APPLIED RESEARCH ASSOCIATES, INC.

HGAC Cost Estimate for Pavement Analysis Services for Burnet County, TX

July 17, 2026

HP08-25

APPLIED RESEARCH ASSOCIATES, INC.

Attn: Megan Schumann
Assistant Auditor
Burnet County

July 17, 2026

Subject: HGAC Cost Estimate for Pavement Analysis Services for Burnet County, TX

Applied Research Associates, Inc. (ARA) is pleased to present this HGAC (HGACBuy) cost estimate to Burnet County, TX for providing pavement analysis services under the HGACBuy HP08-25 Contract for All Hazards Preparedness, Planning, Consulting & Recovery Services.

ARA is a nationwide leader in pavement engineering, management, and design, and has been in business since 1979. Our Project Manager, Mr. Robert "Reuben" Williams, P.E., Principal Engineer, has over 21 years of experience and has implemented and updated numerous pavement management systems throughout the United States, with a strong emphasis on Texas agencies. Mr. Williams is pre-certified by TxDOT for both pavement evaluation and pavement design services. He will serve as the point-of-contact with the County and can be reached at 512-579-7644 | rrwilliams@ara.com | 2217 W Braker Lane, Austin, Texas 78758.

Thank you for the opportunity to provide this cost estimate.

Please do not hesitate to contact us in case of any questions, concerns, or clarifications.

Sincerely,
Applied Research Associates, Inc.
TBPE Firm Registration No. F-4631

Robert R. Williams, P.E., APMP
Principal Engineer
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Vice President, Transportation
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1 ARA INTRODUCTION AND BACKGROUND

Applied Research Associates, Inc. (ARA) is an internationally recognized engineering, research, and technology deployment firm that features a transportation sector focused on municipal government pavement engineering and infrastructure management. Founded in Albuquerque in 1979, ARA has grown steadily and now has offices throughout North America, serving clients worldwide. With over 2,200 employees, most of whom have advanced degrees in engineering and the physical sciences, we have the breadth to tackle the most challenging technical problems. ARA is an employee-owned company dedicated to producing innovative solutions in a timely and cost-effective manner. Our Transportation Sector has locations in Florida, Illinois, Pennsylvania, Maryland, North Carolina, Toronto, Wisconsin, **Texas**, and California.

ARA has over 40 years of experience in pavement engineering and ARA engineers and scientists have played a key role in the development of many currently in-use pavement management technologies. Our staff played lead roles in pioneering the widely used Pavement Condition Index (PCI) standard and the ongoing development of vehicle-based data collection systems and evaluation methodologies. We have since leveraged these pioneering efforts to develop and deploy lower-cost options for assessing pavement conditions on municipal road networks.

The keys to our success include a commitment to clearly understand each client's unique needs, our ability to apply the right set of technologies for each agency, and our commitment to provide outstanding service. Our approach has resulted in critical products used on a long-term basis in many cities. **With approximately 150 pavement-focused staff** and **the largest fleet of pavement condition assessment equipment**, ARA is prepared to provide Burnet County with outstanding and responsive pavement analysis services.

ARA's equipment does not just test the surface condition of the pavement in the traditional sense (identifying surface defects). We also have the capabilities to test the structural capacity, subgrade suitability, and skid resistance of each agency's pavement if needed. ARA also has experience integrating these non-PCI results into pavement management systems, leading to better, more cost-effective improvement plans that go beyond just improving PCI and into addressing the core problems cities and counties face when maintaining their infrastructure.

The below figure shows ARA's unrivalled fleet of pavement testing equipment and services. Our team's experience lies not only in accurate data collection, but also in providing consulting engineering expertise to State, County, City, Municipal and private agencies for roadways and airports.

ARA's engineers are experts in implementing and updating pavement management systems, pavement performance models, policies, life cycle cost analyses, pavement design, and most importantly, **helping agencies develop practical paving, preservation, and maintenance plans**.

This project will be managed out of our Austin, Texas office by experienced pavement engineering professionals. No other professional engineering firm in Texas has the number of professionally registered pavement engineering experts as ARA. Our managing office has four in-house engineers registered in Texas, providing redundancy of personnel and assurance that an experienced registered professional engineer in the state of Texas will always be assigned to the project should any key personnel become unavailable.

Figure 1.1 ARA's Pavement Testing Equipment Fleet

Key Personnel

Selecting the ARA team offers a range of strategic advantages for Burnet County. Our team strictly adheres to the tried and tested protocols of the ASTM D6433-20 "Standard Practice for Roads and Parking Lots Pavement Condition Index Surveys" used by government agencies across the country and our team is comprised of multiple Texas-certified professional engineers experienced in working in the State of Texas. Our pavement data collection equipment holds certifications for laser profilometry data collection from both the Texas A&M University Transportation Institute in College Station, TX and the National Center for Asphalt Technology at Auburn University in Auburn, AL, affirming our expertise and commitment to accurate pavement data gathering.

ARA is committed to serving Burnet County and to providing the highest level of quality in meeting the County's unique pavement management needs. We have assembled a team of professionals with over 100 years' experience in pavement management. Roles for our primary key personnel are summarized below. We also have several additional pavement engineers and asset management specialists available to provide additional support to the project team should the need arise.

Reuben Williams, P.E., APMP – Project Manager: Mr. Williams is located in our Austin, Texas office and will be the primary contact for the County's project management team. He will coordinate communications between all parties while ensuring that scope, budget, schedule, and client expectations are met throughout the project. Mr. Williams has more than 21 years of experience in pavement engineering and management and has worked on more than 200 pavement-related projects. Partial list below:

- Waco, TX
- Bexar County, TX (2)
- Universal City, TX
- Seattle, WA
- Brazoria County, TX
- Crandall, TX
- Georgetown, TX (6)
- Tyler, TX (4)
- Richardson, TX
- Haltom City, TX
- Frisco, TX
- Harker Heights, TX
- Commerce, TX
- Pflugerville, TX
- Mohave County, AZ
- San Marcos, TX (4)
- Nanaimo, BC
- Rockwall, TX
- Los Alamos, NM (2)
- McKinney, TX (5)
- Austin, TX (2)
- San Angelo, TX
- Missouri City, TX
- Austin, TX (2)
- Morgans Point Resort, TX
- SH 130 - Buda, TX (8+)
- Travis County, TX
- Charleston County, SC (2)
- Portland, TX
- Cedar Park, TX
- Corpus Christi, TX
- San Antonio, TX (2)
- Leander, TX (2)
- Coppell, TX
- Irving, TX
- Lytle, TX
- Coppell, TX
- Hudson Oaks, TX

Salil Gokhale, P.E. – Project Principal: Mr. Gokhale is located in our Austin, Texas office. As the Project Principal, Mr. Gokhale will work with the Project Manager to ensure overall quality of the project. Mr. Gokhale has more than 24 years of experience in pavement engineering and management and has worked with more than 50 PCI projects in the past five years. Mr. Gokhale and Mr. Williams have worked together for over 8 years. In Texas, Mr. Gokhale has managed pavement management projects for the City of Frisco, City of Wichita Falls, North Texas Toll Road Authority, Dallas-Fort Worth International Airport, San Antonio International Airport and several other agencies.

Daniel Behnke, PMP, AICP, GISP – Planning and GIS Expert: As a certified planner, project manager, and GIS professional, Mr. Behnke provides a unique skill set to ARA projects. Mr. Behnke will serve the project by leveraging his extensive experience and expertise in transportation asset management. With 10 years of experience managing data collection projects specifically for pavement management and 10 years of GIS analysis work for various municipal agencies, Mr. Behnke brings a comprehensive understanding of the intricacies involved in data collection projects. He has worked with more than 10 HGAC agencies.

2 PROPOSED METHODOLOGY

Our proposed methodology for performing pavement analysis services is summarized in Figure 2.1. Detailed descriptions of individual tasks and potential optional services are provided further on.

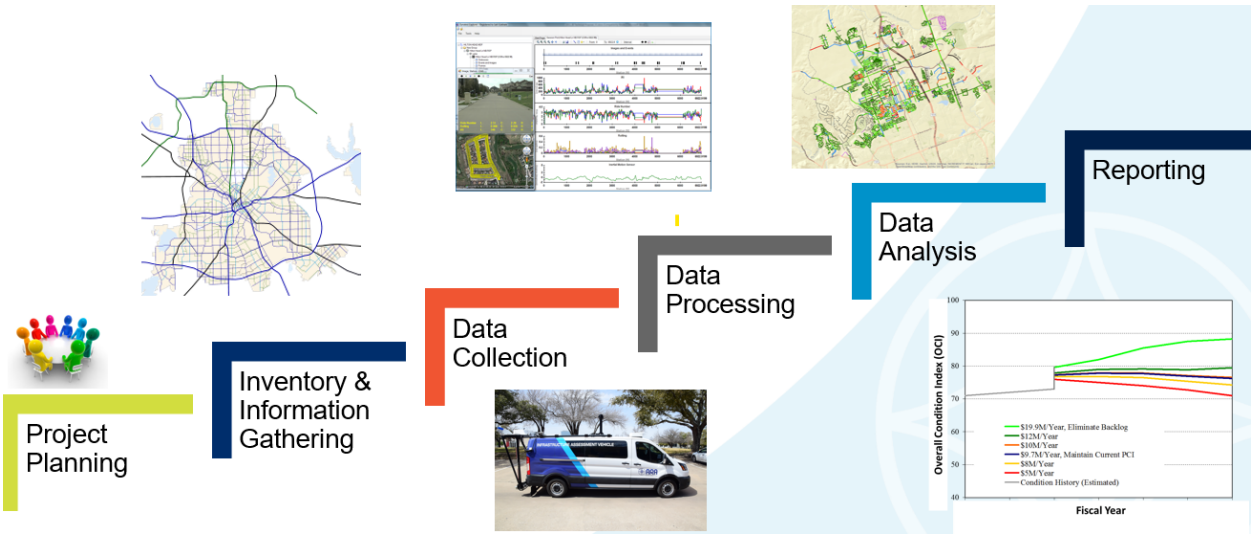


Figure 2.1 Proposed Project Workflow

2.1 Task 1: Kickoff Meeting and Project Planning

ARA will meet with County staff to initiate the project. This meeting will occur following the Notice to Proceed and at the earliest convenience of the County staff. The purpose of this meeting is to review the current pavement network and verify the list of pavement sections to be surveyed and to agree upon the project schedule. Prior to beginning the project, our team will develop a clear communications plan with contact information and a list of key personnel from both ARA and the County, and a comprehensive project plan, including detailed schedule and deliverables. All project-related Tasks and Deliverables will be reviewed during the kick-off meeting.

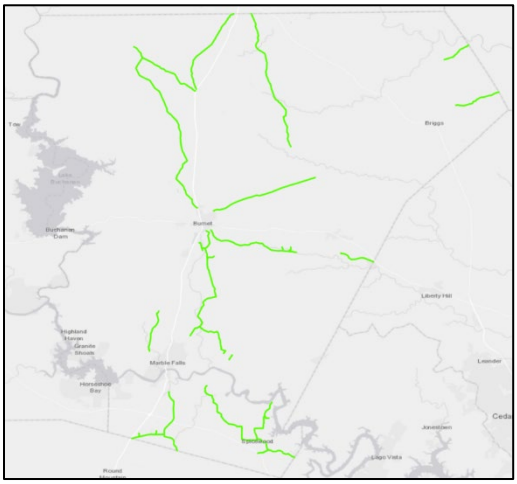
2.2 Task 2: Inventory and GIS Data Review

As a first critical step in this current project, we propose conducting a thorough review of the County's GIS data, including:

- Segment and Section identifiers
- Surface type, number of lanes, functional classification
- From and To descriptions including Begin and End mile points
- Correctly calculated GIS lengths

The ARA team calculated a mileage of approximately 119 test miles based on the GIS centerline file shapefile provided by the County (118 based on distances in the email request).

Our team will develop routing and navigation plans for collecting data on the County's road network. Our routing plans provide our field survey crew with efficient means of collecting data while minimizing dead heading. The routing/navigation software also provides the operators with driving directions and pertinent section information, including RoadLog/StreetID numbers, direction of travel, start/end points etc. The software also includes capabilities to include field notes or observations such as areas under construction, different surface types, or roads with restricted access.



2.3 Task 3: Data Collection

ARA will perform an automated pavement condition survey for this project using industry-standard pavement imaging equipment. Our new PathRunner pavement evaluation vehicles are equipped with top-of-the-line electronic sensors, lasers, and cameras. In addition, the acquisition of these vans includes Pathway's web-based data visualization solution, **PathWeb**.

Benefits of PathWeb

- Web-based viewing/data visualization platform that is fast and provides unprecedented functionality. The software is used by many State DOTs at the Statewide level, **including TxDOT**
- Point-and-click, user-friendly interface including 360° Streetview
- Multi-user, multi-device
- **No software licensing fees**
- No need for local data storage. All data are stored securely in a data center (including redundant backups)

2.3.1 PathRunner Pavement Evaluation

ARA plans on conducting the pavement condition surveys using a PathRunner van (an example is shown in Figure 2.2). All ARA evaluation vehicles vans are equipped with a 3D pavement imaging sensor, Right-of-Way (ROW) cameras for panoramic images, Class-1 roadway surface profilers (including macrotexture) and sub-meter accurate GPS/IMU location data. The GPS/IMU system can also be used for roadway geometry if needed.

Pathrunner in Action

Pathrunner Details

Figure 2.2 PathRunner Hardware Components

2.3.2 Inertial Profiler and Transverse Profile/Rutting

The PathRunner van includes a high-speed laser profiler and a 3D pavement imaging sensor that capture continuous pavement profiles of the roadway surface. The longitudinal profile data is analyzed to calculate the International Roughness Index (IRI) while the transverse profile data is analyzed to provide a complete transverse cross section of the surface to determine rutting.

Figure 2.3 PathRunner Profiler and 3D PAS Sensor

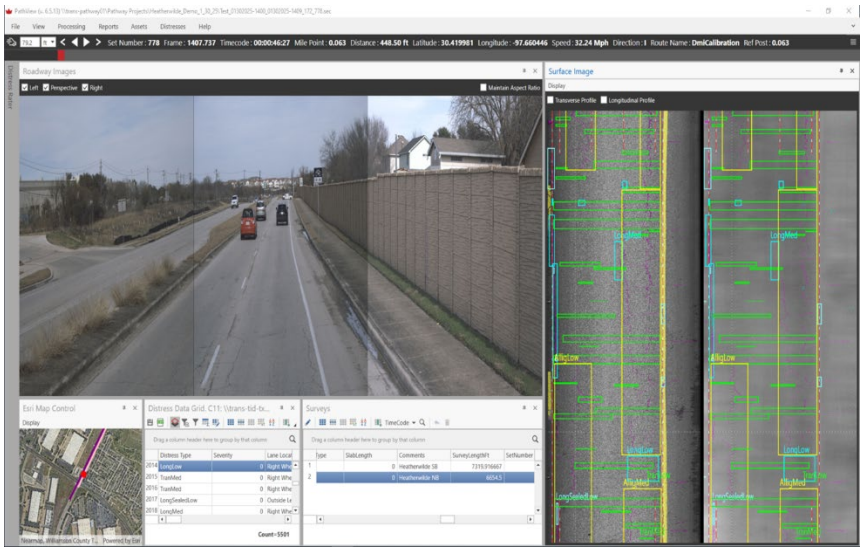
2.3.3 Right of Way (ROW) Images

The PathRunner van includes 4 high-definition ROW cameras, including 3 forward facing and one rear-facing camera, each with a resolution of 2750 x 2200 pixels. The cameras are equipped with wide angle lenses capturing a panoramic-like perspective of the right of way. The forward-facing cameras provide images for verifying the travel lane and identifying right-of-way zones. The front and rear right-of-way cameras can assist with the identification and inventory of signs, sidewalks, ADA ramps, pavement markings and stripings, and other roadway features. The ROW images are typically captured and stored at 20 ft. intervals. The system also includes a 360° Ladybug camera for continuous images similar to those found on Google StreetView.

Figure 2.4 Panoramic Front View

Figure 2.5 360° Imaging - StreetView

2.3.4 Pavement Sensor



All ARA vehicles include a camera and laser 3D system to collect high-resolution 2D (intensity) and 3D (elevation) images of the road surface to view cracks as small as 1mm. Using continuously collected transverse profiles, the software interpolates the 3D data creating the 3D pavement surface image. The resulting data produces a powerful, interactive image that detects cracking, rutting, faulting, and even texture. Not only are the depth readings the most accurate way to characterize cracking in an automated software, but because of the specially configured laser illumination, the 3D system is also not susceptible to environmental shadowing. All 3D images are integrated and tagged with the referenced linear DMI values and GPS information.

2.3.5 Data Delivery and Image Viewer

All data sets acquired by the PathRunner vehicle (along with distress data) can be visualized through the PathWeb website. We propose deploying the PathWeb website for County personnel, which retrieves data from a secure cloud server, removing the need to host raw data internally. The website can be used by multiple County personnel with no loss in speed or functionality. Figure 2.6 shows a screen capture of the PathWeb web site. All collected data is GIS integrated and includes multiple windows showing the ROW cameras, 360° Streetview, a map window, transverse profile at any selected location, IRI graph, and pavement surface images. Users are set up with a single website link and a username/password to access their data. The website also includes video style “play/stop/forward/rewind/step” buttons on the bottom so that users can virtually “drive” along a road.

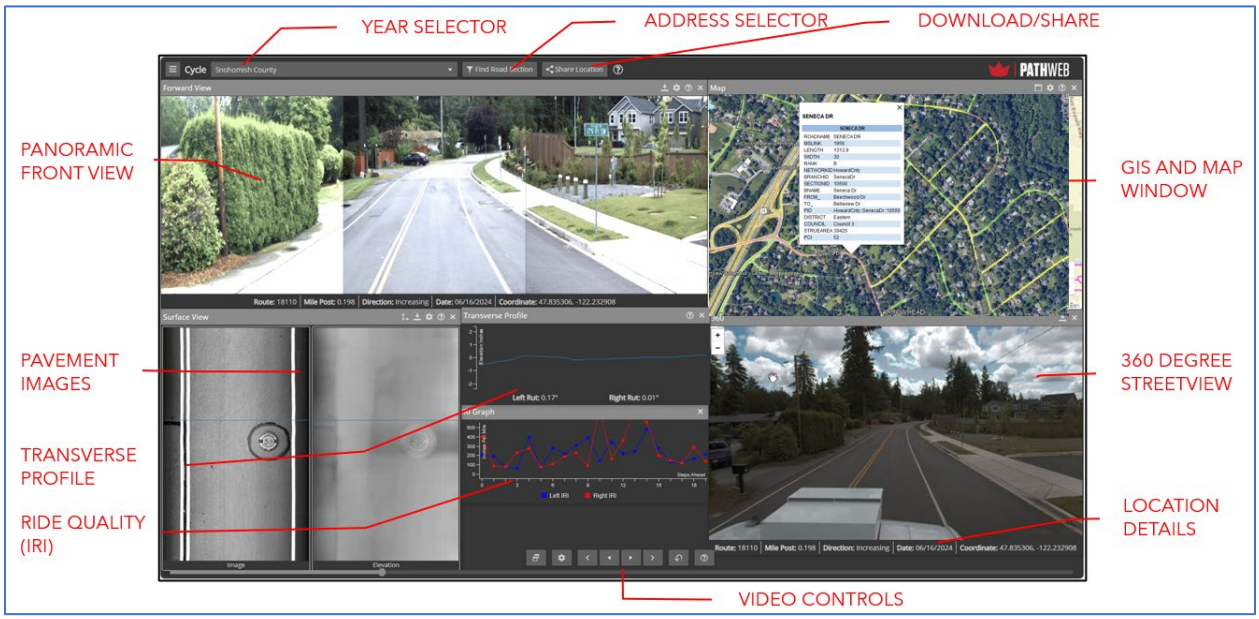


Figure 2.6 PathWeb Visualization Website

2.3.6 Distress Rating

ARA proposes utilizing a 2-step distress rating procedure for the County. In the first step, we plan on using Pathway's AutoCrack software for identifying and locating the extents of distresses. In the second step, our team of experienced pavement inspectors will perform enhanced quality control for false positives or negatives and make changes accordingly. The distress data includes distress types, severities, extents, and locations in accordance with ASTM D6433 and is exported in XML, CSV or XLSX formats.

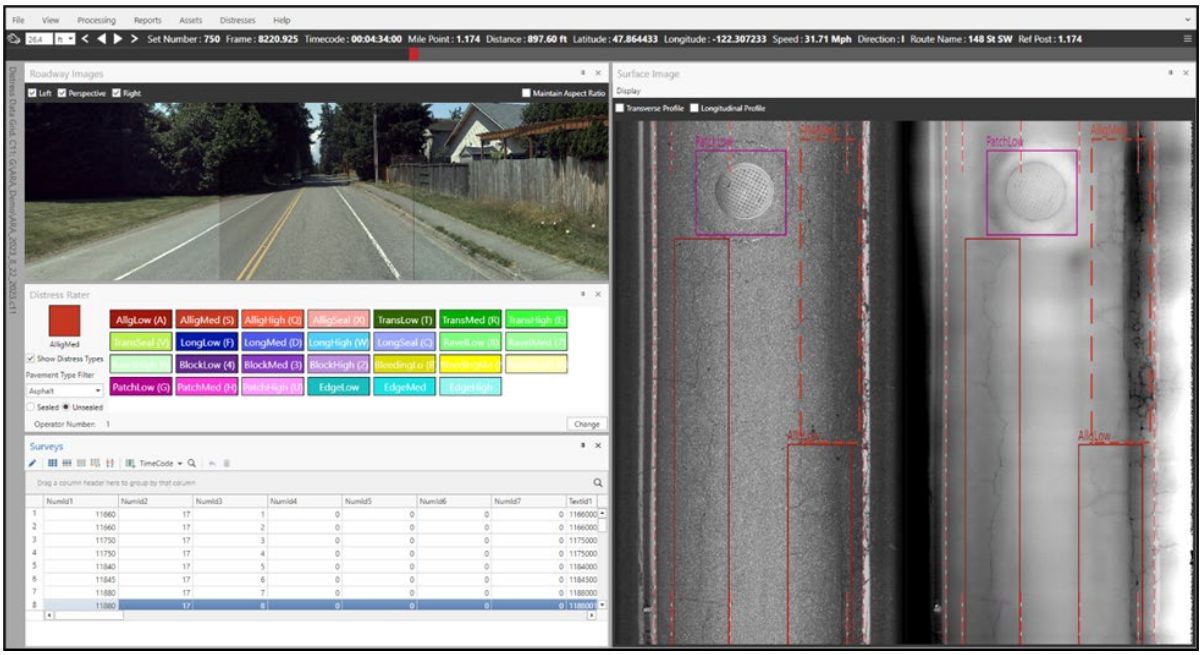
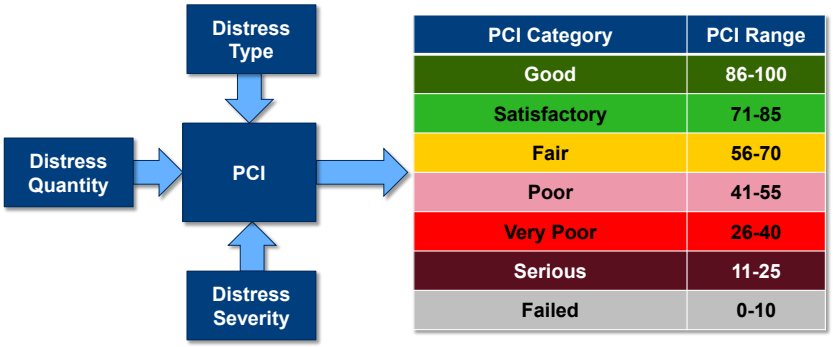


Figure 2.7 Pavement Distress Data

2.4 Task 5: Pavement Distress Calculations

After all pavement distress records have been analyzed, reviewed, and passed through our QC/QA measures, ARA will compile the data into the selected pavement management software to calculate network wide PCI scores in accordance with ASTM D6433-20. The PCI is an objective and repeatable method for assessing pavement condition and is used by agencies worldwide. The PCI is a numerical rating of pavement conditions that ranges from 0 to 100, with 0 being the worst possible condition and 100 being the best possible condition.



PCI Category	PCI Range
Good	86-100
Satisfactory	71-85
Fair	56-70
Poor	41-55
Very Poor	26-40
Serious	11-25
Failed	0-10

Figure 2.8 Pavement Condition Index

2.5 Task 6: Final Deliverables and Ongoing Support

This section will present the deliverables, ensuring alignment with their specific needs and expectations.

2.5.1 Pavement Analysis Services

1. Pavement condition survey results;
2. List of all segments not surveyed, with explanation for why it was not surveyed;
3. List of exceptions found in the field;
4. PCI and IRI scores for all County-maintained streets;
5. Updated County's centerline shapefile including all scores and distresses;
6. Access to PathWeb website for unlimited County personnel
   a. County personnel will be able to point and click roadway sections on the map;
   b. View all imagery through a seamless interface including 360° imaging;
   c. View roadway transverse profiles at any location; and
   d. Ability to save year-over-year data in one location.

2.6 Quality Management

Dedication to quality is paramount to the overall success of this project. The ARA team will call on our extensive experience and previous Data Quality Management Plans (DQMPs) to cover all facets of this project for the County. An example high-level DQMP chart that spans the life of the project is shown below. We will provide the DQMP prior to beginning data collection. ARA defines quality as the degree to which our products and services meet our client's requirements and expectations. Meeting the proposed technical, cost, and schedule requirements of a project is an absolute prerequisite for quality performance.

ARA understands that quality is not something that is added at the end of the project but is the aggregation of the entire team's effort and each employee's individual work product through each phase of the project. ARA's culture hinges on both individual and corporate responsibility. The ARA quality philosophy follows the same approach, as embodied in the following statements:

- **Be Responsible**: Employees of ARA are responsible for the quality of his/her work products on a daily basis, and to communicate quality issues to the appropriate manager.
- **Two Person Rule**: Essential work deliverables and external communications will be reviewed by a second person competent in the task at hand before transmittal to a customer.

To help ensure the integrity and quality of data collected in the field, ARA's field team will adhere to the following requirements:

- **Data will be collected only during daylight hours**, beginning no earlier than one hour after sunrise and ending no later than one hour before sunset to minimize flare and ensure even lighting.
- **Data will be collected only under dry weather conditions**. Clear, dry pavements yield the most accurate and consistent data.
- **Data will be collected while driving at posted speed limits and under prevailing traffic conditions.** For this reason, no traffic control is required during the data collection phase.
- Our team members will perform **daily and real-time QC checks** of vehicle sensor data to ensure it is within acceptable ranges.
- We also perform **real-time visual quality reviews** of the imagery and video during collection to ensure acceptable focus and clarity.

Throughout the processing and analysis steps of the project, specific quality control checks will include:

- GIS coverage review of collected data to ensure no areas were missed.
- Quality checks on no less than 10% of the data to confirm confidence in the validity of the distress ratings and associated scores.

Specific quality acceptance measures will include:

- Regular correspondence with the County to review all collected information.
- Submission of all deliverables in draft form for review and feedback prior to final delivery.

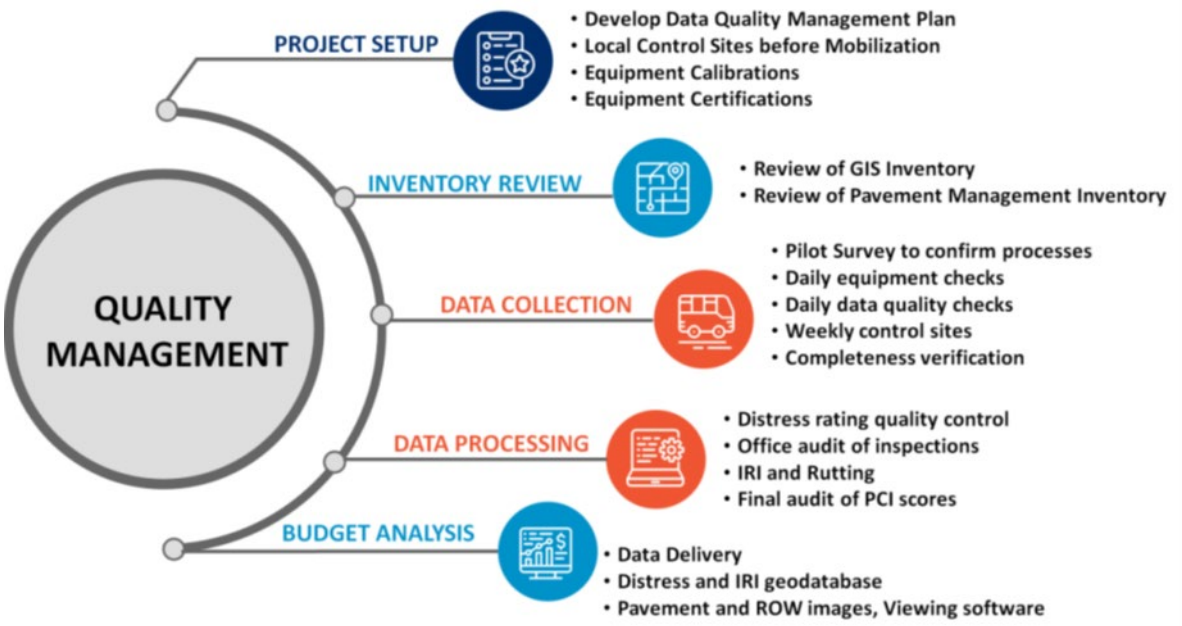


Figure 2.9 Example Data Quality Management Plan

Additional Optional Pavement Management Items Could Include:

2.7 Pavement Performance Models Update

Once the PCI values for each segment are calculated, our team could work closely with County staff to review and refine pavement performance models (based on local experience with pavement repairs, expected life and construction types), update construction history records, incorporate up to date unit construction costs, and repair/preventive maintenance/rehabilitation strategies. These critical items form the basis of all further budgetary analyses. Figure 2.10 is an example of the pavement deterioration models that ARA developed in similar projects. In that example, ARA developed two deterioration models to differentiate between the performance of the pavement sections that constructed on Low and High plasticity index subgrade.

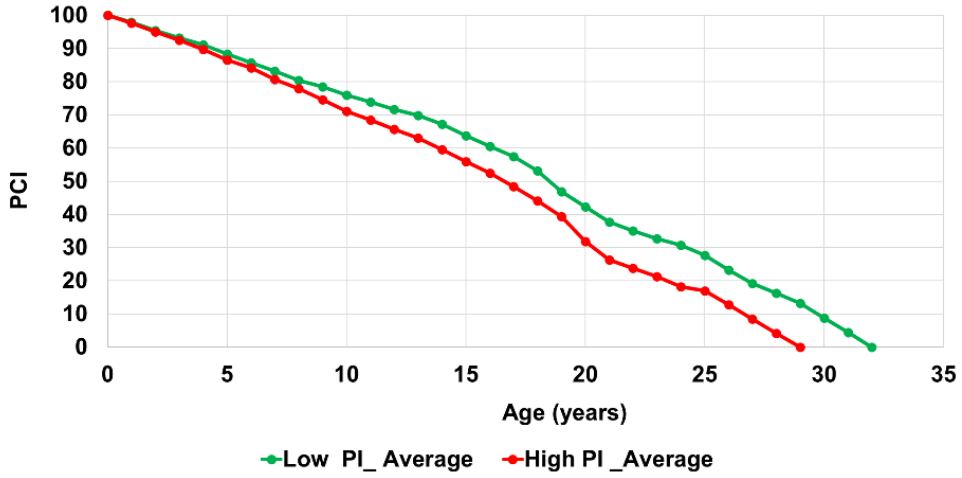


Figure 2.10 Pavement Deterioration Models

2.8 Pavement Rehabilitation Matrix

One of the capabilities of a pavement management system is to analyze different scenarios and determine how the decisions made in the paving department (treatments) and in the County Council impact the future performance of the pavement network and the budget needs in the future. These treatments need to be defined in a logical manner so that the software tools used at the County know when those treatments should be applied and what the consequences of those treatments are (e.g., an increase in PCI for a given segment). A simple way to represent these treatments is through a treatment matrix, such as the one shown in Figure 2.11. In this example, treatment only depends on two factors: the current pavement condition and the functional classification of the roadway. There are other matrices that might be appropriate to the County. For example, ARA has worked with a County that has a load capacity issue on their highways; their factors were functional classification, surface condition (represented by their state's evaluation system), and structural capacity measured with our falling weight deflectometers. This step is about customizing a system that represents what the agency will actually do.

Once the rehabilitation matrix is developed, the next step is to insert it into the County's pavement management software. This process is highly dependent on the software but ARA's experienced pavement management implementation specialists have used a variety of products and understand how to reflect the treatment matrix in parameters that the software can use in the next phase of the process.

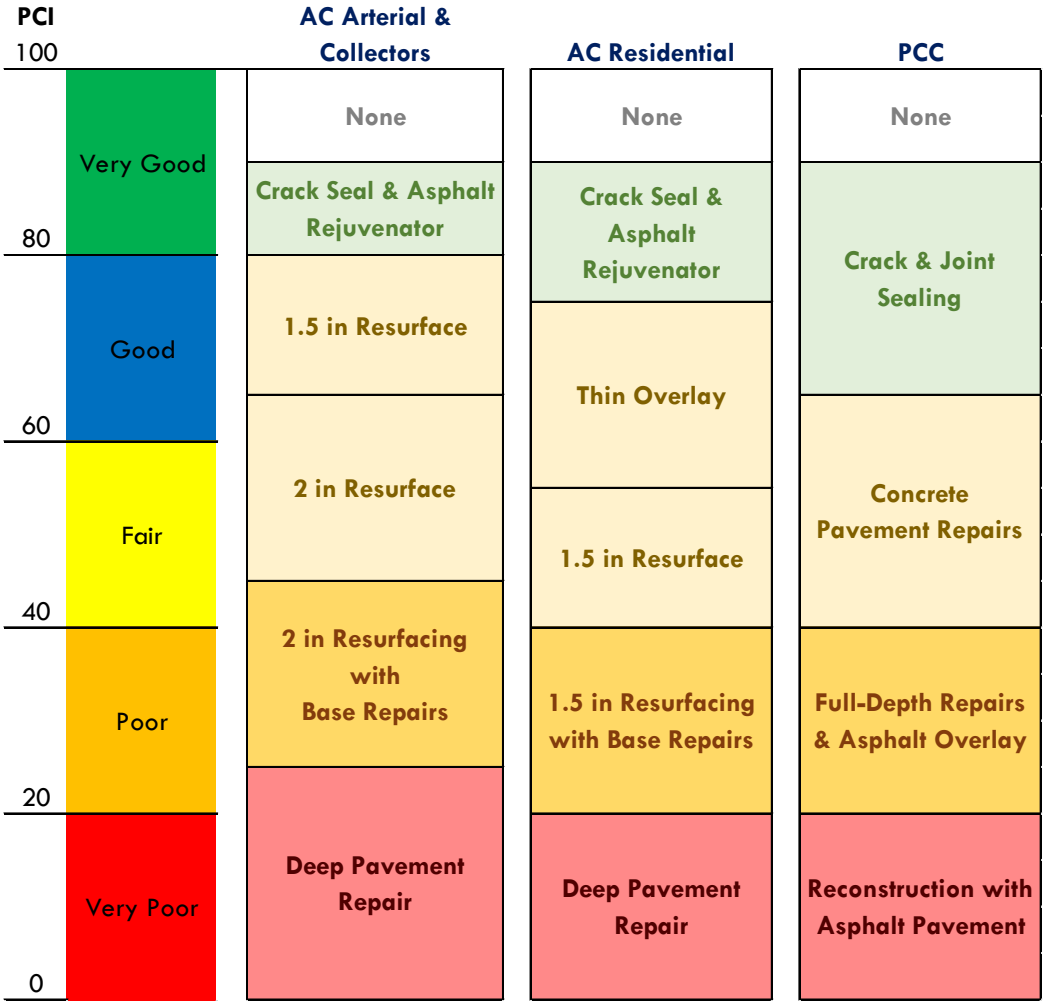


Figure 2.11 Example treatment matrix

2.9 Budget Analysis

After successfully importing all pavement condition data into the selected pavement management software, our team could proceed to analyze the overall pavement condition for the entire network. Based on the results, we could work with County staff to develop practical pavement work plans to:

- Perform network level budget analyses,
- Evaluate Maintenance and Rehabilitation Strategies,
- Identify streets that require immediate maintenance to address safety concerns,
- Identify streets that are good candidates for pavement preservation treatments such as chip seals, micro surface, or slurry seals,
- Identify streets that are good candidates for rehabilitation/new paving,
- Recommended practical management plan project groupings and with recommendation repair activities with estimated costs.

Our team members have extensive experience with pavement management systems including StreetSaver®, Cartegraph (OpenGov), CRAB/Mobility, PAVER, VUEWorks and other systems.

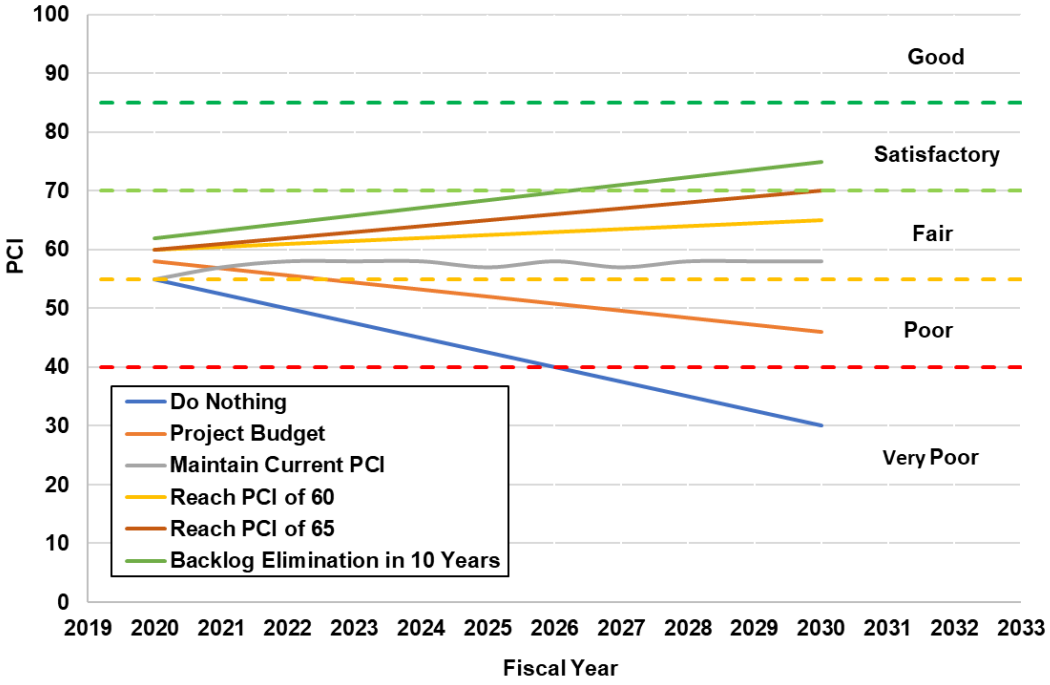


Figure 2.12 Budget Analysis

2.9.1 Data Analysis

1. Updated pavement performance models;
2. Updated treatment matrix;
3. The results of budget analysis;
4. The results for different budget scenarios; and
5. The results of the maintenance and rehabilitation treatment plan.

2.9.2 Final Report

ARA could furnish the County with a comprehensive report outlining the intricacies of the project, encompassing each step taken, assumptions made, and constraints encountered. This report could feature detailed tabular and graphical summaries, offering insights into the condition of the county's street surfaces. Additionally, it could present the outcomes of budget analyses and scenarios, providing a clear picture of financial considerations. Based on the findings of the treatment plan, the report could present the recommended pavement maintenance and rehabilitation activities, aimed at optimizing the longevity and efficiency of the County's infrastructure.

2.9.3 Commissioners Court Presentation

Once the final pavement report has been accepted by County staff, this report could be used for reporting budget needs or shortfalls to boards, commissions, and committees. ARA has performed this task for many municipal government staff members on past projects and is well-versed in presenting relevant information to local officials and constituents that support the proposed fiscal budget requests. ARA's Project Manager could work with County staff to present a report to the Commissioners Court that has been agreed upon by all project stakeholders. This presentation could provide a summary of the pavement network, PCI update, outcomes of the budget analyses and scenarios, and the recommended pavement maintenance and treatments strategies.

3 ADDITIONAL SERVICES

3.1 Asset Inventory Creation

Through the use of the onboard integrated HD LiDAR system, the PathRunner vehicle can collect right-of-way roadside asset inventory data simultaneously with pavement surface and distress data. **This single-pass solution allows for all forward-facing and 360-degree right-of-way imagery, 3D laser-illuminated pavement imagery, and high-definition LiDAR point clouds to be collected at the same time without the need for sending multiple data collection vehicles onto the streets of Burnet County multiple times.**

Figure 3.1 Right-of-Way HD Cameras and 360° Ladybug Camera

The point cloud generated from the LiDAR data can be used to detect and identify all County-maintained right-of-way assets including, but not limited to, signs and supports, sidewalks, ADA ramps, and pavement markings and stripings. After identification, a manual analysis will then be performed to assign required attributes to each asset type. This 2-step asset extraction process serves as an additional Quality Assurance check on the asset data being delivered to the County.

The LiDAR data will also be made available to County personnel through the PathPoints Website (including easy to use measurement tools). Examples of our colorized LiDAR are shown in Figure 3.2 and 3.3 below.

Figure 3.2 Example of a Collected Street Section using LiDAR Technology

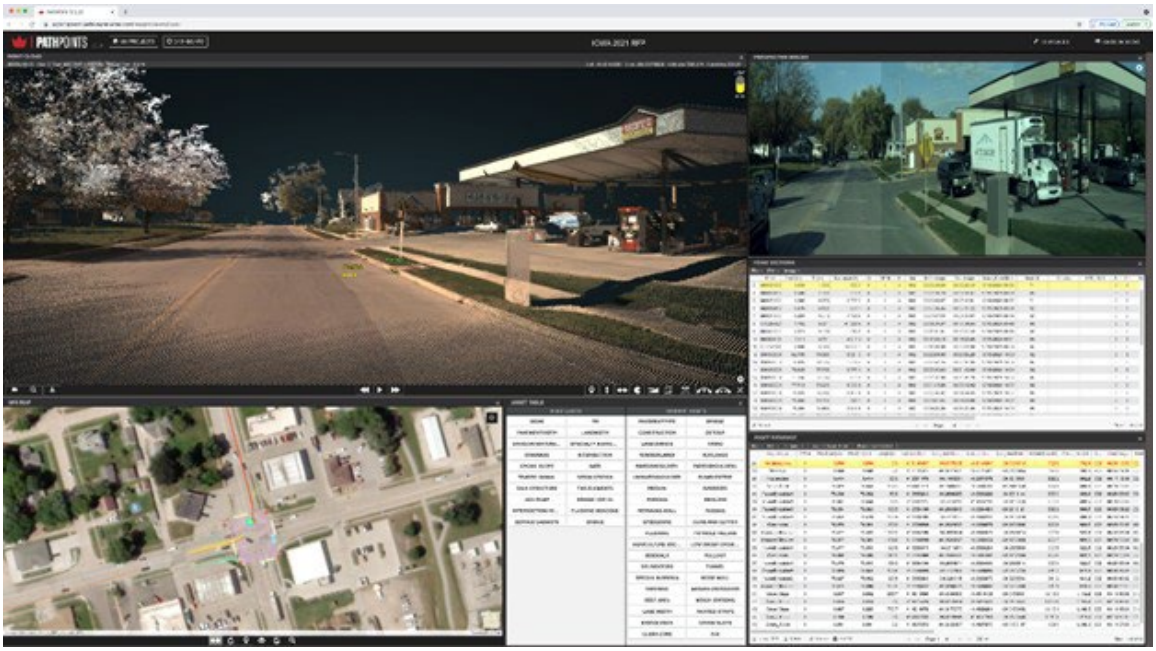


Figure 3.3 PathPoints Software Interface: Where Users Can Extract Assets from LiDAR Data

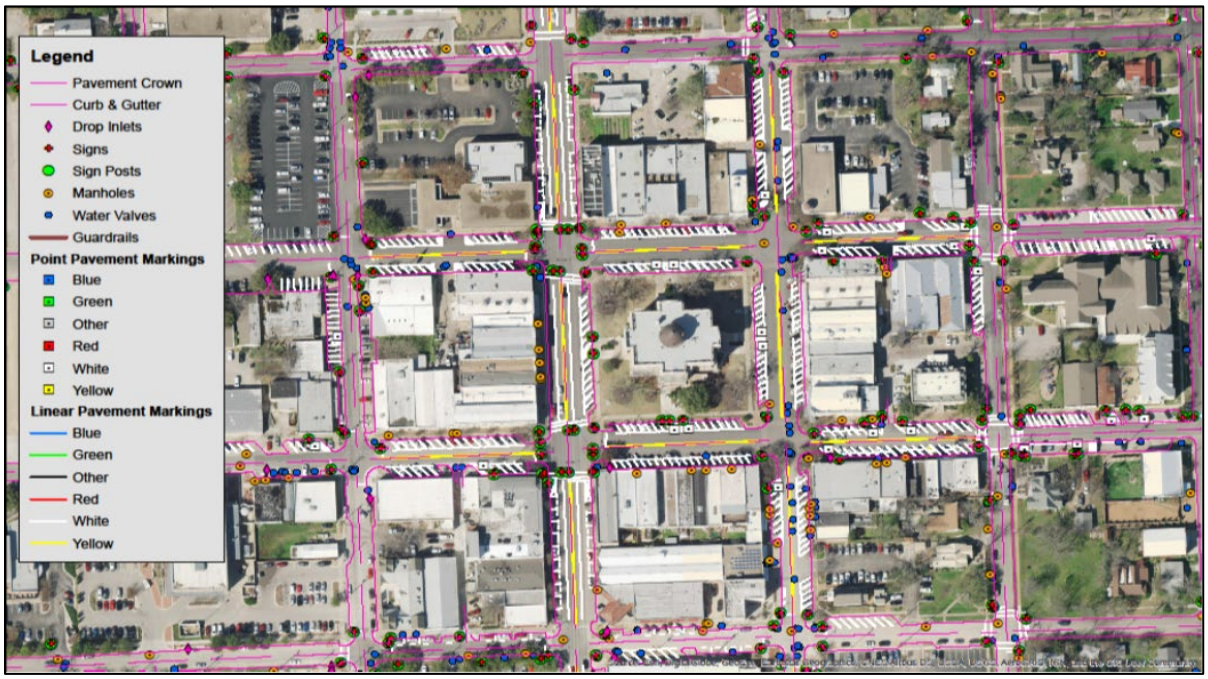


Figure 3.4 GIS-Based Asset Inventory Deliverables

3.2 Falling Weight Deflectometer (FWD)

ARA operates a fleet of seven F/HWD units, providing non-destructive pavement evaluation and analysis to various government agencies across the country, including State, County, City, Tollway, and airport authorities. In Figure 3.5, you can see one of our units in action.

Our approach is to enhance pavement assessments by combining distress surveys with structural condition testing. This comprehensive strategy enables agencies to select the most suitable treatments for each pavement section and make more accurate predictions about pavement lifespan. We conduct FWD testing in accordance with ASTM standards, specifically ASTM D4694 for deflection measurements with a falling weight-type impulse load device and ASTM D4695 as a guide for general pavement deflection measurements.

At the network level, we suggest conducting deflection testing every 528 feet (0.1 miles) to accommodate variations in pavement structure and subgrade conditions. However, when using our pavement condition survey, we recommend focusing on streets with PCI scores ranging from 25 to 55 for project-level structural analysis. For project-level testing, we recommend a maximum spacing of 250 feet between test locations. To ensure consistent and reliable results, it is essential to conduct all deflection testing during the same season to minimize the impact of temperature and moisture differences on the pavement.

During testing, we focus on the right wheel path of one outside lane of each arterial and collector road centerline, typically the area with the heaviest traffic load. ARA's subcontractor takes care of traffic control to ensure safety. Our selection of PCI value range is based on practical considerations. Streets with higher PCI values often require pavement preservation treatments like chip seals, slurry seals, and micro-surfacing, while streets with lower PCI values may necessitate reconstruction.

The deflection values obtained from our testing help optimize the choice of treatment for the streets being evaluated, including options like milling and structural enhancements, removing, and replacing the AC layer only, Cold In-Place Recycling, and Full-Depth Reclamation. This comprehensive approach ensures that agencies can make informed decisions to extend the life of their pavements effectively.

Figure 3.5 ARA's Falling Weight Deflectometer.

3.3 Ground Penetrating Radar (GPR)

ARA owns a variety of GPR units, including both 2D and 3D systems. These GPR units are crucial for determining pavement layer thicknesses and locating underground utilities. Our team offers GPR consulting services to multiple agencies across the country, supporting pavement investigation and design projects. Accurate knowledge of pavement structure is vital for these projects, helping to reduce changes needed during construction and number of cores along a pavement section to determine variability in pavement structure in case as-built plans were not available.

Figure 3.6 displays two of our GPR units: a 2D unit on the left and a 3D unit on the right. We collect GPR data using a multi-channel digital radar system along the outside lane of each tested street, and it could be used for a variety of subsurface exploration including buried utility detection. The GPR equipment can detect pavement layers thicker than 3 inches to a depth of around 2 feet below the pavement surface. Data are collected at a one-foot scan interval, and we recommend summarizing the data at intervals of 10 to 25 feet for most applications. Our analysis focuses on summarizing pavement layer thicknesses in major layer types, such as asphalt layers, granular or bound base, and subbase. We use the RADAN 7 software package to estimate the dielectric properties of pavement layers and determine their thicknesses. These GPR results are calibrated using pavement cores provided by the cores to ensure consistency in the subsurface across the project.

Integration with our FWD system enhances accuracy. Each FWD station corresponds to a reading from the GPR system, and we report pavement thicknesses for every FWD-tested station. This continuous reporting improves the quality of pavement evaluation and design, making it more likely to identify localized anomalies that might be missed by coring alone. This comprehensive approach ensures a higher level of accuracy and quality in our pavement assessment and design work. Therefore, GPR is recommended to be used with the FWD testing at project level on the selected streets.

Figure 3.6 ARA's GPR Units.

3.4 Pavement Rehabilitation Design Report

After performing the overall pavement Non-Destructive Testing (NDT) and analysis for each pavement section, the modulus will be backcalculated for each layer in the pavement structure. Multiple Pavement rehabilitation designs will be performed using the techniques included in AASHTO 1993 design manual, mechanistic-empirical methods (AASHTOWare Pavement ME, ELMOD…) or any preferred local design standard. The optimal design will be recommended based on the Life-Cycle Cost Analysis of each alternative in addition to the engineering judgment provided by our experienced staff.

Deliverables will include KML files showing FWD testing location with deflection values and pavement thicknesses every 10 to 25 ft based on County preference. In addition, ARA can provide a report, detailing the findings and conclusions. After County staff review, ARA will make all necessary changes and submit all data and the report in electronic format (pdf, excel, word, etc.).

3.5 Friction Testing

ARA owns and operates four (4) locked-wheel friction testers and two (2) runway friction testers, and our team performs friction testing on thousands of miles of roads and runways each year. Friction testing is performed in accordance with ASTM E274 and can be performed with either a 'blank' or 'rib' tire in wheel path. The testing is typically performed at 40 or 50 mph, and a resulting Skid Number (SN) provides an indication of the pavement friction. Friction testing is also used to investigate wet weather crash incidents and to assess the effectiveness of high friction surface treatments applied on intersections or bridges. Figure 3.2 shows a photo of one of our friction testers.

Figure 3.7 ARA's Friction Testing Unit.

3.6 Retro-reflectivity Testing of Pavement Markings

ARA owns and operates several Mobile Retroreflectivity Units (MRUs) and provides pavement marking evaluation services to numerous State, County, and other municipal agencies throughout the country. ARA uses the Laserlux G7 (LLG7) MRU unit compliant with ASTM E 1710. Data collected with these units are analyzed to provide an objective measure of the retro-reflectivity of pavement markings.

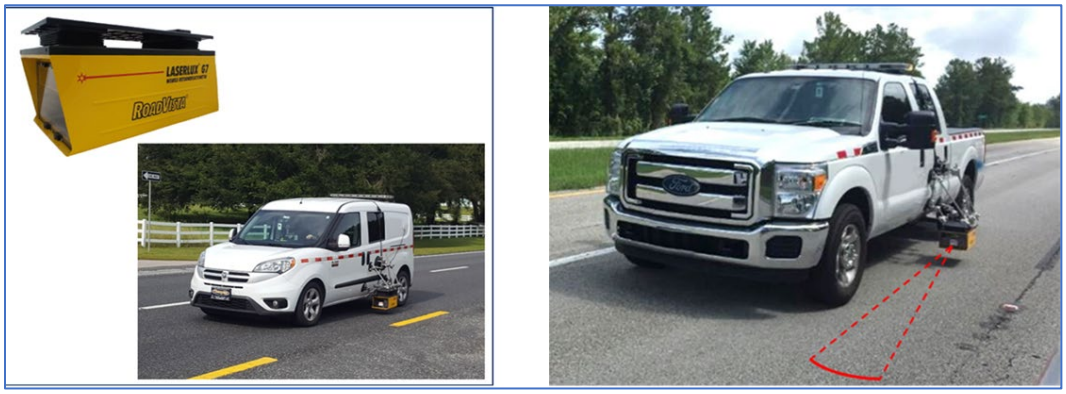


Figure 3.8 ARA's MRU Units.

3 REFERENCES

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4 PROJECT PRICING

Project pricing is set via the agreed upon rates in the Houston-Galveston Area Council (HGACBuy) HP08-25 All Hazards Preparedness, Planning, Consulting & Recovery Services contract. Please see attached spreadsheet for the requested cost estimate. This comes to a price of **$35,680.00.**

ARA welcomes the opportunity to discuss any questions regarding our pricing. Our estimate is based on typical assumptions we use to address the scope of work as we understand it. Further clarifications regarding available information as well as any support from County resources has the potential to lower our pricing.

ARA will provide the services noted in this proposal on a firm fixed price basis and ARA will invoice monthly on a percent complete basis for payment to be made within 30 days of receipt of invoice (Net 30).

5 GROUND RULES AND ASSUMPTIONS

ARA's offering is based on the following ground rules and assumptions. Should any of these be adjusted during negotiations, the proposed offer, including pricing may be subject to change.

1. ARA anticipates a fixed price contract.
2. ARA will submit invoices monthly on a percent complete basis with payment terms of net30.
3. ARA anticipates that the Terms and Conditions hereunder will govern.
4. ARA requires the following support for the effective completion of this project:
    a. Latest GIS Street Segment Centerline File
    b. County's preferred maintenance activities

6 ACCEPTANCE OF PROPOSAL

Your signature below indicates your acceptance of this proposal in accordance with the scope, price, schedule, and the terms and conditions contained herein, and will create a binding agreement between The County and ARA. This acceptance will act as a notice to proceed. **If applicable, indicate the Scope Option you are authorizing on the bottom line.**

Acceptance and Authorization
Name (print)
Title
Signature:
Date:
Option Selected: (if applicable)

TERMS & CONDITIONS

Applied Research Associates, Inc. (ARA) agrees to perform the specified work with the professional skill and care ordinarily provided by firms practicing in the same or similar locality under the same or similar circumstances. The parties acknowledge that there has been an opportunity to negotiate the terms and conditions of this Agreement and agree to be bound accordingly.

1. INDEPENDENT CONTRACTOR

ARA will act as an independent contractor and not as Client's agent for any purpose and will have no authority to make any commitments on behalf of Client or to bind Client in any way whatsoever.

2. PROJECT SUPERVISION AND ASSIGNMENT

ARA shall have wide discretion in the methods used to perform any assigned tasks unless specified otherwise. ARA will cooperate with the Client to the extent possible to arrange for consultations between the Client, ARA personnel, and others engaged in rendering services to the Client related to ARA's performance under this agreement. ARA agrees that no tasks shall be performed or expenses incurred without specific authorization of the Client.

3. OWNERSHIP OF DOCUMENTS

All data, information, software, hardware, and documents produced by ARA under this agreement shall remain the property of ARA and may not be used by the Client for any endeavor outside of the scope of this agreement without the written consent of ARA, unless otherwise noted in this agreement.

4. ACCESS TO PROJECT SITE

If required for the performance of this effort, ARA will be granted timely access to the project site as needed. If traffic control or protection is required, it shall be provided by the Client or specific provisions will be made for ARA to provide traffic control or protection at an additional cost to the Client. ARA will take precautions to minimize damage when performing its work, but ARA is not responsible for any items destroyed as a necessary part of the work.

5. PAYMENT

ARA will invoice monthly and at the completion of the project, with payment due net 30 days. Interest will be charged on amounts outstanding more than 30 days. The interest rate will be 1½ percent per month, compounded until paid. In the event of late payment, the Client agrees to pay all collection costs, legal expenses and attorneys' fees incurred by ARA in collecting payment, including interest. In the event that some portion of the invoice is disputed, payment for the undisputed portion of the invoice will be made within 30 days. If the Parties are unable to reach agreement regarding the disposition of the disputed portions of the invoice within 21 days, the matter will be resolved according to the Dispute Resolution clause of this agreement.

6. HIDDEN CONDITIONS OR HAZARDOUS MATERIALS:

If ARA has reason to believe that a hidden condition may exist, ARA shall notify the client who shall authorize and pay for all costs associated with the investigation of such condition and if necessary, all costs necessary to correct such condition. If (a) the client fails to authorize such investigation of the correction after due notification, or (b) ARA has no reason to believe that such condition exists, the Client is responsible for all risks associated with this condition, and ARA shall not be responsible for the existing condition nor any resulting damages to persons or property. ARA shall have no responsibility for the discovery, presence, handling, removal, disposal or exposure of persons to hazardous materials of any form.

7. TERMINATION OF SERVICES:

This agreement may be terminated upon 10 days written notice by either party. In the event of termination, the Client shall pay ARA for all services performed to the date of termination, all reimbursable expenses and reasonable termination expenses.

8. CONFIDENTIALITY

Unless required by law or Court order to do so, the Parties shall not disclose Confidential Information to anyone other than receiving Party or its authorized employees, agents or representative on a need-to-know basis authorized in writing by the disclosing Party. For purposes of this Article, "Confidential Information" shall mean (1) data, information, processes, or documents, financial information in any form, tangible or intangible, provided to the receiving Party on behalf of disclosing Party for use in performing the services; (2) information generated by a Party in the course of performing the services of this Agreement that has been designated as confidential. Neither Party shall use such Confidential Information for any other purpose than the performance of Agreement.

Confidential Information does not include information that:

a. is already known by or generally available to the public at large; or
b. is already in the possession of the information without confidentiality restrictions; or
c. becomes known to the receiving Party from a source other than disclosing Party, and not subject to an obligation of confidentiality; or
d. was already independently developed by the receiving Party.

9. INDEMNIFICATION

Each party (indemnitor) shall indemnify and hold harmless the other party (indemnitee) from and against any and all (including third party) claims, damages, losses and expenses (including reasonable attorney's fees) arising out of or resulting from the performance of services, to the proportional extent that any such claims, damage, loss or expense is caused by the negligent act or omission and/or liability of the indemnitor, anyone directly or indirectly employed by the indemnitor.

10. CONSEQUENTIAL DAMAGES

Neither Party shall be liable to the other for consequential damages, including, without limitation, loss of use or loss of profits, incurred by one another or their subsidiaries or successors, regardless of whether such damages are caused by breach of contract, willful misconduct, negligent act or omission, or other wrongful act of either of them.

11. FORCE MAJEURE

Neither party shall be liable for any failure of or delay in performance of its obligations under this Subcontract to the extent such failure or delay is due to circumstances beyond its reasonable control, including, without limitation, acts of God, acts of a public enemy, fires, floods, wars, civil disturbances, sabotage, accidents, insurrections, blockades, embargoes, storms, explosions, labor disputes , acts of any governmental body, failure or delay of third parties or governmental bodies from whom a party is obtaining or must obtain approvals, authorizations, licenses, franchises or permits, or inability to obtain labor, materials, power, equipment, or transportation (collectively referred to herein as "Force Majeure"). Each party shall use its reasonable efforts to minimize the duration and consequences of any failure of or delay in performance resulting from a Force Majeure event.

12. GOVERNING LAW

This Agreement shall be governed by and construed in accordance with the laws of the State of New Mexico, excluding its principles of conflicts of laws. The United Nations Convention for the International Sale of Goods is expressly excluded from this Agreement, and shall have no force or effect on the parties.

13. DISPUTE RESOLUTION

Any controversy or claim arising out of or relating to this agreement, or breach thereof, which may be properly submitted to arbitration, shall be settled by arbitration. The substantially prevailing party shall be entitled to recover from the non-prevailing party all costs and expenses and attorney's fees it incurred in connection with any suit or legal or administrative action or appeal with respect to this order or the transaction under it.

14. NO THIRD PARTY RIGHTS

This Agreement shall not create any rights or benefits to parties other than Client and ARA. No third party shall have the right to rely on ARA opinions rendered in connection with the Services without ARA written consent and the third party's agreement to be bound to the same conditions and limitations as Client.

15. COMPLETE AGREEMENT; MODIFICATIONS

This Agreement constitutes the entire Agreement of the parties hereto, and all previous communications between the parties, whether written or oral with reference to the subject matter of this Agreement, are hereby canceled and superseded. No modification of this Agreement shall be binding upon the parties hereto, unless in writing and duly signed by a duly authorized representative of the parties authorized to bind the party to this agreement.