



Memo

To: City Council

From: Danny Paul, Public Works Director

Date: September 9, 2025

Re: Award Recommendation for the Road Master Plan

A Request for Proposals (RFP) for the Road Master Plan (Plan) has yielded eleven proposals from interested candidates. One of the proposals was disqualified for not complying with the RFP criteria. The RFP was properly advertised in the local newspaper on three different days in July and proposals were due on August 13. Below is a summary of the proposals including company name, office location, and total cost. The approved budget for this work is \$50,000.

Road Master Plan - Proposal Summary		
Company	Location	Total Cost
A.G. Wassenaar, Inc.	Englewood, CO	\$82,047.00
Arterial	Disqualified	
Benesch	Denver, CO	\$27,330.00
Diamond Road, Inc.	American Fork, UT	\$162,500.00
Earth Art Engineering	Dolores, CO	\$93,996.60
Interstate Engineering	Broomfield, CO	\$169,062.00
Ironstride Solutions	Denver, CO	\$159,605.00
KLJ Engineering	Grand Junction, CO	\$99,778.00
Metric Engineering, Inc.	Colorado Springs, CO	\$89,950.00
MDS Technologies, Inc.	Park Ridge, IL	\$29,050.00
Tiger Eye Engineering	Columbia, MO	\$70,245.00

As a reminder the Road Master Plan will scientifically evaluate the pavement condition of all the city owned and maintained roads, curbs and gutters, and sidewalks. Each road will be broken down into smaller segments for the analysis. The methodology will conform with the American Society of Testing Materials (ASTM) standards, and each street segment will receive a Pavement Condition Index (PCI) score which is a numerical rating system that assesses the health and quality of the pavement surface. In general, a high PCI value indicates a pavement in good condition and does not require immediate maintenance. The city has never completed a PCI evaluation of its roadway assets before.

The Plan will result in a report and data layer that will be integrated into the city's Geographic Information System (GIS) and used as a tool to guide the recommended annual

road pavement maintenance prioritization and budget. It is suggested that the roads are re-scanned and evaluated every few years so the city can closely monitor the degradation of the pavement to inform when rehabilitation is necessary.

A staff committee reviewed each proposal and scored them according to the evaluation criteria included in the RFP: Team and Experience (35%), Project Approach (40%), and Fee Proposal (25%). **The proposal from MDS Technologies, Inc. (MDST) received the highest score, and it is staff's recommendation to award the work to.**

While MDST is not a locally owned business, they specialize in assessing pavement conditions and implementing pavement asset management systems for Public Works Departments across the country and in Colorado. The owner of the company will personally do most of the work himself and is highly recommended by other Colorado communities he has completed similar work for. This proposal was also the second lowest cost, and the work will be finished within the anticipated timeframe of four months.

Attachments

1. Proposal by MDS Technologies, Inc. (recommended for Award)

MDS Technologies, Inc.

Proposal to Provide Road Master Plan Services

Prepared for:

City of Craig

In Response to:

Request for Proposal Published July 16, 2025

Contact: Trevor Triffo, Principal
MDS Technologies, Inc.
350 S. Northwest Hwy
Park Ridge, IL 60068

Tel: 847-830-1074
E-Mail: ttriffo@mdstechnologies.com



August 13, 2025

City of Craig
300 4th Street
Craig, CO 81625

Attention: Katie Carmody
City Clerk

Re: Proposal to Provide Pavement Condition Data Collection & 10-Year Planning Services

Dear Madam:

MDS Technologies, Inc. (MDST) is pleased to submit this proposal to provide the above-referenced services to the City of Craig (City) in response to the City's Request For Proposals (RFP) dated July 16, 2025. We acknowledge receipt of Addendum 1 to the RFP.

MDST specializes in assessing pavement condition and implementing pavement and right of way asset management systems for the public works departments of municipal and county governments. MDST staff has successfully implemented over one hundred pavement management systems for clients throughout the United States. We have been providing these services continuously for 23 years.

MDST was incorporated in 2002 as a 'C' Corporation in the State of Illinois. MDST is located in Park Ridge in the metropolitan Chicago area and will provide services to the City from this location. Our field crew will be based in the City for the duration of the fieldwork component of the project. Our corporate office is located at:

MDS Technologies, Inc.
350 S. Northwest Highway
Suite 300
Park Ridge, IL 60068

We are uniquely qualified to provide these services to the City for these reasons:

- We have supplied similar services to many municipalities and counties in Colorado, Wyoming, Utah, Idaho, North Dakota, South Dakota and elsewhere around the country;
- We have the vehicle-based technology needed to collect the data needed to assess the condition of the City's road network quickly and cost-effectively;
- We have developed Artificial Intelligence-based tools that allow us to accurately evaluate pavement condition in an automated fashion;
- We have expert knowledge and many years of experience implementing PAVER, Cartegraph (now Opengov) and other pavement management systems; and,

- We have a reputation for providing high quality services delivered according to schedule for a very competitive fee.

Mr. Trevor Triffo is the person authorized to represent our firm in all aspects of this project. He can be reached by telephone at 847-830-1074 or through email at ttriffo@mdstechnologies.com at any time. We look forward to working with City staff on this project.

Sincerely,

MDS Technologies, Inc.

A handwritten signature in blue ink that reads "Trevor Triffo". The signature is written in a cursive, flowing style.

Trevor T. Triffo
Principal

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1 Introduction

MDS Technologies, Inc. (MDST) specializes in assessing pavement condition and implementing pavement management systems for the public works departments of municipal and county governments. We also inventory, map, and assess the condition of other public works assets such as sidewalk, curb and gutter, traffic signs, and pavement markings and striping. We have been providing these services continuously for 23 years.

We use vehicle-based technology and artificial intelligence to assess the condition of entire road networks quickly, accurately and systematically. Since our inception in 2002, we have performed over 250 pavement condition assessment projects for our municipal and county government clients in sixteen States in the US and three Provinces in Canada. Recent clients include the City of Boulder, CO; Summit County, CO; the Town of Superior, CO; the City of Canon City, CO; the City of South Jordan, UT; the City of Green River, WY; the City of Moscow, ID; the City of Dickinson, ND; the City of Box Elder, SD; the Municipality of Whistler, BC; and the City of Fairbanks, AK.

MDST was incorporated in 2002 as a 'C' Corporation in the State of Illinois. MDST is located in Park Ridge in the metropolitan Chicago area and will provide services to the City from this location. Our field crew will be based in the City for the duration of the fieldwork component of the project.

Our corporate office is located at:

**MDS Technologies, Inc.
350 S. Northwest Highway
Suite 300
Park Ridge, IL 60068**

The City of Craig (City) wants to assess the condition of its 55 centerline mile road network systematically and accurately. The City also wants to assess the condition of the curb and gutter and sidewalk adjacent to these roads. In addition, the City wants to develop a multi-year pavement rehabilitation plan that is integrated with the City's Chip Seal program and planned work to replace water and wastewater mains. The pavement condition data and rehabilitation plan data needs to be provided to the City in GIS format. Finally, a written project report that summarizes the condition of the road network that is useful for asset managers, City Council, and other stakeholders must be provided.

Our Project Team and our approach to the project to meet these objectives are presented in the following sections of this proposal.

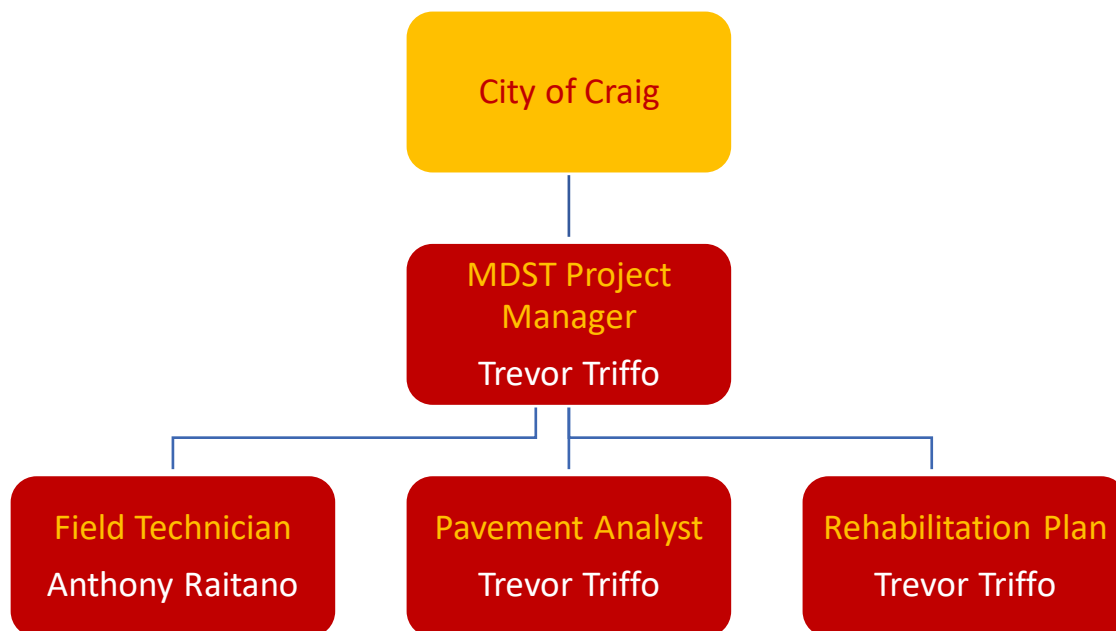
2 Project Team

MDST has assembled an internal team of experienced professionals for this project. Each member of MDST's project team will be assigned to a specific role. MDST's Project Manager will lead this team and personally perform quality control checks to ensure that an accurate, consistent, and complete product is created for the City.

Our project team has worked together for many years on many pavement condition evaluation projects. The experience and continuity that the team brings to this project will be invaluable to the City.

A project organizational chart is provided below.

MDST will perform this project in its entirety with experienced in-house staff. We do not anticipate the use of any sub-consultants for this project.



2.1 Project Manager

Mr. Trevor T. Triffo will function as MDST's **Project Manager** for this project.

Mr. Triffo holds a Master of Science Degree in Civil Engineering and he has worked in the pavement and right of way asset management field in roles of increasing responsibility over his thirty-year professional career and is a recognized leader in this field. He has participated in literally hundreds of pavement and right-of-way asset management system implementation projects as field engineer, data analyst, project manager, and principal in charge. These

projects have been located throughout the United States, Canada, and the Middle East. Clients include municipal and county governments, metropolitan planning organizations, DOTs, and foreign governments.

Mr. Triffo has recently functioned as Project Manager of successful pavement management implementation projects for:

- City of Boulder, CO
- City of Canon City, CO
- Town of Superior, CO
- Summit County, CO
- Town of Frisco, CO
- City of Moscow, ID
- City of Dickinson, ND
- City of Box Elder, SD
- City of Burnsville, MN
- City of South Jordan, UT
- City of Downers Grove, IL
- City of Wheaton, IL
- Fayette County, GA
- City of Fayetteville, GA

Mr. Triffo possesses considerable experience and expertise regarding pavement condition evaluation and implementation of pavement management systems. This experience and expertise are highlighted below.

Pavement Condition Evaluation Using Artificial Intelligence – Mr. Triffo is involved in the ongoing development of applications to utilize Artificial Intelligence (AI) to analyze digital images of pavement surfaces to assess pavement condition. This involved the development of AI-based computer vision algorithms to discern pavement surfaces and edges and AI-based pattern recognition algorithms to recognize and classify pavement distresses. We are now using the AI processes we developed to evaluate pavement condition for entire cities for our municipal and county clients.

Pavement Condition Evaluation Using Traditional Techniques – Over the course of his career, Mr. Triffo also evaluated pavement condition for tens of thousands of miles of pavements nationwide. The severity and extent of distresses occurring on a wide variety of pavement types have been evaluated using a number of techniques including manual surveys, windshield surveys, keyboard surveys, and condition assessment from digital imagery.

Development of Engineering Models for Pavement Management – A key part of implementing a pavement management system is modeling the behavior of the agency's roads and decision process with regard to selection and prioritization of rehabilitation projects. Although there are often similarities between agencies, every agency is unique in some way and this should be reflected in the models developed for the pavement management system. This modeling component requires a thorough understanding of the detailed workings of pavement management software and engineering judgment that is developed through experience. Mr.

Triffo has developed this expertise and judgment through over thirty years of experience performing this task for county and municipal governments throughout the United States.

Pavement Management System User Training – Mr. Triffo has provided system administrator and user training as part of implementing pavement management systems. Training is tailored to meet the needs and experience level of the agency and can range from navigating the user interface, viewing data, and creating standard reports to modifying engineering models, performing complex analysis, creating custom reports, adding new fields, and creating new functionality.

Presentations to City Council – Mr. Triffo is often asked to present the results of the pavement condition and budget analysis projects to City Council.

Pavement Management Software Development – Mr. Triffo has been responsible for the ongoing maintenance and development of pavement management software that was used by municipal and county governments throughout the country. This includes prioritizing and performing bug fixes, and planning, designing, developing and distributing systems enhancements.

A detailed resume for Mr. Triffo is provided in Appendix A.

2.2 Project Manager Role and Involvement

As Project Manager, Mr. Triffo will be intimately involved in all aspects of the work for the duration of the project. Any work not done specifically by Mr. Triffo will be directly overseen, reviewed for quality, and ultimately approved for release to the City by Mr. Triffo.

As MDST's Manager of this project, Mr. Triffo will:

- function as the project team's point of contact for City staff;
- implement a Project Communication Plan to facilitate effective communication between the City and MDST;
- personally attend all project meetings with City staff;
- manage the activities of the MDST field crew;
- personally perform the office-based pavement condition assessment analysis and perform quality control checks to confirm the results of this analysis;
- personally develop a multi-year pavement rehabilitation plan that considers the existing 7-year Chip Seal program and planned water and wastewater main replacements;
- personally evaluate curb & gutter and sidewalk condition;
- write a written project report that documents the project objectives, describes the evaluation and analysis methods used in the project, and summarizes the results of the project; and,
- monitor the status of the project from a cost and schedule perspective and act as required to keep the project on track.

2.3 Field Operations & GIS Technician

Mr. Anthony Raitano will function as MDST's **Field and GIS Technician** for this project. Mr. Raitano has functioned in this capacity with MDST for ten years and has operated our data collection vehicle on a number of data collection projects including the City of Boulder, CO; the Town of Superior, CO; the Town of Frisco, CO, Summit County, CO; and the City of Canon City, CO.

Mr. Raitano's role on this project is to operate our data collection vehicle to capture high quality digital imagery of the City's streets in accordance with company procedures. As part of the assignment, he will keep City's staff informed of his progress and whereabouts as desired by the City.

A detailed resume for Mr. Raitano is provided in Appendix A.

3 Relevant Project Experience and References

MDST has been performing pavement condition assessment and implementing pavement management systems for municipal and county governments continuously since our inception in 2002. We have many clients who are very pleased with our services, and a large majority of our work is with existing clients. The references below are from clients where the scope of work is very similar to this project. We encourage you to contact the individuals identified below to learn about their experiences with our firm. Additional references can be provided if requested by City staff.

Mr. Triffo, MDST's designated Project Manager for this project, was also Project Manager for all the projects summarized below.

Project: City-Wide Pavement Condition Evaluation

Client: City of Boulder, CO

Timeframe: 2007, Annually 2009 through 2025

This ongoing work involves collecting pavement condition data to keep the City's pavement management system up to date. The City maintains approximately 365 centerline miles of roads with both AC and PCC surfaces. MDST was originally hired in 2007 to implement the system for the City. Pavement condition is evaluated using the ASTM D6433 method to determine a Pavement Condition Index (PCI) for each road segment. After the initial implementation, the City was divided into three geographic areas with roughly equal road mileage for purposes of keeping the data current going forward. The pavement condition data in one area (about 125 miles) has been updated annually every year since 2009 so that the data for the entire City is updated on a three-year cycle. This data is uploaded into the City's PAVER pavement management system.

MDST also integrated the pavement management system with the City's GIS. Data can be passed back and forth between the two systems as desired, so the City can graphically display pavement conditional and other data from the pavement management system thematically.

MDST also periodically evaluates the condition of the City's at-grade parking lots. Fieldwork for this evaluation is performed at off-peak times (e.g. early Saturday morning and/or on Sunday) when few vehicles are parked in the lots. The lots are evaluated using the ASTM D6433 PCI method. Larger lots that vary in condition are divided into smaller homogeneous sections with each section evaluated separately. The PCI scores for each section are then combined into a single PCI score for the entire lot.

MDST was also retained by the City to inventory and map pavement striping and markings in GIS on all City maintained roads. This resulted in a geo-database containing approximately 10,000 records.

Contact Info:

James Smith
Tel: 303.895.6438
E-mail: SmithJ@bouldercolorado.gov

Project: PAVER Pavement Management System Implementation
Client: City of Canon City, CO
Timeframe: 2025

Canon City is located on the Colorado Front Range just south and west of Colorado Springs. The City hired MDST to assess pavement condition for the entire road network and all of the at-grade parking lots maintained by the City. We used our vehicle-based data collection technology to continuously capture sequential digital images of the County's road network. MDST successfully used Artificial Intelligence (AI) to assess road condition in accordance with ASTM D6433 from the pavement images we collected for the project.

MDST also defined the City's road network as a series of intersection-to-intersection segments using the PAVER system. The inspection data from the AI process was also loaded into the PAVER database and used to calculate a PCI score for each road segment. The PAVER database was linked to a GIS pavement centerline file so the City can display PCI scores and other data graphically on a map.

MDST created a 10-year pavement rehabilitation program for the City. This program was created using a combination of PCI scores and a Priority Factor that was assigned to each segment based on its functional classification. The City supplied a list of the rehabilitation strategies and associated unit costs to be considered in the analysis. Segments were aggregated together whenever possible to create longer, more cost effective projects whenever possible. Budget analysis was also performed using the PAVER system to determine the budget required to meet the City's long term goals regarding pavement condition. We also created a written project report that summarized the findings of the project.

The pavement inspections were completed within 4 weeks of receiving Notice to Proceed with the project. The entire project was completed within three months of receiving Notice to Proceed.

Contact Info: Leo Evans, P.E., Public Works Director
Tel: 719.276.5291
E-mail: laevans@canoncity.gov

Project: City-wide Pavement Condition Evaluation
Client: Town of Frisco, CO
Timeframe: 2024

The Town of Frisco is located in Summit County near Breckenridge. This project involved assessing pavement condition on the Town's 30-mile road network, 15 at-grade parking lots, and 16-mile paved rec-path network. Pavement condition was evaluated using the ASTM D6433 method to determine a Pavement Condition Index (PCI) for each segment.

MDST integrated the PCI data with the City's GIS so the Town can graphically display pavement condition and other data graphically. MDST was inventoried and mapped the Town's traffic signs and provided this data to the Town in GIS format.

A written project report was also provided that stated the objectives of the project, described the methods used to assess pavement condition, and summarized the condition of the roads, rec-paths, and parking lots using tables, images, charts and graphs.

Contact Info: Chris McGinnis
Tel: 970.668.4579
E-mail: Chrism@TownofFrisco.com

Project: City-wide Pavement Condition Evaluation & Rehabilitation Program
Client: Town of Superior, CO
Timeframe: 2015, 2019, 2024

The Town of Superior is located in the metropolitan Denver area. MDST was originally retained in 2015 to collect and provide pavement condition data for the City's entire 48 centerline-mile road network in accordance with ASTM D6433. A recommended maintenance and rehabilitation program based on PCI scores and the asphalt treatments used by the City was also provided. A written project report summarizing the findings of the project was also provided.

MDST was re-hired in 2021 and 2024 to re-evaluate the condition of the pavement network and update the three-year rehabilitation plan.

Contact Info: Mr. Brannon Richards, Public Works and Utilities Director
Tel: 303.381.2011
E-mail: brannonr@superiorcolorado.gov

Project: City-wide Pavement Condition Evaluation
Client: City of Moscow, ID
Timeframe: 2013, 2015, 2017, 2018, 2021

The City of Moscow, ID is located in western Idaho adjacent to the Washington State line. The City maintains 83 centerline miles of both AC and PCC surfaced roads. In the original project in 2013, MDST implemented pavement management system to help staff manage the City's road network. The road network was segmented primarily on an intersection-to-intersection basis based on data acquired from the City's GIS. MDST assessed the condition of the road network and uploaded the data into the pavement management database. Pavement evaluation training was provided to City staff. Software user training was also provided.

MDST was retained in 2015 to configure the budget analysis module of the pavement management system so that City staff could use it to create multi-year rehabilitation programs and determine the effect that various pavement rehabilitation budget streams would have on the future condition of the City's road network. MDST worked in conjunction with City staff to configure the system to reflect the City's pavement rehabilitation policies and practices.

MDST was retained to re-inspect the City's roads again in 2017. The new inspection data and PCI scores were uploaded to the City's pavement management system.

The City also retained MDST in 2018 to create a traffic sign inventory from the street-level digital imagery captured as part of previous assignments. This data was provided in an ESRI geodatabase.

A pavement condition re-evaluation project was performed in 2021. Another cycle of condition assessment is planned for 2026.

Contact Info: Mr. Steve Schulte, Streets and Stormwater Manager
Tel: 208.883.7130
E-mail: sschulte@ci.moscow.id.us

Project: City-wide Pavement Condition Evaluation and PAVER Implementation
Client: City of Dickinson, ND
Timeframe: 2019, 2023, 2024

The City of Dickinson is located in western North Dakota. The City maintains 160 centerline miles of both AC and PCC surfaced roads. MDST implemented the PAVER pavement management system to help staff manage the City's road network. The road network was segmented primarily on an intersection-to-intersection basis based on data acquired from the City's GIS. MDST assessed the condition of the road network using the ASTM D6433 method and uploaded the data into the pavement management database.

MDST performed budget analysis using the PAVER system to determine the effect that various pavement rehabilitation budget streams would have on the future condition of the City's road network.

In 2024, MDST was hired to develop a multi-year pavement rehabilitation plan that was integrated with the City's Chip Seal program and planned replacement of underground utilities.

Contact Info: Mr. Joshua Skluzacek, Engineer & Comm. Dev. Director
Tel: 701.456.7744
E-mail: Joshua.Skluzacek@dickinsongov.com

Project: City-wide Pavement Condition Evaluation
Client: Village of Downers Grove, IL
Timeframe: 2023

The Village of Downers Grove is located in the metropolitan Chicago area. MDST was hired in 2023 to assess the condition of the Village's 175 centerline-mile road network. The road network was defined as a series of segments that were typically one block in length.

We collected geo-referenced digital imagery using our vehicle-based technology and assessed the condition of these pavements to determine the severity and extent of various pavement distresses that were present on each road segment. This condition data was used to calculate a Pavement Condition Index (PCI) score for each segment in accordance with ASTM D6433.

The PCI scores and supporting distress data were provided to the City in GIS Shape file and Excel spreadsheet format. The project was completed in its entirety in two months.

Contact Info: Stephanie Graves, P.E., Staff Engineer
Tel: 630.434.5487
E-mail: sgraves@downers.us

4 Project Approach

The City wants to assess the condition of its 55 centerline mile (120 lane mile) road network systematically and accurately. The City also wants to assess the condition of the curb and gutter and sidewalk adjacent to these roads. In addition, the City wants to develop a multi-year pavement rehabilitation plan that reflects the policies and practices of the City that is also integrated with the City's Chip Seal program and planned work to replace water and wastewater mains. The pavement condition data and rehabilitation plan data needs to be provided to the City in GIS format. Finally, a written project report that summarizes the condition of the road network that is useful for asset managers, City Council, and other stakeholders must be provided.

Project Tasks

MDST has created a Task-driven Work Plan to meet the needs of the City in an expeditious and cost-effective manner. The required Tasks in the Work Plan are as follows:

- Task 1: Project Initiation
- Task 2: Field Data Collection
- Task 3: Pavement Condition Evaluation
- Task 4: Multi-Year Pavement Rehabilitation Plan
- Task 5: Project Report
- Task 6: Sidewalk Evaluation
- Task 7: Curb and Gutter Evaluation

Each of these Tasks is discussed in detail below.

Task 1: Project Initiation

This Task includes web-based project meeting between MDST's Project Manager and City staff. The project scope, schedule, communication protocols, technical approach, and administrative details of the project will be reviewed and confirmed during this meeting.

We will request a copy of the City's GIS pavement centerline file prior to the project initiation meeting so that we can review it and be in a position to ask any questions about it at the meeting.

The City's policies and practices regarding pavement rehabilitation will also be reviewed during this meeting so that MDST will have the information needed to create the multi-year pavement management program. We will want to develop a list of the pavement rehabilitation strategies the City uses, the types of roads and condition under which they are used, and the unit cost of each strategy.

This meeting can take place with one week of our receipt of Notice to Proceed with the project.

Task 2: Field Data Collection

MDST will collect pavement condition data in a sound, systematic, and reproducible manner for approximately 55 centerline miles (120 lane-miles) of City-maintained roads. We propose to utilize vehicle-based technology to capture the required pavement condition data quickly, safely, and cost-effectively. The approach that we use is specifically designed to be consistent with an ASTM D6433 Pavement Condition Index (PCI) survey.

A GPS-enabled digital camera will be mounted to the roof of the data collection vehicle to capture a pavement-oriented view of the overall streetscape. We use high resolution cameras that are capable of capturing 12 Megapixel images in .JPG format every 0.5 seconds. This ensures complete coverage of the pavement surface even as the vehicle travels at the posted speed limit. Two lane roads of typical width will be tested in one direction, and four lane roads will be tested in both directions of travel. Any two-lane roads that are exceptionally wide (e.g. roads with diagonal parking) will also be tested in both directions to ensure coverage of the entire surface area.

Additional cameras can be positioned and angled as needed to capture imagery of other right-of-way assets such as traffic signs and supports, sidewalk and sidewalk ramps, curb and gutter, pavement striping and markings, etc. For this project we will also use a 360 degree camera to capture imagery to assist with the sidewalk evaluation.

Camera views can be displayed inside the vehicle and are constantly monitored by our field technician to confirm that high quality imagery is being captured at all times.

Data Collection Procedures and Quality Control:

MDST has developed standardized procedures that dictate how the data collection vehicle is to be configured and operated to maximize the consistency and quality of the data. Some of these are:

- Fieldwork does not proceed if the pavement surface is obscured by standing water or other substances/debris.
- The sun must be sufficiently high off the horizon in order to collect quality imagery. This is because a certain amount of light is required to prevent under-exposure. Also, images captured looking into the sun when it is too low on the horizon are subject to a "flash" effect that results in sub-standard images. These problems are avoided by

- starting fieldwork at least one hour after sunrise and finishing at least one hour prior to sunset.
- Camera settings such as aperture, shutter speed, and color parameters are reviewed and adjusted at the start of every day to reflect the current weather conditions. Once initialized, the cameras continually self-correct to account for instantaneous changes in lighting conditions. In addition, the vehicle operator can view the images as they are being captured and make any manual adjustments as required.

We also have standard procedures to review the data on an on-going basis while the fieldwork is progressing. Each image is tagged to spatial data that defines the location at which the image was obtained. This allows us to load the spatial data into GIS and perform analysis to compare the image locations to the road network to be tested to determine if any roads have not been driven. A thorough final review is performed at the end of the fieldwork before the vehicle is de-mobilized from the City.

The duration of this Task is expected to be two to three days on-site. This task can begin immediately after the Project Initiation meeting.

Task 3: Pavement Condition Evaluation

We use Artificial Intelligence (AI) tools to assess pavement condition quickly, accurately, and systematically. Our AI models have been specifically trained by our Project Manager and other highly knowledgeable and experienced pavement engineers to identify distress type, severity, and extent in accordance with ASTM D6433. Use of AI allows us to provide an accurate and consistent evaluation in a significantly reduced amount of time.

The geo-located digital imagery captured in the field is associated with the corresponding road line segment in the GIS road centerline file in a web-based application. An example map showing road centerlines (green lines) and points representing the location of images (blue dots) is shown in Figure 1.

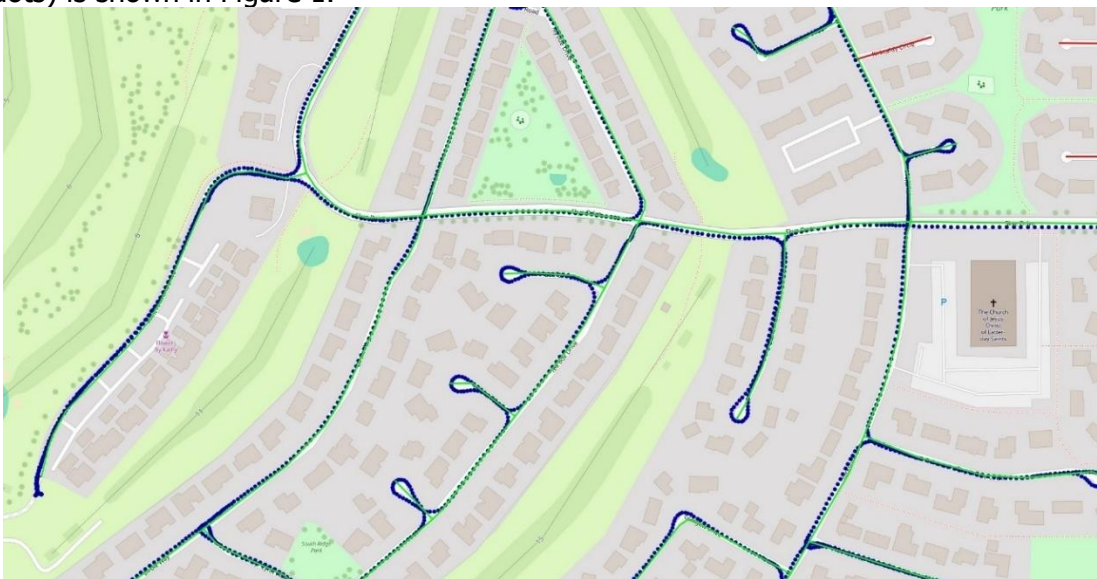


Figure 1: Map Showing Road Centerlines and the Location of Images

A typical pavement image from the rear camera is shown in Figure 2. Images are captured at 0.5 second intervals in the field to ensure complete coverage of the length of a road segment.



Figure 2: Typical Pavement-Oriented Image Obtained for Surface Condition Analysis

Each image is subjected to several types of analysis. First, each image is analyzed to assess which portion of the image contains a road surface. Further analysis is performed to identify pavement markings, utility access points, drainage inlets, vehicles, bicycles, pedestrians, animals, and other items on/within the road surface not related to pavement condition so that these objects can be specifically excluded from the distress evaluation. This is done through Computer Vision analysis, a form of AI that enables a computer to identify and understand objects in images and video.

After the above items have been identified and removed, a second type of AI analysis is performed to classify pavement distresses, assess the severity level of the distresses (low, moderate, or severe), and determine the extent (length or area) of each type of distress. Polygons are drawn around each classified distress. An example is shown in Figure 3. High severity alligator cracking and moderate severity transverse cracking have been identified and quantified in this image.



Figure 3: Pavement Distress Classification through AI

This analysis is performed on all images associated with a road segment. The distressed areas from each image are projected onto a 2D area/planimetric view using photogrammetry techniques and any overlap in distressed areas from one image to the next is identified and eliminated. The resulting area of each distress type/severity level combination is used to calculate the Pavement Condition Index (PCI) in accordance with ASTM D6433.

Quality Control

MDST's Project Manager will perform extensive quality control checks on the PCI data before it is released to the City. He will review the digital imagery for each segment and parking lot and the results of the AI-driven evaluation to assess/confirm that distresses are being properly identified and quantified. If needed, he will modify aspects of an inspection on an individual segment basis so that the PCI score accurately represents the actual condition in the field.

After the PCI scores are approved by our Project Manager, the inspection data will be formatted as needed for uploading into the Cartegraph database. Our Project Manager will be available to assist City staff with the upload through a web meeting if needed.

As mentioned, the use of AI tools significantly reduces the time required to assess pavement condition. This task has an expected duration of approximately three weeks.

Task 4: Multi-Year Pavement Rehabilitation Plan

MDST's Project Manager will create a multi-year pavement management plan for the City. Since the City has a 7-year Chip Seal Program, we anticipate that the overall rehabilitation program we create will also be a 7-year program. He will also perform analysis to assess the effect that the plan will have on the overall PCI of the road network. A list of rehabilitation strategies, the circumstances under which they are used, and associated unit costs will also be required. We will discuss what is required with City staff at the Project Initiation Meeting.

When creating a multi-year capital improvement plan, pavements are generally slotted into groups based on PCI scores. In general, pavements with a PCI score above 55 may be candidates for localized maintenance and/or some form of surface treatment. Pavements with a PCI score below 55 are candidates for some form of rehabilitation (e.g. mill and overlay). Pavements with very low PCI scores (below 25) are typically candidates for reconstruction. However, these figures vary from one agency to the next depending on the policies and practices of the agency, available budget, and the expectations of the City's residents.

MDST's Project Manager will also group individual segments together into specific corridors to form longer, more practical and cost effective projects when creating the plan. Other factors such as the City's Chip Seal program, plans for future road rehabilitation work and plans to replace underground utilities under certain roads, and the condition of curb and gutter can also be factored into the plan.

Task 5: Project Report

MDST will create a hard copy report after the analysis described above has been completed. We have a report template that we use that has been well received by other clients, but the report will be tailored to meet the requirements of the City. The report will state the objectives of the project, the methods used to evaluate pavement condition, and summarize the condition of the road network using tables, images, charts, and graphs. The 7-year pavement management plan will also be included in the report. Both the rehabilitation plan and the project report will be initially provided as a draft version so that comments and questions from City staff can be addressed when the final versions are created.

The PCI scores with supporting data and the rehabilitation plan will also be provided to the City in GIS and Excel format.

Task 6: Sidewalk Evaluation

MDST performs sidewalk condition evaluation in addition to pavement condition evaluation for many of our municipal government clients. While it is possible to evaluate sidewalks like they are a small PCC-surfaced road and calculate a PCI score, most of our clients are more interested in identifying locations where there is a potential safety concern for pedestrians.

An approach that we have used successfully in the past is to identify sidewalk panels that are settled or heaved in relation to the adjacent panels, or are damaged due to cracking, scaling, spalling, etc. to a degree that they pose a potential hazard to pedestrians. In the past we have

also identified two severity levels. If a panel exceeds the threshold to be considered for maintenance or replacement, it is counted as a Level 1 damaged panel (e.g. heaving/settling of 1+ inch). If a panel exceeds a higher threshold (e.g., heaving/settling of 2+ inches), then it is counted as a Level 2 damaged panel. The thresholds to be used in the evaluation will be determined in conjunction with City staff.

We can count the number of Level 1 and Level 2 panels and use this data to calculate a Distress Index for each sidewalk segment. Level 2 panels would have a higher weighting in the Distress Index calculation. Each sidewalk segment can also be assigned an Importance Factor that would consider the amount of pedestrian traffic and adjacent land use. Sidewalks in the downtown areas or near schools and hospitals would have a higher Importance Factor than other sidewalks.

Finally, the Distress Index and the Importance Factor can be combined to create a Priority Score for each segment. A list of sidewalk segments for a maintenance/replacement program can then be created from the segment Priority Scores. For example, sidewalk segments with a poor Distress Index score and a high Importance Factor score would have a Priority Score would therefore appear at the top of the priority list.

The City has stated that it is interested in acquiring useful, actionable data in a cost-effective manner. To achieve this goal, we can simply assign the Distress Index, Importance Factor, and Priority Score for the sidewalk associated with each road segment. If there is sidewalk on both sides of a road segment, separate scores will be provided for the sidewalk on each side of the road.

The above is the least costly approach because it does not require a sidewalk line layer to be created in GIS. It also does not require a point layer showing the location of damaged panels to be created in GIS. However, either or both of these items can be provided at additional cost if desired by the City.

Task 7: Curb and Gutter Evaluation

MDST can estimate the percentage of curb & gutter that needs to be replaced. This could be due to damaged curb, excessively settled or distorted curb, or curb with insufficient curb face due to previous overlays. The criteria used to determine the percentage if curb and gutter that needs to be replaced will be determined at the outset with City staff.

As was the case with sidewalks, this data can be tagged to the existing GIS pavement centerline file, so it is not necessary to create a GIS line layer showing the location of curb and gutter. If desired by the City, this linework can be created at additional cost.

Optional Tasks

MDST can provide other related services in addition to those required by the RFP. These include:

- Presenting the findings of the project to senior staff and/or City Council;
- Provide access to a website to view the digital images that we collect as part of the project;
- Map and assess the condition of other public works assets such as traffic signs and pavement striping and markings.

The additional cost to perform these tasks can be provided after the scope of work for the task is determined.

5 Project Schedule

MDST can complete this project within ten weeks of receiving Notice to Proceed with the project.

The Project Initiation meeting can be held within one week of NTP. The fieldwork can proceed within one week following this meeting. The fieldwork has an expected duration of two days on-site (one week for scheduling purposes).

The office-based task of evaluating pavement condition can proceed immediately after the field work is complete. Evaluating the condition of the City's 55 centerline miles of roads is expected to take about three weeks. This project milestone will occur within five (5) weeks of NTP. The sidewalk and curb and gutter evaluation will be performed concurrently with the pavement evaluation.

Creation of the pavement rehabilitation plan and a draft version of the project report can proceed after the pavement condition evaluation is complete. This task has an expected duration of two weeks. The final version of the rehabilitation plan and project report can be created and provided to the City within one (10 week) after we receive feedback on the draft versions from City staff.

Assuming City staff will need two (2) weeks to review the draft rehabilitation plan and report, the project can be completed in its entirety within 10 weeks of our receipt of NTP.

to complete as the City may want to provide comments/input on an initial draft before it is finalized. The project report can be written after the 10-year plan has been created. This task will take approximately one week to complete.

6 Fee Proposal

MDST is prepared to perform this project for a lump sum, all-inclusive fee of \$29,150 as shown in the Table below. MDST will submit an invoice to the City upon completion of the field work and monthly thereafter. Invoiced amounts will be pro-rated based on percent complete by Task. Payment terms are Net Thirty (30) days. These fees are valid for ninety (90) days.

Project Fee Table

Task	Staff	Hours	Extension	Task Totals
1 Project Initiation	Project Manager	4	\$800	\$800
2 Field Data Collection	Project Manager	2	\$400	
	Senior Technician	26	\$3,900	
	Expenses		\$1,550	\$5,850
3 Pavement Condition Eval	Project Manager	2	\$400	
	Pavement Analyst	40	\$6,000	\$6,400
4 Pavement Rehab Program	Project Manager	12	\$2,400	\$2,400
5 Project Report	Project Manager	16	\$3,200	\$3,200
6 Sidewalk Evaluation	Project Manager	2	\$400	
	Pavement Analyst	34	\$5,100	\$5,500
7 Curb and Gutter Evaluation	Project Manager	2	\$400	
	Pavement Analyst	30	\$4,500	\$4,900
			TOTAL:	\$29,050

Appendix A: Resumes

Trevor T. Triffo
Principal, MDS Technologies, Inc.

Introduction

Mr. Triffo is Principal of MDST Technologies, Inc. In this position, Mr. Triffo is responsible for all aspects of company operations. Mr. Triffo has spent his thirty-year career in the pavement and transportation infrastructure asset management industry. He has participated in several hundred initial implementation and data update projects for clients at the municipal, county, regional, and state level throughout the United States and Canada. On these projects, he has functioned in a variety of positions including Project Engineer, Project Manager, and Principal in Charge. Mr. Triffo has also functioned as co-Project Manager of a comprehensive infrastructure asset management system for the State of Kuwait.

Pavement Inventory and Condition Assessment Experience

Mr. Triffo has designed, participated in, and supervised data collection programs for numerous agencies ranging from small municipalities to state DOTs. Mr. Triffo has extensive experience with a variety of data collection technologies and techniques.

- *Automated Condition Data Collection* – Mr. Triffo has been involved in over 200 projects in which non-contact technology was used to acquire pavement roughness, and wheel track rutting. A significant percentage of these projects also required collection of automated geometric information such as grade, cross-fall, and radius of curvature. This data was collected using a combination of laser cameras, accelerometers, inclinometers, and rate gyroscopes.
- *Surface Distress Surveys* – Mr. Triffo has been involved in roughly an equal number of projects that involved collection of surface distress data. Mr. Triffo is very familiar with numerous ways to collect this data including manual methods and semi-automated (windshield) methods. Mr. Triffo has also been involved in research efforts to develop a totally automated optical crack detection system that utilized high resolution digital cameras, a strobe lighting system, and a parallel process computing system to perform pixel analysis/crack detection in real time.
- *Non-Destructive Deflection Testing* – Mr. Triffo is intimately familiar with non-destructive deflection (NDT) testing of pavements. Mr. Triffo has analyzed deflection data acquired by a Dynaflect device and Falling Weight Deflectometer (FWD) on thousands of miles of pavements of all types and in all areas of the United States and Canada.

Mr. Triffo is trained as an engineer and with an emphasis in soils, materials, and pavements. His Master's research Thesis involved the study of concrete pavement deterioration due to exposure to freeze/thaw cycles. The combination of Mr. Triffo's academic training and practical experience put him in a very strong position to understand an Agency's unique pavement issues and address them in the pavement management application.

Pavement Management System Implementation Experience

Most of the data collection projects mentioned above involved loading data and/or implementation of a pavement management system for client Agencies. Mr. Triffo has vast experience with all aspects of system implementation including:

- Agency needs analysis to determine the required functionality of the system;
- Design of appropriate data collection programs that meet the technical needs and budget constraints of the agency;
- Design and implementation of appropriate quality control plans to ensure data integrity;
- Development of Agency specific models so that the output of the system reflects the Agency's unique combination of conditions, policies, and practices; and
- Training of Agency staff on field data collection, principles of pavement management, and use of the selected system so that the Agency does not need to rely on outside sources to maintain the system.
- Design interfaces between the pavement management application and other systems such as GIS and Work/Maintenance Management.
- Presentation to senior staff and/or elected officials to communicate findings, conclusions, and recommendations resulting from implementation of the system.

System Design and Development

Mr. Triffo has successfully led the design and development of pavement management applications for the private and public sector. For the public sector, systems were designed to meet the specific needs of municipalities, counties, and DOT agencies.

Mr. Triffo also designed and managed the development of a comprehensive right of way asset management system. This system utilized a generalized analytical engine that enabled users to inventory and assess the condition of a wide range of infrastructure assets. The types of assets that can be accommodated by this system are signs and supports, sidewalks, curb and gutter, pavement markings, sound and retaining walls, traffic signals, lighting systems, drainage inlets and manholes, fire hydrants, underground utilities such as storm sewer, sanitary sewer, and water distribution networks.

Work History

MDS Technologies, Inc. <i>Founder/Principal</i>	Park Ridge (Chicago), IL 2003 to Present
IMS Infrastructure Management Services, Inc. <i>Senior Vice President</i>	Arlington Heights (Chicago), IL 1998 to 2003
Stantec, Inc. <i>Manager, Implementation Department</i>	Cambridge, ON, Canada 1989 to 1998
Shiplake Management, Ltd. <i>Construction Engineer</i>	Toronto, ON, Canada 1988 to 1989
Trow Geotechnical, Ltd. <i>Pavement Engineer</i>	Brampton, ON, Canada 1987 to 1988
Pavement Management Systems, Ltd. <i>Data Analyst</i>	Cambridge, ON, Canada 1986 to 1987

Education

<i>York University</i> Toronto, ON, Canada Coursework toward MBA	1989- 1992
<i>University of Manitoba</i> Winnipeg, MB, Canada M.Sc. Civil Engineering (Geotechnical/Pavements)	1984 - 1987
<i>University of Manitoba</i> Winnipeg, MB, Canada B.Sc. Civil Engineering	1980 - 1984

Anthony Raitano **Field Operations Technician**

Professional Experience

Mr. Raitano has functioned as a Field Operations Technician with MDST for over ten years. In his role in the field, Mr. Raitano operates the MDST data collection vehicle. He performs daily calibration/quality checks and operates the vehicle in conformance with established company policies and procedures. Mr. Raitano communicates with clients to keep them informed of his whereabouts as their roads are driven, and keeps them updated regarding his progress. He also contacts our clients when it appears that the field work maps may be inaccurate or incomplete to address the situation and ensure that all roads to be included in the field work program are tested. He has performed demonstrations of our vehicle based technology to clients.

Project Experience

Mr. Raitano has functioned as Field Operations Technician on many projects, including City of Boulder, CO; Summit County, CO; Fayette County GA; City of Fayetteville, GA; Chatham County, GA; City of Green River, WY; City of South Jordan, UT; York County, SC; Village of Downers Grove, IL; Village of Bartlett, IL; Village of Carpentersville, IL; and City of Carmel, IN.

Work History

MDS Technologies, Inc.
Field Operations Technician

Park Ridge, IL
2014 to Present

City of Park Ridge
Police Officer

Park Ridge, IL
1996 to 2014

Education

Harper College, Palatine, Illinois
Criminal Justice Major
Continuing Education 1989 - 2004

Illinois State Police Academy, Springfield, Illinois
Graduated 1995 Class 400-54