



REQUEST FOR PROPOSALS

Humboldt County Association of Governments

2026 Pavement Management System Update

Submitted by:
Quality Engineering Solutions, Inc.
690 West 2nd Street, Suite 201
Reno, Nevada 89503

Submitted to:
Humboldt County Association of Governments (HCAOG)
ATTN: Amy Eberwein
Administrative Services Officer
611 I Street, Suite B
Eureka, California 95501

January 16, 2025

January 16, 2025

Amy Eberwein.
Administrative Services Officer
Humboldt County Association of Governments
611 I Street, Suite B
Eureka, CA 95501

Re: Proposal for 2026 Pavement Management System Update

Dear Ms. Eberwein:

Quality Engineering Solutions, Inc. (QES) is pleased to submit this proposal in response to the Humboldt County Association of Governments' Request for Proposals for the 2026 Pavement Management System Update. QES is a minority, woman-owned business providing pavement engineering, inspection, and pavement management services to public agencies nationwide. For this pursuit, QES will operate from our western regional office located at 690 West 2nd Street, Suite 201, Reno, Nevada 89503.

The primary contact, authorized representative, and proposed Project Manager for this effort is Kurt Keifer, Ph.D., P.E. Dr. Keifer may be reached at (737) 900-6676 or via email at kkeifer@qespavements.com. Dr. Keifer is nationally recognized for his pavement engineering expertise and has more than 25 years of experience in pavement testing, analysis, and management. He spent nearly a decade supporting the development of the U.S. Army Corps of Engineers Pavement Management System and the Pavement Condition Index (PCI), experience that directly supports HCAOG's use of StreetSaver for this project.

QES is currently in our 28th year of business and has successfully delivered pavement inspection, engineering, and pavement management programs for cities, counties, regional agencies, and tribal governments across the United States. Our team includes a designated Data Quality Manager responsible for ensuring the accuracy, consistency, and completeness of all collected and reported data, and all QES pavement condition raters are independently certified on an annual basis. This commitment to data quality and defensibility is central to our approach to Pavement Management System updates.

QES understands the scope of services to be performed for the 2026 PMS Update and is fully prepared to execute the work in accordance with HCAOG requirements, within the established budget and project schedule. We are committed to delivering clear, technically sound, and decision-focused deliverables that support both technical staff and policy makers throughout HCAOG and its member jurisdictions.

Should you have any questions regarding this proposal, please do not hesitate to contact us. This proposal represents a firm offer and shall remain valid for a period of sixty (60) days from the date of submission. We appreciate your consideration and look forward to the opportunity to work with HCAOG on this important effort.

Sincerely,
Quality Engineering Solutions, Inc.



Kurt Keifer, Ph.D., P.E
Project Manager | Executive Vice President

Table of Contents

PROJECT UNDERSTANDING.....	1
QUALIFICATIONS AND EXPERIENCE	3
Firm.....	3
Key Personnel.....	4
References.....	8
PROJECT APPROACH	16
WORK PLAN AND SCHEDULE	25
Task I: Kick-Off Meeting, Project Management, and Reporting.....	25
Task II: Risk Management.....	26
Task III: Data Collection and Reporting	27
Task IV: Review Maintenance and Rehabilitation Strategies	40
Task V: Final Reports	45
Task VI: Presentation of Completed Pavement Management System Update.....	46
Task VII: Training	46
Proposed Project Schedule	48
COST PROPOSAL	49
REQUIRED ATTACHMENTS	51
CONFLICT OF INTEREST.....	52
APPENDIX A RFP Attachment D: Subconsultant List.....	56
APPENDIX B Staff Resumes	58

PROJECT UNDERSTANDING

HCAOG seeks a technically rigorous, consistent, and defensible update to its PMS to support informed decision-making across its member jurisdictions and Tribal partners. The objective of the 2026 PMS Update extends beyond simply refreshing pavement condition data; HCAOG requires a program that produces accurate, repeatable, and transparent results that can be relied upon for capital programming, budget development, performance tracking, and effective communication with both technical staff and policy makers.

This effort encompasses the pavement networks of the Humboldt County, the Cities of Arcata, Blue Lake, Eureka, Ferndale, Fortuna, Rio Dell, and Trinidad, as well as roadways on Tribal lands. QES understands the importance of delivering a consistent and standardized PMS update across jurisdictions of varying size, roadway function, and administrative structure, while maintaining sensitivity to local conditions and agency-specific priorities. The resulting Pavement Management Program (PMP) reports must clearly convey existing conditions, forecast future performance, and illustrate the consequences of alternative funding scenarios in a manner that is both technically sound and accessible to non-technical decision makers.

HCAOG's agencies utilize StreetSaver, and QES understands that full compatibility with this platform is mandatory for this project. All pavement inventory, condition, and maintenance and rehabilitation (M&R) data must be collected, validated, and entered in accordance with the Metropolitan Transportation Commission (MTC) Pavement Management System user guide and associated distress identification standards. QES recognizes the importance of maintaining continuity with prior PMS updates so that historical trends, deterioration modeling, and long-term investment strategies remain credible and defensible.

QES further understands that data quality is a critical cornerstone of this assignment. HCAOG and its member agencies rely on PMS outputs to guide significant funding and policy decisions, and therefore expect data that is auditable, repeatable, and suitable for long-term use. QES's approach incorporates rigorous quality control and quality assurance procedures, including annual independent certification of pavement condition raters, structured field protocols, validation reviews, and transparent documentation of data acceptance criteria. This commitment ensures that the resulting PMS database and reports can be confidently used by HCAOG, local agencies, and Tribal partners over multiple planning cycles.

The Consultant Scope of Work emphasizes not only data collection, but also the review and refinement of maintenance and rehabilitation strategies, development of multi-year work plans, and preparation of multiple budget scenarios. QES understands that these elements are central to helping agencies evaluate tradeoffs between preservation, rehabilitation, and deferred maintenance under varying funding levels. Our team will work closely with HCAOG staff and the Technical Advisory Committee to ensure that treatment decision trees, unit costs, and scenario assumptions reflect local practices and current market conditions, while remaining consistent across jurisdictions.

QES also recognizes the importance of effective communication and stakeholder engagement throughout the project. Regular coordination with HCAOG staff, clear progress reporting, and well-structured presentations to both the Technical Advisory Committee and the HCAOG Board are essential to the success of the 2026 PMS Update. Final deliverables must translate complex technical analyses into clear, actionable information that supports transparent and defensible decision-making at both the staff and policy levels.

Overall, QES understands that the 2026 Pavement Management System Update is a foundational planning effort for Humboldt County and its member agencies. Our approach is centered on delivering a high-quality, StreetSaver-compatible PMS update that provides reliable data, practical maintenance and rehabilitation strategies, and clear funding scenarios to support sustainable, long-term stewardship of the region's transportation infrastructure.

Should HCAOG be open to pavement management tools that complement or enhance its existing StreetSaver system, QES will fully support and maintain compatibility with StreetSaver while proposing our Strategic Asset Management System (SAMS) as a StreetSaver enhancement tool to expand analytical and reporting capabilities. SAMS provides advanced scenario modeling, flexible project grouping, and enhanced visualization to support multi-year funding analyses and policy discussions. To maximize value to HCAOG, QES will provide SAMS at no cost and with no annual license fee for the duration of the data collection cycle, allowing HCAOG to benefit from enhanced decision-support capabilities without additional financial commitment.

QES's approach is therefore centered on delivering not only accurate pavement condition data, but a comprehensive, high-quality pavement management solution that directly supports the Humboldt County's operational, financial, and long-term infrastructure stewardship objectives.

QUALIFICATIONS AND EXPERIENCE

Firm

QES was founded as a pavement consulting firm with the goal of providing technically rigorous, high-quality services in the field of pavement engineering. Now in its 28th year of operation, QES has provided PMS implementation and update services nationwide for cities, counties, regional agencies, tribal governments, airports, and military facilities. Since 2000, QES has completed PMS projects using a wide range of pavement management systems and data collection methodologies, with particular strength in delivering consistent, defensible network-level condition data and M&R strategies.

As pavement engineers, QES brings added value to PMS updates through our ability to translate condition data into practical, cost-effective maintenance and rehabilitation recommendations. Our senior pavement engineers are active contributors to national pavement research through the **Transportation Research Board (TRB)**, the **Federal Highway Administration (FHWA)**, the **National Cooperative Highway Research Program (NCHRP)**, and multiple state transportation agencies. This research involvement ensures that QES's PMS methodologies, treatment strategies, and performance modeling remain aligned with current best practices and emerging industry standards.

QES is a **minority, woman-owned business** and operates offices in Glendale, California; Reno, Nevada; Seattle, Washington; Austin, Texas; Pittsburgh, Pennsylvania; and Cochranton, Pennsylvania. The firm was acquired in 2021 by Ms. Lydia Kennard and operates as an S-corporation with approximately 150 employees, including ten licensed professional engineers. Over nearly three decades in business, QES has successfully staffed and delivered every project awarded and has never defaulted on a contract. Our commitment to data quality is a defining characteristic of the firm and is grounded in our deep understanding of pavement distress variability, its influence on decision-making, and the methods required to measure, control, and document that variability in a PMS environment.

QES's pavement engineering expertise spans both flexible and rigid pavements across a variety of infrastructure types. Our experience includes municipal and county roadway networks, regional transportation systems, and airfield pavements. This breadth of experience positions QES well to support HCAOG's multi-jurisdiction PMS update, which requires consistency across agencies while accommodating differences in roadway function, traffic loading, and maintenance practices.

QES will operate from our western regional office located at **690 West 2nd Street, Suite 201, Reno, Nevada 89503**, providing proximity and responsiveness to Humboldt County and its member agencies.

QES: Forefront of pavement management since the inception of the concept in the 1980s.

Key Personnel

QES proposes a focused and experienced project team structured to provide efficient, cost-effective delivery of the 2026 PMS Update while maintaining strict adherence to MTC and StreetSaver requirements. The project will be led by **Kurt Keifer, Ph.D., P.E.**, who will serve as Project Manager and primary point of contact for HCAOG. Dr. Keifer will oversee all technical and administrative aspects of the project, ensuring that schedules are met, budgets are maintained, and deliverables exceed HCAOG expectations.

To support the integrity and defensibility of the PMS data, QES will assign **Luis Ramirez** as Data Quality Management Engineer. Mr. Ramirez will be responsible for implementing QES's data quality protocols, overseeing field and office quality control procedures, and ensuring that all data collected and entered into the StreetSaver database meets established accuracy and completeness standards.

Field data collection will be performed by **Jason Clinton** and **Matthew Baker**, both of whom are MTC-certified pavement condition raters with extensive experience conducting network-level condition surveys for municipal and regional agencies. Their familiarity with MTC distress definitions and sectionalization criteria ensures consistency with prior PMS updates and long-term comparability of results.

QES intends to engage **Civil Infrastructure Solutions (CIS)** as an essential, specialized subconsultant to provide third-party data science and analytical support, as needed. CIS will complement QES's pavement engineering capabilities by providing independent data review and advanced analytical insight, strengthening the overall defensibility of the PMS outputs. The remainder of the work will be completed by QES staff, allowing for streamlined communication, clear accountability, and efficient project execution.

All proposed staff have the availability and capacity to complete this project within the required schedule. QES's experience has shown that a small, cohesive team of subject-matter experts provides the most effective and economical approach for PMS updates. Should any proposed team member become unavailable, QES maintains a deep bench of qualified personnel, including multiple additional project managers, pavement management engineers, and certified distress inspectors who can be assigned without disruption to the project.

Project Team

Personnel resumes for all proposed project personnel can be found in Appendix B

Kurt Keifer, Ph.D., P.E., Project Manager



Dr. Kurt Keifer will serve as Project Manager, overseeing analysis, reporting, and bi-weekly meetings with HCAOG. With over 25 years of national recognition in pavement engineering, he has led teams in delivering high-quality data and cost-effective recommendations to agencies across the U.S. His project leadership includes managing the world's largest annual pavement condition survey for Texas DOT, successfully collecting 92,000 miles of data in just four months.

Dr. Keifer spent a decade with USACE's Construction Engineering Research Lab, where he helped update ASTM D6433, advanced automated PCI methods, and served as Associate Program Manager for the PAVER R&D team. He is highly proficient in platforms such as StreetSaver, AgileAssets, PAVER, Lucity, and Cartograph. A respected educator, he has taught over 50 pavement management courses for institutions such as the University of Illinois, Colorado State University, and the DoD, and has authored multiple publications.

His expertise in technical oversight, stakeholder collaboration, and pavement management has supported successful PMS implementations and condition surveys for hundreds of municipal, state, and federal agencies worldwide.

Mona Nobakht, Ph.D., P.E., Deputy Project Manager



Dr. Nobakht is a licensed Professional Engineer with over 12 years of experience in both public and private sectors. She holds a Ph.D. degree in Civil Engineering from Texas A&M University. Her expertise spans pavement materials characterization, pavement design and evaluation, forensics, and management. Prior to joining QES, Dr. Nobakht served as a project manager at the Texas DOT, leading various pavement projects. Dr. Nobakht has successfully implemented Pavement Management Systems for several cities and counties in Texas. Since joining QES in 2023, Dr. Nobakht has participated in several StreetSaver-based pavement management projects, including the City of Seattle, WA; Yolo County, CA; Yuba County, CA; among others. On this project, Dr. Nobakht will oversee distress data collection quality and ensure complete and accurate information is loaded into the PMS database. Dr. Nobakht will support this project at a high level.

Carlos Cary, Ph.D., P.E., Senior Engineer



Dr. Carlos Cary, specializes in pavement design and analysis and has 18 years of experience in geotechnical and pavement engineering. His expertise spans geotechnical engineering for pavement structures, unsaturated soil mechanics, pavement instrumentation, and full-scale accelerated testing. Dr. Cary also has extensive experience with conducting non-destructive evaluations and the characterization of pavement construction materials in both the field and in laboratory settings. In addition to this experience, Dr. Cary has studied the environmental effects on pavement performance and, in fact, has

authored more than 40 technical publications and reports, offering significant contributions to the advancement of pavement design and construction.

Luis Ramirez, P.E., Data Quality Management Engineer



Mr. Luis Ramirez is a registered Professional Engineer in the State of Maryland. He holds an M.S. degree from University of Pittsburgh and 12 years of experience with QES. Mr. Ramirez is experienced in design and analysis of pavement structures, pavement management, concrete forensics, concrete mixture design, pavement instrumentation, data acquisition systems, and in-field/lab testing of construction materials. He is skilled in cost analysis and project budgeting and experienced in elaboration of engineering and investigation reports. In the last three

years, Mr. Ramirez has been responsible for the development of pavement management plans for six cities in the San Francisco, CA Bay Area. He will complete independent quality assurance reviews on the collected distress data in addition to performing in-house quality assurance review of each phase of the project.

Mr. Ramirez's level of involvement will be to serve as the Data Quality Management Engineer. During data collection, he will conduct daily data reviews and complete an independent distress rating on a percentage of all inspection units rated as well as conduct an independent review of the PMP analysis and reports throughout the development of the PMP.

Matthew Baker, Senior Technician / Pavement Distress Rater



Mr. Baker has seven years of pavement management experience with QES, primarily in the areas of pavement distress ratings and quality control. He holds a B.S. degree in Computer Science and Engineering from the University of Nevada, Reno. He is an MTC certified pavement distress rater (**MTC Certification #1147**) and has conducted pavement surveys for more than a dozen agencies in California over the past four years, including Yolo County. He is currently providing quality assurance

reviews on high-speed automated pavement distress data for the New Mexico DOT and the Virginia DOT. Mr. Baker's level of involvement will be to serve as a key pavement distress rater.

Jason Clinton, Senior Technician / Pavement Distress Rater



Mr. Clinton has over 19 years of pavement technician experience with QES, primarily in the areas of pavement distress ratings and quality control. He has completed field distress ratings in Seattle WA, Yolo County, CA, Sonoma County, CA; the Cayman Islands; the City of Sacramento, CA; and 25 San Francisco Bay Area cities. In addition, he has completed pavement distress evaluations from digital images on thousands of miles of military base, city, and state roadway pavements. Furthermore, Mr. Clinton is an MTC Certified Pavement Distress Rater (**MTC Certification #1145**).

Mr. Clinton's level of involvement will be to serve as a key pavement distress rater. Following survey completion, Mr. Clinton will assist Dr. Keifer and Dr. Nobakht on an as-needed basis while completing the PMS and pavement management plan efforts.

Eric Miskow Staff Engineer

Mr. Eric Miskow joined the QES Pavements team in 2022 while working to complete his degree in Geological Engineering at the University of Nevada in Reno. He began his career as a part-time pavement distress rater, eventually transitioning into a full-time role following his graduation. He has conducted manual pavement distress ratings and supported digital image-based ratings, gaining valuable field and technical experience. In addition to his fieldwork, Mr. Miskow has assisted senior engineering staff with processing and analyzing pavement distress QA data.

Mostafa Nakhaei, Ph.D., Data Analysis Engineer (CIS)



Mostafa Nakhaei, Ph.D., is a Consulting Manager and Senior Pavement Engineer at CIS with more than 12 years of civil engineering experience. He has guided the development of Capital Improvement Programs for over 120 cities and counties across the United States, directing projects that together exceed \$1 billion in value. His expertise spans construction, management, structural design, laboratory testing, and FWD analysis. Holding a dual degree in Data Science, he has advanced the field by creating MASTIC and Back-MASTIC for layered elastic analysis and modulus back-calculation, as well as leading the development of ISA, a deep learning software for structural data analysis. He has also implemented pavement and asset management systems for numerous municipal agencies and is highly proficient in platforms such as SAMS, ESA, StreetLogix, AgileAssets, PAVER, StreetSaver, Lucity, and Cartegraph.

References

QES has a long history of repeat clients who continue to engage our services based on our pavement engineering expertise, attention to data quality, and ability to deliver clear, defensible PMS updates. For the 2026 PMS Update, HCAOG can draw confidence from QES's recent and ongoing experience completing multi-jurisdiction pavement management programs that require consistent methodologies, transparent assumptions, and reliable outputs suitable for both technical staff and policy makers.

The reference projects summarized in the table below reflect QES's experience performing network-level pavement condition surveys, validating and updating historical M&R records, refining treatment decision trees and unit costs, and entering data into StreetSaver and PAVER databases. These efforts routinely include development of multiple budget scenarios, needs assessments, and multi-year M&R programs that directly support capital planning and funding discussions. All work is documented through comprehensive draft and final reports that meet agency requirements and are structured to clearly communicate pavement conditions, funding tradeoffs, and recommended investment strategies. The QES team members proposed for the HCAOG 2026 PMS Update have collaborated on many of the referenced projects, ensuring continuity of experience and a proven team dynamic.

City/County	Project Manager	Email	Phone	Miles	Year(s)
Yuba County, CA	Brett Poliquin	bpoliquin@co.yuba.ca.us	(530) 749-5416	650	2025
City of Reno, NV	Joe Winkler, P.E.	winklerJ@Reno.Gov	(775)-393-1015	124	2025
Yolo County, CA	Marvin Dinozo	marvin.dinozo@yolocounty.org	(530) 666-8034	657	2024
Bismarck, ND	Gabe Schell, P.E.	gschell@bismarcknd.gov	(701) 355-1507	260	2024
Seattle, WA	Ben Hansen	benjamin.hansen@seattle.gov	(206) 255-1998	1,547	2017/2023
Windermere, FL	Tonya Elliott Moore	tmoore@town.windermere.fl.us	(407) 876-2563	24	2017/2023
Santee, CA	Jim Tourek	jtourek@imsanalysis.com	(408) 462-4030	74	2022
San Leandro, CA	Kyle Lei	klei@sanleandro.org	(510) 577-3971	182	2021
Moraga, CA	Sharon Chan	schan@moraga.ca.us	(925) 888-7028	59	2021
Corte Madera, CA	Christopher Good	cgood@tcmmail.org	(415) 927-5794	35	2021
Mill Valley, CA	Ahmed Aly	aaaly@cityofmillvalley.org	(415) 384-4755	61	2021
San Mateo, CA	Otis Chan	chan@cityofsanmateo.org	(650) 522-7305	200	2021
Newark, CA	Trang Tran	trang.tran@newark.org	(510) 578-4298	106	2020
Los Altos, CA	Victor Chen	vchen@losaltos.ca.gov	(650) 947-2623	111	2018/2020
Los Altos Hills, CA	John Chau	jchau@losaltoshills.ca.gov	(650) 947-2510	60	2018/2020
American Canyon, CA	Cheryl Braulik	cbraulik@cityofamericanacanyon.org	(707) 647-4688	55	2017/2020
Milpitas, CA	Steve Chan	schan@ci.milpitas.ca.gov	(408) 586-3324	42	2014/2020

2024 Pavement Condition & Analysis Report, Bismarck, North Dakota

In 2024, QES conducted a system-wide pavement condition evaluation for the City of Bismarck, ND and updated its PAVER pavement management databases. The project began with the formation of a steering committee and the development of a project-specific Quality Management Plan to establish clear goals, communication protocols, and rigorous QA/QC standards. QES then reviewed and validated existing GIS and pavement data, reconciling roadway attributes and construction histories to ensure an accurate foundation for analysis.

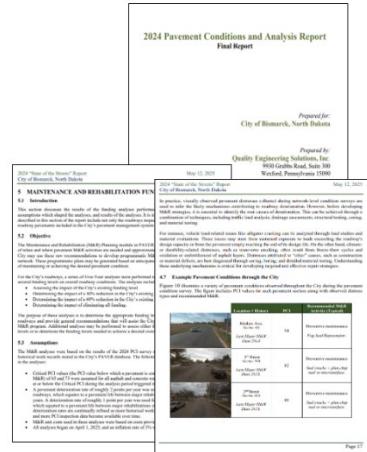
QES performed field data collection to capture high-resolution 2D and 3D imagery, rutting and faulting measurements, right-of-way images, and IRI values. Automated software and certified distress raters worked together in a multi-step workflow to classify cracking and other distresses, with PCI values calculated and loaded into PAVER. Additional verification against historical data ensured accuracy and continuity.

The updated database was customized with realistic deterioration trends, preservation treatments, and rehabilitation strategies, incorporating accurate unit costs and life-cycle models. Using these tools, QES developed a coordinated five- to ten-year

pavement management program, supported by GIS-based maps and budget scenarios, along with a long-term 20-year rehabilitation vision. Results were summarized in “State of the Streets” reports and presented to City staff, providing clear, data-driven recommendations for optimizing limited budgets, extending pavement life, and maintaining higher overall roadway condition levels.



Firm:	Quality Engineering Solutions, Inc.
Project Name:	2024 Pavement Condition & Analysis Report
Location:	Bismarck, ND
Owner:	City of Bismarck, ND
Contact:	Gabe Schell, P.E., City Engineer (701) 355-1507 gschell@bismarcknd.gov
Budget:	\$230,000
Year Completed:	2024
Project Size:	390 Centerline Miles



2024 Pavement Inspection and Pavement Database Updates Yolo County, California

QES recently completed a contract to perform pavement condition inspections for Yolo County's StreetSaver PMS. We provided updates of the entire 657 centerline miles of paved road network (33 miles of arterials, 142 miles of collectors, 40 miles of residential roads and 442 miles of other rural roads). Dr. Mona Nobakht served as PMS Engineer and Jason Clinton and Matt Baker as distress raters.

Manual distresses surveys, following the MTC distress rating methodology, were completed on 100% of the street segments. All field data was collected in 45 days, underwent a rigorous data quality check prior to entry into the StreetSaver database.

Firm:	Quality Engineering Solutions, Inc.
Project Name:	Pavement Inspection and Pavement Database Updates
Owner:	County of Yolo, CA
Contact:	Marvin Dinozo, Assistant Engineer Department of Community Services Public Works Division (530) 666-8034 marvin.dinozo@yolocounty.org
Budget:	\$89,319
Contract Date:	May 30, 2023
Completion Date:	March 31, 2024
Miles:	657 Centerline Miles



2022 Town of Windermere PMP Update Windermere, Florida

QES was awarded this project issued by the Town of Windermere, FL to update the Town's Pavement Management Plan and continue building upon the current data available in the PAVER software implemented by the Town in 2015. The project began with QES conducting a review and confirmation of roadway inventory and performing ASTM D6433-compliant pavement distress surveys by using tablet-based field software to capture distress data, GPS photos, and PCI calculations. All results were meticulously reviewed by QES against historical PCI values, ensuring accuracy and continuity with the Town's baseline.



QES integrated the updated data into PAVER and generated accurate

pavement performance models, deterioration curves, and budget scenarios. QES worked with Windermere Town staff to evaluate unlimited, current, and recommended funding strategies, prioritizing short-term maintenance and rehabilitation project lists through cost-benefit analysis. A 20-year rehabilitation strategy was also developed, providing Town officials with a progressive vision to sustain roadway conditions. Findings and recommendations were presented to staff and Council, equipping the Town with a practical, data-driven roadmap to optimize budgets and extend pavement life.

Firm:	Quality Engineering Solutions, Inc.
Project Name:	2022 Town of Windermere PMP Update
Owner:	Town of Windermere, FL
Contact:	Tonya Elliott-Moore, Director of Public Works Main (407) 876-2563 ext. 5325 Cell (321) 299-2410 tmoore@town.windermere.fl.us
Budget:	\$41,157
Contract Date:	February 01, 2023
Completion Date:	October 05, 2023
Miles:	24.2 Centerline Miles

Seattle DOT Arterial Pavement Condition Rating Seattle, Washington (2018 and 2022)

QES completed a pavement condition survey of the arterial street system for the City of Seattle, WA. The Seattle Department of Transportation's (SDOT) arterial pavement network has a total area of approximately 98,000,000 sf (1,547 12-ft. lane-miles), a total length of 491 centerline-miles, and consists of 3,132 management sections. The QES project manager was supported by Dr. Mona Nobakht (PMS Engineer), and Jason Clinton (Senior Technician).

Our workflow consists first of collecting 3D pavement imagery in the field using IMS operated Road Surface Tester (RST) with state-of-the-art second-generation Laser Crack Measuring System (LCMS-2) technology which provides twice the resolution of most other systems used in the field, of pavement surveys. The LCMS-2 data collection vehicles give our expert team of engineers detailed, objective, and repeatable data to use for their analysis. Pavement images are next analyzed using automated crack detection and classification software tools (RoadInspect), then manually verified by QES staff, supplementing the results of the automated data processing. Quality control and assurance checks are in place at all phases of the project. IMS collects the data and then QES completes the manual pavement distress ratings based upon MTC's StreetSaver pavement distress guides. Approximately one third of the pavements are concrete surfacing and the remainder are asphalt concrete or composite roadways. QES uploaded the survey data into SDOT's MTC StreetSaver Online pavement management system database.



Firm:	Quality Engineering Solutions, Inc.
Project Name:	2022 SDOT Arterial Pavement Condition Rating
Owner:	Seattle Department of Transportation
Contact:	Benjamin Hansen, PE, Project Manager Maintenance, and Operations (206) 684-5304 benjamin.hansen@seattle.gov
Budget:	\$547,000
Contract Date:	July 15, 2022
Completion Date:	July 31, 2023
Miles:	491 Centerline Miles

MTC P-TAP 21 Pavement Management Updates Multiple Cities, California

Under the P-TAP 21 contract, QES was assigned six Bay Area cities to provide StreetSaver PMS updates in 2020. Project details include the confirmation and correction of existing management sections, manual pavement distress surveys, StreetSaver updates (including updating the decision tree and cost table), adding any M&R information, and generating various budget option reports. All six of these projects were completed on time and within budget. The QES Project Manager was supported by Luis Ramierz, Matt Baker, and Jason Clinton.

Two cities provided additional challenges in their request for project lists meeting certain criteria. For the City of San Mateo, the unique challenge of custom scenario generation went beyond StreetSaver's standard capabilities. Many scenarios required the elimination of failed streets (streets that fall below a PCI of 30) over a specified period while maintaining all street sectional PCIs (rather than network PCI) above a certain index such as 50. The desired pavement management plan PMP was achieved with a bit of creativity that involved making changes to the decision tree that would, in turn, generate an annual list of streets which could then be saved as project lists. No single standard StreetSaver analysis or report could be utilized, but by running separate reports and combining the data, QES was able to achieve the City's desired outcome.

Firm:	Quality Engineering Solutions, Inc.
Project Name:	MTC P-TAP 21 Pavement Management Updates
Owner:	Bay Area MTC
<u>San Mateo</u>	
Contact:	Cathi Zammit, Engineering Manager (650) 522-7306 czammit@cityofsanmateo.org
Budget:	\$60,000
Miles:	200 Centerline Miles
<u>City of Mill Valley</u>	
Contact:	Faryal Saiidnia, Project Manager (415) 384-4830 fsaiidnia@cityofmillvalley.org
Budget:	\$18,400 + \$9,300
Miles:	61 Centerline Miles

Additionally, the City of Mill Valley entered into a separate contract with QES to expand on the P-TAP 21 required deliverables, this included updating their 5-year PMP. This update included annual project lists tailored through engineering judgement to reduce treatment costs and provide optimal PCI improvement to their pavement network. Various M&R treatment strategies were evaluated to provide the best solution for long-term pavement performance under their budgetary considerations

Lake Berryessa PCI and FWD Pavement Evaluation

QES was contracted by the Bureau of Reclamation to analyze, evaluate, and report existing pavement conditions following an asset management approach and to provide recommendations for maintenance on approximately 66K SY of asphalt pavements, divided across nine parking lots and roadways. Field testing consisted of PCI distress surveys, deflection testing, and pavement coring and was conducted in November 2015.

The QES team took detailed field measurements of pavement distresses per ASTM D6433 and took photographs of all pavement sections and created GIS maps of the pavement sections. Data were analyzed in PAVER to assess overall pavement functional and structural conditions.

Project-level deflection testing using an FWD was also performed, and coring was conducted to determine the structural capacity of the pavement sections. The ELMOD back calculation software was used to analyze the deflection data.

QES analyzed the data and developed remaining life predictions. QES then made detailed recommendations for future pavement maintenance and rehabilitation activities.

Firm:	Quality Engineering Solutions, Inc.
Project Name:	Lake Berryessa PCI and FWD Pavement Evaluation
Location:	Lake Berryessa, CA
Owner:	Bureau of Reclamation Mid-Pacific Region
Contact:	Peter Funkhouser (916) 978-5100 or (707) 966-2111 pfunkhouser@usbr.gov
Budget:	\$24,000
Year Completed:	2016
Project Size:	66,000 SY (Roadways & Parking Lots)



MTC PCI Surveys and Pavement Management System Update

QES completed four consecutive years of providing ASTM D6433 PCI inspection and pavement management services to San Francisco Bay Area MTC agencies through the P-TAP program. Over these years, QES has been assigned 10 local agencies to provide updates to their current pavement management systems. The agencies include American Canyon, Belvedere, Hercules, Los Gatos, Martinez, Menlo Park, Millbrae, Milpitas, Novato, and Suisun City, all located in the Bay Area. This work was based upon a pavement management system very similar to PAVER called StreetSaver and is similarly based on ASTM D6433 PCI inspection data. (Note: StreetSaver is based on PAVER, but it lacks the more sophisticated analysis capabilities of PAVER).

QES provided additional data collection services as subcontractor to both Nichols Consulting Engineers and Harris and Associates during their P-TAP 17 projects. Each of these projects were completed on time and within budget.

Mr. Jason Clinton served as the lead distress rater on these cities and is a certified pavement distress rater. The database updates were completed, and a minimum of five budget scenarios were run for each city. The budget scenarios included:

- 1) Unconstrained;
- 2) Current investment level;
- 3) Maintain current PCI;
- 4) Increase current PCI by five points, and;
- 5) Do nothing

Firm:	Quality Engineering Solutions, Inc.
Project Name:	MTC PCI Surveys & Pavement Management System Update
Location:	San Francisco Bay Area, CA
Owner:	San Francisco Metropolitan Transportation Commission (MTC)
Contact:	Christina Hohorst (Project Manager, MTC) (415) 778-6700 or (510) 817-5869 chohorst@bayareametro.gov
Budget:	\$228,000
Year Completed:	2014-2017
Project Size:	8,000,000 SY Roadways (approx.)

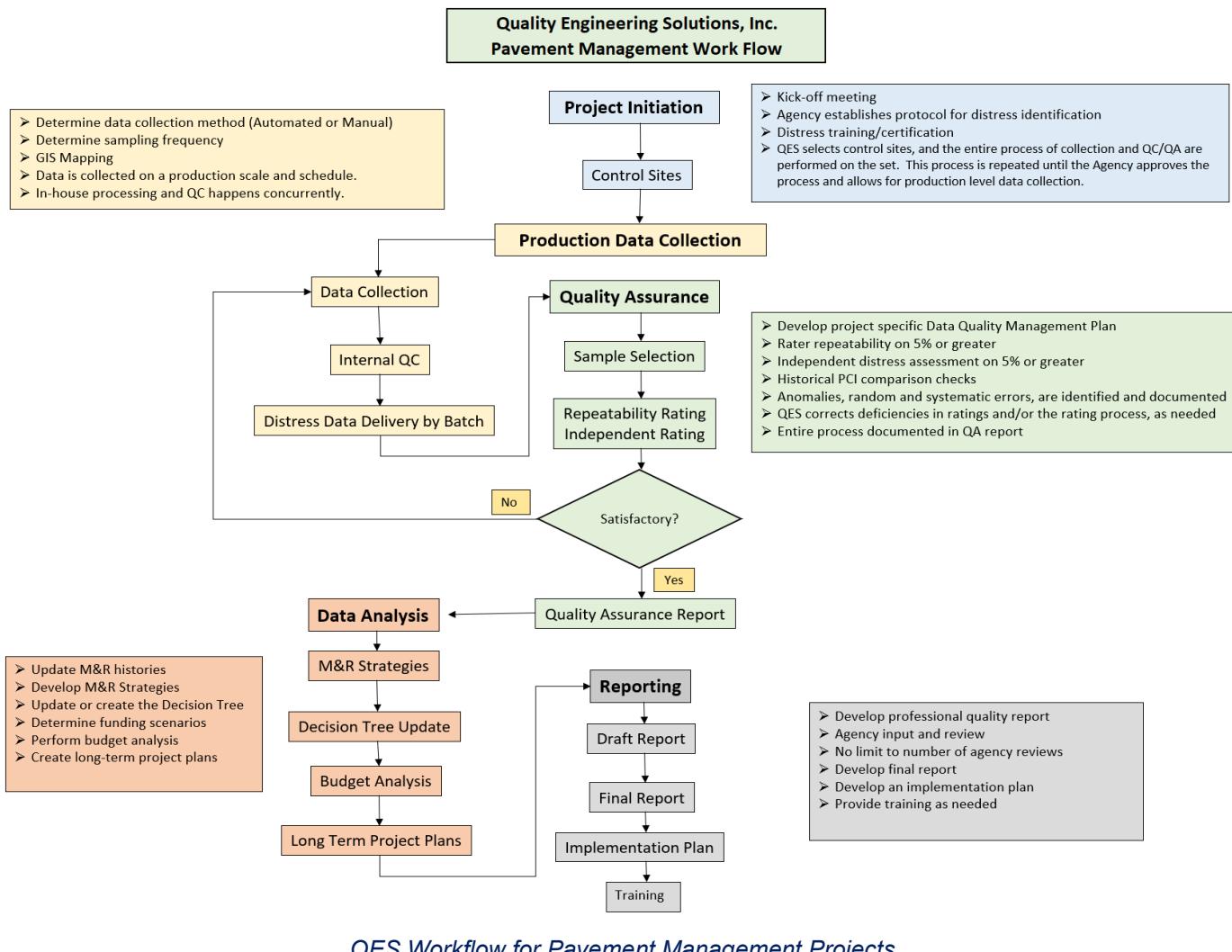
QES provided overall project management, oversight, and quality assurance reviews. In addition to this work as prime contractor, QES has also provided subcontractor services for two additional prime contractors for the cities of Berkley, CA, Pittsburg, CA, San Carlos, CA and for Sonoma County.



PROJECT APPROACH

A successful project begins with strong project management and having a complete understanding of the client's needs. Dr. Keifer has over 25 years of experience managing projects and will ensure the deliverables meet the goals and objectives of this project.

QES has developed a proven workflow for pavement management projects, illustrated in the chart below. As noted, there are at least five steps to each project, 1) **Project Initiation**, 2) **Production Data Collection**, 3) **Quality Assurance**, 4) **Data Analysis**, and 5) **Reporting**. For this project, all five steps are recommended, culminating in multi-year management plans based on several budget scenarios.



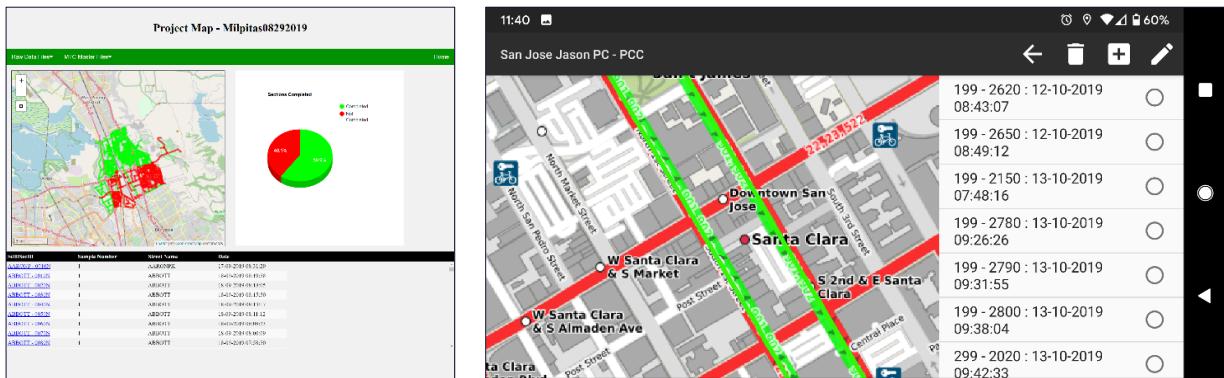
An area where we believe **QES stands above other consultants** is our commitment to collecting quality data, which is supported by our knowledge of distress variability, its effects on decisions, and how to measure and limit this variability. Since 1999, QES staff have collaborated closely with the Virginia Department of Transportation (VDOT) to develop a DQMP and implement this plan on over 22,000 miles of pavement collected annually since 2005. We were

the first company, in conjunction with VDOT staff, to develop a comprehensive DQMP, portions of which **have been used to develop the FHWA requirements for state agencies** in developing their own individual DQMPs, which was then adapted by MTC in developing their DQMP guidelines.

QES has established a proven DQMP which will be provided at the kick-off meeting. This plan has been accepted by the MTC. Highlights of the plan include:

- MTC rater certification
- Annual training and control site evaluations
- Independent quality assurance checks on 5% of the data, consisting of duplicate ratings on your roadways by an independent rater.
- Repeatability checks throughout the data collection effort
- Checks on the PCI value as compared to historical values.
- Completeness and reasonableness checks on 100% of the data

Field data is directly input into a tablet-based system while in the field, including all comments made by the evaluators. An example of the data collection application is shown in the image below. As data is collected, the streets turn from red to green, ensuring that all data is collected.



Example of Data Collection Application System

Additional validation checks are conducted throughout the process to include independent reviews by Mr. Ramirez of the decision trees, and budget option reports. Final reports are reviewed by the quality engineer, the Project Manager and the Deputy Project Manager.

Purpose and Quality Objectives

This DQMP defines the methods, controls, and acceptance criteria used by QES to ensure that pavement condition data collected and analyzed for HCAOG meets the quality requirements of the RFP and complies with ASTM D6433 (Pavement Condition Index Surveys) and StreetSaver system standards.

The primary quality objectives are to ensure that all measurements are:

- **Accurate** (consistent with ASTM distress definitions and severity levels),
- **Repeatable** (producing consistent PCI results across inspectors and time), and
- **Defensible** (supported by documented QA/QC procedures and acceptance criteria).

Measurement Methods

Pavement condition data will be collected in accordance with **ASTM D6433** using **RoadSight Technology**. Measurements include:

- **Distress Identification:**
Visual identification of pavement distresses as defined in ASTM D6433 (e.g., cracking, raveling, patching).
- **Severity Classification:**
Assignment of Low, Medium, or High severity based on ASTM thresholds.
- **Distress Quantity Measurement:**
Measurement of distress extent (area, length, or count).
- **PCI Calculation:**
Distress data is processed in StreetSaver, where deduct values are applied and PCI is calculated at the sample unit, section, and network levels.

Distress-Level Accuracy, Repeatability, and Acceptance Criteria

To ensure that automated and engineer-verified distress identification produces consistent and defensible PCI results, QES evaluates data quality at both the distress level and the PCI outcome level, consistent with ASTM D6433 intent and StreetSaver guidance.

1. PCI-Based Acceptance Criterion (Primary Metric)

The primary acceptance criterion for repeatability is based on PCI, which is the decision-driving metric in StreetSaver.

- **PCI Repeatability Requirement:**
The difference in calculated PCI between independent surveys of the same sample unit shall not exceed **±10 PCI points**.

This threshold recognizes that minor variation in low-impact distresses may occur without materially affecting network-level decision making, while still ensuring overall data reliability.

2. Distress-Specific Measurement Tolerances (Supporting Metrics)

Distress-level agreement is evaluated using tolerances tailored to the relative influence of each distress on PCI, as defined in ASTM D6433 deduct value curves.

Asphalt Concrete (AC) Pavements

Distress Type (ASTM D6433)	Measurement Type	Repeatability Tolerance
Alligator (Fatigue) Cracking	Area	±5% of measured area
Block Cracking	Area	±15% of measured area
Longitudinal & Transverse Cracking	Length	±10% of measured length
Edge Cracking	Length	±10% of measured length
Bleeding	Area	±10% of measured length
Patching & Utility Cuts	Area	±10% of measured area
Potholes	Count	±1 count
Raveling	Area	±20% of measured area
Weathering	Area	±25% of measured area
Edge Cracking	Length	±20% of measured length

**note: severity levels excluded to avoid making this table large, more detailed values for each distress can be provided to HCAOG if interested.*

Higher tolerances are permitted for raveling and weathering due to their diffuse boundaries and lower deduct value sensitivity within the PCI framework.

Portland Cement Concrete (PCC) Pavements

Distress Type (ASTM D6433)	Measurement Type	Repeatability Tolerance
Divided Slab	Count	±2 slabs
Durability Cracking	Length	±10% of measured length
Shrinkage Cracking	Length	±10% of measured length
Linear Cracking	Length	±10% of measured length
Corner Breaks	Count	±1 slab or ±10%
Joint Spalling	Length	±10% of measured length
Corner Spalling	Count	±1 slab
Patching	Area	±10% of measured area
Faulting (where applicable)	Severity Category	±1 severity level

3. Severity Level Agreement

For all distress types:

- Severity classification (Low / Medium / High) shall match between surveys for at least 85% of recorded distresses.
- Any severity misclassification that results in a PCI shift greater than ±10 points requires correction.

4. Evaluation Methodology

Repeatability and accuracy are evaluated using:

- Independent surveys of designated calibration and repeatability sections
- Distress-by-distress comparison of quantities and severities
- PCI comparison at the sample unit and section levels

Distress discrepancies are assessed not only on raw quantity but on their **net impact on PCI**, ensuring that acceptance decisions reflect engineering relevance rather than purely geometric variation.

5. Error Resolution and Corrective Action

If either of the following conditions occur:

- PCI difference exceeds **±10 points**, or
- Distress-specific tolerances are exceeded (e.g., alligator cracking tolerance exceeded 5%)

Then:

1. The affected section is flagged for review.
2. Distress quantities and severities are re-evaluated by a senior engineer.
3. Data is corrected or re-surveyed as required.
4. Root causes are documented and used to refine calibration procedures.

By combining distress-specific measurement tolerances with a PCI-based acceptance threshold, QES ensures that minor variability in low-impact distresses does not compromise decision-making, while maintaining strict control over high-impact distresses that directly influence pavement performance and funding prioritization.

QES Data Quality Management Plan (DQMP)

QES brings more than two decades of direct experience developing and implementing comprehensive Data Quality Management Plans (DQMPs) for pavement management programs nationwide. For more than 25 years, QES staff worked in close partnership with the Virginia Department of Transportation to develop one of the nation's earliest fully documented DQMP frameworks, which has supported the collection of pavement condition data on an annual basis since 2005. The methodologies established through this effort informed subsequent guidance issued by the Federal Highway Administration and were later adapted by the Metropolitan Transportation Commission as the basis for its pavement management data quality standards.



For the 2026 Pavement Management System Update, QES will implement a project-specific DQMP to ensure that all pavement inventory, condition, and supporting data collected for Humboldt County Association of Governments and its member agencies are accurate, repeatable, defensible, and fully compliant with MTC requirements and StreetSaver Online Edition protocols. The DQMP will govern the entire project lifecycle, including equipment calibration and verification, pre-production checks, field data collection, data processing, validation, exception identification, and final data acceptance.

In addition to automated and structured data collection procedures, QES will assign two of its most experienced MTC-certified pavement distress raters, Matthew Baker and Jason Clinton, to serve as quality control reviewers for this project. Their role includes verifying distress identification consistency, sectionalization accuracy, and adherence to MTC distress definitions across all jurisdictions. QES utilizes an in-house, tablet-based field data collection platform that supports efficient navigation of inspection units, direct field entry of distress data, GPS-tagged photographs, and real-time calculation of sample unit PCI values. These capabilities provide an immediate check on field results and enhance consistency between observed and modeled pavement conditions. Field data are uploaded nightly to secure cloud storage and made available to the pavement management engineer and Data Quality Management Engineer for ongoing review.

QES recognizes that data quality is strongly influenced by field conditions and inspection practices. To minimize errors and inconsistencies, all pavement condition surveys will be conducted during daylight hours and under appropriate conditions on clean, dry pavement surfaces. Crews will not be rushed to meet production targets at the expense of data accuracy, and additional resources can be deployed as needed to maintain schedule adherence without compromising quality.

QES is also highly experienced in integrating pavement management data with Geographic Information System (GIS) platforms. All approved data will be provided in GIS format, including ESRI shapefiles, consistent with HCAOG requirements. The GIS framework will serve as the foundation for data collection and reporting, minimizing post-processing effort and ensuring seamless integration with existing centerline datasets used by HCAOG and its member agencies. QES's field technology supports efficient daily production rates, and multiple survey teams can be mobilized concurrently to meet project milestones while maintaining strict data quality controls.

Equipment Calibration and Verification: Prior to production data collection, QES will perform equipment calibration and verification in accordance with its DQMP. This includes confirmation of sensor performance, profiler accuracy, laser system resolution, inertial reference integrity, and GPS synchronization. An initial calibration verification report will be submitted to HCAOG for review and acceptance before full production activities commence.

Accuracy and Repeatability Testing: QES will conduct repeatability testing on representative roadway segments to verify measurement consistency across passes and operating conditions. Accuracy and repeatability thresholds will be documented for each measured attribute, consistent with HCAOG's specifications and applicable standards. Results will be summarized and included in project QA/QC documentation.

Pre-Production Test Sections: In accordance with the RFP, QES will collect and submit an initial dataset covering approximately 5 to 10 miles of roadway segments. This pre-production delivery will allow HCAOG to review data formats, attribute calculations, severity classifications,

and GIS referencing prior to full network deployment, minimizing downstream risk and ensuring alignment with City expectations.

Ongoing Quality Control and Exception Handling: Quality control checks will be performed continuously during data collection and processing. QES will flag and document exceptions including, at a minimum, bridges, railroad crossings, lane deviations, construction zones, and any locations where valid data could not be collected. All exceptions will be logged, reviewed, and reported transparently as part of the project deliverables.

Data Validation, Review, and Acceptance: Collected data will undergo multi-level review, including automated checks and independent technical review by experienced pavement professionals. QC results identifying potential anomalies or outliers will be provided to HCAOG with the final dataset, along with documentation describing resolution procedures and acceptance criteria.

Documentation and Deliverables: The DQMP deliverables will include calibration verification reports, pre-production test section data, final QC summaries, exception reports, and complete documentation supporting data accuracy and repeatability. This documentation ensures that all pavement condition data delivered to HCAOG are auditable, defensible, and suitable for long-term use within HCAOG's Pavement Management System and multi-year capital planning analyses.

Project-Specific QA/QC Activities & Team Responsibilities

For this project, we have identified the following major data sets that will require QA/QC as part of this project. These tasks will be conducted by both QES and HCAOG. It is critical that HCAOG actively participates in QA activities to ensure confident "ownership" of the data at the end of the project.

Data Element(s)	Responsible Parties		Description of Check (Std. Practice)
	Quality Control	Quality Assurance	
Pavement Inventory Definition	QES Project Manager (Kurt Keifer) and Project Engineer (Mona Nobakht)	QES QA/QC Manager (Luis Ramirez) and HCAOG – <i>Before and after the pavement condition survey</i>	Verify that pavement sections and attribute data were collected and entered into PMS prior to and after performing the PCI survey.
GIS Sectioning	QES Project Manager (Kurt Keifer) and Project Engineer (Mona Nobakht)	QES QA/QC Manager (Luis Ramirez) and HCAOG – <i>Before and after the pavement condition survey</i>	Verify that pavement sections were correctly defined in GIS and properly linked to the PMS database.
Automated PCI Inspection Data Collection	QES Data Collection Lead (Jason Clinton)	QES Project Manager (Kurt Keifer) – <i>Review status reports remotely.</i>	Daily checks and calibration of vehicle instrumentation, including DMI, RSP, and image collection hardware and software.
PCI Inspection Data Interpretation and Structural Data	QES Data Processing Lead (Jason Clinton)	QES Project Manager (Kurt Keifer) and HCAOG – <i>Review imagery and ratings.</i>	Verify accuracy of PCI data.
PMS System Tables	QES Project Engineer (Mona Nobakht)	QES Project Manager (Kurt Keifer) and HCAOG	Verify the accuracy of deterioration models, unit cost data, and M&R policies in PMS.
PMS Analyses and Reports	QES Project Engineer (Mona Nobakht)	QES Project Manager (Kurt Keifer) and HCAOG	Verify the accuracy and repeatability of M&R analyses performed with PMS.

QES will ensure that all data and deliverables are thoroughly reviewed before acceptance by HCAOG and its member jurisdictions. QES will adhere to the principle of third-party review of pavement inventory and condition data collected and entered into the PMS database. This means that staff that collected and entered data will not perform the final review their own work. Instead, data will be reviewed by other members of QES team prior to submission to HCAOG. We have significant experience with pavement condition surveys and understand the necessity of collecting accurate data in the field. Incorrect data will inevitably lead to incorrect pavement conditions and thus incorrect treatments. Thus, it is critical that data interpretation be conducted by properly trained and experienced pavement inspectors. QES believes that high quality products are produced by quality people with the right attitude. QES goes to great lengths to recruit technically excellent people and then indoctrinate them with our culture of producing high quality products on schedule and within budget.

Client Support and Staffing

All proposed personnel are committed to supporting HCAOG throughout the duration of the 2026 Pavement Management System Update, from project initiation through final reporting, presentations, and training. QES understands that continuity of staff is critical to project success and that any changes to proposed personnel require prior written approval. Accordingly, no substitutions will be made without HCAOG authorization, and any approved changes will be made using staff with equal or greater qualifications.

QES's team structure is intentionally designed to provide clear accountability, responsive customer support, and direct access to senior pavement engineering expertise. The proposed team brings specialized experience in network-level pavement condition evaluation, StreetSaver database management, GIS integration, maintenance and rehabilitation strategy development, and multi-scenario funding analysis. This structure allows QES to respond quickly to questions, resolve issues efficiently, and maintain consistent communication with HCAOG staff and the Technical Advisory Committee throughout the project.

Customer Support & Issue Resolution Process	
Single Point-of-Contact	Dr. Keifer will remain HCAOG's primary contact for all contract, schedule, and technical issues.
Immediate Technical Support	Engineering and GIS specialists will be available to respond quickly to questions regarding PCI values, treatment decisions, GIS layers, data structure, or PMP outputs.
Weekly or Bi-Weekly Progress Check-ins	QES will hold regular virtual meetings with HCAOG to review progress, address questions, and confirm upcoming milestones.
Rapid Issue Escalation	Any data discrepancies, GIS integration challenges, or concerns related to ADA/multimodal coordination will be escalated directly to senior engineers for same-day review.
Controlled Staffing Stability	QES acknowledges HCAOG requirement for staffing continuity. All key personnel will remain assigned to the project for its duration. Should an unforeseen circumstance arise, QES will notify HCAOG in writing, provide justification, and request approval before any change is made.
Documentation & Transparency	All decisions, revisions, and clarifications will be documented and provided to HCAOG to ensure full traceability and alignment with project expectations.

WORK PLAN AND SCHEDULE

Task I: Kick-Off Meeting, Project Management, and Reporting

QES will implement a structured project management approach that emphasizes clear accountability, proactive communication, and consistent coordination with HCAOG and its Technical Advisory Committee. QES assigns defined roles to each team member to ensure efficient execution of the 2026 PMS Update. The Project Manager serves as the primary point of contact and is responsible for all technical and contractual communications; the Deputy Project Manager provides senior technical oversight and ensures client satisfaction; the Project Engineer performs technical evaluations and database analyses within StreetSaver; and the Data Quality Management Engineer oversees the quality, consistency, and defensibility of all data collected, analyzed, and reported. For this project, QES has designated **Kurt Keifer, Ph.D., P.E.** as Project Manager, **Mona Nobakht, Ph.D.** as Deputy Project Manager, and **Luis Ramirez** as Data Quality Management Engineer. This team brings extensive experience delivering multi-jurisdiction pavement management programs using MTC-compliant methodologies and StreetSaver.

A project kick-off meeting will be scheduled and conducted within two weeks of receipt of the Notice to Proceed. The kick-off meeting will include representatives from HCAOG and the TAC and will be used to confirm project objectives, review the scope of work, establish communication protocols, finalize the project schedule, and identify key milestones and deliverables. During this meeting, QES will develop a comprehensive list of available and required information, including existing StreetSaver databases, GIS centerline files, historical M&R records, and jurisdiction-specific considerations. Secure file-sharing platforms will be used to facilitate efficient transfer of large electronic datasets as needed.

As part of Task 1, QES will also review the most recent PMP updates and coordinate with HCAOG staff to identify pavement segments that have undergone maintenance, rehabilitation, reconstruction, or surface treatments since the last update. These activities will be verified and incorporated into the StreetSaver database prior to initiating field data collection activities to ensure continuity with historical records and accuracy in subsequent analyses. QES will provide ongoing project coordination and management throughout the duration of the project. Regular coordination meetings will be held monthly or more frequently as needed, and will be conducted to review task status, schedule adherence, and emerging issues. Dr. Keifer will oversee all project management activities and has the authority to adjust schedules, priorities, and staffing resources to maintain progress and meet HCAOG expectations. Project progress, staff hours, and milestones will be tracked internally to support timely completion of all deliverables.

QES maintains a written safety plan and incorporates safety considerations into all field and office activities. Mr. Ramirez, as a member of QES's safety committee, will ensure that safety protocols are followed during all phases of the project. Consistent communication, documented progress reporting, and proactive issue resolution will be central to QES's execution of Task 1 and will set the foundation for successful completion of the remaining tasks outlined in HCAOG's RFP Attachment B.

Task I Deliverable(s)

Task	Deliverable
1.1	Technical memorandum summarizing the results of the meeting.
1.2	Schedule of project meetings and project milestones
1.3	Monthly status updates and invoices.

Task II: Risk Management

Effective risk management is essential to the safe and successful completion of pavement condition surveys and associated field activities for the 2026 Pavement Management System Update. QES will implement proactive risk management practices to protect field personnel, the traveling public, and property throughout Humboldt County, its member jurisdictions, and Tribal lands.

All field activities will be conducted in accordance with QES's written safety program and established field safety protocols. QES will ensure that all field staff are trained in situational awareness, traffic safety, and hazard recognition prior to mobilization. At a minimum, field crews will be equipped with appropriate personal protective equipment, including high-visibility reflective safety vests and other safety gear as required by site conditions.

QES understands that field data collection will occur on active public roadways and in a variety of operating environments. To minimize risk, pavement condition surveys will be conducted using methods that limit exposure to traffic and reduce the need for lane closures. Where traffic control is necessary, QES will provide and maintain appropriate traffic control measures in compliance with applicable standards and at no additional cost to HCAOG, as identified in HCAOG's RFP Attachment B.

Risk management considerations will also include environmental and operational factors. Surveys will be scheduled to avoid unsafe conditions such as inclement weather, poor lighting, or wet pavement surfaces, which can compromise both safety and data quality. Field work will be conducted during daylight hours and adjusted as necessary to account for local conditions, roadway geometry, and traffic volumes.

Oversight of risk management activities will be coordinated through the Project Manager and the Data Quality Management Engineer, who is a member of QES's internal safety committee. Any safety concerns or incidents will be documented and addressed promptly, and corrective actions will be implemented as needed to prevent recurrence. These practices ensure that risk is actively managed throughout the data collection process while maintaining adherence to the project schedule and quality standards.

QES's approach to risk management supports the safe, efficient, and uninterrupted execution of field activities and aligns fully with HCAOG's expectations

Task II Deliverable(s)

Task	Deliverable
2.1	Written agreement of adherence to this task.

Task III: Data Collection and Reporting

Automated Pavement Condition Survey

As pavement engineers, our team understands the need to have complete and accurate pavement condition data in StreetSaver. A primary key to the success of this project is the collection of uniform, accurate, and complete pavement condition data, allowing meaningful budgetary decisions to be made. Items essential to the uniformity and accuracy of pavement distress condition ratings include:

- Clearly defined rating guidelines
- Standardized on-site rating processes
- Trained and experienced pavement rater teams
- Adequate rating time and conditions
- On-site quality control
- Overall quality assurance

Pavement Inventory Validation

To begin the project, we will review HCAOG's existing street inventory list to ensure that street sections meet the following criteria:

- Lengths and widths are reasonable for maintenance or reconstruction efforts
- Pavement condition is similarly uniform through the section
- Section experiences the same general traffic loadings throughout
- Section is of the same pavement type and layer structure

During this process, we will review the street sections via Google Earth images to confirm the criteria listed above. We will develop a list of street sections which we believe should be modified to discuss with City staff prior to making any changes. This subtask will serve as the basis for data collection as well as the foundation for reporting the pavement conditions and developing the M&R list in the seven-year plan. QES has developed software that can quickly compare the inventory list to a GIS map. After running the software, each site will be checked for functional classification, surface type, length, width, and number of lanes. This is accomplished by comparing it to Google Earth images.

When QES staff believe any of the current management sections should be modified, divided, or possibly combined with adjoining sections, Dr. Nobakht will coordinate with City staff for approval before any changes are made. At the conclusion of this effort, a section list and corresponding GIS map will be provided to HCAOG for approval, prior to beginning the



QES Data Collection Setup

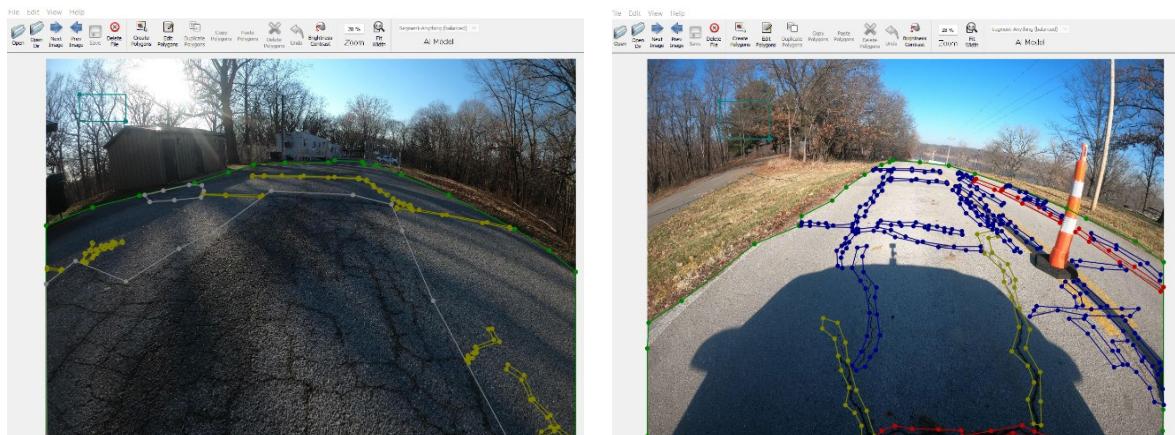
pavement condition ratings. The updated GIS map will be linked to the StreetSaver software for enhanced reporting.

Pavement Surface Condition Survey

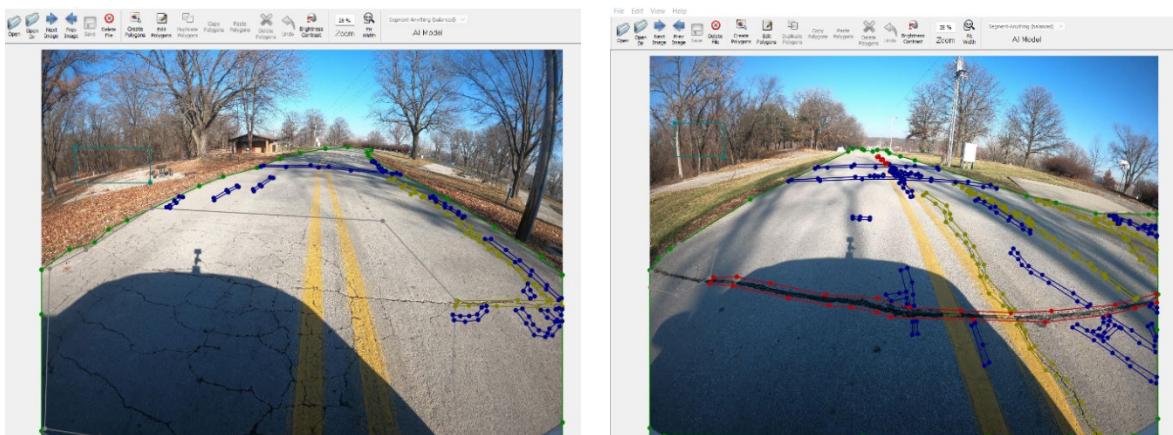
One of QES's greatest strengths lies in our ability to capture pavement condition data across the **entire roadway width in a single pass**, rather than being restricted to just one lane at a time. Older systems, such as LCMS-2, are limited in scope because they can only survey a single lane per run. This limitation not only increases collection time and costs but also produces fragmented datasets that make it harder to achieve a true understanding of network-wide conditions.

In contrast, the QES system can collect data for all lanes simultaneously while maintaining exceptional accuracy and resolution. This capability reduces field time and delivers significant cost savings to our clients. More importantly, it ensures that the resulting dataset provides a complete and continuous picture of pavement conditions across the full roadway width, eliminating blind spots that other systems inherently miss.

What truly sets QES apart is the integration of our state-of-the-art sensors with proprietary AI-driven detection algorithms. Our team of Data Scientists, led by **Dr. Mostafa Nakhaei**, collaborated with **USACE to develop the industry's first solution** to capture and analyze pavement conditions from curb to curb with unparalleled precision. This means every crack and surface anomaly is identified and measured consistently, providing agencies with the confidence that their pavement management decisions are based on the most accurate and comprehensive data available. The following images showcase examples of our system's performance in the field:



Example Rated Pavement Images



Example Rated Pavement Images (continued)

QES will complete the pavement condition ratings following ASTM D6433-23. Each defined street section will be divided into inspection units, with each inspection unit having an area of 2500 square feet (+/- 1000 square feet). For example, if a street section is 1000 feet long and 30 feet wide, then this street section will have 12 inspection units (1000x30/2500). We will survey 100% of the surface area using our sensors, perform quality control on 100% of the automated data collected, and conduct an engineering review of at least 10% of the inspection units. In addition to distress types, severities, and quantities, the survey includes verification of road lengths, widths, surface types, and functional classification.

Pavement Subsurface Condition Survey (Optional)

QES will perform a network-level deflection survey across HCAOG using a Falling Weight Deflectometer (FWD). Traditionally, analyzing FWD data required coring or GPR testing to determine the Effective Structural Number (S_Neff). While this approach is feasible at the project level, collecting pavement thickness data across an entire network is nearly impossible. To overcome this challenge, QES has developed a proprietary machine learning algorithm that calculates S_Neff without requiring thickness as an input. This innovation makes QES one of the very few companies capable of accurately calculating S_Neff at the network level.

QES will conduct one test every 500 feet or a minimum of one deflection tests per block/test section on all major streets (Arterials & Collectors). We will record sensor responses under standardized loading conditions and correct and normalize data for load (9000 kip) and temperature (68°F) to ensure consistency.

QES will compute and report key deflection parameters, including:

- Effective Structural Number (SNeff)
- Required Structural Number (SNreq)
- Temperature (used for accurate measurements)
- Surface Curvature Index (SCI8, SCI12, etc.) [optional]
- Maximum Normalized Deflection, D1 (normalized to 40 kN and temperature of 20°C) [optional]
- Normalized Deflections (normalized to 40 kN) [optional]
- Subgrade Resilient Modulus (MR) [optional]
- Effective Pavement Modulus (EP) [optional]

Our approach combines structural evaluation (FWD) with surface condition data (PCI, distresses) to give HCAOG a true, network-level picture of pavement performance. This ensures that capital improvement decisions are based on both functional and structural capacity, maximizing the return on investment for roadway maintenance and rehabilitation.

PCI Calculation and Analysis

QES calculates PCI using a combination of automated data collection and engineering review. QES collects full-width, high-resolution imagery of the pavement. Our AI tools automatically identify and classify all surface distresses by type, severity, and extent. Deduct values are then applied per ASTM D6433, and QC is performed by certified distress raters to ensure accuracy. This process produces reliable PCI scores for each inspection unit and the overall network. This method allows QES to provide cities with a comprehensive pavement condition assessment, ensuring detailed surface distress evaluations.

Asphalt Evaluation

QES applies the full-width, high-resolution data collection philosophy to asphalt concrete (AC) pavements, providing a comprehensive and highly reliable assessment of surface condition across the entire roadway, from curb to curb. Unlike legacy systems that focus primarily on the wheel paths, the QES system captures the full pavement width, ensuring that distresses occurring outside the traveled lanes—such as edge cracking, longitudinal cracking near gutters, utility patching, and localized surface deterioration—are fully documented and incorporated into the evaluation.

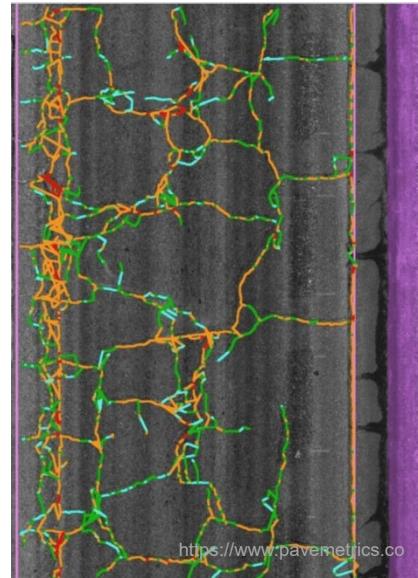
This approach is particularly important for asphalt pavements, where early-stage distresses often initiate outside the wheel paths and progressively migrate inward. By capturing these conditions at an early stage, QES enables agencies to identify emerging maintenance needs before deterioration accelerates, supporting more cost-effective preservation strategies and more accurate PCI scoring.

Asphalt Distress Identification and Measurement

Using automated, high-resolution pavement imagery and advanced distress detection algorithms, the QES system identifies and quantifies all visible asphalt surface distresses in accordance with ASTM D6433 visual distress concepts. Distresses are detected, classified, and measured consistently across the network, with results subjected to rigorous quality control by experienced pavement engineers.

For asphalt pavements, the QES methodology supports the identification and reporting of the following distress categories:

- **Cracking:**
Crack lengths are identified and classified by type, including transverse cracking, longitudinal cracking, and alligator (fatigue) cracking. Automated detection captures crack geometry across the full pavement width, while post-processing rules ensure accurate measurement of crack length and density. Severity levels are assigned based on standardized criteria and verified through independent quality control reviews.
- **Patching and Repairs:**
Patching and repair areas are automatically detected and reported, including both the **count** of patches and their **total surface area**. Full-width imagery ensures that patches near pavement edges, in parking lanes, and around utility corridors are captured with the same fidelity as those in the wheel paths.
- **Potholes:**
Potholes are identified as discrete surface distresses and reported by **count** and **total surface area**, with severity levels assigned based on observable characteristics. Automated detection is supplemented by engineer review to ensure consistent differentiation between potholes, patching, and other surface anomalies.
- **Surface Texture and Material Loss Indicators:**
The QES system evaluates surface characteristics associated with asphalt material degradation, supporting the calculation of raveling-related indicators and surface deterioration metrics (This is not fully supported by legacy systems such as LCMS-2). These outputs provide insight into surface integrity and aging trends that influence long-term pavement performance and maintenance prioritization.



Quality Control and PCI Integrity

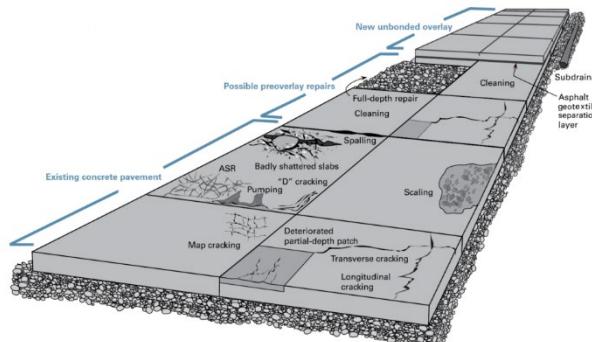
All automated asphalt distress detections undergo structured quality control by certified pavement engineers to confirm distress type, severity, and quantity. This hybrid automated-plus-engineer-reviewed process ensures that the resulting PCI values accurately represent true pavement condition and are consistent with ASTM D6433 intent.

By combining full-width, high-resolution data collection, automated asphalt distress detection, and rigorous quality assurance, QES delivers a pavement condition dataset that is both comprehensive and defensible. This methodology minimizes the risk of missed distresses,

reduces subjectivity, and provides HCAOG with a high-confidence foundation for pavement maintenance planning, budget forecasting, and long-term asset management decisions.

Concrete Evaluation

QES operates what is believed to be the first system capable of full-width, high-resolution pavement data collection, allowing for an evaluation process for Portland Cement Concrete that is both simpler and more accurate than legacy systems like LCMS-2. Unlike older systems that only collect data in the travel lane, our curb-to-curb approach captures the entire pavement surface, ensuring that distresses outside the wheel paths are identified. This is particularly critical for PCC pavements, where conditions can vary dramatically from slab to slab and localized distresses such as corner breaks, joint spalling, or faulting can significantly impact pavement performance.



Our full-width data collection not only improves the detection of localized distresses but also ensures more accurate PCI scoring, reducing the likelihood of underestimating deterioration or missing early signs of structural issues. The QES system automates the identification and classification of all visible distresses, while our certified engineers perform quality control to verify the automated results, following ASTM D6433 guidelines for visual assessment of concrete segments.

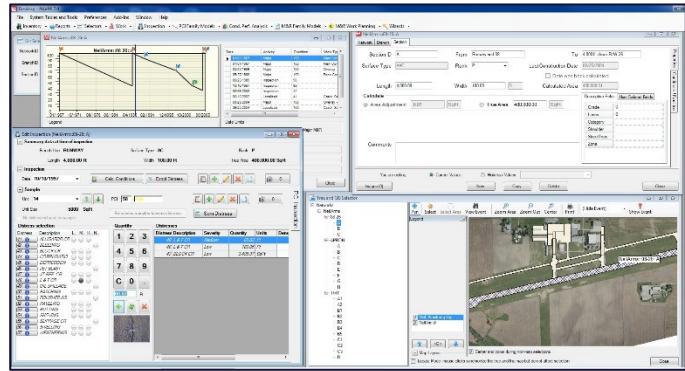
Jointed concrete pavements (JCP), constructed with PCC, perform differently than asphalt concrete pavements. Thus, it is important that streets with JCP within the layer structure are adequately identified. When JCP is the surface, this is easy, however many of the older JCP have likely been overlaid with asphalt concrete pavement which can be more of a challenge. There are several keys to look for when identifying composite pavements (JCP overlaid with asphalt concrete). The cracking is typically reflective cracking over the transverse and longitudinal cracks, which are exhibited as straight cracks. Additionally, the surface layer is typically above the surrounding features, due to the asphalt overlay. Other signs are faulting at the transverse cracks, corner slab reflective cracking and reflective longitudinal cracks. Furthermore, composite pavements can be readily identified with the deflection data. The JCP and composite pavements will need to have their own decision trees in StreetSaver, which QES will develop.

For Continuously Reinforced Concrete Pavement (CRCP), we apply a proprietary QES procedure that ignores cracks narrower than the ASTM threshold, ensuring that intentional, designed cracks inherent to CRCP do not negatively influence the PCI score. This is a critical distinction because it prevents misclassification of healthy CRCP sections as deteriorated, a common limitation in older automated systems.

By combining full-width, high-resolution data capture, automated distress detection, and engineer-verified quality control, QES provides cities with the most complete and reliable assessment of PCC conditions available today. Our methodology not only meets industry standards but enhances them, giving HCAOG confidence that pavement maintenance decisions will be based on accurate, actionable, and network-wide data, maximizing the effectiveness of capital improvement investments.

GIS Integration and StreetSaver Analysis & Update

QES will deliver a fully GIS-integrated pavement condition dataset to support HCAOG in managing its transportation assets efficiently. By combining full-width pavement surveys, deflection data, and automated distress detection with spatial mapping, HCAOG will have a comprehensive, easily accessible, and actionable view of pavement performance across the network.



1. Data Georeferencing

- All pavement survey data (PCI distresses, structural indices, FWD results) will be georeferenced using GPS coordinates collected during field surveys.
- Each inspection unit or pavement segment will be assigned a unique GIS identifier to maintain consistency across datasets.

2. GIS Layer Creation

- QES will generate GIS layers for:
 - ✓ Pavement Type (PCC, AC, AC over PCC)
 - ✓ PCI scores (unit, section, network-level)
 - ✓ Structural indices (SNeff, SNreq, LTE, SCI, etc.)
 - ✓ Distress locations and severity
 - ✓ Recommended maintenance or rehabilitation treatments

3. Attribute Tables

- Each GIS feature will include a comprehensive attribute table with:
 - ✓ Unique segment ID
 - ✓ Pavement type and age
 - ✓ PCI and other condition indices
 - ✓ Structural parameters from FWD (SNeff, SNreq, D0, D1, SCI, etc.)
 - ✓ Distress type, severity, and extent
 - ✓ Recommended treatment and priority

4. Integration with City Systems

- All GIS layers will be fully compatible with HCAOG's GIS platform and StreetSaver asset management system.
- QES can provide data in shapefile, GeoPackage, or other standard formats for easy import and integration.

5. Visualization and Analysis Tools

- Color-coded maps to visualize:
 - ✓ Network-level PCI conditions
 - ✓ Pavement structural adequacy (SNeff vs SNreq)
 - ✓ Distress hotspots for targeted maintenance
- Heatmaps and dashboards can be provided to help planners quickly identify critical areas and prioritize funding.

StreetSaver Analysis & Reporting

QES delivers targeted analysis and reporting services focused on supporting pavement maintenance planning that is just as proactive as it is cost-effective. By using validated PCI data, distress trends and remaining service life modeling within StreetSaver, our team evaluates current network conditions, identifies optimal maintenance and rehabilitation strategies, and quantifies funding needs under multiple budget scenarios. QES develops clear, defensible reports that translate StreetSaver outputs into actionable maintenance programs analyses and recommendations are fully documented and reproducible, ensuring agencies can confidently use the results to support annual work plans, capital improvement programs, and long-term asset management objectives.

Limitations of StreetSaver

QES recognizes the limitations of StreetSaver that can sometimes make its final recommendations less practical for developing Capital Improvement Programs (CIP). Specifically, StreetSaver cannot incorporate structural data collected via FWD into its decision-making process, nor can it directly utilize IRI information. Additionally, its decision trees lack the flexibility to account for more complex scenarios that may exist within a pavement network.

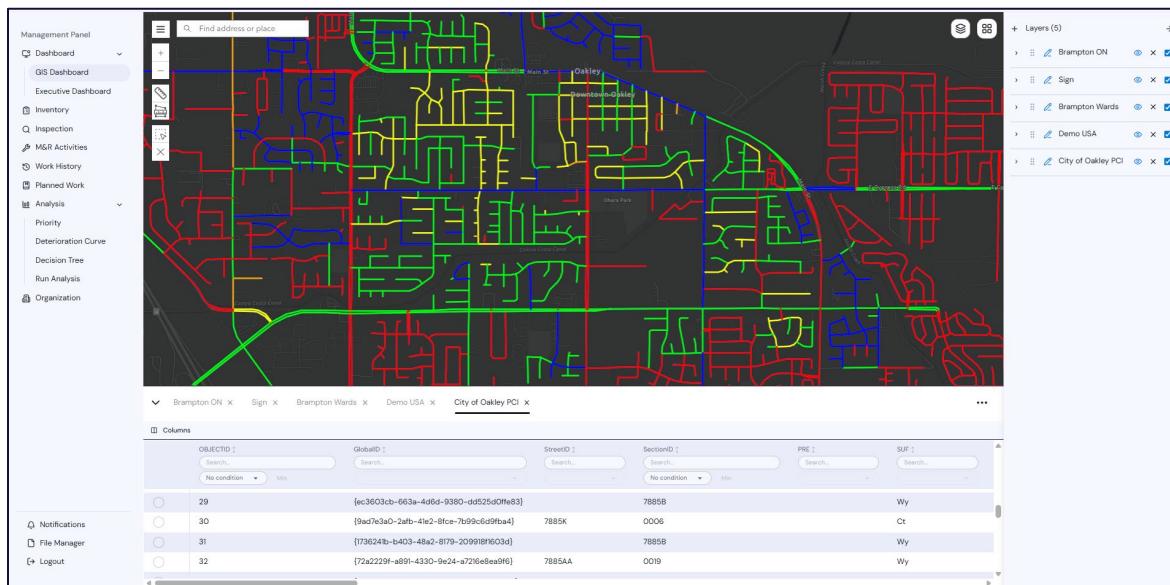
Therefore, in addition to StreetSaver and GIS deliverables, QES proposes SAMS web application as a complementary tool to help with a more comprehensive asset management solution. SAMS will be provided at no extra charge to HCAOG for one year. We will deploy an optimized instance of SAMS, providing HCAOG with advanced maintenance and rehabilitation planning tools.

The primary objective of SAMS is to deliver a user-friendly, GIS-centric pavement and asset management program that is agnostic to any underlying rating system. Whether the asset is pavement, sidewalks, traffic signs, or other infrastructure, SAMS enables users to upload and manage all GIS layers in one location. The system's architecture is designed to ingest any data in any format, without the constraints typically found in commercial software. For example, pavement inspection data may be collected using ASTM D6433, ASTM E3303, or a combination of both; SAMS can seamlessly import and analyze this data with no extra processing. This flexibility enables rapid assessment of current network health and facilitates data-driven, cost-effective maintenance and rehabilitation programs that maximize available resources while extending asset service life.

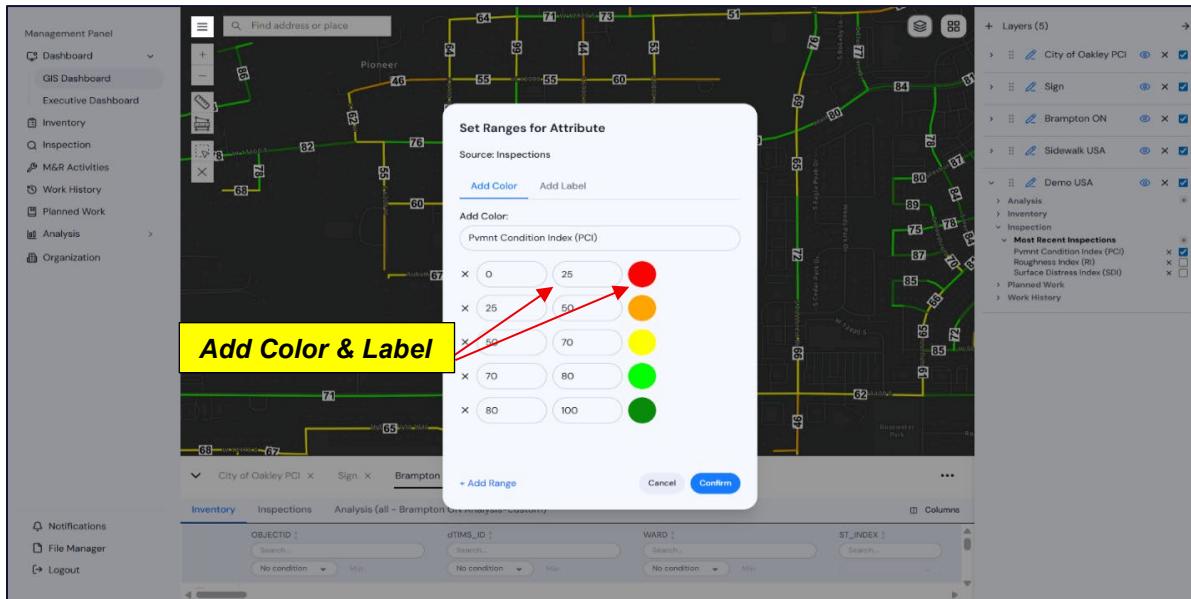
SAMS Introduction – Free StreetSaver Enhancement Tool

SAMS is the next-generation, GIS-centric Enterprise Asset Management (EAM) platform purpose-built to meet the complex infrastructure demands of State DOTs and Municipalities. We replace fragmented legacy systems by consolidating all public assets into a single, intuitive environment. SAMS delivers unprecedented analytical power, enabling engineers and leadership to execute sophisticated predictive modeling and budget scenario planning, resulting in optimized capital expenditure, verifiable compliance, and significantly extended asset lifecycles.

SAMS meets all functional and technical requirements outlined in HCAOG's Scope of Services. The system is designed to offer ease of use, transparent analytical logic, and the ability to store, visualize, and model pavement condition data in a format accessible to City staff with minimal training requirements. The platform combines the analytical rigor of advanced pavement management systems with intuitive navigation commonly associated with spreadsheet-based environments.



SAMS GIS Dashboard



Add labels, color-coded symbology visually representing asset condition

SAMS is a fully **agnostic** platform designed to seamlessly integrate diverse pavement evaluation methodologies into a single, actionable management plan. SAMS standardizes these inputs to provide a comprehensive view of your infrastructure.

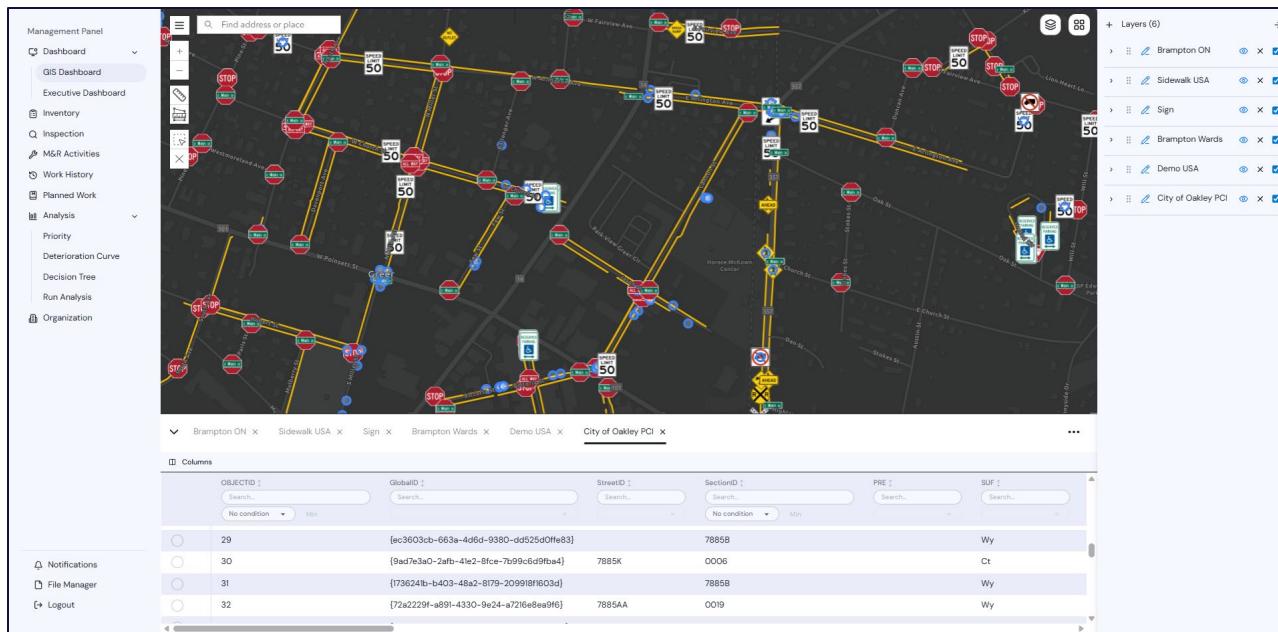
Methodology Agnostic: SAMS can process manual PCR data collected through windshield surveys as well as automated PCI data captured. SAMS is truly agnostic to the underlying rating system.

Unified Analysis: The system allows for the comparison of historical data alongside modern PCI data entered into StreetSaver systems.

Strategic Modeling: Regardless of the rating source, SAMS generates sophisticated budgetary scenarios and multi-year capital program horizons based on your specific network goals.

By bridging the gap between state-level highway ratings and municipal-level residential data, SAMS ensures that all pavement networks are evaluated with precision and consistency

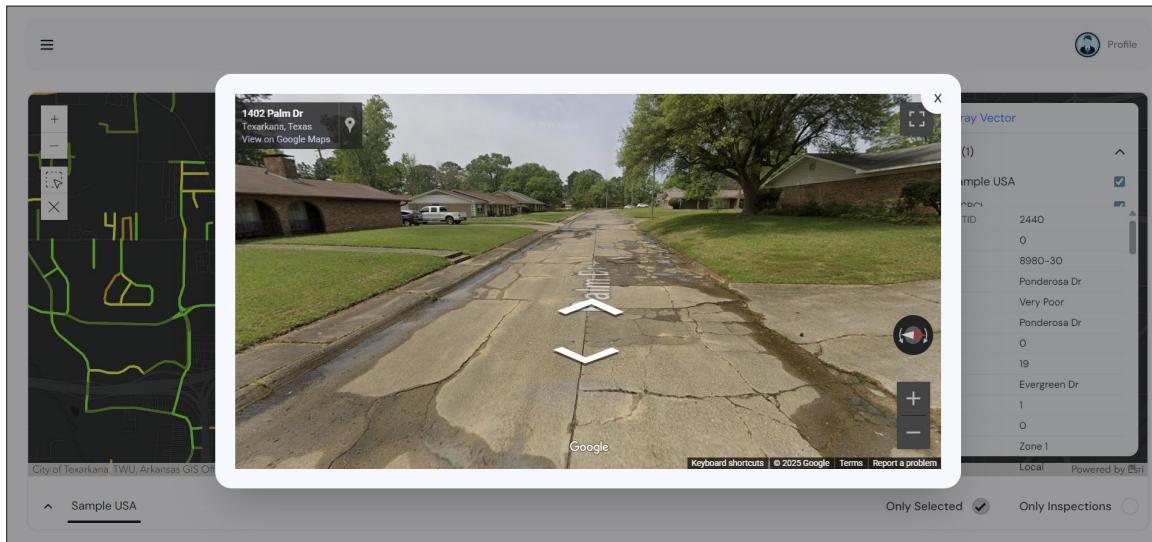
SAMS enables agencies to view pavement data alongside other right-of-way assets and manage them within a single, integrated platform. The system supports management of any asset type, including pavements, sidewalks, signs, and pavement markings using standard shapefiles and Excel files as the only required inputs.



Viewing Assets in SAMS. In this image, sidewalk layer and Signs are turned on together.

Image Viewing Tool

SAMS has a powerful image viewing tool that allow agencies to investigate their data with a single button click.



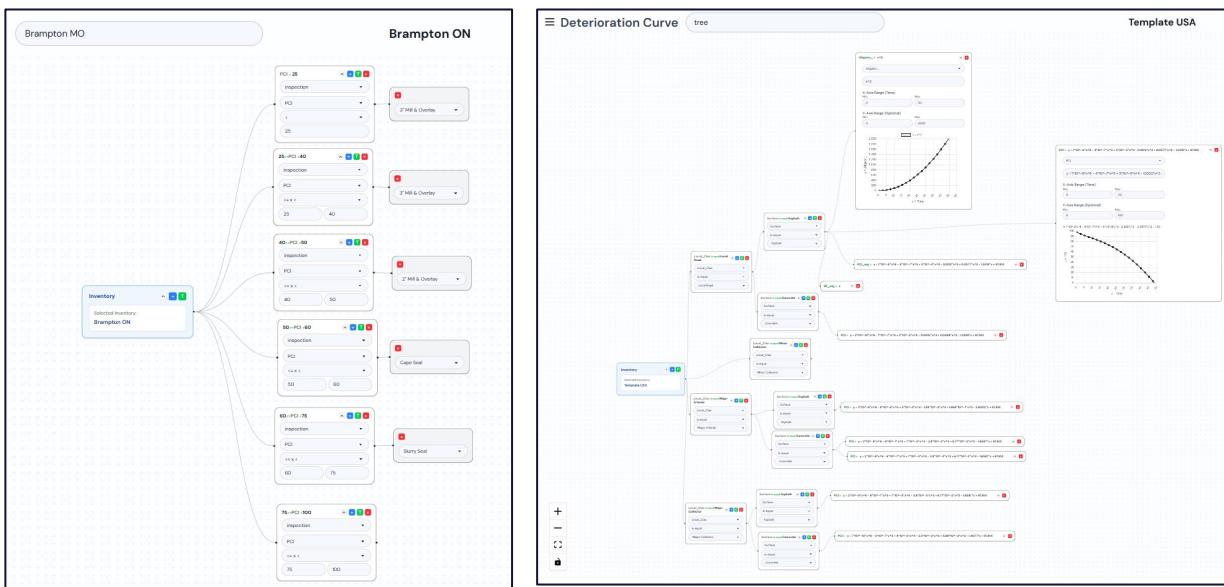
SAMS Image Viewer

Customizable Decision Trees & Deterioration Curves

SAMS includes a fully configurable, visual decision-tree engine that allows agencies to define and apply custom maintenance and rehabilitation strategies based on condition metrics such as PCI, inspection results, or other attributes. As shown in the figure below, users can build, modify,

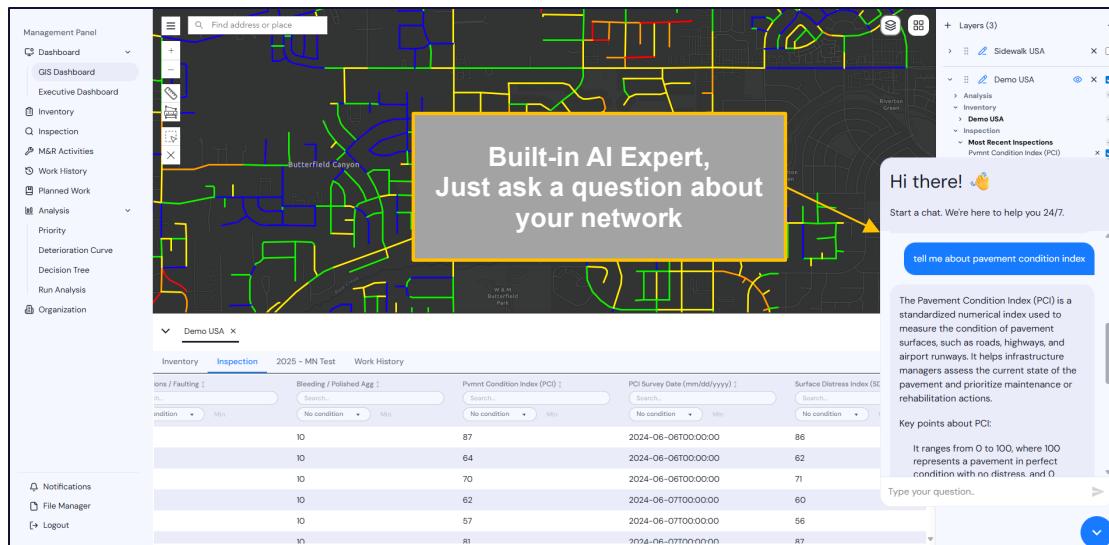
preview, and execute decision trees interactively to generate treatment recommendations tailored to agency-specific policies and practices. This simple decision tree shows how different segments with different PCIs are assigned to different rehab categories. However, users can create complex decision trees that fit their needs.

No two roads age alike. While other systems rely on generalized deterioration curves, SAMS offers granular control, allowing users to define decision trees that factor in varying asset lifecycles. SAMS is uniquely equipped to manage deterioration curves not just on a high-level index (similar to PCI), but on multiple underlying metrics and tracking the growth of specific distresses and the deterioration of structural capacity. This platform is the only solution available that allows users to embed these precise, multi-metric deterioration models directly within the budget optimization decision tree. In the image on the next page you, users can define the rate of increase over time for alligator cracking but rate of degradation in PCI for local roads that are asphalt.



(Above) SAMS Custom Decision Tree & Deterioration Curves

The chatbot interprets the user's question, retrieves the relevant GIS and condition data, and can display results directly on the map or as a summary panel. This capability dramatically reduces the time required to search, filter, or drill into asset records and makes the system accessible even to users with no technical background.



SAMS AI Expert

Another powerful feature of SAMS is the analysis package. SAMS users can generate and assess multiple rehabilitation and maintenance scenarios by considering current budgetary constraints, network performance objectives, and long-term investment goals. These scenarios will allow agencies to compare trade-offs between cost, performance, and risk, enabling them to select a strategy that maximizes roadway condition improvements while staying within financial limitations. Example scenarios may include the following:

- Annual funding required to maintain current pavement conditions.
- Annual funding required to maintain the current network backlog.
- Funding projections needed to achieve and sustain a target PCI over several years.
- Funding projections needed to achieve and sustain a target backlog over several years.
- Minimum funding level required to avoid falling below control PCI limit.
- Minimum funding level required to avoid falling below control backlog limit.
- Future network performance predictions, including the network average PCI and segment level PCI
- Strategic rehabilitation recommendations for pavement treatments based on the current budget.

A PMP can be developed through close collaboration among City stakeholders, key municipal staff, and QES pavement management experts. This collaborative process ensures that local knowledge and agency priorities are incorporated into the final SAMS™ PMS. The QES pavement engineer will work with HCAOG to select and define the analysis parameters. These include:

- **Analysis Period** – Standard analysis period is 5 years but there is no limitation.
- **Road Maintenance Budget** – A single annual value in \$/year (may vary across years).
- **Rehabilitation Types and Unit Rates** – Costs provided in \$/SY for each rehab type.
- **Completed Work** – Details of any work performed after the survey but before the analysis start date, including rehab type and date; data should be provided in a GIS-compatible format (shapefile, geodatabase, or list of Unique ID).
- **Planned Work** – Details of any work planned after the analysis start date (e.g., CIP or other future work), including rehab type and date; data should be provided in a GIS-compatible format (shapefile, geodatabase, or list of IDs).
- **Project Groupings** – Groupings based on proximity, functional class, pavement type, and similar conditions (e.g., PCI spread ≤ 20 and PCI < 40).

Task III Deliverable(s)

Task	Deliverable
3.1	Inventory and condition information for each paved road and street by jurisdiction.
3.2	Photographs of each condition throughout the county.
3.3	Data entered into PMS database, and provided in GIS format.

Task IV: Review Maintenance and Rehabilitation Strategies

Maintenance and Rehabilitation Planning

QES will develop an annual, data-driven Maintenance and Rehabilitation Plan that translates HCAOG's pavement condition data into a clear, defensible, and budget-aligned strategy for preserving HCAOG's roadway network. Using validated PCI results, distress data, and historical maintenance records, QES will identify pavement needs across all roadway segments and prioritize them based on condition, functional classification, severity of deterioration, and HCAOG's operational priorities.

Segment-Level Prioritization

QES will reassess every roadway segment and rank those needing prioritization by using a consistent and transparent methodology. Prioritization will consider (but not limited to):

- PCI score and distress type/severity
- Functional Classification
- Network continuity and corridor importance
- Recent maintenance history
- Utility coordination and known capital project conflicts
- Any other factor that HCAOG considers

This ensures that HCAOG invests in the right treatments at the right time, maximizing pavement life and minimizing long-term costs.

Treatment Strategy Development

QES will recommend the optimal treatment for each segment based on condition, material type, and lifecycle return. Recommendations may include (but not limited to):

- Crack sealing
- Rejuvenators or surface treatments
- Slurry seal / micro surfacing / Cape Seal
- Mill and overlay (edge mill / full depth)
- Full-depth reclamation or reconstruction

For each recommended treatment, QES will provide segment-level cost estimates, expected service life extension, and recommended timing. These segment level costs will be extracted from recent bids or from national averages, if not available in HCAOG.

Budget-Aligned Planning and Scenario Analysis

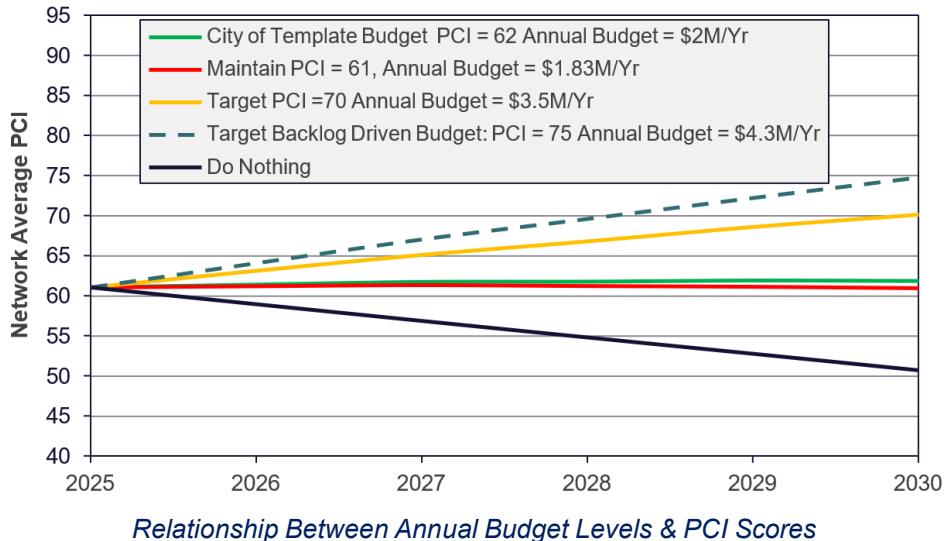
QES will recommend the optimal treatment for each segment based on condition, material type, and lifecycle return. Recommendations may include (but not limited to):

- Crack sealing
- Rejuvenators or surface treatments
- Slurry seal / micro surfacing / Cape Seal
- Mill and overlay (edge mill / full depth)
- Full-depth reclamation or reconstruction

For each recommended treatment, QES will provide segment-level cost estimates, expected service life extension, and recommended timing. These segment level costs will be extracted from recent bids or from national averages, if not available in HCAOG. QES will develop a multi-year Maintenance and Restoration Plan that matches treatments to HCAOG's annual budget. Using SAMS analytics, QES will prepare:

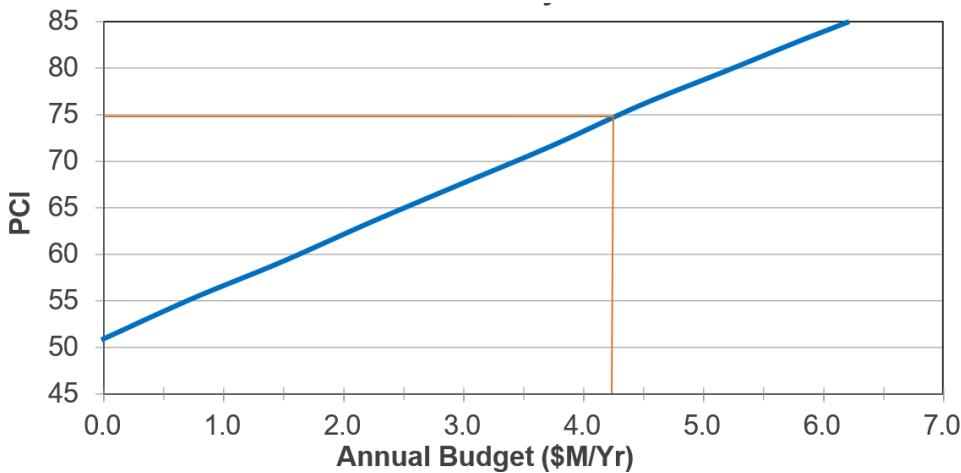
- Funded Scenario: Optimal set of treatments within HCAOG's annual allocation
- Reduced Funding Scenario: Impacts of constrained budgets on network condition and backlog
- Ideal Funding Scenario: Investment required to improve or stabilize the network long-term

The next two Figures present example outputs from our multi-scenario funding analysis. The graph below highlights that an annual investment of \$4.3M (dashed line) increases the network PCI to 75, whereas a \$2M annual investment results in a PCI of 62, only one point higher than today's overall condition. This demonstrates how budget decisions directly influence long-term pavement performance.



Relationship Between Annual Budget Levels & PCI Scores

The next graph is another example output from our analysis that demonstrates the relationship between annual budget levels and resulting PCI scores. This example clearly shows how different investment levels translate into long-term pavement conditions, providing a straightforward and compelling way to communicate funding needs to Council and other decision-makers. These scenarios give City leadership clear visibility into the consequences of various funding levels and support transparent capital planning.



Relationship Between Annual Budget Levels & PCI Scores

Using the updated StreetSaver database, calibrated deterioration models, and City-approved decision trees, QES will develop a comprehensive set of pavement management analyses and funding scenarios. At a minimum, the analyses will include the following:

- Annual funding required to maintain current pavement conditions, defined as the funding level necessary to prevent further deterioration of the existing network-wide average PCI.
- Annual funding required to maintain the current network backlog, identifying the funding level needed to prevent growth of deferred maintenance and rehabilitation needs.
- Funding projections required to achieve and sustain a target network PCI over several years.
- Funding projections required to achieve and sustain a target backlog level over several years.
- Identification of the minimum annual funding level required to avoid falling below a defined control PCI threshold.
- Identification of the minimum annual funding level required to avoid falling below a defined control backlog threshold.
- Future network performance predictions, including projected network-wide average PCI and segment-level PCI forecasts, assuming current funding levels remain unchanged over a multi-year analysis period.
- Strategic rehabilitation and preservation recommendations based on the current budget, optimized through cost-benefit analysis to maximize network performance and return on investment.
- Analysis of pavement conditions and investment needs by logical project groupings, including pavement type, condition range, functional classification, geographic proximity, and similar performance characteristics.
- Integration of structural data when available, allowing StreetSaver deterioration curves to be automatically adjusted based on segment-level structural condition indicators.
- Application of alternative decision trees for structurally tested segments, integrating both surface condition indices (PCI) and pavement structural indices to generate a robust pavement management plan.

Deferred maintenance analyses will also be conducted for each scenario to evaluate the long-term cost implications of postponing M&R treatments and the resulting impact on network condition and backlog growth.

The effects of each budget scenario on pavement condition and treatment selection will be illustrated through GIS-based maps and summarized in a draft PMP provided to HCAOG for review. The draft PMP will include the following sections:

1. Title Page
2. Table of Contents
3. List of Tables
4. List of Figures
5. List of Appendices
6. Executive Summary
7. Statement of Study Objectives
8. Methodology of Study and Analysis
9. StreetSaver PCI Summary Report
10. PCI Distribution by Functional Classification
11. PCI Distribution by Percent Area of Network
12. Network PCI Comparison with Surrounding Agencies
13. Funding sources and needs to reach target PCI over time
14. Multi-Year Management and Financial Plans for current funding levels
15. Multi-Year Management and Financial Plans for additional funding levels
16. Map of Inspected PCI by Section
17. Map of Proposed Treatment by Section
18. Pavement Management Practices
19. Recommendations
20. Quality Management Plan

The draft PMP report will be submitted HCAOG personnel in electronic format for review. Dr. Nobakht will address all comments and corrections suggested by HCAOG. Once finalized, QES will deliver a full-color, professional-quality final report electronically via SharePoint or Dropbox. HCAOG will also have access to the updated StreetSaver pavement management database.

Dr. Nobakht will develop an executive summary presentation in PowerPoint under the direction of City staff, summarizing the pavement management process, updated PCI results, decision tree development, benefit-cost analyses, multi-year funding strategies, and implementation recommendations. Dr. Nobakht or Dr. Keifer will be available to present the findings to City personnel and/or elected officials.

The QES team brings extensive experience in pavement maintenance and rehabilitation planning and has completed multiple research studies evaluating the cost-effectiveness of surface treatments, preservation strategies, and rehabilitation alternatives. QES will review local bid histories, survey regional contractors, and consult with peer agencies to ensure that all unit cost data used in StreetSaver reflect realistic and current market conditions.

At the conclusion of the study, Dr. Nobakht will develop management and financial plans using historical and projected annual funding levels over a **multi-year planning horizon**. A comprehensive needs analysis will be completed to identify all required treatments independent of budget constraints. Treatments and associated costs will be summarized by segment, by year, and over the full analysis period.

Task IV Deliverable(s)

Task	Deliverable
4.1	Maintenance and rehabilitation decision trees.

Task V: Final Reports

Final PMP reports are the primary decision-support deliverables for the 2026 Pavement Management System Update. These reports must clearly communicate existing pavement conditions, forecast future performance, and illustrate the impacts of alternative funding strategies in a format that is technically sound, transparent, and accessible to both engineering staff and policy makers. QES will prepare draft and final PMP reports for each of the participating jurisdictions, including the County of Humboldt, the member cities, and applicable roadway networks on Tribal lands, in accordance with HCAOG's RFP Attachment B requirements.

Each report will be developed using data housed in StreetSaver and will include, at a minimum: an executive summary; network inventory summaries; PCI results; M&R history reports; updated M&R decision trees; unit cost assumptions; and budgetary analyses. The executive summaries will be written for a non-technical audience and will highlight key findings, system needs, and funding implications.

A central element of Task 5 is the development of multiple budget and funding scenarios. QES understands that HCAOG requires a minimum of four scenarios, to be defined and confirmed during the kick-off meeting. These scenarios will evaluate the impacts of varying annual funding levels on network conditions, backlog growth, and long-term sustainability. QES will work closely with HCAOG staff and the Technical Advisory Committee to ensure that scenario assumptions reflect local maintenance practices, realistic cost structures, and jurisdiction-specific priorities while remaining consistent across the region.

All reports will incorporate multi-year work plans that translate analytical results into actionable programs. These work plans will identify recommended treatment types, approximate timing, and associated costs, providing agencies with a clear roadmap for implementing preservation and rehabilitation strategies over the planning horizon. QES will ensure that recommended treatments are aligned with the approved decision trees and that results are traceable back to underlying condition data and assumptions.

Draft reports will be submitted to HCAOG for review and comment prior to finalization. QES will incorporate consolidated comments from HCAOG and its member agencies, document any substantive revisions, and prepare final reports suitable for presentation and long-term reference. Upon completion, the updated PMS databases and supporting analysis files will be finalized and delivered in accordance with HCAOG requirements.

Through this approach, QES will deliver final PMP reports that are defensible, consistent, and directly usable for capital programming, budget development, and policy discussions across Humboldt County and its member jurisdictions.

Task V Deliverable(s)

Task	Deliverable
5.1	Draft and final reports.
5.2	Updated PMS database.



Task VI: Presentation of Completed Pavement Management System Update

Delivering well-structured presentations is a critical component of the 2026 Pavement Management System Update. The presentation phase serves as the bridge between technical analysis and informed decision-making and must be tailored to both technical staff and policy makers.

QES will prepare and deliver two formal presentations upon completion of the PMS update: one for the TAC and one for HCAOG Board. Each presentation will be developed using consistent underlying data and analysis while being customized in content, depth, and terminology to suit the intended audience.

The TAC presentation will be detailed and technically focused, addressing pavement condition survey results, PCI distributions, maintenance and rehabilitation decision trees, unit cost assumptions, and budget scenario outcomes. QES will review methodology, key assumptions, and analytical results to ensure TAC members fully understand the technical basis of the PMS update and can confidently support its use for agency planning purposes.

The HCAOG Board presentation will be structured for a non-technical audience and will focus on high-level findings, trends in pavement condition, funding needs, and the implications of alternative investment strategies. QES will clearly illustrate how different funding scenarios affect long-term pavement performance and backlog growth, supporting transparent and informed policy discussions. Graphics, charts, and summary tables will be used to convey complex information in a clear and accessible manner.

Both presentations will be delivered using PowerPoint or a similar format and will be coordinated with HCAOG staff to confirm scheduling, content emphasis, and presentation logistics. QES will incorporate feedback received during the presentation process and provide final presentation materials for HCAOG's records and future reference.

Through this approach, QES will ensure that the results of the 2026 Pavement Management System Update are effectively communicated, well understood, and ready to support technical planning and policy-level decision-making across Humboldt County and its member jurisdictions.

Task VI Deliverable(s)

Task	Deliverable
6.1	TAC presentation (PowerPoint).
6.2	HCAOG Board presentation (PowerPoint).

Task VII: Training

The QES Team will offer our expertise practical, hands-on instruction that enables participants to independently manage pavement data, perform analyses, and generate reports using StreetSaver.

QES will provide one full day of training, delivered virtually via Microsoft Teams, Zoom, or a comparable platform, in accordance with HCAOG's RFP Attachment B requirements. The training will be structured to address varying levels of user experience and will focus on both fundamental and advanced StreetSaver functionality. Training topics will include pavement

inventory and condition data entry and editing; PCI calculations; maintenance and rehabilitation history tracking; development and evaluation of budget scenarios; generation of standard and custom reports; and use of GIS-related tools available within StreetSaver.

Training will be led by senior QES pavement management professionals with extensive experience supporting municipal and regional agencies using StreetSaver. The session will emphasize real-world application, using data from the HCAOG PMS update to demonstrate workflows that staff are likely to perform during ongoing system use. Time will be allocated for questions and discussion to ensure participants can apply the tools effectively following the training.

QES will prepare and provide training manuals and reference materials to support the session and serve as a long-term resource for HCAOG and its member agencies. These materials will document step-by-step procedures, key concepts, and common use cases, enabling staff to revisit the training content as needed.

Through this training approach, QES will support HCAOG's goal of maintaining a sustainable, user-driven pavement management program and ensure that the benefits of the 2026 PMS Update extend well beyond project completion.

Task VII Deliverable(s):

Task	Deliverable
7.1	Training manuals

Proposed Project Schedule

Task	Activity	Month/Week																																
		March				April				May				June				July				August				September				October				
10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44
1	Project Initiation <i>Milestone(s): NTP Issuance, Project Kickoff Meeting w/ TAC, Submit Project Management Deliverables</i>	◆																																
2	Data Preparation & Risk Management <i>Milestone(s): Review Existing Data, Confirm Risk Mgmt & Safety Compliance</i>		◆					◆																										
3	Data Collection & Validation <i>Milestone(s): Field Collection, Pavement Condition Surveys, Data Review & QC, Entry into StreetSaver</i>						◆										◆																	
4	Analysis & Strategy Development <i>Milestone(s): M&R Strategy Review Meeting, Develop Budget Scenarios & Multi-Year Work Plans</i>										◆								◆															
5	Reporting & Review <i>Milestone(s): Submit Draft PMP Reports, HCAOG Review, Submit Final PMP Reports</i>																						◆											
6	Presentations <i>Milestone(s): TAC Presentation, HCAOG Board Presentation</i>																								◆									
7	Training <i>Milestone(s): Conduct StreetSaver Training</i>																									◆								
NA	Project Closeout <i>Milestone(s): All Reports, Databases, GIS Files, Training Materials Accepted, Issue Final Invoice</i>																															◆		

Task Duration (incl. review time)

Meeting with HCAOG and/or Member Agencies

◆ Milestone Deliverables

COST PROPOSAL

This Page is Intentionally Blank. QES's Cost Proposal is Located on the Next Page.

LABOR COSTS				Task 1		Task 2		Task 3		Task 4		Task 5		Task 6		Task 7		Task 8		TOTALS		
Project Staff	Role in Study	% Time	Rate (\$/hr)	Proj. Mgmt.		GIS Verif.		PCI Survey		PCI QC/QA		Rehab. Analysis		Reporting		Presentations		Training		HRS	COST (\$)	
				Hrs	Cost	Hrs	Cost	Hrs	Cost	Hrs	Cost	Hrs	Cost	Hrs	Cost	Hrs	Cost	Hrs	Cost			
Kurt Keifer	Project Manager		\$115.00	8	\$920		\$0	4	\$460		\$0	8	\$920	8	\$920	12	\$1,380	4	\$460	44	\$5,060	
Carlos Cary	Senior Engineer		\$68.85		\$0		\$0		\$0		\$0		\$0		\$0		\$0		\$0	0	\$0	
Mona Nobakht	Dept. PM		\$67.30	24	\$1,615	4	\$269	16	\$1,077		\$0	192	\$12,922	192	\$12,922	24	\$1,615	12	\$808	464	\$31,228	
Luis Ramirez	Data Quality Mgmt.		\$64.60		\$0		\$0		\$0	24	\$1,550	16	\$1,034	16	\$1,034		\$0		\$0	56	\$3,618	
Matthew Baker	Staff Engineer		\$36.30		\$0	24	\$871	70	\$2,541		\$0		\$0		\$0		\$0		\$0	94	\$3,412	
Jason Clinton	Senior Technician		\$31.15		\$0		\$0	70	\$2,181		\$0		\$0		\$0		\$0		\$0	70	\$2,181	
LABOR HOURS/COSTS				32	\$2,535	28	\$1,140	160	\$6,259	24	\$1,550	216	\$14,876	216	\$14,876	36	\$2,995	16	\$1,268	728	\$45,499	
Escalation				0.000%		\$0		\$0		\$0		\$0		\$0		\$0		\$0		\$0	\$0	
TOTAL LABOR COSTS				32	\$2,535	28	\$1,140	160	\$6,259	24	\$1,550	216	\$14,876	216	\$14,876	36	\$2,995	16	\$1,268	728	\$45,499	
OVERHEAD FEE (% of Total Labor Cost)				156.000%		\$3,955		\$1,778		\$9,764		\$2,418		\$23,207		\$23,207		\$4,672		\$1,978		\$70,978
ENGINEERING LABOR + OVERHEAD FEE					\$6,490		\$2,918		\$16,023		\$3,968		\$38,083		\$38,083		\$7,667		\$3,246		\$116,477	
SUBCONTRACTOR COSTS																						
Subcontractor	Role in Study	Rate (\$/hr, \$/ln)	Proj. Mgmt.		GIS Verif.		PCI Survey		PCI QC/QA		Rehab. Analysis		Reporting		Presentations		Training		HRS	COST (\$)		
			Hrs	Cost	Hrs	Cost	Hrs	Cost	Hrs	Cost	Hrs	Cost	Hrs	Cost	Hrs	Cost	Hrs	Cost				
Civ. Infra. Solutions	Data Analysis (\$/hr)	\$165.00	4	\$660	8	\$1,320		\$0	4	\$660	12	\$1,980	8	\$1,320		\$0		\$0	36	\$5,940		
Civ. Infra. Solutions	PCI Proc. QC/QA (\$/CM)	\$60.00		\$0		\$0		\$0	1113	\$66,780		\$0		\$0		\$0		\$0	1113	\$66,780		
TOTAL SUBCONTRACTOR COSTS				4	\$660	8	\$1,320	0	\$0	1117	\$67,440	12	\$1,980	8	\$1,320	0	\$0	0	\$0	1149	\$72,720	
OTHER DIRECT COSTS																						
Description	Unit	Rate	Proj. Mgmt.		GIS Verif.		PCI Survey		PCI QC/QA		Rehab. Analysis		Reporting		Presentations		Training		Unit	COST (\$)		
			Unit	Cost	Unit	Cost	Unit	Cost	Unit	Cost	Unit	Cost	Unit	Cost	Unit	Cost	Unit	Cost				
Data Collection System - PCI	Day	\$500.00		\$0		\$0		14	\$7,000		\$0		\$0		\$0		\$0		\$0	14	\$7,000	
				\$0		\$0		\$0		\$0		\$0		\$0		\$0		\$0	0	\$0		
TOTAL OTHER DIRECT COSTS				0	\$0	0	\$0	14	\$7,000	0	\$0	0	\$0	0	\$0	0	\$0	0	\$0	14	\$7,000	
TOTAL COSTS					\$7,150		\$4,238		\$23,023		\$71,408		\$40,063		\$39,403		\$7,667		\$3,246		\$196,197	
FEE (% of total QES Labor + OH)				12.00%		\$779		\$350		\$1,923		\$476		\$4,570		\$4,570		\$920		\$390		\$13,977
TOTAL COSTS AND FEE					\$7,928		\$4,589		\$24,946		\$71,884		\$44,632		\$43,972		\$8,587		\$3,636		\$210,175	

REQUIRED ATTACHMENTS

In accordance with the requirements of the Request for Proposals, QES has included all applicable supporting documentation necessary for evaluation of this proposal. The required attachments are provided in the appendices referenced below.

- [Appendix A – RFP Attachment D: Subconsultant List](#)
This appendix includes the completed Subconsultant List form identifying all proposed subconsultants and the associated scope of services to be performed.
- [Appendix B – Staff Resumes](#)
This appendix includes resumes for all proposed key personnel, documenting relevant qualifications, certifications, and experience directly applicable to the 2026 Pavement Management System Update.

These attachments are submitted as part of this proposal and are intended to supplement and support the information presented in the main body of the proposal.

CONFLICT OF INTEREST

QES affirms that no official or employee of the Humboldt County Association of Governments, nor any business entity in which an official of HCAOG has an interest, has been employed or retained to solicit or assist in procuring the Consultant Services Agreement resulting from this Request for Proposals. QES further affirms that no such person will be employed in the performance of services under this contract without immediate disclosure to HCAOG.

QES has reviewed the requirements of the RFP and confirms that no actual, apparent, or potential conflicts of interest exist that would compromise our ability to perform the services requested in an objective, independent, and professional manner. Should any potential conflict of interest arise during the course of the project, QES will promptly disclose such information to HCAOG and cooperate fully in resolving the matter in accordance with applicable policies and regulations.

QES is committed to maintaining the highest standards of professional ethics and integrity and will at all times avoid conflicts of interest, or the appearance thereof, in the performance of services for the 2026 Pavement Management System Update.



APPENDIX A

RFP Attachment D: Subconsultant List

SUBCONSULTANT LIST – RFP EXHIBIT C

The proposal shall include a complete list of all proposed subconsultants. All subconsultants listed must be provided a meaningful element of work within the defined scope of work. Changes to this Subconsultant List will not be allowed without prior written approval from RTPA.

Proposed Subconsultants

Subconsultant Firm Name and Address	Scope of Work	Dollar Amount of Work
Name Civil Infrastructure Solutions, Inc. Address 2253 Lake Crest CT, Martinez, CA 94553	Third-Party Data Science, Analytical Support	\$ 72,720.00
Name Address		\$

Quality Engineering Solutions, Inc.

Name of Lead Firm

Kurt Keifer, Ph.D., P.E., Vice President of Engineering

Printed Name and Title of Signatory



Signature

January 16, 2026

Date



APPENDIX B

Staff Resumes



Kurt Keifer, Ph.D., P.E. Project Manager

QES

Professional Background

As Executive Vice President, Engineering, Kurt Keifer, PhD, PE leads the QES team of civil engineers, pavement engineers, and technicians who provide creative, practical solutions to challenges in aviation, transportation, infrastructure, survey, and water/wastewater. Dr. Keifer has worked in the industry for 26 years developing and deploying both “boots-on-ground” and automated infrastructure condition assessment technologies, including pavement imaging, structural condition evaluation, surface profiling technologies, and software solutions. He has led pavement management system implementations and comprehensive condition surveys for commercial and general aviation airports, states, counties, local agencies, and the DoD across the United States and around the world. Prior to consulting, Dr. Keifer spent a decade with the US Army Corps of Engineers, Construction Engineering Research Laboratory where he served as the Associate Program Manager of the Air Force-funded MicroPAVER™ and Navy-funded WHARFER™ Engineered Management System (EMS) R&D teams. He assisted in updating the ASTM D6433 and D5340 PCI standards and developing the automated PCI method. Dr. Keifer has delivered expert infrastructure management instruction to students and faculty at the US Air Force Academy, Wright-Patterson Air Force Base, University of Illinois at Urbana-Champaign, and Colorado State University. He has taught more than 50 courses and has published several technical papers on infrastructure management.

Education

- Ph.D., Transportation Engineering, University of Illinois at Urbana-Champaign
- M.S., Structural Engineering, University of Illinois at Urbana-Champaign
- B.S., Structural and Geotechnical Engineering, University of Illinois at Urbana-Champaign

Registrations/Certifications

- Professional Engineer: Arizona, Florida, Georgia, Illinois, North Dakota, Ohio, South Dakota, Texas
- Artificial Intelligence (AI) for Leaders Certification Program, University of Texas at Austin (2024)

Key Experience

- Project management
- Quality control/assurance
- Roadway pavement design
- Pavement management
- Research
- Training
- Airport Pavement Design
- Airport Pavement Engineering

Affiliations

- American Society of Civil Engineers, Transportation Research Board: AFP10 Committee on Pavement Monitoring and Evaluation (Member 2012 – Present); AKT10 Pavement Management Systems (Member 2008 – 2017)
- American Public Works Association
- University of Illinois at Urbana-Champaign Department of Civil and Environmental Engineering Alumni Association, Board Member (2022 – 2030)
- ASTM International E17, Voting Member
- Transportation Research Board, Committee Member
- ASCE, T&DI, Airfield Pavement Committee
- ASCE, COPRI – Port Pavement Committee, Chair (2008 – 2010)
- ASCE, Illinois YMG, Chair (2009 – 2010)

Related Project Experience

Project Manager, MicroPAVER™ Pavement and Asset Management System, Prince George's County, MD (2008, 2013, & 2023)

Served as project manager for IMS Infrastructure Management Services, LP (2023) and Dynatest Consulting, Inc. (2008 & 2013) as a major subcontractor to Johnson, Mirmiran and Thompson, Inc. Performed a custom MicroPAVER™ pavement management system implementation and semi-automated pavement distress survey for Prince George's County. Performed an initial MicroPAVER™ implementation and semi-automated PCI survey using 2D/3D pavement imaging technology in 2008 and 2013. The semi-automated PCI distress survey, rutting measurements and roughness evaluation were conducted using the following ASTM standards and uploaded to MicroPAVER™. Worked with the county to develop a "State of the Streets" report and provided a list of MicroPAVER™ candidate projects for federal stimulus funding, assisted county staff in developing MicroPAVER™ based work plans and recommendations.

Project Manager, Pavement Management System Implementation and Condition Survey, Chicago Metropolitan Agency for Planning (CMAP) (2018 – 2020)

Managed the CMAP pilot project and three subsequent rounds of pavement management system implementation for CMAP. The following tasks were performed: 1) implement MicroPAVER and develop a complete pavement inventory using the municipality's GIS and available historical M&R records; 2) perform a comprehensive PCI and IRI survey of the municipality's roadways; 3) upload the collected condition data into MicroPAVER; 4) develop pavement deterioration trends using MicroPAVER; 5) develop five-year pavement M&R plans for each municipality, which include upcoming "fixed" projects; 6) develop a comprehensive "State of the Streets" report; and 7) present the project findings at a formal, open meeting to elected officials and residents. Also provided on-site MicroPAVER and pavement management training workshops for the participating municipalities. Project deliverables included: 1) MicroPAVER software license; 2) MicroPAVER database complete with collected PCI and IRI data, historical M&R data, custom pavement deterioration models, and custom M&R unit cost models and decision trees; 3) five-year M&R recommendations along with analyses illustrating the impact of different M&R funding scenarios, 4) a comprehensive "State of the Streets" report, 5) formal, on-site presentation to elected officials and residents, and 6) MicroPAVER training.

Principal Engineer / Project Manager, MicroPAVER™ Pavement Management System Implementation and Update, Bismarck-Mandan MPO and the City of Bismarck, ND (2015 & 2020)

Dr. Keifer served as project manager and principal engineer for both previous projects with Gorrondona and Associates, Inc. (2020) and Dynatest Consulting Inc. (2015). Performed a custom MicroPAVER™ pavement management system implementation and semi-automated pavement distress survey for Bismarck-Mandan MPO and the City of Bismarck. Performed an initial MicroPAVER™ implementation and semi-automated PCI survey using 2D/3D pavement imaging technology in 2015 and again in 2020. The semi-automated PCI distress survey, rutting measurements and roughness evaluation were conducted using the following ASTM standards and uploaded to MicroPAVER™. Worked with the MPO and the city to develop a "State of the Streets" report and provided a list of candidate M&R projects. Worked collaboratively with the MPO and the city over the past decade and has assisted MPO and city staff in developing MicroPAVER™ based work plans and recommendations.

Project Manager, Airside and Landside Pavement Management System Implementations and MicroPAVER™ Development, US Army Corps of Engineers (2012 – 2017)

Project manager responsible for overseeing the work through all phases of the project. The team implemented MicroPAVER™ and performed both manual and semi-automated ASTM D6433 pavement condition surveys and analyses for more than 30 Army, Air Force, and Navy installations across the United States over a period of five years.

Principal Engineer, Airside Pavement Condition Survey, Eielson AFB, Alaska (2019)

Principal engineer overseeing the performance of a comprehensive PCI inspection of the base's airside pavements and ensuring the data was entered correctly into the MicroPAVER™ pavement management system.

Principal Engineer, Airfield Pavement Management Best Practices Training, Moi International Airport, Kenya (2019).

As principal engineer, Dr. Keifer taught a 40-hour course on airport pavement management to the Kenya Civil Aviation Authority (KCAA). The training included airfield pavement management best practices and how to implement the MicroPAVER™ pavement management system effectively for Kenyan airports. More than 25 KCAA employees and consultants attended the training.

Principal Engineer, Landside Pavement Condition Survey, Raleigh-Durham International Airport, Raleigh, NC (2017)

Principal engineer responsible for leading an automated PCI inspection of select roadways at the airport. Collected data was imported into MicroPAVER™ and used for developing detailed, cost-effective pavement rehabilitation plans.

Dr. Keifer has led pavement management system implementations and condition surveys for several aviation agencies as shown below:

- Eielson AFB, Alaska
- Raleigh-Durham International Airport
- Tyndall AFB, Florida
- Diego Aracena International Airport, Chile
- Laughlin AFB, Texas
- Spofford AFS, Texas
- Niagara Falls ARS, New York
- McGuire AFB, New Jersey
- Charleston AFB, South Carolina
- Cape Canaveral AFS, Florida
- Patrick AFB, Florida
- Orlando International Airport
- Honolulu International Airport
- Inchon International Airport
- O'Hare International Airport
- Philadelphia International Airport
- Colorado GA Airports, Statewide
- Pennsylvania GA Airports, Statewide



Mona Nobakht, Ph.D. P.E. Deputy Project Manager

Professional Background

Dr. Nobakht is a licensed Professional Engineer with over 12 years of experience in the public, private and academic sectors. She holds a Ph.D. in Civil Engineering with a specialization in pavement engineering. Her expertise spans pavement materials characterization, pavement design and evaluation, forensics and pavement management. She is also experienced in automated pavement data collection and surface profiling technologies. Prior to joining QES in June 2023, Dr. Nobakht served as a project manager at the Texas DOT, where she led various pavement forensics, design, and rehabilitation projects and provided technical support to TxDOT districts. Additionally, Dr. Nobakht has successfully implemented Pavement Management Systems for several cities and counties across the U.S. As a former researcher with the Texas A&M Transportation Institute, she also led multiple research projects for the Oklahoma and Texas DOTs. Since joining QES in 2023, Dr. Nobakht has been involved in pavement structural evaluations and traffic impact analyses for energy sector development roads and contributed to QES research projects for state agencies. Additionally, she has led and contributed to multiple Task Orders under QES' FHWA IDIQ contract. She is currently leading the TPF-5(399) Pooled Fund Study efforts to improve the AASHTO R87 and R88 standards.

Education

- Ph.D., Civil Engineering-Pavement Materials, Texas A&M University
- M.S., Civil Engineering-Structure, K.N. Toosi University of Technology, Tehran, Iran
- B.S., Civil Engineering, Amirkabir University of Technology, Tehran, Iran

Registrations/Certifications

- Professional Engineer: Texas, Ohio, North Carolina

Key Experience

- Pavement Management
- Research
- Training
- Project Management
- QA / QC
- Pavement Design
- Automated Data Collection

Professional Affiliations

- Transportation Research Board

Related Project Experience

Since joining QES, Dr. Nobakht has provided engineering support for the following projects:

Task Order Lead/Subject Matter Expert, Federal Highway Administration (FHWA) IDIQ 2025 Pavement Programs (2021- 2024 and 2024 - 2028)

QES has been providing technical and professional support services to FHWA under this project since 2021. Our team has successfully delivered a wide range of services, including developing technical guidance and reports, supporting technology transfer through presentations, workshops, and training, and providing direct technical assistance to state agencies.

Transverse Pavement Profile Study/AASHTO R87 Rut Definition/AI Reference Library TPF-5(399) (2025) - This study facilitates the implementation of the products which are being developed under the pool fund study. Dr. Nobakht is currently leading the efforts to improve AASHTO R87 and R88.

FHWA Pavement Design Peer Exchanges (2024) – QES conducted a comparative analysis of state DOT pavement design practices by organizing and documenting five regional peer exchanges covering all 50 states. The study captured key practices, challenges, gaps, improvement opportunities, and emerging technologies. Dr. Nobakht contributed to synthesizing the findings and preparing the final report and accompanying white paper.

South Dakota Granular Moisture-Density Curve Development and Dynamic Cone Penetrometer (DCP) Implementation (2024)

QES is currently contracted with the South Dakota DOT to analyze moisture-density data and develop the SDDOT Moisture Density Family of Curves. Additionally, the project involves creating DCP-based specifications for quality control of the compaction of base materials. The project is in progress, with Dr. Nobakht leading the data analysis and programming efforts.

Pre-Construction Roads Assessment, Monte Alto and Monte Cristo Wind Farms, Texas (2023)

QES has completed pre-construction road assessments on nearly 200 miles of local roadways in South Texas designated as haul roads for wind farm projects. Data collection included Falling Weight Deflectometer (FWD) measurements, Ground Penetrating Radar (GPR) measurements, and materials sampling and testing. Dr. Nobakht led the pavement structural and traffic impact analysis, estimating the remaining life of each roadway and assessing the potential impact of wind farm construction traffic on the haul roads.

Seattle Department of Transportation, StreetSaver PMS Update (2023)

Using high speed automated data collection technologies, QES was the prime contractor in updating the StreetSaver pavement distress condition on approximately 950 lane-miles of arterial and collector streets in the City of Seattle. QES hired IMS to collect the condition data using a 3-D LCMS laser system. QES then performed QC/QA efforts on all collected data and uploaded the approved distress data into the StreetSaver pavement management software. Dr. Nobakht developed the QA procedures, oversaw all QA efforts and uploaded the data into StreetSaver.

Road Network Inventory Project Yuba County, CA (2023)

QES is currently contracted to support Yuba County in configuring the newly acquired StreetSaver software. The project involves developing roadway segments, updating the inventory, conducting a distress survey on 662 miles of County roads, and configuring the StreetSaver software. Additionally, QES is assisting in developing decision trees and updating maintenance and rehabilitation fields. The project is in progress, with the QES team working on segmentation and data collection. Dr. Nobakht oversees the entire process, including segmentation, data import, quality checks, performance measures calculations, decision tree development, budget scenario analysis, and report development.

Windermere Florida Pavement Management Update (2023)

QES completed a PAVER pavement management system update for the Town of Windermere Florida. QES had performed the initial PMS implementation in 2017. QES completed distress surveys and then developed four budget options illustrating the effects of various budgets over the next five years. In addition, a 20-year maintenance and rehabilitation plan were provided. Dr. Nobakht completed the PAVER analysis to include developing the budget option reports as well as the 20-year M&R plan.



Pavement Inspection and Pavement Database Updates Yolo County, CA (2023)

QES completed a StreetSaver pavement management system (PMS) update for Yolo County covering the entire 657 centerline miles of the paved road network. QES has completed distress surveys, following the MTC distress rating methodology, data quality checks, and the StreetSaver database update. Dr. Nobakht developed the QA procedures, oversaw all QA efforts and uploaded the data into StreetSaver.

Dr. Nobakht's Pavement Engineering experience prior to joining the QES team includes the following projects:

Transportation Engineer IV (Pavement Preservation Branch), Texas Dept. of Transportation (TxDOT), Pavement Asset Management, Austin, TX (12/2022 – 5/2023)

- Conducted the 4-year pavement analysis including prediction and project selection and developed the statewide 4-year pavement management plan report.
- Provided support for TxDOT Pavement Management System - Pavement Analyst, including updating the existing deterioration/statistical pavement and optimization models.
- Provided analytical related specifications for new configuration and testing them in PA.
- Conducted the quality check/quality assurance on the annually collected network-level pavement distress data.
- Served in the research project panels to oversee the PMIS related research projects at both the TxDOT and national levels.

Transportation Engineer IV (Pavement Analysis & Design Branch), TxDOT, Pavement Asset Management, Austin, TX (4/2021 – 11/2022)

- Served as a project manager on pavement forensics and pavement design/rehabilitation projects.
- Provided technical/engineering support to the districts for design and rehabilitation projects scheduled for letting.
- Conducted site visits and supervised non-destructive and destructive testing such as FWD, AC-GPR, GC-GPR and DCP to conduct forensic evaluations.
- Performed pavement data analyses, forecasts, and plan development using TxDOT pavement software packages.
- Coordinated and monitored consultant projects and oversaw their engineering work.
- Involved in evaluation and preparation of Super Heavy Load Permits and changing Load Zone on Roads.
- Served on TxDOT research panels to review proposals and oversee research projects.

**Pavement Engineer (Pavement Management), Fugro USA Land, Inc.,
Austin, TX (3/2019 – 3/2021)**

- Analyzed and interpreted collected asset data using analytical methods and asset management software products to assist transportation agencies in evaluating their pavement and asset inventories.
- Performed pavement management services and developed long-term maintenance and rehabilitation strategies for transportation agencies using the corporate in-house and commercial pavement management software packages.
- Performed network and project level evaluation of pavements using non-destructive testing.
- Developed Quality Control (QC) procedures for transportation infrastructure data such as traffic, friction testing (skid), FWD, and GPR data.
- Developed and analyzed GIS databases using ArcGIS software.
- Involved in business development activities by reviewing RFPs/RFQs, estimating cost, writing proposals, and preparing bid packages.

**Pavement Materials Research Engineer, Texas Transportation Institute (TTI),
College Station, TX (9/2013 – 12/2018)**

Research Project: Asset Management, extreme weather, and proxy indicators (sponsored by Federal Highway Administration/Texas DOT)

- Investigated soil properties in Houston District and extracted required data for pavement analyses.
- Conducted a simulation study to assess the performance of inundated flexible pavements in Houston district.
- Prepared the progress reports and presented the results to FHWA and TxDOT.

Research Project: Compilation of local studies and regional calibration of Pavement ME design for rigid and flexible pavements in Oklahoma (sponsored by Oklahoma DOT)

- Extracted pavement condition data of flexible pavements in the State of Oklahoma from the LTPP database.
- Conducted Pavement-ME analysis and compared distress predictions with LTPP distress data.
- Assisted in calibration of Pavement ME Design for application in the State of Oklahoma.

Research Project: Selection of long-lasting rehabilitation treatments using life-cycle cost analysis and present serviceability rating (sponsored by Oklahoma DOT)

- Conducted performance tests to determine material properties and damage characterization of asphalt mixtures.
- Performed detailed (project level) analyses, including evaluation of FWD data, and structural design of pavements with Pavement-ME Design software.
- Conducted life-cycle cost analysis on a series of flexible and composite pavements.
- Established a decision-making methodology, and a series of time-based rehabilitation strategies for a network of flexible and composite pavement sections in the State of Oklahoma.
- Wrote the project progress reports and research papers.

**Lecturer & Lab Instructor, Texas A&M University,
College Station, TX**

Courses: Mechanics of Materials, Materials Engineering for Civil Engineers,
Materials of Construction

- Designed the course(s), delivered lectures, and performed assessments.

**Structural Engineer, ITCEN Engineering / Consulting Co.
Tehran, Iran (7/2006 – 9/2009)**

- Created structural models by using computer-aided design software for simulation purposes.
- Checked the safety and stability of the industrial/commercial structures in accordance with engineering codes.
- Monitored on-site construction and project progress.

Publications:

Nobakht, M. and MS Sakhaifar, *Dynamic modulus and phase angle prediction of laboratory aged asphalt mixtures*, *Construction and Building Materials* 190, 740-751, 2018.

Nobakht, M., D. Zhang, MS Sakhaifar, and RL Lytton, *Characterization of the adhesive and cohesive moisture damage for asphalt concrete*, *Construction and Building Materials* 247, 118616, 2020.

Nobakht, M., MS Sakhaifar, D Newcomb, and S Underwood, *Mechanistic-empirical methodology for the selection of cost-effective rehabilitation strategy for flexible pavements*, *International Journal of Pavement Engineering* 19 (8), 675-684, 2018.

Nobakht, M., MS Sakhaifar, and DE Newcomb, *Selection of structural overlays using asphalt mixture performance*, *Journal of Materials in Civil Engineering* 29 (11), 04017209, 2017.

Nobakht, M., MS Sakhaifar, and D Newcomb, *Development of rehabilitation strategies based on structural capacity for composite and flexible pavements*, *Journal of Transportation Engineering, Part A: Systems* 143 (4), 04016016, 2017.

Sakhaifar, MS, D Newcomb, M Nobakht, S Underwood, and PP Gudipudi, *Selection of long lasting rehabilitation treatment using life cycle cost analysis and present serviceability rating*, 2015.

Nobakht, M., MS Sakhaifar, D Newcomb, P Gudipudi, and J Stempihar, *Development of performance-based and cost-effective rehabilitation strategies for high-traffic-volume flexible pavement*, *Transportation Research Board 95th Annual Meeting*, *Transportation Research Board*, 2016.

Nobakht, M., *Characterization of Coupled Aging-Moisture Degradation for Hot Mix Asphalt Concrete*, 2018.

Nobakht, M. and D Zhang, *Characterization of the Combined Effect of Temperature and Moisture on the Adhesive Bond Energy of Asphalt Concrete*, *Transportation Research Board 100th Annual Meeting*, *Transportation Research*, 2021.



Carlos Cary, Ph.D. P.E.

Senior Engineer

Professional Background

Carlos Cary, PhD, PE specializes in pavement design and analysis and has 18 years of experience in geotechnical/pavement engineering with more than seven years dedicated to investigations on airport pavement design and construction. In 2014, Dr. Cary took a leadership role in planning and implementing airport pavement research projects for the FAA ATR-E26 branch in support of data development for evaluating the adequacy of current pavement design-standards/ construction-specifications and implementing updates accordingly. Dr. Cary's areas of expertise include geotechnical engineering for pavement structures, unsaturated soil mechanics, highway/airport pavement design and analysis, laboratory and field characterization of pavement construction materials, pavement instrumentation and full-scale accelerated testing, non-destructive evaluation of pavements, and environmental effects on the mechanical response of pavements materials. He is the author of more than 40 publications including technical articles and reports.

Education

- Ph.D., Civil Engineering, Arizona State University, Tempe, AZ
- M.S., Civil Engineering, Arizona State University, Tempe, AZ
- B.S., Civil Engineering, Ricardo Palma University, Peru

Registrations/Certifications

- Professional Engineer: Delaware

Key Experience

- Geotechnical Engineering
- Highway & Airport Pavement Design
- Full Scale Accelerated Testing
- Non-Destructive Evaluations
- Construction Specifications

Professional Development & Service

- Former technical committee member for the Transportation Research Board of the National Academies - Engineering Behavior of Unsaturated Soils Committee.
- Reviewer for the Transportation Research Record: Journal of the Transportation Research Board, Transportation Research Board of the National Academies.
- Reviewer for ASCE International Journals: Transportation Engineering, Journal of Geomechanics, and Journal of Materials in Civil Engineering.
- Reviewer for the International Journal of Pavement Research and Technology

Related Project Experience

South Dakota Granular Moisture-Density Curve Development and Dynamic Cone Penetrometer Implementation (Feb. 2024 – Present)

Dr. Cary serves as the principal investigator for this research project. The Ohio moisture-density family of curves used by the South Dakota Department of Transportation (SDDOT) were not developed specifically for native granular base/subbase materials. The available moisture-density family of curves developed for South Dakota in past research efforts are not useable in their current form and further refinement is needed. Recommendations from previous research also suggested SDDOT use the strength-based Dynamic Cone Penetrometer (DCP) testing procedure for quality control (QC) in field compaction of granular materials. Dr. Cary is leading

the research effort in refining the new SDDOT granular moisture-density curves and validating the DCP-based specifications proposed for SDDOT in past studies.

Quality Assurance of Pavement Distress Data for the North Carolina Department of Transportation (NCDOT) (Jan. 2023 – Present)

Dr. Cary is leading the independent quality assurance effort for the control of pavement distress data for the NCDOT. Pavement data is being collected by Fugro Roadware and delivered to the NCDOT. The project includes over 20,000 miles of pavement survey data from Interstate and Primary route pavements. Data is collected using 3-D digital imaging and automated pavement distress identification techniques. Dr. Cary develops the independent QA reports and Year-to-Year comparison reports, documenting that high quality distress data is delivered.

NCHRP 01-57B: Validating Standard Definitions for Comparable Pavement Cracking Data (Jul. 2023 – Present)

QES is part of the research team working on the validation and refinement of the proposed definitions developed in NCHRP Web-Only Document 288 for cracking in asphalt- and concrete-surfaced pavements. Dr. Cary assisted in the literature review to document current state agency practices related to collection and use of cracking data. Also, Dr. Cary assisted in the development of a cracking data quality assessment plan using the field-based ground referencing method. This plan will be implemented in the second phase of the project as part of the validation of standard crack definitions effort.

Tucson International Airport, PCN and PCR Determination (Jun. 2024 – Present)

QES provides pavement consulting services for the calculation of Pavement Classification Numbers (PCN) and Pavement Classification Ratings (PCR) for 46 facilities and 186 management sections including two runways and multiple taxiways and aprons with flexible and rigid pavement types. Dr. Cary conducted the PCR calculations and assists with the PCN calculations and development of the draft report.

Oakland International Airport FWD Testing, PCR Determination, and Remaining Life Analysis (2023)

QES executed FWD testing, determination of pavement layers and subgrade structural properties, calculation of Pavement Classification Numbers (PCR), and Remaining Life Analysis for 25 facilities and 81 management sections including four runways and multiple taxiways and aprons with flexible, rigid, and composite pavement types. Dr. Cary conducted the data analysis, structural analysis, PCR calculations and Remaining Life analysis and developed the draft report.

Las Vegas International Airport HWD Testing and Tunnel Support Evaluations (2023)

QES completed HWD testing on five separate facilities (two runways and three taxiways) having a tunnel running transversely across the features. Deflection and joint testing were completed before, after, and above the tunnels to evaluate the pavement structural support. Dr. Cary analyzed the HWD data for subgrade support, load transfer, and material properties. Dr. Cary aided in the development of the pavement performance report.

Aspen Municipal Airport FWD Testing, PCR Determination, and Remaining Life Analysis (2023)

QES executed HWD testing, determination of pavement layers and subgrade structural properties, calculation of Pavement Classification Numbers (PCR), and Remaining Life Analysis for the runway at Aspen, CO. Dr. Cary conducted the data analysis, structural analysis, PCR calculations, and Remaining Life analysis, and aided in the development of the draft report.

Post-Construction Roads Assessment, Blue Sky Greenfield Wind Farm, Fond Du Lac County WI and Crane Creek Wind Farm Howard County, IA (2023)

In 2022, QES performed pre-construction assessments of several miles of roadways associated with two separate wind farms collecting base line pavement condition data. In 2023, after completion of the wind farm construction and maintenance operations, QES again collected pavement condition data on the same roadways. The damage created from the construction efforts was documented and reported as the reduction in remaining service life of each route. All efforts were documented in a final report. Dr. Cary assisted in the data analysis, remaining life evaluations and development of draft reports

Appendix A

*Dr. Cary's Engineering experience prior to joining the QES team includes:

Horizon Engineering Consulting

Principal Engineer (Mar. 2020 – Dec 2022)

Roles and Duties: Contract technical lead for planning, design, and implementation of airport pavement investigation projects in support of the development of design standards and construction methods/specifications at the FAA's National Airport Pavement Test Facility (NAPTF). Lead geotechnical engineer for the FAA's ATR-E26 sponsored projects. Specialist in laboratory and field characterization of pavement materials for verification of compliance with and revision of current construction specifications.

Achievements: In support of development and improvement of airport pavement design standards and construction methods/specifications at the NAPTF: (1) Implementation of Construction Cycle 9 (CC9) construction material characterization, full-scale pre-traffic, and traffic test plans, (2) Completion of Construction Cycle 7 (CC7) and Construction Cycle 8 (CC8) comprehensive test reports, and (3) Joint publishing with the FAA's ATR branch personnel and dissemination of findings at conferences.

Gemini Technologies Inc.

Lead Pavement/Geotechnical Engineer (Nov. 2014 – Feb. 2020)

Roles and Duties: Pavement team lead for planning, design, and implementation of airport pavement investigation projects in support of the development of design standards and construction methods/specifications at the FAA's NAPTF. Lead geotechnical engineer for the FAA's ATR-E26 sponsored projects. Field inspection and oversight of laboratory and field technician crews during construction, performance monitoring, condition evaluation, and forensic investigation of flexible and rigid test pavements.

Achievements: In support of development and improvement of airport pavement design standards and construction methods/specifications at the NAPTF: (1) Planned and implemented CC9 material characterization and traffic test plans, (2) Provided technical expertise during construction of NAPTF's CC8 and CC9, and National Airport Pavement and Materials Research Center (NAPMRC) – Test Cycle 1 (TC1), (3) Planning of CC8 post-traffic test, (4) Planning and execution of CC7 post-traffic forensic investigation and preparation of comprehensive technical reports, (5) Execution of full-scale traffic test and preparation of comprehensive technical

reports for CC7 and CC8 projects, (6) Provided geotechnical expertise on field soil exploration as part of FAA's Extended Airport Pavement Life project, (7) Joint publishing with the FAA's ATR branch personnel and dissemination of findings at conferences, and (8) Development of in-house standard operating procedures for construction material characterization and maintenance of the related equipment.

Rowan University

Postdoctoral Research Scholar (Sept. 2013 – Jun. 2014)

Roles and Duties: Program assistant, leading civil engineering undergraduate students in FAA's ATR-E26 sponsored airport pavement research projects to support the development of design/construction methods and standards at the NAPTF. Specialist in laboratory characterization methods for airport pavement construction materials.

Achievements: Investigation of traffic induced compaction using NAPTF instrumentation data. Dissemination of research findings.

North Carolina State University

Postdoctoral Research Scholar (Aug. 2012 – Jul. 2013)

Roles and Duties: Lead geotechnical engineer with specialty in advanced laboratory testing methods/standards. Trained graduate students in advance testing methods for unsaturated soils. Lecturer for graduate level class on Unsaturated Soil Mechanics.

Achievements: Laboratory upgrade of advanced unsaturated soil testing equipment. Provided specialized personnel training and guidance in the implementation of laboratory capabilities for unsaturated soil testing.

Arizona State University

Postdoctoral Research Scholar (Feb. 2012 – Jun. 2012)

Roles and Duties: Team member in the planning and implementation of pavement research projects. Prepared comprehensive technical reports documenting research findings.

Achievements: Completion of a feasibility study on unsaturated soil modeling for airport pavement design methods. Dissemination of research findings.

Arizona State University

Graduate Research Associate (Jan. 2009 – Dec. 2011)

Roles and Duties: Graduate researcher. Specialist in advanced laboratory testing methods for soils and highway pavement materials. Material characterization, data analysis and modeling. Preparation of research reports and technical articles. Teaching assistant for undergraduate level civil engineering courses including geotechnical engineering related subjects and engineering drafting with AutoCAD.

Achievements: Development of a model for pore-water pressure response of a soil subjected to traffic loading under saturated and unsaturated conditions. Integration of a national database of subgrade soil-water characteristic curves and soil index properties for use with the Mechanistic-Empirical Pavement Design Guide (MEPDG). Development of computer program for the structural design of airfield pavements incorporating unsaturated soil mechanics principles. Development of an enhanced model for resilient response of soil resulting from seasonal changes as implemented in the MEPDG. Dissemination of research findings.

Arizona State University

Graduate Research Assistant (Aug. 2006 – Dec. 2008)

Roles and Duties: Graduate researcher. Specialist in advanced laboratory testing for soils and highway pavement materials. Material characterization, data analysis, and modeling.

Preparation of research reports and technical articles.

Achievements: Development of stress-dependent predictive model for resilient modulus in unsaturated unbound materials. Completed research towards the implementation of the MEPDG for the Maricopa County. Collaborated in initial efforts for the development and implementation of the MEPDG in Arizona. Dissemination of research findings.

Camineros S.A.C. - Peru

Junior Engineer (Sept. 2005 – Jun. 2006)

Roles and Duties: Civil engineer supporting projects on rehabilitation and improvement of highways in South America. In-situ evaluation of pavement condition and performance.

Preparation of reports.

Achievements: Collaborated in studies on the rehabilitation and improvement of the Ilo-Desaguadero Highway and Highway Corridor Amazonas-Centro in Peru, and the Santa Cruz-Montero Highway in Bolivia.

Publications

Peer-Reviewed Papers

- Evaluation of Concrete Pavement Joint Performance at the FAA National Airport Pavement Test Facility. In Conference Proceedings of the ISCP 12th International Conference on Concrete Pavements (ICCP), Virtual Conference, 2021.
- Field and Laboratory Characterization of Cement Treated Permeable Base for Flexible Airport Pavement at the FAA's National Airport Pavement Test Facility. In Conference Proceedings of the ASCE International Airfield and Highway Pavements Conference, Virtual Conference, 2021.
- Mechanical Response of Unbound Materials in Perpetual Pavement Sections at the National Airport Pavement Test Facility. In Conference Proceedings of the International Society for Asphalt Pavements 2018 - Fortaleza, Brazil, 2018.
- Effect of Pavement Structure on the Mechanical Response and Performance of Perpetual Pavements at the National Airport Pavement Test Facility. Transportation Research Record, No 2672, 2018.
- Pore-Water Pressure Response of a Soil Subjected to Dynamic Loading Under Saturated and Unsaturated Conditions. In the ASCE International Journal of Geomechanics, Vol. 16, No. 6, 2016.
- Evaluation of Asphalt Concrete Layer Response Using Asphalt Strain Gauges and Fiber Optic Strain Gauges. In Conference Proceedings of the International Conference on Transportation and Development 2016 - Houston, Texas, 2016.
- Subgrade Moisture Measurement at the National Airport Pavement Test Facility. Presented at the Transportation Research Board 95th Annual Meeting, Washington, D.C., 2016.
- Evaluation of Asphalt Concrete Layer Response Using Fiber-Optic Strain Plate and H-bar Strain Gauge. Presented at the Transportation Research Board 95th Annual Meeting, Washington, D.C., 2016.

- Suitability of the Superpave Gyratory Compactor for the Assessment of Compaction Characteristics of Unbound Materials. In Conference Proceedings of the International Symposium on Geomechanics from Micro to Macro (IS-Cambridge 2014), Cambridge, UK, 2014.
- Characterizing and Incorporating Particle Morphology in Discrete Element Modeling. In Conference Proceedings of the International Symposium on Geomechanics from Micro to Macro (IS-Cambridge 2014), Cambridge, UK, 2014.
- Unsaturated Soil Modeling for Airfield Pavement Design. In the ASCE Journal of Transportation Engineering, Vol. 140, No. 1, 2014.
- Integrating a National Database of Subgrade Soil-Water Characteristic Curves and Soil Index Properties with the MEPDG. In Transportation Research Record: Journal of the Transportation Research Board, No 2349, 2013.
- Comparison of Airfield Flexible Pavement Design Thickness Based Upon Differing Agency Limiting Subgrade Strain Criteria. In Transportation Research Record: Journal of the Transportation Research Board, No 2305, 2012.
- Modelo de Predicción del Módulo Resiliente para Suelos no Saturados. In Revista Internacional de Desastres Naturales, Accidentes e Infraestructura Civil, Vol. 12, No 1, Universidad de Puerto Rico, 2012.
- Resilient Modulus for Unsaturated Unbound Materials. In International Journal of Road Materials and Pavement Design, Vol. 12, No 3, 2011.
- Example of data Collection to Support the MEPDG Implementation for County Roads. In Transportation Research Record: Journal of the Transportation Research Board, No 2225, 2011.
- Enhanced Model for Resilient Response of Soil Resulting from Seasonal Changes as Implemented in "Mechanistic-Empirical Pavement Design Guide". In Transportation Research Record: Journal of the Transportation Research Board, No 2170, 2010.
- Comparative Study of a Mechanistic Resilient Modulus Predictive Equation for Unbound Materials. In Conference Proceedings of the 2nd International Conference on Transport Infrastructures ICTI-2010, Sao Paulo, Brazil, 2010.
- Resilient Modulus Testing for Unsaturated Unbound Materials. In Proceedings (Annual Meeting DVD) of the Transportation Research Board-Annual Meeting, 2010.
- A New Generation of Resilient Modulus Characterization of Unbound Materials. In Geotechnical Special Publication No. 187: Selected Papers from the 2009 ASCE International Foundations Congress and Equipment Expo, Orlando, Florida, 2009.
- Evaluating the Utility of Existing Pavement Management System State Deflection Data for Use in the Implementation of the ME-PDG for Arizona. In Proceedings (Annual Meeting DVD) of the Transportation Research Board-Annual Meeting, 2009.

Technical Reports

- Construction Cycle 9 - Construction Report, FAA, 2020.
- Construction Cycle 9 - Comprehensive Test Plan, FAA, 2020.
- Construction Cycle 9 - Material Characterization Plan, FAA, 2018.
- Construction Cycle 8 - Comprehensive Post-Traffic Test Plan, FAA, 2020.
- Construction Cycle 8 Phase 4 – Strength/Fatigue Test Report, FAA, 2020.
- Construction Cycle 8 Phase 3 – Joint Comparison Test Report, FAA, 2019.
- Construction Cycle 8 Phase 2 – Overlay Test Report, FAA, 2018.
- Construction Cycle 7 Post-Traffic Report – Laboratory Testing, FAA, 2019.
- Construction Cycle 7 Test Report – Overload Test, FAA, 2017.

- Construction Cycle 7 Test Report – Perpetual and Asphalt Treated Drainable Base Test, FAA, 2017.
- Compaction Characteristics of Subbase material using the Superpave Gyratory Compactor – Interim Report, FAA, 2014.
- Unsaturated Soil Modeling for Military Airfield Pavement Design – A Feasibility Study, Tigerbrain Engineering Inc./USACE, 2012.
- NCHRP 9-23B-Integrating the National Database of Subgrade Soil-Water Characteristic Curves and Soil Index Properties with the MEPDG, NCHRP, 2012.
- Pore-Water Pressure Response of a Soil Subjected to Traffic Loading under Saturated and Unsaturated Conditions, PhD Dissertation, Arizona State University, 2011.
- Design Practices for Aggregate Bases (AB) in Arizona-Influence of Fines on AB Material Performance, Arizona DOT, 2011.
- Resilient Modulus Testing for Unsaturated Unbound Materials, Master Thesis, Arizona State University, 2008.
- Evaluation of FORTA Fiber Reinforced Asphalt Mixtures Using Advanced Material Characterization Tests, FORTA Corporation, 2008.
- Pavement Design Research Towards the Implementation of the Mechanistic-Empirical Pavement Design Guide – Second Year Summary Report. Maricopa County DOT, 2008.
- Evaluating the Utility of Existing PMS State FWD Deflection Data for Use in Implementing the ME-PDG for Arizona DOT – SPR 606 - Development and Implementation of the Mechanistic Empirical (M-E) Pavement Design Guide for Arizona (Inter Team Technical Report), Arizona DOT, 2008.
- Pavement Design Research Towards the Implementation of the Mechanistic-Empirical Pavement Design Guide – First Year Summary Report, Maricopa County DOT, 2007.



Luis Ramirez, P.E.

Data Quality Management Engineer

Professional Background

Luis Ramirez, P.E. is a licensed Professional Engineer with a Master of Science in Civil Engineering from the University of Pittsburgh. Specializing in pavement engineering, he brings extensive experience in the design and analysis of pavement structures, pavement management systems, and condition assessments. His expertise also encompasses pavement instrumentation and data acquisition, along with field and laboratory testing of construction materials. Adept in geotechnical investigation and design, Luis is well-qualified in overseeing construction activities for transportation projects. He excels in cost analysis and budget management, backed by a solid background in estimation. Additionally, he has a proven track record in crafting comprehensive engineering and investigative reports. Technically proficient, he is skilled in a range of Civil Engineering software including AutoCAD and MicroStation, as well as specialized pavement engineering applications such as Pavement ME, PAVER, Kenlayer, StreetSaver, and MODULUS.

Education

- M.S., Civil Engineering, University of Pittsburgh
- B.S., Civil Engineering, Escuela Colombiana de Ingeniería Julio Garavito (Julio Garavito Columbian School of Engineering)

Registrations/Certifications

- Professional Engineer: Maryland No. 52770

Key Experience

- Pavement Evaluation
- Pavement Design
- Pavement Management
- Material Characterization
- Instrumentation
- Non-Destructive Testing
- Cost Estimating

Related Project Experience

Project Engineer, QA/QC for Semi-Automated Distress Data Collection for the District of Columbia DOT (PSI, 2022-2024)

As Project Engineer, Mr. Ramirez performed comprehensive quality assurance and quality control reviews of semi-automated pavement distress data for approximately 200 lane-miles of the DDOT roadway network each year. Responsibilities included verifying field-collected imagery and sensor data for accuracy, identifying discrepancies in pavement condition ratings, and ensuring compliance with DDOT and industry standards for data integrity. He conducted in-depth analysis to assess surface distresses, categorize severity levels, and validate network-level pavement condition indices. His work directly supported engineering decisions for pavement preservation and rehabilitation, ensuring that the data used for design and maintenance planning was complete, reliable, and technically sound.

Project Engineer, North Carolina Department of Transportation (NCDOT, 2020-2023)

Mr. Ramirez contributed to the development and refinement of distress data control limits for NCDOT's statewide pavement management program, encompassing over 19,000 centerline miles of roadway annually. He established parameters to minimize variability in distress measurement results, ensuring consistency and reliability across multiple data collection cycles and contractors. Mr. Ramirez also performed detailed year-over-year comparative analyses to identify network-level pavement performance trends, assess changes in surface condition, and verify that recorded distresses aligned with expected deterioration patterns. His efforts

enhanced the accuracy of NCDOT's pavement condition database, enabling more effective prioritization of roadway rehabilitation and preservation projects.

Research Engineer, Research for the Federal Highway Administration (FHWA) Office of Federal Lands Highway (FHWA, 2022)

As Research Engineer, Mr. Ramirez conducted in-depth statistical analysis of Highway Performance Monitoring System (HPMS) cracking data collected at six designated control sites. The study evaluated results from both manual and automated distress surveys performed by multiple pavement data collection vendors, enabling a comprehensive assessment of measurement variability and accuracy. He applied statistical methods to compare cracking type, extent, and severity classifications across systems, identifying discrepancies and potential sources of error. His findings provided FHWA with actionable insights to improve data collection protocols, enhance the reliability of HPMS pavement condition reporting, and support more consistent decision-making for roadway asset management.

Project Engineer, Fresno Yosemite International Airport FWD Testing, PCN Determination, and Remaining Life Analysis (Kimley Horn, 2021)

Mr. Ramirez conducted Falling Weight Deflectometer (FWD) testing to evaluate the structural response of airfield pavements on Runways 11R/29L and 11L/29R at Fresno Yosemite International Airport. He analyzed deflection data to determine subgrade and pavement layer moduli, providing critical insight into the structural capacity of the pavement system. Mr. Ramirez calculated Pavement Classification Numbers (PCN) in accordance with FAA standards to assess the runways' capability to support various aircraft loadings, and estimated the remaining structural life to inform long-term rehabilitation strategies. His work supplied FHWA with accurate, engineering-grade data to guide investment decisions and ensure the continued safety and performance of the Fresno-Yosemite International Airport.

Project Engineer, Pavement Management Technical Assistant Program for Multiple Cities in the Bay Area [Metropolitan Transportation Commission (MTC), 2021]

Mr. Ramirez served as a project engineer for the P-TAP 21 contract, which assigned six Bay Area cities to receive StreetSaver PMS updates in 2020. Project details include the confirmation and correction of existing management sections, manual pavement distress surveys, StreetSaver updates (including updating the decision tree and cost table), adding any M&R information, and generating various budget option reports. **All six of these projects were completed on time and within budget.** Two cities provided additional challenges in their request for project lists meeting certain criteria (references provided). For the City of San Mateo, the unique challenge of custom scenario generation went beyond StreetSaver's standard capabilities. Many scenarios required the elimination of failed streets (streets that fall below a PCI of 30) over a specified period while maintaining all street sectional PCIs (rather than network PCI) above a certain index such as 50. The desired PMP was achieved with a bit of creativity that involved making changes to the decision tree that would, in turn, generate an annual list of streets which could then be saved as project lists. No single standard StreetSaver analysis or report could be utilized, but by running separate reports and combining the data, QES was able to achieve the City's desired outcome.



Matthew Baker

Senior Technician / Pavement Distress Rater

Professional Background

Mr. Baker joined QES in 2016 rating pavement distresses and developing software programs. He developed the tablet application we currently use for manual distress ratings. This application is GIS based, has built-in PCI calculations, and provides cloud storage. He has

developed several applications for the processing and comparison of high-speed pavement distress data and has rated hundreds of miles of roadway pavements. Mr. Baker has been performing StreetSaver distress ratings since 2018 and is an MTC certified pavement distress rater. He is the lead data analyst for our distress data Quality Assurance review of 12,000 miles of roadway in New Mexico, annually.

Education

- B.S., Computer Science and Engineering, University of Nevada, Reno, NV
- A.A., Criminal Justice, Los Angeles Pierce College, Los Angeles, CA

Registrations/Certifications

- MTC-Certified Pavement Distress Rater

Key Experience

- Roadway Pavement Distress Identification
- Automated Distress Quality Assurance
- StreetSaver PMS System
- Software Development

Related Project Experience

Implementation of TPF-5(299) study products: Transverse Profiler Certification, 2D/3D Pavement Image Standard Data Format, and Cracking Assessment, Federal Highway Administration (FHWA) (2022 – Active/Ongoing)

This study facilitates the implementation of the three products which have been developed under the TPF pool fund: (1) Transverse Profile Certification Standards (2) 2D/3D Pavement Surface Image Standard Data Format (3) Guidelines for Cracking Assessment for Use in Vendor Selection Process for Pavement Crack Data Collection/Analysis Systems and/or Service. Mr. Baker provides support in conducting TPP certification assessments and processes the resulting data. He provides recommendations and revisions to AASHTO PP106 – PP110 standards and maintains the algorithms used for certification assessment processing.

Distress Data Quality Assurance, New Mexico Dept. of Transportation (NMDOT) (Sub to Fugro) (2022-2023)

QES provided a 2% Quality Assurance check on the pavement distress data provided by the vendor on 12,000 miles annually. Mr. Baker selected samples, directed and reviewed distress ratings by two rating technicians, processed the rating databases and developed comparison reports for NMDOT. In addition to annual checks, a year-to-year data check was also conducted as required.

Bay Area MTC P-TAP 19 through P-TAP 21 (2018-2021)

Led the pavement distress data collection efforts following StreetSaver survey criteria for Alameda, Atherton, Cloverdale, Healdsburg, Los Gatos, Mountain View, San Leandro, San Mateo, and Sebastopol.

QES

Independent Verification & Validation (IV&V) of Pavement Distress Data for the Virginia Department of Transportation (VDOT) (Sub to Fugro Roadware) (2016 – Active/Ongoing)

QES provides direction and oversight of the IV&V of 25,000 miles of pavement distress data collected using digital imaging and semi-automated pavement distress identification. Mr. Baker provides distress rating efforts, completes data processing, and generates comparison files for 19 separate deliverables per year.

CERTIFICATE OF ACHIEVEMENT

This is to certify that

Matthew Baker

has completed the requirements of the

MTC StreetSaver Rater Certification Program

with the skills and knowledge on pavement condition
assessment based on the MTC's modified ASTM D6433

Certificate valid until Jan 27 2027

Serial no: 1184



Sui Tan, StreetSaver Program Manager
Metropolitan Transportation Commission





Jason Clinton

Senior Technician / Pavement Distress Rater

Professional Background

Since June 2004, Mr. Clinton has assisted the QES engineering staff in pavement engineering efforts including pavement distress identification, deflection testing, materials sampling, coring, traffic control and computer maintenance. He has over 15 years' experience in pavement distress evaluations ranging from windshield level surveys to automated data imaging. He is experienced in various distress identification methods including PAVER, StreetSaver, ICON, Pennsylvania DOT, Ohio DOT and Virginia DOT. He has worked on projects ranging from city streets to interstate highways and commercial aviation airfields. Mr. Clinton was initially trained in pavement distress identification by Mr. Frith using the ASTM D6433 principals. Mr. Frith was a primary instructor for the NHI pavement distress identification course as well as for the LTPP regional contracts. Mr. Clinton completes a refresher course and evaluates a minimum of 10 control sites annually for re-certification. He completed the Metropolitan Transportation Commission (MTC) Pavement Management Technical Assistance Program (P-TAP) qualification test and is a certified distress rater.

Education

- High School Diploma, McQueen High School, Reno, NV

Key Experience

- Roadway Pavement Distress Identification
- Automated Distress Measurements
- Airfield Pavement Distress Identification

Registrations/Certifications

- MTC-Certified Pavement Distress Rater

Related Project Experience

Lead Distress Rater, Bay Area MTC P-TAP 14 through P-TAP21 (2013-2021)

Mr. Clinton led the pavement distress data collection efforts following StreetSaver survey criteria for American Canyon (2), Atherton, Belvedere, Cloverdale, Colma, Foster City, Healdsburg, Hercules, Los Altos (2), Los Altos Hills (2), Los Gatos (2), Martinez, Menlo Park, Millbrae, Milpitas, Monte Sereno, Mountain View, Newark, Novato, Pacifica, San Bruno, Sebastopol, Suisun City, Union City, Walnut Creek, and Yountville.

Lead Non-PMS Asset Rater, Bay Area MTC P-TAP 20 (2019)

Led the Non-PMS asset inventory and data collection efforts for the City of Clayton which consisted of the survey of all curb ramps.

Lead Non-PMS Asset Rater, Bay Area MTC P-TAP 18 (2017)

Led the Non-PMS asset inventory and data collection efforts for the Town of Colma which consisted of the survey of all sidewalks, curb, and curb ramps.

Lead Distress Rater, Sonoma County (2016-2022), Berkeley, CA (2015) City of Pittsburg, CA (2016), City of Richmond, CA (2019), and City of Fairfield, CA (2021)

Under subcontract to NCE, served as the lead pavement distress rater for data collection efforts following StreetSaver survey criteria for the entire City of Berkeley, CA, the City of Pittsburg, CA 180 miles of Sonoma County, and 42 miles of the City of Richmond.

Lead Distress Rater, Santa Clara County, CA (2019)

Under subcontract to Harris, served as the lead pavement distress rater for data collection efforts following StreetSaver survey criteria for 35 miles.

Lead Distress Rater, City of Saratoga, CA (2019) & San Jose, CA (2019)

Under subcontract to Fugro, served as the lead pavement distress rater for data collection efforts following StreetSaver survey criteria for the entire City of Saratoga and for 327 miles in the City of San Jose, CA

Associate Distress Rater, Caltrans Airport Pavement Management Systems Update, (2018)

Under contract to Kimley-Horn, completed airside pavement distress evaluations on 15 general aviation airports located throughout California using ASTM 5340 procedures.

Lead Distress Rater, 2014 Statewide Airport Pavement Management Study (DOAV PC# VASP-33, 841:14-002 Pavement Management Services) (2014/2015) Commonwealth of Virginia

Led the pavement distress data collection efforts on numerous commercial and general aviation airfield pavements located throughout Virginia.

Senior Rater, Independent Verification & Validation of Pavement Distress Data for the Virginia Department of Transportation (VDOT) under contract to Fugro Roadware (2004-Present)

QES provides direction and oversight of the Independent Verification and Validation (IV&V) of 25,000 miles of pavement distress data collected using digital imaging and semi-automated pavement distress identification. Mr. Clinton leads the distress rating efforts, completes data processing and analysis for more than 1,250 miles of Interstate, Primary, and Secondary route pavements per year.

Senior Technician, New Mexico High Speed Data Collection (2013)

Developed two data collection verification sites in Santa Fe and Roswell. Provided IV&V of road assets collected under contract to Mandli Communications.

Senior Technician, Southern California IRI Data Collection, Caltrans (2012)

Setup four IRI control sites using ASTM E-950 in Oxnard, Lancaster, Riverside and Escondido, under contract to Mandli Communications.

Senior Technician, Nevada High Speed Data Collection (2012)

Developed three data collection verification sites in Reno, Las Vegas, and Elko areas. Provided independent verification and validation of road assets collected under contract to Mandli Communications.

Lead Distress Rater, Caltrans Airport Pavement Management Systems Update, (2011)

Completed airside pavement distress evaluations on 71 general aviation airports located throughout California using ASTM 5340 procedures.

Field Distress Rater, Arlington County Pavement Distress Survey Updates, Arlington County, Virginia (2007-2009)

Mr. Clinton was the lead pavement distress rater for the collection of 125 roadway miles per year using the ASTM D6433 methodology.

Field Distress Rater, PAVER Pavement Management System Implementation for the National Roads Authority, Cayman Islands (2008)

Mr. Clinton assisted in the pavement distress data collection, using ASTM D6433, for 90 miles of urban roadways.



Senior Rater, City of Cleveland Pavement Distress Data Collection (2007-2008)

Performed pavement distress ratings on six control sites and then on-going QA efforts for over 100 miles of city streets, using the Ohio DOT methodology.

Field Distress Rater, Caltrans Airport Pavement Management Systems Update, (2007)

Completed airside pavement distress evaluations on 22 general aviation airports located throughout Northern California using ASTM 5340 procedures.

Field Technician/Distress Rater, Highway 160 Pavement Evaluation and Remaining Life Analysis, City of Sacramento, CA (2008)

Assisted the QES engineering staff in collection of existing pavement conditions including distress, deflection, and materials sampling.

CERTIFICATE OF ACHIEVEMENT

This is to certify that

Jason Clinton

has completed the requirements of the

MTC StreetSaver Rater Certification Program

with the skills and knowledge on pavement condition
assessment based on the MTC's modified ASTM D6433

Certificate valid until Jun 05 2027

Serial no: 1190



Sui Tan, StreetSaver Program Manager
Metropolitan Transportation Commission



Eric Miskow

Staff Engineer

Professional Background

Mr. Miskow began working with the KDG Pavements team in 2022 while completing his Geological Engineering degree at the University of Nevada, Reno. Mr. Miskow began as a part-time pavement distress rater. Upon graduation, he joined our team full time continuing as a pavement distress rater while also assisting senior engineering staff in the processing and analysis of distress QA data. He has completed many miles of manual distress ratings, in addition to distress ratings from digital images. Mr. Miskow is a key team member in the NCDOT QA project.

Education

- B.S., Geological Engineering, University of Nevada, Reno, NV

Related Project Experience

Pavement Distress Rater, Quality Assurance of Pavement Distress Data, North Carolina Department of Transportation (NCDOT) (2023-Present)

This ongoing project consists of QA reviews on 19,000 miles of Interstate and Primary route pavements in North Carolina.

Key Experience

- Roadway Pavement Distress Identification
- Automated Distress Measurements

Distress Rater, Independent Verification & Validation of Pavement Distress Data for the Virginia Department of Transportation (VDOT) under contract to Fugro Roadware (2004-Present)

QES provides direction and oversight of the Independent Verification and Validation (IV&V) of 25,000 miles of pavement distress data collected using digital imaging and semi-automated pavement distress identification.

Distress Data Quality Assurance for the New Mexico Department of Transportation (NMDOT) under contract to Fugro (2022-2023)

QES provided a 2% Quality Assurance check on the pavement distress data provided by the vendor on 12,000 miles annually. Mr. Miskow served as a pavement distress rater for data collection efforts.

Distress Rater, Yolo County Distress Data Collection (2024)

QES completed a contract to perform pavement condition inspections for Yolo County's Pavement Management System (PMS) covering the entire 657 centerline miles of the paved road network. QES completed manual distress surveys, following the MTC distress rating methodology, as well as data quality checks and updated the distress data in the StreetSaver database. Mr. Miskow served as a pavement distress rater for data collection efforts following StreetSaver survey criteria.

Distress Rater, Yuba County Distress Data Collection (2024)

QES is currently contracted to support Yuba County in configuring the recently acquired StreetSaver software. The project involves developing roadway segments, updating inventory, conducting a PCI distress survey on 662 miles of County roads, and configuring the StreetSaver software. QES will also aid in developing decision trees and updating maintenance and rehabilitation fields. Mr. Miskow served as a pavement distress rater for data collection efforts following StreetSaver survey criteria.

QES

Distress Rater, Seattle Department of Transportation, StreetSaver PMS Update (2023)

Using high speed automated data collection technologies, QES was the prime contractor in updating the StreetSaver pavement distress condition on approximately 950 lane-miles of arterial and collector streets in the City of Seattle. Mr. Miskow was part of the QC Team.

Distress Rater, North Carolina Department of Transportation (2022-2024)

QES provides direction and oversight of approximately 19,000 miles per year. of pavement distress data collected using digital imaging and semi-automated pavement distress identification. Mr. Miskow served as a pavement distress rater for data collection efforts.

CERTIFICATE OF ACHIEVEMENT

This is to certify that

Eric Miskow

has completed the requirements of the

MTC StreetSaver Rater Certification Program

with the skills and knowledge on pavement condition
assessment based on the MTC's modified ASTM D6433

Certificate valid until Aug 06 2026

Serial no: 1178



Sui Tan, StreetSaver Program Manager
Metropolitan Transportation Commission





Mostafa Nakhaei, Ph.D. | Data Analysis Engineer

12 Years of Experience

Mostafa Nakhaei, Ph.D. is Consulting Manager and Senior Pavement Engineer at Civil Infrastructure Solution (CIS) with over 12 years of civil engineering experience. He has developed Capital Improvement Programs for more than 120 U.S. cities and counties in the past four years, totaling over \$1 billion in capital improvement projects. Mostafa specializes in pavement engineering, including construction, management, structural design, lab testing, and FWD analysis. With a dual degree in Data Science, he created MASTIC and Back-MASTIC for layered elastic analysis and modulus back-calculation, and led the development of ISA, a deep learning software for structural data analysis. He has implemented pavement and asset management systems for municipal agencies and is proficient in tools such as SAMS™, ESA™, StreetLogix™, AgileAssets™, PAVER™, StreetSaver™, Lucity™, and Cartograph™.

Education & Credentials

- Ph.D., Civil and Environmental Engineering, Auburn University
- M.S., Data Science, Auburn University

Relevant Experience

City of Dallas, Texas – Project Manager

Mostafa led the comprehensive pavement and asset data collection initiative for the entire City of Dallas, Texas, encompassing over 6,000 centerline miles of roadway. The project utilized a fleet of seven collection vans operating within a compressed schedule, requiring significant coordination to ensure data quality and comparability across all vehicles.

To maintain data consistency, Mostafa established control sites located throughout the city. These sites were evaluated at the start and end of each van's deployment, as well as on a monthly basis, to verify uniformity in measurements. The scope extended beyond pavement assessment to include other critical municipal assets such as sidewalk ramps, retaining walls, and additional infrastructure elements.

Pavement management and analysis were conducted within the AgileAssets platform, with condition ratings reported in accordance with ASTM D6433 and ASTM E3303 standards. Data was collected and delivered at a high-resolution 50-foot interval, providing the City with highly detailed and actionable insights. With operational efficiency, the project was completed and delivered in May 2025—four months ahead of schedule—allowing the City's engineering team ample time to prepare and refine their presentation to the City Council in August 2025.

City of Riverside, California – Project Engineer

From 2022 to 2025, Mostafa led a multi-year pavement condition assessment and management effort for the City of Riverside, building upon a baseline network survey completed in 2017. He oversaw pavement data collection for approximately 875 centerline miles of roadway, as well as a network-level structural evaluation of about 100 test miles using a FastFWD system.

A central success factor of the project was Mostafa's implementation of a rigorous year-to-year comparison methodology. This approach ensured consistency in data across multiple collection cycles, enabling the City to accurately track network health over time and present a clear, reliable narrative to City Council. By maintaining uniform evaluation standards, the program could measure the actual returns on investment from various rehabilitation activities, validate the effectiveness of past interventions, and inform refinements to the City's maintenance strategies.

Drawing on these insights, Mostafa developed a data-driven pavement management plan and multi-year budget forecast within the City's Lacity™ asset management platform. The plan was tailored to integrate seamlessly with Riverside's established rehabilitation strategies, cost models, and priority frameworks—ensuring both operational compatibility and long-term sustainability in the City's pavement management program.

City of Winnipeg, MB – Project Manager

Mostafa served as the project manager for a citywide pavement and asset management program in Winnipeg, Manitoba. The project focused on comprehensive pavement condition surveys and a dedicated sidewalk inventory to support ADA compliance evaluations and long-term accessibility planning.

The asset management implementation utilized the AgileAssets™ Pavement Analyst module, incorporating a highly tailored decision tree model that aligned with the City's funding allocation policies across multiple electoral wards. This customization ensured that rehabilitation and maintenance priorities reflected both engineering best practices and the municipality's budgetary framework. Data collection was completed in 2024, followed by a successful asset management implementation in 2025, providing the City of Winnipeg with a robust, data-driven foundation for long-term asset management and strategic investment planning.

City of North Port, Florida – Project Engineer

Mostafa has collaborated with the City of North Port, Florida, on six separate network-level pavement and asset management projects. Serving as Project Engineer, he oversaw the collection and quality assurance of pavement condition data gathered through an automated ASTM D6433 PCI survey covering 814 centerline miles of city-managed roads. He also managed a structural evaluation program for 100 miles of arterials and collectors within the city.

High-resolution roadway imagery was leveraged to conduct a citywide sidewalk inventory, assessing both condition and compliance. As part of the project, Mostafa facilitated the integration of pavement and sidewalk data into the City's Lacity™ asset management program. He performed budget analyses and developed a comprehensive 5-year maintenance and rehabilitation (M&R) plan, addressing the condition of both roadway and sidewalk infrastructure.

City of Euless, Texas – Project Manager

In 2022, Mostafa directed the implementation of a pavement management system for the City of Euless' roadway network. This work included an automated ASTM D6433 PCI survey of 184 test miles, along with IRI ride quality and rutting data collection for every roadway segment. In addition, 81 miles of arterials and collectors underwent structural testing using a FastFWD system to evaluate network-level structural integrity. The project utilized the ESA™ pavement management platform. Working closely with City staff, Mostafa developed a 5-year pavement preservation and M&R plan, and provided hands-on ESA training to ensure long-term program sustainability. He enabled the City to accurately assess roadway conditions, identify critical maintenance needs, and establish a data-driven plan for strategic investment.

City of Deerfield Beach, Florida – Project Manager

From 2021 to 2022, Mostafa led a full-scale pavement management project for the City of Deerfield Beach. This included an automated ASTM D6433 pavement condition survey of roughly 136 miles of city roadways, supplemented with IRI ride quality measurements.

He collaborated closely with City staff to refine project objectives, scope, and schedule, ensuring alignment with municipal priorities. Using the ESA™ optimization tool, he developed cost-effective rehabilitation strategies that maximized available resources, enabling the City to plan targeted and efficient roadway improvements.

City of Long Beach, California – Project Engineer

Mostafa served as Project Engineer for multiple pavement management program updates in Long Beach, beginning with the original survey in 2013 and continuing through subsequent updates in 2017 and beyond. The initial project encompassed over 900 test miles of roadway, incorporating high-definition imagery and structural deflection testing for arterials. Mostafa has contributed to the City's ongoing pavement and asset management initiatives, ensuring reliable condition assessments and supporting data-driven decision-making.

City of Manhattan, Kansas – Project Manager

From 2021 to 2022, Mostafa managed the development of a pavement management system for Manhattan, Kansas, which included an automated ASTM D6433 PCI survey covering 71 miles of city roadways. The project also gathered IRI ride quality and rutting data for each segment. Structural testing on arterials and collectors was performed with a Dynaflect system to assess pavement layer integrity. The PAVER™ platform was used for management and analysis, and Mostafa worked with City officials to create a 5-year pavement preservation and M&R plan tailored to local needs and budget constraints.

City of Seattle DOT, Washington – Project Engineer

Mostafa served as Project Engineer for the Seattle Department of Transportation's, encompassing approximately 1,547 lane-miles of 12-foot-wide pavement. The survey included both asphalt and concrete surfaces, with about one-third of the network consisting of concrete pavements. Using multiple survey vans, Mostafa ensured accurate data capture and analysis. PCI ratings were developed in StreetSaver™, providing Seattle DOT with a reliable assessment of pavement conditions to inform maintenance strategies and capital planning.