exception reports, risk register, and will detail how issues will be evaluated and resolved.

*Project Startup Meeting*

As part of the project planning, Mr. Hackbart will work with LaDOTD to schedule a startup meeting at the LaDOTD's office in Baton Rouge to finalize the deliverables, methods, technical requirements, procedures and guidelines for the project. Fugro will work LaDOTD staff to develop and finalize the invoicing and project delivery schedule.

*Inspection and Calibration*

Fugro has assigned three (3) field operators to each ARAN and they will rotate on a 14-day cycle having two (2) operators on an ARAN during collection. All field operators are trained on the unique aspects of the project. **Mr. Zoran Arezina, Field Operations Crew Chief for the previous data contract with the DOTD, will continue in his role for the upcoming contract to leverage his experience and knowledge of the DOTD's roadway network**. All ARAN operators will be available at any time for LaDOTD personnel to inspect the equipment, discuss operation details, and communicate with the operators.

Prior to being authorized by the LaDOTD to collect data, the ARANs assigned to the project will be calibrated to a Primary Baseline calibration site. Data acquisition and data evaluation will be performed at least ten times on each pavement calibration section to allow for the calibration of electronic sensor data. The electronic sensor data will be evaluated for accuracy, under LaDOTD supervision, as appropriate for the equipment. ARANs will be monitored that all calibrated systems data at least one per month at LaDOTD meet the approved Primary Baseline calibration sites, or as directed by the DOTD. It is understood that any ARANs that leave the State, require repairs, to either the vehicle or data collection equipment, or are out of service for an extended period of time, must be recalibrated on the DOTD approved Primary Baseline calibration sites. All calibrations procedures performed during the project along with the recorded calibration data will be documented and reported to LaDOTD on a monthly basis. The Final Report will also document the calibration procedures, the calibration data that was collected and any corrective action taken and explained in detail.

*Routing and Linear Reference*

Based on the outcome of the Project Definition and Plan Development tasks and the Project Startup Meeting, an optimal routing plan for field data collection will be developed to ensure timely completion of fieldwork. Inputs to the routing plan will include the LaDOTD-supplied database/description of roadways to be tested and corresponding maps. All specified sections will be routed for collection according to the LaDOTD's Linear Referencing System (LRS). Fugro has been collecting data for the LaDOTD for several years, and as such, our Routing Department has a history of field crew notes that address issues and ambiguities that have been encountered previously. All LaDOTD provided roadway information will be compared against Fugro's historical data, and potential concerns will be addressed proactively with the LaDOTD, thereby reducing the potential for inefficiencies in the field affecting the timing of the data delivery. This step ensures full agreement and a common understanding of the routing plan and the real-time ARAN database (Electronic Field Sheets). Fugro's previously collected GPS will be utilized to assist in routing, and data will be used by collection field crews in real-time during collection. GPS data will be displayed where the ARAN position may be observed in relation to the GPS data during collection. This practice further reduces the possibility of incorrect collection of routes.

*Initial Pilot*

Fugro will participate in a small Pilot Project to finalize and gain acceptance of methods, procedures, deliverables, reporting, etc. that will be used for the remainder of the project. This Pilot Project will include roadway systems as described in solicitation document (Tasks 2 – 9). It is also understood that the DOTD reserves the option to request a Pilot Project at the start of each full cycle.

Deliverables for this task include:

- Detailed Work Plan/Master Schedule for data collection and quantification of the field condition data
- Quality Assurance and Quality Control Program
- Final or updated installation of all appropriate software solutions (Vision, iVision5, and Surveyor). The DOTD already has licenses of Fugro's software, however, Fugro will ensure that the DOTD has the most recent versions of all installations.
- A copy of the processed data results of the calibration test runs.
- Test loading of processed pavement condition data into the DOTD's dTIMS Deighton Pavement Management System import database.
- Forward facing perspective and right facing ROW images with "Header Information" and DOTD Logo.
- Pavement images with distress identifications, road zone and lane markings, joint locations, etc.
- Electronic Data Files, with all appropriate QA/QC data, as identified in the project plan.
- Summary Data Files, with all appropriate summary data, as identified in the project plan.
- All software and the appropriate training for all necessary LaDOTD employees. LaDOTD staff has already received training on Fugro's software as part of the most recent data collection project; however, additional training will be delivered as required.
- Confirmation of data and image synchronization and location verification using the Vision and iVision5 software.

- Monthly Reports, detailing the results of calibration sites, rater calibration, and results of data test load, sensor calibrations, inertial navigation date, etc. including all monthly reporting requirements outlined in the solicitation document.
- All data and image files to be submitted on external hard drives (USB 3.0) or on other pre-approved storage media. District Network Attached Storage (NAS) devices will also be delivered bi-annually during the entire State collection cycle. These NAS devices will contain the same data and images used at the main DOT headquarters and will be delivered to each District for local connections.

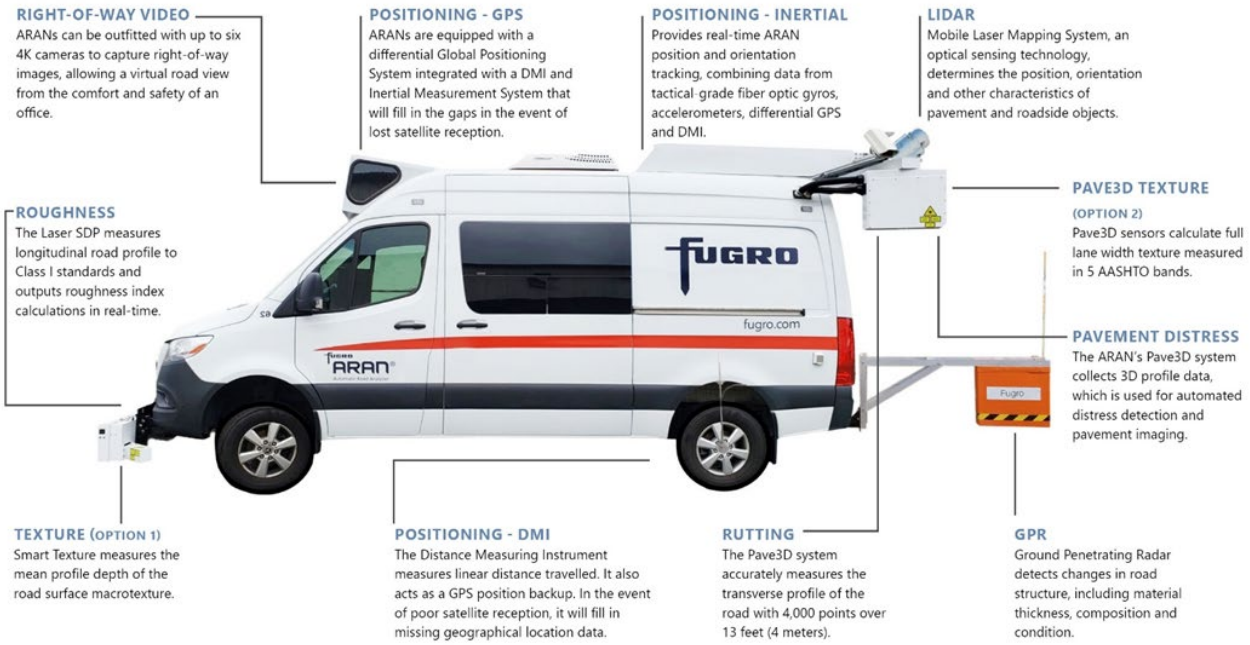
## Field Data and Image Collection (Tasks 2, 4, 8, 10, 12, 16, 18)

Field data collection for the DOTD project will be conducted using our Automatic Road Analyzer (ARAN). Fugro developed the first ARAN in 1983, one of the very first multi-functional pavement data collection vehicles in the world. Now in its 6th generation, everything learned from then until now has been applied to create a robust, accurate and repeatable integrated pavement data collection system. To this day, we design, build and operate our own hardware and software, a turnkey system that many of our service clients go on to buy for their own use. The ARAN has been designed and engineered to withstand the rigors of collecting seven days a week, 365 days a year. We apply the same asset management principles our clients use to manage roads as we do with our ARANs, thereby eliminating downtime and delivering better quality data the first time. Each ARAN carries a full suite of spare parts (including belts, Distance Measurement Instrument (DMI) encoders, lasers, cameras, cables) and every field crew member follows a rigorous, technical, driving and safety training regime to ensure we have only the best operators working for our clients.

Fugro's ARAN data collection vehicle conforms to the AASHTO standards and specifications for automated distress data collection, and offers the ability to automatically and synchronously collect the following pavement data types:

- Linear reference data with the use of a Distance Measurement Instrument (DMI)
- Geo-referenced data with the use of an inertial aided Global Positioning System (GPS) and orientation (POS LV)
- Right of Way (ROW) digital images using cameras with broadcast quality optics
- Longitudinal profile, Roughness (IRI) data from a Laser SDP system
- Texture data , mean profile depth (MPD) from our laser based system
- Transverse profile and Rutting from Fugro's 3D systems
- Pavement images and surface distress from Fugro's 3D systems
- Subsurface analysis using Ground Penetrating Radar
- LiDAR

All ARAN vehicles and operators are certified yearly through NCAT.




*Data Collection Protocols*

Fugro will comply with all LaDOTD data collection requirements in the solicitation document. All data will be collected in the right lane of the ascending direction of Control Section log mile on undivided two, three and four lane roads and from the right lane in each direction on divided roads with four or more lanes.

Additionally, there will be a limited number of two lane roadways that will be run in both directions. The ARAN will begin collection of digital images and data not less than a tenth (0.100) mile before the beginning of each control section and will stop collection of digital images and data not less than a tenth (0.100) mile past the end of the control section.

All images will be collected in the right lane of the secondary direction of Control Section. All data will be collected via the "from" location descriptions and the "to" location descriptions in the DOTD Location Referencing System and the GIS base map. All ramps will be collected in the primary direction of travel only. Fugro will report when construction zones, bridges, lane deviations, and railroad crossings occur, or are encountered, during data collection in accordance to the requirements as outlined in the solicitation document.

Deliverables for data and image collection include:

- Images to the DOTD are available on external hard drives (USB 3.0) or on other pre-approved storage

media, on a bi-weekly basis or via web application iVision5 accessing Fugro Servers. The bi-weekly delivery will be accompanied by all required files needed for viewing the images with Fugro's software. The DOTD will also have access to the collected data and images through both the DOTD internal iVision5 website, and/or the Fugro-hosted iVision5 website.

- Delivery of bi-weekly Raw Data Files containing the ARAN's electronic sensors (rutting, IRI, faulting, GPS data, etc.). As noted, the DOTD will also be able to view the data through the Fugro's hosted iVision5 website.
- All daily/weekly equipment calibrations test results (i.e. DMI, Laser Profiler, video footprint, etc.) submitted on a monthly basis.
- All daily/weekly electronic sensor verification results (i.e. re-run of sections that had been run from the previous Monday to determine the ARAN is still in calibration, submitted on a monthly basis).

### Distress Data Analysis and Delivery (Tasks 3, 5, 9, 11, 13, 17, 19)

Fugro is a pioneer in developing data processing and visualizing software products. Fugro's software programs are customized to be used in combination with ARAN for efficient data processing and asset extraction processes. Fugro's engineers have developed sophisticated and proven algorithms to greatly improve the detection, classification, rating, and reporting of data. Fugro's Vision software will be used to evaluate and report on tenth mile (0.100) increments all distresses in accordance with the Louisiana Distress Identification Protocols. Our Vision processing software is used to identify and rate surface distresses and has already been calibrated for the DOTD's distress types and protocols. These calibrations will be reviewed and approved prior to the start of the next collection cycle.

Using Vision, Fugro staff will quantify and summarize distresses and report those quantified distresses (along with the rutting, roughness, faulting, and GPS data). Fugro will load this data into the DOTD dTIMS import database and query for errors before delivery. This import database containing the summarized district data will be delivered by Fugro staff that is responsible for preparing and loading the summarized data for the dTIMS. Fugro staff will assist the DOTD in the review of the data and immediately reschedule for testing any section found to be invalid. Fugro will deliver all distress data on external hard drives (USB 3.0) or DOTD approved storage media, to the DOTD Management Systems offices located at 1201 Capitol Access Road, Baton Rouge, Louisiana. DOTD staff will also be able to access through the current iVision5 website hosted by Fugro, and/or the DOTD's internal iVision5 website.

Deliverables for distress data analysis and delivery include:

- All quantified pavement condition assessment data properly loaded into the dTIMS import database and reported in tenth (0.001) mile increments as required.
- All data/images delivered on external hard drives (USB 3.0) or on other pre-approved storage media. DOTD staff will also have access to the data/images through the iVision5 website currently being hosted by Fugro, and/or the DOTD's internal iVision5 website.
- Electronic Data Files/Tables containing all relevant requirements outlined in the solicitation document.

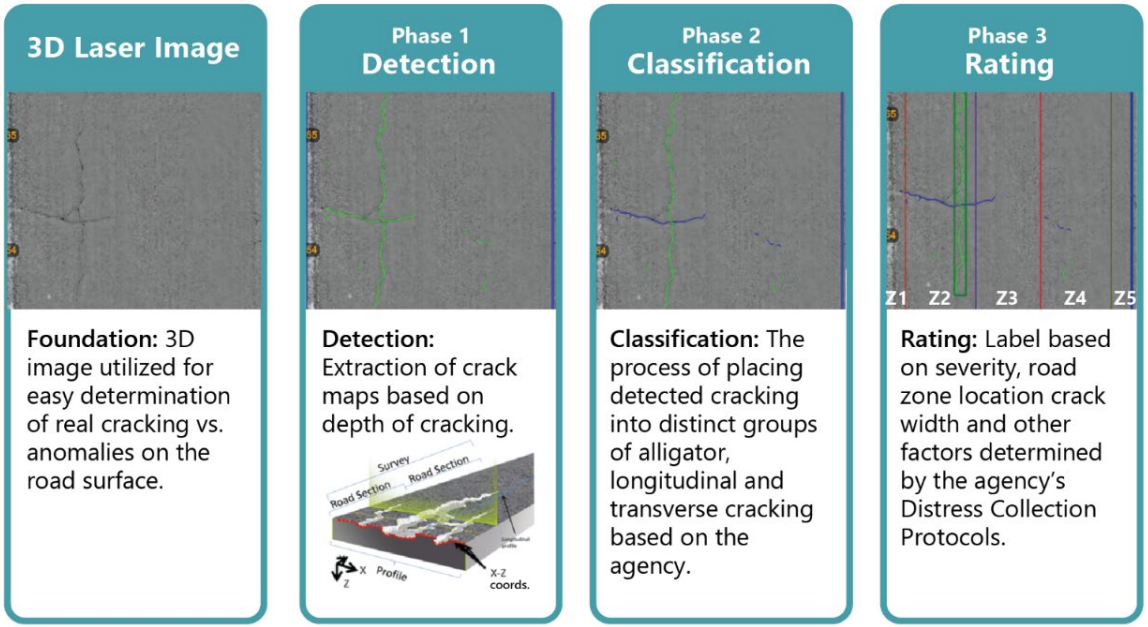
- Image Location Data Files/Tables containing all relevant location information and image file storage location.
- All LiDAR data to be delivered in the format requested (compatible with POSPAC, Trimble Business Center or TopoDOT).
- Raw Data Files containing the ARAN's electronic sensors (rutting, IRI, faulting, pavement distress, GPS data, etc.).
- As a final delivery, Fugro will supply each district all approved forward facing perspective images and right facing ROW images accompanied by all approved associated files and databases with supporting files for that district.

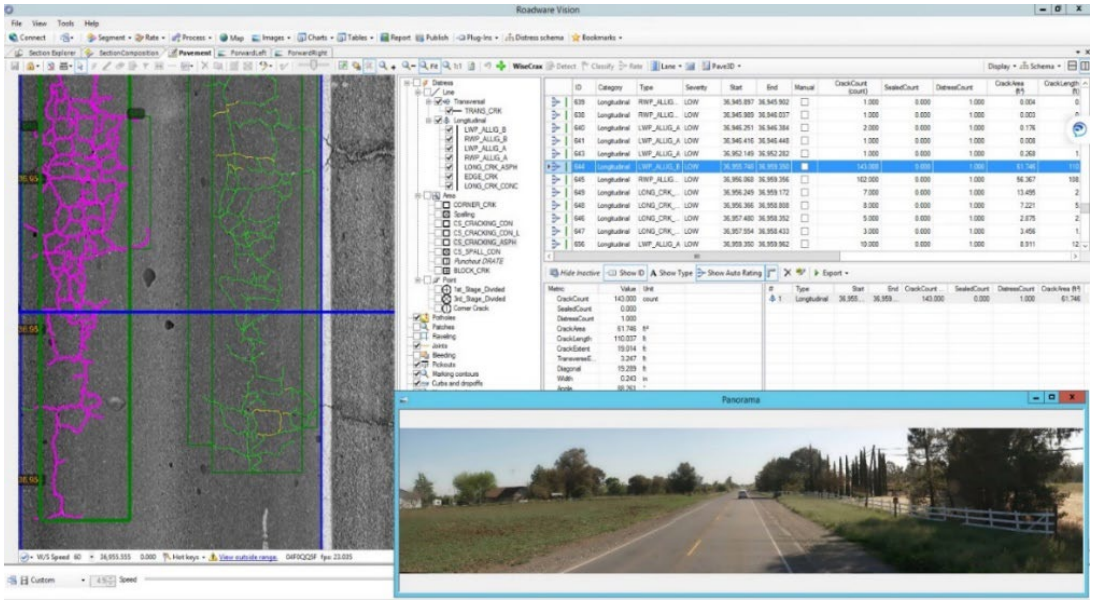
*Pavement Data Processing*

Vision software is considered an integral part of data processing and QC methodology in Fugro's pavement condition assessment approach. The software facilitates the entire data processing workflow including key modules for data upload, georeferencing and segmentation, video and sensor data quality analysis, and pavement distress analysis. It synchronizes all of the data (imagery along with sensor and map data) allowing the analyst to virtually drive on the road to assess quality, investigate anomalies, and confirm locations and conditions.

## Cracking

Accurate and consistent crack measuring starts with a good foundation. In this case, the good foundation is our ARANs equipped with LCMS, supplying a superior laser-based image for the identification of true cracking. This allows for easy determination of cracking versus other elements such as texture in the pavement. Fugro builds upon its superior hardware used to collect the raw data with our world leading Vision software. WiseCrax offers a customizable surface distress setup for classification and severity rating, continuous full-lane or zone rating, zone detection, and crack maps for quality control of the distress rating. Our distress technicians use this module to easily quantify each pavement crack by the software's automatic determination of a crack's beginning, end, width, depth, and orientation. Measuring cracks is conducted using a three-phase process.






Fugro's WiseCrax editor allows our technicians to easily input specific distress severity and extent criteria such as:

- Number of cracks and their respective severity per cracking type (e.g., Alligator, Block, Edge, Longitudinal, Transverse, etc.).
- Location and orientation of the cracking across the lane width.
- The total length of a given crack and its orientation.
- Total crack lengths per distress type and severity summarized on a pavement image and segment/network basis.
- Visual representation of pavement crack location on a given pavement image; color-coded according to its allocated severity state. (Cracks can be manually overwritten or deleted by the distress technicians.)
- Automated determination of pavement line markings, which can be used to restrict and classify pavement cracking.
- Automated statistic reports displaying summary graphs and tables of the entire collection (network) or defined section.
- The distress information in WiseCrax is visually overlaid on the pavement imagery to facilitate the manual validation of the automated distress rating and to add in any distresses that require manual intervention.

## Roughness – (IRI) International Roughness Index

Fugro's South-Dakota Profiler (SDP) subsystem provides longitudinal profile measurement that will be collected in both wheel paths for 100% of all Analysis Lane Miles to calculate the International Roughness Index (IRI) standard. The Laser SDP is a non-contact inertial profiler that uses lasers and accelerometers mounted over each wheel path to measure the longitudinal profile and calculate IRI in real time. Equipment complies with profiling equipment requirements as specified in the Highway Performance Monitoring System (HPMS) Field Manual, as well as the ASTM E950-09 Standard Test Method for Measuring the Longitudinal Profile of

Traveled Surfaces with an Accelerometer Established Inertial Profiling Reference, and AASHTO R43-13 Standard Practice for Quantifying Roughness of Pavements.

Highlights of Fugro's SDP system include:

- Flexible Testing Speeds – The Laser SDP is able to collect accurate longitudinal profile and roughness data at highway testing speeds while maintaining a bias of 5%.
- Low Speed Collection Limitation – The Laser SDP allows for testing at lower speeds and in stop-and-go conditions, for example, in urban environments.
- High Accuracy – Measurements are within +/- 5% of the measurements made by manual profiling techniques such as rod and level. Class 1 benchmarking devices that are typically used for inertial-profiler conformance testing include the ARRB Walking Profiler, and the Sure Pro.
- High Repeatability – The Standard deviation for repeat runs for the Laser SDP are within+/- 5% of the mean IRI for each run, however summarized IRI results are typically well within this accuracy range.
- Real Time - Ability to calculate IRI in real-time which facilitates vehicle operators in the identification of non-operational or ill-functioning subsystems; reducing the amount of time to identify problems with the system, limiting the extent of data collection affected.
- Reporting Parameters - In addition to reporting the mean IRI results for each segment of a route, IRI statistics such as the standard deviation, and

maximum IRI for each wheel path are reported alongside.

Roughness data will be calibrated using the Quarter Car Simulation and IRI will be reported in inches/mile. For QA/QC purposes, IRI values will be summarized in section lengths of 0.004 miles (21.12 feet) in the Electric Data Files. In addition, longitudinal profile data will be in Raw Data Files for every one (1) inch of pavement, while the computed IRI values will be summarized and retained for every four (4) inches of pavement in the left wheel path and the right wheel path, along with the standard deviations of the left and right wheel paths. These values will be made available to the DOTD for further review via Fugro's Vision data processing and management software.

For reporting purposes, computed IRI values will be averaged and reported for each tenth (0.100) mile segment (528 feet) for both the left and right wheel paths in the Summary Data File. These reports will include an average IRI for the tenth (0.100) mile segment.

For the upcoming contract, we can discuss with the DOTD the benefits of using the GoCator dispersion lasers. Fugro has been equipping ARANs with the GoCator 3.6kHz scanning laser system, providing a full 100mm (4-inch) line of data across the road surface (similar to that of a tire footprint). These offer improved consistency, repeatability and accuracy in the collection of the longitudinal profile.

### Faulting

Fugro 's Pave3D system will be used to collect faulting data along all concrete pavements. The operating frequency (longitudinal interval) of these systems ensures that all occurrences of faulting will be captured, even at highway speeds. This system reports height differentials between consecutive slabs to the nearest 0.01 inch, and allows for the collection of multiple readings across transverse joints to reduce the occurrence of false positives. The Pave3D system automatically detects transverse joints reducing the amount of time required for processing resulting in a quick delivery of the data to our client. Faulting values will be reported for each tenth mile (528 feet) segment as both the segment average as well as the maximum value. All faulting measurements will be in accordance with AASHTO R 36-13.

Fugro will capture and deliver faulting data, longitudinally, in the right wheel path only, for 100% of the analysis lanes on all joined concrete pavements. The average faulting for each tenth (0.001) mile increment (528 feet) will be calculated using the absolute value of all fault measures, including faulting measures of (0.0 inch), and using the actual number of manually identified joints. For reporting, the maximum positive fault, maximum negative fault, and the computed increment (528 feet) will be reported in the Summary Data File. This

reporting will be compiled from faults derived using defined joints using no minimum fault threshold.

### Rutting

Rutting is one of the most critical distress outputs and drives a significant series of maintenance strategies. The real-time values for rutting calculated using the Pave3D system, which collects transverse profiles at an interval of 0.2 inches and entirely across the driven lane. The calculation uses ASTM E1703 (straight-edge method), AASHTO R48 (wire method), or a simulated N-point method (e.g., 7-point).

Highlights of Pave3D for rut calculation include:

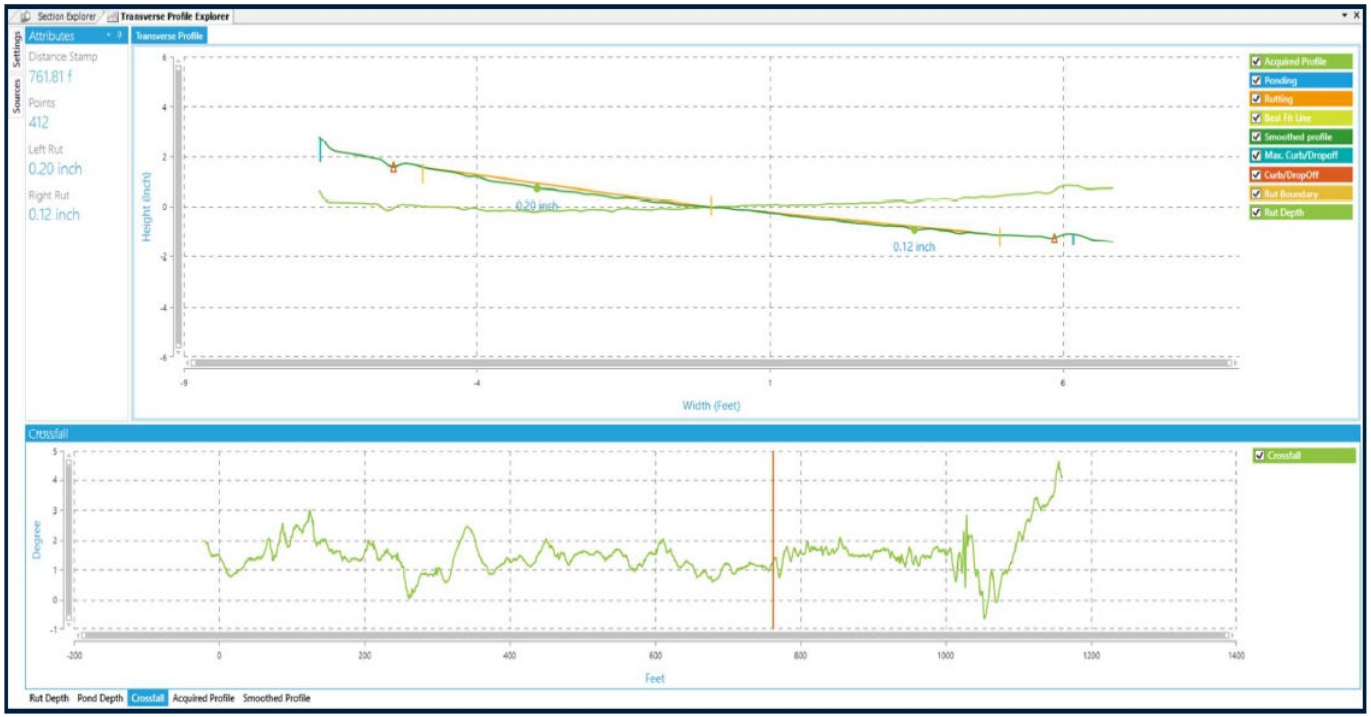
- Transverse Resolution – Dispersion lasers have significant benefits over conventional 'N' point rut collection, including accuracy of the TP compared to ground truth data and improved repeatability.
- Correlating to Historical Collection –Pave3D calibration to calculate ruts to historic rut values measured using any historical system. iVision5 can calculate secondary rutting values according to an N-point rut bar (user-defined number of points and spacing between points).
- Compliance with Standards – AASHTO PP 38-00 Standard Practice for Determining Maximum Rut Depth in Asphalt Pavements.

Advanced Transverse Profile Processor and Rut Depth features include;

- Calculate ruts using a Wire algorithm or Straight Edge with varying widths (half-lane, full-lane, 6-foot, etc.).
- Auto Lane Striping Detection to set true lane widths, satisfying LaDOTD requirement to start and end transverse profiles from the inside edges of the traffic stripes where striping is present.
- Where lane striping is not present, the user can set defined lane widths or use the edge detection processor to invalidate unwanted changes in height differentials like edge drop-off or curbs.
- Smoothing of transverse profiles removes non-rutting deformations in the pavement surface, such as surface texture and severe cracking.
- Rut values leverage the ability to perform rut location optimization.
- Use the ARAN's inertial component (multi-axis gyroscopes) to correct the transverse profile's orientation (i.e., remove the influence of vehicle roll).

The ARAN will collect rutting values across the entire lane. The transverse spacing of each data point in the table represents 0.0254 mm. Measured rutting values will be averaged and reported for each tenth (0.1) mile segment (528 feet) for both wheel paths.

For QA/QC purposes, computed rutting data will be summarized in section lengths of 0.004 miles (21.12 feet) in the Electronic Data Files, for the left wheel path and the right wheel paths. For reporting




purposes, the average rut depth will be reported for each tenth (0.100) mile increment in the Summary Data File. The maximum rut depth of each tenth (0.100) mile increment will be reported. The count of rut depth measures, identified at each 0.004 miles (21.12 feet) measure, that exceed 0.40 inches, summarized for each tenth (0.100) mile increment will be reported.

Fill quantities are calculated using the transverse profile data and the calculated rut positions. After determining the edges of the ruts in both the left and right wheel paths, the individual transverse measurements between the rut edges are used to calculate the difference in depth between the measured transverse profile and the projected un-rutted pavement surface to calculate the rut area for each transverse profile. By combining the rut area with the linear distance represented by each transverse profile, the volume of asphalt required to fill the ruts is calculated. Fill quantities will be reported for each tenth (0.100) mile increment, in cubic feet.

The figure above provides a graphical representation of rut depth measurement using Vision's Transverse Profile module.

### High/Low Shoulders

The difference in relative elevation between the pavement edge and the right side shoulder is measured using the transverse profile data referenced to the measured position of the pavement edge.

For QA/QC purposes, computed high/low shoulder data will be summarized in section lengths of 0.004 miles (21.12 feet) in the Electronic Data Files. For reporting purposes, the high/low shoulder

data will be averaged and reported for each tenth (0.100) mile increment in the Summary Data File. The number of high shoulders exceeding (2) two inches, for each tenth (0.100) mile increment will be reported in the Summary Data File. The number of low shoulders exceeding (-2) negative two inches, for each tenth (0.100) mile increment will also be reported in the Summary Data File.

### Macrotexture

Macrotexture is important as an indicator of several conditions, including tire/road interaction, the potential for aquaplaning, and tire/road noise level. Fugro's Pave3D offers automated detection of texture across the travel lane according to the five AASHTO bands. We report Macrotexture in each area to the nearest thousandth (0.001) of a millimeter. Pave3D acquires sufficiently dense 3D data to measure standard MPD (Mean Profile Depth) and evaluate MTD (Mean Texture Depth) using a digital model of the sand patch method.

We worked closely with the LaDOTD research team over the years to calibrate the process and the sensor alignments to achieve the values. These texture values help them plan their friction testing requirements each year and have significantly saved time and resources when planning their state network surveys.

Fugro will provide the Mean Profile Depth, the Root Mean Square and the Percentage of Valid Samples, for the right wheel path, for 100% of all pavements. The Mean Profile Depth and Root Mean Square will be identified in units of inches in four (4) decimals.

The sampling frequency will comply with the ASTM E1845-15 specification, and the Percentage of Valid Samples will remain above 90% or the data will be recollected. For QA/QC purposes, macrotexture data will be summarized in section lengths of 0.004 miles (21.12 feet) in the Electronic Data File. For Reporting purposes, RMS, MPD & Percentage of Valid Samples will be reported for each tenth (0.100) mile increment in the Summary Data File.

| Grade Classification | Percent Grade |
|---|---|
| A | 0.0 – 0.4 |
| B | 0.5 – 2.4 |
| C | 2.5 – 4.4 |
| D | 4.5 – 6.4 |
| E | 6.5 – 8.4 |
| F | 8.5 or Greater |

### *Pavement Grade Classification & HPMS Reporting*

Pavement Grade Classification Data for the upcoming contract shall be collected using the ARAN POS LV subsystem, continually during collection, and will be summarized and reported according to the contract HPMS reporting requirements.

The ARAN POS LV system will be calibrated and certified on each ARAN prior to collection and the Grade Data is monitored during collection and through weekly verification site runs to ensure the highest accuracy Grade Classification reporting to the DOTD and this to the Federal Government as part of the HPMS reporting requirements. Specifics for this quality assurance will be covered in the Quality Control Plan.

All collection, processing and reporting will conform to the current HPMS Field Manual. Also, through the life of the contract, any updates or revisions to this Field Manual will be accommodated in the Pavement Grade Classification reporting.

All Grade Classification data will be; specifically HPMS Item 45 using Grades A through F for all pavement sections as follows:

Fugro will report Grade Classification data in a Grade data table with the field name “Grade” and reported as summarized in the “Grade” Data Dictionary. This data will be summarized to tenth mile (0.100 mile) increments. This shall be for QA/QC and Reporting purposes.

Fugro will also deliver a separate HPMS Grade Table with the same data as identified in the previous “Grade” table and will be summarized to tenth mile (0.100 mile) increments. This shall be for Reporting HPMS Sections only.

### *Vertical Curve Classification*

Vertical Curve Data for the upcoming contract shall be collected using the ARAN POS LV subsystem continually during collection. This subsystem will be calibrated and monitored according to Fugro’s standard quality assurance procedures to ensure accurate data.

The raw Vertical Curve Data is processed within the Vision processing suite and is converted to Vertical Curve Classifications for all pavement sections according to the following table:

Fugro will report Vertical Curve Classification data in a Vertical Curve data table with the field name “Vertical Curve” and reported as summarized in the “Vertical Curve” Data Dictionary. This data will be summarized to tenth mile (0.100 mile) increments. This shall be for QA/QC and Reporting purposes.

### *Pavement Curve Classification & HPMS Reporting*

Pavement Horizontal Curve Classification Data for the upcoming contract shall be collected using the ARAN Inertial GPS system with corrections being done using the ARAN POS LV subsystem and post processed using the POSPac software along with the base station reference data supplied by CORS and the LSU Center for GeoInformatics (C4G) networks.

All collection, processing and reporting will conform to Item 43 (Curves Classification) from the March 2014 HPMS Field Manual. Also, through the life of the contract, any updates or revisions to this Field Manual will be accommodated in the Pavement Curve Classification reporting.

| Curve Classification | Degrees |
|---|---|
| A | < 3.5 degrees (< 0.061 radians) |
| B | 3.5 – 5.4 degrees (0.061 – 0.094 radians) |
| C | 5.5 – 8.4 degrees (0.096 – 0.147 radians) |
| D | 8.5 – 13.9 degrees (0.148 – 0.243 radians) |
| E | 14.0 – 27.9 degrees (0.244 – 0.487 radians) |
| F | > 28.0 degrees (> 0.489 radians) |

This position data is processed using Fugro's Vision software to calculate curve geometry on the collected routes and converted to Curve Classifications A through F as outlined in the following table:

Fugro will report Horizontal Curve Classification data in a Horizontal Curve data table and reported as identified in the "Horizontal Curve" Data Dictionary. This data will be summarized to tenth mile (0.100 mile) increments. This shall be for QA/QC and Reporting purposes.

Fugro will also deliver a separate HPMS Horizontal Curve Table with the same data as identified in the previous "Horizontal Curve" table and will be summarized to tenth mile (0.100 mile) increments. This shall be for Reporting HPMS Sections only.

## Image Collection and Image Delivery (Tasks 6, 7, 14, 15, 20, 21)

The ARAN can be fit for up to 6 cameras to collect ROW images continuously. Images will be taken every 21.12 feet. The proposed ARAN camera configuration for this project will be one (1) forward-facing and one (1) right facing camera. LaDOTD will have the option to choose between the Sony D320 ROW cameras used in the previous data collection project or to upgrade at no cost to the 4K camera solution (Sony FX9). LaDOTD will approve the camera field of view, image size, and image quality before data collection. Both cameras exceed the resolution requirements of 1920 x 1080 pixels.

The current Sony D320 camera contains three (3) EXMOR full high definition (HD) CMOS sensors. This camera offers improved image sharpness and contrast in both extremely bright and extremely dark

lighting environments, leading to clear imagery in both sunny and overcast conditions. Three sensor cameras in general offer better color density and color saturation of the image, accurately reproducing the colors encountered across the roadside environment.

The Sony FX9 camera offers a full-frame 6K sensor with high-quality recording in DCI 4K, Ultra HD and HD resolutions. Powerful image processing with debayering and oversampling ensures image quality beyond the limits of conventional 35-mm sensors. The FX9 is the world's first full-frame camcorder with electronic variable ND, Fast Hybrid AF and has Dual Base ISO 800/ISO 4000 for stunning images in any lighting condition. Alaska DOT&PF will approve the camera field of view, image size, and image quality before data collection.

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. Fugro will deliver an X/Y image reference file. Distance measurements will be accurate to the nearest 0.001 mile. Fugro will compile and attach metadata to each image that, at a minimum, identifies highway number, direction, elevation, milepost (as "rubber-banded" to the mileposts in the field) and date.

The forward facing perspective camera will be angled to optimize the view of the entire roadway, shoulders and overhead roadway signs:

- This camera will have a sky to pavement ratio of sky 45% / pavement 55%.
- This camera will have a left to right ratio of left 60% / right 40%.

The right facing right-of-way camera will be angled to optimize roadside asset inventory collection. For the most recent contract, this right facing camera is sky 45%/pavement 55%, with an overlap of approximately 30%. For the upcoming contract, we will revisit the positioning of this camera with the DOTD for approval of the final angle.

The forward facing perspective and right facing right-of-way camera images will be collected to represent a 0.004 miles (21.12 feet) segment length. All image locations will be identified to the nearest

Deliverables for image collection and image delivery include:

- JPEG images delivered to the DOTD on external hard drives (USB 3.0) as a backup or on other pre-approved storage media, on a bi-weekly basis. The bi-weekly delivery will be accompanied by all required files needed for viewing the images with Fugro's software. DOTD staff will also have access to the images through the iVision5 website currently being hosted by Fugro, and/or the DOTD's internal iVision5 website.
- Images will initially be submitted without "Header Information". Upon QA/QC and acceptance testing approval, Fugro will resubmit the final images with appropriate "Header Information" applied.
- All weekly equipment calibrations test results (i.e. DMI, camera angles, video footprint, etc.) submitted on a monthly basis.
- All weekly electronic sensor verification results (i.e. re-run of sections that had been run the previous Monday to determine that the ARAN is still in calibration) submitted on a monthly basis.

## Continuous Friction Testing (Task 22)

For Continuous Friction Testing Fugro will utilize the GripTester MK2. This equipment is in compliance with:

- ASTM E274, the Standard Test Method for Skid Resistance of Paved Surfaces Using a Full-Scale Tire
- ASTM E501 Standard Rib (Tread) Tire Specification
- ASTM E524 Standard Smooth (Blank) Tire Specification.

This is the world's number one trailer-based continuous friction measuring equipment and works on a principle of measuring the skid resistance of a surface by running a measuring wheel that slips or skids compared to two drive tires. The single measuring wheel is braked by 15% and the load and drag on this wheel are continuously measured. The friction coefficient (load/drag), known as the GripNumber, is transmitted to a data collection computer held in the cab of the towing vehicle. Fugro will utilize the Roadbase software when collecting the friction data. This software is designed specifically for use on roads and highways and quickly and easily allows for the collection of skid resistance data as well as the input of investigatory levels. Roadbase generates easy to read reports as well as giving real time data displays to our operator during surveys. By outputting data in csv format, skid resistance data can be easily viewed. The data is easily converted to shp files, allowing the data to be overlaid within Fugro's iVision5 data viewing software. Data can also be converted into HMDF format for insertion into Pavement Management Systems.

Fugro will provide certification of calibration and correlation conducted at a nationally recognized certified friction measuring system evaluation site such as Central/Western Field Test and

Evaluation Center located in College Station, TX or Eastern Field Test and Evaluation Center located in East Liberty, OH upon start of contract.

Deliverables for this task include:

- Separate Friction data table, with the same data as identified in the "Friction" Data Dictionary.
  a. Continuous skid testing data shall include the date and time of collection
  b. The data will include the location of each test shall include control section, LRS-ID, direction of travel and LRS-ID logmile. Also to be recorded with each test will be the friction number, test speed, tire type used, wheel path (right or left) and the pavement surface type.

- Report/record i it is determined at the time of collection that tests could not be performed on all or a portion of a section because of construction, unsafe condition or other factor.
- GPS coordinates reported for the beginning, at every tenth (0.100) mile increment, at every testing location and at the end of each section.

### Historical Data Conversion (Task 23)

It is understood that a requirement of this project is for the conversion of the past three (3) data collection cycles, including images for use within the proposed software solutions. The LaDOTD data for the past three (3) collection cycles is already available in Fugro's Vision, iVision5 and Surveyor software. Furthermore, Fugro's proposed software is already implemented and in use at the LaDOTD, with LaDOTD staff already trained. Included in the most recent pavement distress data collection project is annual training for LaDOTD staff on Fugro's software.

### Final Documentation (Task 24)

LaDOTD shall be the owner of all data and images delivered for this Project and the Consultant shall not be allowed to subsequently charge or make money for this data and images.

Fugro will provide:

- A final delivery of all quantified data (i.e. previously delivered district data inclusive of any subsequent required revisions) for all districts, on external hard drives (USB 3.0) or on other pre-approved storage media.
- Final copies of all Raw Data Files, Electronic Data Files, and Summary Data Files generated during the course of the Project with the appropriate software to access, review, view, etc. these files.
- Copies of all reports, routing sheets, field notes, documents relating to or affecting the Project, etc.
- All reports in hard copy format and in electronic format (Word 2016) (.docx) on external hard drives (USB 3.0) or on other pre-approved storage media.
- Fugro will prepare a comprehensive final report including::
    a. Executive summary
    b. Study objectives
    c. Description of methodology
    d. Inventory of all roads
    e. Current pavement conditions for each interval
    f. Total amount of centerline and lane miles surveyed

#### *iVision5*

Fugro is pleased to continue providing LaDOTD enterprise-wide access to our Fugro hosted web-based iVision5 viewing software that meets a remotely positioned workforce's needs. 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, our latest iVision5 module.

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, this meets a

remotely positioned workforce's needs. 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. The open data schemas that enable customized data querying, extraction, and linking with other systems to provide maximum flexibility and data-synchronization capabilities. These advanced data sharing and integration mechanisms allow the application to be launched and linked to multiple asset management applications. Fugro will continue to provide LaDOTD unlimited licenses and access to iVision5 within 30 days of final execution of contract.

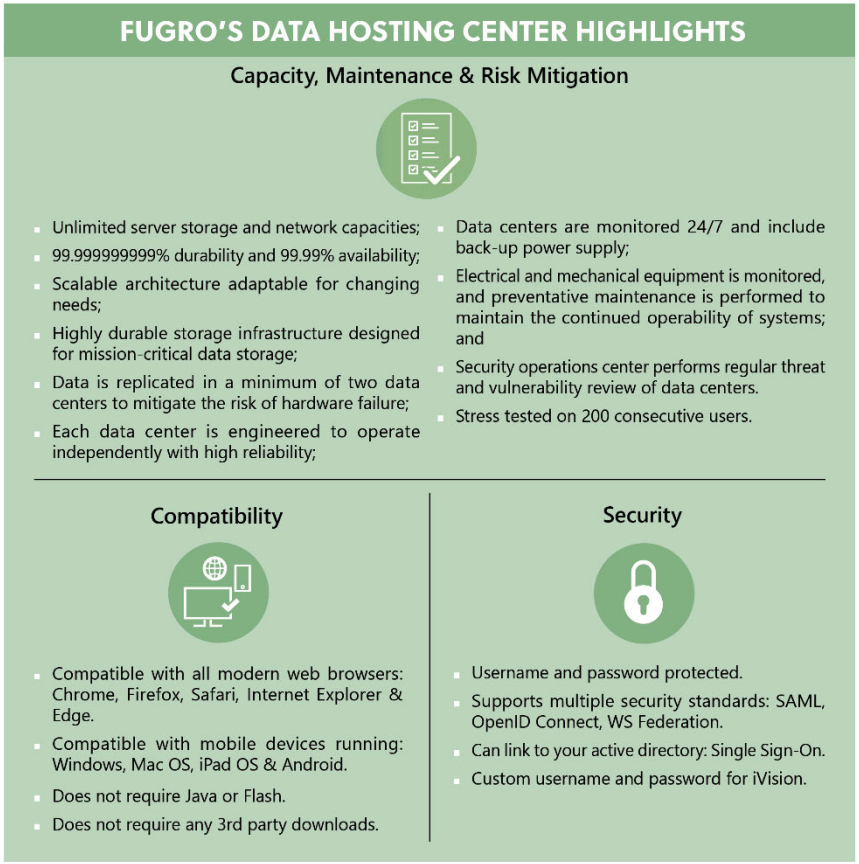
Fugro will continue to provide LaDOTD access to the custom Gateway widget that connects iVision5 to the locally hosted images in a user friendly button to navigate between the full dataset and the imagery.

## Pavement Viewing Interface Hosting State (Task 25)

Fugro understands many transportation agencies require a significant investment to supply and support the necessary infrastructure, such as web-based applications for data review and sharing if managed hosting by the vendor is not included. Our hosting services help to alleviate the burden of having to manage these resources and required infrastructure. All servers, computers, software, programming capability, equipment and technical resources are a part of our Amazon Web Services (AWS) hosting and nothing is required from LaDOTD other than access to a web browser.

Hosting includes:

- State ROW and pavement images for the term of this contract. 3 Cycles (2023-2028)
- Access to hosting within 30 days of final execution of contract.
- Hosted imagery will be available to LaDOTD at a 99.5% uptime over the life of the contract during core operating hours of 6:00 am and 6:00 pm CST and as needed when an emergency event such as a hurricane, flooding, etc. occurs.
- A Point of Contact notice in at least 24 hours of advance of anticipated downtime during core operating hours.
- Photos available at a minimum resolution of 1920 x 1080.
- A Technical Support contact will be provided to DOTD for use in the case of non-performant or unavailable services.



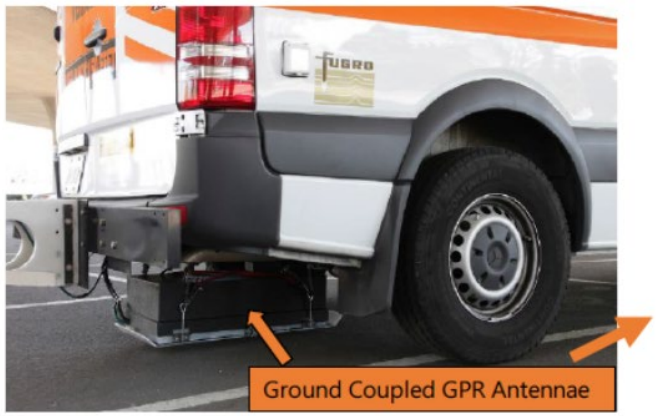
## Ground Penetrating Radar (GPR) (Task 26)

GPR is a non-destructive testing method used to obtain pavement layer thickness information while running at traffic speeds. GPR data will be collected using a multi-channel digital radar system along one outside lane of each arterial centerline. Using this equipment, the pavement layers greater than 3 inches thick can be resolved to a depth of approximately 2 feet below the pavement surface. Continuous pavement layer thicknesses will be summarized in the generic major layer types such as: asphaltic material, granular or bound base, and subbase. The GPR data will be collected using a one-foot scan interval (one measurement every foot). The raw data will be combined and reported at a 25-foot interval.

Fugro will conduct the GPR survey using the GSSI SIR-30 system with two ground-coupled antennae at central frequencies of 900 and 1600 MHz. This combination of frequencies provides the resolution and depth of penetration required to identify the anomalies. The 1600 MHz and 900 MHz antennae can investigate the shallow layers (up to 1.5 ft from the surface) and the deeper layers (up to 3 ft from the surface), respectively. The image below shows Fugro's Automatic Road Analyzer (ARAN) equipped with ground coupled GPR antennae.

This system is capable to scan the roadway at every 1 ft interval at the prevailing traffic speed. This allows the investigation of the subsurface anomalies larger than 1 ft wide. Data will be collected in the traveled direction with an integrated GPS and Distance Measuring Instrument (DMI) system. The collected data will be referenced to known features along the traveled lane. All GPR data will be saved to a hard drive to allow post-processing of the dataset at Fugro offices. Post-processing of the data removes systematic "noise", inherent in all GPR data, and allows filtering of the data, which provides the analysts a clearer picture of the sub-surface characteristics.

Fugro will process the GPR data using GSSI RADAN software. The software illustrates the pavement layer interfaces graphically and provides layer thickness information based on the electromagnetic theories. The amplitude of the reflected GPR signals, amplitude phase (i.e., positive or negative), and layered dielectric properties will be employed by Fugro to investigate the subsurface pavement anomalies.




## Additional/Optional Services: Road Asset Inventory Data Conversion (Task 27)

Transportation agencies rely upon asset management principals and base many of their decisions on information to get performance results and to ultimately gauge a prescribed level of service at the lowest cost. At the core of any successful asset management plan is data. Asset data that is relevant, objective and creditable and is then distributable to others is a requirement. Fugro understands why the asset data is collected and how to use this information to make informed and optimized maintenance decisions. Extracting assets can be done through processing the collected ROW imagery and/or through processing the collected LiDAR data.

For this project-

Asset deliverables extracted through **photogrammetry** include:

a. Cable Barrier (556 miles)
b. Guardrails (50,000)
c. Cross Drains (99,000)
d. Traffic Signal Inventory (2,800)
e. Highway Signs (42,267)
f. Soundwall (265)

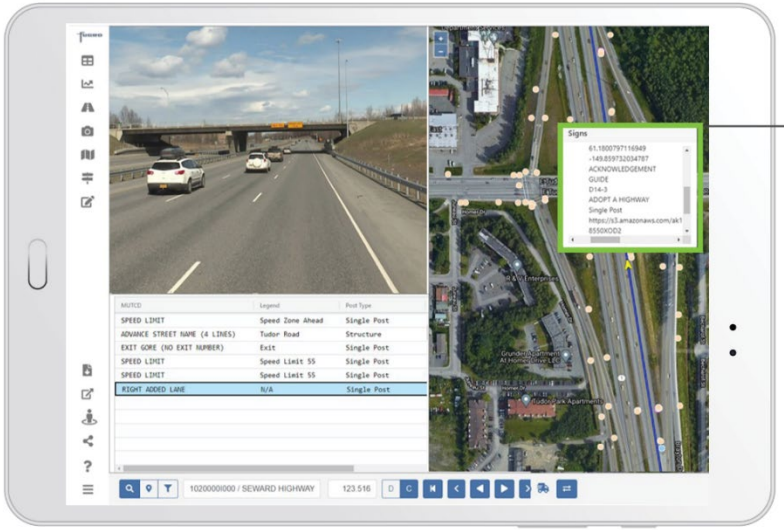
Assets deliverables extracted through **LiDAR** data include:

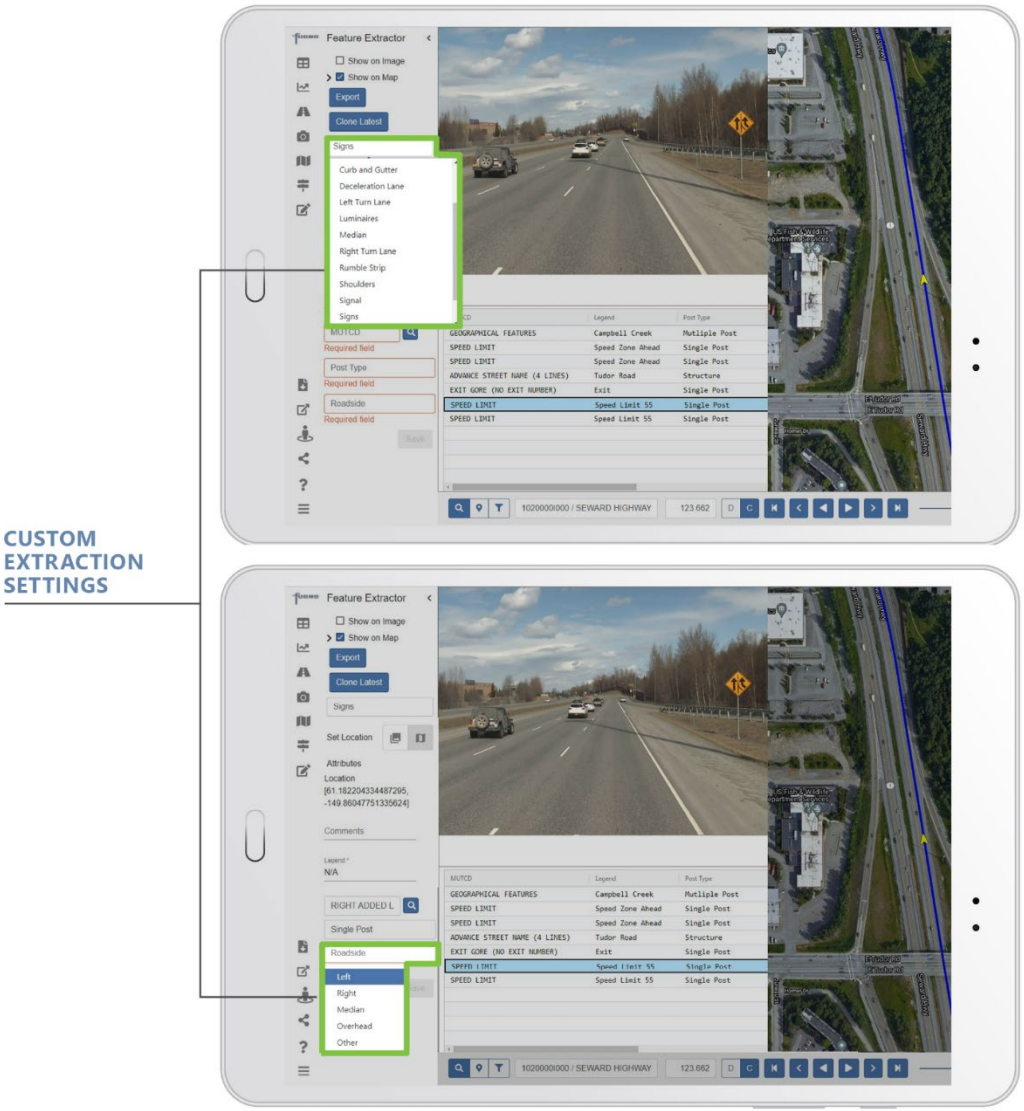
g. Vertical Bridge Clearance (2,500)

Fugro has learned from our numerous asset data collection assignments, including collection for LaDOTD, that it is critical to develop a detailed plan to ensure that assets are captured and attributed correctly so the data is useful to the policy driven goals of the department. An accurate inventory is the first step to identify problems and predict future conditions and risks.

### *Asset Extraction from ROW Imagery (Photogrammetry)*

Fugro has developed an application within iVision5 for asset extraction and inventory, this interface can be seen below and on the following page.




CUSTOM
EXTRACTION
SETTINGS
Feature Extractor
Show on Image
Show on Map
Export
Clone Latest
Signs
Curb and Gutter
Deceleration Lane
Left Turn Lane
Luminaires
Median
Right Turn Lane
Rumble Strip
Shoulders
Signal
Signs
Required field
Post Type
Roadside
Set Location
Attributes
Location
Comments
Legend *
N/A
Single Post
Left
Right
Median
Overhead
Other
GEOGRAPHICAL FEATURES
SPEED LIMIT
ADVANCE STREET NAME (4 LINES)
EXIT GORE (NO EXIT NUMBER)
Campbell Creek
Tudor Road
Exit
Speed Limit 55
Single Post
Multiple Post
Structure
SEWARD HIGHWAY
123.662

The display to the right is an example of the how the user would manually assign the MUTCD code to an extracted sign record using a catalog of sign face images, with the ability to filter by color and/or shape.


*Some examples of how asset collection is being used in harmony with other data sources to make decisions include:*

- Identification of speed signs can be used along with highway geometry and cross-slope to identify risk areas. This can also be further combined with friction testing.
- Geospatial data can also be used to link warning signs and crash prevention infrastructure to areas such as steep inclines.
- Guide rail and barrier data can also be linked to areas where roads are placed along cliffs and other steep drop offs which could add a lot of risk to minor collisions.
- Completing many elements of the Model Inventory of Roadway Elements (MIRE) can be used to flag locations associated with safety concern.
- Combining the asset management system with other data sources such as police reports, crash reports and traffic studies can help identify potential “hot spots” for accidents and their root causes.
- Construction history, along with site specific deterioration curves, can indicate premature failures and link them to information such as new construction materials, environmental conditions, construction quality, and areas of new development.
- Change detection can be used from year to year to identify areas where substantial changes have occurred, likely due to construction activities. Minor elements of change can also be used to identify missing infrastructure that may have been involved in a collision and not noticed by maintenance teams.

Once an inventory has been created and evaluated, it is also possible to track the condition of many of these assets. Some assets, such as roadway lighting, tend to have a very binary condition where it either functions or it does not. At the opposite end of the spectrum are pavements and bridges which have a complicated set of distresses to

assist in predicting their gradual deterioration. Most roadside assets however can be judged with a simple Good, Fair, or Poor rating. Probabilistic methods such as Markov can also be used to estimate, on a network level, the rate of replacement for many of these assets. This will allow LaDOTD to plan for the costs, resources, and materials to maintain the network at the desired level of service.

All of these scenarios can then be used to plan repair strategies or mitigate potential future costs through preventative measures. By describing clear policies for what various infrastructures should exist and what conditions are acceptable, rules can then be used to identify areas that are non-compliant with the policies. The list can then be prioritized based on the anticipated risk caused by any of these predefined differences. This list of projects can then be grouped based on priority and safety risk or tied into existing repair programs and future projects.

Each project is rigorously controlled to ensure we deliver the correct data set to our clients. The format of the data deliverable is always predicated on what the ultimate use is for the data or what asset management tool is being implemented. The collected data is georeferenced and delivered in either a CSV or database so it can be uploaded to multiple management applications if necessary.

Fugro has a long history of reporting asset data for state DOTs including Louisiana, California, Virginia, West Virginia, Pennsylvania, and many more.

Fugro's iVision5 software suite will be used to locate and measure specified assets within the right-of-way. Attributes for roadside assets including type, position (linear and GPS), basic condition, dimension measurements and a picture of the asset, are recorded quickly and efficiently using this application and written in real time

to a relational database from which reports are generated. Attribute data is input through mouse interactions with customizable drop-down menus and through the keyboard (e.g. for comments and condition rating information pertaining to a sign or an extent of damaged guardrail). **Assets are provided to clients in a geodatabase for use with ESRI products or any other asset management applications.**

### *LiDAR*

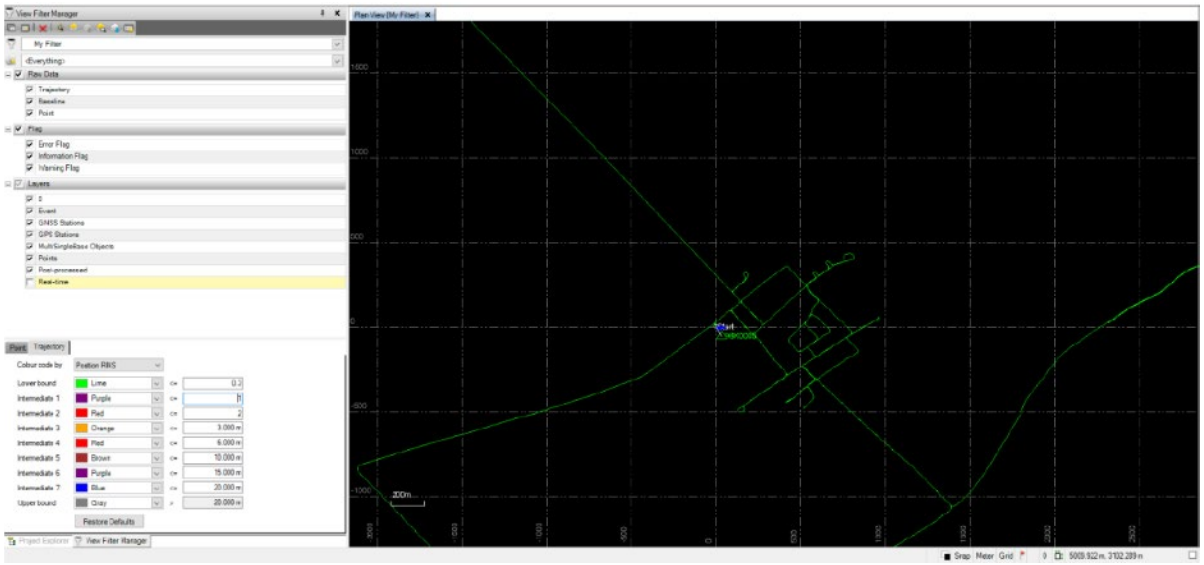
The Trimble MX50 is includes a 2 laser scanner with a range up to 80m each with a scan rate up to 500,000 pts/sec. The MX50 also incorporate a Ladybug 5+ camera capable of collecting 360 degrees images for viewing purposes and pointcloud colorization purposes. Finally, the Applanix AP20 IMU and the Trimble GNSS antenna are mounted on the equipment and are calibrated with the camera and both of the lasers. All of the control of this unit is from the Trimble Control unit, install in the ARAN vehicle with WIFI enabled and data storage.

The potential LiDAR deliverables can include:

- LiDAR data can be used for the following assets:
  a. Vertical Bridge Clearance (2,500)
- Software that allows for collection of highway inventory assets, make linear measurements and gather GPS point locations on the perspective view and right view camera images.
- Data synchronized with the Linear Reference System Identification (LRSID) provided by DOTD.
- Ability to be export data to an appropriate geodatabase and shapefiles for use in GIS applications.
- Data to have the ability to be processed with POSPAC, Trimble Business Center or TopoDOT.

*LiDAR Data capture software – TMI*

The TMI software, as seen below, is a software install in the Control unit, providing access through a web-browser. All system configuration, vehicle configuration, creating, starting, modifying your mission area all controlled through the TMI software. Operators have access to a live view of the cameras, pointcloud, map window, dashboard and navigation view. We can import KML files into the TMI software for all highway or area requirements.



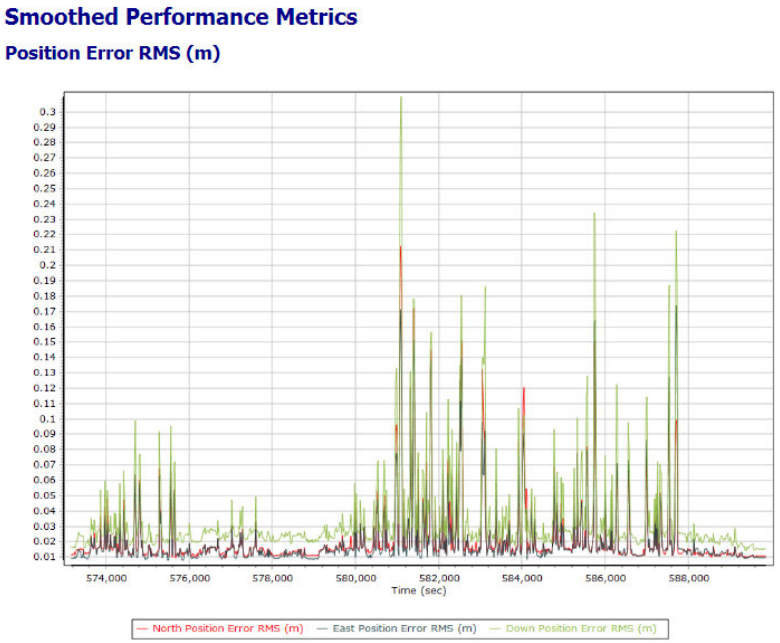
*Processing software*

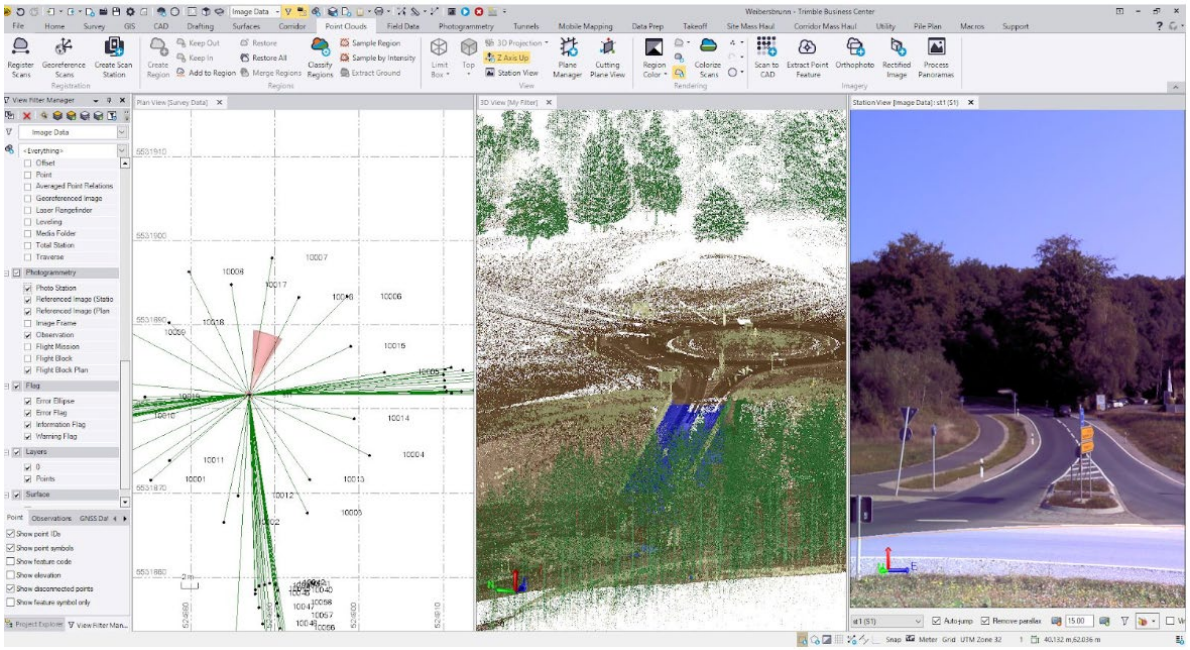
The collected data can be processed with a variety of softwares, including POSPac, Trimble Business Center or TopoDOT. An example of processing with POSPac and Trimble Business Center are detailed within the following section.

## POSPac

Once all of the data collected and downloaded, Applanix POSPac software begins the processing. The first step processes the trajectory with the local base station. Once the trajectory is processed, a new SBET (Smooth Best Estimated Trajectory) file is created to update the survey. POSPac handles all the coordinates system and epoch as well.

Finally, POSPac software prepares tools to QC the trajectory. An example accuracy report from the software is seen to the right.

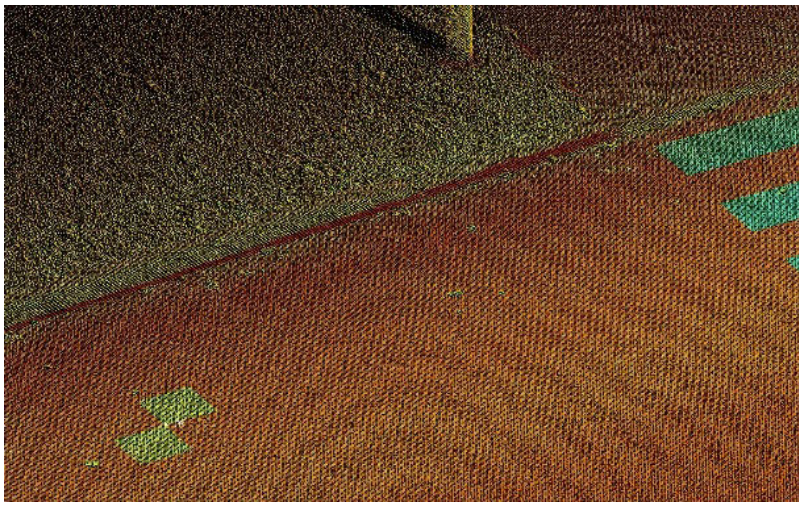




## Trimble Business Center

Once the trajectory has been post proceed, Fugro will import the project into Trimble Business Center (TBC). TBC has different modules, such as GIS, Scanning and Mobile mapping module with the Trimble MX50 system, as seen above.

Importing the trajectory, the scans and the images through the TBC, begins the process. The first step will be to create the pointcloud, tightly aligning to the SBET, which is creating a 5-30cm accurate pointcloud. A control point example is seen to the right.



Once the pointcloud is correctly positioned, TBC applies the images on the pointcloud to produce a colorized view. TBC also has a feature available to blur licenses plates of vehicle.

TBC has a robust exporting feature. If the final LaDOTD team or project scope wants to jump directly into another extraction software, the software can automatically create TopoDOT project, or a TMX project from the export menu in TBC.

However, the processing can remain in TBC, to classify your pointcloud on different elements (ground, trees, building, pole and sign, powerlines). After classification, extraction in TBC is available.

There are functions to extract automatically the pavement marking lanes, curb and gutter, power lines and other features. Additionally, semi automatically extract poles and signs, trees and other point or line feature. Ultimately, every point or line feature can be extracted manually using the tools available

Once the data has been extracted, data will be exported into GIS, CAD, and/or ASCII files to be utilized in LaDOTD's in-house LiDAR viewing software.

**LiDAR Assets are provided to clients in a database for use with POSPAC, Trimble Business Center or TopoDOT.**

## Quality Control/Quality Assurance

**FUGRO UNDERSTANDS THAT THE QUALITY OF COLLECTED PAVEMENT DISTRESS DATA IS THE KEY TO THE SUCCESSFUL IMPLEMENTATION AND MAINTENANCE OF ANY ASSET MANAGEMENT SYSTEM AND OUR TEAM PROVIDES 100% QUALITY CONTROL ON ALL DATA. FUGRO WILL DEVELOP A FORMAL DATA COLLECTION QA/QC PLAN.**

The QA/QC Plan will use reasonable quality control and manage the data collection and delivery process to effectively provide data that meets or exceeds the County's expectations. Fugro understands that data quality is imperative for all transportation agencies.

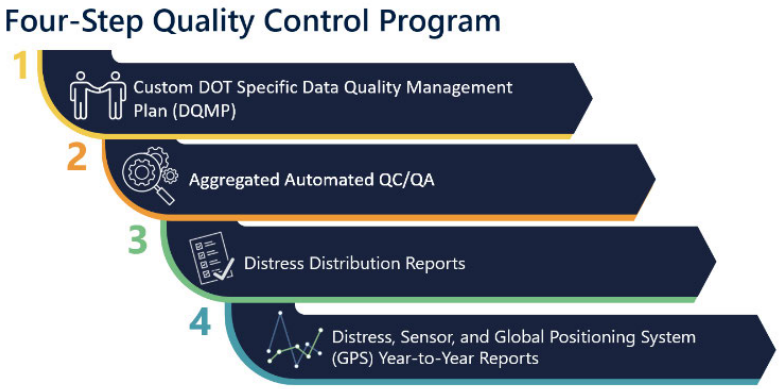
Fugro will finalize the QA/QC plan based on the LaDOTD's review within 20 working days after the NTP.

### Step 1 - Custom LaDOTD Specific DQMP:

All Fugro operators and equipment will be calibrated on site and control sites will be run before collection begins. All Fugro operators and equipment are NCAT certified for operation of a profiler. Fugro has included copies of the custom LaDOTD DQPMs within this section starting on p.117.

### Step 2- Aggregated Automated QC/QA:

Our LaDOTD custom QA/QC tool automatically reviews each data element to validate against approved metrics.

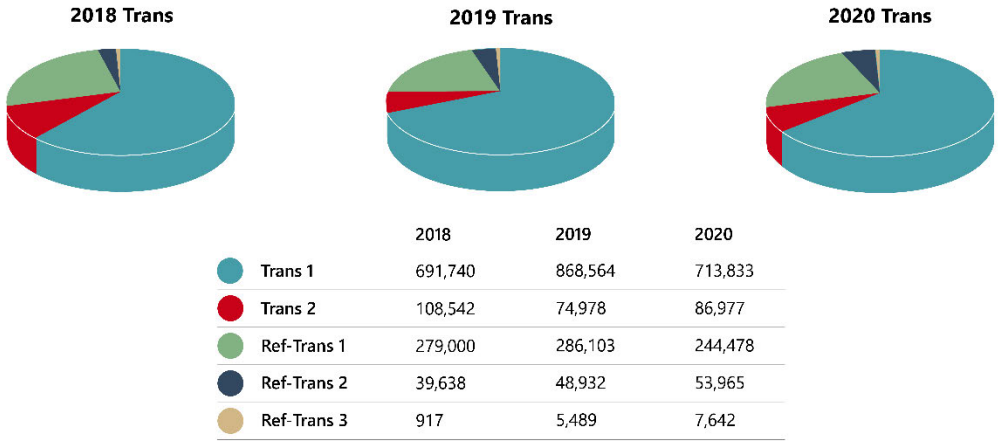


### Step 3 - Distress Distribution Report:

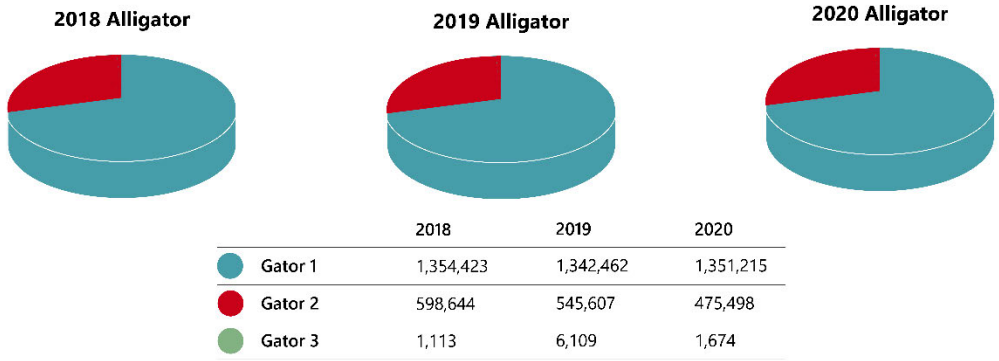
Fugro will provide LaDOTD with a Distress Distribution Report, which provides a snapshot of your pavements' health using the distribution for cracking and sensor data. This detailed report also facilitates easy identification of data that fall outside of expected trends.

### Step 4 - Distress, Sensor, and Global Positioning System (GPS) Year-to-Year Report:

Fugro's automated year-to-year comparison tool provides confidence in the delivered pavement condition data confirming data consistency between consecutive data collection cycles.




| | 2018 | 2019 | 2020 |
|---|---|---|---|
| Trans 1 | 691,740 | 868,564 | 713,833 |
| Trans 2 | 108,542 | 74,978 | 86,977 |
| Ref-Trans 1 | 279,000 | 286,103 | 244,478 |
| Ref-Trans 2 | 39,638 | 48,932 | 53,965 |
| Ref-Trans 3 | 917 | 5,489 | 7,642 |




| | 2018 | 2019 | 2020 |
|---|---|---|---|
| Gator 1 | 1,354,423 | 1,342,462 | 1,351,215 |
| Gator 2 | 598,644 | 545,607 | 475,498 |
| Gator 3 | 1,113 | 6,109 | 1,674 |

## Standard Operating Procedures

Fugro has utilized an ISO 4501:2018 registered Quality Management System (QMS) since 2011. This QMS includes a comprehensive set of Standard Operating Procedures (SOPs) for defining work processes and methods, and for controlling quality; both in the field collection and in-office processing of automated pavement condition data. These SOPs are available through a business management system so that both Fugro employees and DOTD staff can access it in real-time and ensure each task is performed with consistency and discipline ensuring data accuracy, repeatability, and delivery in a timely manner. The following is a brief overview of the SOPs that are the foundation for all of Fugro's data collection projects; including the enhancements that have made over the past year that will continue to be of benefit to the DOTD for the upcoming contract.

## Quality Control/Assurance SOPs

Automatic Road Analyzer (ARAN) Certification – The ARAN Certification process ensures that data collection vehicle settings and data collected are within project guidelines. Real-time Quality Monitoring on the ARAN – Quality control subsystems are built into each ARAN vehicle. If a sensor is recording out-of-range or does not register a change for a predetermined length of time, the system alerts the operator to the potential malfunction and the need to take action. Real-time health monitoring and live remote access into any ARAN by Fugro's technical support team ensures that only good quality data is collected.

Electronic Field Sheets – The ARAN field team uses electronic field sheets (EFS) to schedule road sections for collection. EFS provide key landmarks and linear references to the ARAN operator, facilitating mission management during collection. The EFS are sorted in the order of data collection, so the operator can readily load in the next section. This minimizes data entry errors and prevents missed sections.

Vehicle Sign Off (VSO) – The VSO process ensures that vehicle settings and data collected are within project guidelines. VSO will enable subsequent data collection by Fugro to meet the requirements of the project.

Verification/Control Sites - The ARAN Collection Software (ACS) interface controls all ARAN subsystems independently to ensure maximum flexibility and robustness during testing / collection. These systems allow operators to perform daily verification that ensures every vehicle delivers optimum data accuracy and repeatability, using features such as user-specified data ranges to establish out of range or non-functioning subsystems. A data subset is uploaded daily and examined by trained data analysis staff in the office.

All data and images are collected, processed and reported for calibration sites in order to verify that data collected will conform to DOTD standards. All ARANs assigned to the Louisiana project will be calibrated on the DOTD Primary

Baseline calibration sites prior to data collection, and also just prior to establishing any of the District Quality Control Verification Sites (DQCVS) in a district.

During the first week of data collection in each new district, a DQCVS will be established by Fugro on a Control Section. Fugro will establish a DQCVS with known IRI and Rutting and Faulting values. Separate DQCVS sites are required for each district.

For subsequent ongoing data collection within a particular district, the DQCVS will be run weekly by each ARAN and compared with the original data collected for that section. Fugro will evaluate these measurements to determine the accuracy of field measurements and to identify needed equipment recalibrations at the Primary Baseline calibration sites.

All weekly DQCVS data collection will be documented in writing and electronically (digital images with electronic sensor data) and both shall be delivered to the DOTD in monthly reports.

Daily Quality Assurance Cycle – A quality assurance cycle is performed daily on all subsystems to ensure each is operating properly. The data collected at the end of the day is also checked for completeness against log sheets and routing schedules. Samples from each system are then uploaded to be evaluated by Data Services personnel to ensure settings and results are within project guidelines.

Adverse Weather, Road and Environmental Conditions - Weather and other environmental or road conditions can make the data less valuable or, in some cases, unusable. Understanding when to stop collection and how to verify suitability for collection is a key SOP for ARAN field operators. This SOP is customized to fit with each client's unique environment. A data collection SOP for Louisiana contract has been developed and is reviewed with and kept for reference by all field crew assigned to the Louisiana project.

### Post Processing and Reporting Quality Control / Assurance SOPs

Data Handling – SOPs have been developed to cover the handling and processing of all collected data. The data handling SOP covers the control of all data collected and ensures that all original ARAN files are copied from the ARAN to removable hard drives creating the redundancy necessary to safeguard the original field data. The data will then be shipped to Fugro's processing team.

From the hard drives our processing team creates the database format for upload to the Fugro's Vision software. Once all data is available within Vision, our Quality Assurance Manager Initiates data audits prior to any reports being generated. Data is then published to iVision5 for further quality checks and corrections are made as required. The quality checking at this stage validates the publishing is as intended.

Applying Customer Requirements – Fugro SOP is to fully understand and proactively implement its clients' data acceptance criteria. Before delivery to the DOTD, all data will undergo exactly the same quality checks the DOTD staff would perform. Data that fail to meet the acceptance requirements will be scheduled for rework.

Data Audits and Spot Checks – Fugro ensures that accuracy is maintained by performing audits and spot checks on a continuous and random basis throughout the overall data process flow.

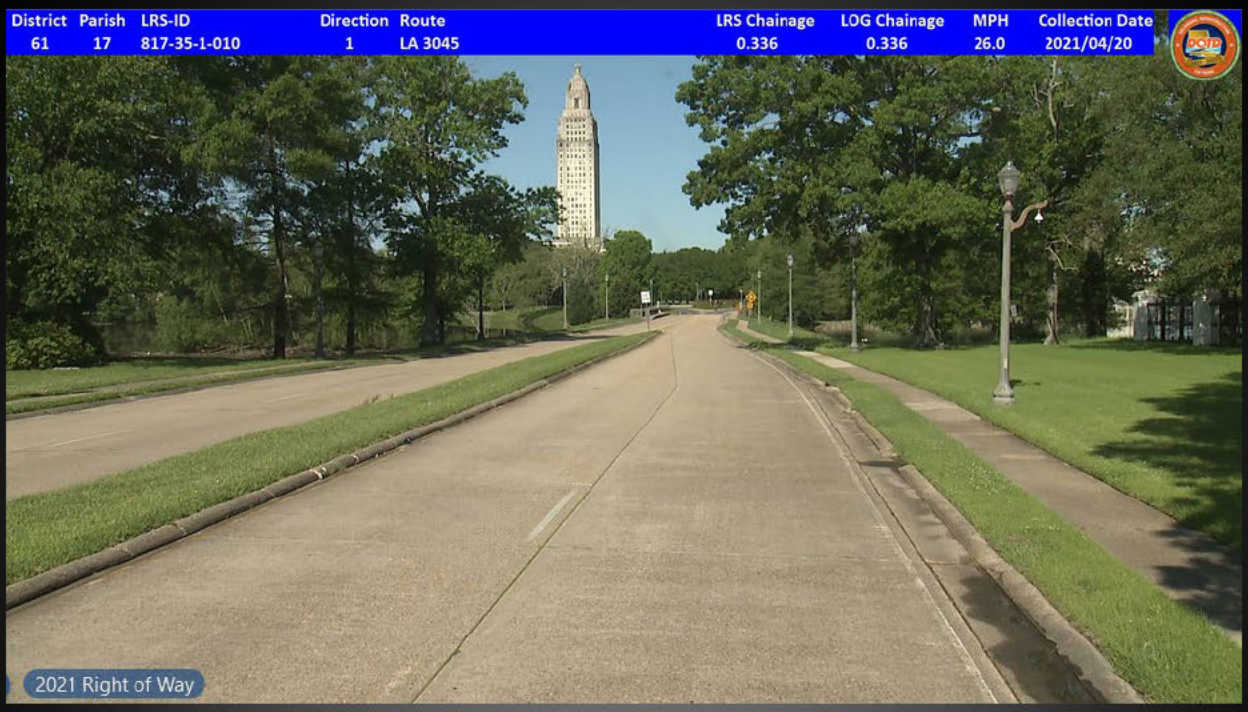
Incoming Data – Standard quality checks performed at this stage include:

- Automated flagging of incoming data to eliminate the possibility that any results are outside of pre-defined limits. This includes data collection completeness.
- Investigating data outside these pre-defined parameters to determine whether or not the results are within the data acceptance criteria.
- Image quality control checks for quality, completeness and integrity of the images.
- Processing – Standard quality checks performed at this stage include:
- Queries and analysis to ensure high accuracy is met on Rutting, Faulting Height and Number, MPD, IRI and GPS. These checks are performed to ensure the data meets ASTM E950, ASTM E1845-09, AASHTO M328-10, AASHTO R56-10, AASHTO R57-10, AASHTO PP70-10, TEX-1001S and those of stringent projects we have done for Model Inventory of Roadway Elements (MIRE) and Strategic Highway Research Program (SHRP) 2.
- Noting and correcting any errors resulting from processing.
- Reporting – Standard quality checks performed during this stage of data reduction include:
- Ensuring all final processed data matches the acceptance criteria, through a series of queries.
- Ensuring that reporting requirements are met where events such as bridge decks, railroad crossings, and construction zones are present.
- Copying data to an appropriate-sized media source (external hard drive) and performing the same processes as run on the Incoming Data section to ensure that the data set has been properly compiled, and no files have become corrupted or lost.
- Data Acceptance SOPs
- Fugro SOPs are to fully understand and implement each client's data acceptance criteria. A few highlights of the SOP are identified as follows:
- Run A Mile – a small sample of data is processed end to end for internal signoff.
- Pilot Delivery – a larger representative data set is delivered for approval by the DOTD
- 1st Full Production Delivery – this delivery is the third opportunity to identify anomalies prior to all other deliveries being made
- Final Delivery – in some cases a final and full re-delivery of the entire project is made
- Sign Off – in a project or cycle close out meeting a full review is made of the data delivered.

- Post-Delivery – Standard Operating Procedures have been put in place to ensure:
    a. Concerns, when raised, are put through Fugro's Corrective Action process to ensure timely resolution of all issues with full traceability. This can be accomplished with client interactive web site access through Force.com which is currently available to DOTD staff.
    b. Analysis of these issues for ongoing improvement through Fugro's preventive action system.

## Custom LaDOTD DQMPs

Fugro has provided custom LaDOTD DQMPs for this project in the subsequent pages.




# Louisiana Quality Assurance Plan

This Quality Assurance Plan is intended to be a living document which will be mutually approved by LADOTD and Fugro and updated and improved through the life of the project.

Fugro Roadware

September 2022

# Table of Contents

This Quality Assurance Plan is intended to be a living document which will be mutually approved by LADOTD and Fugro and updated and improved through the life of the project.

## Document Change Control

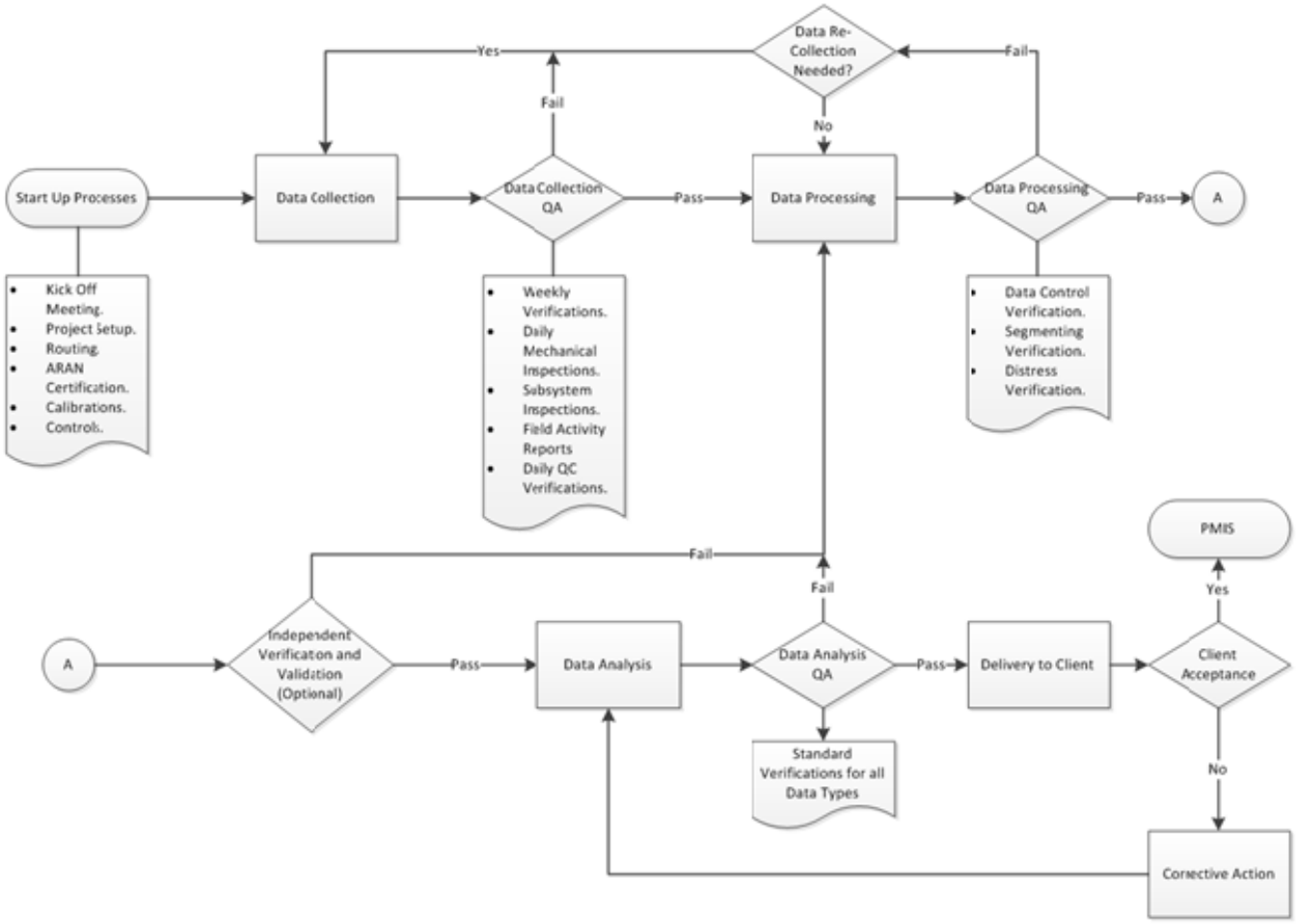
The following is the document control for revisions to this document.

| Version Number | Date of Issue | Authors | Brief Description of Change |
|---|---|---|---|
| Initial RFP/Proposal | Sept 30,2022 | Cory Hackbart | *LADOTD Quality Assurance Plan - V1.2.doc* |
| | | | |
| | | | |

# Introduction

Fugro Roadware is committed to delivering road condition and asset data to the highest level of quality, while maintaining data value through quick, efficient delivery. This requires quality control to be incorporated into every process, ensuring that any exceptions are caught as early as possible and handled according to pre-defined rules and is showed in the following figure:

Figure 1 Process Flow




As an integral part of our registration with ISO 4501:2018 Quality Management System (QMS) these principles are built into our day-to-day procedures, using a combination of standard and project-specific quality assurance processes. Fugro Roadware has a comprehensive set of standard operating procedures (SOPs) for controlling quality both in the field and in our offices. These SOPs ensure that each task is performed with consistency and discipline. Numerous checkpoints throughout the data life cycle ensure we identify and re-survey, as early as possible, any roadway segments that do not meet specified quality standards. Our consistency and discipline ensure data accuracy and repeatability.

Our quality management system (QMS) and our standard operating procedures (SOPs) link to Fugro Roadware's Continuous Improvement and Customer Satisfaction processes and extend to all programs, suppliers, and activities that affect the quality of our services. This will effectively reduce the time needed for LADOTD to monitor the data as it is being collected and processed.

This quality assurance plan is intended to be a living document which will be mutually approved by LADOTD and Fugro and updated and improved through the life of the project. The processes outlined in this plan have been created from valuable lessons learned on previous LADOTD projects which include having a set of mutually agreed upon control sites with adequate benchmarks and a clear communication process between LADOTD and Fugro for any clarification of requirements.

Fugro has adopted a Red Flag Program which automatically identifies any situation that commonly leads to collection, processing or delivery errors. These identifications are automatically sent to appropriate party members which may include the Senior Management of Fugro. For example, an ARAN which has not been certified to collect, and begins data collection, would be Red Flagged.

# Start Up Processes

## Project Management

The dedicated Fugro project manager ensures that all key internal stakeholders provide their respective expertise to plan out the path to a successful project completion, prior to submitting a formal response to an RFP.

Upon the award of the contract, the project manager will create a detailed project plan which will ensure that throughout the duration of the project, the technical project team is fully informed of all project requirements at all times.

Through life the project, the Fugro project manager will be LADOTD's single point of contact and they will be dedicated to ensuring the project is delivered properly and on time.

### Internal Project Setup

In preparation for the LADOTD kickoff meeting, the project manager will hold an internal project setup meeting to finalize the project plan, clarify the scope to the technical project team, and gather any questions or clarifications from the internal project team. The first draft of the ARAN configuration, data dictionary, and the processing plan will be established during this meeting to ensure that we have a common understanding of the data deliverables and format required, and the steps required to create those deliverables.

### LADOTD Kickoff Meeting

An in-person kickoff meeting with LADOTD will ensure that all internal and external project stakeholders have a clear and thorough understanding of the project requirements, and acceptance criteria prior to the commencement of any data collection or data processing. During this meeting, all of the following items will be discussed:

- All deliverables are defined and clarified.
- Any questions from the Internal Project Setup process are discussed.
- Schedules for all tasks and deliverables are presented, clarified and agreed to.
- Control site schedule, locations and benchmarks.
- Introduction to Customer Community Portal and logins provided for LADOTD.

### Final Project Setup

During the final project setup phase, the software configurations and project protocols will be finalized for every department involved in the collection or processing of data. This includes ARAN sub-system settings, project protocols, the internal processing plan and the quality plan. At this time project network directories, databases, and documentation repositories will be created following standard structures and formats to ensure that data and information is well organized and easily accessible by all parties.

## Routing

Upon receipt of the LADOTD road network definition, an experienced GIS analyst will review the LADOTD network attributes such as the expected number of miles, functional class, number and order of road segments, polyline topology, beginning/end descriptions, GPS and direction of travel to ensure that the data is collected completely in the proper direction, to the desired limits and in the correct lane.

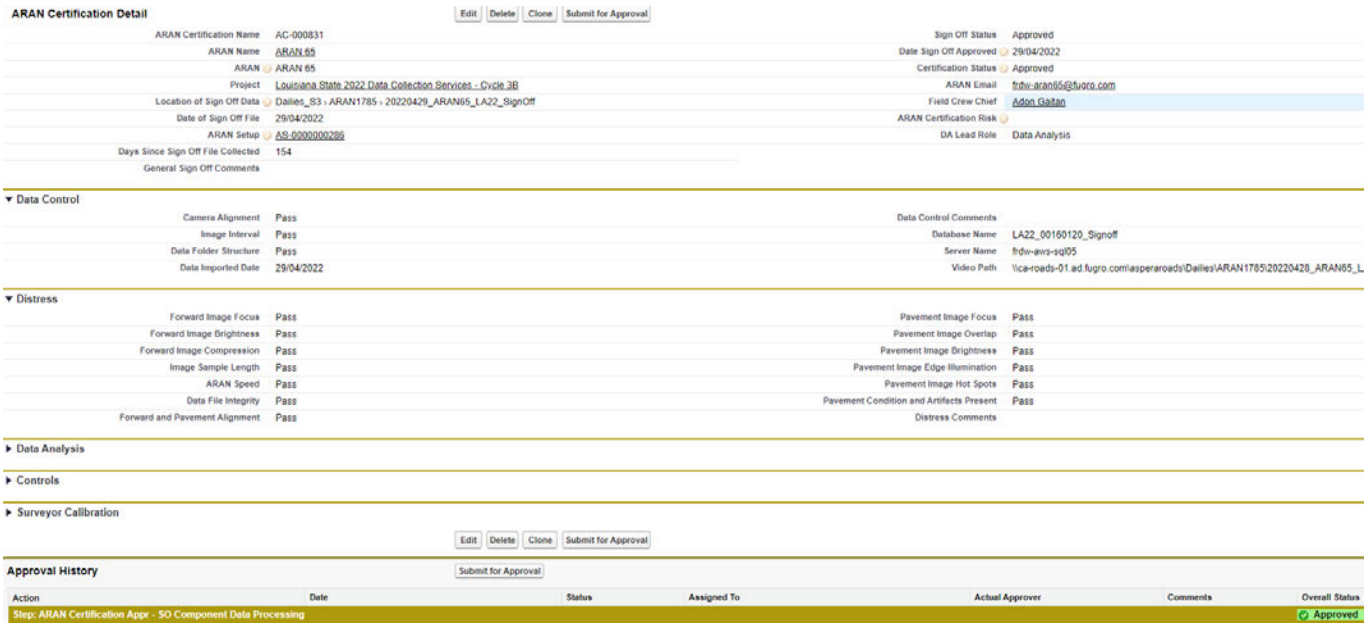
The Routing department will then prepare a collection package for the ARAN including all necessary entry, exit and monthly control sites. Once this package is completed, and before sending to the ARAN for collection, a series of standard queries are performed that ensure the road network elements such as road description, GPS, length, one way roads, lane designation and direction are logical, correct and in a proper order to ensure the correct and timely collection of these sections.

The master routed table produced by the routing department will be used by downstream quality control and quality assurance procedures in both the data collection and also the data processing departments, to ensure full coverage of the LADOTD network.

# ARAN Certification

The ARAN certification process ensures that only quality data is collected. The ARAN certification is required to be completed prior to the ARAN being authorized to commence collection within a project.

Figure 2 is an example of one of these ARAN Certification records.

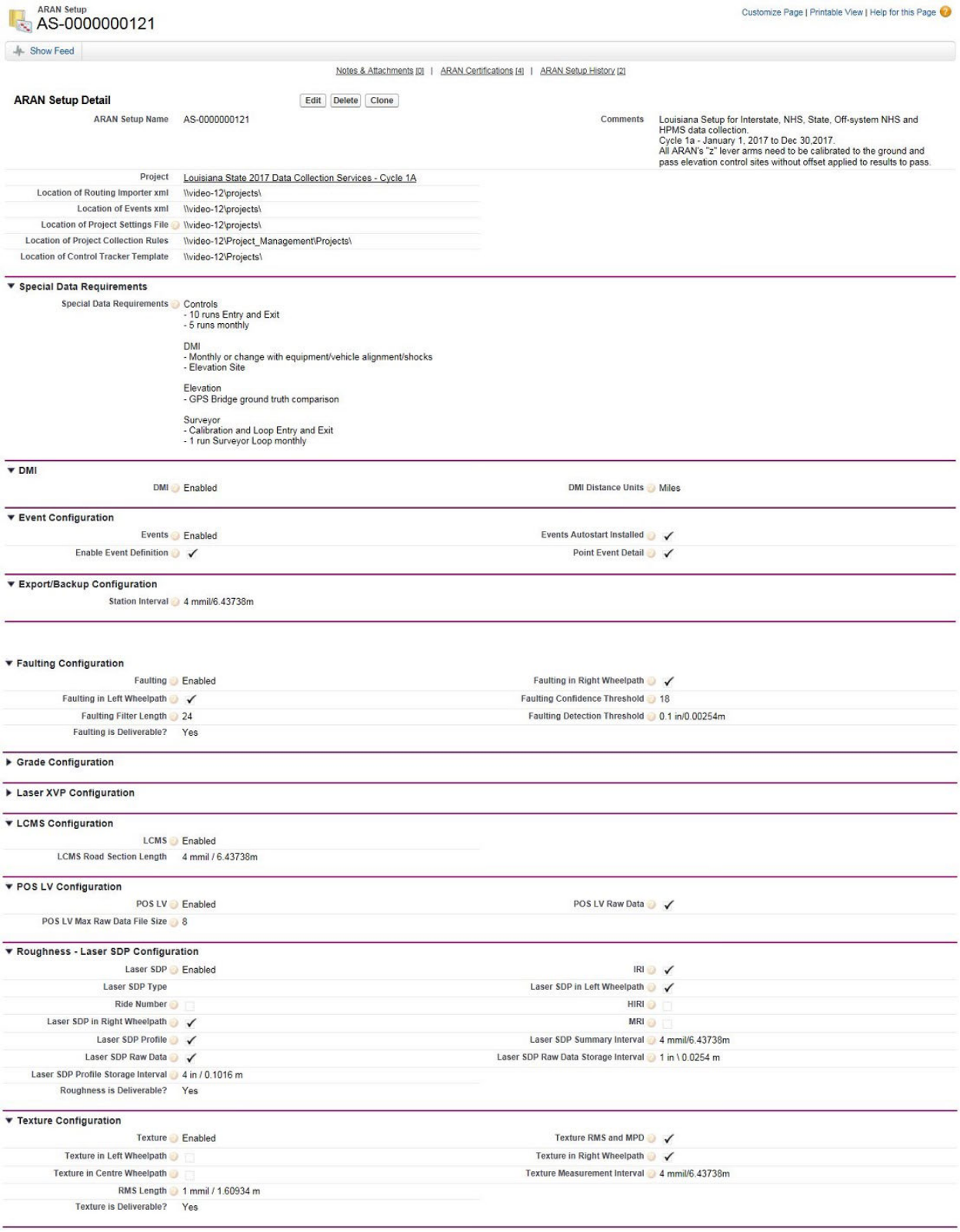



The ARAN certification is composed of several distinct validation processes:

## Definition of ARAN Configuration

Part of our quality management system includes an ARAN setup phase to determine the ARAN configuration that is required to collect the data elements defined by the project scope and is performed by the Project Manager in conjunction with our technical experts.
The configuration requirements are documented via the pre-defined ARAN Setup record (Figure 3). This guarantees consistency and ensures that every ARAN entering a specific project uses an identical configuration.

Figure 3 ARAN Setup Record



ARAN Setup
AS-0000000121

Customize Page | Printable View | Help for this Page

Show Feed

Notes & Attachments [0] | ARAN Certifications [4] | ARAN Setup History [2]

**ARAN Setup Detail** Edit Delete Clone

| | | | |
|---|---|---|---|
| ARAN Setup Name | AS-0000000121 | Comments | Louisiana Setup for Interstate, NHS, State, Off-system NHS and HPMS data collection.<br>Cycle 1a - January 1, 2017 to Dec 30,2017.<br>All ARAN's "z" lever arms need to be calibrated to the ground and pass elevation control sites without offset applied to results to pass. |
| Project | Louisiana State 2017 Data Collection Services - Cycle 1A | | |
| Location of Routing Importer xml | \\video-12\projects\ | | |
| Location of Events xml | \\video-12\projects\ | | |
| Location of Project Settings File | \\video-12\projects\ | | |
| Location of Project Collection Rules | \\video-12\Project_Management\Projects\ | | |
| Location of Control Tracker Template | \\video-12\Projects\ | | |

**Special Data Requirements**

Special Data Requirements: Controls
- 10 runs Entry and Exit
- 5 runs monthly

DMI
- Monthly or change with equipment/vehicle alignment/shocks
- Elevation Site

Elevation
- GPS Bridge ground truth comparison

Surveyor
- Calibration and Loop Entry and Exit
- 1 run Surveyor Loop monthly

**DMI**

| | | | |
|---|---|---|---|
| DMI | Enabled | DMI Distance Units | Miles |

**Event Configuration**

| | | | |
|---|---|---|---|
| Events | Enabled | Events Autostart Installed | ✓ |
| Enable Event Definition | ✓ | Point Event Detail | ✓ |

**Export/Backup Configuration**

Station Interval: 4 mmil/6.43738m

**Faulting Configuration**

| | | | |
|---|---|---|---|
| Faulting | Enabled | Faulting in Right Wheelpath | ✓ |
| Faulting in Left Wheelpath | ✓ | Faulting Confidence Threshold | 18 |
| Faulting Filter Length | 24 | Faulting Detection Threshold | 0.1 in/0.00254m |
| Faulting is Deliverable? | Yes | | |

**Grade Configuration**

**Laser XVP Configuration**

**LCMS Configuration**

| | |
|---|---|
| LCMS | Enabled |
| LCMS Road Section Length | 4 mmil / 6.43738m |

**POS LV Configuration**

| | | | |
|---|---|---|---|
| POS LV | Enabled | POS LV Raw Data | ✓ |
| POS LV Max Raw Data File Size | 8 | | |

**Roughness - Laser SDP Configuration**

| | | | |
|---|---|---|---|
| Laser SDP | Enabled | IRI | ✓ |
| Laser SDP Type | | Laser SDP in Left Wheelpath | ✓ |
| Ride Number | | HIRI | |
| Laser SDP in Right Wheelpath | ✓ | MRI | |
| Laser SDP Profile | ✓ | Laser SDP Summary Interval | 4 mmil/6.43738m |
| Laser SDP Raw Data | ✓ | Laser SDP Raw Data Storage Interval | 1 in \ 0.0254 m |
| Laser SDP Profile Storage Interval | 4 in / 0.1016 m | | |
| Roughness is Deliverable? | Yes | | |

**Texture Configuration**

| | | | |
|---|---|---|---|
| Texture | Enabled | Texture RMS and MPD | ✓ |
| Texture in Left Wheelpath | | Texture in Right Wheelpath | ✓ |
| Texture in Centre Wheelpath | | Texture Measurement Interval | 4 mmil/6.43738m |
| RMS Length | 1 mmil / 1.60934 m | | |
| Texture is Deliverable? | Yes | | |

## Verification of ARAN Configuration and Sign Off

The first step for an individual ARAN certification is for the field crew to configure the ARAN in accordance with the ARAN Setup record (Figure 3) created in the Definition of ARAN Configuration stage. Once this is complete, the field crew collects a 'sign off' file, which will then be used to validate that the ARAN settings are identical to those defined in the ARAN setup record. The sign off file data is uploaded for independent verification by the ARAN Fleet Support and Data Processing teams.

## ARAN Calibration and Control Sites

All equipment shall be calibrated according to the manufacturer's recommendations before the initiation of the data collection activities.

This equipment calibration and check will ensure that the equipment remains within acceptable precision and bias limits, and that the data is being collected and stored properly by the onboard computer system.

Equipment Calibration Schedule:

| Equipment | Calibration Interval |
|---|---|
| Cameras | At start of project, there is a change in mechanical components or if it has become necessary as a result of our Corrective Action process. |
| Laser SDP | At start of project, there is a change in mechanical components or if it has become necessary as a result of our Corrective Action process. |
| Pave3D | At start of project, there is a change in mechanical components or if it has become necessary as a result of our Corrective Action process. |
| DMI | At start of project, every 28 days, or if there is a change in mechanical components or if it has become necessary as a result of our Corrective Action process. |
| GPS | At start of project, there is a change in mechanical components or if it has become necessary as a result of our Corrective Action process. |

## Control sites

Control sites are established for two specific purposes: to calibrate the distress rating process and to establish the precision and bias for the roughness and rutting information. For this project, control testing will consist of pre-survey calibration testing, as well as scheduled correlation testing throughout the project.

The calibration sites shall be collected three to five times each at the beginning of the project, and again three to five times each every month, and/or after completion of collection in each district. As well as electronic sensor data, full Right-Of-Way (ROW) (both forward perspective and right facing images) as well as pavement images will be collected on all calibration site runs. Standard procedures will be followed as for regular production data collection and processing.

An experienced member of the Data Processing team assigned to the project will then review the control site data to ensure that the data collected is comparable to known benchmarks for those sites, and is repeatable across multiple passes of the same site.

If any data type fails both the percentage and absolute value thresholds, the ARAN will fail its certification.

| Data Type | Percentage | Absolute Value | |
|---|---|---|---|
| IRI | 5% | 1.000 | Inch per mile |
| Rutting | 5% | 0.050 | Inches |
| Macro Texture MPD | 10% | 0.080 | Inches |
| Macro Texture RMS | 10% | 0.050 | Inches |
| Cross Fall | 5% | 0.500 | Percent Slope |
| Roll | 5% | 0.500 | Percent Slope |
| Grade | 5% | 1.000 | Percent Slope |
| Pitch | 5% | 1.000 | Percent Slope |
| Fault Height | 5% | 0.039 | Inches |

Any failing ARAN will be assessed by our technical experts to ensure the issue causing the failing data is resolved, and the ARAN will then restart the Controls process. Depending on the nature of the issue, any data collected by that ARAN since the last successful verification run could be slated for recollection and the suspect data discarded. The ARAN cannot pass its certification until all data types pass the Controls process. Once completed the ARAN is fully certified to collect the project.

The following sites are prepared for use and will be confirmed with the DOTD during the startup meeting for the contract. Any changes to the sites to be used will be documented in this Quality Plan.

| Site | Csect-Dir | Route | Pavement | From | To | Test lane |
|---|---|---|---|---|---|---|
| C01 | 008-01-1 | US 190 | CRC | 6.80 | 7.30 | RH lane |
| C02 | 013-01-1 | LA 415 | JCP | 0.40 | 0.90 | RH lane |
| C03 | 019-05-1 | US 61 | Comp | 11.00 | 11.50 | RH lane |
| C04 | 060-02-1 | LA 67 | JCP | 0.40 | 0.90 | RH lane |
| C06 | 060-04-1 | LA 67 | ASP | 6.30 | 6.80 | RH lane |
| C07 | 061-05-1 | LA 10 | ASP | 3.50 | 4.00 | RH lane |
| C08 | 250-01-1 | LA 19 | COM | 6.80 | 7.30 | RH lane |
| C09 | 250-01-1 | LA 19 | COM | 11.40 | 11.90 | RH lane |
| C10 | 255-02-1 | LA 408 | ASP | 6.20 | 6.70 | RH lane |
| C11 | 258-31-2 | LA 42 | JCP | 5.00 | 4.50 | RH lane |
| C12 | 817-08-1 | LA 946 | JCP | 4.30 | 4.80 | RH lane |
| C13 | 863-09-1 | LA 964 | ASP | 0.20 | 0.70 | RH lane |
| C21 | | Frontage | | 0.9 | 0 | DMI and GPS Test Site |
| C22 | 450-07-1 | I 10 | | 0 | 0.66 | GPS Test Site |
| C24 | 225-02-1 | | | | | Surveyor Loop Site |

All sensor data calibration that are done during the course of the contract will be documented and uploaded to the mutually accessible SHAREPOINT site for LADOTD verification within one week of executing these calibration runs. All calibration results for each full cycle will also be reported to the LADOTD in a full Quality Report at the end of each cycle. For example, the 2022 control site results can be found on the SharePoint site in the following location:

(\\DS_Louisiana\Delivery\Reports\2022\2022_Monthly_QAQC_Cycle_3b\)

As this contract will cover 3 cycles over 6 years, there may be a need to adjust the benchmark values due to regular deterioration or maintenance work being performed on those sections. In each case, Fugro Roadware will work with the LADOTD to either adjust the benchmark values or choose a new calibration sites and establish benchmark values for those new sites.

The results of the control site testing will be documented and reported to the LADOTD in the final project quality report and can also be found on the SharePoint site.

## DMI Calibration

DMI is a critical component of the ARAN's Linear References system. A calibrated DMI is necessary to ensure that all collected data is correctly correlated. As such we have developed a DMI Calibration Process that is performed during the initial certification process as well as every 28 days, or if the mechanical attributes of the ARAN change e.g. tires, by the ARAN's Field Technicians. Local district specific verification sites will also be setup for the ARAN to perform

weekly checks of the DMI calibration. It is necessary to have five repeat runs within +/- 0.5% variance in order to pass.

Figure 4 below is an example of one of these records

**DMI Calibration Detail**

| | | | |
|---|---|---|---|
| DMI Calibration Name | DMI-0000002750 | Project | Louisiana State 2022 Data Collection Services - Cycle 3B |
| ARAN | ARAN 65 | Field Project Change Review | |
| Pulse Encoder Type | 10000 | Date of Calibration | 13/09/2022 |
| | | DMI Calibration Result | Pass |
| | | DMI Calibration Reviewed Result | Accepted |

**Pulse Counts**

| | |
|---|---|
| DMI Count - Server | 1,600,279 |
| DMI Count - Pavement | 1,600,279 |
| DMI Count - ROW | 1,600,279 |
| DMI Count - ROW-B | |
| DMI Count - ROW-C | |

**Tire Verification**

| | | | |
|---|---|---|---|
| Tire Pressure Driver Front | 65 | Tire Pressure Driver Front Result | Pass |
| Tire Pressure Passenger Front | 65 | Tire Pressure Passenger Front Result | Pass |
| Tire Pressure Driver Rear | 75 | Tire Pressure Driver Rear Result | Pass |
| Tire Pressure Passenger Rear | 75 | Tire Pressure Passenger Rear Result | Pass |
| Tread Depth Driver Front | 0.325 | | |
| Tread Depth Passenger Front | 0.325 | | |
| Tread Depth Driver Rear | 0.325 | | |
| Tread Depth Passenger Rear | 0.325 | | |
| Tire Width | 245 | | |
| Tire Aspect Ratio | 75 | | |
| Tire Wheel Diameter | 16 | | |

**DMI Calibration Values Entry**

**DMI Calibration Values Results**

| | | | |
|---|---|---|---|
| 1st Accepted Value Min | 4,200.000 | 1st Accepted Value Result | Pass |
| 1st Accepted Value Max | 4,295.000 | | |
| Verif Value Min | 4,212.281 | 1st Verif Value Result | Pass |
| Verif Value Max | 4,215.281 | 2nd Verif Value Result | Pass |
| | | 3rd Verif Value Result | Pass |
| | | 4th Verif Value Result | Pass |
| Created By | George Leanza, 13/09/2022 12:38 PM | Last Modified By | George Leanza, 13/09/2022 12:38 PM |

The DMI calibration logs will be documented and reported to LADOT in the final project quality report and can also be found on the SharePoint site. For example, the 2022 DMI calibration site results can be found on the SharePoint site in the following location:

(\\DS_Louisiana\Delivery\Reports\2022\2022_Monthly_QAQC_Cycle_3b\DMI\)

# Data Collection

During collection, real time monitoring systems are employed to ensure data quality. These include:

## Data Collection Personnel Certification Programs

One of the key QC activities is training the personnel that will be collecting the data. Field Technicians must learn how to operate and troubleshoot complex computer hardware/software, video, and automotive systems. Their training includes calibrating the equipment, monitoring the data and video systems in real time, and understanding the multitude of factors that can affect data quality during the collection process.

Field Technicians are trained to review data in the field to look for inconsistencies and to check error logs. This allows the crews to spot problems, take corrective actions, and re-collect the segments before leaving the area.

## Daily Mechanical Inspection

Prior to each collection day the ARAN technicians will perform a 50 point mechanical inspection that will ensure the safe operation of the ARAN, as well as a verification of the mechanical equipment which could impact the validity of the data collected (e.g. Tire Pressures, Suspension, etc.). Any mechanical anomalies are rectified immediately or if minor are noted on the Mechanical Inspection checklist and then rectified at the earliest convenience.

Figure 5 is an example of one of these records that shows the 60 points being inspected

**Mechanical Inspection Detail**

| | | | |
|---|---|---|---|
| Mechanical Inspection Name | MI-000050768 | Date of Inspection | 27/09/2022 |
| Vehicle Status | Available | Vehicle | ARAN 65 |
| **Tires** | | | |
| Tire Treads and Fasteners | Pass | Tire Pressure | Pass |
| Suspension and Springs | Pass | DMI and Tire Bolts | Pass |
| **Emergency Equipment** | | | |
| First Aid Kit | Pass | Flares | Pass |
| Emergency Triangles | Pass | Reflective Vests | Pass |
| Hard Hats | Pass | Fire Extinguishers | Pass |
| Reflective Cones | Pass | | |
| **Engine** | | | |
| Engine Fuel System | Pass | Engine Oil Level | Pass |
| Brake Fluid Level | Pass | Power Steering Fluid | Pass |
| Windshield Washer Fluid | Pass | Engine Exhaust System | Pass |
| **Generator** | | | |
| Generator Oil Level | N/A | Generator Fuel System | N/A |
| Generator Exhaust System | N/A | Generator Coolant Level | N/A |
| **Lights** | | | |
| Head Lights | Pass | Tail Lights | Pass |
| Top Clearance Lights | Pass | Flashing Beacons | Pass |
| Hazard Lights | Pass | Turn Signals | Pass |
| Brake/Reverse Lights | Pass | | |
| **GPR** | | | |
| GPR Enabled | Not Enabled | GPR Sled, Ropes and Hooks | |
| GPR Horn Height | | GPR Sled Height | |
| **Miscellaneous** | | | |
| Seatbelts | Pass | Airconditioning | Pass |
| Defrosters / Heaters | Pass | Windshield and Windows | Pass |
| Brakes Working | Pass | Wipers | Pass |
| Washer Fluid Sprayer | Pass | Horn | Pass |
| Backup Alarm | Pass | Backup Camera | Pass |
| Roughness Lasers | Pass | LRMS | N/A |
| Pavement Camera/Scan Laser | Pass | Environmental Cameras | Pass |

## Daily Subsystem Check

Prior to commencing the collection of data on behalf of the LADOTD, the ARAN Field Technicians will clean lens covers of all sensors, check mounting and wiring connection, and verify that test signals are received by the on-board computer. Output from the computer will be verified. Sensors will be physically checked by interfering with the laser beam and observing the corresponding response. Signal output and computer generated data will be verified to ensure

that all components are working properly. This procedure is to ensure that all of the ARAN Systems (including both the software and the associated hardware) are functioning correctly and that all of the Data collected is validated, accurate and of the highest quality possible.

## Real-time Quality Monitoring on the ARAN

Quality control subsystems are built into each ARAN. Each ARAN is equipped with ergonomic, front-mounted computer controls and a High Definition screen that enable the Technician to actively monitor all images, all data streams and confirming stored data. Onboard software monitors the individual data collection subsystems in real-time and alerts the operator when data is out of range or if an equipment malfunction has occurred. If a sensor is recording out-of-range (IRI, rutting, grade, GPS), or does not register a change for a predetermined length of time, the system uses audio and text alerts to notify the operator of the potential malfunction.
Any collection section in which the real-time quality monitoring identifies an issue that will result in data that does not meet our strict quality standards will be rejected by the Field Technician in the ACS, and will be recollected. These rejected collections are excluded from the data processing steps.

## Field Activity Report and End of Day Verification

A Field Report is created each day when collection has finished. This includes names of each ARAN operator, number of miles collected in each functional class, start and end times of collection, number of collected LADOTD network sections, and comments pertaining to issues encountered during collection.

Data integrity log files are generated by the ARAN Collection Software (ACS) which contain the following information:

1. Current ARAN configuration settings.
2. A list of collected sections with a summarized data value from each sub-system collected, rejection status, and any comments pertaining to any anomalies of the collection to communicate to Data Processing staff.
3. LADOTD network sections still requiring collection.
4. Locations of any images not recorded.
5. References of all GPS files collected.

In addition to the log files, sample images are automatically selected from each camera system as follows:

1. 3 images from the start of the collection day
2. 3 images from the middle of the collection day
3. 3 images from the end of the collection day
4. 3 images randomly selected by the ACS

The Field Technicians review the content of the data integrity log files and the sample images from that day, and will reject any collection where the log data or image data shows it does not meet the quality standards. Additional comments pertaining to any anomalies of the collection are added at this point for use by Data Processing staff.

## Daily Quality Control Verifications

Following the Field Technician review, the data integrity log files, the sample images and comments are uploaded for secondary verification by Data Processing staff. The Data Processing technician assigned to the ARAN will review the data integrity log files and sample images following a 15 point checklist:

1. Camera Alignment conforms to project requirements
2. Missing images are few enough to conform to our quality standards
3. ARAN configuration settings conforms to the project requirements
4. Format of summarized data report meets quality standard
5. Chainage flow is consistent with project requirements and quality standards
6. Summarized data values are within standard tolerances and are reasonable
7. Summarized data values are populated for each enabled sub-system
8. GPS files collected conform to our quality standards
9. Any project specific data requirements have been met
10. ROW images conform to our quality standards
11. Environmental images conform to our quality standards
12. Pavement images conform to our quality standards
13. Pavement image Width conforms to project requirements
14. Pavement image Length conforms to project requirements

The status of the checks is entered into a DS Daily Verification record. If the daily quality control checks are approved, then the DS Daily Verification record is set to pass. If the daily quality control checks fail, then the DS Daily Verification record is set to Fail, an automatic notification of the failure is delivered to the Project Manager, Field Technicians, Field Supervisors, Fleet Support, Technical Manager, and Director of Operations, root cause analysis is completed, and corrective actions are initiated. The suggested corrective action, which may include recollection of data, is submitted for review, and must receive approval of both Fleet Support and our technical manager before any further acceptance of collected data.

Figure 6 below is an example of one of the DS Daily Verification records.

**DS Daily Verification Detail** — Edit | Clone | Submit for Approval | View ARAN Setup

| | |
|---|---|
| DS Daily Verification ID | DV-0000037382 |
| ARAN Daily Report | ADR-000067418 |
| ARAN Status 1 | Collection (Full Day) |
| ARAN Status 2 | |
| Complete | Yes |
| Created By | Duaa Ismail, 26/09/2022 12:37 PM |
| Last Modified By | Duaa Ismail, |

**ARAN Daily Report Information**

| | |
|---|---|
| Project | Louisiana State 2022 Data Collection Services - Cycle 3B |
| ARAN | ARAN 65 |
| Date of Collection | 23/09/2022 |
| Total Collection | 54.313 |
| Days Since Waiting on ARAN Data | 0 |

**Data Control**

| | |
|---|---|
| Data Control Status | Pass |
| Camera Alignment | Pass |
| QC_Video_.CSV | Pass |
| QC_Data_Files_.CSV | Pass |
| Data Control Comments | |
| Data Control Actions | |

**Data Analysis (all settings must match ARAN Setup record)**

| | | | |
|---|---|---|---|
| Data Analysis Status | Pass | | |
| 1M0 File Name | Pass | Daily CSV Format | Pass |
| XML/1M0 Comparison | Pass | Daily CSV Chainage | Pass |
| Datachek Log | Pass | Daily CSV Sensor Data | |
| PCS Data | Pass | Daily CSV GPS Data | |
| Export Log CSV | Pass | Controls Validation | |
| GPR Data | N/A | Controls Comments | |
| Special Data Requirements | N/A | Controls Tracker Location | |
| Data Analysis Comments | | | |
| Data Analysis Actions | | | |

**Distress**

| | | | |
|---|---|---|---|
| Distress Status | Pass | Pavement Images | Pass |
| ROW Images | Pass | Pavement Image Width | |
| Environmental Images | Pass | Pavement Image Length | |
| Distress Comments | | | |
| Distress Actions | | | |

**Fleet Support**

Edit | Clone | Submit for Approval | View ARAN Setup

## Weekly Verifications

In addition to the calibration site testing, data validity will be assured through weekly collection of verification, or quality assurance, sites.

During the first week of data collection in each new district, a verification site will be chosen and the data on that section will be collected by the first ARAN to be assigned to that district. The sites may be selected from historical use or a new section may be chosen; to be agreed upon by the ARAN crew and the DOTD. Starting with the second week of data collection in the district, the verification site will be run and compared with the original data collected previously for that site. The roughness and rutting results will be field-verified by the ARAN crew, and the results sent back to the office for tracking and reporting to LADOTD. The verification sites will provide a continuous check of the calibration of the ARAN subsystems on a weekly basis. When collecting in or near District 61, the verification site may be chosen from the list of the calibration sites listed above.

Fugro Roadware shall also utilize calibration sites specifically to verify correct calibration of the Distance Measuring Instrument (DMI). This calibration site shall be run monthly. Weekly checks of the DMI will be performed on local District specific verification sites.

At any time during the ensuing week, should the data collection crew experience problems with any of the ARAN subsystems that require minor adjustments or modifications, the Project Manager, at his/her discretion, may decide to direct the crew back to the verification and/or DMI site to ensure proper calibration.

If complete re-calibration of any of the electronic sensor data subsystems is necessary, or deemed advisable by the Project Manager for any reason, the ARAN will return to the original calibration sites for verification. All data collected during the period from the last successfully passed calibration check will be thoroughly re-assessed, and will be recollected if deemed necessary.

Any problems experienced which could lead to verification site reruns will be reported to the DOTD by Fugro Roadware's Project Manager.

For acceptance, the tolerances used on the weekly verification site shall be the same as those for the calibration site testing; for roughness data, the results of each run must not deviate more than 10% from the average of the three (3) runs and for rutting data, the results of each run must not deviate more than 3mm (0.1 inch) from the average of the 3 runs.

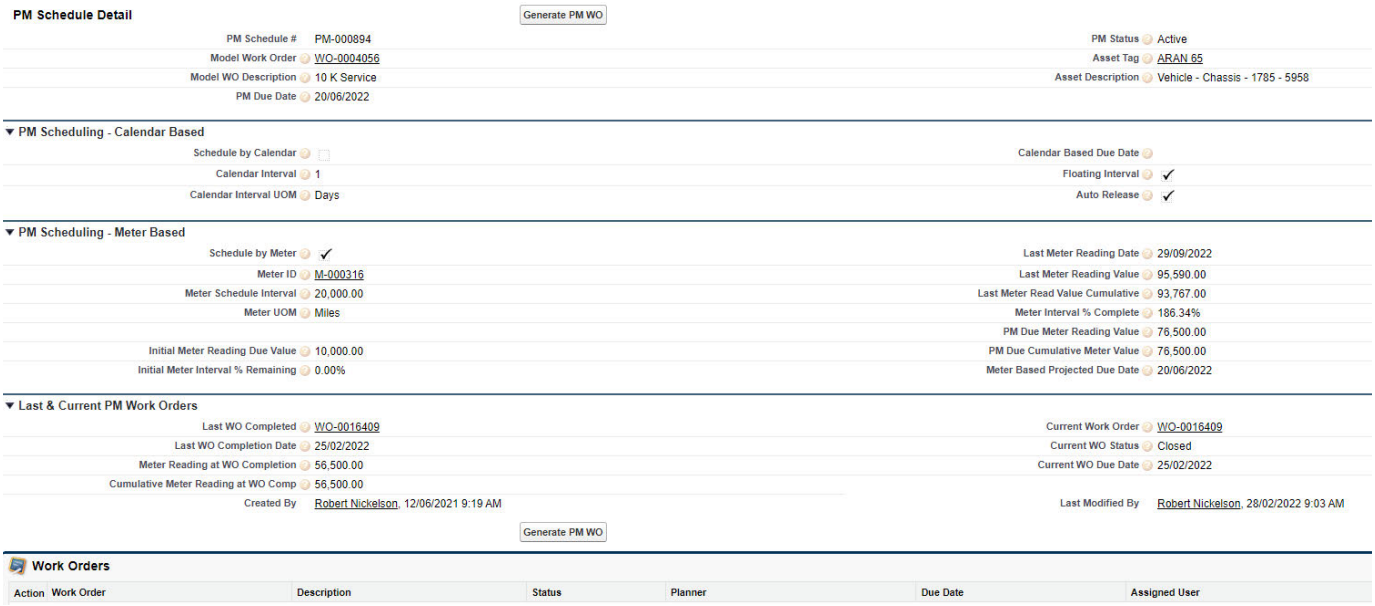
All sensor data verifications performed during the course of the project shall be documented and reported to LADOTDD in the final Project Quality Report and can also be found on the SharePoint site. For example, the 2022 weekly verification site results can be found on the SharePoint site in the following location:

(\\DS_Louisiana\Delivery\Reports\2022\2022_Monthly_QAQC_Cycle_3b\Weekly_Verifs\)

## Preventative Maintenance Program

To ensure that the uptime of our ARAN collection fleet is at its highest possible, we have implemented a robust and automated Preventative Maintenance Program. Automated Work Orders are issued based on meter readings from the ARAN such as the odometer or generator hour's meter. There are five different types of preventative maintenance performed on the ARANs. They are a 10K (miles), 20K, 80K, 120K and Generator 250 hour preventative maintenances.

Figure 7 below is an example of a 10 Kilometer preventative maintenance schedule




# Data Processing

There are many quality control and quality assurance processes that occur during the data processing phase of a project. At each process, if data does not meet quality standards, or LADOTD specifications, that data is recorded on the project non-conformance report. All non-conformances are reviewed by the Project Manager in conjunction with the project team in order to determine if the data will be recollected, reprocessed as part of an exceptions batch, or is suitable to be delivered to the LADOTD with a documented exception.

## Data Processing Personnel Certification Programs

Data Processing Technicians will be trained on how to use all applications and tools and how to perform analytical checks to verify data meets requirements. Their training includes identifying common place errors, such as image brightness issues, out of range sensor readings or incorrectly detected pavement distress. All training is tracked in our training matrix to ensure that staff do not begin work until they have the necessary skills to do so.

## Data Control

Data Control Technicians in our offices receive the shipments of collected data and begin the data processing effort by uploading the data to our data storage servers and importing the data into our production databases. All data is then backed up to tape which is stored in a secure, climate controlled facility, to ensure that a copy of the data is available if a major incident were

to impact our primary data storage (See Business Continuity and Disaster Recovery Plan). As a part of the setup phase of the project, the necessary project network directories and databases into which this data is to be stored were created in accordance with our standards for data locations and structures. Due to these standard locations and structures all staff are able to find the information they require with minimal effort. Templates are created that govern the behavior of the tools used to upload, import and backup the data and effectively automate the majority of the Data Control process, reducing downtime between processing steps and eliminating manual error. Recollection of a road or part of a road shall be deemed necessary when either five or more consecutive images, or 5% or greater are found to be "defective images"; where either the images are not present or have outlying histogram values as identified by Fugro Roadware's initial video checks.

Sections containing questionable images could be submitted to the DOTD for review and a course of action shall be agreed upon by Fugro Roadware's Project Manager and the DOTD. The resulting action could include acceptance of the images, batched or individual photo manipulation, or full recollection of the suspect data. Fugro Roadware would like to receive the LADOTD QC results after each District's video images are reviewed. Fugro Roadware will then use the input from LADOTD during final quality checks, recollection, and re-deliveries.

The following checks are completed to ensure data quality at this stage:

1. Data Shipment Work Order information is compared to the data on the physical media and to the Field Daily Reports for the relevant date range. If any data is found missing from the physical media, the ARAN operators are contacted in order to ship the remaining data.
2. Data transferred to our servers is compared to the data on the original physical media. If discrepancies are identified, corrective actions will be taken by the Data Control Technician, including rerunning the automated processes or manually uploading the data to ensure a complete copy of the collected data exists on our storage servers.
3. The images on our storage servers are compared to the images expected based on the data collected and stored in our production databases. Any discrepancies between the expected images and the images on the storage servers are logged as an exception in our production database. Any collection session that does not meet our quality standards will be rejected.
4. Each image on our storage servers is run through multiple automated algorithms to check them for common image issues such as brightness, contrast, and clarity. Any image that does not meet our quality standards will logged as an exception in our production database. Any collection session that does not meet our quality standards will be rejected.
5. The playback sequence of the images is checked and any incorrect sequencing is reprocessed to resolve the issue.
6. A detailed comparison is conducted of the data integrity log files created by the Field Technicians for each day of collection, to the comments contained within the production database. Any changes or updates to the comments on each collected session from the Field Technician responsible for the collection can be incorporated at this stage to provide the most complete annotation of the collection. If a collected data file is identified as not meeting quality standards, these comments are used to exclude that data

from any further processing. The comments are also available in the production database throughout the processing effort to provide On-the-Ground insight about the collected session so that Data Processing staff can make the most informed decisions when processing the data.

7. Data is automatically verified to ensure that there is no duplicate data imported into the production database.

## Segmenting

Segmenting is the method of trimming and creating the best fit for the ARAN data to the LADOTD's network definition. This is primarily achieved by comparing that the GPS collected by the ARANs matches the expected coordinate definition for the beginning and end of each LADOTD segment. Where GPS is unable to provide a suitable solution, further refinement is achieved using a combination of the description for the start and end of segment, imagery collected by the ARAN, and mapping tools. The Vision software suite synchronizes all data streams to allow our technicians to make the best possible informed decisions to produce the most accurate results. Any discrepancies will be verified with LADOTD. During the segmenting process the data undergoes the following quality control checks:

1. The overall position of the collection in regard to the LADOTD network is checked during the segmentation process. Files that are collected and associated to one routed section but belong entirely to another routed section will be transferred to the relevant routed section if required. If this leaves a gap in collection for the initial routed section, this routed section will be added to the non-conformance list for review by the Project Manager to schedule recollection of the section. This applies to collection in a different district, county, route, lane, direction or mile point.
2. Once segmentation is complete the image exceptions recorded during the Data Control processes will be reviewed to determine if segmented data meets our standards. Any data that does not meet our quality standards will be rejected and added to the non-conformance list for review by the Project Manager to schedule recollection of the section.
3. The LADOTD segments expected to be covered by the collected data are compared to the actual segments covered by the collected data after the segmentation process is completed for a specified data set. This identifies any collected session that has been missed in the segmentation process, so that they can be corrected.
4. The chainage of all segments is checked to ensure no matches begin before the expected linear reference, resulting in a negative chainage value. If any cases are identified, the Data Processing Technician will investigate and correct.
5. The segmented length of each segment is checked to ensure no negative lengths exist. If any cases are identified, the Data Processing Technician will investigate and correct.
6. In the case where data was collected for one routed section but a portion of the collected session belongs to a separate routed section, the portion is transferred to the correct routed section. All transfers are reviewed to ensure they are correct and intentional.
7. Segments that have had their length and position changed during the segmentation process are reviewed when the level of change exceeds the project tolerance. If any cases

are identified, the Data Processing Technician will investigate to ensure the best solution has been identified. If necessary the segment will be escalated to the project manager to discuss with LADOTD.

8. Segments that have had the length of the collected data compressed or stretched to match the definition of the segment during the segmentation process are reviewed when the level of change exceeds the project tolerance. If any cases are identified, the Data Processing Technician will investigate to ensure the best solution has been identified. If necessary the segment will be escalated to the project manager to discuss with LADOTD.
9. Segments with a length less than the defined tolerance. If any cases are identified, the Data Processing Technician will investigate to ensure the best solution has been identified.
10. If any anomalies are identified during the segmentation process that do not result in failure of our quality standards but could assist with later processing stages, the Data Processing Technician will add the comments to the production database so that they are visible to other Data Processing staff.

## Distress

As a part of the setup phase of the project, the LADOTD distress protocol is translated into Fugro's standard distress protocol format, which is a familiar format to all of our Distress Rating Technicians, contains photo examples of distress types and examples and ensures that the protocol is well understood and not misinterpreted. The protocol document is provided to all Distress Rating Technicians before the project starts so that any clarifications required can be added. New distress rating scenarios may be identified during the course of the project, at which point scenario will be reviewed by the Senior Distress Lead, in conjunction with the Project Manager and LADOTD as appropriate, in order to identify the best possible approach. The protocol will be updated to include the new information, and a new version released to all parties.

A Distress Schema that corresponds to the distress protocol is embedded in the production database for the Project. This Distress Schema contains only the specific distress types and a severity required for the specific project, and ensures that only those distresses can be rated. The distress classification and rating settings are also defined in the Distress Schema, ensuring consistency across the entire project.

## Distress control sites

Prior to starting network production a set of distress controls sites are chosen. The control site process ensures inter-rater consistency and compliance to the distress protocols as defined in the project setup phase. These sites will be used to 1) Set the reference or benchmark standard for the project and 2) Calibrate the rating team. Using the distress identification criteria outlined in the Distress Protocol, the project lead or QC delegate will rate each of the control sites which then become the benchmark to be submitted to the DOTD for approval. Once the benchmark has been approved, all other members of the distress rating team for the project must rate each of the control sites. The results will be compared against the project lead or QC delegate, for rating technician calibration purposes. Before any technician will be allowed to proceed with

production work on the project, he/she must pass all the verification sites consistently. This process will ensure that every technician is producing the same results, within acceptable limits, prior to beginning production.

## Distress Review

Upon completion of a batch of data, standard queries on the distress data are run by a separate team of independent distress raters/QC to ensure that they meet project requirements. Based on the results, the technician(s) will be instructed to either redo the file, entire day or entire batch of data.
To ensure consistency among technicians, the rating team will rate the distress verification sites at the mid-point of the project. Results will be compared to the reference standard to ensure that each operator remains consistent and accurate.
This combination of benchmarking, standard queries, and inter-operator consistency will assure the overall consistency and validity of the distress ratings.
Each set of data will also be validated with the following quality control measures to ensure all data delivered is of the best possible quality:

1. Collected sessions in which no distress has been rated are reviewed to identify missed ratings or to confirm a valid reason such as being under construction or new pavement.
2. Automated distress that has not been classified is reviewed and classified in a separate review.
3. Any portion of a collected session that does not have a pavement type rating or a number of lanes rating is reviewed and re-rated to ensure the data is complete.
4. Any portion of a collected session that has more than one rating of pavement type or number of lanes is reviewed and re-rated to ensure the rating is accurate.
5. All occurrences of a milled pavement rating where construction is not rated are reviewed for accuracy and consistency.
6. Lane width ratings less than the defined minimum threshold will be reviewed and edited to ensure accurate measurements.
7. Locations where only one of Construction or Lane Deviation rating occurs are reviewed to ensure these ratings are accurate.
8. All locations where a specific distress occurs on an incompatible pavement type are reviewed edited to ensure pavement types and distresses are correlated correctly.
9. Any portion of a collected session that does not have a Shoulder type rating is reviewed and re-rated.
10. Any portion of a collected session that has more than one Shoulder type rating is reviewed and re-rated.
11. Any portion of a collected session where density or length of cracking exceeds the defined threshold is reviewed for accuracy.

## Distress Year to Year Comparison

To ensure consistency over many cycles of data collection, historic information is compared to current information at the same geographic location. If this is available from LADOTD for year

one it will be performed otherwise it will be performed in all subsequent years. This will allow the identification of any unanticipated changes in roadway performance. This process often identifies sections that have been rehabilitated or have deteriorated drastically. For the purposes of quality control, the amount of each distress type is compared between consecutive years and a section that has improved by 5% without rehabilitation or that has decreased in condition by more than 15% is manually reviewed to ensure accuracy in the current data.

## Analysis of Results

A full analysis of the distress rater verification results will be completed and included in the final Project Quality Report. All values will be highlighted according to their relative tolerance checks and any abnormal values will be explained.

Further to this, a full analysis of all distress results will be performed and reported; highlighting the results and offering analysis of any anomalies or trends that would be of interest to the LADOTD. This analysis will be performed and reported for the Full Network as well as by Distress Type and by District. For example, the 2022 distress verification site results can be found on the SharePoint site in the following location:

(\\DS_Louisiana\Delivery\Reports\2022\2022_Monthly_QAQC_Cycle_3b\Inter-Rater_Distress\)

## Data Analysis

During the Data Analysis phase the outputs of all previous steps are combined to achieve a holistic view of the data. Once processing of the profile data is complete, quality checks are implemented at this stage to ensure that all delivered data is logical, GPS and linear reference flow properly, and proper format and units are used. The results are combined and completeness checks are performed to ensure that the results meet the LADOTD's needs.

For initial quality checks, sensor deliveries are put together which include segmented data, roughness, rutting, and faulting sensor data. Along with sensor data deliveries, Fugro Roadware shall send a copy of all right-of-way images collected for each District to LADOTD for review. An iVision instance will be setup containing both sensor and right of way imagery to facilitate viewing and initial QC by DOTD personnel. Although no edits will be performed on the data prior to these initial preliminary deliveries, the overall quality of the images can be checked easily and early by the DOTD at this stage.

The work conducted during the segmenting and distress rating steps is reviewed again to ensure the linear referencing, and reported distresses are logical and reasonable. These additional checks can identify anomalies that were not apparent without the holistic view of all data streams, and ensure that our data deliveries are of the highest possible standard and include:

- Checking the quantity of data before and after segmentation to ensure that no data is missing.
- Identifying and correcting any errors resulting from segmentation.

- A preliminary comparison between the segmented data and the master routed table, checking for section length discrepancies, section start and end discrepancies, partial collections, and missing sections without a valid explanation.
- Checking that pavement specific distresses are only being rated on the appropriate pavement types.
- Checking that distresses and pavement types have been rated properly, as outlined by LADOTD's approved Distress Protocol.
- Checking that distress ratings meet minimum requirements and do not exceed maximum thresholds as defined industry and LADOTD standards.
- Checking that rated pavement types align with LADOTD expectations and providing sound reasoning if there is a valid discrepancy.
- Checking to make sure that rated lane widths and pavement widths are present and accurate.

Once the data has been verified that it meets project requirements with the segmentation and distress rating data, algorithms are applied to the longitudinal and transverse profile data in order to extract roughness, faulting, crossfall, and rutting measurements. Algorithms are also applied to the vehicle position and orientation data in order to calculate the geometric attributes of the roadway. The settings to be used in each of these algorithms are defined during the project setup phase based on the requirements of the project, and are then stored in template files that are used each time the algorithms are run on that project. This greatly reduces the risk of suboptimal settings being used during the project and ensures consistency between data sets.
LADOTD locations, distress, pavement events, and sensor data, are then reviewed at the micro level and, if applicable, against previous years data.

Standard completeness quality control includes:

- Total length of delivery matches expected length.
- Total number of sections matches expected number of sections.
- No data in delivery has been previously rejected.
- No section in delivery has been delivered previously without valid exception.
- Sections shorter than expected length have valid exception e.g. road turns to gravel.
- Any sections not delivered have valid exception e.g. road closed.

Standard locator information quality control includes:

- No blank or NULL values.
- All locator values match LADOTD specified locator values.
- All combined locator values are the sum of their component reported parts.
- All hierarchical relationships between locators are maintained.

Standard length quality control includes:

- All rubberbanded segments will match the expected length.
- All rubberbanded segments with an adjustment of +/- 20% will be validated.

- All rechained segmented with an adjustment of +/- 5% will be validated.
- No segments with a 0 length.
- No segments with negative lengths.
- Segment lengths that differ from historical length by 5% or more will be validated (applicable in subsequent years).
- For fixed interval reporting, the interval length will match LADOTD specification except at homogenous section break, or collection session break.

Standard linear reference quality control includes:

- No blank or NULL values.
- Direction and chainage flow relationship matches LADOTD specification.
- Direction values meet LADOTD specification.
- Chainage flows within contiguous sections.
- No overlapping chainage.
- No duplicate mile points within locator definition.

Standard GPS quality control includes:

- No blank or NULL values.
- Confirming percentage of post-processed GPS coverage is within tolerance.
- Reported latitude and longitude values plot within expected boundaries.
- Reported elevation values are within expected boundaries.
- Segment elevation within +/-6 inches from historical data.
- Segment latitude and longitude within +/-1 meter from historical data.
- Segment latitude and longitude within +/-1 meter from LADOTD location definition.

Standard speed quality control includes:

- No blank or NULL values.
- No negative speed values.
- No 0 speed values.
- For any section requiring pavement images speed will be less than 55mph.

Standard date field quality control includes:

- No blank or NULL values.
- Date format will match specification.
- Date of collection is within data collection period.

Standard roughness quality control includes:

- No negative values, except for -1 where used as invalidation identifier.
- No blank or NULL values.

- IRI values correlate with the functional class of the road, other reported pavement condition data, and reported events such as speed bumps, railroad crossing, cattle guards, round-abouts, or stop-and-go traffic.
- Summarized maximum, minimum, or average reported values will be validated against the reported data before summarization.
- Large discrepancies between left and right IRI values will be validated.
- Conducting a visual investigation using the ROW and pavement images and charted IRI data to determine the causes of these irregular values.
- Review sections which show more than 5% improvement in values without reported rehabilitation, and sections which show more than 15% deterioration in values, per year compared to historical data.

Standard faulting quality control includes:

- Checking that the number of faults is not greater than the number of number of rated joints.
- Checking that faulting is not occurring on non-jointed pavements unless requested specifically by LADOTD.
- Summarized maximum, minimum, or average reported values will be validated against the reported data before summarization.
- Conduct a visual investigation using images to determine the causes of any fault values which are outside of the expected range.
- Review sections which show more than 5% improvement in values without reported rehabilitation, and sections which show more than 15% deterioration in values, per year compared to historical data.

Standard rutting quality control includes:

- Ensure % of valid transverse profiles is sufficient to provide rutting values that are representative of the section.
- No negative values, except for -1 where used as invalidation identifier.
- No blank or NULL values.
- Conduct a visual investigation images and Transverse Profile rut values which are outside of the expected range, or which contain large discrepancies between left and right wheelpaths.
- Summarized maximum, minimum, or average reported values will be validated against the reported data before summarization.
- Review sections which show more than 5% improvement in values without reported rehabilitation, and sections which show more than 15% deterioration in values, per year compared to historical data.
- Review to ensure that shallow, deep, severe and failure ruts are correctly allocated and add to a total of 100%.

Standard road geometry quality control includes:

- No blank or NULL values.
- All values outside of typical design tolerances will be validated.
- Conducting a visual inspection of the route using ROW images, a GIS map, and our Curve Fit Module to ensure algorithms are detecting features optimally.
- Reprocessing of exception data commonly caused by vehicle deviation from collection path or required lane changes.
- Comparison of geometric features detected in the opposing directions and reprocessing if applicable to ensure optimal curve representation in both directions.

All of these checks during the Data Analysis stage are done to ensure high accuracy is met on Rutting, Faulting Height and Number, MPD, IRI and GPS. These checks are performed to ensure the data meets ASTM E950, ASTM E1845-09, AASHTO M328-10, AASHTO R56-10, AASHTO R57-10, AASHTO PP70-10, TEX-1001S and those of stringent projects we have done for Model Inventory of Roadway Elements (MIRE) and Strategic Highway Research Program (SHRP) 2.

### Project Reporting and Aggregation

Once the micro level quality control is complete, the final delivery report is generated with data aggregated to the LADOTD's specifications. This report undergoes further quality control and assurance processes, much like the micro level processes to ensure that the aggregation step has not introduced any errors, and that the data in its aggregated form is logical and reasonable. The aggregated report is checked to make sure that all expected data is present and that it meets all linear reference requirements, distress and sensor data requirements, and additionally all final delivery format requirements, so that the data will smoothly integrate with the LADOTD pavement management system.

## iVision

Once the reported data has passed all quality control steps previously documented, the data is published to iVision for online review purposes. Additional quality control steps are completed on the iVision instance including:

- User list matches LADOTD user expectations and internal standards.
- Validation of image links.
- Validation of playback synchronization.
- Length data published matches delivery.
- Number of segment records published matches delivery.

# Final Quality Assurance

When data has passed all quality control steps and has been published to iVision, a final quality assurance step is completed in which a second suitably qualified Data Analyst will review the reported data to ensure it complies with our internal standards and the project data dictionary. Any anomalies found at this stage must be validated or reprocessed to remove the anomaly.

## Image Deliveries

During the project setup phase, a sample image banner is created based on LADOTD requirements, and this banner is adjusted until LADOTD is satisfied with the results. Once the sample banner has been approved the settings used to create the banner are stored in a template file that is used by our Vision software to create every banner on every image for the remainder of the project. This minimizes the opportunities for manual error, and ensures that the banner on each delivered image meets LADOTD specifications. At the same time any specifications for image renaming or folder structure are recorded in the project template file.
During the project the following standard quality control measures are completed on each image delivery:

- List of collected sessions to be included in the image delivery is created and confirmed by the Data Analyst to ensure it matches the corresponding data delivery.
- Files are processed to add the banner, and update metadata as per the project template file. During this process an exception log is automatically created which records any issues encountered. Any exceptions created during this process are investigated and reprocessed after correcting the source data, or by applying a custom template for the exception files only.
- Once the banner processing is complete, sample images from 10% of collected sessions are manually reviewed to ensure the banner information is correct in terms of formatting and the data displayed.
- An algorithm is run on the delivery images to compare the images in the delivery folder to the expected images based on our production database. Any exceptions will be reprocessed using a custom template for the exception images only.
- An algorithm is used to compare the folder structure and image names of the delivery images to the project template file to ensure that they match LADOTD specifications.
- Once all quality controls steps have passed and the Data Technician responsible for completing the image delivery is satisfied with the quality, a final Quality Assurance step is completed with a second suitably experienced Data Technician completing the same quality control steps to ensure nothing has been overlooked.
- Once the quality assurance steps have passed for the image delivery it is copied to our storage servers, removable media for delivery to LADOTD, and backed up to tape. This ensures that a copy of the data is available if a major incident were to impact our primary data storage, or the LADOTD data storage.
- When the images have been backed up to tape the removable media will be shipped to LADOTD, and the shipment tracking number communicated to the Project Manager to ensure the LADOTD is aware of the impending delivery.

## Pilot Test Delivery

To ensure that Fugro Roadware is meeting LADOTD's requirements, we process and deliver a pilot data set as soon as a representative sample of the network (between 250 and 500 miles) has been collected.
The pilot gives both LADOTD and Fugro Roadware the opportunity to follow their typical end to end process using real data, ensure that all procedures, software, and configurations, are working as designed, evaluate the final reports, and if necessary to make changes to any step of the process. If any rework is required this same Pilot Data set shall be reworked as a priority and resubmitted to the DOTD for acceptance before any further data deliveries are made.

## Resource Planning and Forecasting

On a weekly basis the Project Manager and Director of Operations meet to review the project forecast and resource needs to ensure that this project has the staff it needs to ensure the on time delivery of the data.

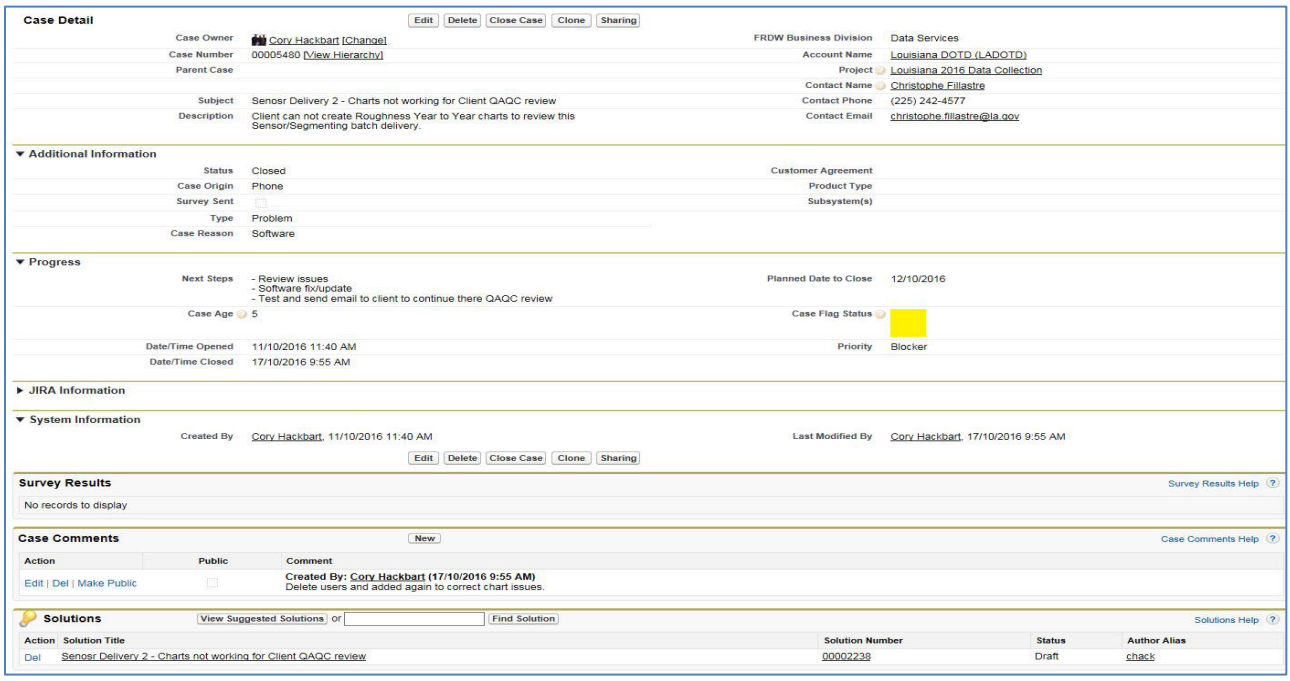
# LADOTD Identified Issues and Corrective Action

## LADOTD Identified Data Issues

Fugro Roadware proposes that concerns be communicated according to the following Policy. If for any reason, the integrity of data delivered to LADOTD by Fugro Roadware is found to be questionable or unsatisfactory, the following steps will be performed:

1. An email sent to the Fugro Project Manager by LADOTD
    - A clear description of the problem(s)
    - LADOTD's network locators e.g. District, CSECT etc.
    - File Name (if possible)
    - Chainage
    - Direction
    - Length
2. Creation of a case (Figure 8) for LADOTD tracking by the Fugro Project Manager.
3. Activation of the Corrective Action process if necessary by the Quality Manager.
4. Verification of the problem by the Fugro Project Manager and Processing Team.
5. Appropriate corrective action employed by Fugro.

Figure 8 example of a submitted case



Corrective Action

When the QC or QA process reveals errors in the data, the data must be appropriately reprocessed and a Corrective Action (CAPA) record created (Figure 9). This reprocessed data must also be documented as part of the QC/QA report. Errors can either be discovered by Fugro during the QC process or by LADOTD during the QA process. In addition, LADOTD staff may also identify problems prior to accepting the final deliverables. The steps for correcting the errors identified at each stage of the process are described below.

Figure 9 example of a corrective action report

**CAPA Detail** Edit | Delete | Clone

| | | | |
|---|---|---|---|
| Owner | Denis Charland [Change] | Impact | 3 |
| CAPA Number | CAPA-0522 | Probability | 2 |
| Status | Implemented | Risk | |
| Nature of Non-Conformity | Per the linked customer survey result by Daniel Sokolnicki, Segmented Delivery 13 was missing ARAN 34 data for the Michigan 2016 project. | Age | 0 |
| Scheduled Date | | Days Since Last Action | 0 |
| Root Cause(s) of Non-Conformity | The project number on the data shipement was mis-labled to VA16 instead of MI16 by an employee cross-training in the data control. | Red Flag | No Flag |
| Action to Prevent Recurrence | The employee in question was reminded of the importance of ensuring that the Fedex shipments are properly labeled. | Audit Record | |
| Date of Implementation | 03/08/2016 | OFI | |
| Date of Verification | | Related CAPA | |
| Record Type | Corrective [Change] | Case | |
| | | Survey Result | SR-0000000926 |
| Created By | Brock Newitt, 03/08/2016 7:50 AM | | |

All sections failing Fugro internal quality review will be corrected prior to forwarding the deliverable to LADOTD. Fugro will provide documentation of these checks, identifying any management sections which required re-rating and identifying the potential source of the original errors. If the errors are identified as systematic, then all similar roadways rated by the individual identified as being in error will be reviewed and corrected as appropriate. This includes data from previous deliverables as well. Upon identification of errors, additional clarification or training will be provided, as needed.

As the QA review identifies differences between Fugro's ratings and LADOTD's ground truth ratings, these differences will be scrutinized to determine the magnitude and the cause of the errors. When errors are discovered in 10% or less of the deliverable checked, the entire deliverable will be accepted. However, if more than 10% of the data checked during QA falls outside of the allowable limits, then the entire deliverable will be returned to Fugro for correction.

If a deliverable is returned to Fugro, each difference is noted as whether LADOTD believes the difference to be caused by a random or systematic error. Random errors require that the specific pavement section be corrected. Systematic errors require an entire data set to be corrected.

Final acceptance activities are performed by LADOTD to determine if deliverables have met the established acceptance criteria. Should the LADOTD acceptance review find the data unacceptable for a given deliverable, the deliverable will be returned to Fugro for correction. In such cases, it is critical that both Fugro and LADOTD understand the reasons for deliverable rejection and work together to ensure the current deliverable is corrected and also to determine

the impact on other deliverables. Data will be accepted as LADOTD year-to year comparisons are completed.

## Warranty

Fugro warrants the quality of the data shall meet the needs of LADOTD and will make remedy to the data if any errors are discovered by either party within a mutually agreed timeframe.

**Data Processing and QC Procedures for Continuous Friction Data**

**In Truck**

- View graph while testing for proper speed, water flow rate, software sample window.
- Note and mark change in pavement type.
- Check files at the end of day to ensure they are properly saved and backed up.
- Zip and email data, and Operator Spreadsheet, which contains Exception/Fixes, miles driven, and miles collected daily.
- Email verification spread sheet weekly.

**In Office – Processing Raw Data Daily**

- Navigate to the Project folder on the network drive.
- Copy the data to **Raw** folder.
- Copy the data and Verifications to **Processing** folder
- Create a **CSV** folder in each of the data folders. This is where all the processed CSV files will be saved for further processing. Leave a window open in this folder for further processing.
- Open the Operator Spreadsheet and navigate to **Exceptions/Fixes** tab. Review for corrections for the sections run on the date. Make corrections to the CSV file that is processed in Roadbase.
- Run Roadbase
    - Check settings for the appropriate client
    - Review **Exceptions/Fixes** tab to see if there are any known fixes needed.
    - Change **Output Directory** to correspond to **date processing CSV folder**
    - Navigate to the **date folder.**
    - Open the first/next file.
        - QC the Filename, County (or Parish), Highway, Log Mile (ascending or descending), correct length, GPS, etc. Essentially, look for consistency and accuracy.
        - If corrections are needed, **navigate to the CSV folder in the date folder (that is already open) and open the desired file**. If no corrections are needed **navigate back to Roadbase** and process the next file.
        - Repeat until all files for the day are processed.
- Notify the data processors as to which dates are processed and/or need further processing.
- Notify field crew any anomalies that need their attentions.

**In Office – Initial QC by Data Processor**

- Make sure all files have been uploaded when using the macro or Python scripts.

- Make sure the number of rows added to the friction table after running the queries matches the number of rows in the import format table. If not, determine why.
- QC GPS- Put -9999 for bad GPS (do this for elevation as well).

**In-Office – QC Before Delivery**

- Run the Python scripts to combine CVS files.
- QC File Names-make sure format is right. Format should be "Control_Section"-"direction"_"year""month"_"day""hour""minute""second"

  Example: 052-05-1_20120710_114906
- Make sure **Exceptions/Fixes** are up to date, the newest set can be found in the most recently processed data folder. Remember that the list is additive. Look for consistency in wording for like exceptions.
- Run GIS spatial analysis, against ARAN bridge database, to verify if field noted bridge locations are accurate. Update pavement type as needed.
- QC Water- Determine an allowable water flow rate range that creates a nominal water film thickness of 0.0197 inche (0.5 mm) or otherwise specified by LADOTD. Delete the record if the water flow rate is outside the determined water flow rate range
- QC Speed- Delete entire record if speed is <25 or >52 mph (query should take care of this, but check)
- QC GPS again
- QC FN Number- Delete entire record if FN=0 (query should take care of this, but check)
- Add new names to Operator and Driver Decodes if needed
- Add new names to Data Summary if needed
- Check for same Control Section run on different days, the newest run is what we use.
- QC all relevant fields for null values.
- Plot GPS in excel to make sure there are no outliers – when found, replace the GPS info with -9999 and leave other info intact.
- Rerun summary queries if changes are made to "FRICTION" table.
- Run the "COMPLETENESS_CHECK" query: make sure to specify the district you are checking for in design mode before running.
- **AFTER** moving the database to the delivery folder, delete all queries, reports, and the "IMPORTFORMAT" table.
- Sort "FRICTION" and "FRICTION_SUMMARY" in order: district-> county name->route type-> route id-> data accumulation direction-> beg post (logmile for "FRICTION").
- Make sure "FRICTION" and "FRICTION_SUMMARY" tables' columns are in the proper order
    - "FRICTION": ELEMENT_ID, CSECT, PARISH, DISTRICT, ROUTE, LOGMILE, DIRECTION, SHS, FN, FN_DATE, SPEED, FN_LATITUDE, FN_LONGITUDE, FN_ELEV,

FN_ELLIPS, OID, FN_LANE, COMMENT, VPAVETYPE, DATASUMMAR, OPERATOR, OPERATOR2, FN_FILENAME, VEHICLE_ID, TEMPERATURE, WATER_AVG
    - "FRICTION_SUMMARY": CSECT, PARISH, DISTRICT, ROUTE, DIRECTION, FN_DATE, NUMSTESTS, AVG_FN
- Remove data other than the district being delivered. For LADOTD we deliver one district at a time.
- Remove all data but the district we are delivering from the Friction table and the Exceptions table.
- Run summary queries/Python Scripts.
- Run COMPLETENESS_CHECK Query/Python Scripts
- Compact database before delivery.

**In-Office – Creating Report Summary Tables**

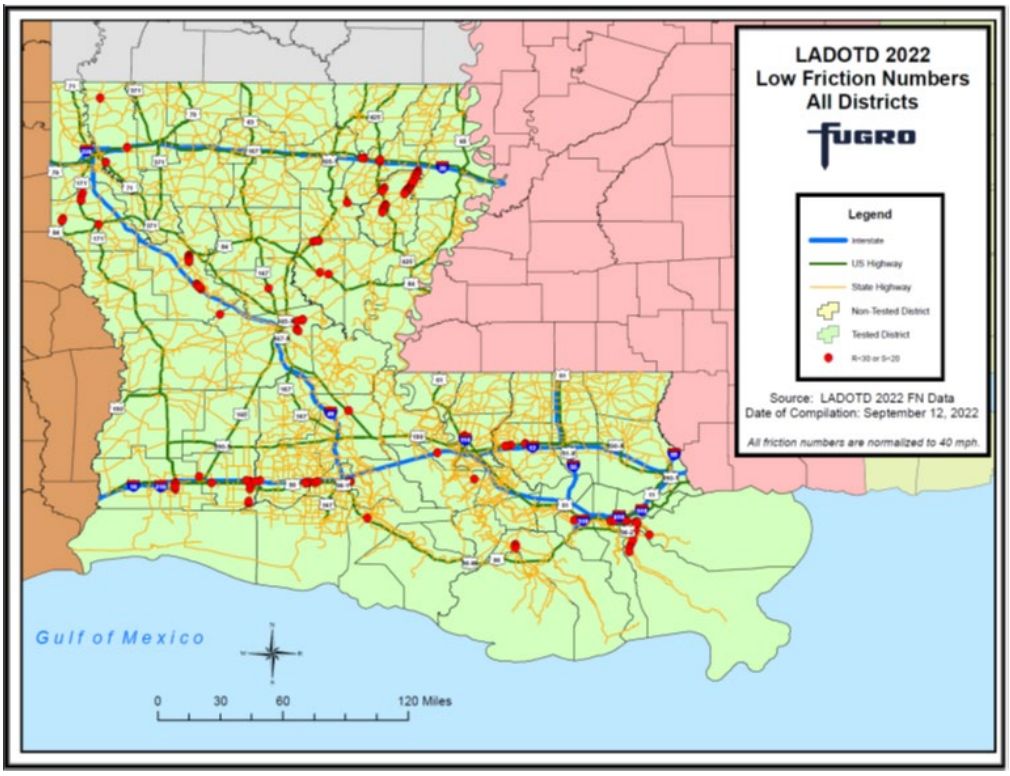
In addition to preparing the database for delivery, several friction tables must be generated for inclusion in the final report. These tables are generated in Access using a variety of queries or Python Scripts. After running these queries or Python Scripts, the summarized data may be copied into Excel to generate tables for the report.

- Run the QUERY/Python BY CONTROL SECTION to develop a table sorted by control section.
- Run the QUERY/Python BY DISTRICT to develop a table sorted by district.
- Run the QUERY/Python BY FUNCTIONAL CLASS to develop a table sorted by functional class.
- Run the QUERY/Python BY PARISH to develop a table sorted by parish.

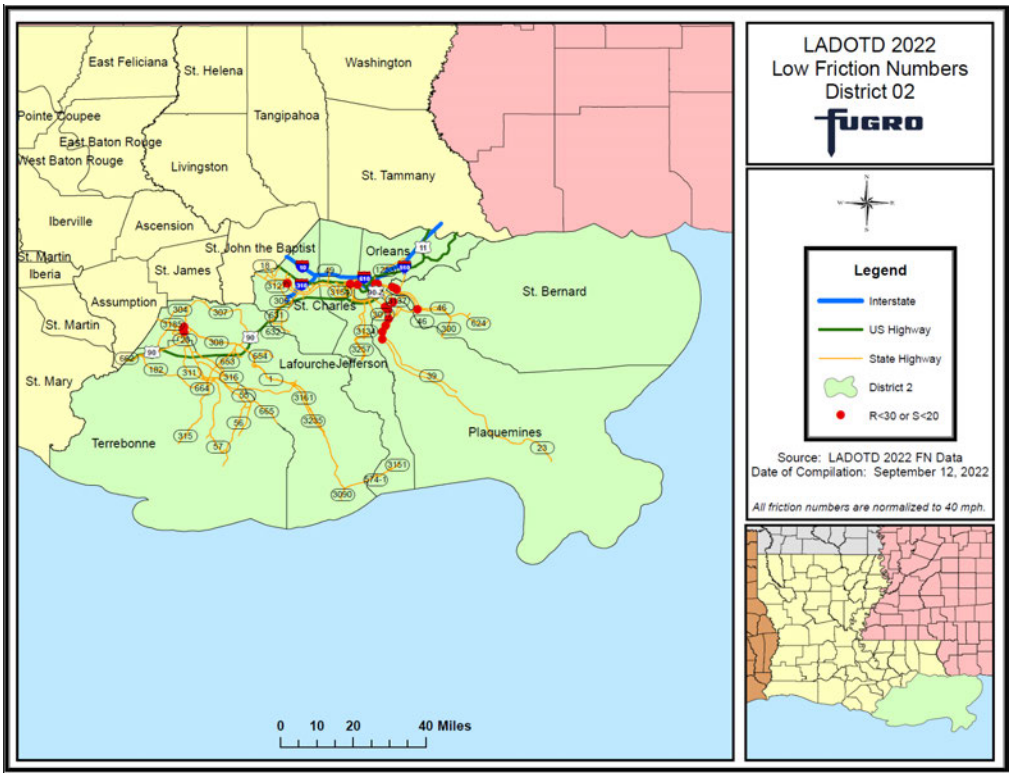
**In-Office – Creating ArcGIS Maps**

After extracting all the data and fixing all the issues in the spreadsheet, maps will be made in ArcGIS. **Maps are for low friction numbers only**.

- One Map showing all districts with low friction numbers (see Example 1).
- Maps for each district showing low friction numbers (see Example 2).




Example 1 -- Low Friction Numbers – All Districts




Example 2 -- Low Friction Numbers – Individual District

**GPR DATA COLLECTION SETUP AND QC PROCESS**

**Data Collection:**

- Perform data collection using a combination of antennae:
  - Air-Coupled Antenna: shallow layers or pavement surface layers
  - Ground Coupled Antennae: Base, sub-base layers
- Set the equipment for a collection rate of at least 1 scan/ft (horizontal scale) with 256 or 512 samples/scan (vertical scale).
- Make sure the DMI is calibrated properly and the GPS unit is integrated. Perform test runs and sent out the data to office to ensure all antennae are functioning.

**Daily Checks:**

- Before the start of the day, run the GPR unit while the controller screen is on to check the unit is capturing the data with distance measurement.
  - While collecting data in the field, the operator should always keep an eye on the GPR controller screen to make sure the data is collected.
- Perform the smallest unit of collection similar with the ARAN collection unit. Name the GPR collection file similar to the ARAN file with location information (Road name, to and from etc.)
- Use the clicker button, if possible, to designate the structures that can affect the GPR reading (i.e. bridge deck, box culvert etc.).
- Perform checks at the end of the day to make sure all the run-miles are collected.
- Provide the raw data to office in batches (i.e. 3 – 5 days of collection).

**Data Loading and Processing:**

- Load the raw data to RADAN to create the processed file.
  - Check the integrity of data for the whole sections and look for missing sections/anomalies.
- Perform horizontal scaling to prepare data at a desired scan density (preferably 1 scan per 10 – 25 ft for a network level collection).
- Review the coring data (or as-built drawings/construction history information) to identify the best possible channel in tracking pavement layers.
  - Define appropriate/reasonable dielectric constant (layer properties) for different layers.
- Use the processed split channel data to track the layers in RADAN software (Detail stepwise process can be found upon request).
- Extract the raw data in a CSV file format. Summarize the pavement layers at 500 - 1000 ft interval in an excel spreadsheet using statistical analyses by removing outliers from the extracted raw data.

**22. Sub-consultant information:**

If one or more sub-consultants will be used, provide the name, address, point of contact and phone number for each. Otherwise, leave this section blank.

| **Firm Name (as registered with Louisiana's Secretary of State)** | **Address** | **Point of Contact and email address** | **Phone Number** |
|---|---|---|---|
| Acacia Industries, LLC | 11507 Old Mansfield Rd, Keithville, LA 71047 | Carla Maynard, acacia.ind@gmail.com | 318-470-1917 |
| Traffic Commander, LLC | 3200 Turnbull Dr , Metarie, LA 70002 | Maddie Commander, maddie@trafficcommander.com | 504-416-9449 |
| A&A Enterprises, Inc | 84 23 rd St, Kenner, LA 70062 | Gail Ablaral, galbara@aa-companies.com | 504-468-2527 |
| J. Star Enterprises, Inc | 2882 Allen St, New Orleans, LA 70119 | Jill Coleman, jstarenterprises@bellsouth.net | 504-302-9892 |
| Accel Talent and Development Group | 11 S. 12th Street, Richmond, VA 23219 | Pam Allen, pallen@acceltalentgroup.com | 877-562-7584 |
| Data Collection Infotech(I) Pvt Ltd | Asia-Pacific Office<br>721/26 3rd Floor<br>18th Main<br>38th Cross<br>4th T Block Jayanagar<br>Jayanagar, Bangalore<br>India | Narasimhan Aravamudhan, nara@datacollectionindia.co.in | 0091 80 28367642 /43 |

**23. Location:**

If location is an evaluation criterion for this advertisement and the prime consultant intends to establish a local presence, describe the plan for doing so. Otherwise, **leave this section blank**.

[redacted]

# Appendix A- Additional Information

[redacted]