Quotation for Professional Services

IMS Infrastructure Management Services
1820 W Drake Drive, Suite 104 Tempe AZ 85283
Phone: (480) 839-4347 Fax: (480) 839-4348
www.imsanalysis.com

To:	Alonzo Linan, PE, POE, MPA, Public Works Director	**Date:**	October 17, 2019
From:	Jeff Myers,MSA, Client Services Manager	**Project:**	Keller, TX
Subject:	Pavement Management Update	**Project No.:**	N/A

Thank you for taking the time to review the pavement data collection services offered by IMS. We excel in pavement and asset management solutions and can provide a full suite of data collection and software implementation services.

IMS has been the City of Keller's pavement condition service provider since 2004 and our team is extremely familiar with the City's roadway network and enterprise asset management system, Lucity. As we understand, the City of Keller is interested in an automated pavement condition update with integration into Lucity. IMS will survey approximately **252 test miles** as we will perform two passes on the arterial and collector roadway network. The IMS approach to pavement data collection allows for detailed coverage of residential roadways with just a single pass. IMS collects all pavement distress data in accordance with a modified version of the ASTM D6433 data collection protocols.

The base scope of this project includes configuration of the Lucity pavement analysis module to ensure it is functioning as designed and that all inherent software upgrades are being utilized to their fullest extent. The Lucity software is capable of prioritizing and optimizing a multi-year rehabilitation plan but the intelligence to do so must be configured within the system and updated with each data collection cycle. The end deliverables will take the form of a Lucity data upload, a GIS geodatabase (or series of shape files), a detailed pavement analysis, Lucity configuration, and a comprehensive report that details the findings of our analysis. IMS also has the capability to perform a structural analysis via deflection testing, deliver HD imagery, complete ADA compliance surveys and collect right-of-way asset inventories.

Our approach, and key service differentiator, is based on three, time proven fundamentals:

Answer the questions that are being asked – don't over-engineer the system or make it needlessly complicated. Databases and the application of technology are meant to simplify asset management, not make it more difficult.

Service and quality are paramount to success – the right blend of technically correct data, condition rating, and reporting will provide the agency with a long-term, stable solution. Service to the Client remains our top priority.

Local control and communications are key – it is important that all stakeholders understand the impacts of their decisions and have the system outputs react accordingly. We excel in making ourselves readily available.

Objective Pavement Data Collection

IMS is unique to the industry, as an objective and repeatable ASTM D6433-11 data collection effort will be completed. The Laser RST performs a linear surface condition assessment of all City streets. Instead of using the subjective feet-on-ground or windshield sampling method, all data will be collected continuously and recorded in 100-foot intervals in the form of a detailed database complete with GPS coordinates. The data will also be aggregated to the section level, maintaining Keller's sectioning and referencing methodology or implementing a block-to-block approach.

GIS and Pavement Management Linkage

The role of GIS in pavement management cannot be overstated. It is a powerful tool that provides the capability to handle and present vast amounts of data in an efficient manner. IMS will provide a link between the City's GIS program and the pavement management data to enable the City to display and generate color-coded maps based upon existing pavement conditions,

street rehabilitation plans or most of the data in the pavement management program. An output of the PCI score for each segment is illustrated in the adjacent image.
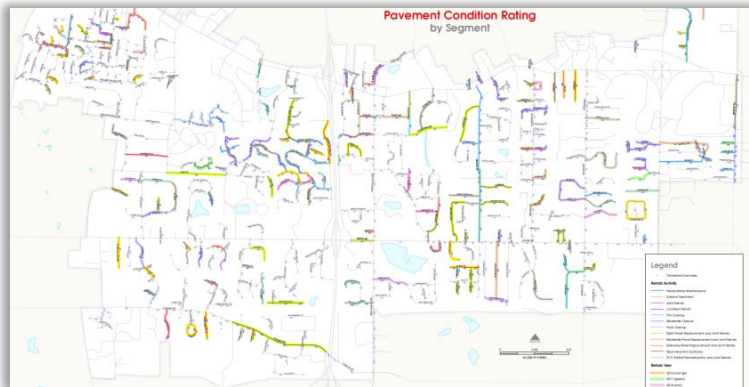
Provision of Digital Images and ROW Assets

In conjunction with the surface condition survey, each test section is recorded on digital video with a forward-facing and downward HD camera, used as part of the IMS QA/QC procedures. Additional cameras can be mounted to expand the viewing area or to include right-of-way asset features of special interest to the City, such as signs, sidewalks, curb & gutter, and pavement markings amongst other assets. IMS can provide digital images at specified intervals (e.g. 10', 25' or 50') for viewing in selected third party software, and/or through the City's GIS.

The following diagram illustrates the full configuration of the RST for pavement condition data collection assignments. The RST is operated by three highly trained technicians.
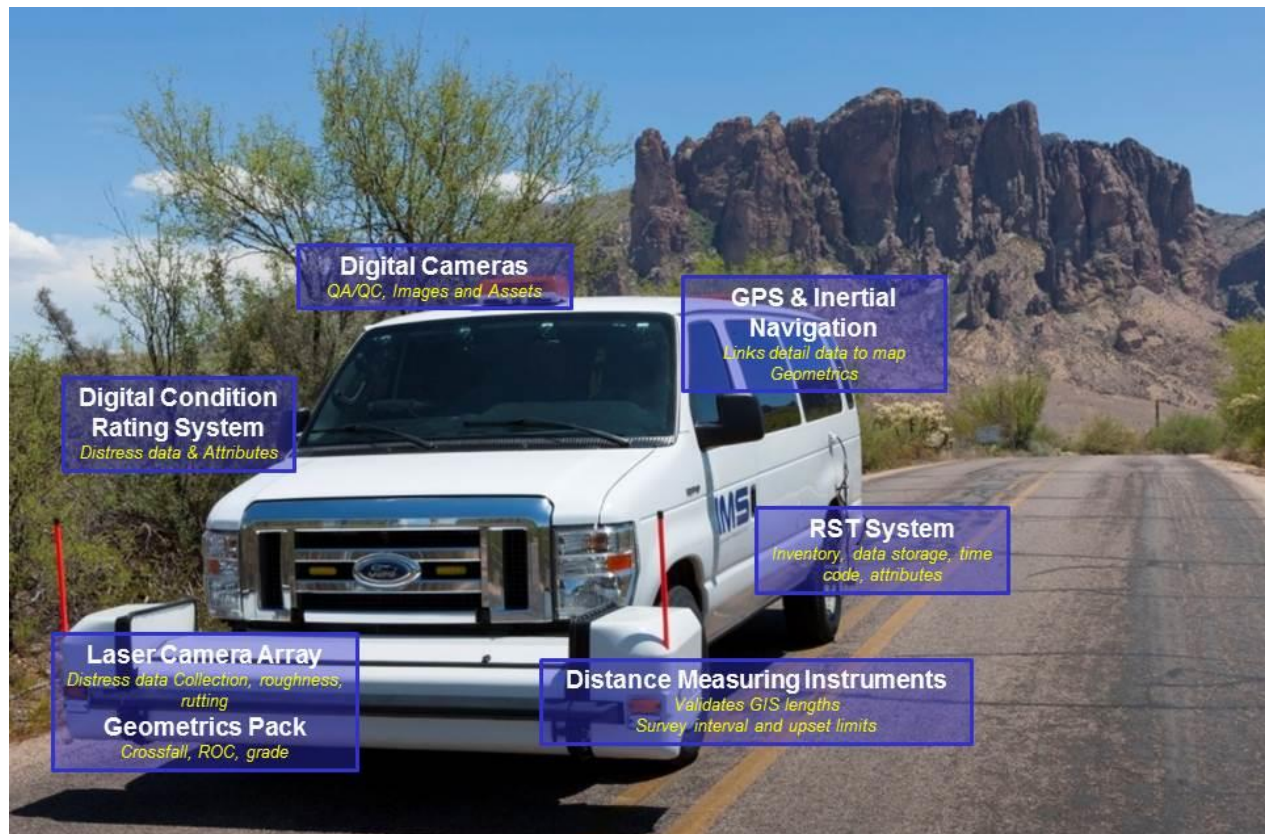
Laser Camera Array (LCA)	11 laser sensors that objectively quantify pavement cracking, texture, rutting, roughness, cross fall, crown, grade, and radius of curvature. The lasers collect data in a severity and extent format that conforms to ASTM D6433 protocols.
Digital Cameras	The Laser RST can be mounted with up to 7 HD digital cameras depending on each project's unique requirements. Digital images are largely used for many purposes: data validation, virtual drive deliverables to clients, and right-of-way asset inventory development.
GPS Acquisition	GPS technology is coupled with inertial navigation to enhance the acquisition of accurate longitude and latitude coordinates. Municipal agencies are becoming GIS centric and thus all data must be georeferenced for plotting in a GIS environment.
Distance Measuring Instruments (DMI)	Dual DMI pulse transducers that accurately collect and report vehicle distance and speed. The distance data is integrated with the inventory, GPS data flow, and time code.
Hardware & Storage	The Laser RST is equipped with multiple servers and computers that store the data collected from the lasers, cameras, GPS, and touch-screen event board.
Digital Direct Condition Rating System (DDCRS)	The touch-screen event board allows IMS to collect a wide range of data from pavement distresses to the validation of pavement attributes. The touch-screen event board can be configured in any manner we desire and conforms to the ASTM severity and extent data collection protocols. This is also used for unique asset attribute identification.

Lucity Analysis Configuration & 5-Year Plan

Immediately following the completion of the field survey's IMS will begin processing the pavement distress severity and extent scores in an effort to develop a Pavement Condition Index (PCI) for each roadway segment. The condition results are analyzed by a team of IMS engineers, who then develop a 5-year pavement management plan for the City. This section provides a brief summary of the functionality of the Lucity pavement analysis in order to emphasize our implementation expertise as well as the abilities and constraints within a pavement analysis.

The purpose of pavement management is to produce cost effective maintenance programs that maximize available resources and roadway life. By incorporating key components of a cost benefit analysis into the program operating parameters, we can develop a game plan that is optimized to meet the needs of Keller staff. In addition, the Lucity analysis operating parameters described within this section will be delivered in an easy to understand Excel Spreadsheet including the segment PCI data, pavement deterioration curves, triggers (priority weight factors), and the prioritized 5-year plan. Everything is linked to GIS in the form of simple shape files or even a personal geodatabase.

Lucity & Pavement Management Software Experience

IMS has completed over 70 Lucity software implementation and data collection assignments throughout the United States and is the **only dedicated asset management firm who participates in the software updates as they relate to the pavement and asset tools**. IMS routinely utilizes the Lucity "pavement analysis tool" in-house to develop reports for our clients that do not maintain a pavement management software application. Our team of qualified engineers possesses the expertise and skill set to update, modify, and configure the City's existing Lucity application.

In addition, we work closely with Lucity's Chief Executive Officer, Don Pinkston, and his software development team to ensure their clients harness the full potential and capability of the pavement management application. We pride ourselves in creating a client-consultant relationship that is second to none.

Field Inspection Data and Pavement Condition Index (PCI)

The Lucity analysis allows you to store information regarding your pavements, including surface types, number of lanes, patching estimates, and cross slopes with replacement estimates. Pavement condition data including surface distress, roughness, and deflection results can be stored and analyzed. Using the Lucity Pavement Manager Setup module, we can develop customized condition elements, distress types (load & non-load), Indices (SDI, RI, & SI), weightings, and overall PCI calculations.

In addition to the yearly programs, the net impact each budget scenario has on the expected condition of the road network over time can be determined. This budget impact can be illustrated both in terms of the yearly increase or decrease in the average network PCI score, PCI distribution, or % Backlog of roads that were not selected by the budgets. IMS converts the difficult to understand FHWA and ASTM D6433 data to a 0-10 distress rating scale with distress weighted factors (DWF), where DWF = {Area under D6433 deduct curves/3000}.

Set Points and Operating Parameters

One of the most important aspects of the IMS approach is determining the 'set points' or thresholds of the performance curves and other factors. In general, these set points determine what type of treatment will be selected given the current or predicted condition of a road segment over time.

For example, the scatter plot displayed below illustrates a potential rehab selection process that may be incorporated for the City of Keller. Each dot represents the outcome of a pavement condition assessment on each segment in the road network. The X-axis is the pavement condition index while the Y-axis is the Sum of Load Associated Distresses (or the Structural Index if deflection testing was conducted). The boundaries created by the intersection of the vertical green lines and horizontal dashed black lines represent the potential rehabilitation strategy for those given conditions. Each maintenance and rehabilitation strategy is programmed to take place in the most optimal year for each roadway segment.

The color bands are also an effective way of illustrating the activity priorities through an analysis that takes into account critical PCI drops, also known as "cost of deferral." The IMS analysis specifically targets "critical segments", which is defined as segments that will drop into a more expensive treatment category if they are not selected now. By presenting the rehab strategies in a visual format such as this, the user, City staff, management, and Councils can easily understand, follow, and potentially modify the results with confidence.
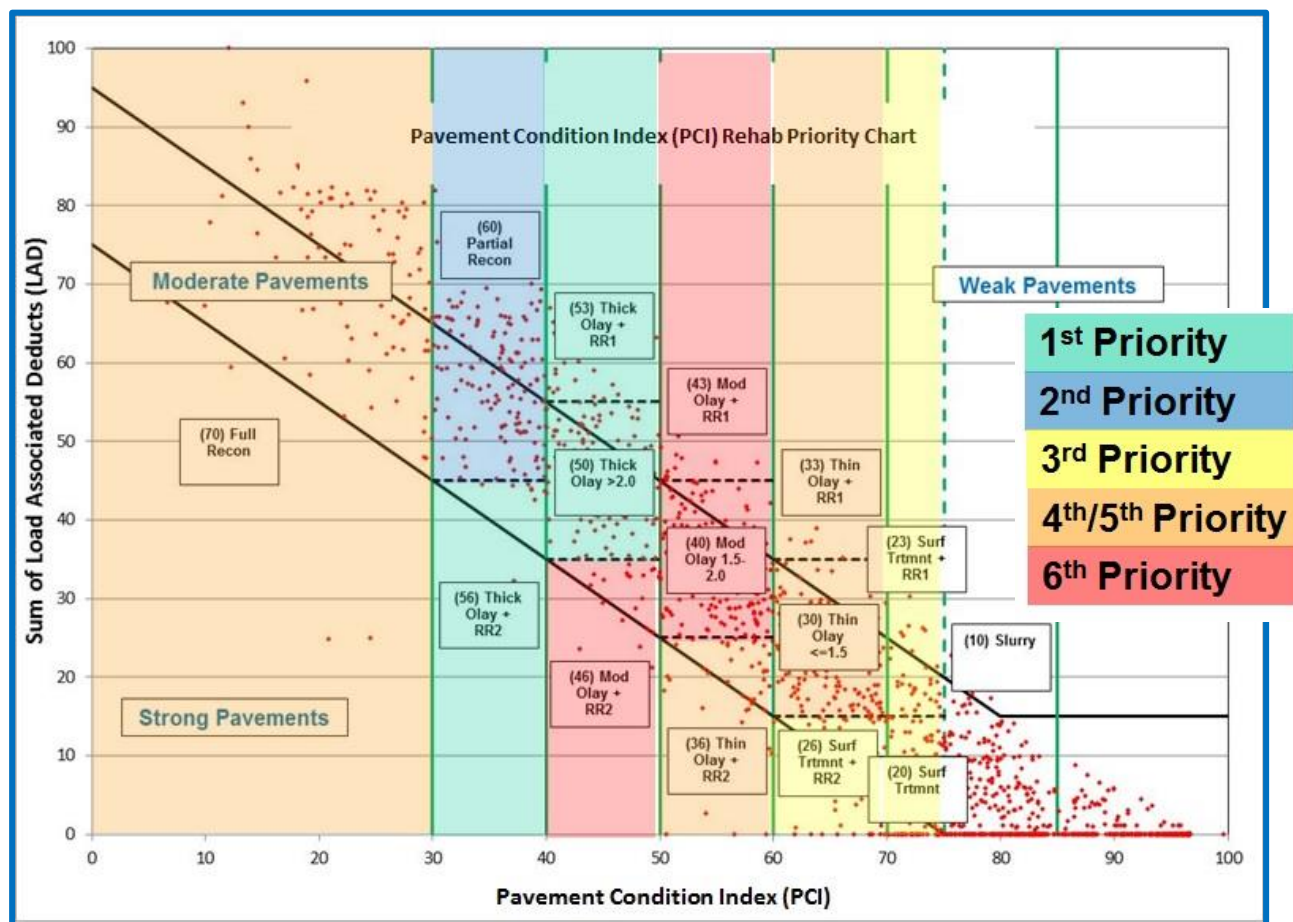
Rehabilitation Analysis

An unlimited number of pavement maintenance and rehabilitation strategies can be defined within our system. An analysis is then run, incorporating the performance curves, set points, filter criteria, and rehab alternatives. This identifies the overall need in terms of rehab strategies and costs for the City's road network, for today as well as year on year for the next 5 years.

The IMS approach allows you to input any number of "what if" budget scenarios and produce prioritized yearly

rehab programs based on those funding levels over a 5-year analysis period. Typical budget scenarios include Budget $/Year, Unlimited Budget $, "Do Nothing" Budget, and a Target PCI Budget.
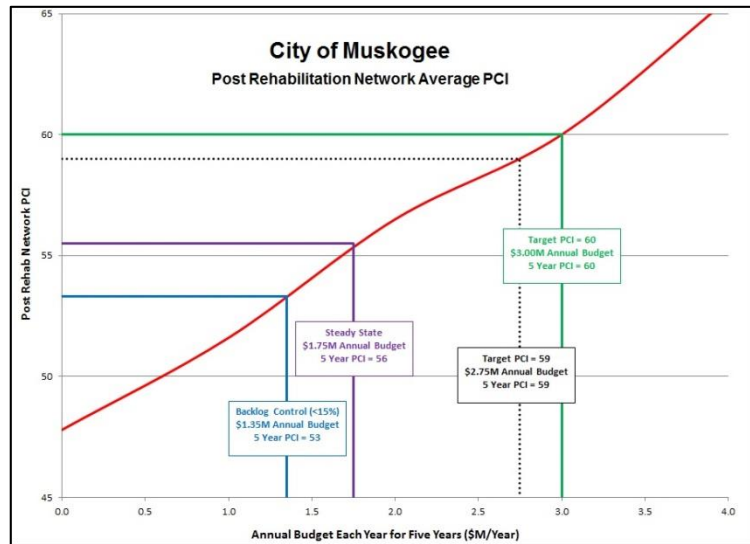
What is included in an IMS analysis & report?

- *Street ownership and inventory/attribute report.*

- *Present condition ranking* – detailed and summary condition data including; Good/Fair/Poor, Load Associated Distresses (LAD), Non-LAD, and Project reviews of each street in the network, as well as the network as a whole.

- *Fix all budget analysis* – this identifies the upper limit of spending by rehabilitating all streets assuming unlimited funding.

- *Do nothing analysis* – this identifies the effects of not performing roadway rehabilitation projects.

- *Steady state rehabilitation life cycle analysis* – this identifies the minimum amount of rehabilitation that must be completed in order to maintain the existing level of service over 3, 5, or 10 years.

- *PCI & funding levels* – what funding will be necessary to maintain a PCI of 70, 75 & 80.

- *Plus or minus 50% and other additional runs* – additional budget runs are completed at rates of +50% and -50% of the suggested steady state analysis. Up to 10 budget scenarios will be run.

- *Integration of capital projects and Master Plans* – ongoing and proposed projects that affect roadway rehabilitation planning will be incorporated into the analysis.

- *Draft multi-year rehabilitation and prioritized paving plans* – based on need, available budget and level of service constraints; a minimum of three budget runs will be completed.

- *Final prioritized paving plan* – incorporating feedback from stakeholder departments and utilities, complete with budget and level of service constraints.

Lucity Integration Expertise

Lucity is an enterprise-wide software application that is dedicated to managing public works infrastructure in the most advanced and efficient manner available. Through their advancements in software development, they have quickly become national leaders in the supply of intuitive software that offers a range of configuration options for each municipal user.

While any qualified engineer can collect some form of pavement condition data, IMS is truly a pioneer in the integration of objective distress data within the Lucity application. In addition, IMS is the only data collection firm that is officially recognized for Lucity pavement and right of way asset data collection projects as we participate in the software development and updates regularly.

The Lucity expertise retained by the IMS team goes far beyond data collection. In the last 12 years, IMS has been involved in over *70 Lucity assignments that range from full implementations to simple data updates.* With this type of level of service, Keller can rest easy knowing that IMS is more than qualified to collect data and at the request of agency staff, configure the Lucity software in a manner that maximizes the City's investment.

Integrating with the Keller Lucity Pavement Management System:

At the start of this project, IMS will request a copy of the City's existing GIS and the Lucity Stret and Comm databases. Our team will compare the two databases to ensure a one-to-one GIS linkage is still retained. If the two no longer retain a one-to-one relationship, IMS will work with agency staff to determine the correct referencing information and method of correction. IMS offers full services GIS clean-up activities that can be added to the scope of services if desired by City staff. Upon completion of the distress data processing, IMS will again request a current copy of the City's Lucity Stret and Comm database so that the distress data can be updated and moved into production.
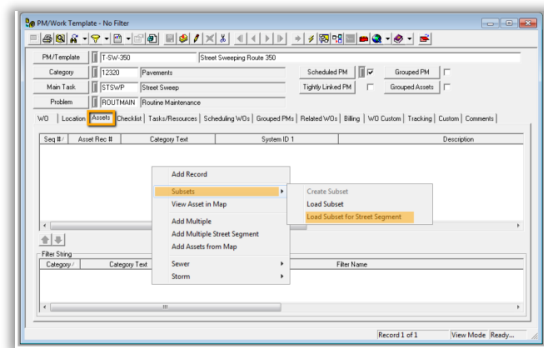
In conjunction with the ASTM D6433 data collection, IMS is also capable of ensuring the City is maximizing its return through the utilization of new and available features of Lucity's current version. As is inherent with all software applications, they continually improve and new features are added in scheduled updates. As a key developer for the software, IMS engineers have an unmatched expertise with the software's ability to calculate PCI scores, integrate structural condition results, store pavement deterioration models, utilize prioritization matrices, develop Supersegments, optimize through cost of deferment, and configure key triggers for appropriate maintenance and rehabilitation activities. In addition to the pavement analysis features, IMS has extensive experience working with the right-of-way asset (ROW) modules for Lucity.

IMS has the Lucity expertise to ensure the development of a defensible and optimized 5-year plan that meets the needs of City staff and elected officials. Our team will ensure that the Lucity software is properly configured and that the modules are being utilized to their potential.
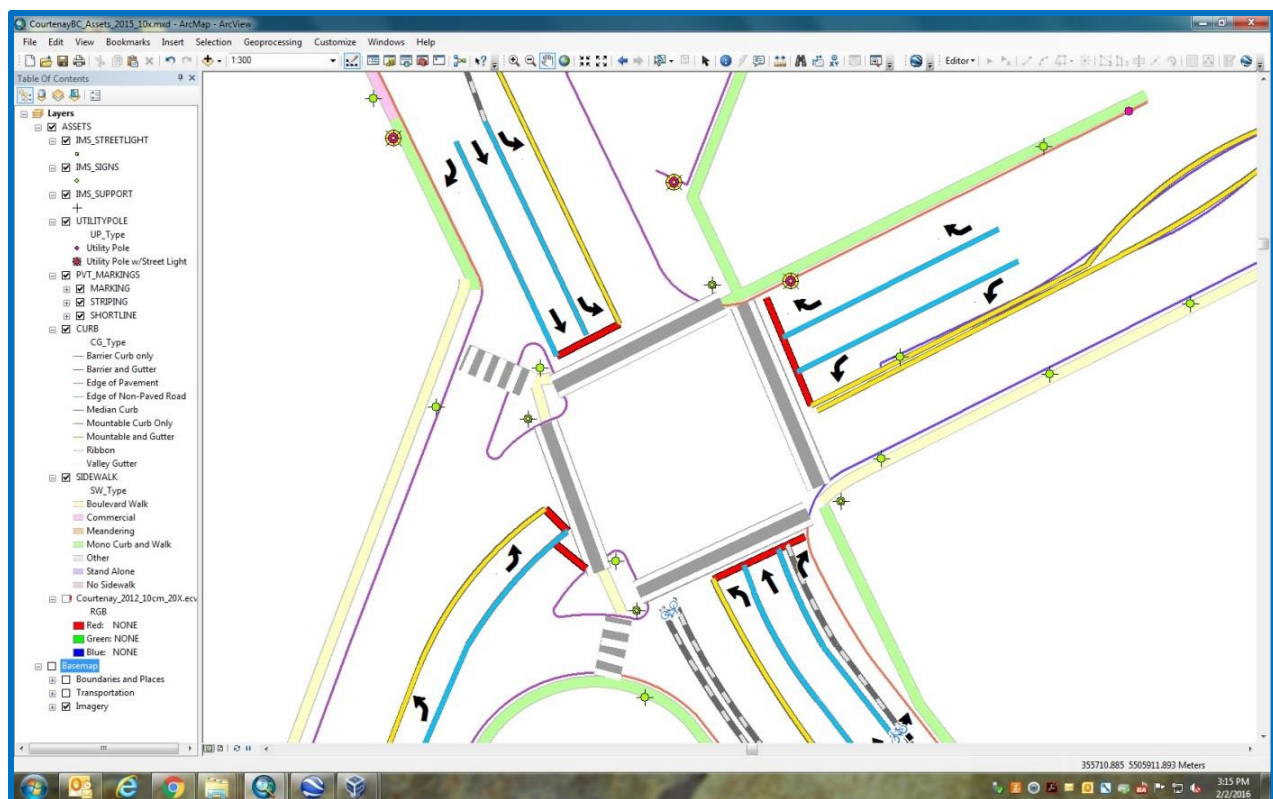
Right-of-Way Asset Inventories (Optional)

The IMS Laser RST uses high-end GPS coordinate data and digital cameras positioned so that all assets/attributes requiring data capture are visible with the front, side, and rear cameras. For the City of Keller, IMS has the capability to collect information for sidewalks, ADA Ramps and Curbs/Gutters for location verification and condition assessment. IMS can also complete ADA compliance surveys on sidewalks, trails and paths utilizing the Sidewalk Surface Tester (SST). *The right-of-way asset inventories are supplemented with air photos and GIS to ensure positional accuracy.*

The IMS technology is an open architecture system that allows virtually any type of asset to be defined for collection of location, attribute, and condition data. Once an asset is observed, the operator toggles to the individual record input screen and proceeds to input the appropriate attribute and associated information. Wherever possible, "pick lists" are employed to streamline the data entry function and provide uniform, high quality data. IMS confirms the feature attributes to be collected with the client.

The images and GPS data are merged on a frame-by-frame basis. The images are then post-processed using a specialty piece of GIS and image viewing software. Using RST imagery, the existing centerline GIS, and aerial photography, IMS spatially plots each right-of-way asset in its real world location.

Prior to commencing each asset inventory, a document called the **Master Asset List** (MAL) will be developed, using each applicable exhibit as a starting point. The MAL defines what assets or inventory items are to be logged and what attributes will be extracted. The MAL also defines the methodology for condition rating each asset. Essentially the MAL is the direct equivalent of a "data dictionary" as it sets the rules for right-of-way asset data collection. The GIS screenshot below depicts an IMS asset inventory of sidewalks, ADA ramps, pavement striping and markings, curb & gutter and signs.

Proposed Budget

The detailed budget presented below is based on the IMS work plan and deliverables for this 2019 assignment, including ongoing support as described below. It represents a realistic budget to complete the work, and we are confident we can maintain an on-time, on-budget approach to the assignment.

Task	Activity	Quant	Units	Unit Rate	TOTAL
	Project Initiation				
1	Project Initiation & Set Up	1	LS	$3,000.00	$3,000.00
2	Network Referencing, GIS Linkage & Inventory Definition	252	T-Mi	$17.00	$4,284.00
	Field Surveys				
3	RST Mobilization/Calibration	1	LS	$3,000.00	$3,000.00
4	RST Pavement Distress Data Collection	252	T-Mi	$110.00	$27,720.00
5	Dynaflect Mobilization	1	LS	$2,500.00	$2,500.00
6	Deflection Testing (arterials & collectors only @ 400-foot intervals)	84	T-Mi	$200.00	$16,800.00
7	Provision of Digital Images at 20-30 foot Intervals (Per View)	252	T-Mi	$16.00	$4,032.00
	Data Management				
8	Data Processing QA/QC, Processing, & Formatting	1	LS	$8,000.00	$8,000.00
9	Project Management	1	LS	$5,201.00	$5,201.00
10	Asset Data Collection (GPS & Camera Configuration)	252	T-Mi	$15.00	$3,780.00
	a. Curb & Gutter Database Development	252	T-Mi	$50.00	$12,600.00
11	Ongoing Pavement Management (Year 1)	1	LS	$20,000.00	$20,000.00

Project Total (Year 1): $110,917.00

Ongoing Pavement Management (Annual Option)

Monthly
Update completed and planned work (including any new or annexed)

Annually
Pavement Analysis, budget development and report
Pavement Data Load - Lucity
5 hours Consulting

*Ongoing Support will be considered an annual option, dependent upon appropriation of funds

Annual Total (Years 2-5): $20,000.00

Thank you for considering IMS as a viable solution to your pavement management needs. If any questions arise, please do not hesitate to contact me at (417) 372-7021 or jmyers@imsanalysis.com.

Sincerely,

IMS Infrastructure Management Services

Jeff Myers, MSA
Client Services Manager