PURCHASE OF SERVICE AGREEMENT

THIS AGREEMENT ("Agreement") is made this 26th day of August 2014, by and between the Adams County Board of County Commissioners, located at 4430 South Adams County Parkway, Brighton, Colorado 80601, hereinafter referred to as the "County," and Cartegraph Systems, Inc. located at 3600 Digital Drive, Dubuque, IA 52003 hereinafter referred to as the "Contractor." The County and the Contractor may be collectively referred to herein as the "Parties".

The County and the Contractor, for the consideration herein set forth, agree as follows:

1. **SERVICES OF THE CONTRACTOR:**

   1.1. All work shall be in accordance with the attached RFP 2014.149 and the Contractor's response to the RFP 2014.149 attached hereto as Exhibit A, and incorporated herein by reference. Should there be any discrepancy between Exhibit A and this Agreement the terms and conditions of this Agreement shall prevail.

   1.2. Emergency Services: In the event the Adams County Board of County Commissioners declares an emergency, the County may request additional services (of the type described in this Agreement or otherwise within the expertise of the Contractor) to be performed by the Contractor. If the County requests such additional services, the Contractor shall provide such services in a timely fashion given the nature of the emergency, pursuant to the terms of this Agreement. Unless otherwise agreed to in writing by the parties, the Contractor shall bill for such services at the rates provided for in this Agreement.

2. **RESPONSIBILITIES OF THE COUNTY:** The County shall provide information as necessary or requested by the Contractor to enable the Contractor's performance under this Agreement.

3. **TERM:**

   3.1. Term of Agreement: The Term of this Agreement shall be for one-year from the date of this Agreement.

   3.2. Extension Option: The County, at its sole option, may offer to extend this Agreement as necessary for up to two, one year extensions providing satisfactory service is given and all terms and conditions of this Agreement have been fulfilled. Such extensions must be mutually agreed upon in writing by the County and the Contractor, and approved by the Adams County Board of County Commissioners.

4. **PAYMENT AND FEE SCHEDULE:** The County shall pay the Contractor for services furnished under this Agreement, and the Contractor shall accept as full payment for those services, the sum of sixty-eight thousand six hundred ninety seven dollars and sixty-seven cents ($68,697.67).

   4.1. Payment pursuant to this Agreement, whether in full or in part, is subject to and contingent upon the continuing availability of County funds for the purposes hereof. In

the event that funds become unavailable, as determined by the County, the County may immediately terminate this Agreement or amend it accordingly.

5. **INDEPENDENT CONTRACTOR:** In providing services under this Agreement, the Contractor acts as an independent contractor and not as an employee of the County. The Contractor shall be solely and entirely responsible for his/her acts and the acts of his/her employees, agents, servants, and subcontractors during the term and performance of this Agreement. No employee, agent, servant, or subcontractor of the Contractor shall be deemed to be an employee, agent, or servant of the County because of the performance of any services or work under this Agreement. The Contractor, at its expense, shall procure and maintain workers' compensation insurance as required by law. **Pursuant to the Workers' Compensation Act § 8-40-202(2)(b)(IV), C.R.S., as amended, the Contractor understands that it and its employees and servants are not entitled to workers' compensation benefits from the County. The Contractor further understands that it is solely obligated for the payment of federal and state income tax on any moneys earned pursuant to this Agreement.**

6. **NONDISCRIMINATION:**

   6.1. **The Contractor shall not discriminate against any employee or qualified applicant for employment because of age, race, color, religion, marital status, disability, sex, or national origin. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices provided by the local public agency setting forth the provisions of this nondiscrimination clause. Adams County is an equal opportunity employer.**

   6.1.1. The Contractor will cause the foregoing provisions to be inserted in all subcontracts for any work covered by this Agreement so that such provisions will be binding upon each subcontractor, provided that the foregoing provisions shall not apply to contracts or subcontracts for standard commercial supplies or raw materials.

7. **INDEMNIFICATION:** The Contractor agrees to indemnify and hold harmless the County, its officers, agents, and employees for, from, and against any and all claims, suits, expenses, damages, or other liabilities, including reasonable attorney fees and court costs, arising out of damage or injury to persons, entities, or property, caused or sustained by any person(s) as a result of the Contractor's performance or failure to perform pursuant to the terms of this Agreement or as a result of any subcontractors' performance or failure to perform pursuant to the terms of this Agreement.

8. **INSURANCE:** The Contractor agrees to maintain insurance of the following types and amounts:

   8.1. Commercial General Liability Insurance: to include products liability, completed operations, contractual, broad form property damage and personal injury.
   8.1.1. Each Occurrence: $1,000,000
   8.1.2. General Aggregate: $2,000,000

   8.2. Comprehensive Automobile Liability Insurance: to include all motor vehicles owned, hired, leased, or borrowed.

8.2.1. Bodily Injury/Property Damage: $1,000,000 (each accident)
8.2.2. Personal Injury Protection: Per Colorado Statutes

8.3. Workers' Compensation Insurance: Per Colorado Statutes

8.4. Professional Liability Insurance: to include coverage for damages or claims for damages arising out of the rendering, or failure to render, any professional services, as applicable.
8.4.1. Each Occurrence: $1,000,000
8.4.2. This insurance requirement applies only to the Contractors who are performing services under this Agreement as professionals licensed under the laws of the State of Colorado, such as physicians, lawyers, engineers, nurses, mental health providers, and any other licensed professionals.

8.5. Adams County as "Additional Insured": The Contractor's commercial general liability, comprehensive automobile liability, and professional liability insurance policies and/or certificates of insurance shall be issued to include Adams County as an "additional insured" and shall include the following provisions:
8.5.1. Underwriters shall have no right of recovery or subrogation against the County, it being the intent of the parties that the insurance policies so affected shall protect both parties and be primary coverage for any and all losses resulting from the actions or negligence of the Contractor.
8.5.2. The insurance companies issuing the policy or policies shall have no recourse against the County for payment of any premiums due or for any assessments under any form of any policy.
8.5.3. Any and all deductibles contained in any insurance policy shall be assumed by and at the sole risk of the Contractor.

8.6. Licensed Insurers: All insurers of the Contractor must be licensed or approved to do business in the State of Colorado. Upon failure of the Contractor to furnish, deliver and/or maintain such insurance as provided herein, this Agreement, at the election of the County, may be immediately declared suspended, discontinued, or terminated. Failure of the Contractor in obtaining and/or maintaining any required insurance shall not relieve the Contractor from any liability under this Agreement, nor shall the insurance requirements be construed to conflict with the obligations of the Contractor concerning indemnification.

8.7. Endorsement: Each insurance policy herein required shall be endorsed to state that coverage shall not be suspended, voided, or canceled without thirty (30) days prior written notice by certified mail, return receipt requested, to the County.

8.8. Proof of Insurance: At any time during the term of this Agreement, the County may require the Contractor to provide proof of the insurance coverage or policies required under this Agreement.

9. TERMINATION:

9.1. For Cause: If, through any cause, the Contractor fails to fulfill its obligations under this Agreement in a timely and proper manner, or if the Contractor violates any of the covenants, conditions, or stipulations of this Agreement, the County shall thereupon

have the right to immediately terminate this Agreement, upon giving written notice to the Contractor of such termination and specifying the effective date thereof.

9.2. For Convenience: The County may terminate this Agreement at any time by giving written notice as specified herein to the other party, which notice shall be given at least thirty (30) days prior to the effective date of the termination. If this Agreement is terminated by the County, the Contractor will be paid an amount that bears the same ratio to the total compensation as the services actually performed bear to the total services the Contractor was to perform under this Agreement, less payments previously made to the Contractor under this Agreement.

10. MUTUAL UNDERSTANDINGS:

10.1. Jurisdiction and Venue: The laws of the State of Colorado shall govern as to the interpretation, validity, and effect of this Agreement. The parties agree that jurisdiction and venue for any disputes arising under this Agreement shall be with Adams County, Colorado.

10.2. Compliance with Laws: During the performance of this Agreement, the Contractor agrees to strictly adhere to all applicable federal, state, and local laws, rules and regulations, including all licensing and permit requirements. The parties hereto aver that they are familiar with § 18-8-301, et seq., C.R.S. (Bribery and Corrupt Influences), as amended, and § 18-8-401, et seq., C.R.S. (Abuse of Public Office), as amended, and that no violation of such provisions are present. The Contractor warrants that it is in compliance with the residency requirements in §§ 8-17.5-101, et seq., C.R.S. Without limiting the generality of the foregoing, the Contractor expressly agrees to comply with the privacy and security requirements of the Health Insurance Portability and Accountability Act of 1996 (HIPAA).

10.3. OSHA: The Contractor shall comply with the requirements of the Occupational Safety and Health Act (OSHA) and shall review and comply with the County's safety regulations while on any County property. Failure to comply with any applicable federal, state or local law, rule, or regulation shall give the County the right to terminate this agreement for cause.

10.4. Record Retention: The Contractor shall maintain records and documentation of the services provided under this Agreement, including fiscal records, and shall retain the records for a period of three (3) years from the date this Agreement is terminated. Said records and documents shall be subject at all reasonable times to inspection, review, or audit by authorized Federal, State, or County personnel.

10.5. Assign Ability: Neither this Agreement, nor any rights hereunder, in whole or in part, shall be assignable or otherwise transferable by the Contractor without the prior written consent of the County.

10.6. Waiver: Waiver of strict performance or the breach of any provision of this Agreement shall not be deemed a waiver, nor shall it prejudice the waiving party's right to require strict performance of the same provision, or any other provision in the future, unless such waiver has rendered future performance commercially impossible.

10.7. Force Majeure: Neither party shall be liable for any delay or failure to perform its obligations hereunder to the extent that such delay or failure is caused by a force or event beyond the control of such party including, without limitation, war, embargoes, strikes, governmental restrictions, riots, fires, floods, earthquakes, or other acts of God.

10.8. Notice: Any notices given under this Agreement are deemed to have been received and to be effective: 1) Three (3) days after the same shall have been mailed by certified mail, return receipt requested; 2) Immediately upon hand delivery; or 3) Immediately upon receipt of confirmation that an E-mail was received. For the purposes of this Agreement, any and all notices shall be addressed to the contacts listed below:

Department: Adams County Transportation Department
Contact: Jennifer Shi
Address: 4430 South Adams County Parkway
City, State, Zip: Brighton, CO 80601
Phone: 720.523.6968
E-mail: jshi@adcogov.org

Department: Adams County Purchasing
Contact: Liz Estrada
Address: 4430 South Adams County Parkway
City, State, Zip: Brighton, Colorado 80601
Phone: 720.523.6052
E-mail: lestrada@adcogov.org

Department: Adams County Attorney's Office
Address: 4430 South Adams County Parkway
City, State, Zip: Brighton, Colorado 80601
Phone: 720.523.6116

Contractor: Cartegraph Systems, Inc.
Contact: Ben Murray
Address: 3600 Digital Drive
City, State, Zip: Dubuque, IA 52003
Phone: 800-688-2656
E-mail: administration@cartegraph.com

10.9. Integration of Understanding: This Agreement contains the entire understanding of the parties hereto and neither it, nor the rights and obligations hereunder, may be changed, modified, or waived except by an instrument in writing that is signed by the parties hereto.

10.10. Severability: If any provision of this Agreement is determined to be unenforceable or invalid for any reason, the remainder of this Agreement shall remain in effect, unless otherwise terminated in accordance with the terms contained herein.

10.11. Authorization: Each party represents and warrants that it has the power and ability to enter into this Agreement, to grant the rights granted herein, and to perform the duties and obligations herein described.

11. CHANGE ORDERS OR EXTENSIONS:

11.1. Change Orders: The County may, from time to time, require changes in the scope of the services of the Contractor to be performed herein including, but not limited to, additional instructions, additional work, and the omission of work previously ordered. The Contractor shall be compensated for all authorized changes in services, pursuant to the applicable provision in the Invitation to Bid, or, if no provision exists, pursuant to the terms of the Change Order.

11.2. Extensions: The County may, upon mutual written agreement by the parties, extend the time of completion of services to be performed by the Contractor.

12. COMPLIANCE WITH C.R.S. § 8-17.5-101, ET. SEQ. AS AMENDED 5/13/08: Pursuant to Colorado Revised Statute (C.R.S.), § 8-17.5-101, *et. seq.*, as amended May 13, 2008, the Contractor shall meet the following requirements prior to signing this Agreement (public contract for service) and for the duration thereof:

12.1. The Contractor shall certify participation in the E-Verify Program (the electronic employment verification program that is authorized in 8 U.S.C. § 1324a and jointly administered by the United States Department of Homeland Security and the Social Security Administration, or its successor program) or the Department Program (the employment verification program established by the Colorado Department of Labor and Employment pursuant to C.R.S. § 8-17.5-102(5)) on the attached certification.

12.2. The Contractor shall not knowingly employ or contract with an illegal alien to perform work under this public contract for services.

12.3. The Contractor shall not enter into a contract with a subcontractor that fails to certify to the Contractor that the subcontractor shall not knowingly employ or contract with an illegal alien to perform work under this public contract for services.

12.4. At the time of signing this public contract for services, the Contractor has confirmed the employment eligibility of all employees who are newly hired for employment to perform work under this public contract for services through participation in either the E-Verify Program or the Department Program.

12.5. The Contractor shall not use either the E-Verify Program or the Department Program procedures to undertake pre-employment screening of job applicants while this public contract for services is being performed.

12.6. If the Contractor obtains actual knowledge that a subcontractor performing work under this public contract for services knowingly employs or contracts with an illegal alien, the Contractor shall: notify the subcontractor and the County within three (3) days that the Contractor has actual knowledge that the subcontractor is employing or contracting with an illegal alien; and terminate the subcontract with the subcontractor if within three days of receiving the notice required pursuant to the previous paragraph, the subcontractor does not stop employing or contracting with the illegal alien; except that

the Contractor shall not terminate the contract with the subcontractor if during such three (3) days the subcontractor provides information to establish that the subcontractor has not knowingly employed or contracted with an illegal alien.

12.7. Contractor shall comply with any reasonable requests by the Department of Labor and Employment (the Department) made in the course of an investigation that the Department is undertaking pursuant to the authority established in C.R.S. § 8-17.5-102(5).

12.8. If Contractor violates this Section, of this Agreement, the County may terminate this Agreement for breach of contract. If the Agreement is so terminated, the Contractor shall be liable for actual and consequential damages to the County.

The remainder of this page is left blank intentionally.

IN WITNESS WHEREOF, the Parties have caused their names to be affixed hereto:

Board of County Commissioners

Chairman — Date: 8-26-14

Cartegraph Systems, Inc.

Signature — Date: 8/19/2014

Randy L. Skemp — Printed Name

Exec Vice President/CRO — Title

Attest:

Karen Long, Clerk and Recorder — Deputy Clerk

Approved as to Form: Adams County Attorney's Office

NOTARIZATION OF CONTRACTOR'S SIGNATURE:

COUNTY OF Dubuque)

STATE OF Iowa)**SS.**

Signed and sworn to before me this 19 **day of** August **, 2014,**

by Kimberly S. Klauer **,**

Kimberly S Klauer

Notary Public

My commission expires on: September 5, 2016

CONTRACTOR'S CERTIFICATION OF COMPLIANCE

Pursuant to Colorado Revised Statute, § 8-17.5-101, *et.seq.*, as amended 5/13/08, as a prerequisite to entering into a contract for services with Adams County, Colorado, the undersigned Contractor hereby certifies that at the time of this certification, Contractor does not knowingly employ or contract with an illegal alien who will perform work under the attached contract for services and that the Contractor will participate in the E-Verify Program or Department program, as those terms are defined in C.R.S. § 8-17.5-101, *et. seq.* in order to confirm the employment eligibility of all employees who are newly hired for employment to perform work under the attached contract for services.

CONTRACTOR:

Cartegraph Systems, Inc. — Company Name

8/19/2014 — Date

Randy L Skemp — Signature

Randy L. Skemp — Name (Print or Type)

Exec Vice President/CRO — Title

Note: Registration for the E-Verify Program can be completed at: https://www.vis-dhs.com\employerregistration. It is recommended that employers review the sample "memorandum of understanding" available at the website prior to registering

BEST AND FINAL OFFER

	Cost per mile County Urban, Suburban, and Rural Roads (based on 395 lane miles annually)			
	Item	* Per Mile Cost		
1	IRI data	$7.14	$2,820.30	
2	Rut data	$7.53	$2,974.35	
3	Faulting data	$3.05	$1,204.75	
4	Cracking data reduction ** includes all ASTM Standard D 6433 -11 Pavement distresses required in order to calculate pavement section OCI scores	$56.14	$22,175.30	
5a	Digital images on removable hard drives and CDOT-wide non-proprietary software proprietary software. Includes: Forward, Right, left, and rear facing right-of-way jpgs with GPS coordinate hyperlink.	$28.00	$11,060.00	
5b	optional earthmine solution (as replacement option of item 5a) Digital images earthmine option - 360° Geo-referenced digital imagery with point cloud data	$31.67	$12,509.65	
6	GPS data	$8.10	$3,199.50	
7	Horizontal curvature	$7.50	$2,962.50	
8	Grade data	$7.50	$2,962.50	
9	Thumbnail JPEGs Included in task item 5a option	N/A	N/A	
10	Shoulder data	$7.69	$3,037.55	
11	Curb, Gutter, Sidewalk data	$15.38	$6,075.10	
	Total unit cost per mile with task item option 5a	**$148.03**	**$58,471.85**	
	Total unit cost per mile with task item option 5b	**$151.70**	**$59,921.50**	
	Total Lane mile	395		
		Network Fixed fee		
			Yr 1	Annual fee (yr 2-5)
12	Option 5 b 360° earthmine imagery software & cloud hosting annual fee		$4,500.00	$3,250.00
13	Optional PMP Initial Engineering Set-up & Pavement Program Refinement fee (yr 1)		$4,700.00	Not required
14	Optional PMP Program Optimizing (M&R) Work Planning & Program Reports		$5,500.00	$4,250.00

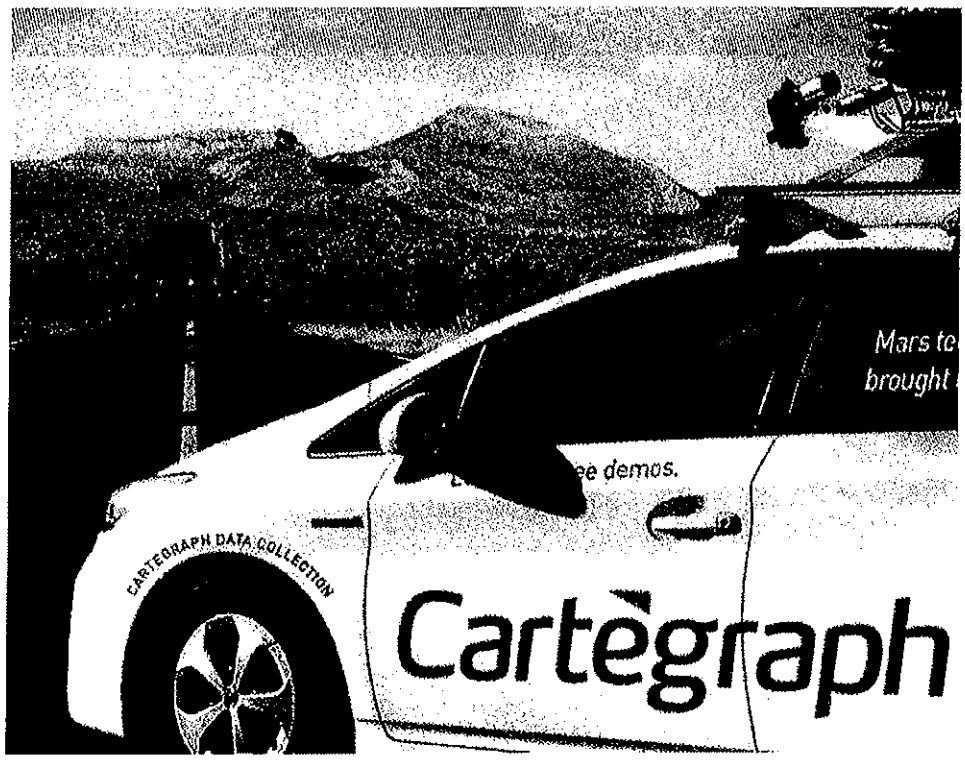
* Note: price per lane mile fees provided is based on the survey methodology outlines in section 1.36.1 Data Collection Lane of the County issued RFP.

Adams County, Colorado

Transportation Asset Data Collection Services RFP 2014.149

July 3, 2014

Cartegraph™
The Operations Management System.



Letter of Interest

July 1, 2014

Ms. Liz Estrada
Adams County Government Center
Finance Department
4430 South Adams County Parkway, Suite C4000A
Brighton, CO 80601-8218

Dear Ms. Estrada and Members of the Selection Committee:

Enclosed is Cartegraph's response to Adams County's Request for Proposals for Transportation Asset Data Collection Services. It is through our team's expertise and commitment to a quality deliverable that we will work with the County to effectively and efficiently provide the proposed services. Ultimately, our mission is to assist Adams County in providing exceptional service to its community and citizens.

Pavement / Cartegraph Software Expertise
Cartegraph has an extensive background in providing Pavement / Asset Management Services. As the sole source developer of Adams County's chosen Cartegraph pavement and asset management solution, we believe we are the best resource to provide support, training, and pavement management program implementation services.

Adams County's Future with Cartegraph and Project Familiarity
Scot Lewis, our proposed team's project engineer, has worked extensively with all Cartegraph asset management products. Scot has been an integral part of the process in developing a transition in data collection methodologies and format that will seamlessly work in Cartegraph OMS. *No other firm will be able to provide Adams County with this expertise*. In addition, Jared Kasten, Adams County's current Account Executive will serve as the primary point of contact for all account management throughout this project. Jared's familiarity with Adams County's data and policies will serve as an invaluable resource for this project.

Quality Management Plan (QMP)
We put a tremendous amount of emphasis on quality assurance/quality control into our projects. We focus on building client confidence by interacting with our customers throughout the entire course of the project with meetings, progress reports, workshops, and go/no go approval stages. All protocols for the County's pavement management program will be based on ASTM D6433 standards and Cartegraph's program guidelines along with the information outlined in Adams County's RFP. We trust you will understand the value of this commitment and our dedication to the success of your project.

Summary
The Cartegraph team will use a blend of the County's own policies, Cartegraph's pavement rating manual methodology, procedures used by the American Society of Civil Engineers (ASCE) in assessing pavement and public works infrastructure; as well as utilize practices conducted by a number of other local municipal agencies. When you compare Cartegraph to other responders, I'm confident you'll see that it's more than just data. It's a plan for the future. It's an engine for smart spending and good decision making. It's a place where safety, performance, sustainability, and engagement all meet — and our 20 years of industry experience and 1,000+ customers are testaments to this.

It is with this local experience as mentioned above, our understanding of the County's current Cartegraph Software, and with our teams past history in performing previous pavement inspections and asset data collection that we are confident that the proposed pavement and asset management services will achieve all of the desired objectives from the County. Adams County can be assured of Cartegraph's commitment to provide a quality deliverable as clearly defined in the request which the following response addresses.

As your Cartegraph Account Executive, I will serve as your primary point of contact for this procurement. Co-signed below, Mr. Randy Skemp, the Executive Vice President of Sales and the Chief Revenue Officer, is authorized to bind the firm to the scope of work outlined herein. On behalf of my entire organization, I'd like to thank you for considering Cartegraph. We look forward to working together into the future!

Sincerely,

Jared Kasten, Account Executive
(800) 688-2656, ext. 3343
jaredkasten@cartegraph.com

Randy L. Skemp, Executive Vice President
(800) 688-2656, ext. 3323
randyskemp@cartegraph.com

Proposal Section 1 – Project Approach

Current Situation

Adams County, Colorado is looking for a qualified consultant to perform a detailed pavement evaluation that will support the County Transportation Asset Management System (TAMS). This project includes a pavement condition assessment of approximately 395 lane miles of County maintained roads annually and the upload all required data into the County's Cartegraph Navigator or OMS database.

Project Challenges

- Provide annual pavement condition data collection for each specified road segment within Adams County's jurisdiction in order to provide objective up-to-date pavement management program results.
- Provide repeatable/ defendable surface condition assessment in accordance with ASTM standards, TAMS requirements, and Cartegraph program guidelines.
- Provide a solid quality assurance plan to ensure quality data and build client confidence.
- Upload all collected pavement condition data into the County's existing pavement management system, Cartegraph Navigator or OMS, and run OCI calculations for future management and planning purposes.
- Provide street level Imagery in conjunction with the pavement survey.
- Cost effective solution to provide other right of way asset data collection and database development for example: signs, sidewalks, and other relevant County maintained assets.

Methodology / Guidelines

We intend to use a blend of County's own policies and guidelines, TAMS requirements, follow procedures used by the American Society of Civil Engineers (ASCE) in assessing pavement infrastructure, as well as utilize practices conducted by a number of other local municipal agencies.

As standard protocol, Cartegraph adheres to the following ASTM and standard guidelines for assessing pavements including:

- International Roughness Index - **ASTM E1926-08**
- Network Level Pavement Management - **ASTM E1166-00(2009)**
- Pavement Management Implementation - **ASTM E1889 – 97(2009)**
- AASHTO Standard Guidelines for Pavement Management
- Pavement Condition Index Surveys - **ASTM D 6433-10, &11**
- Automated Pavement Condition Survey Equipment - **ASTM E1656-06**

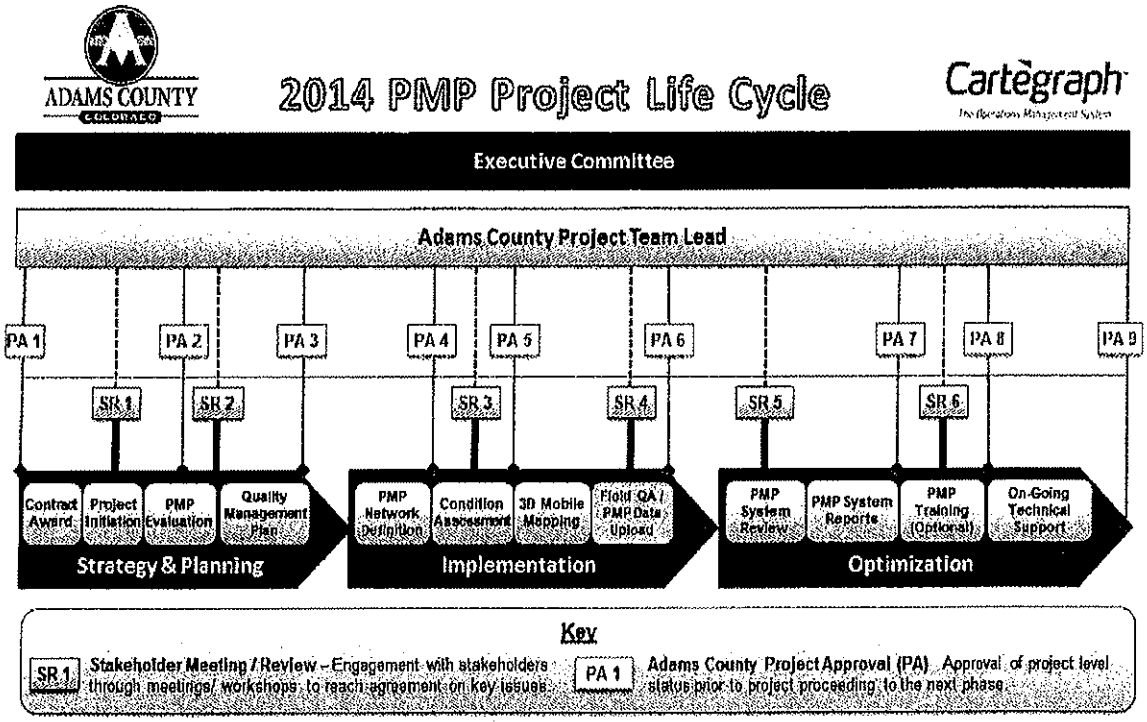
Services Outline

Management Plan

We will carefully approach this opportunity by teaming our senior project manager with engineers, system analysts, and field / software technicians who have extensive experience in Pavement & Asset Management and we know how to make these programs work for our clients.

Our value added services provide helpful solutions throughout the entire life cycle process of asset/pavement management. Cartegraph can put in the hands of public works users and decision makers, a variety of innovative infrastructure asset/pavement management tools. Our team will work hand-in-hand with Adams County to ensure the best solutions in the industry are provided. We have structured our services to assist Adams County's pavement management life cycle into three distinct phases of Planning, Implementing and Optimizing your program.
The following service overview and work plan are provided for the County's consideration. This approach has been utilized in numerous successful projects, and we are confident that Adams County will realize the many benefits by allowing Cartegraph to guide the County project team through the same process.

Work Flow - Management Services Project Life Cycle



County staff will become a true partner in the success of the project.

Phase 1: Strategy & Planning

The County will provide:

1) GIS file containing of roadway segment ID #'s and locations

2) Bridge ID #'s and locations

Project Initiation

Upon project award/ Issue of notice-to-proceed, the Cartegraph project manager will schedule a project initiation (kick-off) meeting in conjunction with Adam's County project team. During this meeting, the entire team will review the proposed project work plan, including scope of work, QA/QC Plan, budget, schedule, and deliverables. The kick-off meeting will include:

- Introduction of the project team and their respective responsibilities.
- Review the work plan & schedule - milestone dates for data review, delivery & acceptance.
- Review the proposed Quality Management Plan (QMP) and expectations.
- Information Exchange – (gathering history, background, levels of service measures, decision-making framework, and all available data).
- Identification Adams County's best practices on pavement/ infrastructure asset management.

Progress Reports

These reports will summarize the project progress to-date and provide an update of the project progress and are typically generated bi-weekly. They include:

- Survey Schedule and % complete milestones of the project including map highlighting streets tested
- Details of validation surveys completed during recent weeks including upcoming field schedules
- Major issues faced during field operation, and any incidents that may have occurred, health and safety issues and traffic management and remedial measures taken to resolve these issues
- Quality Control and Assurance results
- Data acceptance processes and task sign-offs

Phase 2: Pavement Management Program (PMP) Development & Implementation

PMP Review - Network Definition & Requirements

In order for Adams County to take full advantage of the functionality of their Cartegraph Pavement Management Program (PMP), and in order for Adams County staff to have confidence in the system-generated results and recommendations, it is imperative that the system contains the most complete, accurate, and up-to-date data available.

Data Completeness/Gap Analysis - recent pavement treatment projects, updated traffic data, and any legacy system data will be loaded into the program (i.e. any other information provided from Adams County's existing systems and databases).

After all the street segments and historical data is reviewed and loaded into the database, the next task will be to complete a full and thorough assessment of the County's Cartegraph PMP database. This will include a review of Adams County's agency data requirements (i.e., what information is needed/desired) and subsequent data gap analysis (i.e., what is missing).

Cartegraph will therefore collect all digital and hard copy data and include the following in our review:

- Basic inventory information by functional class (i.e. lengths, areas, surface type, etc.)
- Current condition information, if any
- Status of survey history, if any
- Construction and maintenance history
- Review of maintenance and rehabilitation treatments and unit costs

Pavement Data Collection

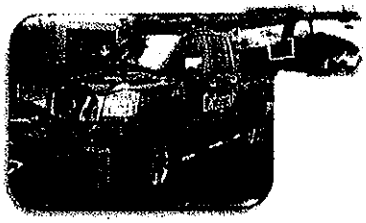
The data will be collected in only one direction of all two-lane roads. The direction of data collection shall change from year-to-year on these two-lane roads. On all multiple lane highways that have two or more lanes through one direction, lane #2 will be rated in both directions. Lane #2 is the second lane counting out from the median.

Surface Distress

The "fuel" for your pavement management engine is the surface condition data. Pavement distress provides that important set of data in determining the costs to maintain your road network.

Cartegraph is well positioned to collect/gather data in a sophisticated and proven automated (with linescan cameras), hybrid (semi-automated) as well as the conventional walking (manual) methods to provide the County with an accurate and repeatable condition assessment.

walking (manual) method



hybrid (semi-automated)

automated (with linescan cameras)

In every instance, our pavement inspection technicians will identify and load the required pavement distresses data into the pavement management program utilizing Cartegraph's pavement inspection guidelines, the Federal Highway Administration (FHWA) distress rating manual, as well as, ASTM Standard D 6433 -11.

The evaluation of the pavement surface distress is on the basis of two components:

- ***Severity*** is defined as ***'How bad is the defect?'*** in terms of the measurement or degree of wear associated with the condition.
- ***Extent*** refers to quantity or ***'How much?'*** of the pavement is affected by a particular distress.

The identification of distresses to calculate the pavement condition include:

Asphalt rating System		
Patching (AC)	Area %	Condition
Rippling & Shoving	Area %	Roughness
Raveling & Streaking	Area %	Appearance
Flushing & Bleeding	Area %	Appearance
Deformation & Distortions	Area %	Profile Deviation "
Excessive Crown	Area %	Elevation "
Progressive Edge Cracking	Area %	Width '
Alligator Cracking	Area %	Crack Width "
Potholes (AC)	Count/Area	Width "/Depth"
Map (Block) Cracking	Area %	Crack Width "
Longitudinal Cracking	Crack Length	Crack Width "

Portland Rating System		
Patching (PCC)	Area %	Condition
Scaling	Area %	Surface Peeling
Raveling (PCC)	Area %	Aggregate Loss
Polishing	Area %	Appearance
Distortion, Frost Heave	Area %	Profile Deviation "
Corner C & D Cracking	Area %	Crack Width "
Coarse Aggregate Loss	Area %	Pocked Areas
Potholes (PCC)	Count/Area	Width "/Depth"
Joint Sealant Loss	Joints / Sample	Exposed Sealant %
Linear Cracking (PCC)	Crack Length '	Crack Width "
Transverse Cracking	Crack Length '	Crack Width "

	'	
Transverse Cracks (AC)	Crack length '	Crack Width "
Wheel Track Rutting	Area %	Rut Depth "

(PCC)		
Joint Spalling	Joints / Sample	Crack Progress "
Joint Faulting/Stepping	Joints / Sample	Displacement "

100% of the roadway surface of County maintained roads will be inventoried using the suggested hybrid approach in order to accurately update the County's pavement network database.

Roughness Profile Survey IRI (International Roughness Index)

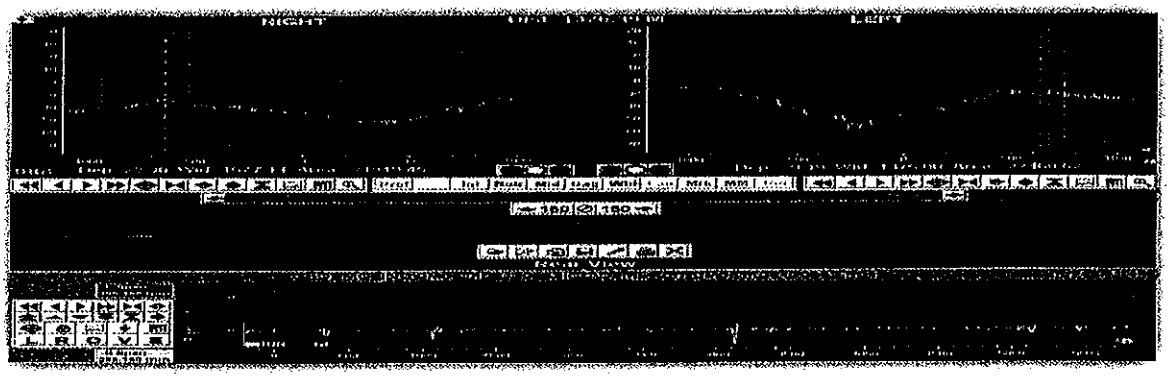
Cartegraph roughness measuring device meets the Class 1 ASTM E 950-98 designation for measuring the longitudinal profile of traveled surfaces, with an accelerometer established inertial reference.

IRI is widely accepted and endorsed by world leading institutions such as FHWA, ASTM, and the World Bank, as the technical standard for determining roadway roughness.

Rutting and Transverse Profiles

Our system will be capable of rut depth measurements for both traveled wheel track ruts simutaneously at client specified intervals while operating at posted speeds. The accuracy of our system provides +/- 1 mm as compared with manual measurements using ASTM procedures with a stralght edge device.

Average rut depths will be reported for left wheel path, right wheel path, and a combined average over the length of the pavement segment. A minimum of a 3-laser sensor rut bar will be used for this assignemnt. The results are triggered by the longitudinal distance traveled, independent of longitudinal speed and measured. A sample screen shot of the RutView application is shown below.



Concrete Faulting

Concrete faulting data will be collected using equipment also provided by ICC. This sub-system is housed in the front bumper of our collection vehicle and contains mounted lasers used for measuring heights to the road surface for the purpose of calculating road profile measurements. The lasers are positioned over wheel paths and provide high quallty infrared height sensors. This laser module sends an infrared beam to the pavement and samples the height value at a rate of 16,000 times per second and these samples will be averaged and referenced to time, GPS, and distance (at a recording rate every 1 inch) so that it may be allgned with the accelerometer data to provide longitudinal profile and roughness indices which meet Highway Pavement Management System (HPMS) submittal specifications.

Field Verification – Pavement Segments

Additional information that is collected and verified during the pavement condition survey include street name, number of travel lanes, segment quantities (indicate the length of the section and pavement surface type, number of

travel lanes). A short report highlighting the collected data elements from the field survey will be provided to Adams County for their review. Upon authorization by Adams County, corrected and/or updated values will be inserted into the final PMP database.

GPS Data

The global positional system collects vehicle location, velocity, attitude, track, speed, and dynamics from a moving vehicle. The POS also provides motion compensation information to all other sensor systems onboard the data collection vehicle. The system incorporates a POS unit, an Inertial Measurement Unit (IMU) with real-time differential, and a wheel encoder Distance Measurement Instrument (DMI) that provides a measure of the vehicle's linear distance traveled, and is used to constrain errors in vehicle velocity and displacement.

Shoulder Data

Shoulder data will be collected for all specified county roads and report shoulder related data including:

- Shoulder type reported as none observed, flexible, rigid, gravel, or curb & gutter.
- Shoulder width in feet.
- The presence of rumble strips.

Curb, Gutter, and Sidewalk Data

Data will be collected for all curbs and gutters and sidewalks along collecting roadways. Data shall contain the width, and length (no grade) for each segment and beginning and ending points of width changes.

Collected Events

Events are the main focal point that the pavement data is tied to. The events listed below will be collected during the pavement data collection.

- Every field mile reference post alongside the road identified along with its number.
- Every block to block segment and intersecting block identification.
- Every bridge and its beginning point and ending point.
- Every railroad crossing and its beginning point and ending point.
- The beginning point and ending point of any road section that is under construction or marked for construction along the roadway system.
- Anytime the road transitions from a multilane facility (at least two lanes in each direction) to a single lane facility, or vice versa identifying the beginning and ending points of such change.

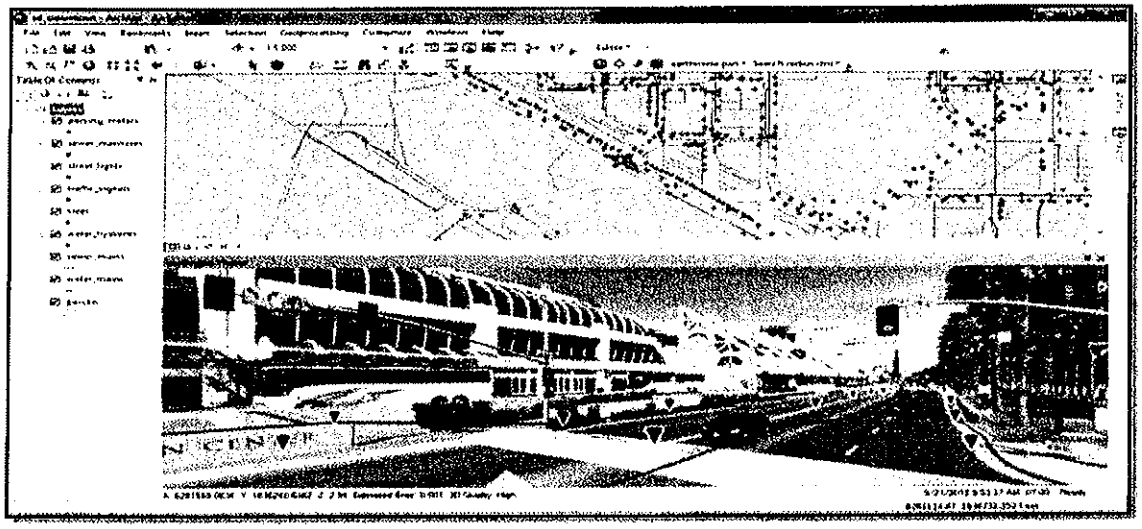
All information will be compiled and submitted in Microsoft Access 2002 format.

Scalable 3D Street Level Geospatial Mapping Solution

Concurrent with the pavement condition survey, our Cartegraph mobile data collection units are capable of gathering high-resolution 360° geo-referenced street level digital imagery along with rich immersive 3D point cloud data.

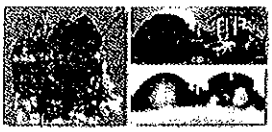
By simply driving your streets, our mobile mapping solution gives users the ability to visualize, measure, edit, and validate infrastructure and roadway / roadside assets. Such items include; collection and condition assessments for pavements, utilities, properties, markings, traffic signs & signals, ADA curb ramps, drainage & bridge structures and much more, all with a high level of accuracy and from the comfort and safety of the office. This can be done right in the GIS programs you are familiar with such as; ESRI ArcMap 10.X.

This information can be widely used for an array of management applications. By either having us build rich spatial datasets for your organization or simply provide your team with safe, fast & innovative tools to do it yourselves, Cartegraph can provide your team with a full-service experience in providing Operation Management System (OMS) technologies.



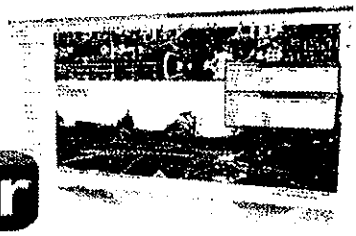
Cartegraph - Street Level / Roadway Imagery GIS Products and Solutions

- GIS, web-browser, desktop and mobile application integration
- Add-in for ArcGIS Desktop & AutoCAD Map 3D
- Widget for ArcGIS Viewer for Flex
- Applications easy to install & use
- Direct integration with ArcMap 10
- Visualize, measure, and map
- Advanced 3D features

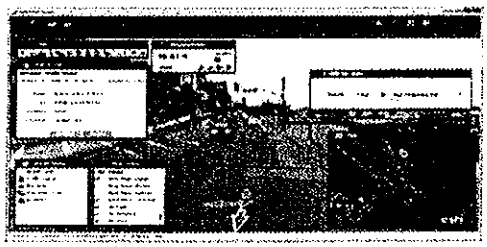


Cloud
earthmine Cloud

Server
earthmine Server



Hosting service Connect your data to a scalable online web (cloud) based distribution of data or server software.



Viewer
earthmine Viewer

ArcGIS
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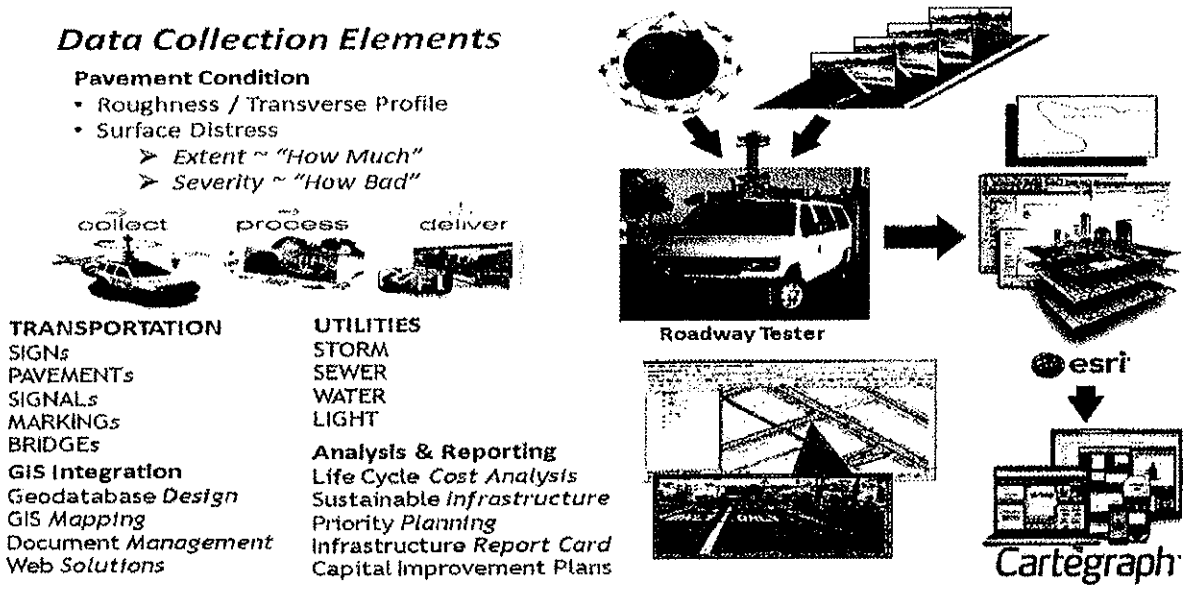
Public Works Asset Management Field Services Summary



Advantages of Cartegraph Pavement Inspections

- 100% area (full length & width) pavement inspections (Cartegraph is one of the only consultants in the industry to provide 100% pavement inspection coverage).
- This method has been used by our inspection team for over three decades and has allowed us to accurately and repeatedly inspect over **200,000 miles** of pavements for federal, state, and MPO municipal levels of government.
- The use of our high quality street level imagery deliverable, in combination with the County's ESRI GIS program allows users to examine pavement / roadside properties at any time, in any location without leaving your office.
- A GIS spatial location of all pavement inspection samples which includes GPS & 360º web-based street level imagery collections with 3D point cloud data
- Roughness Profile Survey – our method is widely accepted and endorsed by world leading institutions such as FHWA, ASTM, the World Bank, as the technical standard for determining roadway roughness.
- Buy American - All service deliverables and equipment proposed for this assignment are produced in the USA.

Advantages of the Cartegraph 3D Street Level Imagery Mapping Solution:

- Better utilize data from the office – eliminate the need for multiple site visits thus reducing time spent in the field exposed to traffic.
- Provide a safe, fast & inexpensive way to populate/update your GIS with quality data right in the County's ESRI GIS system.
- Introduce a new standard for mapping imagery via web deployment, utilizing seamless desktop and cloud-based GIS integration.
- Provide a useful integrated solution for ongoing network-wide Cartegraph system asset management programs.
- Efficiently resolve grievances by utilizing real quality imagery integrated with GPS locations.
- Improves data sharing, analysis, organization and communication - usable by everyone in the department (including the general public).

Phase 3: Program Optimization & Deployment

This approach defines a roadmap to ensure Adams County has an optimized, defensible and maintainable Cartegraph pavement management software application.

Cartegraph Pavement Management Program (PMP)

PMP Overall Condition Index (OCI) Analysis

The condition of a road is based on the data collected by our automated collection vehicle and pavement inspection team. The Overall Condition Index (OCI) is derived from a combination of the Pavement Condition Index (per ASTM D6433) and Ride Index (International Roughness Index per ASTM E950) collected field data. All required data will be loaded into the County's Cartegraph Pavement view by the Cartegraph and our team will calculate the Overall Condition Index (OCI) for each roadway section in the pavement database.

PMP Engineering Review & Refinement (Optional)

Undoubtedly, Adams County agency staff is experienced in assessing pavement conditions and determining appropriate maintenance and rehabilitation needs. The purpose of the engineering review and refinement tasks is to take this knowledge and experience and work through the logic of this pavement work planning decision-making process.

Here the Cartegraph project team will work closely with County staff to review and adjust all appropriate engineering models and settings ultimately, to ensure that Adams County is using the most suitable calculations, analyses and decision-making processes for its own unique pavement management needs.

PMP Program Optimizing - Maintenance & Rehabilitation (M&R) Work Planning (Optional)

Our team will assist Adams County in providing an M&R work plan within the Cartegraph PMP system by utilizing the basic inventory data combined with inspection information, maintenance policies, and future maintenance predictions regarding the condition of the pavement. All factors used in determining the M&R or construction activities will be configured to reflect the County's pavement management practices and their costs.

Work plan options include:

- Determining Budget Consequences,
- Eliminate M&R Backlog in (x) years,
- Maintain Current OCI and
- Reach Preferred Area OCI in (x) years.

PMP Work Planning & System Reports (Optional)

Our project team will provide a series of detailed technical reports to include:

- **Network Summary Statistics** - breakdown of sections and miles tested by functional class
- **Inspection History Report** - electronic list of all sections in the pavement network
- **OCI Report** - listing of every section, latest performance (OCI), & inspection date.
- **Quality Management Plan (QMP)**
- **Performance Prediction & Needs Reports** - Future performance of each pavement section tested will be analyzed to determine annual pavement performance and potential needs over the next X-year period. In simplistic terms, the needs analysis answers the questions: "If I have unlimited funding for street maintenance and repair":
    1. Which streets should I fix?
    2. When should I fix them?
    3. What treatments should I apply?
    4. How much will it cost?

- **Performance Budget Scenarios Reports** - Our evaluation uses a weighted effectiveness rating to prioritize sections for repair under constrained, realistic, budgetary assumptions. The effectiveness rating is defined as the area under a pavement performance curve. The effectiveness rating is weighted to place a higher priority on certain streets, such as arterials and collectors.
    - Multiple funding scenarios may be performed to answer "what-if" questions. Our team will perform up to four budget scenario runs based on input from Adams County. Typical funding scenarios include:
    - Existing funding levels
    - Existing funding levels increased (or decreased) by 10%, 20% etc.
    - Budgets that accommodate spikes in funding from STP, for example
    - Funding levels required to maintain (or increase) the OCI over time
    - Funding levels to maintain (or decrease) backlog over time

- **Executive Summary Report** - Our team will prepare a final report that summarizes the results of the surveys and analyses. This report will provide a brief overview of the project activities, outputs and achievements for distributing to wider audience such as senior management or the general public. The final report will contain:
    - Executive Summary
    - Study Objectives
    - Description of methodology
    - Results of Study
        - Inventory reports for the entire PMS database
        - Condition (OCI) reports
        - Maintenance and rehabilitation history and decision tree reports
        - Budget needs and budget scenario reports
    - Conclusions & Recommendations

The Executive Summary will be a 10-15 page report (excluding appendices) that will summarize the overall condition of the pavement network, maintenance and rehabilitation strategies used, results of budgetary analyses and scenarios and various treatment recommendations.

Council Board/ Agency Presentation (Optional)

Our team will provide an oral presentation of findings and recommendations to Adams County, agency manager(s), and/or employee groups.

If addressed to agency staff, the presentation will typically be about an hour and will review the results of the analyses and our recommendations. Here, we will be able to illustrate the long term effects that your current budgets would have on the level of service for Adams County, along with additional funding that may be required for future planning.

If addressed to the County Board, these presentations are typically "state of the pavement" summaries and targeted at a non-technical audience. Because the audience is non-technical, graphs are used to illustrate the results, and more importantly, the consequences of any decisions made about street maintenance funding levels and priorities.

Depending on the County's needs, our team can prepare a 20-30 minute formal presentation for Council, or more detailed one hour long presentations to County technical staff.

Other ROW Information (Optional)

In addition to the pavement condition update the County has expressed the need for some optional data gathering to assist them in achieving the requirements for their financial reports, ADA compliance, FHWA MUTCD or other mandates. Cartegraph is providing these types of inventories for other agencies and in this regard can offer the County similar services to inventory and manage some of their other physical assets both above and below ground.

Past Performance

Cartegraph's history with Adams County and exclusive responsibility for the support of the Cartegraph software implementation and support makes us uniquely qualified to provide the County with a superior project. Our familiarity with your data, policies and practices will yield considerable efficiencies in our work.

Work Plan Deliverable Summary

We are confident that the proposed pavement data collection services will achieve all of the desired objectives from Adams County.

For the investment in Cartegraph, the County will have an up-to-date Cartegraph pavement management program and TAMS data format delivery that includes:

- A centralized, comprehensive, and consistent pavement inventory of data
- Quick & objective pavement condition results loaded in the County's Cartegraph Pavement view or OMS
- Present status of a complete network wide pavement needs assessment
- ROW Assets - 3D Street level mapping Solution - By either having us build rich spatial datasets for your organization or simply provide your team with safe, fast & innovative tools to do it yourselves, Cartegraph can provide your team with a full-service experience in providing Operation Management System (OMS) technologies.
- Optional Pavement Management Services:
    - Pavement Management work plans to be able to estimate future pavement conditions for various budget and service levels, which help:
        - ⇨ identify pavement funding needs and shortfalls
        - ⇨ build support for increased pavement funding, and
        - ⇨ flag potential pavement performance concerns
- A full backup of Cartegraph staff and resources to assist with the County's Operations Management System needs

Technical Approach Summary

We trust that the content of this proposal meets the needs of the technical requirements of County's Request for Proposals for Transportation Asset Data Collection Services. We have reviewed all the components of this RFP including the County's general contract agreement and Cartegraph is confident that we are in compliance with the terms, conditions, and other provision requirements outlined by Adams County.

We do understand that it is difficult to review the capabilities of our services and technologies in just a few short pages. Our aim was to provide as much information as possible so the selection team has a good understanding of the deliverables and our capabilities to successfully complete the tasks outlined in the RFP.

Proposal Section 2 – Work Experience and Capability

Company Information & Brief History

COMPANY NAME:	Cartegraph
ESTABLISHED:	1994
COUNTRY:	United States
COMPANY STRUCTURE:	Iowa Corporation
FEDERAL ID NUMBER:	42-1419553
COMPANY ADDRESS:	3600 Digital Drive
CITY/STATE/ZIP:	Dubuque, Iowa 52003
TELEPHONE #:	(800) 688-2656
FAX #:	(563) 556-8149
EMAIL:	Info@cartegraph.com
WEBSITE:	www.cartegraph.com

A history of success.
Over the past 20 years, Cartegraph has provided software and solutions specifically to the municipal government market. For the last 7 years, Cartegraph's Data Collection Services team has provided industry-leading technology to systematically collect pavement condition and other right of way asset attribute data for government clients. Using our high-resolution 360° cameras, we collect street-level digital imagery and translate the data for import in to GIS mapping interfaces.

Bringing our experience to you.
Cartegraph's business focus is the development, implementation and support of solutions that are designed for the government sector. Cartegraph has conducted hundreds of implementations of varying degrees for government agencies around North America and to a lesser degree, the world. Cartegraph's staff includes individuals with prior experience in IT departments at software companies, government agencies and in a wide range of private and public firms. In addition to acquiring a high level of competence in developing, implementing and supporting our systems, we have become experts in operational consultations, problem recognition, change management and project management. We have also become experts in recognizing hindrances to technology adoption and developing best-practice approaches to overcome them.

Technology that evolves with you.
Every day, we partner with and learn from people just like you. Our client roster includes some of the most innovative and forward-thinking public sector agencies in the world. Organizations big and small. Organizations with complex needs and genuine concerns. Organizations that, together, represent the interests of more than 100 million people and counting.

When client retention averages 95%, there is good reason to believe our long-term strategies for client satisfaction work. Our ongoing assignment of a dedicated Account Executive keeps the County continually abreast of changes and opportunities to better the organization. Our technical support currently provides a 93% live call rate which means the Cartegraph Technical Support Team is ready to help with your immediate needs post-implementation.

Five (5) Most Relevant Projects Relative to Adams County Scope

Project Name and Location:	**Pavement Assessment & Asset Management Program** **City of San Diego, California**
Year Completed:	2011 (new contract in 2014 anticipated August / September)
Client Contact:	Walter Gefrom, Roadways Engineer ph: 619.527.7541 wgefrom@sandiego.gov
Type of Survey:	Pavement Condition - Surface Distress & Roughness (IRI), 360° Web based Street Level Imagery + GIS Roadway/Roadside Inventory- ADA Ramp Compliance
Miles Surveyed:	3,600 mile network
Cartegraph Personnel:	Ken Huisman, Project Manager, Gus Velez, Field Manager Ausrine Kelbauskiene, GIS Winfield Cash, Dylan Rickards - Field Technicians
Service Summary:	We were involved in the design, development and installation of a comprehensive pavement management system to assist in managing the rehabilitation of the City's street network of over 3,600 miles. A pilot area was conducted by the City's project team to ensure confidence in the pavement performance data and that the delivered product met City distress identification specifications. The outcome, the City was pleased with the results.
Dollar Amount of Project:	$560,000
Pricing and Contractual Terms:	Lump Sum – Fixed fee

Project Name and Location:	**Pavement Management Services** **City of Liberty, Missouri**
Year Completed:	Pavements 2007 & 2010, 2013
Client Contact:	Brian Hess, City Engineer/Assistant Public Works Director ph: 816.439.4500 bhess@ci.liberty.mo.us
Type of Survey:	Pavement Condition - Surface Distress & Roughness (IRI)
Miles Surveyed:	162 mile network
Cartegraph Personnel:	Ken Huisman, Project Manager, Gus Velez, Project Coordinator Ben Culbertson, Spencer Pocock – Field Technicians
Service Summary:	Every three years the City is provided a pavement condition inspection update on their 162 miles City street network. This included training on the use of the Cartegraph software program along with updated Overall Pavement Performance Indices (OCI) in order for the City to prioritize all maintenance and rehabilitation work on a network-wide basis.
Dollar Amount of Project:	$24,950
Pricing and Contractual Terms:	Lump Sum – Fixed fee

Project Name and Location:	**Pavement Assessment & Asset Management Program** **County of San Diego**
Year Completed:	2012 (additional work on reports and training ongoing in 2014)
Client Contact:	Marcos Peraza, Field Engineering ph: 858.874.4060 marcos.peraza@sdcounty.ca.us
Type of Survey:	Pavement Condition, Surface Distress & Roughness (IRI), 360° Street Level Imagery plus GIS Roadway/Roadside Inventory, Pavement Markings, Sidewalks, and Guardrails
Miles Surveyed:	1,950 mile network
Cartegraph Personnel:	Ken Huisman, Project Manager Ausrine Kelbauskiene, GIS Coordinator, Brock Duos – GIS Technician Winfield Cash, Dylan Rickards, Field Technicians

Service Summary:	San Diego County was looking for a qualified consultant to perform pavement condition inspections and the development of PCI values for all County maintained roads using the County's Pavement Management Program (PMP) including a spatial (GIS) and digital imagery log in a web-based application in order to review all their pavement sections and create a GIS inventory of all their guardrails, pavement markings, sidewalks, curb and gutters.
Dollar Amount of Project:	$348,000
Pricing and Contractual Terms:	Lump Sum – Fixed fee

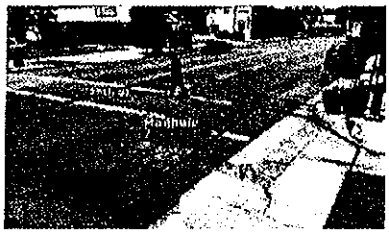
Project Name and Location:	**Earthmine Imagery Collection Project** **Columbia County, Georgia**
Client Contact:	Mary Howard, GISP, GIS Manager mhoward@columbiacountyga.gov or ph: (706) 312-7313
Type of Survey:	360° Street Level Imagery plus Sign Inventory
Completion Date:	2013
Miles Surveyed:	1200 survey miles – 100% of County Network
Cartegraph Personnel:	Ken Huisman - Project Manager, Gus Velez – Field Manager Brock Duos – GIS Technician, Spencer Pocock – Field Technician
Service Summary:	Cartegraph performed a sign inventory on 100% of County owned streets. All the information was carefully inventoried and loaded into the City's asset management software. In addition, we provided a complete 360 street level imagery inventory with point cloud data. The County has used this solution in multiple departments including the implementation of Emergency Management program which is being used to assist with safety measures for the public. This project is now being used as a model case study agency by the NCHRP regarding the safety of public works assets.
Dollar Amount of Project:	$156,000
Pricing and Contractual Terms:	Lump Sum – Fixed fee

Project Name and Location:	**Pavement Condition Assessment** **City and County of Honolulu, HI**
Client Contact:	James Matsuzaki, Depart of Facility Maintenance / Road Division ph: (808)768-7679 or jmatsuzaki@honolulu.gov
	Type of Survey: Pavement Condition, Surface Distress & Roughness (IRI) + 360° Street Level Imagery
Completion Date:	Entire Network 2014, Partial Network 2011
Miles Surveyed:	2,800+ survey miles – 100% of County Network
Cartegraph Personnel:	Ken Huisman - Project Manager, Ben Culbertson – Senior Field Technician Brock Duos – GIS Technician, Justin Wilson – GIS Technician
Service Summary:	Cartegraph was contracted to provide pavement management services for the City and County of Honolulu. Responsibilities included the delivery of automated pavement condition data including surface distress and roughness data. The pavement information was provided for the entire network for the City and County of Honolulu. All data was loaded into the County's PMS in order to determine the current and future rehabilitation/ replacement needs, review of current rehabilitation practices in order to development a 5-year maintenance and rehabilitation program.
Dollar Amount of Project:	$252,350
Pricing and Contractual Terms:	Lump Sum – Fixed fee

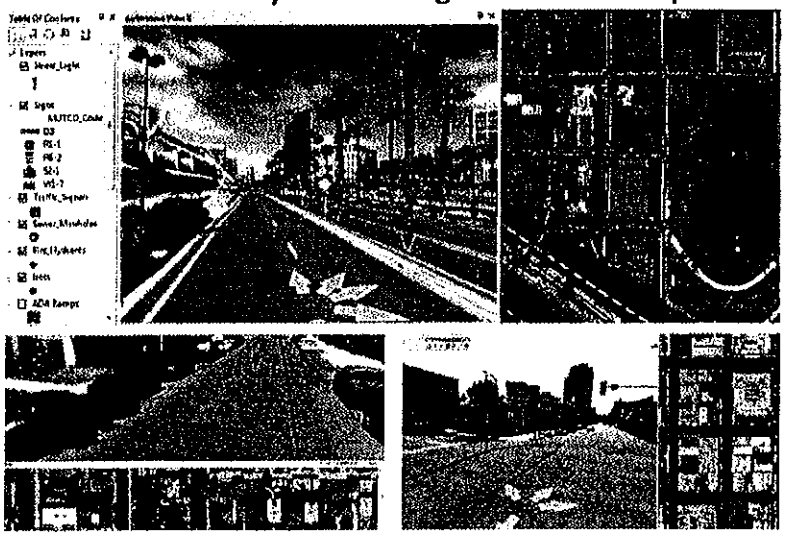
Additional Representative Clients – Infrastructure / Pavement

- City of San Diego, CA
- City & County of Honolulu, HI
- El Paso County, CO
- Clark County, NV
- Jefferson Parish, LA
- Orange County, CA
- San Diego County, CA
- Clackamas County, OR
- City of Liberty, MO
- City of Anaheim, CA
- Santa Cruz County, CA
- Oakland County, MI
- City of Sandy, UT
- City of Fort Lauderdale, FL
- City of New Iberia, LA
- Columbia County, GA
- Newport Beach, CA
- City of Chandler, AZ
- City of Great Falls, MT
- City of Augusta, GA
- City of Strasburg, VA

Detailed project profiles on significant recent projects with the Earthmine software and MARS camera video image data collection are detailed on the following pages.



City of San Diego Pavement Inspection



Project Info

Location – San Diego, CA – United States

End User / Customer Name – The City of San Diego

Amount of Data – 2800 miles

Application – pavement condition inspection and asset management

Products –Earthmine for ArcGIS, Earthmine for AutoCAD Map 3D

Delivery Method – Earthmine Cloud

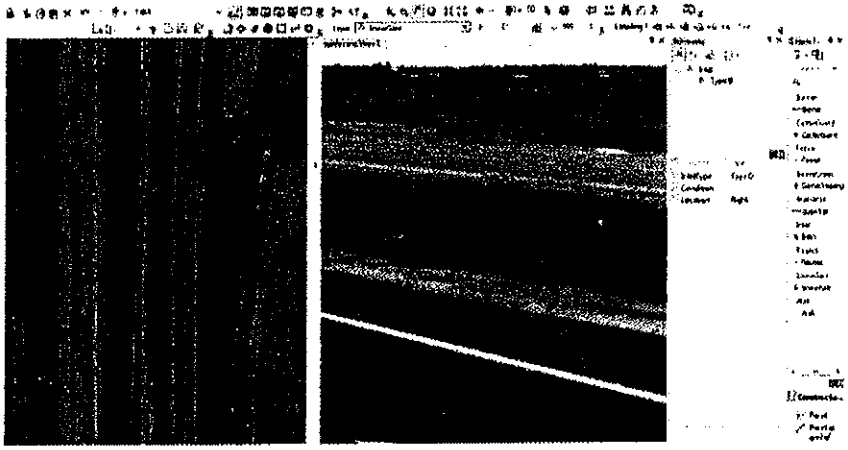
The City of San Diego, a city of approximately 1.5 million people is the second largest City in California, and the 7th largest city in the United States. Managing the public assets and infrastructure of a city this size is a constant and growing challenge. The City of San Diego's Public Works Asset Management Division currently maintains an extensive amount of critical urban infrastructure, including over 2,800 miles of street and alleys, 5,800 miles of sidewalks, 200,000 trees located in the public right-of-way, 70,000 drain structures, 53,000 street signs and 40,000 street lights.

In order to effectively project and plan future maintenance for all the public works assets mentioned above, the City requires sophisticated and robust GIS technologies and services. To address a portion of these assets, the City of San Diego sought a qualified consultant to perform pavement condition inspections and provide a solution to validate other public works roadway/roadside infrastructure on their entire 2800+ mile road network. Cartegraph, Earthmine's partner, was able to leverage Earthmine's 3D accurate street level collection and data delivery to not only meet this demand, but deliver a data set that will service a broad range of the City's street infrastructure management needs.

Cartegraph provided the City of San Diego with a complete citywide pavement condition assessment by combining the Earthmine MARS collection system with their automated pavement laser profiler. Reduced collection time is one of the primary cost saving components of the Earthmine solution, and mounting these two systems together on one vehicle allowed Cartegraph to gather a comprehensive data set without doubling their collection efforts. This approach met multiple standards and requirements for pavement inspection provided by the Federal Highway Administration (FHWA) and the American Society for Testing and Materials (ASTM) Standard Practices.

Cartegraph used Earthmine for ArcGIS and Earthmine for AutoCAD Map 3D alongside their pavement inspection software to streamline their QA/QC process. When a portion of the pavement scan came into question, Earthmine's high quality imagery could be used to quickly visually inspect the area and clarify any uncertainty. Incorporating the Earthmine solution into the pavement inspection workflow saved Cartegraph numerous field inspections, resulting in valuable time savings and efficiency gains that were simply unavailable with more traditional methods.

Colorado DOT Asset Collection



Project Info

Location – Colorado, United States

End User / Customer Name – Colorado Department of Transportation, Department of Transportation Development

Application – highway asset collection

Products – Earthmine ArcGIS add-in

Delivery Method – Earthmine Cloud

The Colorado Department of Transportation (CDOT) is responsible for a 9,146 mile highway system. Each year, this system handles over 27.4 billion vehicle miles of travel, with 40 percent of all travel taking place on interstate highways. Building an up to date and accurate data set of this infrastructure is a key part in maintaining safe and efficient highways throughout the state. To achieve this goal CDOT, in conjunction with the Division of Transportation Development, are collecting and mapping highway field data long major highway segments to verify data and make updates to existing GIS layers for the state of Colorado. Cost and time associated with this collecting a large quantity of assets along nearly 10K miles of road using traditional methods is prohibitive. By leveraging Earthmine's 3D accurate street-level imagery to acquire and document highway infrastructure, this collection goal was readily achievable while saving CDOT significant time and money.

CDOT worked with Earthmine to collect imagery between Denver and Wyoming borders to map a wide variety of assets including guardrails, fences, walls, barriers, inlets, snow gates, cattle guards and game crossings. Earthmine's MARS collection system captures all of this information at highway speeds, reducing the need for multiple and length field collection. CDOT seamlessly integrated the Earthmine solution into their existing workflow with the Earthmine for ArcGIS add-in and asset identification was done completely in the ArcGIS environment. Assets were mapped in the Earthmine environment and then assigned appropriate attributes regarding their construction and placement along the highway. Earthmine provided a detailed street level view of assets that aerial imagery simply could not provide. Earthmine's high quality imagery allowed CDOT to not only accurately record locations of assets, but also identify their specific construction materials. These detailed inventories gave maintenance divisions a list and location of assets that fall in their regions and are used to determine their respective monetary values.

This project demonstrated great value to all CDOT business units that need to visually view the highway infrastructure as part of their job and integrated Earthmine imagery into their existing workflows and processes. The Environmental Department has already conducted their own project using the same Earthmine data to collect information on sound wall foundations, construction and condition. Traffic safety can use the data to collect information on lighting. Outdoor advertising also plans to use Earthmine to verify the locations and types of advertising signs. This interdepartmental use illustrates the high-re-use value of Earthmine imagery, and demonstrates yet another cost savings component of the Earthmine solution.

Project Info

Location – Oakland, CA – United States

End User / Customer Name – The City of Oakland

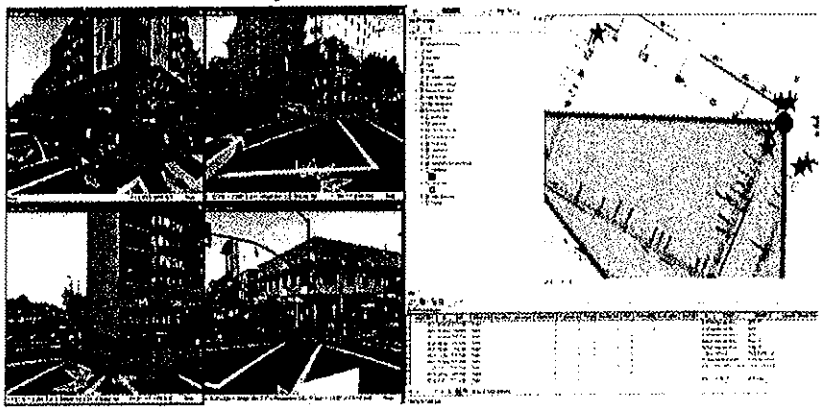
Amount of Data – 60-100 miles

Application – curb ramps and parking meters

Products – Earthmine Viewer, Earthmine for ArcGIS add-in

Delivery Method – Earthmine Cloud

City of Oakland Infrastructure Evaluation



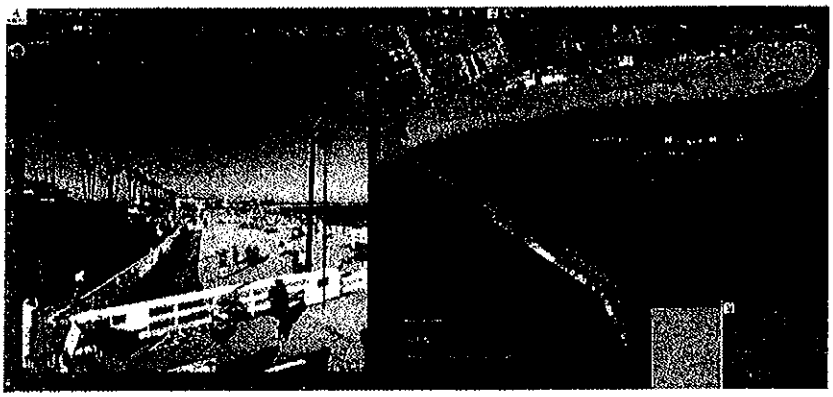
The City of Oakland, a city of approximately 390,000 located in California, recently implemented a complete Earthmine solution in order to rapidly populate and update their GIS data for a number of asset types and to share this data across multiple departments within the city. Within the Department of Public Works, the Earthmine solution was used for an evaluation of curb ramp compliance with the Americans with Disabilities Act of 1990 (ADA). In addition, a survey of parking meters was also conducted. These two asset types are representative of typical infrastructure in the City of Oakland that require continuous evaluation, and typically result in significant costs to collect and manage using traditional survey and inspection methods.

Ensuring that sidewalks and pedestrian routes are ADA compliant is an important and ongoing issue for all Public Works Departments throughout the United states. Numerous costly field inspections have traditionally made identification of non-compliant conditions cost prohibitive. This often results in insufficient documentation and allows potential obstructions to be left in disrepair. The Earthmine solution is able to mitigate those costs by eliminating unnecessary field inspections, and by moving the evaluation process into the office.

Once collected with the MARS system, the first step was to identify any potential non-compliant candidates, through visual inspection using the Earthmine for ArcGIS add-in. The purpose of this step was to identify the presence of detectable warnings, severe cracking, lifted pavement or any other obvious obstructions. Any ramps found to be non-compliant based on this criteria would then be flagged for further inspection. The next step was then to take measurements in the Earthmine view, in order to evaluate features such as ramp dimensions, flare dimensions, rough slope, vertical clearances, and any abrupt changes in grade. At this point it could be determined if a ramp required physical inspection by a technician. By integrating the Earthmine solution in their workflow, individuals are dispatched to the field on an as-needed basis. The end result is increased efficiency and cost savings at every level – collection, inspection, and time spent in the field.

It was also decided to collect meter locations using Earthmine Viewer, and then tag them more accurately using the Earthmine ArcGIS ad-in. This allows staff to get a clean capture, snap to other GIS features using native ArcGIS tools, and rely on editing templates in ArcGIS 10 to streamline the editing time and process. In order to preserve internal accuracy in GIS, new parking meters were snapped to existing sidewalk segments (the centerline of the sidewalk digitized from ortho-photos). Parking meter staff is in charge of attributing the meter ID information, notes and address information to preserve existing conventions. This information was back-filled through an ArcGIS Server application which writes the data to Oakland's centralized GIS database.

City of Santa Cruz Urban Services Information



Project Info

Location – Santa Cruz, CA – United States

End User / Customer Name – The City of Santa Cruz

Amount of Data – 280 miles

Application – GIS and Urban Services Information

Products – Earthmine Viewer, Earthmine for ArcGIS add-in, Earthmine Flex Widget

Delivery Method – Earthmine Cloud

The City of Santa Cruz, a city of approximately 60,000 located along the Northern California Coast implemented the Earthmine solution for asset management. Due to the high reuse value of Earthmine data, what began as a focused asset collection effort for the City's Department of Public Works resulted in an easily accessible and effective data set for many City departments and its residents. The main goal of the project at its onset was to address an immediate need within the city to collect and document two main assets. The first was to address the lack of geo-spatial information associated with the city's signage database. The second was to update light pole feature class information to more accurately identify and locate which poles are owned by the City versus owned by the utility company. To fund this project, the City sought support from many departments by presenting the Earthmine solution to the city's respective department heads. Among them were the Building Department, Planning Department, and Police Department.

The benefits of the Earthmine solution versus traditional methods for DPW were immediately apparent. Sending interns on costly and potentially unsafe trips to the field were among many fundamental problems with the traditional approach. Collecting data with the Earthmine MARS Collection System eliminated these complications as it dramatically decreased collection time, while increasing accuracy. Once collected, interns and GIS professionals alike used Earthmine's easy to use ArcGIS add-in to collect assets and input data out of the field and in the office.

The next step was to demonstrate the value of the Earthmine solution to department heads outside of DPW. These individuals were not by-in-large familiar with GIS systems and workflows. For this data set to be valuable, it would need to address the specific needs of their department, while being easily accessible without the use of complex software and large overhead. Again, the Earthmine solution proved successful for all these criteria. The MARS Collection System captures detailed 3D information about any object or asset visible from the street and as such all these departments were able to find useful information within the same data set. There was no need to re-capture or re-survey the area. For example, the Police Department could measure things such as fence heights for tactical reasons and the Building Department was able to visually compare Earthmine imagery against older street view imagery from other sources to assess for possible permit violations.

This project has demonstrated how the Earthmine solution can save money and increase efficiency throughout an organization's various departments. It addresses both GIS and non-GIS requirements, even when that need may not be apparent upon the time of collection. This is due to the robust and flexible nature of the Earthmine solution that can be easily deployed and is intuitive to use.

Staff Capacity for Adams County's Requirements

Cartegraph employs around 100 full time employees. For the purposes of this project, the key roles will be:

- Project Engineer
- Project Manager
- Data Services Subject Matter Expert
- Pavement Field Inspector
- Field Technician (Earthmine Imagery capture)
- GIS Technician
- Implementation Specialist
- Data Specialist

For each of these roles, Cartegraph will propose a Key Employee, as well as designate back up resources. Based on the current projects under contract and in some phase of delivery, the current staff and equipment are available to begin work upon notice to proceed.

Key Employees

Cartegraph commits the following employees to this proposed project for the duration of the contract and will only remove or substitute other resources with the County's prior written consent.

Project Engineer – Scot Lewis, P.E. (Cartegraph employs three other engineers on staff)
Project Manager – Gus Velez (Cartegraph employs three other senior PM's and 2 additional PM's)
Data Services SME – Ken Hulsman (Cartegraph employs four other Subject Matter Experts)
Pavement Field Inspector – Ben Culbertson (Cartegraph employs three other Field Inspectors)
Field Technician – Spencer Pocock (Cartegraph employs three other Field Technicians)
GIS Technician – Brock Duos (Cartegraph employs three other GIS Technicians)
Implementation Specialist – Mike Franzen (Cartegraph employs seven other Implementation Specialists)
Data Specialist – David Hawkins (Cartegraph employs 3 other Data Specialists, with additional resources in the development division.

Key Employee Resumes

Scot Lewis, P.E. – Project Engineer

Relevant Experience – Scot's role for this project will be to serve as the Project Engineer. Scot will be responsible for all engineering aspects of the project from the initial kick off meeting to preparing any project work planning reports or deliverables. Scot is a Professional Engineer with over 20 years of experience providing exemplary customer service with confident communication skills and a proven approach to project management. During his career, he has provided services to hundreds of municipal clients, specific to the area of pavement and traffic engineering. While employed with the City of Golden, CO, Scot managed water, sewer, storm sewer, concrete and street improvement projects totaling over $100 million dollars without one single claim against the City.

Some of Scot's Similar Project Accomplishments:

- City of Pekin, IL –Project Engineer (2014)
- Orange County, CA – Project Engineer (2014)
- City of University Park, TX –Project Engineer (2014)
- City of Napa, CA –Project Engineer (2014)
- Town of Strasburg, VA –Project Engineer (2014)
- Jefferson County, CO – Transportation Operations Engineer
- Weld County, CO – Senior Traffic Engineer
- City of Golden, Colorado – City Engineer

Gus Velez – Project Manager

Relevant Experience – Gus's role for this project will be to serve as the Project Manager and he will be the key point of contact for the data services portion of this assignment. Gus will coordinate and be responsible for all facets of the proposed data services work plan, including project meetings, scheduling, quality components, and the timely delivery of all data deliverables.

Gus brings over 28 years of professional experience in Project Management and design of public works and private development projects in the civil engineering field. His immense knowledge with design standards and practices for both public works and privately funded projects makes his role as Project Manager a tremendous value to the success of this assignment. Mr. Velez's project history includes engineering design for streets and roadways, major drainage faculties, storm sewer, sanitary sewer, and potable water distribution systems.

Some of Gus's Similar Project Accomplishments:

- City of University Park, TX ~ 80 mi. Road Network - Project Manager (2014)
- County of Orange, CA ~ 650 mi. Road Network - Data Services Project Manager (2014)
- Town of Strasburg, VA ~ 50 mi. Road Network - Data Services Project Manager (2014)
- City of Thousand Oaks, CA ~ 460 mi. Road Network - Project Manager (2014)
- Town of Castle Hills, TX ~ 460 mi. Pavement Network - Project Manager (2014)
- City of Central Point, OR ~ 70 mi. Road Network - Project Manager (2014)
- El Paso County DOT,CO ~ 850 mi. - Road Network - Data Services Project Manager (2013)
- Columbia County, GA ~ 1,250 mi. Road Network - Data Services Project Manager (2013)
- Santa Cruz County, CA ~ 1,325 mi. Road Network - Data Services Project Manager (2013)

Ken Hulsman – Data Services Subject Matter Expert

Relevant Experience – As the Data Services Project Advisor / Subject Matter Expert Ken will be an on-call resource for this project. Participating in discussions from industry standards, to best practice techniques, his services will be readily available to the project team throughout the entire course of this assignment. Ken will have authority to make key decisions on the project with respect to pricing, work planning, helpful business solutions and any other important high-level items that may arise.

Ken brings more than 23 years of experience in the pavement / infrastructure management consulting business. Over the course of Ken's career, he has provided many aspects of infrastructure management to various levels of government agencies throughout North America. His career began with designing of some of the earlier automated pavement /asset collection systems ever produced in the marketplace. Ken is routinely consulted by various agencies to provide helpful solutions that are applied throughout the entire life cycle of public infrastructure management.

Career Accolades:

- Participated in the Federal Highway Administration (FHWA) on the long term pavement performance (LTPP) program (1999-2006)
- Served and helped over 200+ local government public works agencies
- Aided eleven (11) State and Provincial governments on pavement management projects
- Involved with the development in some of the earlier high speed pavement profiling equipment provided in the industry
- Led the Jefferson Parish, Louisiana Department of Public Works to a confirmed settlement of $100,000,000 with FEMA over funding of repairs from roads flooded during Hurricane Katrina

Some of Ken's Similar Project Accomplishments:

- City & County of Honolulu, HI ~ 3,650 ln. mi. Pavement Network - Project Manager (2014)
- City of Auburn, WA ~ 385 mi. Pavement Network - Project Manager (2014)
- City of Great Falls, MT ~ 400 mi. Pavement Network - Project Manager (2013)
- City of Fort Lauderdale, FL~ 575 mi. Pavement Network - Project Manager (2013)
- City of Liberty, MO ~ 175 mi. Pavement Network - Project Manager (2002, 2005, 2007, 2013)
- County of Orange, CA ~ 650 mi. Pavement Network - Project Manager (2013)
- City of Anaheim, CA ~ 300 mi. Pavement (Major) Network- Project Manager (2013)
- County of San Diego DOT, CA ~ 1,950 mi. Pavement Network – Project Manager (2012)
- City of San Diego, CA ~ 3,600 mi. Pavement Network - Project Manager (2003, 2006,& 2012)
- Clackamas County DOT, OR ~ 1,100 mi. - Field Manager (1998 - 2006, 2009, 2011)
- City of Chandler, AZ ~ 850 mi. - Pavement Network - Project Manager (2001, 2004, 2007)
- Clark County, NV ~ 1,800 mi. Pavement Network - Project Manager (1997 - 2006)
- City of Salem, OR ~ 450 mi. Pavement Network - Project Manager (2002, 2004,2006, 2008)
- City of Virginia Beach, VA ~ 1,800 mi. Pavement Network Field Manager (2000, 2004)
- City of Greenville, SC ~ 224 mi. Pavements / Sidewalks - Field Manager (2001)
- City of Sacramento CA, ~ 1,500 mi. Pavements - Field Manager (1998, 2001, 2003,& 2006)

- Los Angeles County DOT, CA ~ 8,000 mi. Pavement (Major)Network - Field Manager (2003)
- City of Las Vegas, NV ~ 650 mi. Pavement Network - Field Manager (2001,2005)
- City of Austin, TX ~ 2,500 mi. Pavement Network - Field Manager (1995)
- Adams County, KS ~ 1,750 mi. Pavement Network - Field Manager (1993)

Ben Culbertson – Pavement Field Technician

Relevant Experience – Ben will provide his extensive pavement profiling, and data mapping expertise to this project. He has numerous years of hands-on experience in data collection and condition analysis in all areas of Cartegraph's field service offerings. It is with his continued willingness to develop QC/QA techniques and attention to detail out in the field that provides our clients with the assurance and confidence of meaningful and useable data.

Ben always takes a keen interest in every one of his assignments. He will be the primary field contact for this assignment and will be on-site for the entire data collection timeline. During this time, he will personally monitor the field staff, project progress, and the data quality and coordinate with the project manager on all project deliverables.

Some of Ben's Similar Project Accomplishments:

- City of Pekin, IL ~ 230 mi. Pavement Inspection - Senior Field Technician (2014)
- City/ County of Honolulu, HI ~ 3,650 lane mi. Senior Pavement Inspection (2014)
- City of University Park, TX ~ 80 mi. Senior Pavement Inspection (2014)
- City of Thousand Oaks, CA 460 mi. Pavement Network - Senior Field Technician (2014)
- City of Auburn, WA ~ 385 mi. Pavement Inspection (2013)
- City of Great Falls, MT ~ 400 mi. Pavement Inspection (2013)
- Town of Strasburg, VA ~ 60 mi. Pavement Inspection (2013)
- County of Orange, CA ~ 650 mi. Road Network - Field Coordinator (2013)
- City of Central Point, OR ~ 70 mi. Pavement Inspection (2013)
- El Paso County DOT, CO – 900 mi. Senor Field Operator (2013)
- City of Fort Lauderdale, FL~ 575 mi. Pavement Network - Field Technician (2013)
- City of Davis, CA~ 175 mi. Road Network - Field Technician (2013)

Spencer Pocock – Field Technician

Relevant Experience – Spencer has over three (3) years' experience as a field technician with Cartegraph. During this time he has been an instrumental part of our field team in delivering timely accurate and reliable data. He always strives to provide the best possible service for each of our clients.

Spencer is a graduate of the University of Colorado, Boulder in Environmental Design. Between his academic and professional career he has gained valuable experience with using ESRI's suite of desktop software products along with spatial remote sensing field equipment.

Some of Spencer's Similar Project Accomplishments:

- City of Pekin, IL ~ 230 mi. Pavement Inspection - Field Technician (2014)
- City of University Park, TX ~ 80 mi. Pavement Inspection - Field Technician (2014)
- City of Sunnyvale, CA~ 320 mi. Road Network Mapping (2013)
- County of Columbia, GA ~ 1,100 mi. Road Network Mapping (2013)
- City of Auburn, WA ~ 385 mi. Road Network Mapping (2013))
- County of Orange, CA ~ 650 mi. Road Network - Field Technician (2013)
- City of Bend, OR ~ 250 mi. Road Network Mapping (2013)
- City of Great Falls, MT ~ 400 mi. Road Network Mapping (2013)
- City of Glendale, CA ~ 400 mi. Road Network Mapping (2013)
- City of Fort Lauderdale, FL~ 575 mi. Pavement Network - Field Technician (2013)
- City of Davis, CA~ 175 mi. Road Network - Field Technician (2013)
- El Paso County DOT, CO – 900 mi. Field Technician (2013)
- County of Santa Cruz, CA ~ 1,150 mi. Pavement Inspection - Field Technician (2012)
- City of Arvada, CO ~ 450 mi. Pavement Inspection - Field Technician (2012)
- City of Newport Beach, CA~ 275 mi. Road Network - Field Technician (2012)

Brock Duos – GIS Technician

Relevant Experience – Brock's role for this project will be to serve as a lead GIS Technician. Brock will apply his extensive mapping skills, various geospatial analytical methods, overall data quality assurance, data management and software knowledge to this project.

Brock is a graduate of Bachelors of Science in Geographic Information Science at Louisiana Tech University. Between his academic and professional career Brock brings several years of experience in Geographic Information Sciences and database applications, serving a variety of clients in both the public and private sectors.

His overall knowledge of a variety of asset mapping practices and software packages as well as a keen eye for detail and accuracy will assure that the final deliverable will meet and exceed any expectations for the project. Brock's project history includes a wide variety of asset inventory collection and editing, throughout the country, in order to meet client demands.

Some of Brock's Similar Project Accomplishments:

- City of University Park, TX ~ 80 mi. Pavement Data Processing (2014)
- City of Napa, CA ~ 275 mi. GIS Mapping – Trees, Signs, Markings, Curbs, Sidewalks, ADA Ramps, Storm Drains, Street Lights, Traffic Signals, Utilities (2014)
- City of Sunnyvale, CA~ 320 mi. Sign Inventory – GIS Technician (2014)
- City/ County of Honolulu, HI ~ 3,650 lane mi. Pavement Data Processing (2014)
- City of Thousand Oaks, CA ~ 460 mi. 360° Street Level Imagery, Pavements (2014)
- City of Liberty, MO ~ 265 mi. Pavement Data Processing (2013)
- City of Central Point, OR ~ 70 mi. GIS Mapping – Signs, Curb & Sidewalks (2013)
- City of Banning, CA ~ 125 mi. GIS Mapping – Signs, ADA Ramps, Sidewalks (2013)
- County of Columbia, GA ~ 1,100 mi. 360° Street Level Imagery, Sign Inventory (2013)
- County of Orange, CA ~ 650 mi. GIS Mapping - ADA Ramps, Pavement Markings, Curb Markings, Sidewalk / Curb & Gutter, Signs, Catch Basins, , Storm Drains, Manholes, Street Lights, Traffic Signals, Utilities, Pavement Data Processing (2013)
- City of Bend, OR ~ 250 mi. 360° Street Level Imagery Data Processing (2013)
- City of Great Falls, MT ~ 400 mi. 360° Street Level Imagery Data Processing (2013)
- City of Glendale, CA ~ 400 mi. 360° Street Level Imagery Data Processing (2013)
- City of Fort Lauderdale, FL~ 575 mi. 360° Pavement Data Processing (2013)
- City of Davis, CA~ 175 mi. GIS Mapping - ADA Ramps, Pavement Markings, Curb Markings, Sidewalk / Curb & Gutter, 360° Street Level Imagery (2013)
- El Paso County DOT, CO – 900 mi. Pavement Data Processing (2013)
- County of Santa Cruz, CA ~ 1,150 mi. GIS Mapping -, Signs, Pavement Data (2012)
- City of Newport Beach, CA~ 275 mi. GIS Mapping – Signs, Curb Markings (2012)
- City of Anaheim, CA ~ 300 mi. Pa Pavement Data Processing (2012)

Mike Franzen – Senior Implementation Specialist

Relevant Experience – Mike's role for this project will be the implementation specialist for the County. This means that he will be working closely with the data collection team to ensure that the Cartegraph application is appropriately configured to receive the data collected, as well as provide any user training on the various asset applications for the County staff to effectively manage the assets beyond this project. Mike is a skilled presenter and communicator having moderated sessions and trained on all sizes of audiences. He is also a trainer and mentor to Cartegraph Implementation Staff and often works with his peers to provide constructive feedback and improve the overall delivery of the Cartegraph services team. Mike's demeanor, intrapersonal skills, extensive knowledge not only of the software, but also with the industry are the reasons that he is one of Cartegraph's most in demand resources for implementation services. Some of Mike's career accomplishments include:

- Created and initiated entire accounting system including chart of accounts, cash handling procedures, and payroll for start-up small business
- Coordinated the planning and preparation, including hardware installations and software programming, for new business telephone systems, voicemail systems, and integrated data products
- Worked closely with new clients, installers, and sales staff to configure, design, and implement new telecom equipment and services
- Provided extensive onsite training and customer support for new clients

- Provided training, technical assistance, service, and sales to existing telephone and data equipment clients both by phone and at the clients' offices
- Ensured resolution of problems, developed account portfolios and referred customers to additional products and services.

David Hawkins – Data Specialist

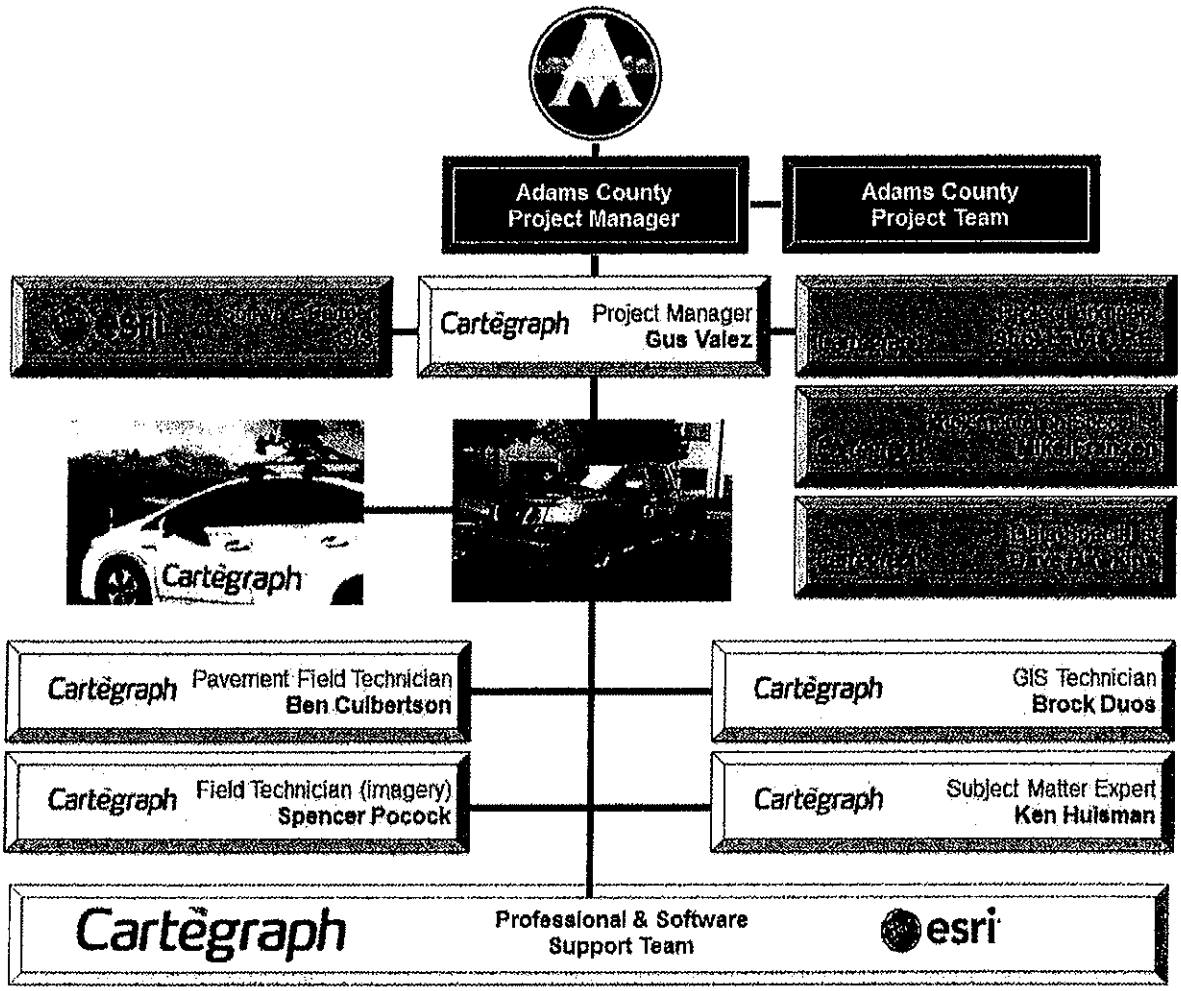
Relevant Experience -- David has been with Cartegraph for over 16 years, and has been the key resource in developing the procedures and protocols for managing data within the application. He has worked in the development side of Cartegraph also, providing information from the end user perspective to continually be the catalyst for produce improvements. David also provides external and internal support for advanced database related needs and provides business / data analysis and database design and administration consulting services. David also provides the actual data migration services from other applications, does application training and support, and hardware system review and product testing. Noted career accomplishments for David include:

- City of Livonia, MI
  Business Analysis; Hardware System Review; Custom Design and Development; Product Testing; Database Design/Administration; Support; Training (end user/administration)
- Marion County, FL
  Database Administration- Replication Design/Configuration/Deployment
- Sarasota County, FL
  Application Training; Application and Database Administration Training
- Idaho Transportation Department
  Design/Develop Data migration systems for field units to department MS SQL Server; Design/Develop/Deploy database security systems; Train users and administration personnel.
- City of Golden, CO
  Design and Develop database security systems for users and train application administration personnel.
- City of Tallahassee, FL
  Business Analyst - review business practices and develop strategies to address end user needs within Cartegraph applications. Provide data migration services, application training and support

Staffing Plan

Project Role	Skill Set	% FTE	Duration
[illegible]	Consulting, Technical, Management	4%	3 months
[illegible]	Management, Technical	20%	3 months
[illegible]	Consulting, Technical	1%	3 months
[illegible]	Field Services, Technical	100%	2.5 months
[illegible]	Field Services, Technical	100%	2.5 months
[illegible]	Technical	10%	1 months
[illegible]	Consulting, Technical, Training	25%	1 months
[illegible]	Technical	75%	3 months

Organizational Chart



Proposal Section 3 – Conflict Identification

Cartegraph is in compliance with all contractual requirements and conditions specified in the Adams County, Colorado Request for Proposals for Transportation Asset Data Collection Services and is not a party to any current or former contract activity with any existing state agency or transportation authority related to this proposal.

Proposal Section 4 – Cost / Staffing Proposal

Our proposed team of experienced pavement management specialists truly help agencies implement, update, and operate sound Pavement Management Program's (PMP). We own and operate a fleet of right-of-way data collection equipment and utilize proven technologies to successfully complete pavement data collection and asset management projects similar to the one being considered by Adams County.

Members of our dedicated team have advanced civil engineering backgrounds, which allow them to offer practical solutions to the unique needs of the public/municipal works setting. We bring sophisticated pavement management knowledge to this assignment and have full back up of equipment and resources to meet any schedule or unforeseen issues.

Detailed Staff Hourly Estimates

Task Description	Qty	Units	PM	PE	TE	SS	FT	AD
Phase 1 - Strategy & Planning			$175	$195	$104	$150	$93	$52
Project Management, Mobilization, Project Initiation Meeting, Quality Management Plan (QMP), Progress Reports, Progress Review Meetings	1	network	10	2	1	1	2	5
Phase 2 - Development & Implementation								
Pavements - PMP Review - Network Definition & Requirements *- Surface Distress – ASTM Standard D 6433 -11* *- Roughness Profile - Class 1 profiler exceeds ASTM E 950-98* *- Field Verification – Data QA/QC Pavement Segments* *- Condition Data Upload* *- PMP Overall Condition Index (OCI) Analysis, - GIS Integration*	395	Lane miles	15	10	20	10	120	12
Scalable 3D Street Level Geospatial Mapping Solution *- ROW Inventory (360° geo-referenced street level digital imagery + 3D point cloud data)* *- Field Verification – Data QA/QC Street Segments* *- Imagery Stitching and point cloud data processing* *- GIS Integration*	395	miles	10	3	40	3	90	12
Phase 3 - Program Optimization & Deployment								
Training + yr 1 Annual Maintenance, Subscription and support	1	Network	1			8		4
PROJECT SERVICES TOTAL HOURS			**36**	**15**	**61**	**26**	**212**	**33**

Provided is our cost estimate for all elements of the project, including a firm fixed price for each task in the scope of work and staffing.

Cost per Mile - County Urban, Suburban, and Rural Roads

Item	Per lane Mile Cost
IRI data	$ 7.14
Rut data	$ 7.53
Faulting data	$ 6.05
Cracking data reduction	$ 57.14
Digital images on removable hard drives and CDOT-wide nonproprietary software	$ 31.67
GPS data	$ 8.10
Horizontal curvature	Not Available
Grade data	Not Available
Thumbnail JPEGs	Not Available *
Shoulder data	$ 7.69
Curb, Gutter, Sidewalk data	$15.38

Additional Item	Annual fee
360° geo-referenced street level digital imagery along with rich immersive 3D point cloud Viewing software and cloud license option (Note: this is an annual fee)	$4,500

* Note: proposed high-resolution 360° geo-referenced street level digital imagery along with rich immersive 3D point cloud data delivered instead of Thumbnail JPEG images

Modifying the Scope and Deliverables

The services provided herein represent our understanding of the work and level of effort required for the successful implementation of the proposed work plan. Cartegraph is certainly open to modifying the scope and deliverables in conjunction with negotiating the fee schedule, to provide Adams County with the highest return on its investment.

Consultant Rates - On-Call Pavement Management Program Support Services

Note: These rates will hold valid for the term of the project. A cost of living increase will be applied to rates for each accumulative year. Any additional agreed upon onsite expense will be negotiated outside the scope of this contract.

Proposal Section 5 – Equipment Accuracy

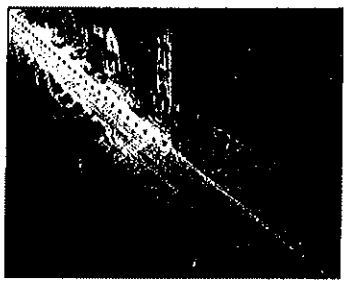
Our data collection equipment and team are capable of collecting

- Pavement Distress
- Pavement Profiling (Roughness / Rutting)
- Positioning Spatial GPS & Linear Reference
- 360 Right-of-way Imagery and Point Cloud
- Roadway / Roadside Assets

Pavement profiling (ride quality, rutting), GPS, and surface distress data is collected continuously and seamlessly by our pavement technician team using our data collection vehicle which makes available a wide range of survey technologies. Our pavement distress data collection process involves the use of 3D digital imaging technology along with customized, integrated keyboards which are used by to collect the type, severity, extent, start and stop points of all 39 ASTM Standard D 6433 -11 pavement surface distresses.

GPS Data

GPS coordinates will be collected for any and all roadway data collection related to this assignment. This data will include longitude/latitude in decimal degrees, and elevation data with an accuracy level of (+/-) 5 feet. Cartegraph will synchronize the GPS data with IRI, Rut, Cracking Distress, and Images. Condition data will be reported at the same interval to which the road centerline is segmented. GPS Specifications include:



- High definition mobile 3D mapping
- Dual frequency GPS (GNSS) tracking
- High accuracy 6-Axis IMU integration
- Odometry and tracking from on-board vehicle
- Positional data is synchronized with all other collected datasets
- Integrated DMI and IMU increase accuracy of data
- Accurately time-stamping and geo-referencing inventory data

Pavement Profiling

Cartegraph's road profilers are all produced and manufactured by International Cybernetics Corporation (ICC). ICC has produced over 350 of these devices and they have become the industry leader for Road Profilers by manufacturing very accurate, repeatable pavement evaluation equipment. Cartegraph's roughness measuring device equipment will be operated in accordance with AASHTO Standards and all IRI data will be reported at the pavement segment level.

Roughness data will be collected using a fully automated and certified Class I profilometer as per ASTM E950. The specialized profile measurement system, mounted on the front bumper of our survey vehicle, employs 3 different sensing devices;

1. A laser height sensor that measures the distance between the vehicle and the pavement surface while the vehicle is traveling at up to posted speed.
2. An accelerometer that measures the vertical acceleration of the vehicle as it bounces in response to the pavement surface profile.
3. The Distance Measuring Instrument (DMI) to provide a reference measurement of the vehicle as it traverses the road.

These three measurements are combined during post-processing to eliminate the effects of vertical vehicle motion and thereby defining the vertical profile of the pavement surface. The longitudinal roughness profile of each driven wheel track is obtained using an accelerometer and height sensor in each wheel track. Roughness data is computed from this profile and expressed in terms of the standard International Roughness Index (IRI) in units of in/mile.

Surface Distress

Cartegraph utilizes an automated hybrid process where visual distress evaluations are recorded in real-time on an event keyboard while the pavement inspection team traverses the road network. The technique is a well-established visual pattern recognition process that has been shown to provide accurate and repeatable condition assessments. This approach allows the field technicians to traverse the County roads at posted speeds (up to 50miles/hr) without impeding traffic flow.

The location of each defect along the roadway or individual pavement section is logged automatically with a Distance Measuring Device (DMI), which is accurate to + - 3ft per mile. The post-processing of the real time data calculates the quantities of the defects based on the location of the keyboard entries and leaves the technicians to focus only on the identification of the distresses and severity levels. This is a significant improvement over the traditional 'windshield surveys' of the past, thereby providing high production rates and ensuring data integrity and repeatability.

Recognizing the technical skills required to perform pattern recognition in a high-speed, semi-automated data collection operation, Cartegraph requires our raters to be evaluated and accredited on their abilities.

In every instance, our pavement inspection technicians will identify and load the required pavement distresses data into the pavement management program utilizing Cartegraph's pavement inspection guidelines, the Federal Highway Administration (FHWA) distress rating manual, as well as, ASTM Standard D 6433 -11.

3D Street Level Geospatial Mapping

Concurrent with the pavement condition survey, our Cartegraph mobile data collection units are capable of gathering high-resolution 360° geo-referenced street level digital imagery along with rich immersive 3D point cloud data. This technology was built by Earthmine/ Nokia. Earthmine/ Nokia is a leading provider of full motion, high resolution, and interactive spherical (360°) video. In 2010, Cartegraph became an authorized agent to provide Municipal Public Works Agencies, State Transportation Departments, and Private/Public entities with Earthmine technology.

Key Features

- High resolution panoramic imagery and 3D point data for every pixel.
- 32 megapixel 360°(H) x 180°(V) stereo panoramic imagery.
- Wide angle 360°(H) x 165°(V) 3D Data Capture.
- Up to 8 million 3D points per image and 24 million points per second (scene dependent).
- Data will be captured at 18ft intervals

Resolution & Quality

Data gathered from the cameras is used to automatically calibrate the system and generate seamless 32 megapixel 360°(HFOV) x 180°(VFOV) panoramic imagery and 360°(HFOV) x 165°(VFOV) 3D data. It is then optimized for web-based delivery and a copy of all data is provided on disk for internal hosting and backup.

Note: high-resolution 360° geo-referenced street level digital imagery will replace thumbnail JPEGs

Proposal Section 6 – Quality Plans

Cartegraph's data services office is located in Monument, Colorado less than one (1) hour away from Adams County.

Upon award, we will station our data collection team and survey inspection vehicle **on-site** throughout the entire project and will set up a field office no further than 10 miles from the Adams County project office. Adams County will always have a **"reachable"** contact with our project manager as well as field team.

We strongly believe that partnering with our clients is the most effective approach to ensure the highest quality and assurance of data. The Quality Management Plan will ensure that all procedures used to collect distress data and that all the processes, procedures and systems being deployed will provide the safest and best service for this project assignment.

We put a tremendous amount of emphasis on quality assurance / quality control into our projects. We aim to focus on building client confidence by interacting with our customers throughout the entire course of the project with meetings, progress reports, workshops, and go/no go approval stages.

QMP key items include:

- Strategy & Planning - **Project Initiation (kick-off Meeting)**
- **Progress Status Reports** - regular status updates and project "go/no go approval" stages
- **Survey Procedures** - methodology and inspection rating manual
- **Field QA/QC Program** - field calibration and data validation
- **Traffic Management & Safety** - appropriate traffic control public safety requirements
- **Data Management & Acceptance** - data transfer and deliver
- **System / Engineering** - software/hardware, IT and engineering requirements
- **Reporting Training & Deployment** - Reports, Training , and on-going Technical Support

Field QA/QC Program Protocols - Pavement Distress Data

Quality management practices for pavement management suggest that a one-time inspection of the final data deliverable, are typically inadequate and involve a high risk of failure. We have recognized the importance to effectively implement and ensure quality control and assurance practices on pavement distress data. We use a proven approach that integrates quality management and control procedures throughout the entire data collection and delivery process. Here are some of our QA/QC protocols.

- Calibration of all data collection activities.
- Reviewing field procedures and making changes as needed.
- Comparing the field data collected with on-site conditions.
- Review of all data entry functions, including random spot checks.
- Review of reports generated and analyses performed to ensure a quality product

Field QA/QC Step 1: Correlation

The first step in this process is having our project manager, field technician team and County staff members go out into the field together, drive some roads and review some of the variety of pavement conditions that exist in the County. We found this to be a valuable exercise as it builds good dialogue and is an excellent way to get a handle on the types of issues and pavement preservation strategies that are presently working or have not worked for the County in the past.

Field QA/QC Step 2: Pilot "Ground Truth SDI"

The recommendation to establish ground truth is accomplished by carefully selecting a series of "blind" sites that will be used to compare the surface distress results from County inspected surveys to those values inspected by Cartegraph. These "blind sites" sites are predetermined by County staff but are not known to Cartegraph at the time of the survey. If Cartegraph does not obtain the County desired results the data is deemed unacceptable and is corrected and resubmitted. The survey is not allowed to continue to the next area until the acceptable criteria is met and sign off is given from the County division manager.

Field QA/QC Step 3: Re-Inspection "Check" (internal)

Each week a percent of all inspections are put back on the re-survey list and re-inspected by other team members. Sections with an Overall Condition Index (OCI) points difference between the two surveys are flagged for revisit. All field members including the inspection supervisor review these sites and collectively determine the revised pavement distress measurements. If initial inspection is determined to be inaccurate, that member is retrained before being allowed to continue with any further inspections.

Field QA/QC Step 4: Inspection Supervisor "Spot Check" Review (internal)

One of our standard procedures for every field survey is to log and take pictures at each inspection site. These images are spot checked and reviewed by the inspection team supervisor to ensure that the inspection ratings are deemed true and accurate. If inconsistencies in the pavement ratings are identified from viewing the images, these inspection units are flagged and sent back out to the field for further review by a different team member. Upon field confirmation, inaccurate ratings are corrected and re-entered back into the system.

Field QA/QC Step 5: Compare Network OCI's from past survey

In this step, OCI values for each section are calculated from the current survey and compared to the OCI values from the last known condition survey. Any sections that fall out of the predicted performance curve by more than 15% of the expected change (or OCI's have improved with no maintenance work logged in the history) are flagged for review and resolve.

Field QA/QC Program Protocols Pavements Roughness Measurements

Equipment Calibration—Equipment Calibration (accelerometers and non-contact sensors) is done in accordance with specific manufacturer recommendations. A regular maintenance and testing program is established for the equipment in accordance with the manufacturer's recommendations.

Verifications Sections—Verifications sections are selected with previously determined IRI statistics for both wheel paths. These sections are measured by equipment operators on a regular basis. Evaluations of these measurements can provide information about the accuracy of field measurements and give insight into needed equipment calibration.

Quality Checks—The reference method for obtaining IRI data procedures can be found in the AASHTO Standard Practice for Determination of International Roughness Index for Quantifying Roughness of Pavements, AASHTO PP 37-04. This Standard Practice calls for the use of a longitudinal profile measured in accordance with ASTM E-950 as a basis for estimating IRI.

Quality Management Plan (QMP) Summary

We encourage our clients to actively participate in the entire process; however, we do recognize the time demands of County staff. In this regard, our QMP plan will lay out all of the quality management responsibilities and deliverable expectations for this assignment so the Adams County project team has a complete understanding of our work plan. The QMP plan will be submitted to the County for review and approval before any project work will begin.

Proposal Section 7 – Schedule of Service

Cartegraph collects pavement condition data on approximately 7,000 miles of roads annually. We have a total of four (4); one (1) automated field data collection vehicle and, three (3) hybrid-automated pavement distress evaluation vehicles currently available to collect pavement surface condition (OCI), pavement roughness (IRI), transverse profile (rutting) and inertial GPS, digital imagery and geometrics surveys.

Based on Cartegraph's past project experience, along with our full back up of equipment, staffing and resources, we are completely comfortable that we can complete a third of the County's pavement network annually within **96 calendar days** (3.2 months) from notice to proceed (NTP).

Cartegraph Services - Proposed Project Schedule

Task	Duration	Start	Finish
Project Summary	**96 days**	**Wed 7/30/14**	**Mon 11/3/14**
Phase 1 - Strategy & Planning	10 days	Wed 7/30/14	Tue 8/12/14
• Notice to Proceed	1 day	Wed 7/30/14	Wed 7/30/14
• Strategy & Planning - Kick-off Meeting	1 day	Wed 8/6/14	Wed 8/6/14
• Project - Quality Management Plan (QMP)	5 days	Wed 8/6/14	Tue 8/12/14
Phase 2 - Development & Implementation	62 days	Thu 8/7/14	Fri 10/31/14
Pavements	55 days	Thu 8/7/14	Wed 10/22/14
• PMP Database Review - Network Definition	6 days	Thu 8/7/14	Thu 8/14/14
• CDOT Correlation Sites	5 days	Fri 8/15/14	Thu 8/21/14
• Pavement Condition Assessment - Batch 1	15 days	Fri 8/15/14	Thu 9/4/14
• Pavement Condition Assessment - Batch 2	15 days	Fri 9/5/14	Thu 9/25/14
• Pavement Condition Assessment - Batch 3	15 days	Fri 9/26/14	Thu 10/16/14
• Pavement Data Processing	33 days	Fri 9/5/14	Tue 10/21/14
• Pavement Data load into Navigator/OMS	1 day	Wed 10/22/14	Wed 10/22/14
3D ROW Mapping Solution	56 days	Fri 8/15/14	Fri 10/31/14
• 3D 360° ROW Mobile Mapping Collection	11 days	Fri 8/15/14	Fri 8/29/14
• ROW 360° Imagery Stitching & Processing	45 days	Mon 9/1/14	Fri 10/31/14
Phase 3 - Program Optimization	9 days	Wed 10/22/14	Mon 11/3/14
Pavements	5 days	Wed 10/22/14	Tue 10/28/14
• PMP Pavement Condition Analysis (OCI)	4 days	Thu 10/23/14	Thu 10/23/14
• Optional PMP (Work Planning)	TBD		
3D ROW Mapping Solution	1 day	Mon 11/3/14	Mon 11/3/14
• Imagery Viewer Install & Training	1 day	Mon 11/3/14	Mon 11/3/14
	Project Completion		**Mon 11/3/14**

The above schedule is valid based on the County keeping its proposed timeline. If the notice to proceed is delayed, Cartegraph reserves the right to re-evaluate the above proposed schedule based on staffing and equipment availability and conflicts with other awarded work in the interim. Cartegraph will not agree to liquidated damages for schedule delays resulting from weather conditions or unresponsiveness of client.

Contractor's Certification of Compliance

CONTRACTOR'S CERTIFICATION OF COMPLIANCE

Pursuant to Colorado Revised Statute, § 8-17.5-101, *et. seq.*, as amended 5/13/08, as a prerequisite to entering into a contract for services with Adams County, Colorado, the undersigned Contractor hereby certifies that at the time of this certification, Contractor does not knowingly employ or contract with an illegal alien who will perform work under the attached contract for services and that the Contractor will participate in the E-Verify Program or Department program, as those terms are defined in C.R.S. § 8-17.5-101, *et. seq.* in order to confirm the employment eligibility of all employees who are newly hired for employment to perform work under the attached contract for services.

CONTRACTOR:

Cartegraph Systems, Inc.
Company Name

July 1, 2014
Date

Ben Murray
Name (Print or Type)

Signature

VP of Corporate Services, CFO
Title

Note: Registration for the E-Verify Program can be completed at: https://www.vis-dhs.com\employerregistration. It is recommended that employers review the sample "memorandum of understanding" available at the website prior to registering

ADAMS COUNTY
COLORADO

PROPOSAL FORM
2014.149 Transportation Asset Management System

VENDOR'S STATEMENT

I have read and fully understand all the special conditions herein set forth in the foregoing paragraphs, and by my signature set forth hereunder, I hereby agree to comply with all said special conditions as stated or implied. In consideration of the above statement, the following proposal is hereby submitted.

WE THE UNDERSIGNED HEREBY ACKNOWLEDGE RECEIPT OF

Addenda # 1 Addenda #_____
If None, Please write NONE.

Cartegraph Systems, Inc.	July 1, 2014
Company Name	Date
3600 Digital Drive	B M
Address	Signature
Dubuque, IA 52003	Ben Murray
City, State, Zip Code	Printed Name
Dubuque	Vice President of Corporate Services, CFO
County	Title
(800) 688-2656	(563) 556-8149
Telephone	Fax
administration@cartegraph.com	
E-mail Address	