For Every...

Request For Proposal

City of Rochester, New York

Pavement Management System Implementation

December 2014

MRB group
Engineering, Architecture, Surveying, P.C.

transmap

December 18th, 2014

City of Rochester, New York
Attn: Jeron Rogers, PE, Assistant City Engineer
30 Church Street, City Hall
Rochester, New York 14614

RE: Pavement Management System Implementation

Mr. Rogers:

Thank you for allowing Transmap Corporation and MRB Group to propose our solution. We are pleased to present the City of Rochester with our response to your Request For Proposal. Transmap Corporation and MRB Group can meet and exceed the technical requirements for this project. We put forth **Good Faith Efforts** to solicit and utilize eligible M/WBE firms. *Unlike other vendors, we use a Hybrid Approach for measuring pavement.*

As a Rochester native, I grew up on the east side and was raised by a Wilson Magnet High School Physics/Chemistry teacher. I understand the City, its local climate factors, and regional influences.

I have outlined a few key features that you will find beneficial in qualifying Transmap as the best provider for your pavement and asset management needs:

- ***New York Presence*** - President/CEO and Vice President are New York natives - Excellent New York project experience (Jefferson and Lewis County (JIMI Project - 13 communities total), City of Watertown, Erie County, City of Buffalo, and Town of Greenburgh)
- ***Transmap/MRB Group Team*** - Strategic Partnership - PhDs, PEs, and GISPs on staff
- ***WBE Participation*** - Contact Printing Solutions - Over 30 years of experience
- ***Hybrid Approach*** - Latest mobile mapping technologies supported by field walkout - *NEW 4K Laser Crack Measurement System (LCMS)* - LiDAR to support asset collection
- ***Our System*** - SaaS (Web-based ArcGIS Online) - MicroPAVER pavement software - Certified APWA MicroPAVER trainer - Over 25 successful MicroPAVER projects in the last two years alone
- ***GIS-Focused*** - Esri Public Works Solution Partner - Web GIS reporting - Map-based analysis
- ***Schedule*** - Aggressive timeline including all major project milestones (3.5 - 4.5 months)

Please feel free to call with any questions. I can be contacted at hluxhoj@transmap.com or on my mobile at 614-886-4100. For a digital copy of our response, please log on to tmap.pro/RN.

Best regards,

Howard Luxhoj, PE
President and CEO
Transmap Corporation

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Executive Summary

For a digital copy of our response and to see a video, please log on to tmap.pro/RN.

City of Rochester, NY

Pavement & Asset Management is our *only focus*

MicroPAVER TRAINER DEVELOPERS

ArcGIS Online

Similar Pavement/Asset Projects

- ***City of Buffalo, NY***
- ***City of Watertown, NY***
- ***Lewis County, NY***
- ***Jefferson County, NY***
- ***Town of Greenburgh, NY***
- ***Erie County, NY***
- Allegheny County, PA
- City of Alexandria, VA
- Franklin County, OH
- City of Kettering, OH
- City of Xenia, OH
- City of Huber Heights, OH
- Washington Township, OH
- City of Rockford, IL
- Evansville, IN MPO
- City of Wilmington, NC
- Town of Cary, NC
- City of Greenville, NC
- City of Raleigh, NC
- City of Durham, NC
- City of Milton, GA
- City of Shreveport, LA
- Seabrook Island, SC
- City of Hollywood, FL
- City of Delray Beach, FL
- City of Lakeland, FL
- City of Sarasota, FL
- Putnam County, FL
- City of El Paso, TX
- City of Conroe, TX
- City of Midland, TX
- City of Killeen, TX

ASTM INTERNATIONAL

APWA AMERICAN PUBLIC WORKS ASSOCIATION

Pavemetrics

100% Roadway Coverage & Repeatable Solution

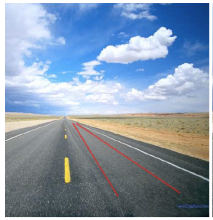
PAVEMENT MANAGEMENT 2.0

-Hybrid Approach (ASTM D6433)
-Latest hardware & software (Laser Crack Measurement System (LCMS), LiDAR)
-Robust reporting (catered to client)
-Field verification
-Pavement Management Practices Definition (boot camp)
-360° view, total coverage of both lanes

transmap

ON-SIGHT™ Mapping Vehicle

NEW Laser Crack Measurement System (LCMS)



Old System (3, 5 or 7 point laser)

4K System (Complete coverage)

Field Verification QA/QC

OUR SYSTEM

-MicroPAVER pavement software
-Esri Public Works Partner
-APWA certified pavement trainers (15 trained municipalities)
-Open source policy (can implement into any software system)
-Customer-centric approach
-Hosts results (PCI, reporting, media) in ArcGIS Online

EXPERIENCE

-Excellent New York client references
-PEs, PhDs, GISPs on staff
-Accomplished strategic partner on team
-25 MicroPAVER implementations in the last two years alone
-Hosted PCI results in ArcGIS Online
-Over 20 years of pavement and asset management experience

esri Public Works PARTNER

Transmap is the ONLY vehicle-based asset management company hired by Esri to collect roadway infrastructure

Full Automation

Strategic Partnership with MRB Group
WBE Participation: Contact Printing Solutions

MRB group Engineering, Architecture, Surveying, P.C.

Contact Printing Solutions

Windshield

green BUSINESS

Work Plan

Understanding of the Project: Pavement Management System Implementation

Transmap has read and understands the tasks described in the City of Rochester's Request For Proposal. **We believe our approach and plan to this project would be the most beneficial to the City of Rochester because our only focus has been pavement and roadway asset management for over 20 years.** *Unlike other vendors, Transmap makes actual measurements.*

Rochester Living Wage Ordinance Statement

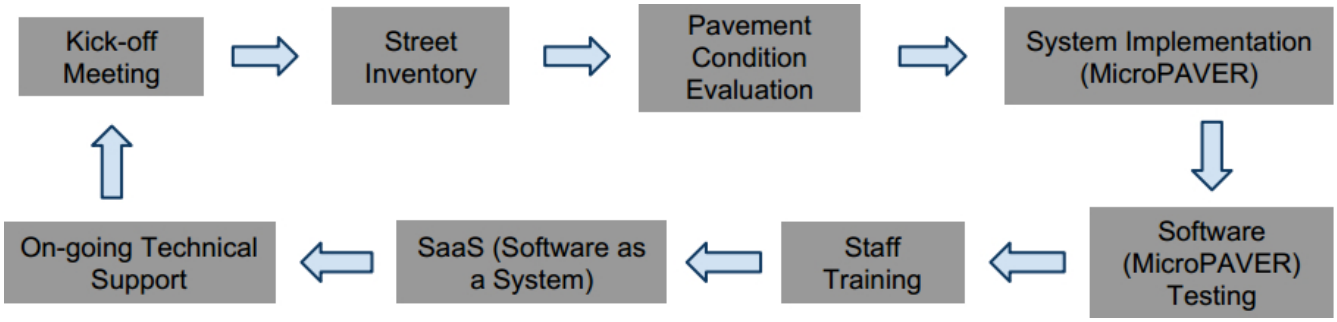
Transmap commits to pay all covered employees a living wage, pursuant to Section 8A-18 of the Rochester Municipal Code, "Rochester Living Wage Ordinance."

Pavement Management System Implementation (Overview)

Transmap offers a total pavement management solution that we call **Pavement Management 2.0**. **Pavement Management 2.0** is based on a **Hybrid Approach** for data collection and assessment, employing cutting edge hardware and software. Clients benefit from robust reporting of pavement condition data fully integrated into a GIS. We offer on-site support and customized training based on your specific needs.

Please read the next section for details on how Pavement Management 2.0 will provide the best solution for your project and exceed your expectations. The flowchart below shows how Transmap will conduct this pavement management project for the City.

Pavement Management 2.0 Core Principles



This unique approach to pavement management was exclusively developed by Transmap. Pavement Management 2.0 exceeds industry standards and provides our customers with a reliable and robust solution to pavement management. Furthermore, this unique approach generates real savings and improves efficiencies in public works and highway departments throughout the USA. Pavement Management 2.0 combines the following 8 components to a smooth system: **Kick-off Meeting, Street Inventory, Pavement Condition Evaluation, System Implementation (MicroPAVER), Software Testing (MicroPAVER), Staff Training, SaaS (Software as a System), and On-going Technical Support.**

Pavement Management System Implementation (Detailed Description)

Kick-off Meeting: Project Administration

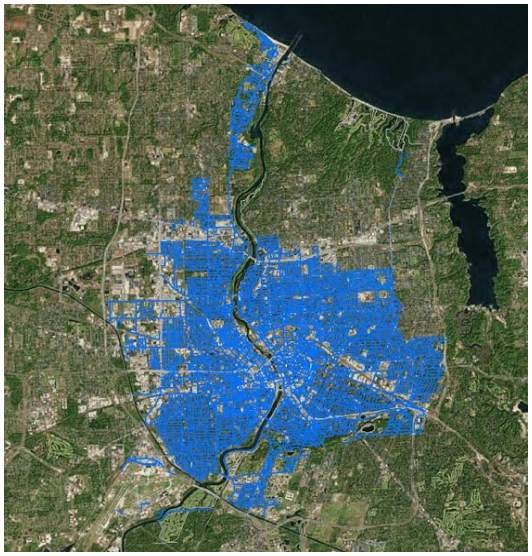
Transmap will hold a Kick-off Meeting on-site at the City of Rochester. Project Managers from both Transmap and MRB Group will be on-site at this meeting. The Kick-off meeting will contain a discussion of expectations for the project. The topics discussed at the Kick-off meeting will include, but not be limited to, a project overview, scope, methodology, schedule, budget, project team, risk management and communication/public involvement.
Transmap has a standard Request for Information Process that will be discussed during the Kick-off meeting. The purpose of reviewing this process before the project begins is for the City to inform Transmap of any special circumstances (i.e. flooded roads, gated communities,

City of Rochester's GIS Centerline Review

6982 Segments
548 Miles
Min - 2 ft.
Max - 5518 ft.
Avg - 415 ft.
Std Dev - 330 ft.
10,396 Samples (300')

additional codes to access certain streets, etc.)

Also prepared for the Kick-off meeting will be a drive coded centerline basemap of the City (direct right). A drive coded basemap depicts the valid roads Transmap will drive in the project area. The image to the far right is a drive code legend, which is reviewed for roads driven and not driven (and why they were not driven).



Midland_Drivecode

- 0 - Not Scheduled for Driving
- 1 - Driven
- 2 - Does Not Exist
- 3 - Gated
- 4 - Under Construction
- 7 - Driven (One-Way)
- 13 - Driven w/Partial Not Scheduled to Drive
- 14 - Driven w/Partial Private
- 22 - Driven w/partial One-Way
- 24 - Driven w/Partial Impassable
- 29 - Driven w/Partial Does Not Exist
- 30 - Driven w/Partial Gated
- 31 - Driven w/Partial Construction

Project Management Tasks

Transmap's standard project management tasks include managing the personnel assigned to the project, project progress reports, ArcGIS online project tracking, on-site Kick-off meeting, web meetings, etc.

Street Inventory: Hybrid Approach

The ON-SIGHT™ Mobile Mapping System

Once the drive coded centerline file is approved by the City, Transmap's state-of-the-art ON-SIGHT™ mobile mapping system will drive the City of Rochester's roads. The ON-SIGHT™ system can capture vehicle-based LiDAR, 360 degree street-level HD images, and a dedicated LCMS scanning for pavement distresses. All data is tied to an accurate GPS location and heading of the vehicle. Technical details of its sensors can be found in the box on to the right.

The following is a list of the mobile pavement/asset inspection equipment:

Freightliner Sprinter 2500 Full Size Van (Clean diesel)

Trimble POSLV 420 DGPS fully integrated system (best solution on the market)
- GPS-Ag 332 (L1,L2, Omnistar real-time correction)
- Litton LN 200 at 400hz (highest accuracy)
- X, Y position 1.5 feet

HD and Ultra HD Cameras
- 1628 x 1236 Color Images
- 2448 x 2048 Pavement Camera
- 5616 x 3744 Pavement Camera (Optional)

4K Laser Crack Measurement System (LCMS)

Distance Measurement Instrument (DMI)

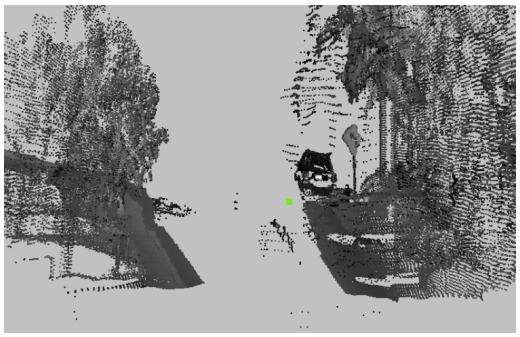
Sick LMS211 Ground-based LiDAR

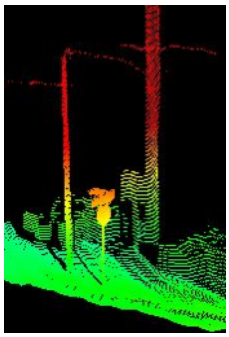
Two Servers to run up to six devices at one time
- Real time Raid array

Trimble 5700 Geodetic Base Stations for post processing data

Vehicle-Based LiDAR

Transmap employs an infrared LiDAR sensor that assists us in asset extraction and identification by scanning the Right-of-Way (ROW) in each travel direction. LiDAR has been successfully used to inventory traffic signs, street lights, and to accurately measure their dimensions. The images to the right are LiDAR examples.





ON-SIGHT™ HD Imaging & Raw Data Collection

To record pavement condition data and roadway assets in the field, Transmap drives its ON-SIGHT™ **HD** mapping vehicles along all roads specified during the network definition phase of the project. The system captures pavement and ROW images on both sides of each roadway for a **360-degree view of the road**. This process allows us to capture **100 percent** of the pavement surface and ROW of each road. As a standard, Transmap records images at **13.1-foot intervals** in order to capture a clear view of every ROW feature and pavement distress. This spacing can be customized in order to meet specific customer needs.

QC for ON-SIGHT™ HD Imaging/Global Positioning System (GPS) Data

Transmap performs daily quality control checks for all ON-SIGHT™ HD data. Each day, the **GPS data** is processed, reviewed, and backed up. If the results do not meet our standards, the GPS data will be re-collected the following day. On any given day, the ON-SIGHT™ HD data is processed and basically ready for delivery. In terms of **Completeness Checks**, Transmap has created a drive coding system that allows for simple completeness tracking at any stage of the imaging process. **Imaging Quality Control** starts with the ability to view all images being collected in the field as they are recorded.

Future ROW Asset Extraction Options

In addition to providing the City with a complete pavement management solution, Transmap can inventory roadway assets that will provide cost savings for the City of Rochester. We have the capability to extract and populate roadway assets such as *traffic and street name signs, nighttime sign collection, ADA ramps, parking lots, sidewalks, asphalt paths, curbs, valley gutters, trees, medians, guardrails, manholes, valves, hydrants, school zones, speed zones, storm drains, etc.*

Falling Weight Deflectometer (FWD) - As Needed Basis

Transmap can supply the City with project-level FWD testing using our trailer mounted KUAB 2m-FWD dynamic impulse loading device. The KUAB meets or exceeds all requirements of ASTM standard test method D4694-96 and the SHRP calibration protocol for FWD equipment.

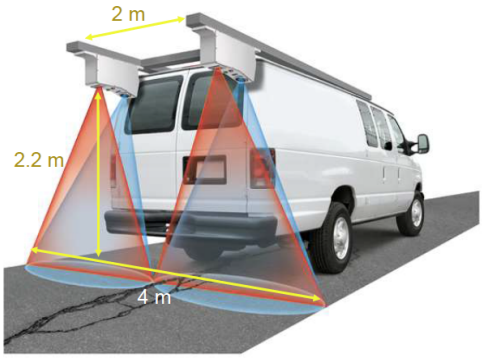
Advanced Inspections: Laser Crack Measurement System (LCMS)

Transmap's ON-SIGHT™ vehicle is equipped with the newest Laser Crack Measurement System (LCMS), which uses laser line projectors, high speed cameras, and advanced optics to acquire high resolution 3D profiles of the road.

LCMS Features: LCMS 2D/3D Models and Delivery

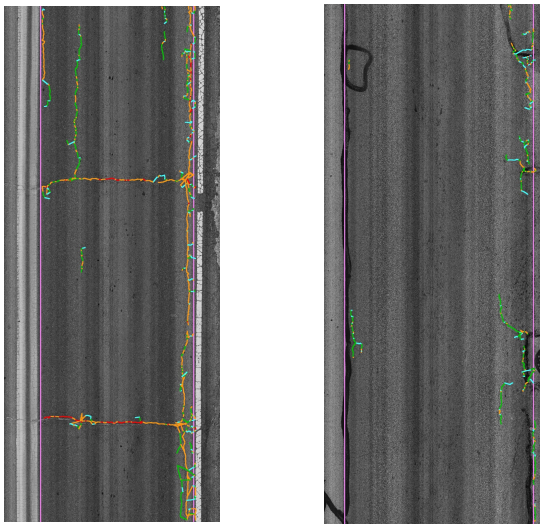
LCMS 2D Analysis

The LCMS captures surface conditions up to a 4m **(13.1 foot)** width and is broken up in 10m lengths. Transmap will drive in both directions for a complete view of all surface distresses and can deliver a complete **Crack Map** of surface distress data. A Crack Map shows the cracking of a road over a .jpeg image. The images can be viewed as a link in the Esri (GIS) system.



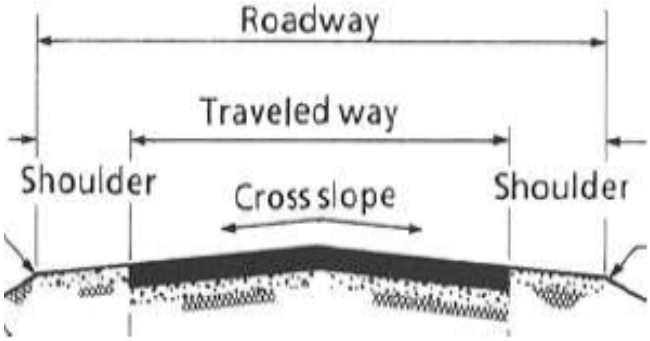
13.1 Feet

The images below are 2D LCMS examples.

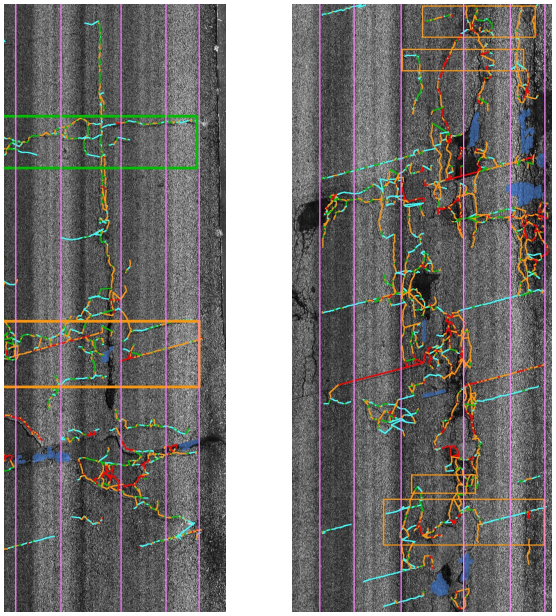


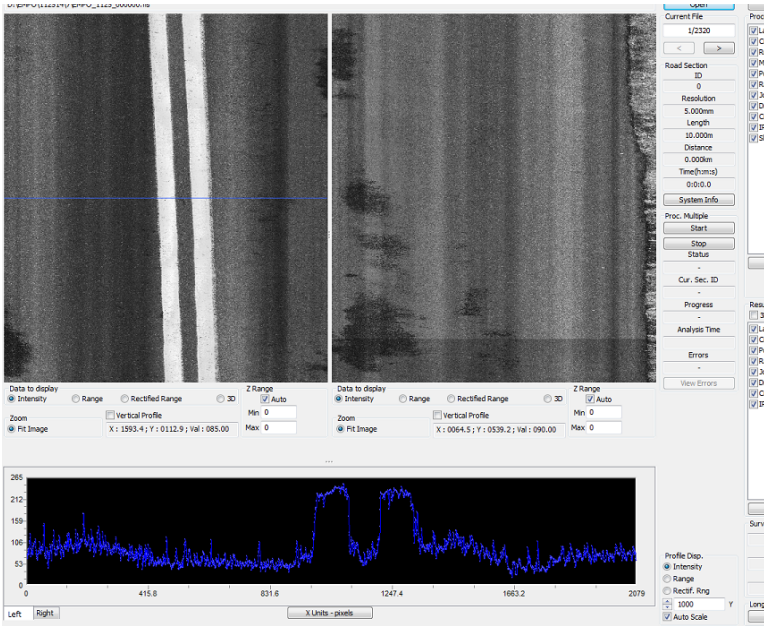
LCMS 3D Analysis

Transmap's vehicle is capable of collecting data at speeds up to 62 mph and acquires both 3D and intensity (image) data of the road surface with 1mm resolution. This allows for the characterization and visualization of high quality images and shape (textures) of the road surface. The high precision Inertial Measurement Units (IMUs) are added to each of the LCMS sensors in order to allow us to collect and report **Longitudinal Grade, Horizontal Cross Fall (cross slope),** and **Super Elevation** of curves.



The images below to the left show how the 3D image differs from the 2D image. The 3D image has the ability to show depths, rutting wheel paths, drop offs at the edge of pavement, and depths of cracks not just widths. The roadway surface model is still in Beta format. The image below to the right is a screenshot of LCMS post-processing (LCMS Processing Suite).





LCMS 3D Images **LCMS Processing Suite**

Roughness and Rutting Data

The **International Roughness Index (IRI)** and rutting data will be collected for the left wheel track, the right wheel track, and the average of the two wheel tracks in a manner that meets all **ASTM E950 standards.** The equipment captures continuous pavement data as the vehicle drives along a roadway. The 4,000+ points of our combined lasers are far more advanced than a typical 3 or 5 point laser. These lasers will capture IRI data across 13.1 feet of the surface and the operator does not have to worry about having the vehicle exactly in the wheel paths for rutting. The rutting depth will be delivered as minimum, maximum, and average per wheel path and the IRI data will be delivered as a value over the whole section of pavement. The IRI data represents the total anticipated vertical movement a vehicle would experience over a given stretch of road. This data is acquired from the profiler and delivered as a field in the centerline file segment by segment.

Key Features of the LCMS:

- **Crack detection and severity**
- **E950 IRI data**
- **4160 point rutting (rut depth, rut type)**
- **Multiple macro-texture measurements (MPD)**
- **3D and 2D data to characterize: Potholes, patching, ravelling, sealed cracks, joints in concrete, tinning, etc.**
- **Day and night operation**
- **Low power consumption**

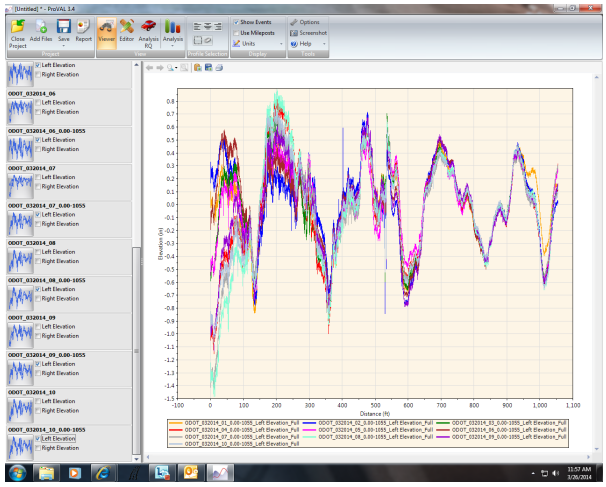
Single Point IRI/Rutting Collection

LCMS 4000 point IRI/Rutting Collection

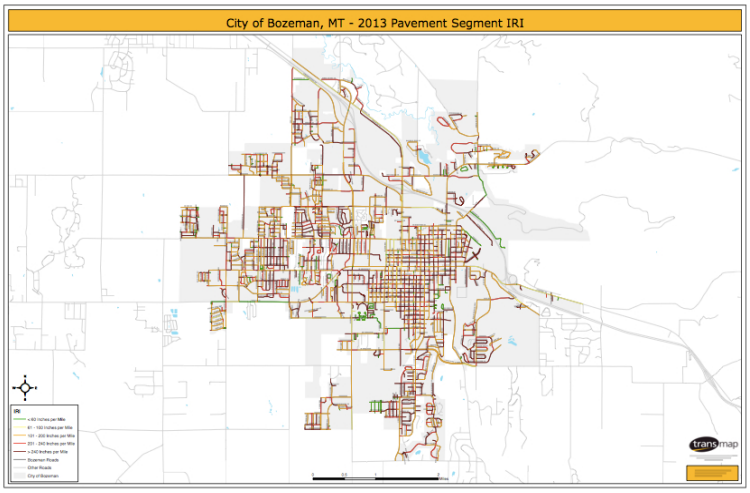
The results from these measurements are based on ASTM standards and rely on the data collection vehicle traveling at a predetermined speed. Both the rutting and IRI data will be collected and delivered as an average for each line segment as attributes in the GIS file. The rutting data will be imported into MicroPAVER as part of the distress collection.

"Your IRI values are exactly where we would expect them to be. Generally we see a run that is a little different than the others, but all ten of these are dead on." - *Ohio Department of Transportation (ODOT) Representative.*

IRI Values



Pavement Segment IRI



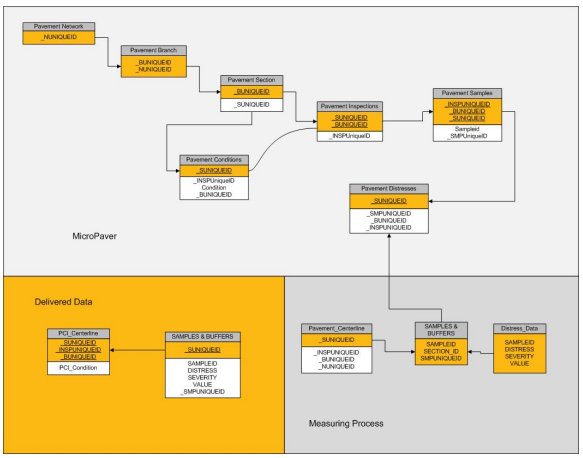
Calibration Table (Quality Control/Quality Assurance of Profiler)

Distance Calibration	Performed to calibrate the distance measurement instrument - Performed every 1-2 weeks
Validation Object	Performed to ensure the accuracy of each height sensor on the profiler - Performed every 2-3 weeks
Laser Calibration	Performed to mathematically compute the optimum levelness of the laser sensors mounted on the vehicle - Performed whenever a sensor is added, changed, or removed from the vehicle
Accelerometer Calibration	Performed to cancel out the effect of weight shifting in the van - Performed every day and/or whenever there is a shift of weight change in the vehicle
Accelerometer Repeatability	Performed before the start of every project by running an ODOT IRI test area 10 times to test the repeatability of the IRI system

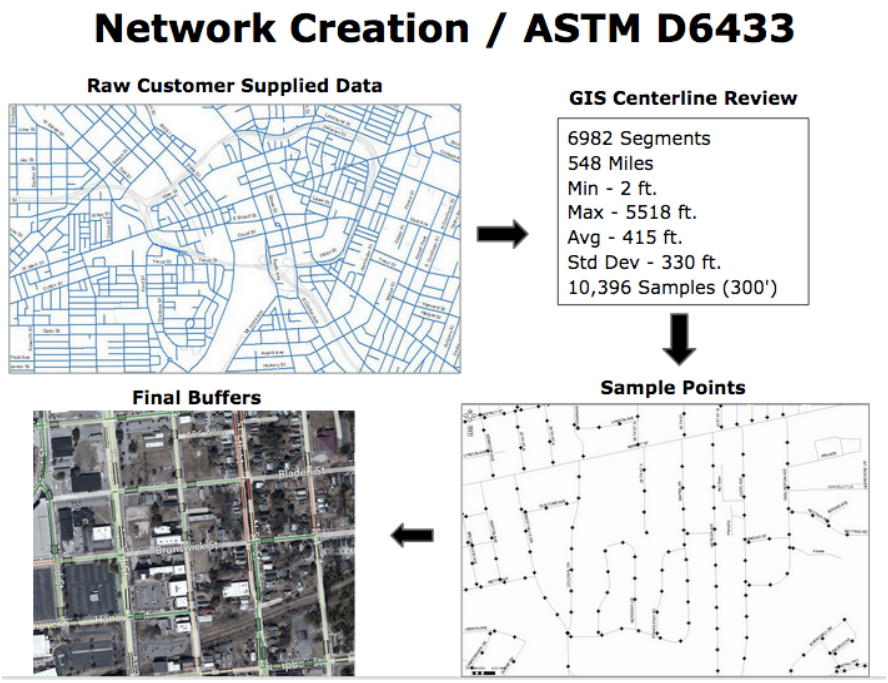
Pavement Condition Evaluation

Establishing the Pavement Network System

Once the ON-SIGHT™ raw data collection is finished, Transmap begins with an analysis of the pavement inventory. The first step is to prepare an **updated version of the client's road centerline**. The centerline serves as the route network and establishes the hierarchical structure. All pavement condition data are linked to the roadway network. Transmap has developed a unique method that ensures that all pavement and asset data are correctly related to the centerline file. The image on the right is an example of an **Entity Relationship Diagram** (ERD). This is represented in our ERD that is delivered to the client.



The pavement condition assessment is conducted for all routes driven by Transmap. The following terminology is used to define the hierarchy of the route system: **Network - Branches - Sections.**



Roadway Inventory

As part of any pavement condition survey, Transmap collects the road width and surface type at every sample location, which is critical for establishing a pavement management plan. We will also collect any historical data on M&R and construction dates of the client's road network. This information is vital to establishing accurate pavement curves that are modeled on the client's roads.

Sampling

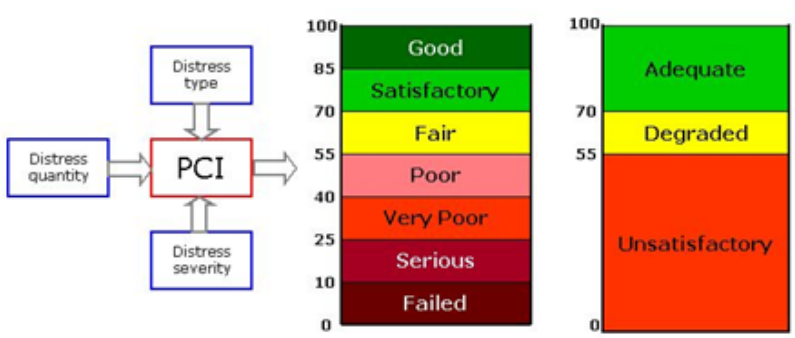
Transmap can accommodate any sampling methodology that our clients request. As a standard, we use 300-foot long management sections. All samples must belong to a network, branch, and section. All pavement sections are divided into 300-foot pieces. The general goal is to have sample areas between 1,500 sq. ft. and 3,500 sq. ft., which is the industry and ASTM standard. Transmap has suggested this initial approach for this project.

Transmap drives both sides of each roadway. This allows us to sample distress data on both lanes. In the case of divided roads, we sample both sides of the median. For large and more spread out highways, Transmap can use a wider and more cost effective sampling method. If clients wish to get 100-foot sample locations analyzed and loaded into a PMS, Transmap can accommodate that as well. As **Transmap captures 100% of every roadway** in each direction, any custom sampling method could be applied.

Pavement Distress Analysis

The assessment of surface condition will be based on the distress definitions described in ASTM D-6433-11 "Standard Proactive for Roads and Parking Lots Pavement Conditions Index Surveys" or FHWA "Distressed Identification Manual for the long term performance program." Transmap will assess the condition of all roadways in the City's network using the LCMS data captured during raw data collection in the field. The LCMS captures all cracking in each travel direction. Trained pavement technicians analyze the LCMS 2D and 3D solutions to determine the **type of distress**.

Typical distresses such as alligator cracking, bleeding, block cracking, bumps and sags, corrugation, depression, edge cracking, joint reflection cracking, lane/shoulder drop off, longitudinal and transverse cracking, patching and utility cuts, potholes rutting, weathering and raveling, as well as the severity of each distress, following the guidelines established by the **ASTM D6433** standards, will be captured. Our distress analysis also includes surface type, ride quality, and average segment road width. Our robust quality control procedures ensure that the measurements comply with ASTM D6433 standards.



Severity levels are typically classified as None, Low, Moderate, or High. Once related to the centerline, the severity data are processed to compute a **Pavement Condition Index (PCI)** - a number between 0 (worst) to 100 (best) that indicates the overall condition of the pavement for a specific segment. **Transmap is a total Pavement Solution Provider.** If any other testing is required by our customer, Transmap will make sure it is collected on time and within budget. **Transmap does not rely on a totally automated approach** to pavement inspection. We use field walkout inspections to supplement our LCMS and perform quality control in the field.

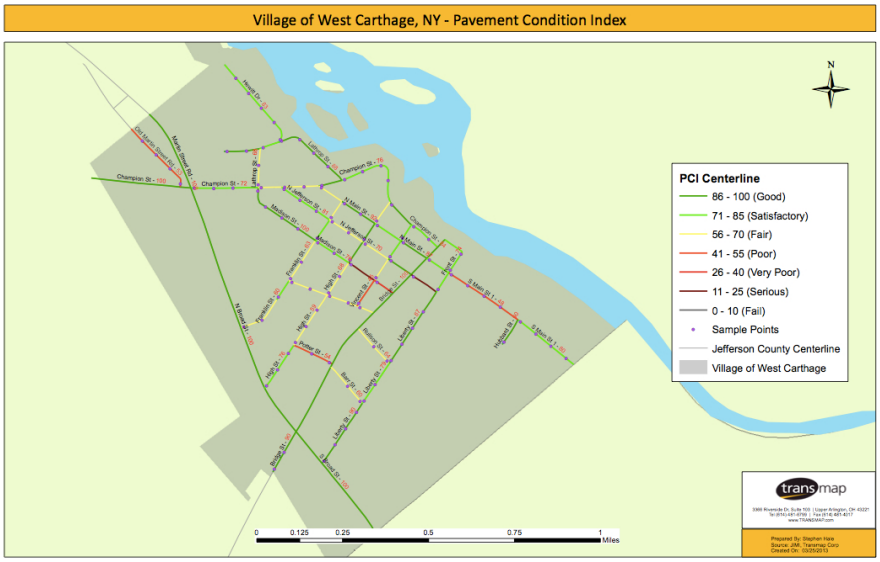
Field Walkout - QA/QC

The field **QA/QC "boots-on-the-ground"** occurs after all of the pavement network and samples are loaded into MicroPAVER to produce a PCI value for each segment. The purpose of field QA/QC is to verify that the distresses measured in the office align with what actually exists in the pavement. Transmap will select random samples to verify, while also focusing on roads that exhibit notable deviations from segment to segment. After the field QA/QC, Transmap updates the samples with any changes found in the field and re-loads MicroPAVER to produce the final PCI values for each roadway segment. Both the office and field QA/QC are designed to check for any inconsistencies with the analyzed samples. With more than 20 years of experience and a highly trained GIS staff, Transmap has mastered the quality assurance process. Our highly regarded quality control methodology ensures that our customers receive a quality product that exceeds their expectations.

Tabular and Map-Based Reporting

At Transmap, we cater to our client's needs. We do not believe in just one style of reporting. Since we are also a GIS company, **our reports always include *easy-to-interpret* maps**. Maps are great for board presentations, for planning and justifying your budget, and to easily visualize the overall condition of your roadway network.

Transmap can customize reporting to fit the client's needs. Our reporting is both tabular and map based. We are a GIS company and believe that the best way to express the data is in full-size, easy-to-interpret GIS maps with colors that represent Good, Fair, and Poor conditions. We split up maintenance procedures based on preventative and traditional approaches. The colors of the text match which colors would be on the GIS roads file and the ranges are Pavement Condition Index values.



Maintenance & Repair Activities

The Maintenance and Repair (M&R) work planning feature is a MicroPAVER tool for planning, scheduling, budgeting, and analyzing alternative pavement M&R activities. The M&R plan utilizes basic inventory data combined with inspection information, maintenance policies, maintenance costs, and predictions about future pavement conditions. Work plan results are specific to your site.

All factors used in determining the M&R or construction activity (to apply or the costs to use) can be configured to reflect your pavement management practices and costs. Work plan options include determining budget consequences, eliminating M&R backlog in a specific number of years, maintaining Current Area Weighted PCI, and reaching Preferred Area Weighted PCI. M&R work planning is used to

see the effects of different budgets and work plans on future conditions.

M&R Category	Treatment	Result
Rejuvenation PCI 86-100	None, reclamite, fog seal	5 year stabilization
Global Maintenance PCI 71-85	Slurry seal, chip seal, micro surfacing	5-8 year stabilization
Critical Maintenance PCI 60-70	Cape seal, Hot-In-Place	10-15 year stabilization
Conventional Maintenance PCI 40-59	Mill & pave, ARMI	PCI reset to 100
Reconstruction PCI 0-39	Reconstruction	PCI reset to 100

Customized Reporting & Planning

Transmap has provided support for creating custom reports to many of our clients. These reports have assisted our clients in identifying roads that may need M&R based on budget, target PCI, and other customer-defined criteria.

System Implementation

Pavement Management Software: MicroPAVER

Our system-wide solution for pavement management is MicroPAVER. MicroPAVER provides pavement management capabilities to develop and organize the pavement inventory, assess the current condition of pavements, develop models to predict future conditions, report on past and future pavement performance, develop scenarios for M&R based on budget or condition requirements, and plan projects.

Distress data will be automatically loaded into MicroPAVER for processing and analysis. The **Pavement Condition Index** (PCI) is computed for all segments of the street network. PCI data is immediately linked to the GIS based on the road centerline network. **Transmap has completed over 25 successful MicroPAVER projects in the last two years alone.** Although we suggest MicroPAVER, Transmap can implement your data into any Pavement Management System. MicroPAVER is currently being used by over 600 cities, counties, airports, and private consulting firms. MicroPAVER's Pavement Condition Index methodology received the American Society for Testing and Materials **(ASTM) standard D6433**. Receipt of this standard means that MicroPAVER is the only Pavement Management System to have received an ASTM standard designation. Standard D6433 is the only pavement rating methodology recognized for rating road and parking lot pavements. The following is a brief overview of MicroPAVER's components and capabilities.

Inventory

MicroPAVER inventory management is based on a hierarchical structure composed of networks, branches, and sections, with the section being the smallest managed unit. This structure allows users to easily organize their inventory while providing numerous fields and levels for storing pavement data.

These are some of the other features included in inventory:

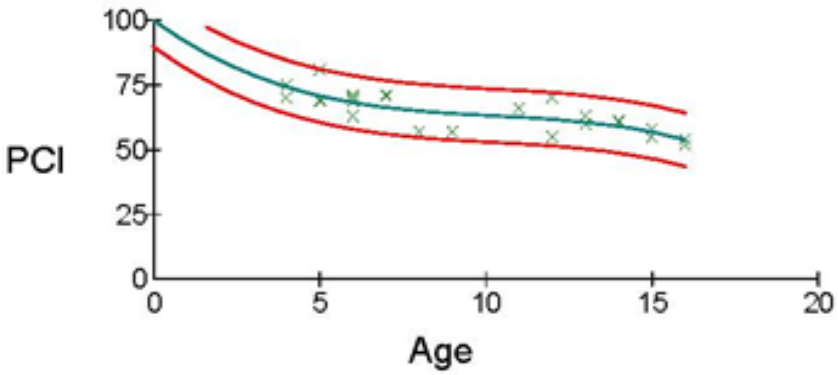
- User-Defined Fields: In addition to the standard inventory information, users can define their own fields to meet their management requirements
- Virtual Inventory: Allows the user to create virtual copies of the existing inventory and group sections for easy presentation
- Surface Change: Automatically calculates and updates pavement surface based on work history information
- Edit Historical Inventory: Easily edit historical inventory values associated with previous inspections

Field Inspection

To assess pavement condition, MicroPAVER uses the Pavement Condition Index (PCI) as its primary standard. The PCI measures pavement condition on a scale from 0 (worst) to 100 (best). ASTM has adopted the PCI as standard practice for roads (D-6433). MicroPAVER provides users with the ability to customize the PCI condition rating categories. It also allows the user an interface for recording the results of an inspection, as well as for easily importing data from automated vehicle collection sources.

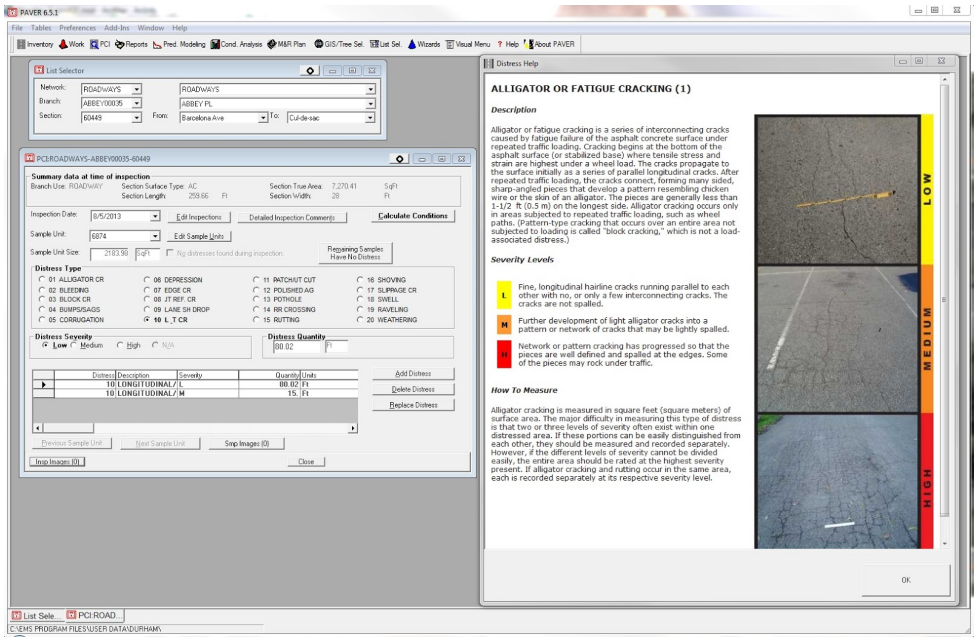
Prediction Modeling

The Prediction Modeling function in MicroPAVER helps identify and group pavements of similar construction that are subjected to similar traffic, weather, and other factors affecting pavement performance. The pavement condition historical data are used to build a model that can accurately predict the future performance of a group of pavements with similar attributes. This will help determine your Remaining Service Life (please refer to the "Additional Information" tab in this response.



Condition Analysis

The Condition Analysis feature allows users to view the condition of the entire pavement network or any specified subset of the network. This feature reports past conditions based on prior interpolated values between previous inspections as well as projected conditions based on prediction models. ***In MicroPAVER, conditions can be viewed on GIS maps in addition to tables and graphs.***



MicroPAVER Condition Analysis Window

Recent Pavement/Asset Management Projects

***Jefferson County, NY* ***	City of Shoreline, WA *	City of Schertz, TX * *
***Lewis County, NY* ***	City of SeaTac, WA *	City of Wilmington, NC * *
City of Watertown, NY	City of Casper, WY	Town of Cary, NC * *
***Erie County, NY* ***	City of St. Charles, MO * *	City of Durham, NC * *
City of Buffalo, NY	City of Hollywood, FL * *	City of Greenville, NC * *
***Town of Greenburgh, NY* ***	City of Delray Beach, FL *	City of Rialto, CA
Allegheny County, PA *	City of Lakeland, FL *	City of Santa Barbara, CA
City of Huber Heights, OH * *	City of Sarasota, FL *	City of Simi Valley, CA
City of Xenia, OH *	Manatee County, FL * *	City of Redwood City, CA
City of Kettering, OH *	Putnam County, FL *	City of Hanford, CA * *
Franklin County, OH *	The Villages, FL * *	Kings County, CA * *
Washington Township, OH *	Escambia County, FL *	City of Rancho Cordova, CA
Miami Township, OH *	Osceola County, FL	Seabrook Island (SIPOA), SC *
Evansville MPO, IN *	City of Midland, TX * *	City of Milton, GA * *
City of Rockford, IL *	City of Conroe, TX *	City of Louisville, KY *
City of Ann Arbor, MI *	City of Killeen, TX * *	City of Newport News, VA * *
City of Bozeman, MT *	City of El Paso, TX * *	City of Alexandria, VA * *

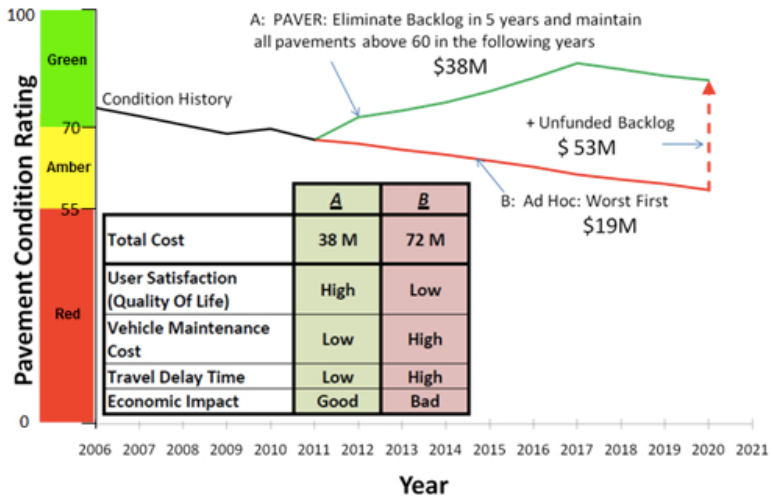
***Trained by Transmap *MicroPAVER Implementations**

Open Source Policy

With an increasingly changing software environment, Transmap's open source policy allows for data to be seamlessly implemented into *any software system*.

Software Testing

Transmap will load MicroPAVER for the City of Rochester and test the system in-house before coming on-site to the City to load the software. We will have export files (.e7x) that will be directly loaded on the City's servers.



MicroPAVER Work Planning Feature

Staff Training

Pavement Boot Camp

The boot camp is customized for every client and is designed as two half-day, fact-finding meetings on-site with the client. The boot camp gives the client and Transmap an understanding about which pavement reports the client needs and which legacy data Transmap needs to collect to achieve these reports.

Transmap has successfully managed a boot camp for many customers. This process is considered necessary in establishing a proper PMS project from the beginning. During the boot camp, we will review any current maintenance and rehabilitation (M&R) practices that the City is using. The main focus will be to gather information on M&R practices and pricing. Transmap will suggest some preventative treatments that might best fit the project area. Transmap will use this information to gather regional cost data for the alternative methods of pavement practices. The boot camp will be the foundation for the reporting task. The following list represents examples of which information Transmap will discuss in the boot camp:

- **Functional class** - The class or group of roads that the road belongs to. MicroPAVER uses the following classes: Principal, Arterial, Collector, Industrial, Residential, Primary, Secondary, and Tertiary.
- **Traffic count data**
- **Budgets** - Current pavement rehabilitation budgets
- **Material costs** - Typical cost of materials for rehabilitation
- **M&R practices** - Types of rehabilitation or reconstruction practices the City is performing. Some examples are Microsurfacing, Cape Seal, Slurry Seal, Hot-In-Place Recycling, etc.
- **ArcGIS Online site** - Transmap media site. Transmap will host the geodatabase data in the cloud. The site is created to assist in the tracking of the project deliverables.
- **Overall digital centerline file** - We will review the final centerline file that was provided to Transmap by the City.
- **Construction dates** - Approximate or actual major M&R dates per roadway segment
- **Family grouping** - Information on how the City wants roads to be grouped in order to have the correct deterioration model for each family

On-site MicroPAVER Training

Transmap uses the only APWA certified trainer, Scott McDonald, to train all of our clients. A representative from Transmap who has completed advanced MicroPAVER training will be on-site speaking about the data Transmap collected. The City can obtain a Professional Development Credit (PDH) from completing the training. The training will happen after collection activities, so all training will be based on the City's data. Transmap will facilitate a training session (up to 2 days) with City staff to review the MicroPAVER software, including topics such as applying updates, performing edits, prediction modeling, condition analysis, GIS capabilities, and availability for further support or consultation. We have conducted 2-day training classes for many of our clients.

Go Live Approach

Transmap will be on-site to assist the City of Rochester in loading MicroPAVER. We will also be on-site to talk the City through the MicroPAVER/GIS integration process.

Your Data, Your Way

We adapt the training to each client's specific needs. We always train your staff on your pavement data and street networks, and we will provide ongoing support by email or phone once the project has been completed.

Council and Mayor Presentations

Transmap can help you prepare your budgets and even present our findings at a council meeting. Most recently, Transmap performed City Council Workshops for the City of Hollywood, FL, the City of Killeen, TX, and the City of Durham, NC. We have a great set of references who will agree that our specifications are the most valuable. These specifications have a tremendous impact on the customer getting what is expected. (Note: **The City of Wilmington received a $22 million dollar bond over four years because of Transmap's reporting and analysis.** The City of Wilmington was receiving $750,000 per year *before* Transmap's analysis.)

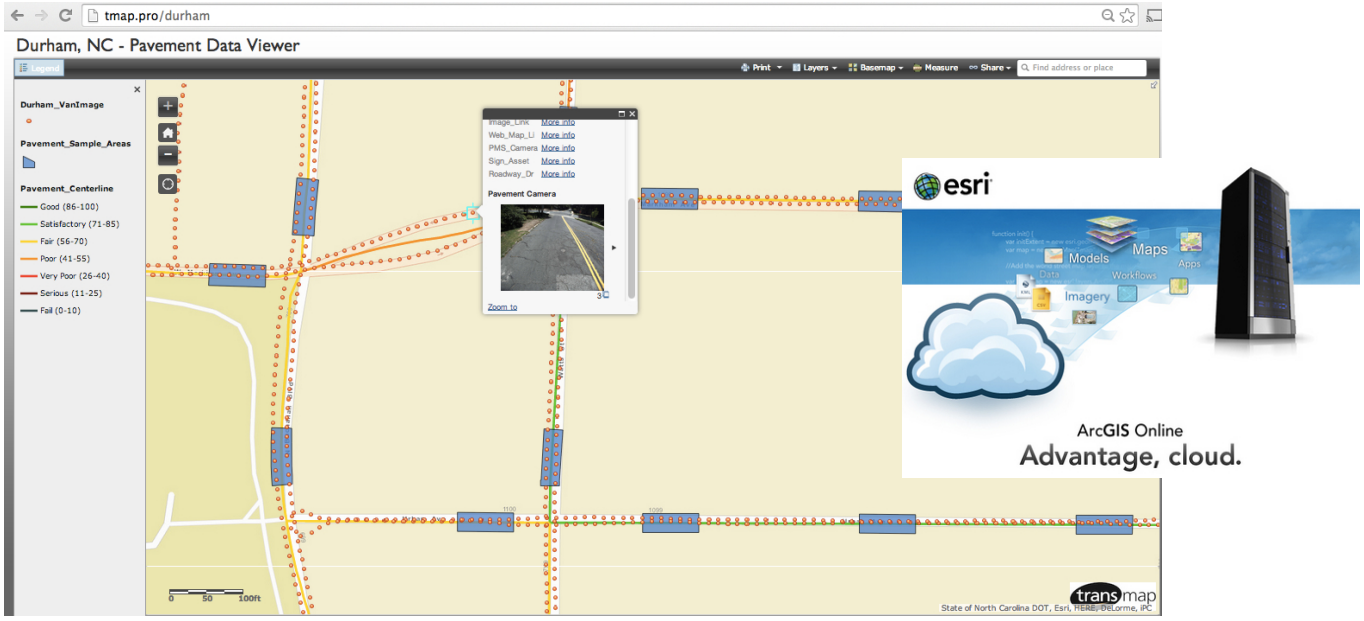
SaaS (Software as a Service)

Web-Based Reporting in a GIS

Transmap incorporates all collected pavement and asset data in the client's existing GIS (Esri ArcGIS 10, Microsoft SQL Server 2008, and ArcSDE 10). As street data are linked to the road centerline network, the pavement condition information can be immediately displayed on a map. Typically, the PCI layer is shown in different colors (Red = Poor Condition, Yellow = Fair Condition, Green = Good Condition) on top of the road centerlines. **Transmap will host the PCI data online** using the ArcGIS platform so that the City can access pavement condition maps online and display them in a regular map browser. Reports can be printed without the need for any extra software programs. **MicroPAVER 7 web version is coming soon.**

MicroPAVER TRAINER DEVELOPERS

ArcGIS Online allows for multiple users to view and use the data in their web browser. Some clients choose to make their GIS and asset information available to their constituents. ***"This is fantastic… Transmap is doing some amazing stuff."*** *- David Totman, Esri's Public Works Industry Manager*



ArcGIS Online Viewer

Esri Developer

Transmap is an Esri Public Works Partner and Developer. Transmap is the only vehicle-based pavement and asset management company hired by Esri to collect roadway infrastructure data.

On-going Tech Support

The City of Rochester will have continued technical support through APWA Certified Trainer Scott McDonald and Transmap for MicroPAVER. The first year of MicroPAVER technical support is included with the cost of MicroPAVER, through Scott McDonald at pavertechsupport@apwa.net.

Scott McDonald has 14 years of experience in the planning and management of technology-based asset management solutions, development and execution of technical training programs, project budget development and financial management, staff leadership, and client support within a variety of organizational environments.

Schedule/Major Project Milestones

Transmap will complete this project on time and within budget. We can accelerate the project completion date by working on an aggressive schedule. Since this type of collection and GIS implementation is all Transmap does, we do not foresee any issues, other than weather, that would prevent us from meeting the City's time schedule. Transmap has the unique opportunity to shift project personnel according to specific timelines. Some of our current projects are long-term, repeat customers who allow us to do this.

Transmap Corporation 12/19/2014

Pavement Management Schedule

City of Rochester Day Schedule/Project Milestones

Task	# of Days
Notice to Proceed	1
Mobilization	1
Project Kickoff Meeting	1
Street Inventory	14
Advanced Inspections - (Post Processing)	7
Pavement Inspection	32
Walkout Inspection	4
System Implementation (MicroPAVER Load)	2
Hosted Images Available ArcGIS Online (on-going)	
PCI Results Delivered	2
Pavement Reporting	10
Draft Pavement Reporting Delivered	1
Software Testing	3
Staff Training	4
Software Implemented On Site (Rochester)	1
Final Pavement Reporting Delivered	2
SaaS Web Hosting (on-going during project)	
Transmap Project Management (on-going during project)	

*Project will start when ON-SIGHT vehicle is mobilized to The City of Rochester, NY

Total pavement project will be approximately 3.5 - 4.5 months, weather permitting

Major Project Milestones

- **Project Kickoff**
- **Hosted Images Available ArcGIS Online**
- **PCI Results Delivered**
- **Draft Reporting Delivered**
- **Staff Training MicroPAVER**
- **Software Implemented at Rochester (MicroPAVER)**
- **Final Pavement Report Delivered**

Transmap Firm Profile

Transmap is a national provider of professional, technical, and management support services to the transportation industry. The focus of Transmap's services is directed toward city-owned and county-owned transportation systems in order to provide the highest quality infrastructure management solutions. Transmap specializes in the mobile data collection, processing, analysis and inventory of roadway assets (e.g., pavement condition and traffic signs).

Transmap was founded in 1994 by Dr. Kurt Novak as a spin-off from The Ohio State University's Center for Mapping. Transmap graduated from the business incubator at the university, Tech Columbus, in 2002. This experience has led to Transmap's recognition as a leading innovator in the mobile mapping, public works and infrastructure management arenas for over 20 years.

Like any truly successful firm, Transmap's people are the leading reason behind its success. From ownership down to staff personnel, Transmap's team consists of Professional Engineers (PEs), professionals holding advanced degrees in physical sciences (PhDs), Geographic Information Systems Professionals (GISPs), and experienced technical professionals to deliver the highest quality solutions. Customer experience is paramount at Transmap. With a highly effective and experienced project management team, Transmap provides an incomparable customer-centric approach to implementing desired outcomes.

The technologies and equipment utilized for Transmap's operations are state of the art and regularly updated to exceed industry standards. With its fleet of mobile mapping vehicles, high definition imagery in conjunction with vehicle-based LiDAR, web-based implementation, and an emphasis on green operations, Transmap is a progressive specialist for any modern, urban or rural environment. Due to a long-standing Public Works Solutions Partnership with Esri, Transmap is extremely well-versed in Geographic Information Systems (GIS), and how to best utilize GIS tools in the infrastructure management needs of its customers. With an increasingly changing software environment, Transmap's open source policy allows for data to be seamlessly implemented into many software systems.

Transmap constantly emphasizes client satisfaction by providing the highest value at the lowest cost for all of its customers. With a highly capable and exceptionally trained staff, implementing the best solutions for infrastructure management is what separates Transmap as the best provider in the industry.

Firm Overview

Why We Are Different

As engineering and architectural professionals, MRB Group provides common-sense solutions to communities across New York State. More than 50 respected professionals and support staff provide responsible solutions to public and private clients across New York State. When specific expertise is required, we work with qualified specialists who enhance our team's capability to address the multi-dimensional challenges our clients face in today's tough economic climate.

OUR TEAM

The licensed engineers and operators at MRB Group provide a comprehensive range of professional services to municipal, commercial, and not-for-profit clients in the following fields: civil engineering, structural engineering; architecture; site development; GIS and mapping services; community planning; master plans and strategic studies; code revision and compliance; legal and SEQR review and documentation; and municipal efficiency initiatives.

With years of experience, MRB Group is familiar with the delicate balance between providing necessary public services, preserving natural resources, protecting community assets and safeguarding municipal finances. With ***over 85 years of experience*** we provide services that ***enhance operational efficiencies and minimize costs***.

GIS Expertise

MRB Group has provided a comprehensive range of professional expertise to clients for many years. Our broad range of GIS services include:

- GIS Needs Assessment and Conceptual System Design
- Geodatabase Design and Data Migration
- ESRI ArcGIS for Server Installation, Configuration, and Administration
- ESRI ArcGIS.com Organizational Account Setup and Configuration
- Web Map Application Development and Implementation
- ESRI Collector for ArcGIS Mobile Device Application Configuration and Training
- Surveying and Asset Field Data Collection for GIS Utility Mapping
- GIS Utility Map Creation and Maintenance
- Tax Map Maintenance and Conversion
- Street Sign Mapping Inventory
- Pavement Management System Database Setup, Field Distress Survey Collection, and GIS Map Integration

Contact Printing Solutions, Inc.
1322 Culver Road
Rochester, 14609
Office: (585) 288-7700
Email: contact@rochester.rr.com
Web: contactprintingsolutions.com

Contact Printing Solutions, Inc
1322 Culver Road
Rochester, NY 14609

Barbara Lester President
Patricia Conn Secretary

Family owned since 1985

Formally Contact Supply Inc.

Servicing the architectural and engineering printing needs for over 30 years.

WBE certified since April 2013
WBE ID# 20201696

President and CEO
Project Principal / Project Manager

18 Years of Experience

Education and Training

B.S. Engineering - Environmental
The Ohio State University
MicroPAVER Advanced Training
2011-2014
LTAP Center 2011-2013

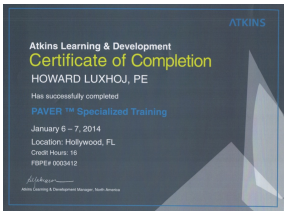
Registrations

Professional Engineer, Ohio #E-67242
Professional Engineer, Florida #E-73717
Professional Engineer, North Carolina #E-038445
NCEES Record #46928
Model Law Engineer (MLE)
APWA Member - Ohio
FCC - KD8TVB

Conferences/Presentations

APWA GIS Pavilion 2008-2013
GIS-T 2008, 2011
TRB 2011, 2014
Google IO 2011-2013
NACE 2012
Council/City Manager Presentations
TRB 2011
Google IO 2008-2011
Google Bootcamp 2011

The Ohio LTAP Center
Certificate of Accomplishment
HOWARD LUXHOJ
has completed 5.0-hours of training in
ASPHALT PAVEMENT PRESERVATION
April 17, 2012


ATKINS
Atkins Learning & Development
Certificate of Completion
HOWARD LUXHOJ, PE
Has successfully completed
PAVER ™ Specialized Training
January 6 – 7, 2014
Location: Hollywood, FL
Credit Hours: 16
FBPE# 0003412

Howard Luxhoj, PE

Mr. Luxhoj is the President/CEO and Project Principal of Transmap Corporation and provides extensive engineering and transportation experience. He works to ensure constant communications with the client, sub-consultants, project team members and regulatory agencies from project inception through completion.

He has expert knowledge of GIS products, database tools, asset management databases and commercial asset management systems. He is also well schooled in the requirements pertaining to GASB-34 and NPDES, legacy system databases, project consulting, technical staff for data collection, asset inventory systems and system integration.

He has also developed and implemented project-specific, integrated quality control measures for condition assessments of infrastructure and has been responsible for asset data creation on numerous Transmap projects nationwide.

Similar Project Experience

Town of Greenburgh, New York 2008 & 2012 - Pavement/asset management
Joint Infrastructure Management Initiative (JIMI) project, New York MPO 2011 - Pavement/asset management
Erie County, New York 2011 - Pavement/asset management
City of Watertown, New York 2010 - Pavement/asset management
City of Buffalo, New York 2010 - Asset management
Allegheny County, Pennsylvania 2014 - Pavement management
City of Xenia, Ohio 2014 - Pavement management
Washington Township, Ohio 2014 - Pavement management
Franklin County, Ohio 2003-2014 - Pavement/asset management
City of Huber Heights, Ohio 2011 - Pavement/asset management - training - Falling Weight Deflectometer testing
City of Hollywood, Florida 2013 - Pavement management - Training
Manatee County, Florida 2005 & 2013 - Pavement/asset management
City of Lakeland, Florida 2011 - Pavement/asset management - Training
City of Sarasota, Florida 2009 - Pavement/asset management
City of Killeen, Texas 2013 - Pavement/asset management - Nighttime sign assessment
City of El Paso, Texas 2001-2011- Pavement/asset management - Training
City of Greenville, North Carolina MPO 2014 - Pavement management
City of Durham, North Carolina 2013 - Pavement/asset management - Training
City of Wilmington, North Carolina 2011-2012 - Pavement/asset management - Training
Town of Cary, North Carolina 2011-2012 - Pavement management - Training
City of Shreveport, Louisiana 2013 - Pavement/asset management
City of Rockford, Illinois 2012 - Pavement/asset management - Nighttime sign assessment
Louisville Metro, Kentucky 2013 - Pavement management
City of Saint Charles, Missouri MPO 2013 - Pavement management
City of Milton, Georgia 2013 - Pavement/asset management - Training
City of Bozeman, Montana 2013 - Pavement/asset management

Vice President
Account Manager / GIS Professional

18 Years of Experience

Education and Training
B.A. Geography, Minor in Business, State University of New York at Albany
MicroPAVER Training 2011-2014
LTAP Center 2011-2013

Registrations
URISA Leadership Academy 2008
URISA GISP Certified 2006

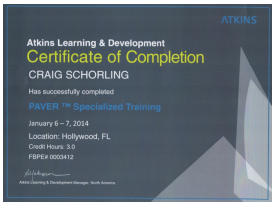
Industry Presentations
NYGIS - Ignite Session 2010
APWA, New York Chapter 2011
Cityworks/MicroPAVER Presentation 2012, 2013
Cityworks 2007-2013
Esri International User Conference 2008
GIS-T 2010, 2011
OTEC 2008
NACE (Exhibitor) 2012, 2013

Council Presentations
City of Durham, NC 2014
City of Hollywood, FL 2014
City of Killeen, TX 2014

The Ohio LTAP Center
Certificate of Accomplishment
CRAIG SCHORLING
has completed 4.50-hours of training in
AUTOMATED PAVEMENT DISTRESS DATA COLLECTION DEMOSTRATION

Craig A. Schorling
Certified Geographic Information Systems (GIS) Professional (GISP)

The Ohio LTAP Center
Certificate of Accomplishment
CRAIG SCHORLING
has completed 5.0-hours of training in
ASPHALT PAVEMENT PRESERVATION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Atkins Learning & Development
Certificate of Completion
CRAIG SCHORLING
Has successfully completed
PAVER ™ Specialized Training
January 6 – 7, 2014
Location: Hollywood, FL
Credit Hours: 3.0
FBPE# 0003412

CERTIFICATE OF MEMBERSHIP
URISA
OHIO CHAPTER
This certifies that
Craig Schorling
is a member in good standing of
The Ohio Chapter of URISA
for the 2014 membership year

Craig Schorling, GISP

As Transmap's Vice President and Account Manager, Mr. Schorling provides Transmap Corporation with sound fundamentals in both GIS project management and client development. He employs his extensive experience with Esri products, database tools, asset management databases, commercial asset management systems, project consulting, system implementation and training, and customer support to provide project management for many of Transmap's clients.

Craig's background includes 11 years of experience in a management capacity and a combined 18 years of experience using and developing GIS tools. He also has experience running the mobile mapping vehicle, asset collection software and CMMS implementation. Mr. Schorling has worked primarily with municipalities and counties to improve the process and systems behind Transmap's customer-centric management approach.

- Multiple municipality preventative maintenance boot camps
- MicroPAVER training experience
- Over 18 years of PMS experience
- Attended preventative maintenance seminars and training

Similar Project Experience

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City of Xenia, Ohio 2014 - Pavement management
Washington Township, Ohio 2014 - Pavement management
Franklin County, Ohio 2003-2014 - Pavement/asset management
City of Kettering, Ohio 2012 - Pavement/asset management
City of Huber Heights, Ohio 2011 - Pavement/asset management - Training - Falling Weight Deflectometer testing
City of Hollywood, Florida 2013 - Pavement management - Training
Manatee County, Florida 2005 & 2013 - Pavement/asset management
Escambia County, Florida 2011 - Pavement management
City of Lakeland, Florida 2011 - Pavement/asset management - Training
City of Sarasota, Florida 2009 - Pavement/asset management
City of Killeen, Texas 2013 - Pavement/asset management - Nighttime sign assessment
City of El Paso, Texas 2001-2011 - Pavement/asset management - Training
City of Schertz, Texas 2010 - Pavement/asset management
City of Greenville, North Carolina MPO 2014 - Pavement management
City of Durham, North Carolina 2013 - Pavement/asset management - Training
City of Wilmington, North Carolina 2011-2012 - Pavement/asset management - Training
Town of Cary, North Carolina 2011-2012 - Pavement management - Training
City of Shreveport, Louisiana 2013 - Pavement/asset management
City of Rockford, Illinois 2012 - Pavement/asset management - Nighttime sign assessment
Louisville Metro, Kentucky 2013 - Pavement management

Project Manager
Senior Reporting Analyst

41 Years of Experience

Education
B.S. Civil Engineering
The Ohio State University

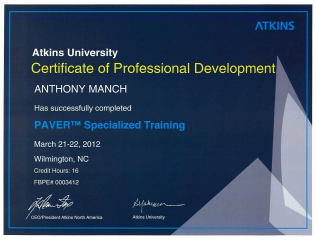
Registrations
Professional Engineer, Ohio
#E-39571

Additional Courses
FHWA and NHI Planning and Design Courses

ODOT Courses
Project Development Process, Scientific Approaches to Transportation, Analysis of New and Rehabilitated Pavement Performance with Mechanistic-Empirical Design
Highway Safety Features
Quality in Concrete Paving
Pavement Preservation Training

Conferences
Ohio Transportation Engineering Conference (OTEC) 1990-2013
Asphalt Paving Conference 2012
LTAP 2014

The Ohio LTAP Center
Certificate of Accomplishment
ANTHONY J. MANCH
has completed 4.00-hours of training in
ASPHALT PAVEMENT PRESERVATION


ATKINS
Atkins University
Certificate of Professional Development
ANTHONY MANCH
Has successfully completed
PAVER™ Specialized Training
March 21-22, 2012
Wilmington, NC
Credit Hours: 16
FBPE# 0003412

Anthony J. Manch, PE

In August 2010, Anthony retired from the Ohio Department of Transportation (ODOT). Mr. Manch spent the majority of his forty-year career working in the Office of Technical Services. He specialized in providing traffic and truck weight data for planning and design. Mr. Manch provided traffic engineering expertise to internal and external customers. He has extensive experience in field data collection, data processing, data analysis and report writing.

Earlier in his career, he was the Chairman of ODOT's Pavement Management Committee. This committee was responsible for development of all policies for the planning, design, construction, and feedback mechanisms for ODOT's Pavement Management System.

Similar Project Experience

- E-950 Calibration Compliance experience: Data checks by ODOT, ODOT test area run before every project
- ODOT's original Pavement Management Process used a network level priority ranking system. The system was based on identifying and repairing the pavements in the worst condition first. The identified pavements were used to develop ODOT's five-year resurfacing program.
- Developed a Pavement Management System database consisting of construction, maintenance, materials, and cost elements
- Assisted in developing a decision tree for the correct maintenance treatment, depending on the measured pavement distresses
- Worked with upper management to develop a network prioritization model. The user could input an anticipated budget, and the model would output the level of service.
- Mr. Manch was in charge of the pavement reporting for Transmap for projects such as the **Joint Infrastructure Management Initiative (JIMI) project, NY MPO, City of Watertown, NY, Town of Greenburgh, NY, City of Buffalo, NY, Erie County, NY and Allegheny County, PA.**

Traffic Data Collection Experience

- Developed a statewide plan for the installation of Automatic Traffic Recorders (ATR) and Weigh-In Motion (WIM) data collection sites
- As part of developing the Statewide Plan, he met with representatives from MPO's and ODOT offices to ensure their traffic data collection needs were met and in compliance with Federal regulations and guidelines.
- Developed and reviewed plans and other related engineering documents, summarized traffic data used to recommend highway improvements or appropriate traffic control devices

Project Manager
MicroPAVER Integration

8 Years of Experience

QA/QC Pavement Walkout: 30,000+ miles and 500,000+ samples
Pavement Analysis
Robust Preventative Maintenance Reporting
ASTM D6433 Compliance Collection

Education and Training

B.S. Geographic Information Science, Ohio University
APWA MicroPAVER Advanced Training 2013
ODOT Pavement Preservation Training 2014

The Ohio LTAP Center
Certificate of Accomplishment
CHRIS CROCKER
has completed 4.00-hours of training in
ASPHALT PAVEMENT PRESERVATION
April 3, 2014

Certificate of Professional Development
To
Chris Crocker
In Recognition of Participation in
MicroPAVER Training Course I - 16 Hours
February 28th, 2013 and March 1st, 2013
City of Milton, Georgia
Howard Quiroj, PE - President and CEO
Craig Schering, GISP - Vice President

Chris Crocker

As Project Manager, Mr. Crocker has provided presentation and maps of deliverables, involved the client when elaboration was necessary, created project schedules, and used the client's project priorities as the guideline.

He has performed post-processing of GIS data to ensure quality control, appropriated staff to meet goals for timely deliveries, and continued communication with the client in order to ensure customer satisfaction.

Mr. Crocker is reliable and effective part of our team who has experience with running the mobile mapping vehicle, asset collection software, CMMS implementation, and training.

Mr. Crocker has over 8 years of pavement analysis, walkout QA/QC pavement experience, and robust preventative maintenance reporting experience. He also has experience in performing nighttime MUTCD assessments.

Similar Project Experience

Town of Greenburgh, New York 2008 & 2012 - Pavement/asset management
Joint Infrastructure Management Initiative (JIMI) project, New York MPO 2011 - Pavement/asset management
Erie County, New York 2011 - Pavement/asset management
City of Watertown, New York 2010 - Pavement/asset management
City of Buffalo, New York 2010 - Asset management
Allegheny County, Pennsylvania 2014 - Pavement management
City of Xenia, Ohio 2014 - Pavement management
Washington Township, Ohio 2014 - Pavement management
Franklin County, Ohio 2008-2014 - Pavement/asset management - Pavement QA/QC walkout
City of Kettering, Ohio 2012 - Pavement/asset management - Pavement QA/QC walkout
City of Greenville, North Carolina MPO 2014 - Pavement management - Training - Pavement QA/QC walkout
City of Durham, North Carolina 2013 - Pavement/asset management - Training
City of Wilmington, North Carolina 2011-2012 - Pavement/asset management - Training
City of Hollywood, Florida 2013 - Pavement management - Training - Pavement QA/QC walkout
Manatee County, Florida 2013 - Pavement/asset management - Pavement QA/QC walkout
City of Killeen, Texas 2013 - Pavement/asset management - Nighttime sign assessment - Pavement QA/QC walkout
City of Conroe, Texas 2012 - Pavement/asset management - Pavement QA/QC walkout
City of El Paso, Texas 2008-2011 - Pavement/asset management - Training
City of Milton, Georgia 2013 - Pavement/asset management - Training - Pavement QA/QC walkout
Louisville Metro, Kentucky MPO 2013 - Pavement management - Pavement QA/QC walkout
City of Saint Charles, Missouri MPO 2013 - Pavement management - Training - Pavement QA/QC walkout

Project Manager
Field Data Collection

4 Years of Experience

Pavement Analysis
Field Verification
Data Collection
Network Verification
Spacial Processing
Basemap Anomalies
LCMS Operation

Education and Training

B.S. in Geography
Minor in City Regional Planning
Ohio State University

Michael Weakley

As Project Manager of field operations, Mr. Weakley has provided robust field verication, performed detailed pavement analysis, and collected and organized vast pavement and asset data.

He has also performed post-processing of GIS data to ensure quality control, met goals for timely deliveries, and continued communication with the client throughout the project in order to ensure customer satisfaction.

Mr. Weakley is a reliable employee with experience with running the mobile mapping vehicle, asset collection software, CMMS implementation, LCMS operation, and training.

With over 4 years of experience in pavement analysis, pavement QA/QC, preventative maintenance reporting, data processing, and nighttime MUTCD assessments, Mr. Weakley is an integral part of Transmap's team.

Similar Project Experience

Town of Greenburgh, New York 2012 - Pavement/asset management - ON-SIGHT data collection
Joint Infrastructure Management Initiative (JIMI) project, New York MPO 2011 - Pavement/asset management - ON-SIGHT data collection
Erie County, New York 2011 - Pavement/asset management - ON-SIGHT data collection
City of Watertown, New York 2010 - Pavement/asset management - ON-SIGHT data collection
City of Buffalo, New York 2010 - Asset management - ON-SIGHT data collection
Allegheny County, Pennsylvania 2014 - Pavement management - ON-SIGHT data collection
City of Xenia, Ohio 2014 - Pavement management - ON-SIGHT data collection
Washington Township, Ohio 2014 - Pavement management - ON-SIGHT data collection
Franklin County, Ohio 2010-2014 - Pavement/asset management - ON-SIGHT data collection
City of Kettering, Ohio 2012 - Pavement/asset management - ON-SIGHT data collection
City of Greenville, North Carolina MPO 2014 - Pavement management - Training - ON-SIGHT data collection
City of Durham, North Carolina 2013 - Pavement/asset management - Training - ON-SIGHT data collection
City of Wilmington, North Carolina 2011-2012 - Pavement/asset management - Training - ON-SIGHT data collection
City of Hollywood, Florida 2013 - Pavement management - Training - ON-SIGHT data collection
Manatee County, Florida 2013 - Pavement/asset management - ON-SIGHT data collection
City of Lakeland, Florida 2011 - Pavement/asset management - ON-SIGHT data collection
City of Killeen, Texas 2013 - Pavement/asset management - Nighttime sign assessment - ON-SIGHT data collection
City of Conroe, Texas 2012 - Pavement/asset management - ON-SIGHT data collection
City of El Paso, Texas 2011 - Pavement/asset management - Training - ON-SIGHT data collection
City of Milton, Georgia 2013 - Pavement/asset management - Training - ON-SIGHT data collection
Louisville Metro, Kentucky MPO 2013 - Pavement management - ON-SIGHT data collection
City of Saint Charles, Missouri MPO 2013 - Pavement management - Training - ON-SIGHT data collection

Project Manager
Quality Control/Quality Assurance - GIS Analyst

4 Years of Experience

QA/QC Pavement Walkout

Pavement Analysis

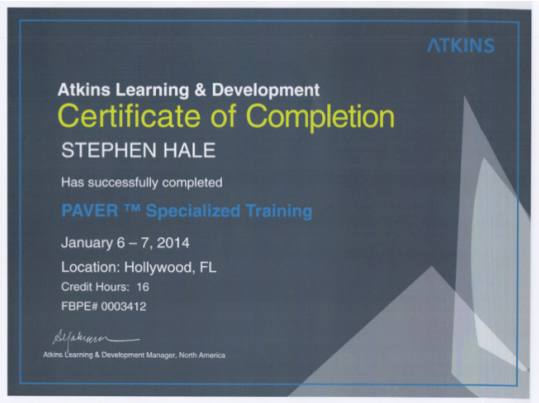
ArcGIS Online

Education and Training

B.S. Geographic Information Science
Ohio State University

MicroPAVER Specialized Training

APWA GIS Pavilion



Stephen Hale

As Project Manager, Stephen is responsible for reviewing customer supplied centerline files for pavement and asset analysis. He creates the pavement networks, including sampling methods based on a linear reference system using Esri GIS tools.

Stephen has assisted in running our pavement management boot camps with customers. He has experience with running the mobile mapping vehicle, asset collection software, CMMS implementation, and training.

Stephen also has experience in supporting and post-processing MUTCD nighttime assessment data.

Similar Project Experience

Town of Greenburgh, New York 2012 - Pavement/asset management
Joint Infrastructure Management Initiative (JIMI) project, New York MPO 2011 - Pavement/asset management
Erie County, New York 2011 - Pavement/asset management
City of Watertown, New York 2010 - Pavement/asset management
City of Buffalo, New York 2010 - Asset management
Allegheny County, Pennsylvania 2014 - Pavement management
City of Xenia, Ohio 2014 - Pavement management
Washington Township, Ohio 2014 - Pavement management
Franklin County, Ohio 2010-2014 - Pavement/asset management - Snow fighter data analysis
City of Kettering, Ohio 2012 - Pavement/asset management
City of Huber Heights, Ohio 2011 - Pavement/asset management - Training
City of Killeen, Texas 2013 - Pavement/asset management - MUTCD nighttime assessment data post-processing
City of Conroe, Texas 2012 - Pavement/asset management
City of El Paso, Texas 2010-2011 - Pavement/asset management - Training
City of Schertz, Texas 2010 - Pavement/asset management
Manatee County, Florida 2013 - Pavement/asset management
City of Hollywood, Florida 2013 - Pavement management - Training
Escambia County, Florida 2011 - Pavement management
City of Lakeland, Florida 2011 - Pavement/asset management - Training
City of Greenville, North Carolina MPO 2014 - Pavement management
City of Durham, North Carolina 2013 - Pavement/asset management - Training
City of Wilmington, North Carolina 2011-2012 - Pavement/asset management - Training
Town of Cary, North Carolina 2011-2012 - Pavement management - Training
City of Shreveport, Louisiana 2013 - Pavement/asset management
City of Rockford, Illinois 2012 - Pavement/asset management - MUTCD nighttime assessment data post-processing
City of Saint Charles, Missouri MPO 2013 - Pavement management
Louisville Metro, Kentucky 2013 - Pavement management
City of Milton, Georgia 2013 - Pavement/asset management - Training

James J. Oberst, P.E., LEED AP

Executive Vice President/Chief Operating Officer

An exacting professional engineer and fiscal manager, whose attention to detail keeps projects on-time and on-budget. Multi-disciplined with extensive experience in project and team management, engineering design, construction administration, and observation services on public and private projects.

A trusted resource to municipal planning boards providing valuable expertise in federal, state, and local regulatory and permitting processes. LEED accredited with a focus on both fiscal and environmental sustainability.

Expertise

Municipal Engineering Services – Respected advisor to communities across New York State with years of direct field and design experience, addressing widespread aging municipal infrastructure, community growth, and long-term planning under increasing budgetary constraints and financial uncertainty.

Planning/Regulatory Review – Provides trusted counsel to municipalities as Planning Board and/or Town Board liaison. Expertise in planning and design, compliance with the State Environmental Quality Review Act (SEQR), various subdivision/zoning regulations, site plan requirements, local development plans, policies, and preservation guidelines, Environmental Protection Agency (EPA) Phase II Stormwater Regulations, and Phase II Construction and MS-4 permit requirements. Familiarity with establishing special districts and managing design of municipal stormwater, water, sewer, park, and road projects.

Water and Sewer/Wastewater Treatment – Possesses years of accumulated knowledge in water/wastewater treatment facilities and system components, project management and engineering design, including analysis and evaluation of existing systems and equipment, recommendations for infrastructure and/or design improvements, preparation of formal studies, reports, and other documentation, and long-term strategic and capital project planning.

Education:

- B.S. Civil Engineering Technology, Rochester Institute of Technology, 1986
- A.A.S. Construction Engineering Technology, SUNY Alfred, 1983

Professional License:

Professional Engineer, New York and Pennsylvania

Professional Affiliations:

- American Society of Civil Engineers (ASCE)
- Finger Lakes Water Works Association
- New York Water Environment Association (NYWEA)

James J. Oberst, P.E., LEED AP

Executive Vice President/Chief Operating Officer

Key Projects

Sewer/Wastewater Treatment Plant Projects

- Town of Ontario, Wastewater Treatment Plant Upgrades and Composting
- Village of Marcellus, Wastewater Treatment Plant Upgrades and Composting
- Village of Mount Morris, Sewer Rehabilitation Project at NYS Routes 36 & 408
- Town of Jasper, Wastewater Plant and Collection System
- Town of Leicester, Route 36/Seneca Foods Sewer Project
- American Rock Salt, Sewer Collection System and Pump Stations
- Village of Mount Morris, Wastewater Treatment Plant
- Town of Ontario, Knickerbocker Road
- Town of Ontario, Lakeside Road and NYS Route 104
- Town of Penfield, Hatch Road Sanitary Sewer
- Village of Lima, Wastewater Plant

Water Supply/Water Treatment Projects

- Town of Sweden, Shumway/Sweden-Walker Road
- Town of Geneseo, Court Street Watermain
- Village of Van Etten, New Municipal Water System
- Village of Leicester, North Street
- American Rock Salt
- Town of Sweden, Gallup/Gordon Road and Colby/Sweden-Walker/Shumway Road Water Extensions
- Town of Geneseo, Country Club Road
- Town of Ontario, Water Treatment Plant
- Town of Geneseo, Reservoir Road
- Village of Naples, Water System Improvements
- Village of Avon, Water Treatment Plant
- Town of Ontario, Raw Water Intake

Road Projects

- Town of Ontario, Timothy Lane
- Village of Mount Morris, Conlon Ave
- Town of Geneseo, Gateway Park (Volunteer Road)
- Town of Ontario, New Street

Daniel S. Allen, GISP

Senior GIS Analyst

A highly respected, GIS Analyst with 13 years of experience in assisting municipal clients with utilizing GIS technology and applications to manage existing data and infrastructure. Well-versed in numerous GIS related disciplines, with a strong focus on GIS needs analysis, system design, project planning, grant procurement, utility mapping, mobile applications, tax map conversion and maintenance, and GIS training.

Works closely with multiple project teams, providing GIS support and technical expertise to maximize efficiency and minimize costs for clients.

Expertise

Municipal Assistance – In-depth knowledge of municipal information software programs and GIS integration with existing infrastructure and mobile technology, improving clients' planning, design, and records management processes. Proven success in assisting clients with preparing and submitting grant applications.

GIS Needs Assessments – Strong background in assessing clients' information management needs and implementing greater efficiencies and best practices. Responsible for conducting interviews with municipal officials, addressing software needs and physical-system configurations, determining cost estimates, implementing new applications, and providing hands-on training and support to necessary personnel.

Utility Mapping and Geodatabase Design – Thorough understanding of data capture procedures and geodatabase design and implementation. Vast experience creating comprehensive, multi-user geodatabases to manage assets (e.g. public utilities) and resources, maintain continuity of information, and streamline data retrieval.

Web and Mobile Application Development – Expertise includes utilization of the latest technology, developing innovative online and mobile applications for municipal clients that can provide low-cost, real-time access to utility mapping on mobile devices for municipal employees and/or residents.

Tax Map Conversion and Maintenance – Considerable experience assisting local governments convert and maintain GIS tax maps.

Education:

B.S. Environmental Management & Technology, Rochester Institute of Technology, 2001

Professional Certification:

Geographic Information System Professional (GISP)

Professional Associations:

- Adjunct Professor, SUNY Geneseo
- President, Geographic Information System Special Interest Group (GISSIG)
- New York State GIS Association

Daniel S. Allen, GISP

Senior GIS Analyst

Key Projects

GIS Needs Assessments

- Wayne County Water and Sewer Authority
- Town of Ontario
- Town of Canandaigua
- Town of Clarkson
- Town of Gates
- Town and Village of Avon

ArcGIS.com Implementation and Mobile App Integration

- Allegany County
- Village of Avon
- Village of Lyons
- Town of Canandaigua
- Town of Penfield
- City of Auburn

GIS Utility Mapping and Geodatabase Design

- Wayne County Water and Sewer Authority
- Village of Avon
- Village of Geneseo
- Village of Spencerport
- Village of Waterloo
- Town of Ontario
- Town of Savannah
- Town of Canandaigua

GIS Tax Mapping Services

- Tioga County
- Allegany County
- Westchester County
    - Town of Eastchester
    - City of Mount Vernon
    - City of Peekskill
    - Village of Scarsdale

Pavement Management Services

- City of Geneva
- City of Fair Oaks Ranch, TX
- Town of Big Flats
- Town of Gates
- Town of Riga
- Village of Churchville
- Village of Spencerport
- Village of Wellsville

David R. Willard, P.E.

Project Manager

As Project Manager on wastewater collection and sanitary sewer system projects, and on numerous water and sewer main projects, experience includes planning, design, bidding, and construction observation services.

A highly respected civil engineer, with a wide range of experience working on various projects for his municipal clients, from large wastewater projects, sidewalk design, to sanitary sewer rehabilitation. Knowledgeable in project management with considerable background in federal, state, and local regulatory processes, permitting, and funding.

Expertise

Roads and Intersections – Vast experience in roadwork projects, instrumental in the planning and design of various repairs and improvements, including grading, intersection realignments/turning lanes, and the construction and/or replacement of box culverts, storm drains, water mains, curbs, sidewalks, and streetlights. Well-versed in overseeing large-scale municipal street reconstruction projects, drafting multi-year capital plans, and working with state, county, and local departments of transportation.

Inflow and Infiltration (I&I) Studies/Surveys – Significant experience conducting sanitary sewer system studies and evaluations to identify areas susceptible to increased I&I, and making design recommendations to reduce excess groundwater infiltration in the existing system, mitigate structural damage, and/or replace failing sewers. Strong background in preparing comprehensive reports of surveyed sanitary systems, analyzing data, and utilizing GIS mapping to depict more accurate sewer conditions.

Wastewater Collection Systems/Sanitary Sewers – Specialized expertise in planning, design, and construction observation of wastewater collection systems, sanitary sewers, and pump stations. Thorough understanding of design techniques and infrastructure related to gravity sewer mains, force mains, trunk interceptors, sewer relocation and realignment, sewer relining, and trenchless sewer repair methods and other sewer rehabilitation methods. Considerable knowledge in pump station design and construction, incorporating advanced controls/meters, variable high-frequency drives, odor and chemical control facilities, and other innovative design features to maximize efficiency and minimize costs.

Education:

B.S. Civil Engineering Technology, Rochester Institute of Technology, 1993

Professional License:

Professional Engineer, New York

David R. Willard, P.E.

Project Manager

Key Projects

Water and Sewer Main Projects

- Monroe County Department of Environmental Services/Village of Spencerport, Sanitary Sewer, Pump Station, and Force Main Project
- Village of Marcellus, Sanitary Sewer Improvements
- Village of Newark, East Newark Pump Station
- Village of Spencerport, Inflow and Infiltration (I&I) Study
- Village of Spencerport, I&I Reduction Project
- Village of Spencerport, Sanitary Sewer System Rehabilitation
- Monroe County Department of Environmental Services, Village of Scottsville, and Town of Wheatland, Regional Pump Station and Force Main
- Village of Scottsville, Scott Crescent Sewer and Water Main Replacement
- New York State Office of General Services, Attica, Wyoming, and Oneida Correctional Facilities I&I Survey
- Town of Pittsford, Golf Avenue Pump Station and Force Main
- Town of Pittsford, Tobey Road Sanitary Sewer
- Town of Farmington, Loomis Road Sanitary Sewer
- Town of Penfield, Creek Street Sanitary Sewers
- Town of Penfield, Extension No. 19 Force Main Rehabilitation
- Village of Spencerport, Maplewood Water Main
- Village of Geneseo, Water Plant Improvements
- Village of Churchville, Howard Avenue Drainage Study and Design
- Bristol Mountain Ski Resort, Reservoir Stop Gate

Pavement Management Services

- City of Geneva
- City of Fair Oaks Ranch, TX
- Town of Big Flats
- Town of Gates
- Town of Riga
- Village of Churchville
- Village of Spencerport
- Village of Wellsville

Roadwork Projects

- Town of Bergin, Lake Street Improvements
- Town of Farmington, Beaver Creek Road Box Culvert Improvements
- Town of Canandaigua, Route 332 Street Light Project
- Wellsville Pavement Management System
- Village of Hilton, Hazen, Upton, and Canning Streets Intersection Improvements
- Village of Spencerport, Comprehensive Street Reconstruction Program
- Town of Penfield, Atlantic Avenue/Scribner Road Intersection Improvements
- Village of Spencerport Pavement Management System and Capital Road Improvement Program

JOINT
INFRASTRUCTURE
MANAGEMENT
INITIATIVE

Joint Infrastructure Management Initiative

Lewis and Jefferson County, New York

transmap

"You guys have been great. Everyone agrees that you deserve 5 stars (out of 5 stars). Thanks for all your efforts."

Mickey Dietrich

"Having a digital inventory should provide long-term savings by allowing better, more efficient oversight of municipal assets," said Beyer in a Watertown Daily Times article, "It also may help municipalities in seeking grant funding for road and utility improvements."

Renee J. Beyer
Senior Planner

MicroPAVER TRAINER DEVELOPERS

PubWorks The Software For Public Works

CarteGraph

CLIENT REFERENCE:

Mickey Dietrich
GIS Specialist
317 Washington Street
Watertown, New York 13601
(315) 785-2389
mickey@tughill.org

- **The Lewis and Jefferson County Infrastructure Management Initiative received grant funding through the state Local Government Efficiency Grant program to cover 90 percent of the $708,954 project.**
- Lewis and Jefferson County, along with 13 other townships and villages are included in the JIMI project.
- Transmap digitally mapped more than 1,384 miles of roads and streets.
- Transmap performed pavement analysis and extracted roadway assets, including signs and water features.
- Transmap integrated the data collected into PubWorks and CarteGraph.
- The pavement data was loaded into MicroPAVER.

PARTICIPANTS

Jefferson County
Town of Adams
Town of Alexandria Bay
Town of Champion
Town of Clayton
Town of Philadelphia
Village of Philadelphia
Village of West Carthage

Lewis County
Town of Croghan
Town of Denmark
Town of Lowville
Town of Leray
Village of Lowville
Town of Martinsburg

Transmap Professional Services

Pavement Management
Integration into CarteGraph and PubWorks

Asset Features
Signs
Water Infrastructure
Culverts
Water Valves
Water Meters

City of Watertown
Watertown, New York

CLIENT REFERENCE:

Eugene Hayes
Superintendent
Public Works Department
245 Washington Street
Watertown, NY 13601
(315) 785-7774
ehayes@watertown-ny.gov

Phase I – 2006:

- 100 miles of asset and pavement management data collected
- Cartegraph Asset Management Software Integration (PaveView, work orders, FlexView, etc.)
- Sidewalk, curbing, PMS distresses, etc. collected into an ArcGIS environment

Phase II – 2010:

- Re-inspection of 100 miles of pavement management data collected
- Ultra HD images collected
- Cartegraph Asset Management Software Integration (PaveView, work orders, FlexView, etc.)
- LiDAR Street-Scape Data Collection

Cartegraph

esri Public Works PARTNER

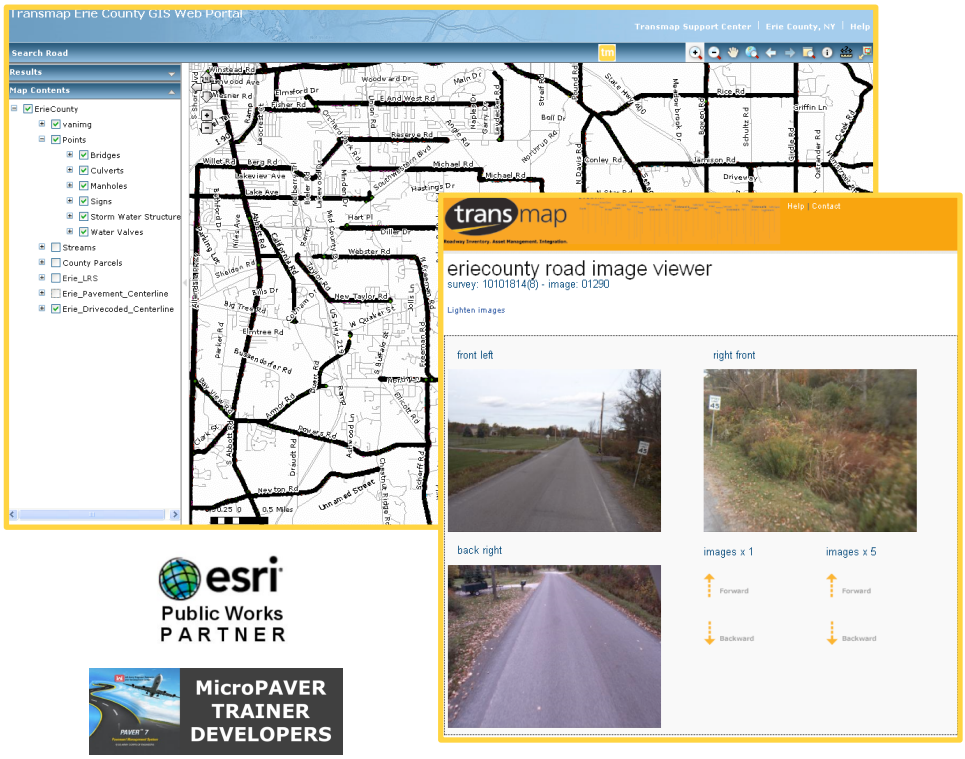
"Transmap was able to provide the data in such a format that allows us to use this information when compiling our paving and street maintenance budgets. If you are considering the implementation of GPS/GIS based roadway asset inventory and management systems that can be quickly implemented… I would strongly recommend Transmap. The folks at Transmap have always been helpful whenever we call and are on a first name bases with our people in IT and Public Works."

Eugene Hayes

"Transmap was instrumental in building an Enterprise Pavement Management Solution. Transmap's deliverables seamlessly integrated into CarteGraph and Esri geodatabases".

Mathew Owen
GIS Coordinator

Erie County
Erie County, New York



"Transmap Corporation was instrumental in mapping the County of Erie's storm water shed area, storm sewer system and receiving waters which is required by the United States Environmental Protection Agency (U.S.EPA) Phase II storm water requirements to reduce the negative impacts of storm water pollution into the County's infrastructure."

Melissa Tupis

esri
Public Works
PARTNER

MicroPAVER
TRAINER
DEVELOPERS

CLIENT REFERENCE:

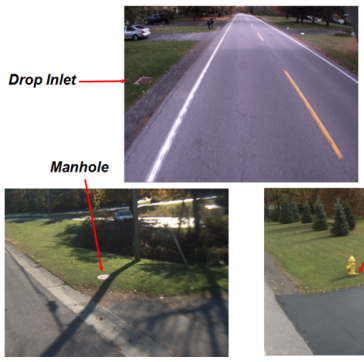
Melissa Tupis
Asst. to Deputy Director of Public Works
Dept. of Public Works - Highways
95 Franklin Street, 14th floor
Buffalo, New York 14202
(716) 858-7686
Melissa.tupis@erie.gov

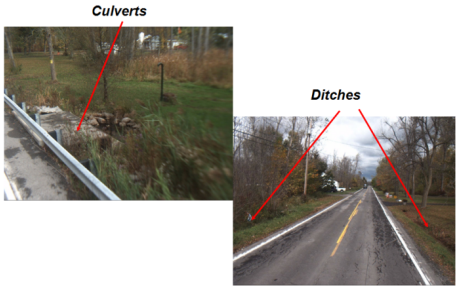
Erie County selected Transmap to assist in the collection of storm water for **MS4 Reporting.** Transmap successfully inventoried **1,168 centerline miles** of roadway. The raw data collected by the mapping vehicle was post processed for sub-meter asset extraction.

Transmap extracted **over 46,000** features through photogrammetric means. Transmap set up an ArcGIS Server site with all images and asset data loaded, so Erie County could view their data in a cloud environment.

The assets collected for Erie County included signs, drop inlets, manholes, water valves, culverts, bridges, and ditches.

Erie County also decided to start managing pavement distress data. Transmap set up a pavement network in **MicroPAVER** and collected surface distress data for all Erie County roads.





Transmap Professional Services

ON-SIGHT Raw Data Collection
Roadway Asset Inventory
Populate MicroPAVER Data
Signs Inventory
Storm Water Inventory
Ditch Inventory
Culvert Inventory
Bridge Inventory
Web-based/Asset Image Viewer
Linear Reference System

Allegheny County
Allegheny County, Pennsylvania

"The folks at Transmap have always been responsive to the needs of Allegheny County and have helped Public Works advance its goals creatively and economically. If you are considering the implementation of GPS/ GIS based roadway pavement/asset inventory and a management system that can be quickly implemented and used by your existing operations people, then I would strongly recommend Transmap."

Philip LaMay
Deputy Director of Operations

CLIENT REFERENCE:

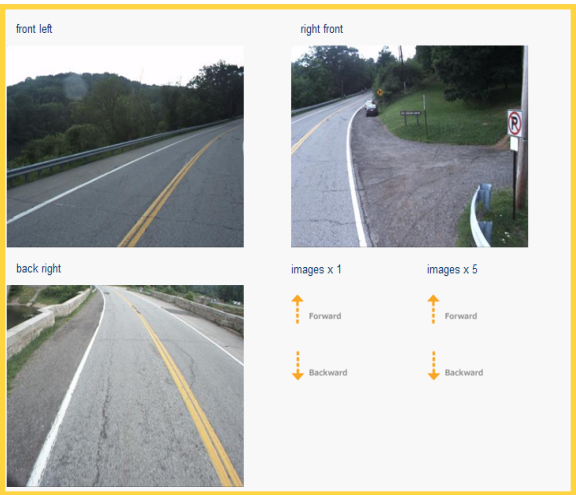
Steve Smallhoover
Project Engineer Public Works
502 County Office Building
542 Forbes Avenue
Pittsburgh, PA 15219-2904
steve.smallhoover@alleghenycounty.us
(412) 350-5923

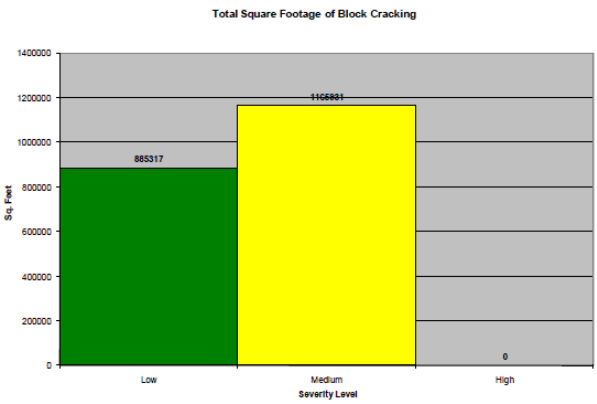
Eric Allen
IS Manager Public Works
502 County Office Building
542 Forbes Avenue
Pittsburgh, PA 15219-2904
eric.allen@alleghenycounty.us
(412) 350-5668

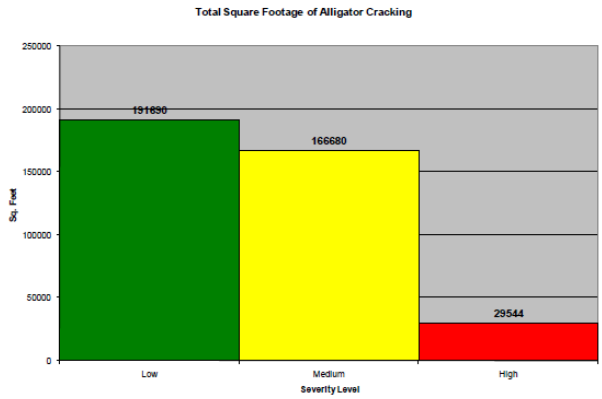
Transmap Corporation partnered with the A & A group to support the County of Allegheny in their goal of having intelligent pavement distress data. Allegheny is using MicroPAVER™ to analyze pavement distress data that Transmap collected to make objective decisions on pavement rehabilitation projects.

Phase I – 2009: Transmap successfully inventoried **400 miles** of pavement distresses. These distresses were put into **MicroPAVER** and the County directly imported the export file into their MicroPAVER system. Transmap also delivered GIS data of the pavement condition index to overlay on their existing data layers. Transmap set up an **ArcGIS Server site** with all images and distress data loaded, so the County can view their data in a cloud environment.

Phase II – 2014: After redriving all of the County's roads, Transmap linked all PCI data to the County's centerline file and ran all pavement distress data through MicroPAVER to produce PCI values. Transmap merged the 2009 data with the new data and provided on site MicroPAVER training. Transmap also packaged all traffic assets into a logical extraction pass and performed nighttime MUTCD sign assessments.

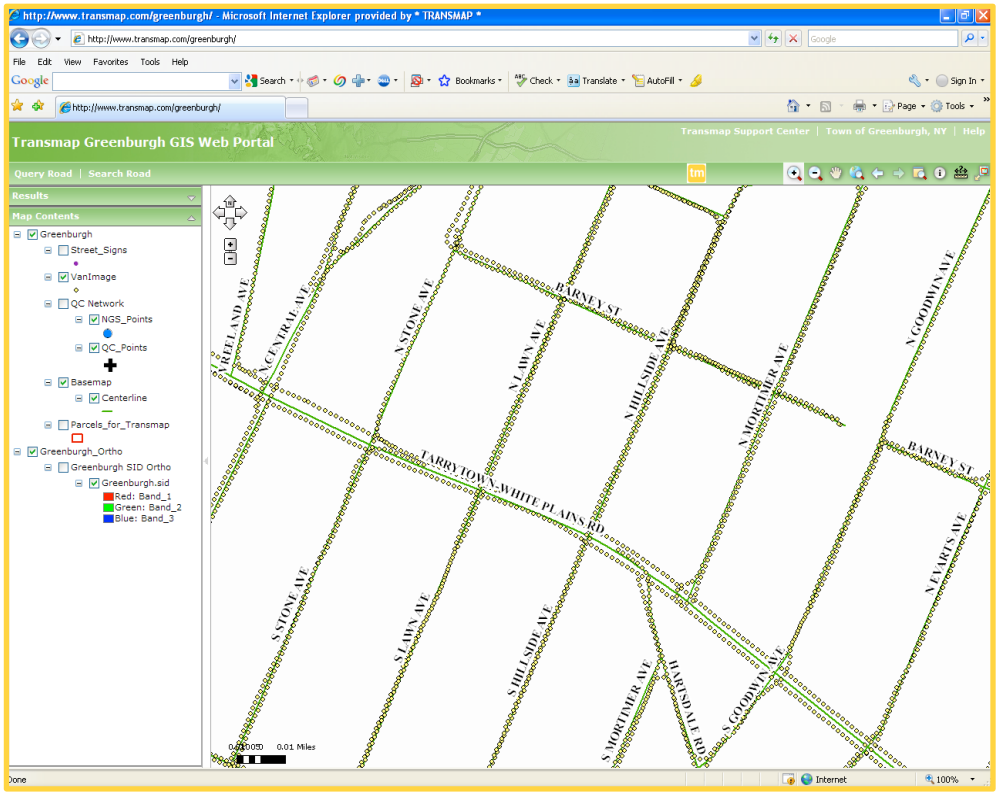






Pavement Analysis Examples

Town of Greenburgh
Greenburgh, New York



"I wanted to acknowledge the information that Transmap collected for the Town of Greenburgh. Your team not only did an excellent job in collecting the infrastructure data, but the coordination effort among you, the Town, and the five (5) villages was outstanding...

Thank you for your efforts and we look forward to working with you again with our future updates."

Victor G. Carosi, PE

CLIENT REFERENCE:

Victor G. Carosi, PE
Commissioner of Public Works
Town of Greenburgh
177 Hillside Avenue
Greenburgh, NY 10607
(914) 933-1644

Phase I - 2008-2009: Transmap successfully inventoried **270 miles** of pavement distresses. These distresses were put into **MicroPAVER**, and the Town directly imported the export file into their MicroPAVER system. Transmap also delivered GIS data of the pavement condition index to overlay on their existing data layers. Transmap set up an **ArcGIS Server site** with all images and distress data loaded, so the Town could view their data in a cloud environment.

Transmap supplied MicroPAVER and GIS support that helped Greenburgh obtain funding and acceptance from their council members and constituents.

Phase II - 2011-2012: Transmap completed a pavement re-inspection on the existing polygon layer. Transmap did robust GIS reporting, which included pavement preservation procedures based on available funding, and started to establish a Greenburgh pavement degradation curve based on 2008 and 2011 PCI results.

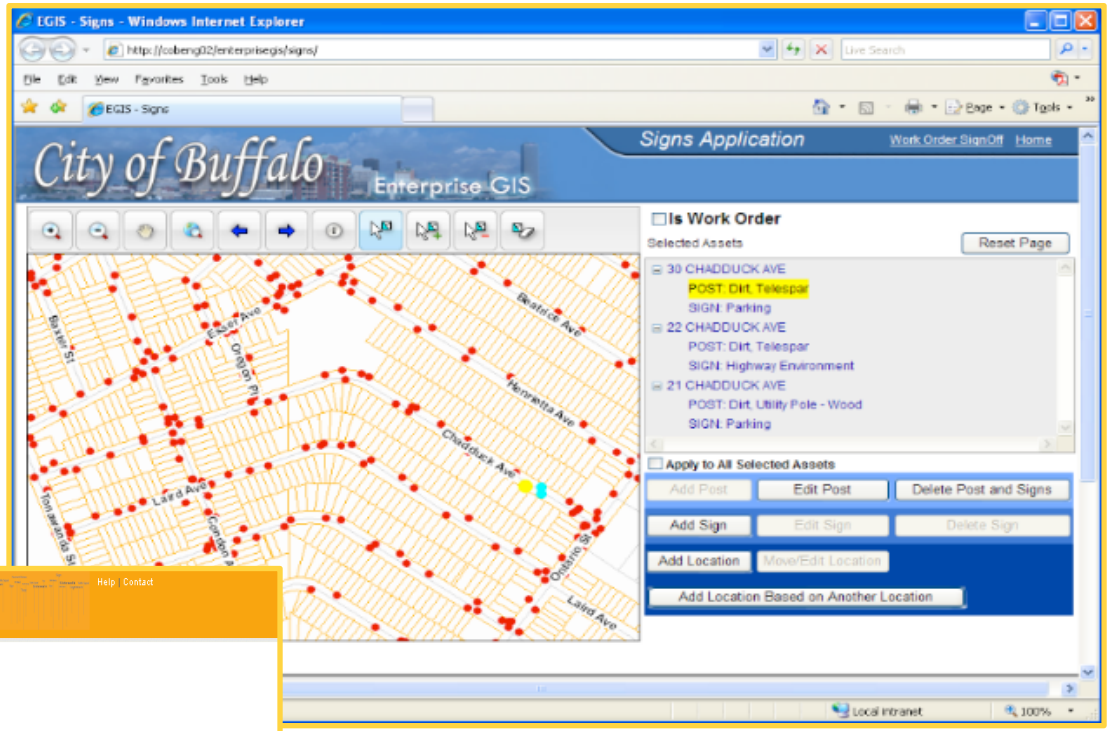
Transmap Professional Services

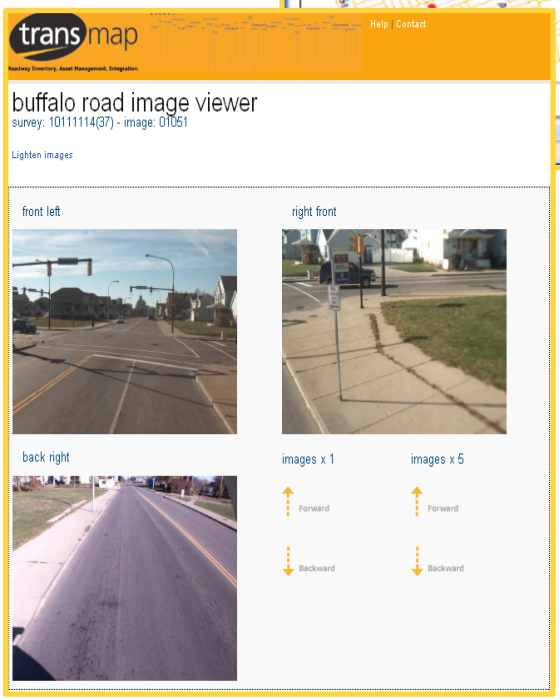
Data Development Manual
Field Data Collection Manual
Pavement Distress Manual
Intelligent Transportation Database
Road Inventory
Road Width Inventory
Populate MicroPAVER Data
Populate Esri data
Data Dictionary
Roadway Image Database
Web-Based/Asset Image Viewer
Linear Reference System
UNETRANS Data Model
Lane Inventory
Road Surface Inventory

Public Works PARTNER

MicroPAVER TRAINER DEVELOPERS

City of Buffalo
Buffalo, New York





2010: Transmap Corporation is currently supporting the City of Buffalo, NY in their goal of becoming **MUTCD compliant sign management.**

There were a total of **63,587 signs and 1,768 hand holes** collected in the City of Buffalo.

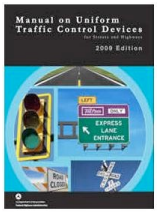
Transmap successfully inventoried **696 centerline miles** of roadway. The raw data collected by the mapping vehicle was post processed for sub-meter asset extraction. Transmap extracted sign features and hand holes for signals through photogrammetric means. Transmap set up an **ArcGIS Server** site with all images and sign data loaded, so the City of Buffalo could view their data in a cloud environment.

The City of Buffalo has set up a home-grown, Esri-based sign management system. Transmap's data will seamlessly integrate with this system and their Esri ArcGIS platform.

CLIENT REFERENCE:

Eric Schmarder
City of Buffalo, NY
Traffic Engineer
502 City Hall
Buffalo, New York 14202
(716) 851-5647
eschmarder@ch.ci.buffalo.ny.us

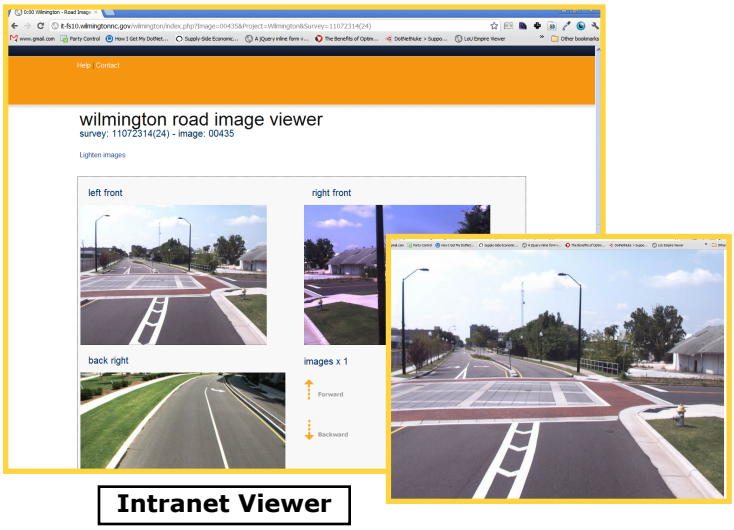
esri
Public Works
PARTNER



City of Wilmington
Wilmington, North Carolina

CLIENT REFERENCE:

Jay Carter
Project Manager
305 Chestnut Street, 5th Floor
Wilmington, NC 28402
(910) 341-7899
jay.carter@wilmingtonnc.gov



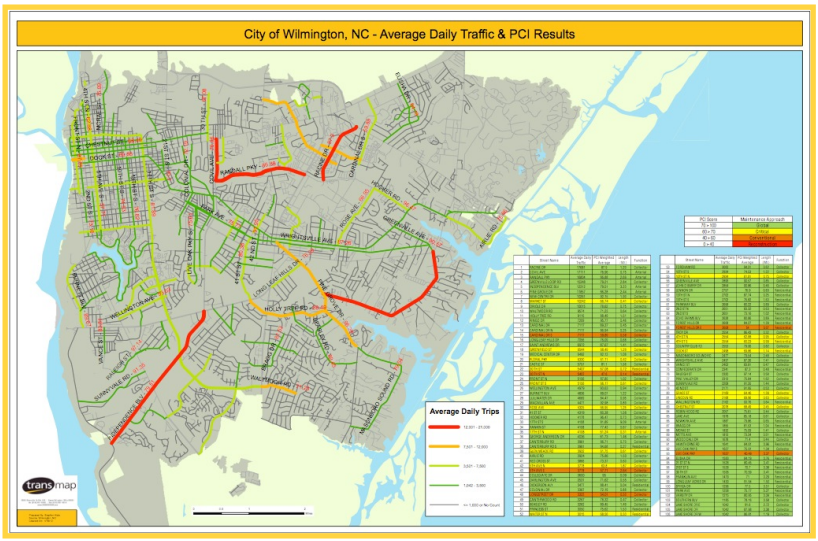
Intranet Viewer

The City of Wilmington received a $22 million bond over 4 years because of Transmap's reporting and analysis.

(Note: The City of Wilmington was receiving $750,000 per year *before* Transmap's analysis.)

"The asset survey completed by Transmap provided data that has proven essential to the development and implementation of the City's Sign Management System required to meet the FHWA requirements."

Randall Glazier
Sign and Marking Engineer



ADT vs. PCI

Public Works PARTNER

MicroPAVER TRAINER DEVELOPERS

Pavement Boot Camp: Transmap conducted a boot camp on-site at the City of Wilmington. This allowed us to review the specifics of the data collection and assessment process, conduct a needs analysis and collect existing data currently used by the City of Wilmington. Topics discussed at the boot camp included drive coding, sampling, measuring, data collection, pavement maintenance, and reporting.

On-Site MicroPAVER Training: Transmap provided on-site training at the City of Wilmington. This training was a beginner MicroPAVER class using the City's data.

Phase I – 2011: Transmap successfully inventoried **428 centerline miles** of roadway with our mobile mapping vehicle, using our *Ultra* HD imaging system and ground-based LiDAR.

- Transmap performed a two-day pavement management boot camp, which laid the foundation for future maintenance activities.
- Transmap used real photogrammetric measurements combined with additional walk-out inspections.
- Pavement analysis data was formatted and loaded into MicroPAVER to produce PCI values.
- Transmap used tabular and GIS maps to produce a preventative maintenance plan.
- Transmap set up an **ArcGIS Server site** with all images, signs and distress data loaded; so the City of Wilmington can view their data in a cloud environment.

Phase II - 2012: Using ground-based LiDAR and HD photogrammetric images Transmap extracted **12,633 signs** with robust attribution.

Pavement Management Systems

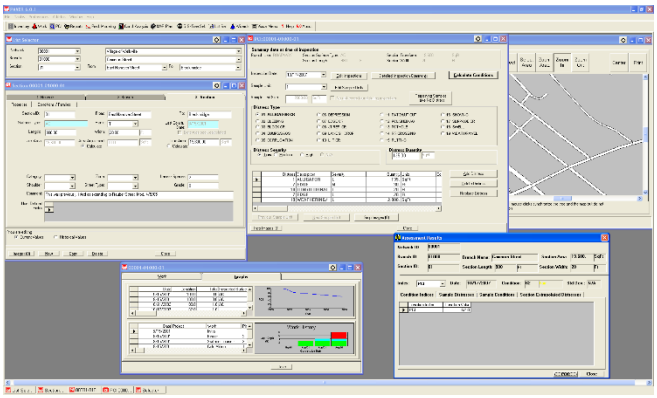
Various Clients

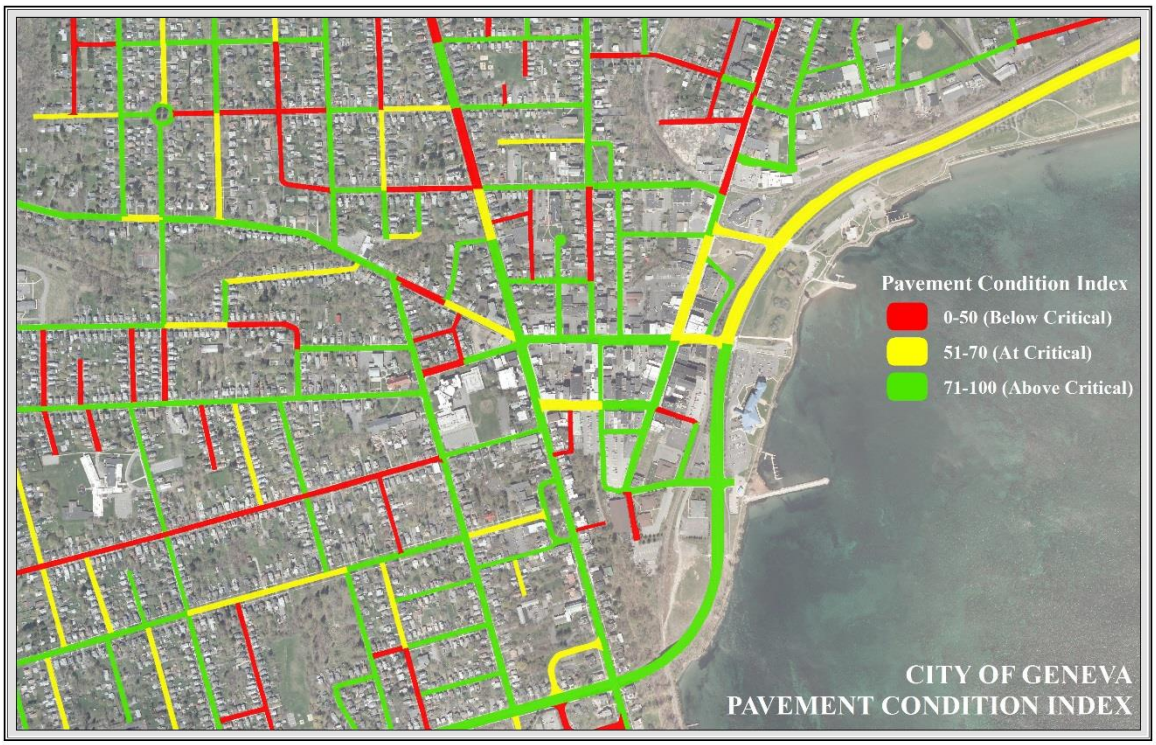
MRB Group has assisted several communities with pavement management by using the GIS enabled MicroPAVER software developed by the Army Corps of Engineers.

A typical study includes database setup, data entry of historical work, field pavement condition inspections, existing and future conditions modeling, and budget forecasting. The results of the field pavement surveys are then visualized using GIS to provide a color-coded map of the condition of all roads. This is a very effective way for highway departments to communicate the current and forecasted conditions of the roads to the necessary decision makers.

Clients:

- City of Geneva
- City of Fair Oaks Ranch, TX
- Town of Big Flats
- Town of Gates
- Town of Riga
- Village of Churchville
- Village of Spencerport
- Village of Wellsville





MRB group

GIS Web Services Implementation

Penfield, NY

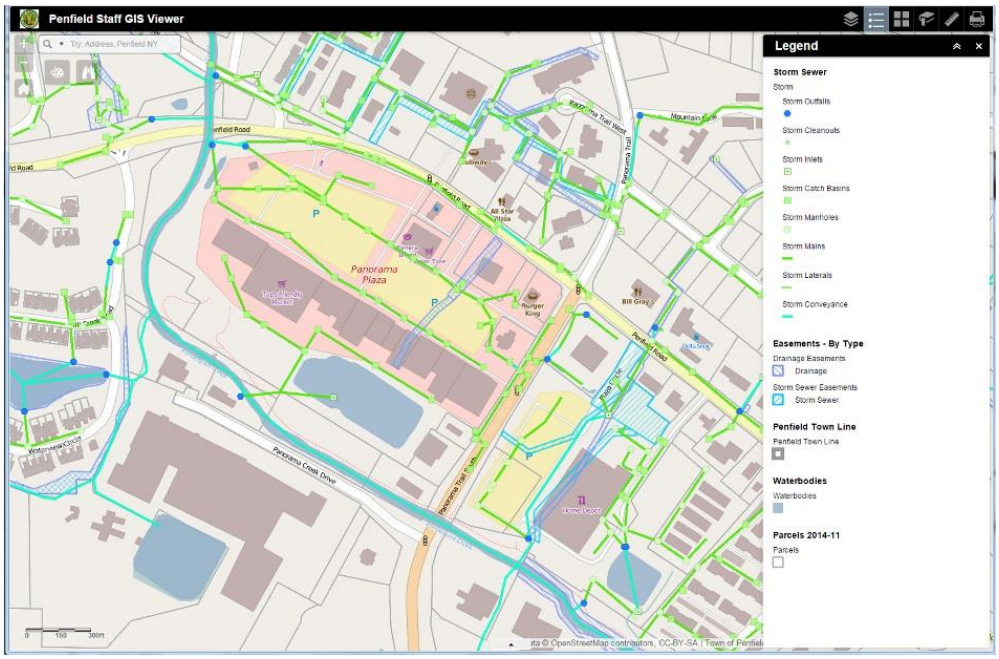
MRB Group completed a project for the Town of Penfield to rebuild and transition their staff GIS viewer to the ArcGIS.com infrastructure platform. Key components of this project included:

Client: Town of Penfield

Completion: 2014

- ArcGIS for Server 10.2 installation and configuration
- ArcGIS.com account configuration
- Geodatabase design and data migration
- Dynamic and tiled map service publishing (ArcGIS for Server)
- Feature service publishing (ArcGIS.com)
- ArcGIS.com map creation and configuration
- Utilize Web AppBuilder for ArcGIS to create GIS viewer for all Town Staff
- Configure ArcGIS.com maps for mobile map access with the Collector for ArcGIS app.
- GIS viewer training

Always mindful of tight municipal budgets, MRB Group was able to recommend some cost savings options to the town. For example, by utilizing an existing application rather than building a custom application. The town was also able to reduce the number of internal servers by utilizing a cloud-based application, thereby reducing hardware and administrative costs.



MRB group

Transmap Corporation

December 19, 2014

City of Rochester, NY

Professional Sevices Pricing (ASTM Minimum Standard)

1) Pavement Management System Implementation

Task	Description	Comments	Transmap Units	Transmap Price	Total
1a	Kick off Meeting (units = lump sum)	The preliminary on site Kick off Meeting is included in our standard Project Management cost.	1	$0.00	$0.00
1b	Street Inventory File Import - Network Setup (units = estimated hours)	Transmap will review the City's centerline file and set up the required network for loading into MicroPAVER. This includes any existing data from the City that needs to be incorporated into the pavement management system.	16	$99.00	$1,584.00
1c	Pavement Condition Survey - ON-SIGHT™ Raw Data Collection Includes LiDAR (units = centerline miles)	Raw roadway data and image capture. 360-degree image view of all roadways (ROW) with dedicated pavement camera and ground-based LiDAR (100% roadway coverage). Transmap will utilize our 4K Laser Crack Measurement System (LCMS). Miles based on Appendix A	554	$92.99	$51,516.46
1d	Advanced Inspection Processing - Profilometer (units = lump sum)	Transmap uses an ASTM compliant E950 profilometer and will process all rut and ride collected data.	1	$3,995.00	$3,995.00
1e	Network Setup and Review (units = hours)	Transmap will review the City's centerline file and set up the required network for loading into MicroPAVER. This includes any existing data from the City that needs to be incorporated into the pavement management system.	10	$99.00	$990.00
1f	Pavement Inspection/Rating (units = samples) minumum samples based on RFP miles	Detailed surface distress analysis using Transmap's Pavement 2.0 approach. Transmap uses ASTM D6433 compliant methods - One sample per segment per Appendix A in RFP - Vehicle automated collection using a combination of lasers, 2D/3D images and field walkout, pavement width included at sample area (price includes field verification)	3,495	$5.69	$19,886.55
1g	MicroPAVER Load (units = lump sum)	Formatting pavement sample data and centerline file for mass load into MicroPAVER using scripts	1	$1,360.00	$1,360.00
1h	GIS Integration (units = hours)	Transmap will link all PCI data to the City's centerline file. If any other GIS work is needed to be done, the hours can be purchased.	12	$99.00	$1,188.00
1i	Pavement Management Practices Definition "Boot Camp" (price is per day)	Transmap will meet with the City to review maintenance/rehabilitation activities, analysis procedures, and collect any existing information on roadways (ADT data, construct dates, maintenance dates, etc)	2	$1,750.00	$3,500.00
1j	Pavement Reporting (units = hours)	Transmap will put together tabular and GIS map data to support traditional/preventative maintenance pavement reporting. 5 year budget scenarios with actual dollar amounts per M&R activity and priority lists.	73	$125.00	$9,125.00
1k	Advanced MicroPAVER Database Design (units = lump sum)	Creating customized tables, work manager and predictive modeling within MicroPAVER	1	$6,300.00	$6,300.00
1l	MicroPAVER Software (units = software)	Transmap will purchase MicroPAVER software for the City. One license comes with 2 installations. This is a download from American Public Works Association. This also includes one year of ongoing technical support from APWA.	1	$1,205.00	$1,205.00
1m	On-Site MicroPAVER Training (units = days) Expenses included	Transmap will provide on-site training for up to five City personnel on MicroPAVER 1 training.	2	$2,800.00	$5,600.00
1n	Project Management (units = hours)	Standard project management includes managing the personnel assigned to the project, monthly project updates, ArcGIS Online project tracking, on-site support, kick off meeting.	128	$99.00	$12,672.00
1o	ArcGIS Server Web-Based Image Viewer (free access for 6 months after project completion)	Transmap will set up the City to view all collected images in a web hosted environment. PCI results, Sample locations, Distress data, Orthophotography and GIS basemap layer will be posted in ArcGIS Online.	0	$875.00	
				Subtotal	*$118,922.01*

Transmap Corporation

December 19, 2014

City of Rochester, NY
Professional Sevices Pricing
Transmap Recommended Approach (Enhanced ASTM Standard - Upper Limit)

1) Pavement Management System Implementation

Task	Description	Comments	Transmap Units	Transmap Price	Total
1a	Kick off Meeting (units = lump sum)	The preliminary on site Kick off Meeting is included in our standard Project Management cost.	1	$0.00	$0.00
1b	Street Inventory File Import - Network Setup (units = estimated hours)	Transmap will review the City's centerline file and set up the required network for loading into MicroPAVER. This includes any existing data from the City that needs to be incorporated into the pavement managment system.	16	$99.00	$1,584.00
1c	Pavement Condition Survey - ON-SIGHT™ Raw Data Collection Includes LiDAR (units = centerline miles)	Raw roadway data and image capture. 360-degree image view of all roadways (ROW) with dedicated pavement camera and ground-based LiDAR (100% roadway coverage). Transmap will utilize our 4K Laser Crack Measurement System (LCMS). Miles based on Appendix A.	554	$92.99	$51,516.46
1d	Advanced Inspection Processing - Profilometer (units = lump sum)	Transmap uses an ASTM compliant E950 profilometer and will process all rut and ride collected data.	1	$3,995.00	$3,995.00
1e	Network Setup and Review (units = hours)	Transmap will review the City's centerline file and set up the required network for loading into MicroPAVER. This includes any existing data from the City that needs to be incorporated into the pavement management system.	10	$99.00	$990.00
1f	Pavement Inspection/Rating (units = samples)	Detailed surface distress analysis using Transmap's Pavement 2.0 approach. Transmap uses ASTM D6433 compliant methods - Samples based on City GIS files 300' sample method - Vehicle automated collection using a combination of lasers, 2D/3D images and field walkout, pavement width included at sample area (price includes field verification)	10,396	$5.69	$59,153.24
1g	MicroPAVER Load (units = lump sum)	Formatting pavement sample data and centerline file for mass load into MicroPAVER using scripts	1	$1,360.00	$1,360.00
1h	GIS Integration (units = hours)	Transmap will link all PCI data to the City's centerline file. If any other GIS work is needed to be done, the hours can be purchased.	12	$99.00	$1,188.00
1i	Pavement Management Practices Definition "Boot Camp" (price is per day)	Transmap will meet with the City to review maintenance/rehabilitation activities, analysis procedures, and collect any existing information on roadways (ADT data, construct dates, maintenance dates, etc)	2	$1,750.00	$3,500.00
1j	Pavement Reporting (units = hours)	Transmap will put together tabular and GIS map data to support traditional/preventative maintenance pavement reporting. 5 year budget scenarios with actual dollar amounts per M&R activity and priority lists.	95	$125.00	$11,875.00
1k	Advanced MicroPAVER Database Design (units = lump sum)	Creating customized tables, work manager and predictive modeling within MicroPAVER	1	$6,300.00	$6,300.00
1l	MicroPAVER Software (units = software)	Transmap will purchase MicroPAVER software for the City. One license comes with 2 installations. This is a download from American Public Works Association. This also includes one year of ongoing technical support from APWA	1	$1,205.00	$1,205.00
1m	On-Site MicroPAVER Training (units = days) Expenses included	Transmap will provide on-site training for up to five City personnel on MicroPAVER 1 training.	2	$2,800.00	$5,600.00
1n	Project Management (units = hours)	Standard project management includes managing the personnel assigned to the project, monthly project updates, ArcGIS Online project tracking, on-site support, kick off meeting.	180	$99.00	$17,820.00
1o	ArcGIS Server Web-Based Image Viewer (free access for 6 months after project completion)	Transmap will set up the City to view all collected images in a web hosted environment. PCI results, Sample locations, Distress data, Orthophotography and GIS basemap layer will be posted in ArcGIS Online.	0	$875.00	
				Subtotal	*$166,086.70*

Additional Asset/Pavement Options City of Rochester, NY

Task	Description	Comments	Transmap Units	Transmap Price	Total
		Optional Assets			
	*Linear Assets (units = centerline miles) Rates based on standard attributes	Transmap will package all linear assets into a logical pass (sidewalks, ditches, pavement striping, curbs, gutters, guiderails, shoulders, etc)	554	$35-$125	
	*Point Utility Assets (units = centerline miles) Rates based on standard attributes	Transmap will package all utility assets into a logical extraction pass (drop inlets, curb inlets, manholes, culverts, bridges, light poles, fire hydrants, water valves, etc)	554	$25-$75	
	*Point Traffic Assets (units = centerline miles) Rates based on standard attributes	Transmap will package all traffic assets into a logical extraction pass (signs and posts, pavement markings, signals and poles, ADA ramps, bridges, sidewalk failure locations, etc)	554	$45-$110	
	*Point Asset Trees (units = centerline miles) Rates based on standard attributes	Transmap will collect ROW and medium trees and tree stands.	554	$72.00	$39,888.00
	Nighttime MUTCD Sign Collection (units = hours)	Nighttime Assessment (Good, Replace)	1	$99.00	
	Per Asset Pricing (units = per asset)	Transmap can extract any additional assets at a per asset cost	1	$1.79	
		Additional Value			
	Advanced MicroPAVER Database Design (units = lump sum)	Creating customized tables, work manager and pedictive modeling within MicroPAVER	1	$6,300.00	$6,300.00
	Advanced Inspection Processing - 4K LCMS 2D (units = lump sum)	Delivery of 2D Crackmap image of all cracks detected by the 4K pavement scanning	1	$16,795.00	$16,795.00
	Advanced Inspection Processing - 4K LCMS 3D (units = lump sum)	Delivery of 3D images/model of the entire pavement network (includes average cross slope per segment)	1	$7,199.00	$7,199.00
	Pavement Inspection (units = samples) Additional Samples	Detailed surface distress analysis using Transmap's Pavement 2.0 approach. Transmap uses ASTM D6433 compliant methods - Vehicle automated collection using a combination of lasers, 2D/3D images and field walkout, pavement width included at sample area (price includes field verification)	1	$5.69	
	Advanced Inspections (units = days) FWD	Transmap can have Falling Weight Deflectometer data collected. A maximum of 30 lane miles can be done in one day. There is a $3,500 mobilization charge	1	$3,195.00	
	Additional Project Management (units = hours)	If the City changes the Scope or needs additional project managment the following rates apply.	1	$99.00	

* Package rates may vary based on the amount of attribution the City wants. Transmap uses photogrammetry and ground-based LiDAR to extract assets

Pavemetrics

www.pavemetrics.com

Laser Crack Measurement System

The laser crack measurement system (LCMS) uses laser line projectors, high speed cameras and advanced optics to acquire high resolution 3D profiles of the road. This unique 3D vision technology allows for automatic pavement condition assessment of asphalt, porous asphalt, chipseal and concrete surfaces. The LCMS acquires both 3D and 2D image data of the road surface with 1 mm resolution over a 4 m lane width at survey speeds up to 100 km/h.

LCMS data is acquired and compressed in real time in the survey vehicle so as to minimize storage needs (<1Gb per km). The collected data can then be analyzed using Pavemetric's data processing toolbox (DLL library of C/C++ functions). This library has functions to detect and analyze cracks, lane markings, potholes, ravelling, and macro-texture. Rutting is also measured and characterized using more than 4 000 points and rut depth and type (short, multiple, long radius) is evaluated. Concrete road surfaces can be scanned to evaluate joints, tinning and faulting between the concrete slabs. IMUs can be added to the sensors in order to measure longitudinal profiles, IRI, slope and crossfall.

KEY FEATURES

- Automatic crack detection and severity
- 4 160 point rutting (rut depth, rut type)
- Macro-texture measurements over 100 % of the lane width.
- 3D and 2D data to characterise: cracks, pot holes, ravelling, sealed cracks, joints in concrete, tinning, etc.
- Day and night operation
- Low power consumption
- High resolution (1mm) downward images
- IRI and longitudinal profile
- Slope and crossfall

***Vision Systems** for the Automated Inspection of Transportation Infrastructures*

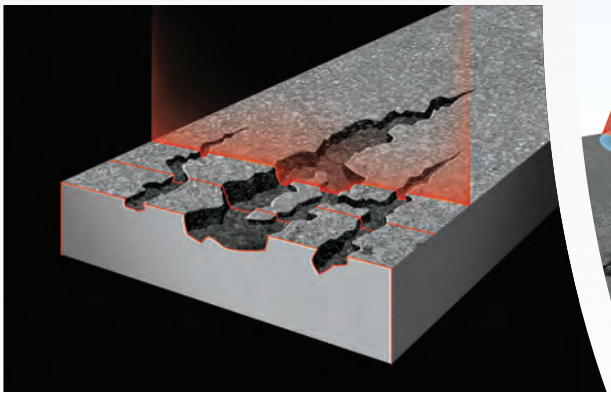
Pavemetrics

www.pavemetrics.com

Laser Crack Measurement System

SYSTEM SPECIFICATIONS

- Number of laser profiles : 2
- Sampling rate : 5 600 profiles/s or 11 200 profiles/s
- Vehicle speed : 0 to 100 km/h
- Profile spacing : 1 to 5 mm (adjustable)
- Transversal field of view : 4 m
- Transversal accuracy : 1 mm
- Transversal resolution : 4 096 points/profile
- Depth range of operation : 250 mm (adjustable)
- Depth accuracy : 0.5 mm
- Laser profiler dimensions : 428 mm (h) x 265 mm (l) x 139 mm (w)
- Weight : 10 kg
- Power consumption (max) : 150W at 120/240 VAC



All specifications subject to change without notice

***Vision Systems** for the Automated Inspection of Transportation Infrastructures*

"Remaining Service Life"(RSL) is the tool we need to apply. RSL generally uses data already being collected though the agency's pavement management system (PMS). Construction and rehabilitation costs and performance can generally be pulled from existing databases. Maintenance and preservation data can be estimated until the agency gains actual experience with preservation treatments and integrates maintenance and preservation costs into their PMS.

For more information, please contact the National Center for Pavement Preservation.
www.pavementpreservation.org
(517) 432-8220

If you would like to view the electronic version of this exercise along with the worksheet, please visit the FHWA System Preservation Web site at http://www.fhwa.dot.gov/preservation/library.cfm.

Publication No. FHWA-IF-07-006

U.S. Department of Transportation
Federal Highway Administration

ncpp
National Center for Pavement Preservation

A Quick Check of Your Highway Network Health

by Larry Galehouse, Director,
National Center for Pavement Preservation
and
Jim Sorenson, Team Leader,
FHWA Office of Asset Management

Historically, many highway agency managers and administrators have tended to view their highway systems as simply a collection of projects. By viewing the network in this manner, there is a certain comfort derived from the ability to match pavement actions with their physical/functional needs. However, by only focusing on projects, opportunities for strategically managing entire road networks and asset needs are overlooked. Although the "bottom up" approach is analytically possible, managing networks this way can be a daunting prospect. Instead, road agency administrators have tackled the network problem from the "top down" by allocating budgets and resources based on historic estimates of need. Implicit in this approach is a belief that the allocated resources will be wisely used and will prove adequate to achieve desirable network service levels.

By using a quick checkup tool, road agency managers and administrators can assess the needs of their network and other highway assets and determine the adequacy of their resource allocation effort. A quick checkup is readily available and can be usefully applied with minimum calculations.

It is essential to know whether present and planned program actions (reconstruction, rehabilitation, and preservation) will produce a net improvement in the condition of the network. However, before the effects of any planned actions to the highway network can be analyzed, some basic concepts should be considered.

Assume that every lane-mile segment of road in the network was rated by the number of years remaining until the end of life (terminal condition). Remember that terminal condition does not mean a failed road; rather, it is the level of deterioration that management has set as a minimum operating condition for that road or network. Consider the rated result of the current network condition, shown in Figure 1.

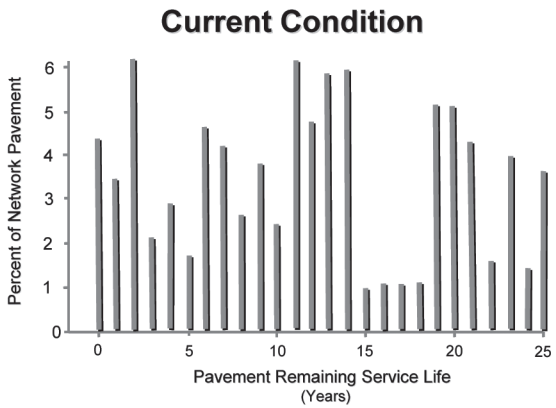


Figure 1. Current condition.

If no improvements are made for 1 year, then the number of years remaining until the end of life will decrease by 1 year for each road segment, except for those stacked at zero. The zero stack will increase significantly because it maintains its previous balance and also becomes the recipient of those roads having previously been stacked with 1 year remaining. Thus, the entire network will age 1 year to the condition shown in Figure 2, with the net lane-miles in the zero stack raised from 4% to 8% of the network.

Some highway agencies still subscribe to the old practice of assigning their highest priorities to the reconstruction or rehabilitation of the worst roads. This practice of "worst first," that is, continually addressing only those roads in the zero stack, is a proven death spiral strategy because reconstruction and rehabilitation are the most expensive ways to maintain or restore serviceability. Rarely does sufficient funding exist to sustain such a strategy.

The measurable loss of pavement life can be thought of as the network's total lane-miles multiplied by 1 year, that is, *lane-mile-*

mile-years added to the network. A palette of pavement preservation treatments, or mix of fixes, is available to address the network needs at a much lower cost than traditional methods.

Preservation treatments are only suitable if the *right* treatment is used on the *right* road at the *right* time. In Figure 9, the added treatments used include concrete joint resealing, thin hot-mix asphalt (HMA) overlay (≤1.5 in.), microsurfacing, chip seal, and crack seal. By knowing the cost per lane-mile and the treatment life extension, it is possible to create a new strategy (costing $36,781,144) that satisfies the network need. In this example, the agency saved in excess of $500,000 from traditional methods (costing $37,323,132) while erasing the 1,654 lane-mile-year deficit produced by the initial program tally.

Network Strategy

Programmed Activity		Lane-Mile-Years	Total Cost
Reconstruction	(31 lane-miles)	820	$15,200,340
Rehabilitation	(77 lane-miles)	1,125	$14,545,002
Pavement Preservation	(84 lane-miles)	412	$1,475,850
Concrete Resealing	(4 yrs x 31 lane-miles)	124	$ 979,600
Thin HMA Overlay	(10 yrs x 16 lane-miles)	160	$ 870,560
Microsurfacing	(7 yrs x 44 lane-miles)	308	$1,309,000
Chip Seal	(5 yrs x 79 lane-miles)	395	$1,104,420
Crack Seal	(2 yrs x 506 lane-miles)	1,012	$1,296,372
		4,356	**$36,781,144**

Figure 9. New program tally.

In a real-world situation, the highway agency would program its budget to achieve the greatest impact on its network condition. Funds allocated for reconstruction and rehabilitation projects must be viewed as investments in the infrastructure. Conversely, funds directed for preservation projects must be regarded as protecting and preserving past infrastructure investments. Integrating reconstruction, rehabilitation, and preservation in the proper proportions will substantially improve network conditions for the taxpayer while safeguarding the highway investment.

knowing the only two components for reconstruction and rehabilitation projects: lane miles and design life of each project fix. Figure 4 shows the agency's programmed activities for reconstruction, and Figure 5 displays it for rehabilitation.

Reconstruction Evaluation

Projects This Year = 2

Project	Design Life	Lane-Miles	Lane-Mile-Years	Lane-Mile Cost	Total Cost
No. 1	25 yrs	22	550	$463,425	$10,195,350
No. 2	30 yrs	18	540	$556,110	$10,009,980
	Total	=	**1,090**		$20,205,330

Figure 4. Reconstruction evaluation.

When evaluating pavement preservations treatments in this analysis, it is appropriate to think in terms of "extended life" rather than design life. The term *design life*, as used in the reconstruction and rehabilitation tables, relates better to the new pavement's structural adequacy to handle repetitive loadings and environmental factors. This is not the goal of pavement preservation. Each type of treatment/repair has unique benefits that should be targeted to the specific mode of pavement deterioration. This means that life extension depends on factors such as type and severity of distress, traffic volume, environment, and so forth. Figure 6 exhibits the agency's programmed activities for preservation.

Rehabilitation Evaluation

Projects This Year = 3

Project	Design Life	Lane-Miles	Lane-Mile-Years	Lane-Mile Cost	Total Cost
No. 10	18 yrs	22	396	$263,268	$5,791,896
No. 11	15 yrs	28	420	$219,390	$6,142,920
No. 12	12 yrs	32	384	$115,848	$3,707,136
	Total	=	**1,200**		$15,641,952

Figure 5. Rehabilitation evaluation.

Projects This Year = 5

Project	Life Extension	Lane-Miles	Lane-Mile-Years	Lane-Mile Cost	Total Cost
No. 101	2 yrs	12	24	$2,562	$30,744
No. 102	3 yrs	22	66	$7,743	$170,346
No. 103	5 yrs	26	130	$13,980	$363,480
No. 104	7 yrs	16	112	$29,750	$476,000
No. 105	10 yrs	8	80	$54,410	$435,280
	Total	=	**412**		$1,475,850

Figure 6. Preservation evaluation.

To satisfy the needs of its highway network, the agency must accomplish 4,356 lane-mile-years of work per year. The agency's program will derive 1,090 lane-mile-years from reconstruction, 1,200 lane-mile-years from rehabilitation, and 412 lane-mile-years from pavement preservation for a total of 2,702 lane-mile-years. Thus, these programmed activities fall short of the minimum required to maintain the status quo and hence would contribute to a net loss in network pavement condition of 1,654 lane-mile-years. The agency's programmed tally is shown in Figure 7.

Network Trend

Programmed Activity	Lane-Mile-Years	Total Cost
Reconstruction	1,090	$20,205,330
Rehabilitation	1,200	$15,641,952
Preservation	412	$1,475,850
Total	**2,702**	**$37,323,132**
Network Needs (Loss)	(—) 4,356	
Deficit =	**—1,654**	

Figure 7. Programmed tally.

This exercise can be performed for any pavement network to benchmark its current trend. By using this approach, it is possible to see how various long-term strategies could be devised and evaluated against a policy objective related to total-network condition.

Once the pavement network is benchmarked, an opportunity exists to correct any shortcomings in the programmed tally. A decision must first be made as to whether to improve the network condition or to just maintain the status quo. This is a management decision and system goal. Continuing with the previous example, a strategy will be proposed to prevent further network deterioration until additional funding is secured.

The first step is to modify the reconstruction and rehabilitation (R&R) programs. An agonizing decision must be made about which projects to defer, eliminate, or phase differently with multiyear activity. In Figure 8, deductions are made in the R&R programs to recover funds for less costly treatments in the pavement preservation program. The result of this decision recovered slightly over $6 million.

Program Modification

Programmed Activity	Lane-Mile-Years	Cost Savings
Reconstruction *31 lane-miles* (40 lane miles)	*820* ~~(1,090)~~	$5,004,990
Rehabilitation *77 lane-miles* ~~(82 lane-miles)~~	*1,125* ~~(1,200)~~	$1,096,950
Pavement Preservation (84 lane-miles)	(412)	0
Total =	*2,357* ~~(2,702)~~	**$6,101,940**

Figure 8. Revised R&R programs.

Modifying the reconstruction and rehabilitation programs has reduced the number of lane-mile-years added to the network through reconstruction and rehabilitation from 2,702 to 2,357. However, using less costly treatments elsewhere in the network to address roads in better condition will increase the number of lane-

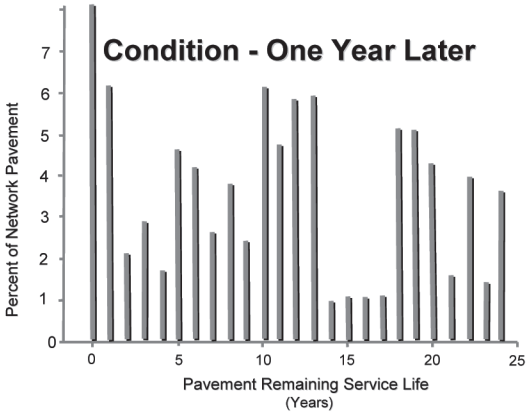


Figure 2. Condition 1 year later.

years. Consider the following quantitative illustration: Suppose your agency's highway network consisted of 4,356 lane-miles. Figure 3 shows that without intervention, it will lose 4,356 lane-mile-years per year.

Agency Highway Network = 4,356 lane-miles

Each year the network will lose

4,356 lane-mile-years

Figure 3. Network lane-miles.

To offset this amount of deterioration over the entire network, the agency would need to annually perform a quantity of work equal to the total number of lane-mile-years lost just to maintain the status quo. Performing a quantity of work that produces fewer than 4,356 new lane-mile-years would lessen the natural decline of the overall network but still fall short of maintaining the status quo. However, if the agency produces more than 4,356 lane-mile-years, it will improve the network.

In the following example, an agency can easily identify the effect of an annual program that consists of reconstruction, rehabilitation, and preservation projects on its network. This assessment involves

If you would like to view the electronic version of this exercise along with the worksheet, please visit the FHWA System Preservation Web site at **http://www.fhwa.dot.gov/preservation/library.cfm**.

A Quick Highway Network Evaluation Worksheet

A Removable Worksheet to Assess the Needs of the Highway Network and the Adequacy of Resource Allocations

PAVEMENT NETWORK EVALUATION WORKSHEET

Total Network Lane Miles = _____

RECONSTRUCTION

Project	Design Life	Lane Miles	Lane Mile Years	Lane Mile Cost	Total Cost
	×		=		
	×		=		
	×		=		
			Total =		

REHABILITATION

Project	Design Life	Lane Miles	Lane Mile Years	Lane Mile Cost	Total Cost
	×		=		
	×		=		
	×		=		
	×		=		
			Total =		

PAVEMENT PRESERVATION

Project	Design Life	Lane Miles	Lane Mile Years	Lane Mile Cost	Total Cost
	×		=		
	×		=		
	×		=		
	×		=		
	×		=		
			Total =		

NETWORK TREND

Project	Lane Mile Years	Total Cost
Reconstruction		
Rehabilitation		
Preservation		
Total		

SUMMARY

Programmed Activity (Lane Mile Years)	=
Total Network (Lane Mile Years)	=
Gain (+) / Deficit (-)	=