EXHIBIT “A”

City of Garden Grove

PROPOSAL TO PROVIDE

2017-2021 Pavement Management Program

March 28, 2017

Submitted By:
Fountain Valley Office
9550 Warner Avenue, Suite 370
Fountain Valley, CA 92708
Phone: 714.848.8897
NCE Proposal No. 917.01.30

Table of Contents

Appendices

Collaboration. Commitment. Confidence.℠

March 28, 2017

City of Garden Grove
Attention: Mr. Mark Uphus
Public Works-Engineering
11222 Acacia Parkway
Garden Grove, CA 92842

Re: Proposal for 2017-2021 Pavement Management Plan (PMP)

Dear Mr. Uphus and Members of the Selection Committee:

Pavement networks are often the most valuable asset that a city owns. This asset is not only expensive to replace, but it is an essential component to the traveling public's safety. Cities are looking for more cost-effective ways to perform engineering, maintenance, management, and rehabilitation of roadways more than ever before to stretch funding allocations. An essential tool to assist in cost-effective roadway maintenance planning is a current pavement management program (PMP).

Currently, in Sacramento, Assembly member Jim Frazier and Senator Jim Beall have reintroduced their transportation funding bills (AB1 and SB1) for the new session; if passed, the City of Garden Grove is expected to receive as much as $6 million annually. However, additional funds may come with requirements on how streets are selected and transparency reporting requirements. These are easily accomplished with an updated PMP.

With more than 80 person-years of experience with pavement management programs, NCE has more knowledge and understanding than any other pavement consulting firm. Our team can provide the City with the technical and management experience to address the data collection, analysis and reporting the City requires for this project. Our highly trained and capable technical staff are experienced in data collection, have worked together on numerous other similar projects and have developed an excellent reputation for dedication, integrity, productivity, quality of work and service to our clients.

Specifically, the NCE team provides the following capabilities to the City:

- **OCTA certified inspectors** - NCE's field inspectors and engineers are certified through both the Metropolitan Transportation Commission (MTC) and **OCTA's Inspector Certification** Programs.

- **Familiarity with OCTA's M2 requirements** - NCE assisted OCTA in the development of OCTA's countywide PMP requirements, and can ensure that Garden Grove is in compliance. Our participation at the TAC meetings allows us to be up-to-date on any new developments.

- **Southern California experience providing PMP** - NCE has performed dozens of similar PMP projects for agencies within Orange County such as the Cities of Anaheim, Buena Park, Dana Point, La Habra, Laguna Niguel, Lake Forest, Mission Viejo, Orange, San Clemente, Seal Beach, Stanton, and Tustin and Orange County. We have also worked with other agencies such as Santa Monica, Carson, San Gabriel, Torrance and the Counties of San Diego, Santa Barbara and Ventura. NCE has worked with more than 200 local agencies throughout California (see map, on right) delivering PMS projects.

Fountain Valley, CA
9550 Warner Ave., Suite 370
Fountain Valley, CA 92708
(714) 848-8897

- **Understanding of funding challenges and policy** - We are currently leading the California Statewide Local Streets and Roads Needs Assessment Project, and are thus intimately aware of the funding sources and challenges agencies face in roadway maintenance programming. We are providing supporting information for both AB1 and SB1 and we can perform similar analysis to ensure that the City's needs are accurately represented.

- **Local firm** – NCE is a local firm only 30 minutes from the City's offices, which equates to easy access to our staff during the project and the ability to facilitate on-site meetings as necessary.

- **Automated surveying teaming –** NCE and märker geospatial, llc have teamed together on many projects throughout California and offer the City reliable, efficient and comprehensive automated survey services and analysis. Our team recently completed a similar project for Orange County, Dana Point and Lake Forest.

- **Real-life knowledge of local agency needs -** NCE understands the types of challenges frequently encountered by Cities, such as lack of trained personnel or funds, budgetary concerns, and other institutional issues inherent in the use of pavement management programs.

- **Expertise in pavement engineering** - NCE has a depth of pavement experts that specialize in asphalt and concrete materials. We will assist the City in developing practical and economical solutions for maintenance and rehabilitation as part of the budget analyses, if desired. NCE staff serve on more than 10 pavement related committees of the Transportation Research Board, which translates to extensive in-house resources we can access for innovative pavement solutions.

- **Rigorous Quality Control** - All of NCE's projects include a QC Manager who reports directly to the Project Manager. Additionally, NCE's engineers and technicians undergo a mandatory internal training/calibration once a year for field condition surveys, as well as for other PMP related activities. This oversight and training enables NCE to provide high quality deliverables to the City.

As a Principal of the firm, I am authorized to negotiate and obligate NCE to this contract. Lisa K. Senn will serve as the proposed Project Manager and single point of contact for any questions that may arise in the review of our proposal. Our contact information is as follows:

Ms. Lisa K. Senn
Sr. Project Manager
Phone: (714) 848-8897
LSenn@ncenet.com

9550 Warner Avenue, Suite 370
Fountain Valley, CA 92708
Fax: (775) 329-5098

NCE's proposal is valid for 90 days after the date of submission. NCE has reviewed the procurement and selection process and has submitted the Fee Proposal in a separate sealed envelope. We have also received and reviewed addendum #1 dated March 20, 2017. We look forward to your favorable review of our proposal so we can begin work with the City on this project. During your review of our proposal, please feel free to contact either of us at (714) 848-8897 with any questions or concerns that may arise.

Yours truly,

NCE

Margot Yapp, PE
Principal/QC Manager

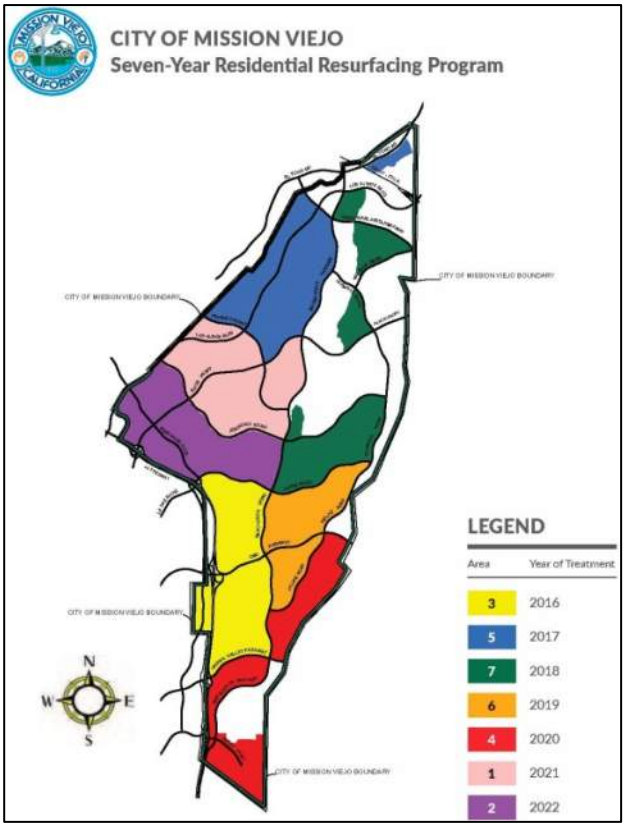
Lisa K. Senn
Project Manager

Project Understanding

NCE understands the City of Garden Grove seeks an engineering consultant to update the City's pavement management program (PMP) in compliance with OCTA's Measure M2 requirements. The City's pavement network consists of approximately 300 miles of paved roads and the PAVER™ (version 7.0.6) program is currently being utilized.

Passage of Measure M2 includes assurances of transparency and accountability to the public so voters can see and understand that this funding source is spent in the most cost-effective manner, and that performance measures are instituted. One such measure is the Pavement Condition Index (PCI) which is reported periodically to elected officials and/or the public. To ensure that the City's PCI is accurate and updated appropriately, the NCE team consists of certified and experienced inspectors that will collect accurate, reliable and consistent data, which will be the foundation for all analyses and reports.

NCE is experienced not just in collecting data but also developing maintenance and rehabilitation strategies that are sustainable, innovative and cost effective. An example is our evaluation of light colored coatings for asphalt concrete streets in Santa Monica as one way to reduce the heat island impact. Another is the design of composite pavements that may be an appropriate alternative on major arterials, since OCTA has authorized the purchase of buses that exceed the legal axle load limits which are expected to accelerate pavement deterioration.



We have performed similar updates for many other agencies throughout California. Within Orange County, our analyses and reports meet OCTA's guidelines (we have set the standard in many cases). We assisted OCTA in the development of the countywide pavement management guidelines and therefore we are highly familiar with local conditions and OCTA's requirements.

Ideally, the PMP should be used to prepare a seven year maintenance plan, which consists of a rotating maintenance schedule using a zone improvement approach. This is similar to the approach used by other cities, as it optimizes construction costs by reducing mobilization and also minimizes disruptions to businesses and residents. NCE has prepared similar analyses, most recently for the City of Mission Viejo, which has seven residential zones (see map on the left).

For the 2017 update, it is NCE's understanding that the City wants to update the pavement conditions of the street network, and then develop a seven-year improvement plan using the most effective maintenance and repair strategies. Also, in order to incorporate sustainable maintenance strategies as well as seamlessly develop a multi-year CIP using a zone approach, we understand that the City is considering switching to the StreetSaver® software to better facilitate this analysis. Therefore, an optional task has been included in our scope of work for software analysis.

Specifically, NCE's scope of work includes the following:

- Software assessment (optional task) to determine the most appropriate PMP software for City.
- Collect pavement condition data as per ASTM D6433 on the entire street network.
- Perform rigorous QC for data control and delivery.
- Review current procedures for pavement maintenance, available resources, historical expenditure levels and the desired service level of the street network.
- Recommend and update unit costs and maintenance treatments based on City policies.
- Recommend and perform multiple funding scenarios.
- Develop a seven-year maintenance plan.
- Link the PMP database to a GIS shapefile.

Project Approach and Methodology

NCE has formed a project team consisting of pavement engineers and certified technicians that have the skills and local knowledge necessary to deliver on this project. The NCE team has developed a scope of work with detailed tasks that will accomplish the City's goals of developing a well thought out pavement management program that will address the City's long-term maintenance and operation needs.

Lines of Communication and Responsive Project Management

NCE's project managers have an unfailing commitment to client service which has earned them a well-deserved reputation for meeting project milestones and deliverables within budgets. Our project managers consistently manage their teams to successful, timely conclusions on projects through proven NCE management techniques and tools, highlighted by effective communication. NCE's approach to project management is geared toward providing rapid, high quality, cost effective project execution. There is a four-step process:

Without downplaying the importance of all the tools and processes available for project management, the single most important tool for successful project management is clear, consistent and cooperative communication. As project manager, Ms. Senn's prime responsibility is to communicate and create conversation on the purpose, plans and progress of the project. Her 17 years of experience on projects primarily in California, has involved delivering numerous similar pavement management projects. Ms. Senn has created excellent working relationships with the public works entities throughout the local area and statewide. She will serve as the single point-of-contact for the project and will make certain that project deliverables and milestones are achieved.

Budget

NCE has an established centralized computerized cost accounting system that accurately tracks specific job costs. Real-time project reporting capabilities will allow Ms. Senn to quickly get the information she needs any time, from any device. NCE's cost control and invoicing system are well suited to tracking costs, preparing invoices in styles and formats consistent with the City's requirements, and providing all necessary backup in a complete and easy to follow package.

Managing Subconsultants

Managing the subconsultant contracting process and performance needs to be as structured as other aspects of project management. Just as the City looks to NCE as the overall responsible party for the contract with them, NCE will be diligent with its teaming partner to be sure their performance is going to enhance the overall project results and meet the goals and expectations of the City. NCE requires a quality assurance/quality control (QA/QC) program plan from each teaming partner. NCE will make sure the scope of services in märker geospatial, llc's subconsultant

contract is clearly written with identified deliverables and milestones and the division of work and responsibilities is clearly defined to eliminate confusion, duplication, and gaps in the project work.

Standardization/Quality Control

The NCE team holds quality of utmost importance – not just because of the City and other clients' requirements, but because it is vital to our continued professional and commercial viability. NCE's Quality Assurance Management Program (QAMP) reduces production costs and ensures quality deliverables. NCE's QAMP is based on four principles: **client satisfaction**, **employee participation**, **problem prevention**, and **continuous quality improvement**. The QAMP includes detailed review of engineering specifications, drawings and calculations, engineering letters, reports, and design documents prior to submittal to the client as well as providing meticulous record keeping and high standards of field documentation. The goal of NCE's QAMP is to infuse quality throughout the entire project, and that goal is shared by every NCE staff member.

Scope of Work

The proposed tasks below describe NCE's approach to successfully complete the scope of work. Since the duration of the contract is for three years, but OCTA certification only occurs every other year, not all tasks will occur every year.

Task 1 – Kickoff & Progress Meetings

NCE will first meet with City staff to kick-off the project and review and discuss the technical approach (covering both field and office work) and any administrative matters as may be necessary. At a minimum, items to be discussed will include the following:

- Scope of work, project schedule, budget and invoicing requirements
- Points of contacts
- Field work
    - Scheduling and access requirements for field work
    - Public safety concerns, requirements and procedures
    - Quality Control Plan (QCP)
- Maintenance and rehabilitation (M&R) practices, records and costs
- Paving or maintenance budgets
- GIS shapefiles
- Other issues as appropriate

During this meeting NCE will need to obtain the most recent copies of the City's PAVER™ database and GIS shapefiles. Prior to the kickoff meeting, NCE will prepare a detailed agenda which will be sent to City staff for review prior to the meeting. Examples of the questions we anticipate discussing include:

- New streets that need to be added.
- Functional classifications, e.g., do they match FHWA classifications? And if not, should they be changed?
- Are there any MPAH streets included in the National Highway System (NHS)? If so, they will need to comply with the MAP-21 performance measures.

In addition to the kick-off meeting, NCE will schedule additional meetings with City staff at appropriate milestones to review the work performed, inspection progress, and to address any questions or issues that arise. NCE is also available upon request of the City's staff to assist with preparing materials and presentations for City Council meetings or any public meetings.

Finally, NCE will schedule at least one meeting in the years when no surveys are required (e.g., 2018) to discuss any items regarding the pavement management system. An example may be modifications to OCTA's submittal requirements, or programming additional transportation funds if SB1/AB1 passes at the Legislature this year.

Deliverables:

- Kick-off/Progress meeting agenda and meeting summaries
- Draft QA/QC Plan

Task 2 – Software Needs Assessment (Optional)

Given that the City is assessing different software needs, NCE recommends a task to perform a software needs assessment. This is particularly important if the City wants to link the PMS database to a GIS or desires a seven zone improvement program. Not all PMP software can perform this task seamlessly.

We have previously conducted this software assessment with other cities such as Anaheim, Santa Monica, Thousand Oaks, and Santa Barbara. There are more than twenty different software programs readily available, and the typical criteria we will use in this assessment include:

- Cost of software and future upgrades
- Ease of operation
- Security and access issues
- Technical support availability – online, phone, or on-site
- User support meetings including training for city staff
- Inventory data collected, e.g., geometric, surface types, functional classifications, cul-de-sacs, geographical or political boundaries, digital images or files associated with street
- Condition data collected, e.g., pavement distress, IRI, drainage, etc.
- Integration with other transportation assets, e.g., sidewalks, curbs and gutters, storm drains, signs, etc.
- Maintenance and rehabilitation (M&R) strategies including sustainable pavement policies
- Historical data, e.g., construction, M&R, condition data
- Pavement performance curves – are they appropriate for the City?
- Remaining service life
- Funding analyses – different funding scenarios ("what if" analyses), committed projects, packaging projects, zone type analysis
- Other data needs, e.g., pavement structural sections, traffic
- Linkage to GIS maps and ability to create exhibits for presentations and City Council
- Ability to create custom reports/export to other programs

Typically, there is no one perfect software program that will meet all the City's needs. However, through a process where the different criteria are weighted, NCE will assist the City in making tradeoff decisions and arrive at a software program that will best meet the City's needs. The table below is an excerpt from a recent assessment performed with the City of Santa Monica.

Software Attributes / Features	MicroPAVER	StreetSaver	Cartegraph
General			
Vendor	U. of Illinois / APWA	MTC	CarteGraph
Current Version	7	9	8.2 (Pavement View)
Online Version available?	No	Yes	No
Annual Cost	$1100 (discount available to APWA members)	$1,500	$5000+ $1400 annual maintenance
User's meetings	None	2/year (Northern & Southern CA)	3~5/ year Usually Iowa
Technical Support	List serv/email/phone	Online/phone/email	Online/phone/email
Budget related			
Analysis period (yrs)	5-20	5-30	5-30
Constrained budgets	Yes	Yes	Yes
"What-if" scenarios	Yes	Yes	Yes
$ to maintain PCI	Yes	Available in 2011	Iterative procedure
Packaging of projects	No	Yes	Yes
Committed projects	No	Yes	Yes
Backlog/Deferred costs	Yes	Yes	Yes
Stop-gap costs	Yes	Yes	No

If a software conversion is desired, this process will include the review and verification of street names, begin locations, end locations, functional classifications, surface type, number of lanes, and designations for MPAH or National Highway System (NHS) streets. With the new MAP-21 performance measures, the City may wish to begin to track NHS streets. NCE staff will work closely with City staff during this conversion. This is also a good time to re-segment any streets or add any newly annexed streets and NCE will review the current data with the City prior to entering it into the new database.

Deliverables:

- Selected PMP Software
- Converted PMS database (if software other than PAVER™ is selected)

Task 3 – Update Maintenance & Rehabilitation History

NCE will work with City staff to update and enter maintenance and rehabilitation (M&R) treatments performed since 2015 for both the MPAH and the Local network into the PAVER™ database. These historical records must include the following information:

- Road name
- Beginning and ending limits of work
- Type of treatment
- Date of treatment
- Cost of treatment (optional)

Populating the PAVER™ database with recent historical data is extremely useful for determining future treatments and predicting performance of the various pavement sections. This includes overlays, reconstructions and any surface seals. This task will be performed every other year.

Deliverables:

- PAVER™ database with M&R work history
- M&R work history report

Task 4 – Pavement Condition Surveys

Next, NCE will perform pavement condition surveys on the City's arterial and collector network and 1/3 of the residential streets in FY 2017/18 (approximately 150 centerline miles). Like many Southern California communities, the City has a pavement network that is subjected to high traffic volumes and heavy loads from the surrounding area. The distresses present are reflective of the traffic levels, as well as the local environment and climate. Common distresses include alligator cracking, rutting, distortions, patches and utility cuts, as well as weathering and raveling.

We have seen considerable advancements in technology over the last ten years. The assessment of pavement condition has seen a transformation from more labor intensive manual efforts to high-speed automated surveys that combine the use of roadway sensors and digital imagery. Our team is well positioned to collect,

measure and map all pavement condition data using a sophisticated automated approach using LiDAR. Our goal is to provide accurate, repeatable and economical pavement condition assessments.

Our mobile data collection equipment and team are capable of collecting (only the first bullet will be collected in this project):

- ✓ Pavement Surface Distress (ASTM D6433)
- ✓ Pavement Profiling (Roughness / Rutting / Macrotexture)
- ✓ Positioning Spatial GPS & Linear Referencing
- ✓ 360 Right-of-way digital Imagery and 3D LiDAR Point Cloud Data
- ✓ Mobile Collection Roadway / Roadside Asset Inventories
- ✓ Sign/Pavement Marking Reflectivity
- ✓ Roadway Cross Slope / Grade and Curvature

ROADWAY COLLECTION VEHICLE SYSTEM OVERVIEW

During our roadway inspections, pavement profiling (ride quality, rutting, macrotexture), GPS, and surface distress data can be collected continuously and seamlessly by our pavement technician team using our automated 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, Laser and LiDAR scanning which are all used by to collect the type, severity, extent, start and stop points of all the ASTM Standard D 6433 -11 or StreetSaver® pavement surface distresses.

NCE is an OCTA certified firm with inspectors that have successfully passed a rigorous field test. NCE has over 20 years of experience utilizing and training staff on both the PAVER™ and StreetSaver® programs.

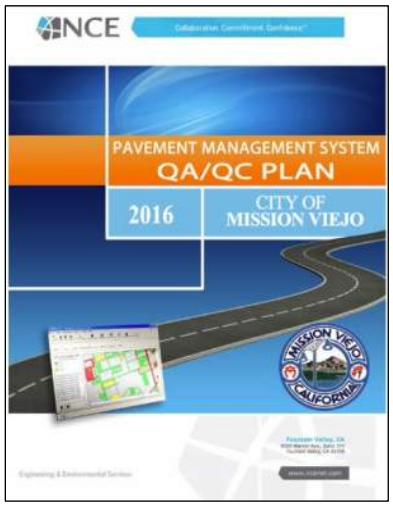
NCE will be responsible for providing all equipment necessary to perform this task. Should City personnel wish to observe NCE's crews during the surveys, we will be more than happy to accommodate them.

Note that this scope of work and condition surveys do not address issues including, but not limited to traffic, safety and road hazards, geometric issues, road shoulders, sidewalks, curb and gutters, drainage issues or short term maintenance that should be performed.

In addition, NCE will identify any exceptions to the database during the field work. This may include examples such as different spellings on street names, renamed streets, changes to the widths from widening projects, etc. All changes will be identified and summarized in an exceptions report for the City's approval before any changes are made to the database.

Data Entry and PCI Calculations

All data collected from the condition surveys will then be downloaded into the PAVER™ database. This task will be performed at NCE's office in order to provide Quality Control. NCE will perform the pavement condition index (PCI) calculations, and correct any errors found.



Quality Control Plan

Quality control/quality assurance checks are critical when a large amount of data needs to be collected, processed and incorporated into PAVER™. NCE incorporates a stringent QA/QC component into all of its projects. For this project, we have proposed the inclusion of a QA/QC Manager, Ms. Margot Yapp, as noted on the Project Organization chart. She will have the following project responsibilities:

- Calibration of all data collection activities
- Review of field activities, including spot checks on the field crews
- Review of field procedures and making changes as needed

- Comparison of 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

NCE has developed and currently conducts the on-going StreetSaver® and PAVER ™ training workshops for OCTA, which includes computer and field distress training. OCTA's guidelines require the submittal of a QC/QA plan by each local agency. The purpose of the QC/QA plan is to ensure that procedures used to collect distress data comply with OCTA's and the City's procedures, guidelines, and standards and results in the delivery of a quality data product. The QC/QA plan provides for corrective actions when deficiencies are encountered. NCE will prepare a QC Plan that will include the following components:

- Description of condition survey procedures (distress types, severities). Documentation of procedures, changes and/or modifications for consistency with future updates. In particular, documentation of unique situations is important.
- Data collection procedures.
- Level of accuracy required for data collection or acceptability criteria. Typical examples include accurate identification of distress types 95% of the time or 90% of re-inspected sections must be within ±10 PCI points.
- Description of agency requirements and data entry guidelines, by agency, e.g., 5% re-inspections.
- Data submittal schedule.
- Experience of inspectors including past training on condition surveys or calibration procedures.
- Field data collection safety procedures.

A draft quality control plan will be submitted to the City for approval during the kickoff meeting, and no field work will commence until a final plan has been accepted.

Any findings that may compromise data integrity and consistency will be discussed and corrected. Examples of this include differences in survey methods from the last update (e.g., changing from windshield to walking surveys), collecting additional distress types and unique situations that may not lend themselves to existing condition survey procedures (e.g., gap-graded mixes, edge cracking with unpaved shoulders).

This task will be performed every other year.

Deliverables:

- Final QC/QA Plan
- Exceptions report and list of corrections made to the database
- PCI report in Excel format (electronic)
- Updated PAVER™ database

Task 5 – Budgetary Analysis

Maintenance and Rehabilitation Strategies

NCE will first review maintenance and rehabilitation (M&R) strategies with City staff. This will include the recommendation and selection of appropriate treatments such as cape seals or overlays, and the determination of treatment unit costs. This will also be an appropriate time to review the use of new/sustainable treatments or materials, such as rubberized asphalt, rubberized chip or cape seals, microsurfacing, rejuvenators, cold-in-place recycling, full depth reclamation, warm mix asphalt, etc.

NCE's experience in pavement engineering and design, as well as local conditions, allows our staff to be able to provide the City with solutions that are innovative, sustainable, practical, and workable. **For example, we**

recently worked with Chula Vista to develop strategies for implementing "cool pavements".

The development of a M&R decision tree is a critical step in any pavement management update as it has a direct and significant impact on the final work plan that is developed, as well as the budgeting sequence and ultimate consequences.

The M&R alternatives are used to determine effective treatments for each street section based upon criteria such as condition, pavement type, and functional class. Once these M&R alternatives are defined, a treatment unit cost will be determined for each alternative. These alternatives and costs will then be entered into the PMP database for budgetary analyses.

NCE's experience in pavement engineering and design, as well as local conditions, allows our staff to provide the City with solutions that are practical and workable. The M&R alternatives are used to determine effective treatments for each street section based upon criteria such as condition, pavement type, and functional class. Once these M&R alternatives are defined, a treatment unit cost is determined for each alternative and the alternatives and costs are then be entered into the PMP database for budgetary analyses.

The unit costs will have a huge impact on the City's projections or needs assessments. Therefore, NCE will review any recent bid tabs, together with those from neighboring cities as appropriate. Also, unit prices will be fully-loaded rates, and will include not just contractors' prices, but also design, inspection and testing costs.

Budgetary Analyses

NCE will next perform a **Budget Needs** analysis using an analysis period to be determined by the City (assumed to be seven years per the RFP, although this can be as long as 30 years). This will identify M&R requirements for each road section and determines the total maintenance and rehabilitation requirements over the entire analysis period. The Needs Analysis identifies road sections that need treatment and applies the M&R decision tree to each section. The costs are then summed for the entire period. This forms the basis for performing Budget Scenario evaluations, which optimize the street sections for repair under constrained budgets.

In simple terms, the Budget Needs analysis answers the questions:

"If unlimited funding is available for street maintenance and repair, which streets should the City fix?" "When should the City fix them?" "What treatments should the City apply?" "How much will it cost?"

The **Budget Scenarios** evaluation prioritizes sections for repair under constrained, realistic, budgetary assumptions.

This module answers the question:

"If the City has only limited funds for street maintenance and repair, which streets have the highest priority for repairs, when should the City perform the repairs, and how much will it cost?"

Multiple budget or target-driven scenarios will be performed after discussion with City staff. Examples of typical scenarios include:

- Impacts of existing funding levels
- Impacts to model drops in funding, e.g., the gas tax is expected to drop in FY 2016/17
- Impacts if there are increases in funding levels, e.g., sales taxes, legislative proposals (SB1/AB1)

- Funding required to maintain certain PCI levels (as per OCTA requirements)

NCE will then prepare a final report that summarizes the overall condition of the City's pavement network, the M&R strategies used by the City, the results of budgetary analyses, and different budget scenarios and recommendations on the recommended scenario with selected road sections for maintenance and rehabilitation. In addition to the City's requirements, *this report will meet OCTA's Measure M2 requirements*, as outlined by the **OCTA M2 "Checklist"**.

The OCTA checklist is a new item for the City to include, as OCTA incorporated the checklist into its 2016 requirements. In particular, determining the percentage of total network in each of the five condition categories based in centerline miles will be an important addition to the PMP element from the OCTA Checklist.

This task will be performed every other year.

Deliverables:

- Updated M&R strategies and decision tree
- Results of budget needs and scenarios
- Seven-year rehabilitation program

Task 6 – Final Report & OCTA Submittals

Upon completion of the budget analysis phase of this project, NCE will prepare a draft report for the City's review. This report will cover all items as set forth by the OCTA PMP Guidelines, such as:

- Executive Summary
- Methodology of work performed
- Changes in overall condition of street network
- Updated list of streets (MPAH and Local) with their respective PCI's
- Results of budget scenarios
- QC Plan
- Certification for PMP update

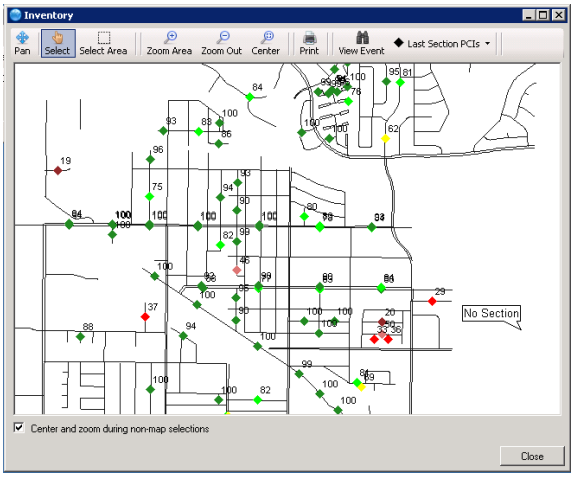
NCE has programmed into the schedule a two week review time for the City. The final report will address the City's comments. This task will be performed every other year.

Deliverable:

- Draft Report (electronic format)
- Final Report included all OCTA required materials (3 hard copies)
- Two copies of the digital files mentioned in previous deliverable

Task 7 – GIS Linkage (Optional)

The GIS linkage consists of matching segments in the basemap based on road name, type and/or direction. In the PAVER™ software, the GIS Settings Screen is used to create the link between database and the basemap. The ShapeFile ID, Street Name, Street Type and StreetDir fields are selected from the available fields within the basemap. It is assumed that the City's GIS shapefiles will be provided for the linkage.



Built-in queries are available with the toolbox to generate maps or export to shape files. Standard Queries include:

- PCI Range by street section
- Future PCI by street section
- Functional classification

- Maintenance treatment history
- Impacts of different budget scenarios
- Sections selected for treatment

Once linked, powerful maps can be generated within minutes, as shown in the example below:

2013 | 2032 with current funding $1.25 m/year | 2032 with sales tax $6.25 m/year

Using the City's most recent GIS database, NCE will compare and verify street information. This will be an appropriate time to verify that all street information is accurate and valid. NCE will compare the following for accuracy:

- Street names and extensions (i.e., St, Av, Rd or Cir)
- Lengths
- Functional classifications
- National Highway System (NHS) designations
- Surface type
- Number of lanes

Ideally this work will occur prior and during the condition surveys. Any discrepancies found will be consolidated and sent to the City with a recommendation for correction.

Deliverable:

- GIS shapefile linked to PMP database

Schedule

The table below is NCE's proposed work schedule illustrating the work can be completed within 12 weeks after receipt of the Notice to Proceed.

Task Description	Weeks from NTP											
	1	2	3	4	5	6	7	8	9	10	11	12
1. Kickoff & Progress Meetings	X				X				X			
3. Update Maintenance & Rehabilitation History												
4. Pavement Condition Surveys												
5. Budgetary Analysis												
6. Final Report & OCTA Submittal												
Draft Report												
City Review												
Final Report												
Optional Tasks												
2. Software Needs Assessment												
7. GIS Linking												

Assumptions:

NTP = Notice to Proceed

Task 6 includes 2 weeks for City review and comment.

Firm Experience

NCE is a client-focused engineering, science, planning, and construction services firm with five offices in California and Nevada and over 90 employees. **Unique from other civil engineering firms, we specialize in pavement technology, including pavement management, design and research.** Founded in 1990, NCE has focused on developing repeat clients by providing high value services. Our clients continuously work with NCE staff because of our collaborative style of working on projects, our commitment to making sure the project is a success, and the confidence they have in our ability to complete the project to their satisfaction.

Our firm has been in business for over 26 years and during this time, we have performed pavement condition surveys ranging from state highways in 12 states to local street networks in over 200 cities and counties in California, Oregon, Nevada, Washington and Idaho. We have surveyed over 80,000 miles of pavements.

Firm Capabilities

The City of Garden Grove (City) can expect superior customer service and high value work products tailored to this specific project. NCE's civil engineers and technicians have extensive experience in collecting pavement distress data, analysis and design as well as developing plans, specifications, construction cost estimates, and providing construction management for infrastructure projects. It is the fundamental goal of NCE to produce high quality work products while maintaining a reputation for timely service.

More than 85% of NCE's revenues come from City and County governments. NCE's innovative thinking goes beyond accurate technical solutions and builds client confidence through the delivery of successful projects. NCE provides the following core capabilities and services to its clients. **The capabilities in bold are directly relevant to this project.**

NCE CAPABILITIES	
Asset/Pavement Management	Geotechnical Engineering
Pavement Testing, Analysis & Design	Sustainable Design & Low Impact Development (LID)
Civil Engineering Design	Construction Documents (PS&E)
GIS & Database Management	Construction Management / Inspection
Pavement Rehabilitation and Sustainability	Utility Relocation Design
Bike & Pedestrian Path Design	Hydrology & Hydraulic Analysis
ADA Retrofit Design	Stakeholder Facilitation/Public Outreach
Sanitary Sewer Design	Water, Wastewater and Recycled Water Facility Design
Environmental Studies	Water Quality/Erosion Control Systems
Stormwater Management	Water System Modeling &Design
Watershed Planning and Wetland Delineation	Hazardous Materials Assessments
Regulatory Compliance & Permitting	Leadership in Energy & Environmental Design (LEED)

Pavement Management

NCE has an extensive background providing Pavement Management Program (PMP) services and is proficient with most pavement management programs currently in use. These software systems include:

- PAVER™
- StreetSaver®
- Cartegraph

We are active in over 10 pavement related (including pavement and asset management) committees at the Transportation Research Board, a national research organization. Some of the relevant ones include:

- Pavement Management Systems (AFD10)
- Pavement Preservation (AHD18)
- Pavement Condition Evaluation (AFD20)
- Long-Term Pavement Performance (E1002A)
- Pavement Materials and the Urban Climate (AF000 2)
- Design and Rehabilitation of Asphalt Pavements (AFD60)
- Design and Rehabilitation of Concrete Pavements (AFD50)
- Flexible Pavement Design (A2B03A)
- NCHRP Project Panel on Handbook for Pavement Design, Construction, and Management (DO146)

With NCE's prior experience with hundreds of other cities on pavement management systems, as well as pavement designs, NCE will deliver accurate, reliable, consistent pavement data which may then be used by the City to develop the pavement management strategies and make future funding decisions.

As an indicator of our experience and the quality of our work, NCE received MTC's award for **"Best Pavement Management Consultant"**. With our vast experience delivering PMP projects throughout California, we are very familiar with all aspects of a PMP, including:

- Pavement management software evaluation
- Database development
- Establishing pavement inventories
- Pavement data collection
- Rigorous QC/QA procedures
- Funding (or "what-if") analyses
- GIS links to PMP and development of user interfaces
- Training (both field and computer operations)
- Providing technical support
- Presentations to elected officials, advisory boards and agency staff

NCE has assembled a team of highly experienced individuals who have implemented PMP throughout California and the West Coast. We are committed to providing our clients continuity in staff and quality in service. Our staff benefits from continuous training in the latest versions of software, design and construction techniques. We not only frequently participate in such training, but also instruct others throughout the engineering community. The City of Garden Grove can count on our team to provide superior, responsive service on this project. Any changes to the team shall be submitted to the City for review and approval prior to any change.

NCE's staff has used both the StreetSaver® and PAVER™ software since 1987. Our engineers and technicians have also undergone training on both software programs. We have developed and conducted training for numerous cities and counties (both field and computer training) on both programs as well as for OCTA.

OCTA Methodology Experience

NCE developed and wrote OCTA's "Countywide Pavement Management Program - Guidelines Manual" which was adopted by the Board in May 2010. Ms. Yapp was the Project Manager and worked with both OCTA staff and the Technical Advisory Committee in the development of the guidelines.

In addition, since adoption of the guidelines, NCE has performed similar projects and successfully prepared submittals to OCTA for other cities such as Mission Viejo, Fullerton, Stanton, Seal Beach, Buena Park, Dana Point, Laguna Niguel, Lake Forest, San Clemente and Orange County.

As such, NCE is intimately familiar with the guidelines and the submittal requirements for member jurisdictions such as the City. Additionally, **NCE's proposed field inspectors are all OCTA prequalified** to perform condition assessments per ASTM D6433 standard protocols. This certification program includes a rigorous field test where approximately twenty sites are selected to test the inspector's knowledge of the distress procedures. Only those inspectors who have passed the exam may perform pavement condition surveys.

NCE is **OCTA prequalified and we have a solid familiarity and working knowledge of PAVER™ and StreetSaver®.** We have also trained hundreds of city and county staff on both software programs for over 20 years. Therefore, we offer the City a depth of knowledge and skills working with the program and utilizing the data to apply and recommend new pavement technologies for design and rehabilitation.

Pavement Design & Analysis

Pavement designs, plans, specifications and estimates (PS&E) for preventive maintenance, rehabilitation, and reconstruction are NCE's specialty and we offer extensive experience and expertise with pavement treatment alternatives. We have designed hundreds of roads throughout California and Nevada and have most recently performed these services for the Cities of Thousand Oaks, Camarillo, Santa Clarita, San Ramon, Mountain View, Berkeley, Davis, San Bruno, San Mateo, Pleasant Hill, Moraga, Orinda, Richmond, Fairfield and Santa Cruz.

Our expertise in pavement treatment alternatives includes, but is not limited to, cost saving, cutting edge, and green/sustainable paving technologies such as warm mix asphalt and in-place recycling technologies. NCE's pavement design services emphasize realistic economic solutions and pavement design procedures tailored to our client's needs.

Our civil and geotechnical engineers not only understand the types of pavements and treatment options, they also understand the significance and cost implications of proper roadway support on competent subgrade soils to limit future settlement and cracking. Pavement design begins with an accurate assessment of the existing structural adequacy. Unlike traditional civil firms who rely on core samples, we employ our pavement inspection expertise in conjunction with deflection data and materials testing to more accurately assess the engineering properties of the existing roadway.

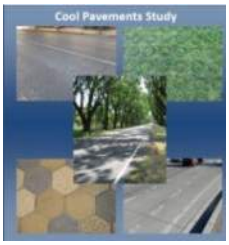
NCE has comprehensive knowledge of both the Greenbook and the Caltrans Standard Plans and Specifications, which are most commonly referenced throughout California cities.

Sustainable and Innovative Pavement Technologies

There are numerous pavement rehabilitation techniques available today with new binders, new additives and polymers all of which may be applied in various layers to preserve pavement life. NCE constantly seeks to identify the most cost-efficient alternatives for cities and counties such as cold-in-place recycling, full depth reclamation, warm mix asphalt, terminal blend asphalt rubber binders, etc. **Many of the technologies NCE can implement will meet potential City sustainability or**

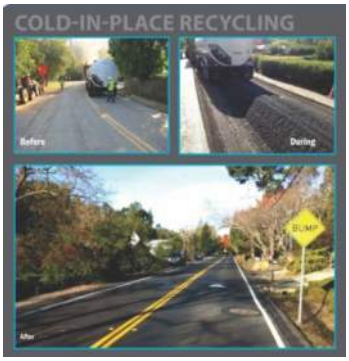
environmental goals and policies. Some examples are described in the following paragraphs.

Sustainable Pavements – NCE is involved with projects at both the national and local levels on issues such as sustainable pavements and premature failures. For example, Dr. Tom Van Dam is NCE's Principal Investigator for the FHWA on Sustainable Pavement Systems. Dr. Van Dam has developed technical guidelines and a webinar series; he is an internal resource for NCE when addressing sustainability for any of our projects.



Cool Pavements – NCE prepared a report to discuss cool pavement alternatives for the City of Chula Vista as a means of mitigating the urban heat island impact. This included the use of pavement alternatives such as porous or permeable pavements, pavers, concrete pavements, use of light colored aggregates, etc.

Composite Pavements – NCE worked for the Strategic Highway Research Program (SHRP2 R21) to develop best practice standards for AC/PCC composite pavements nationwide. This project resulted in the development of best practices in construction, specifications, and quality management procedures for these pavements. NCE is currently teaching a series of workshops for State Highway Agencies (SHA) nationwide to help them implement key best practices for Composite Pavements. While this work was funded and aimed at SHAs, the fundamental concepts of Composite Pavements and the best ways to implement them can be translated to cities as well.



Cold-In-Place Recycling (CIR) – A cost-effective alternative to traditional "mill and fill" pavement treatments, CIR can yield cost savings of as much as 30% by the use of existing asphalt concrete (AC) materials, which produces less truck hauling and better time efficiency during construction. The technology involves milling of existing AC (asphalt concrete), pulverizing and processing to a specified material size, adding emulsion, mixing, and then placing and compacting it onto the roadway. A thin AC overlay is typically placed as a smooth wearing course.

Full Depth Reclamation (FDR) – is a process that reconstructs failed AC pavements by recycling the existing roadway materials; old AC and aggregate base materials are pulverized and "mined" utilizing specialized equipment. The FDR method recycles the materials in-situ, and can offer significant cost savings over conventional roadway reconstruction techniques. It is generally cost effective for areas as little as 25,000 sf.

Subconsultant

NCE's team includes **märker geospatial, llc**, a firm that has provided pavement and asset management solutions specifically to the municipal government market for over 25 years. They have implemented numerous industry-leading technologies in order to successfully collect, process, and deliver accurate up-to-date pavement conditions along with other various public works roadway and roadside infrastructure assets for government agencies across the country.

märker owns and operates a fleet of right-of-way data collection equipment and utilize proven technologies to successfully complete pavement data collection and asset management projects.

Roadway Collection Vehicle System

märker's Roadway Collection Vehicle System is comprised of many sub-components that provide automated, real time roadway results such as: inspection survey distances, longitudinal roughness, transverse pavement profiles, wheel track rutting depths, as well as incorporating our global positioning (GPS) system, roadway reflectivity, and innovative 3D 360° imagery LiDAR mobile mapping solutions. The pavement distress data collection process involves the use of 3D digital imaging

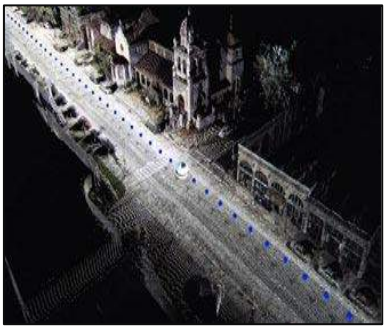
technology and integrated distress laser pavement roadway scanners which are all used to collect the type, severity, extent, start and stop points of the ASTM D6433-11 pavement surface distresses.

Unlike other consultants using similar technologies, we have OCTA prequalified technicians in the survey vehicle to identify and confirm all of the pavement distress data (in real time) using on-board surface distress recording subsystem. These specially designed touch screen data entry devices are integrated with the vehicle's GPS and allows the inspector to further accurately quantify the severity and extent along with the GPS beginning and end point locations of every pavement distress that is present on the City's roadways.

Since the distress data is collected by a combination of qualified inspectors and automated pavement profiling equipment, there is no extensive off-site processing required. Most firms outsource the distress recognition analysis to technicians in an office that may be outside the United States. However, märker can assure the City that all their equipment used and all results produced from this project will be "all American".

märker inspects 100% full width "curb-to-curb" pavement survey coverage; not just sample inspection information provided from downward image scanning devices taken only in a specific travel lane. They are one of the few consultants to provide 100% pavement inspection area coverage "curb-to-curb", which provides the most complete and accurate pavement inspection data possible.

All required pavement condition data for this assignment will be timestamped with a GPS location and reported (typically) at 100 ft. intervals and associated and referenced to the appropriate pavement section. GPS and linear referencing specifications include:



- ✓ High definition mobile 3D mapping
- ✓ Dual frequency GPS (GNSS) tracking
- ✓ High accuracy 6-Axis IMU integration
- ✓ Odometry & precise pin point positioning from on-board vehicle
- ✓ Positional data is synchronized with all other collected data sets
- ✓ Integrated DMI and Inertial Measurement Unit (IMU) increase accuracy of data
- ✓ Accurately time-stamping and geo-referencing inventory data

In summary, märker's mobile data collection equipment and team are capable of collecting and assessing:

- ✓ Pavement Surface Distress as per ASTM D6433-11
- ✓ Pavement Profiling (Roughness/Rutting/Macrotexture)
- ✓ Positioning Spatial GPS & Linear Referencing
- ✓ Surface Friction Skid Testing, Structural Capacity (FWD) and Structural Inventory (GPR) Surveys
- ✓ 360° Right-of-way digital imagery and 3D LiDAR Point Cloud Data
- ✓ Mobile Collection ~ Other Roadway/Roadside Asset Inventory / Condition Assessments
  - ⇨ Such as: traffic signs, traffic signals, streetlights, sidewalks and curbs, street furniture, pavement markings, guardrails, bike paths and trails, and trees in the public right of way
- ✓ ADA Ramp Compliance and Sign/Pavement Marking Reflectivity
- ✓ Roadway Safety ~ Roadway Cross Slope/Grade, and Curvature

Digital Pavement Scanning System

This subcomponent uses lasers, high resolution cameras, and advanced optics to acquire high resolution profiles to create detailed 2D and 3D models of the road surface. This data is acquired and compressed in real time in the vehicle collection system to minimize onboard storage needs. We can process and analyze the data immediately to automatically detect a number of pavement defects including, cracks, lane markings, wheel track rutting, potholes, distortions, spalling, macrotexture (MPD), patches, raveling, and faulting.

Roughness Profile Survey

Pavement smoothness is a key factor in determining roadway user satisfaction. To adequately represent drivers' opinions of roadway conditions, we use a laser road profiling device to measure pavement roughness (or ride quality).

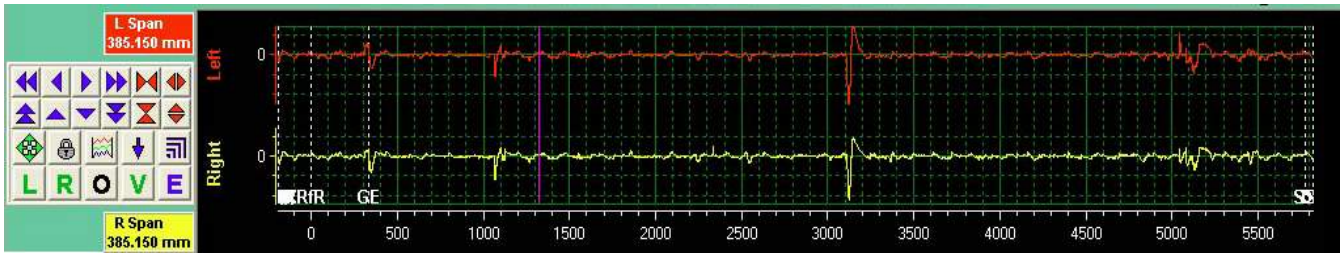
This laser sub-system is housed in the bumper of their collection vehicle and contains mounted lasers used for measuring heights to the road surface for the purpose of calculating road profile measurements. The lasers are positioned over wheel paths and provide high quality infrared height sensors. This 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 so that it may be aligned with the accelerometer data to provide longitudinal profile and roughness indices.

märker geospatial's laser roadway profiling device meets the Class 1 ASTM E 950-98 and AASHTO PP 51 designation for measuring the longitudinal profile of traveled surfaces. The results of our Class 1 laser precision profilers produce the International Roughness Index (IRI).

Rutting and Transverse Profiles

märker's laser measuring subsystem is also capable of rut depth measurements for both traveled wheel track ruts simutaneously while operating at posted speeds. The accuracy of märker's system provides +/- 1 mm depths, similar to manual measurements accuracies using ASTM procedures with a straight 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 assignment. The results are triggered by the longitudinal distance traveled, independent of longitudinal speed and measured. A sample screen shot of the Wheel Rut View application is shown below.



Demonstrated Record of Success

NCE has delivered hundreds of PMS projects similar to the City's project. Our best indicator of our success is our history of repeat clients and their testimonies of our work. Below are a few testimonials from our clients. In addition, the subsequent Project Experience section of our proposal includes detailed project descriptions which serve as our references as well.

"We are very happy with the final product and look forward to the kick-off meeting for Year 3. The extensive work put in by NCE . . . is much appreciated."

– Steven R. Clayton, Pavement Management Supervisor | County of Orange

"For several years, NCE has conducted the biennial surveys of our streets in Buena Park. They have analyzed our data and produced the certification reports for the Orange County Transportation Authority (OCTA). They have demonstrated an extensive knowledge of Pavement Management Systems and a keen understanding of our organization's needs.

NCE has provided excellent services and value, and always willing to do whatever it takes to get the job done on time and within budget. We are extremely pleased with the services and continue to request NCE technical support and there is always someone available to help us work through any issue."

- **Jim Biery, P.E., Retired Director of Public Works, City of Buena Park, CA**

***"**Our Department in conjunction with the League of Cities, California State Association of Counties, County Engineers Association of California, California Regional Transportation planning Agencies and the Rural Counties Task Force hired NCE to complete a statewide local streets and roads needs assessment study … We are very pleased with the outcome. Ms. Yapp demonstrated her knowledge and skills of the subject matter as well as her ability to manage her team in delivering the project tasks on schedule and within budget … Ms. Yapp and her team performed very well on this project. We would not hesitate to utilize NCE again in the future."*

- Greg Kelley, P.E., Assistant Deputy Director of Public Works, County of Los Angeles

"NCE has worked diligently with the City in this area to develop work schedules that smoothed the peaks and valleys from a budgetary standpoint. The end result has been that the City's Pavement Condition Index is improving without any long term increase in the cost of achieving this."

- **Dan Wall, Director, City of San Marino**

"The City has been very satisfied with the work done by NCE staff. Their work has been of high professional quality and we have been satisfied with the accuracy of their work. I have been impressed with Margot Yapp's knowledge of the subject of pavement management and preservation."

– Elizabeth Chopp, Senior Civil Engineer, City of Chula Vista

"Since 1999 City of Corona has awarded annual contracts to NCE to update the street database and provide an updated five year program map. In addition, NCE prepared an Executive Summary and held a few workshops for City of Corona staff and policy makers."
"NCE provided exceptional service to City of Corona and worked with staff to implement and provide an effective program to maintain city streets…The City of Corona's staff is pleased with NCE services and continue to utilize their technical support in the future. The schedule is always met and there is always someone available to help us work through any issue."

– Reza Zolghadr, Senior Civil Engineer - City of Corona

Project Experience

NCE staff are certified by OCTA to perform pavement condition surveys and have worked together for many years delivering projects to OCTA clients. Our proposed Project Manager, Ms. Lisa Senn has recently worked on the following PMP updates as per OCTA guidelines within the last five years. She is highly familiar with OCTA reporting requirements and budgeting directives and has thought workshops for OCTA for many years. Some of her Orange County clients include:

- Anaheim
- Orange County
- Buena Park
- Mission Viejo
- Fullerton
- La Habra

Local Clients

Some of our local clients include the following:

Orange County	Centerline Miles	Los Angeles County	Centerline Miles
Anaheim	577.8	Burbank	280.2
Buena Park	191.3	Carson	253
Dana Point	95.1	Commerce	67
Fullerton	67	Corona	400
La Habra	115	Diamond Bar	146.6
Laguna Niguel	141.5	Manhattan Beach	120
Lake Forest	194.7	Redondo Beach	126
Mission Viejo	228.2	San Dimas	122.5
Orange	324.1	San Gabriel	189
Orange County	378.9	San Marino	62
San Clemente	140	Santa Monica	155
Seal Beach	41.1	Torrance	15
Stanton	45.1	West Covina	245
Tustin	96	Whittier	210

Program Management System Updates (2009 - 2020)

Orange County, CA

The County and its contracted cities have a road network of approximately **674 centerline miles** or approximately 3,604 pavement sections. The County road network consists of approximately 378.4 centerline miles, **Dana Point** has approximately 93.5 centerline miles and **Lake Forest** has approximately 192.2 centerline miles.

NCE's scope of work consists of:

- Converting the PAVER™ databases to StreetSaver® in 2016
- Verifying all road inventory, i.e., lengths, widths and locations.
- Surveying all roads using ASTM D6433-11 protocols.
- Updating the maintenance history
- Developing maintenance strategies and updating the decision tree
- Performing multiple budget scenarios
- Linking the database to a GIS shapefile
- Developing a seven-year work plan
- Preparing reports for OCTA certification

Reference

County of Orange, Public Works/OC Construction
Vinh Tran
Sr. Civil Engineer
Tel: 714.955.0210

Project Team

Margot Yapp, PE
Lisa K. Senn
Ken Huisman
Narut Leehacharoenkul, EIT
Franc Escobedo

Concurrent with the pavement condition survey, mobile data collection units gathered high-resolution 360 degree geo-referenced right-of-way street level digital imagery along with 3D point cloud data. This mobile mapping system gives the ability to visualize, measure, edit, and validate infrastructure assets (such as pavements, markings, lanes, surface areas, shoulders, signs, and drainage features) with a high level of accuracy.

"Thank you to you and your team for all your efforts in providing the County of Orange with the Year 2 deliverables. Due to the difficulties encountered with the large number of assets within the County, this was quite a task. We are very happy with the final product and look forward to the kickoff meeting for Year 3. The extensive work put in by NCE and Cartegraph is much appreciated."

Steven R. Clayton, Pavement Management Supervisor, County of Orange

Orange County Transportation Authority (OCTA) – Various PMS Studies

Orange County, CA

NCE has worked with OCTA since 1997 on various projects related to pavement management systems. There are over 6,500 centerline miles of paved streets and roads in Orange County, which serves a population of almost 3 million. In 1990, voters approved a ½ cent sales tax measure for transportation improvements. This measure was subsequently renewed in 2007 and is expected to sunset in 2041. In order for the 35 Cities/County to be eligible for Measure M funds, OCTA required them to implement and maintain a pavement management system to select projects for rehabilitation. Over the past 12 years, NCE has worked with OCTA to provide guidelines and recommendations on how this may be accomplished.

Reference

Orange County Transportation Agency
Harry Thomas
Project Manager
Tel: 714.560.5617

Project Team

Margot Yapp, PE
Lisa K. Senn
Shahram Misaghi, PE

Countywide Assessment of Existing & Future Pavement Needs – In 2006, NCE completed a study to assess the existing and future pavement conditions of the roadways operated and maintained by the 34 cities in Orange County and the County of Orange over the next twenty years. The overall goal of the study was to determine the pavement condition deficiencies as well as to quantify the investment needed to bring the deficiencies to various levels of improvement. The project required collecting PMS data from local agencies, normalizing the pavement condition ratings, normalizing the maintenance and rehabilitation (M&R) strategies with associated unit costs, and normalizing the "trigger points" requiring a specific M&R strategy.

The completed study defined current status of pavement conditions within Orange County; quantified current pavement maintenance backlog in monetary terms; forecasted costs of improving current pavement maintenance backlog condition; and forecasted countywide "shortfalls" based upon a the data from a countywide revenue survey.

This information was used to determine if any shortfalls would exist if Measure M were to sunset in 2011. The study showed that a significant shortfall would exist if this were to occur, thus assisting OCTA in making the case for a renewal of Measure M to the voters.

Countywide Pavement Management Program Guidelines – In 2010, NCE assisted OCTA in developing countywide guidelines for the pavement management program. This is to ensure consistent data collection procedures for all 35 jurisdictions so that funding allocations may be made on an "apples to apples" comparison.

A survey by NCE showed that there were variations in the data collection process, e.g., agencies employed different survey methods, such as windshield surveys or walking surveys or semi-automated surveys, or combinations thereof. Other elements that NCE will review include:

- Variations in data collection processes
- QC/QA procedures for data collection
- Trigger levels or thresholds for pavement maintenance and rehabilitation
- Prioritization techniques
- Costs of maintenance
- Performance prediction models

PAVER™ & StreetSaver® Training Workshops (2011-2015) – NCE developed and conducted the training workshops for PAVER™ on both pavement distress and software training for OCTA between November 2011 and February 2016. Generally, the two-day training workshops in the fall are focused on pavement distress data collection as per ASTM D6433-11; the spring workshops are focused on the PAVER™ software and report submittals for OCTA, respectively. In 2016, OCTA added StreetSaver® to the workshop.

Over 100 city and county personnel have been trained to ensure that they were familiar with the PAVER™ software as well as OCTA's requirements for the countywide pavement management program. The feedback from ALL respondents indicated that the workshop was "good/excellent".

"Our experience with NCE has been very good. They were extremely responsive and professional. We have found them to be very knowledgeable and experienced in the field of Pavement Management. They have completed the projects on time and within budget…The analysis and recommendations presented in their reports have really helped demonstrate…the need for additional pavement maintenance and rehabilitation funding and the need for commonality and comparability of pavement management systems used by Orange County cities"

Harry W. Thomas, P.E., Orange County Transportation Authority

Pavement Management Plan Update (2017)

Anaheim, CA

NCE updated the City of Anaheim's PMP in compliance with OCTA's Measure M requirements in 2014 and is currently performing the 2017 update. The street network consists of approximately 584 centerline miles of pavement including 155 miles of Arterial Highway System (AHS) and 429 centerline miles of Local Street System (LSS).

Reference

City of Anaheim
Cesar Carrillo
Principal Civil Engineer
Tel: 714.765.5175

Project Team

Margot Yapp, PE
Lisa K. Senn
Narut Leehacharoenkul, EIT
Franc Escobedo
Ken Huisman – marker geospatial

NCE's scope of services for 2017 include the following tasks:

- Performing distress/condition surveys as per the most current version of ASTM D6433. Surveys will be conducted using automated vehicles.
- Collecting both ride quality (International Roughness Index) and digital images of the pavements.
- Implementing a rigorous QC plan for data control and delivery.
- Updating the maintenance and rehabilitation (M&R) history since 2015.
- Creating shapefiles and KML files with the pavement condition information.
- Performing funding scenarios:
    - Maintain current PCI: AHS PCI of 73 and LSS PCI of 69 (based on 2015 results)
    - Maintain the current backlog of streets i.e. PCI<40 or 12% (whichever is lower)
    - Target 7-year network average AHS PCI of 75 and PCI 71 for LSS with no more than a 12% backlog
    - Target 7-year network average AHS PCI of 75 and PCI 71 for LSS with backlog below 12 %
- Perform Budget Scenarios per OCTA guidelines (these are different from preceding scenarios and are required).
- Prepare all reports and submittals to OCTA.

PMS Implementation (1997 - 2016)

Mission Viejo, CA

NCE implemented the City's PMS in 1997 and has performed updates every two years since then (with the most recent update completed in 2016). The City has approximately 178 centerline miles of local and collector streets and 52 miles of arterial highways (approximately 1,082 pavement sections). All of the City's streets were surveyed and a database was created to store the pavement inventory and pavement condition data. Pavement maintenance and rehabilitation historical records for the past 10 years were also entered into the database.

Reference

City of Mission Viejo
Joe Ames, PE
Assistant City Engineer
Tel: 949.470.8419

Project Team

Lisa K. Senn
Margot Yapp, PE
Narut Leehacharoenkul, EIT
Marvin Mann
Franc Escobedo

As part of the project, the maintenance and rehabilitation (M&R) decision tree was updated with new treatments and unit costs re-evaluated prior to performing any budgetary analyses. In addition, the City's projected 20-year pavement budget was analyzed and a seven-year work plan prepared. Numerous custom reports were prepared for the City, and finally, an executive summary was submitted to OCTA for the Measure M2 program. Specifically, the following tasks were performed:

- Condition surveys
- Calculated a Pavement Condition Index (PCI)
- Updated maintenance & rehabilitation (M&R) strategies and life cycle costs
- Determined the budget needs of the road network
- Provided input for Grant Applications
- Prepared seven year Capital Improvement Program
- Prepared submittal to OCTA for Measure M program
- Presentation to City staff
- Technical assistance as needed

Pavement Management Program Update (2009 - 2017)

Stanton, CA

NCE was selected by the City to perform a pavement management program update in 2009. Since then, the City has renewed NCE's contract every 2 years for PMP updates to stay in compliance with the OCTA Guidelines. As part of the updates, NCE has performed the following tasks:

Reference

City of Stanton
Allen Rigg, PE AICP
Public Works Director / City Engineer
Tel: 714.890.4203

Project Team

Lisa K. Senn
Margot Yapp, PE
Narut Leehacharoenkul, EIT
Franc Escobedo

- A peer review of the 2007 report
- Field verify the pavement inventory as necessary
- Perform distress/condition surveys on the entire pavement network.
- Calculate pavement condition indices (PCI) for each street section as well as citywide.
- Perform budgetary analyses including two funding scenarios
- Develop a multi-year maintenance and repair work plan.
- Prepared final report included in submittal to OCTA.

Peer Review and Pavement Management Update

Buena Park, CA

In 2008, NCE provided a peer review of the City's PAVER™ pavement management data collection procedures. This was accomplished by surveying a representative portion of the network and comparing NCE's distress findings with those collected by the City. Any anomalies and/or discrepancies were noted in a technical memorandum provided to the City. NCE also provided the City with training for the PAVER™ program.

Since then, NCE has updated the City's pavement management program to bring the City into compliance with OCTA's Measure M2 requirements. This includes pavement condition surveys of approximately 190 centerline miles of streets, quality control checks, reclassification of the MPAH streets, PCI calculations and performing the budgetary analysis to prepare the reports required by OCTA.

Reference

City of Buena Park
Mr. David Jacobs
Director of Public Works
Tel: 714.562.3679

Project Team

Margot Yapp, PE
Lisa K. Senn
Franc Escobedo

"For several years, NCE has conducted the biennial surveys of our streets in Buena Park. They have analyzed our data and produced the certification reports for the Orange County Transportation Authority (OCTA). They have demonstrated an extensive knowledge of Pavement Management Systems and a keen understanding of our organization's needs.

NCE has provided excellent services and value, and is always willing to do whatever it takes to get the job done on time and within budget. We are extremely pleased with the services and continue to request NCE technical support and there is always someone available to help us work through any issue."

- Jim Biery, PE, Former Director Public Works, City of Buena Park

Pavement Management Plan Update (2016)

Laguna Niguel, CA

NCE was selected by the City for a four year contract to perform its pavement management program update in 2016, a project very similar to this one. The scope of work included performing walking surveys on the Master Plan Arterial Highway (MPAH) street sections. This was needed in order to fulfill the requirements of OCTA's Measure2 guidelines. As part of the update, NCE performed the following:

- Conducted a peer review of the 2013 report;
- Field verified the pavement inventory;
- Performed distress/condition surveys on the MPAH pavement network as per ASTM D6433 protocols;
- Calculated pavement condition indexes (PCI) for each street section as well as citywide;
- Performed budgetary analyses including three funding scenarios;
- Developed a seven-year maintenance and repair work plan; and
- Prepared final report and submitted to OCTA.

Reference

City of Laguna Niguel
Frank Borges
Senior Civil Engineer
Tel: 949.362.4325

Project Team

Lisa K. Senn
Margot Yapp, PE
Narut Leehacharoenkul, EIT
Franc Escobedo

Pavement Management Implementation, GIS Linkage, and System Update (2005-2015)

Chula Vista, CA

Reference

City of Chula Vista
Elizabeth Chopp
Sr. Civil Engineer
Tel: 619.691.5046

Project Team

Lisa K. Senn
Margot Yapp, PE
Narut Leehacharoenkul, EIT
Franc Escobedo
Marvin Mann

In 2005, NCE implemented the City's PMP (converted from a custom PMP to StreetSaver®) and GIS linkage then performed updates in 2009, 2011, 2014 and 2016. The City's street network consists of 443 centerline miles. NCE provided PMP software selection recommendations, created the pavement database, performed condition surveys and PCI calculations, identified maintenance and rehabilitation historical data, provided budgetary analyses and final reports, and developed customized GIS interface links to the City's enterprise-wide GIS. NCE also provided presentations to City Council and provided training and technical support to the City's staff.

In 2012, NCE performed a Cool Pavement Study as part of the investigation into innovative energy efficient opportunities. Traditional asphalt pavements produce dark impervious surfaces that easily absorb and retain heat from solar radiation resulting in higher temperatures. NCE's study provided the City with a qualitative assessment that rated the UHI impact for selected cool pavement technologies and a two-tiered implementation plan for incorporating cool pavement technologies on future pavement projects.

"The City has been very satisfied with the work done by NCE staff. Their work has been of high professional quality and we have been satisfied with the accuracy of their work. I have been impressed with Margot Yapp's knowledge of the subject of pavement management and preservation."

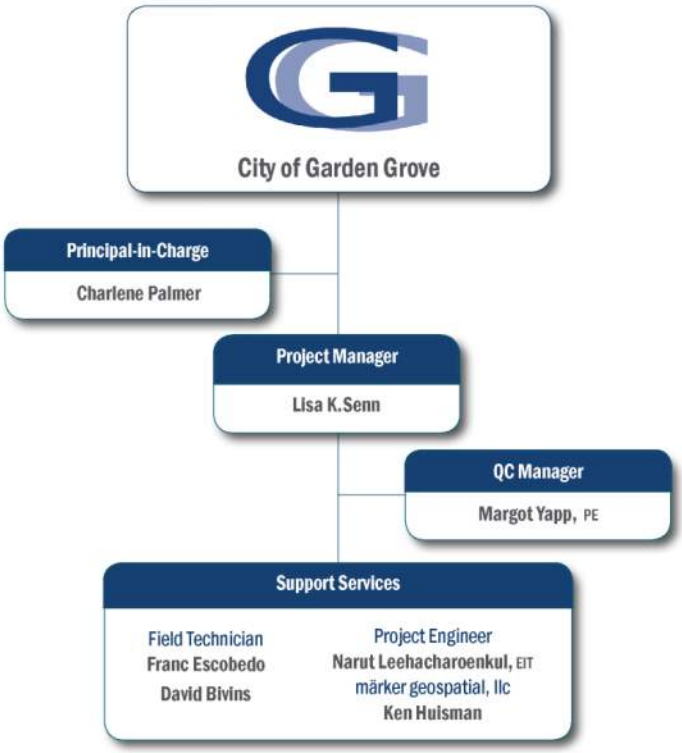
Elizabeth Chopp, City of Chula Vista

Key Personnel and Organizational Chart

Project Team

NCE has assembled a seasoned team well-versed in collecting pavement condition data for either the PAVER™ or StreetSaver® pavement management programs (PMP). Staff biographies below highlight our team's experience and detailed two page resumes are included at the end of the proposal per the RFP.

Our organizational chart below details the roles and responsibilities of the team



Lisa Senn is NCE's proposed Project Manager for this project. Ms. Senn has more than 17 years' experience completing pavement engineering and transportation projects. She has managed many PMP projects and has been involved in every aspect of PMP implementations and updates including collecting field data, performing condition surveys, and calculating analyses to report preparation, and result presentations to decision makers, project management, and quality control.

Ms. Senn has provided PMP training to over 200 city and county engineers and technicians in California including the **Cities of Anaheim, Buena Park, Dana Point, Lake Forest, La Habra, Manhattan Beach, Santa Monica, San Gabriel, Torrance, and Whittier in addition to the Counties of Orange, Santa Barbara, Ventura, and San Luis Obispo**. Ms. Senn is also responsible for developing and delivering the pavement management field and computer training for OCTA.

Margot Yapp, PE is NCE's proposed QC Manager for this project. Ms. Yapp has over 27 years of experience in implementing and updating pavement management programs. Her experience includes numerous turnkey implementations and updates of pavement management programs for cities, counties and airports throughout California, Oregon, Nevada, Idaho, Hawaii and Texas. She has worked with both the PAVER™ and StreetSaver® software since 1987 and implemented pavement management programs for over 100 cities and counties in California.

She has managed numerous PMP projects and has been involved in every aspect of PMP implementations and updates from collecting field data, performing condition surveys, calculating analyses, report preparation, and result

presentations to decision makers, project management, and quality control. **Her recent experience includes similar PMP projects for Anaheim, Orange County, Buena Park, Whittier, Mission Viejo, Corona, Stanton, Orange and La Habra.** She is the Project Manager for the California Statewide Needs Assessment, and will bring a wealth of knowledge and expertise on statewide funding issues, as well as providing a perspective from a policy level on transportation issues at the State Legislature.

Charlene Palmer Is NCE's proposed Principal-in-Charge for this project. Ms. Palmer brings 35 years of extensive experience in the engineering consulting industry for services covering a broad base of engineering disciplines to a project. Her consulting experience includes the transportation, civil, rail / transit, infrastructure, water resources, environmental, materials testing and inspection, and geotechnical engineering arenas. She has won and directed projects with services varying from feasibility studies through design support during construction and construction management and inspection services.

Narut Leehacharoenkul, EIT is NCE's proposed Project Engineer. He has been involved in multiple pavement management projects using both PAVER™ and StreetSaver®. He is fully versed in pavement condition surveys, and performing funding analysis. **He is certified by both the MTC and the OCTA inspector certification testing programs.** In addition, he has been involved with developing transportation asset inventories using digital imagery from Earthmine and populating geodatabases with ArcMap and ArcGIS Online. Mr. Leehacharoenkul's PMP experience includes the Cities of Anaheim, Stanton, Seal Beach, Fullerton, Lake Forest, Dana Point, Corona, Diamond Bar, San Gabriel, Torrance, and West Covina as well as Orange County.

Franc Escobedo proposed Senior Field Technician, has over 15 years of experience as a pavement management technician for NCE. He has performed numerous pavement condition surveys throughout California, Idaho and Washington and has collected distress data for various Pavement Management Systems, including StreetSaver®, PAVER™ and Cartegraph. He has collected data for the Cities of Manhattan Beach, Santa Monica, Anaheim, La Habra, Buena Park, Stanton, Commerce, San Dimas, Torrance, and West Covina, and the Counties of Orange, Ventura and San Diego. **Mr. Escobedo is certified by both the MTC and the OCTA inspector certification testing programs.** Both of these agencies require companies and inspectors to pass a rigorous field test in order to work in their respective jurisdictions. He also assists with the training of agency staff.

David Bivins is NCE's proposed Senior Field Technician. Mr. David Bivins has over 17 years of experience as a pavement management technician. He is one of NCE's most experienced distress collectors and our primary choice for working with/training our clients in field data collection activities. His field experience and expertise is an added benefit to agencies during field training. **Mr. Bivins by both the MTC and the OCTA inspector certification testing programs**, which require inspectors to pass a rigorous field test in order to work in their respective jurisdictions. He has performed condition surveys of over 15,000 centerline miles in California, Washington, Idaho and Nevada. He has not only attended yearly in-house training, but has assisted in training local agencies on distress identification and collection procedures.

Ken Huisman, märker geospatial's proposed Field Manager, will coordinate and be responsible for all facets of the automated survey field work, including crew coordination, survey scheduling, quality components, and the timely delivery of all project fieldwork collection deliverables. His responsibilities include the development of QA/QC procedures and the tools used to validate the quality control criteria, as well as organizing all the data collection aspects of the project.

Ken brings more than 25 years of experience in the infrastructure management consulting business and provides all aspects of the infrastructure management business to more than 100 clients. He will be märker geospatial's primary field contact for this project and will personally monitor the staff, project progress and data completeness. He will have authority to make key decisions on the project with respect to the field equipment and coordination, and any other important field issues related to safety and data quality.

Resumes

Resumes for the NCE team are included as Appendix A for the City's review.

Appendix A - Resumes

The subsequent pages contain the NCE team's resumes for the City's review.

Lisa K. Senn

Project Manager

Education

A.A., Business Administration, 2000 Cuesta College

Registrations/Certifications

OCTA PAVER™ Certification, 2018

PAVER™ Level 1 & 2, 2015

Affiliations

American Public Works Association

Lisa Senn had a job in music when she agreed to help a friend's company with requests for information. This evolved into preparing inspections for field crews, and after a firm principal saw she had a knack for the work, he taught her about deflection testing and coring. The more Lisa learned, the more she wanted to know, and her career in pavement management and transportation began.

Lisa's experience includes managing projects and overseeing field surveys and quality control procedures for cities and counties throughout California. A natural teacher, Lisa trains engineers, technicians, agencies and municipalities on various aspects of pavement management, software, and field distress. A member of MTC's software development team, she has helped beta test new StreetSaver® modules and enhancements.

Finding comfort in knowing that what she does benefits others, Lisa enjoys working with and learning about agencies. Honest and hardworking, she considers historical knowledge gained on past projects, yet stays up-to-date on developments in the ever-evolving area of pavement management.

PROFESSIONAL EXPERIENCE

Pavement Evaluation Services

Lisa has managed numerous pavement evaluation projects that include using deflection testing to measure a pavement's structural properties by applying a load on the pavement and measuring the resulting deflection. In connection with deflection testing, coring is completed to measure existing pavement thicknesses to determine pavement structural capacity. Used in conjunction with deflection testing and visual observations of current cracking conditions and roadside draining, core testing provides the necessary data to provide sound repair or maintenance recommendations.

Pavement Management

For Pavement Management System updates and implementation, Lisa is responsible for the analysis and quality control of pavement distress data, updating maintenance and rehabilitation decision trees and the treatment unit costs, and the development of budget scenarios and summary reports. She has developed the cost-effective maintenance treatments and strategies, prepared custom multiple-year detailed street maintenance plans and budget option reports, and linked GIS maps with management sections in the client's PMS database. She is also an advanced user of both the PAVER™ and StreetSaver® pavement management software. Her clients include the following California cities and counties:

- **Anaheim**
- Calistoga
- **Camarillo**
- **Chula Vista**
- **Commerce**
- **Corona**
- **El Centro**
- **Fullerton**
- **La Habra**
- **Lake Forest**
- Lompoc
- Los Gatos
- Milpitas
- **Mission Viejo**
- Napa
- Oakley
- **Orange (City)**
- **Orange (County)**
- Petaluma
- Pittsburg
- Rocklin
- San Carlos
- **San Diego (County)**
- **San Gabriel**
- San Ramon
- **San Clemente**
- Santa Barbara (City)
- Santa Barbara (County)
- **Santa Clarita**
- **Santa Maria**
- Sonoma (County)
- **Stanton**
- **Thousand Oaks**
- **Torrance**
- Ventura (County)
- **Whittier**
- Woodland

I have had the pleasure of working with Lisa for many years . . . She was instrumental in facilitating the County's migration from PAVER™ to StreetSaver® in 2011, and she continues to be an integral part of our Pavement Management Team.. . . Lisa demonstrated extensive knowledge of Pavement Management Systems, and a keen understanding of our organization's needs and goals. . . .Lisa has vast and intricate knowledge of the StreetSaver Program, . . .

Scott D. McGolpin, Director, County of Santa Barbara Public Works Department

Pavement Management Program Update - Mission Viejo, CA | Project Manager

The City has approximately 178 centerline miles of local and collector streets and 52 miles of arterial highways (approximately 1,082 pavement sections). Ms. Senn has managed a number of the recent biennial updates for the City. Surveys were performed with either 'walking surveys' or 'windshield surveys' and the PAVER™ database was updated with the pavement condition data. Pavement maintenance and rehabilitation historical records for the past 2 years were also entered into the database. As part of the project, the Maintenance and Rehabilitation (M&R) decision tree was updated with new treatments and unit costs re-evaluated prior to performing any budgetary analyses. In addition, the City's projected 20-year pavement budget was analyzed and a 7-year workplan prepared. Numerous custom reports were prepared for the City, and finally, an executive summary was submitted to OCTA for the Measure M2 program.

Pavement Management Program Updates & StreetSaver® Conversion - Corona, CA | Project Manager

Lisa managed the City's annual PMS updates, which included pavement condition surveys and budgetary analyses. In 2012 and 2013, she assisted the City as they converted from PAVER™ to StreetSaver®. This included a review of current functional classifications, generating a list of roads needing surveys prior to conversion and helping to define information migrated. She collaborated with City's GIS department to obtain a current shapefile for GIS integration for StreetSaver®. She also trained with City staff on the use of StreetSaver®, including database entry and how to generate GIS Maps.

Pavement and Asset Management Program - County of Orange, CA | Project Manager

For the current 3-year contract with the County of Orange and its contract Cities of Lake Forest and Dana Point (over 600 miles), Lisa is responsible for quality control of collected pavement distress data, updating maintenance and rehabilitation decision trees and the treatment unit costs, and the development of budget scenarios and summary reports. She works closely with Cartegraph who is contracted data collection for roads and non-pavement asset collection. Lisa works with County and City staff to determine unit costs, applicable treatments for the seven-year budgeting scenarios and development of the respective street sections slated for rehabilitation over the next seven years.

Pavement Management Program Update - Fullerton, CA | Project Manager

The City's biennial pavement management condition surveys and budget analyses includes the City's entire pavement network of more than 290 centerline miles. Lisa updated the preventative maintenance and rehabilitation strategies and treatment unit costs to more accurately reflect the effects of different multiple-year budgets on the pavement network's condition and the backlog of work. She also coordinated the migration of the City's GIS shapefiles to PAVER™ in order to provide a visual linkage to sections in the City's pavement network.

Training

Training and Technical Support - Santa Barbara County, CA | Project Manager

Project Manager. Since 2003, Lisa has assisted the County to define the yearly rotation of roads to be surveyed, managed the survey crews, data entry technicians and QA procedures. She assisted with the data gathering for the yearly "Road Book", which encompassed the yearly maintenance and rehabilitation projects. In 2010, Lisa assisted the County with a software conversion from PAVER™ to StreetSaver®. This included a review of current functional classifications, generating a list of roads needing surveys prior to conversion and helping to define information migrated. Lisa collaborated with the County's GIS department to obtain a current shapefile for GIS integration for StreetSaver®.

Asset Management

Lisa has managed the collection of data related to sidewalk, curb and gutter, tree root damage, ADA ramps, cross slopes of street segments, trip fall hazards, culverts, storm drains and catch basins. In addition, the data she has collected includes a variety of storm drain features, such as manholes, catch basins, streams and curb inlets, and determining their physical characteristics and connection to other nearby storm drain elements. These projects included evaluating thousands of feet of concrete and identifying, quantifying and recording the data spatially to incorporate them on maps for future reference.

Roadway Pavement Distress Evaluations - Orange County, CA | Project Manager

In 2012, the County of Orange contracted with NCE to update the PMS databases using semi-automated distress collection and catalogue non-pavement assets. The mobile data collection units gathered high-resolution 360° geo-referenced right-of-way street level digital imagery along with 3D point cloud data. The mobile mapping system provided the ability to visualize, measure, edit, and validate infrastructure assets (such as pavements, markings, lanes, surface areas, shoulders, signs, and drainage features) with a high level of accuracy. The assets collected included curb and gutter, sidewalk, signalizations, signs, striping, drop-inlets and manhole covers. ArcMAP 10.2 was used to 'drop' points to the various layers of the agencies shapefiles.

Margot Yapp, PE
QC Manager

Education
B.S., Forest Engineering, 1985
B.S., Civil Engineering, 1985
M.S., Civil Engineering, 1987
Oregon State University, Corvallis

MPP Public Policy, 2005
University of California, Berkeley

Registrations and Certifications
Professional Engineer - Civil, CA #45027
Professional Engineer - Civil, OR #15129

Affiliations
American Society of Civil Engineers
American Public Works Association
TRB Subcommittee A2B01 – Local Agency Pavement Management

"Margot Yapp has been the project manager of our last four projects with NCE. Margot has made sure the projects run smoothly and efficiently. Her project management and people skills have been great assets to the projects. She has conducted meetings and provided training for local agency staff and is always very thorough and does a great job of making things easily understood for all involved."

Nephele S. Barrett, Senior Planner, Mendocino Council of Governments

"NCE, through Ms. Yapp's leadership, has built a very good reputation implementing pavement management systems for local agencies throughout the west coast and in the San Francisco Bay Area in particular. . . . NCE has been a pleasure to work with, Ms. Yapp and her team have helped inform and increase the value of the P-TAP program for it participant jurisdictions. The firm pays attention to customer needs and has been fast to respond to the needs of MTC and its jurisdictions."

Christina Hohorst, PTAP Manager, MTC

Ms. Margot Yapp, PE is a Principal of the firm and our proposed **Project Manager**.

Ms. Yapp has over 25 years of experience in the area of transportation engineering specializing in pavement design, asset/pavement management and research for roads, highways and airfields. She has also implemented many Pavement Management Systems for cities, counties and airports in California, Oregon, Nevada, Hawaii and Texas. She has taught workshops on pavement management systems for the National Highway Institute/ Federal Highway Administration. She is also involved in the evaluation and design of airfield pavements for civilian and military airports.

She has been the Project Manager for the California Statewide Local Streets and Roads Needs Assessment since 2008 and recently completed the 2016 update. On this project, she directed the development of a website, online database and data collection from all 540 cities and counties, the development of the needs and scenario methodologies for both pavement and non-pavement assets, and the funding analysis. She was also responsible for communicating the results to a wide variety of audiences, including state legislators, elected city and county officials, Directors of Public Works, engineers and planners.

RELEVANT PROJECTS

Asset/Pavement Management Systems | Project Manager

Ms. Yapp, has worked with pavement management software since 1987. She has worked with over 100 agencies in California, Oregon, Washington, Hawaii and Nevada to implement PMP, from condition surveys to setting up budget parameters to preparing final reports to making presentations to City Councils for cities (Southern California - San Marino, Highland, San Dimas, Mission Viejo, and Torrance; and Northern California – Hayward, Alameda, Emeryville, Antioch, Daly City, Foster City, Portola Valley, Orinda, Oakland, Fremont, Albany, San Jose, San Bruno, Campbell, San Ramon, Lafayette, San Francisco, Newark, Gilroy, Fairfield, Brentwood, Benicia, El Cerrito, Richmond, Mountain View, Walnut Creek), counties (Orange, San Bernardino, San Mateo, Marin, Stanislaus, and Monterey) and federal agencies (US Forest Service, Presidio of San **Ms. Margot Yapp, PE** is a Principal of the firm and our proposed **Project Manager**.

Ms. Yapp has over 25 years of experience in the area of transportation engineering specializing in pavement design, asset/pavement management and research for roads, highways and airfields. She has also implemented many Pavement Management Systems for cities, counties and airports in California, Oregon, Nevada, Hawaii and Texas. She has taught workshops on pavement management systems for the National Highway Institute/ Federal Highway Administration. She is also involved in the evaluation and design of airfield pavements for civilian and military airports.

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online database and data collection from all 540 cities and counties, the development of the needs and scenario methodologies for both pavement and non-pavement assets, and the funding analysis. She was also responsible for communicating the results to a wide variety of audiences, including state legislators, elected city and county officials, Directors of Public Works, engineers and planners.

RELEVANT PROJECTS

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Ms. Yapp, has worked with pavement management software since 1987. She has worked with over 100 agencies in California, Oregon, Washington, Hawaii and Nevada to implement PMP, from condition surveys to setting up budget parameters to preparing final reports to making presentations to City Councils for cities (Southern California - San Marino, Highland, San Dimas, Mission Viejo, and Torrance; and Northern California – Hayward, Alameda, Emeryville, Antioch, Daly City, Foster City, Portola Valley, Orinda, Oakland, Fremont, Albany, San Jose, San Bruno, Campbell, San Ramon, Lafayette, San Francisco, Newark, Gilroy, Fairfield, Brentwood, Benicia, El Cerrito, Richmond, Mountain View, Walnut Creek), counties (Orange, San Bernardino, San Mateo, Marin, Stanislaus, and Monterey) and federal agencies (US Forest Service, Presidio of San Francisco, and Barbers Point NAS). Ms. Yapp has been involved in all aspects of PMP implementation, from collecting field data, performing condition surveys, performing analyses, preparing reports, presenting results to decision makers, and managing projects. Ms. Yapp has worked with the following PMP software: MTC's StreetSaver®, PAVER™ and Cartegraph.

Currently, she works with both regional and local agencies to use their PMP data for developed work plans and also to project long-term needs for sales tax or bond measures. She has used PMP data to develop performance prediction models, to monitor performance of projects constructed with new pavement materials such as crumb rubber, and to develop new specifications. Ms. Yapp recently prepared a long-term regional pavement needs analysis for all 34 cities in Orange County for the Orange County Transportation Authority.

Pavement Management System | Principal-in-Charge

Mission Viejo, CA

NCE implemented the City's PMS in 1997 and has performed updates biennially since then including the 2014 update. The City has approximately 178 centerline miles of local and collector streets and 52 miles of arterial highways (approximately 1,082 pavement sections). All of the City's streets were surveyed and a database was created to store the pavement inventory and pavement condition data. Pavement maintenance and rehabilitation historical records for the past 10 years were also entered into the database. NCE continues to provide biannual services and updates to the City. (1997-Current)

Multiple Pavement Management Systems Studies | Principal-in-Charge

Orange County, CA

NCE has worked with OCTA since 1997 on various projects related to pavement management systems. There are over 6,500 centerline miles of paved streets and roads in Orange County, which serves a population of almost 3 million. In 2010, NCE assisted OCTA in developing countywide guidelines for the pavement management program. This was to ensure consistent data collection procedures for all 35 jurisdictions so that funding allocations may be made on an "apples to apples" comparison. Since 2011, NCE has developed and conducted training workshops on the PMP software as well as conducting field surveys as per ASTM D6433. To date, over 12 workshops have been delivered to all 35 local agencies in Orange County.

Various PMS Studies - Orange County Transportation Authority, CA

NCE has worked with OCTA since 1997 on various projects related to pavement management systems. There are over 6,500 centerline miles of paved streets and roads in Orange County, which serves a population of almost 3 million. In 2010, NCE assisted OCTA in developing countywide guidelines for the pavement management program. This was to ensure consistent data collection procedures for all 35 jurisdictions, so that funding allocations may be made on an "apples to apples" comparison. Since 2011, NCE has developed and conducted training workshops on the PMP software as well as conducted field surveys as per ASTM D6433. To date, over 12 workshops have been delivered to all 35 local agencies in Orange County.

Pavement Management Systems Update | QA/QC Manager

Seal Beach, CA

NCE was selected by the City of Seal Beach to implement a pavement management program in 2004. The City's pavement management system was converted to the PAVER™ (MicroPAVER) program in 2010 in compliance with OCTA's Measure M2 requirements. Updated its network in 2012 and 2014, the City again contracted NCE to perform distress/condition surveys on approximately 41.1 miles of roadway in accordance with ASTM D6433-11; calculation of pavement condition indices (PCI's) for each street section and the entire network; defining the maintenance and rehabilitation strategies and unit costs; budgetary analyses and develop a seven year maintenance work plan; and prepare the final report for both the City and OCTA.

Charlene Palmer, PE
Principal-in-Charge

Education
B.S., Civil Engineering, Ohio State University, 1981
A.A.S., Environmental Sciences, M.A.T.C., 1975

Registrations/Certifications
Professional Engineer – Civil, KY (#15269)
E-Railsafe
Roadway Worker Qualified
TSA TWIC Card Expires 3-04-2018
PBSJ: Project Management Bootcamp Certified (2010)

Affiliations
American Public Works Association
American Society of Civil Engineers (ASCE)
National Society of Professional Engineers (NSPE)
Women's Transportation Seminar, So. CA (WTS)
Order of the Engineer

Charlene Palmer brings 35 years of extensive experience in the engineering consulting industry for services covering a broad base of engineering disciplines to a project. Her consulting experience includes the transportation, civil, rail / transit, infrastructure, water resources, environmental, materials testing and inspection, and geotechnical engineering arenas. She has won and directed projects with services varying from feasibility studies through design support during construction and construction management and inspection services.

She has focused on the areas of business development, operations, and management within the past 25 years of her professional career. This experience includes business development, sales, and marketing activities; client relationship management; the establishment and coordination of winning pursuit teams; leading office and area operations; resource acquisition, management and cultivation; developing strategic and annual plans and their budgets; evaluating financial performance; establishing new offices and market sectors; initiating mentoring programs; project / program management and team coordination; handling and negotiating contractual elements, task orders, and agreements; writing scopes and project understanding and approaches; setting budgets and schedules; providing technical oversight; and researching and preparing technical documents, training and safety manuals, and technical reports.

PROFESSIONAL EXPERIENCE

On-Call Traffic Engineering Services | Project Manager
Mission Viejo, CA

As Project Manager and her responsibilities included: project studies, traffic studies, public presentations, plan reviews, study reviews, traffic signal design, Consultant Management, signing/striping plan, stop sign warrants, signal warrants, resident interface, neighborhood traffic calming programs, and City Council and Planning Commission presentations.

OCTA Engineering Plan Check & Design Review for Railroad Grade Separation Projects | Technical Advisor
Orange County, CA

As part of a subconsultant team, she served as Technical Advisor for the traffic component, which included coordination with Metrolink, BNSF, UPRR, and Amtrak for the railroad grade separation project review. Stage Construction, Traffic Handling, Detour Plans, and Transportation Management Plan (TMP) reviews provided OCTA with real and relevant information necessary to understand the impacts to the local community and to direct this important project's elements to consensus between the affected agencies the railroads, and MUTCD. Standard traffic engineering practices were used to ensure that safety and constructability standards were met.

Development of Project Management Practices, Procedures, and Manual | Sr. Project Manager
Caltrans, CA

As Sr. Project Manager, Ms. Palmer was responsible for developing a project management manual of practices, procedures, and a supporting manual for DOR staff. The effort was developed with concurrence of DOR and verified and documented Caltrans DOR contract work in order to make it consistent with industry standards, government and safety statutes/regulations and financial and funding contractual requirements.

State College Boulevard Grade Separation | Project Director
Fullerton, CA

She was Project Director for this project estimated at $65 million for construction that involves the design of a grade separation (depressing a major arterial under the BNSF facility) and related improvements on State College Boulevard. An environmental analysis was conducted to determine the extent, type and duration of any impacts. The design involves specific coordination and compliance with current OCTA, City, BNSF, Metrolink, Amtrak, and CPUC guidelines and specifications. The project includes performing traffic engineering, civil and structural design, environmental reporting, estimating, right-of-way determinations, hydraulics and drainage analysis for a pump house, railroad interactions and approvals, construction drawings and improvement plans, contract specifications, special provisions and quantity and cost estimates.

Narut Leehacharoenkul, EIT

Project Engineer

Education
B.S., Civil Engineering, 2013
University of California - Irvine

Registrations/Certifications
Engineer-In-Training – CA (#143045)
OCTA PAVER™ Certification 2017
MTC StreetSaver® Certification 2017

Affiliations
American Society of Civil Engineers
American Public Works Association

Mr. Leehacharoenkul has engineering project experience including pavement management budget analyses using both PAVER™ and StreetSaver® software, pavement condition survey QA/QC inspection, asset management using EarthMine, AutoCAD Civil 3D, ArcMap, and ArcGIS Online. Narut interned in Bangkok in the summer of 2012 assisting the field engineer document various phases of construction. Mr. Leehacharoenkul worked at the City of Stanton as an engineering intern in 2013.

PROJECT EXPERIENCE

Pavement Management Systems | Staff Engineer

Mr. Leehacharoenkul is responsible for updating the analysis and quality control of pavement distress data, updating maintenance and rehabilitation decision trees and the treatment unit costs, and the development of budget scenarios and summary reports. His clients include the following cities and counties:

- **Buena Park**
- **Camarillo**
- **Carson**
- **Commerce**
- **Corona**
- **Dana Point**
- **Diamond Bar**
- **El Centro**
- **Fullerton**
- **Highland**
- **La Habra**
- **Laguna Niguel**
- **Lake Forest**
- **Mission Viejo**
- **Manhattan Beach**
- **Orange County**
- **San Clemente**
- **San Gabriel**
- **San Marino**
- Santa Barbara County
- **Santa Clarita**
- **Seal Beach**
- **Stanton**
- **Thousand Oaks**
- **Torrance**
- **West Covina**

Citywide Sidewalk Assessment | Staff Engineer

Carson, CA

NCE conducted a citywide inspection in City of Carson for tripping hazards in the public right-of-way as well as ADA-compliance of curb ramps at street intersections. Field staff performed walking surveys and took photographs along the entire public sidewalk network. Mr. Leehacharoenkul was in charge of the data collection effort, preparing a combination of "high-accuracy" and "mapping grade" data collectors. He also created a GIS system with all of the data to generate a 5-year maintenance implementation program and associated planning-level cost estimates.

Pavement Management Update | Staff Engineer

Mission Viejo, CA

The City converted from PAVER™ software to StreetSaver® software in 2014. Mr. Leehacharoenkul assisted with the conversion and verified the accuracy of the data. As part of the project, the maintenance and rehabilitation (M&R) decision tree was updated with new treatments and unit costs re-evaluated prior to performing any budgetary analyses.

In addition, the City's projected 20-year pavement budget was analyzed and a 7-year work plan prepared. Numerous custom reports were prepared for the City, and finally, an executive summary was submitted to OCTA for compliance with the Measure M program.

Asset and Pavement Management Implementation | Staff Engineer

Orange County & Cities of Lake Forest and Dana Point, CA

Mr. Leehacharoenkul assisted in the QC for the pavement distress data collection and performed the PCI calculations as well as funding scenario analysis for these agencies. Additionally he provided on-site training for all agencies.


This is to certify that

Narut Leehacharoenkul

has completed the requirements of the

MTC StreetSaver Rater Certification Program

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

Certificate valid until Apr 12 2017

Serial no: 1027

Sui Tan, StreetSaver Program Manager
Metropolitan Transportation Commission

StreetSaver

Franc Escobedo

Senior Field Technician

Education

Computer Operations Program
Computer Learning Center, Los Angeles, CA, 1983-84
Network Engineering & Administrative Program
Computer Learning Center, Anaheim, CA, 1997
Certified Network Administration
Computer Learning Center, Anaheim, CA 1997

Registrations/Certifications

OCTA PAVER™ Certification 2018
MTC StreetSaver® Certification 2017

Mr. Franc Escobedo has over 15 years of experience as a pavement management technician for NCE. He has performed numerous pavement condition inspections throughout California, Idaho, and Washington. He experience includes distress collection across various Pavement Management Systems including the Metropolitan Transportation Commission StreetSaver®, PAVER™, Cartegraph, and Hansen systems.

Additionally, Mr. Escobedo has completed both the OCTA PAVER™ and MTC "Distress Identification" courses for both Asphalt Concrete and Portland Cement Pavements and now assists with the training of agency staff on both courses.

Mr. Escobedo performs all activities relating to pavement data collection using hardcopy forms or tablets. As part of the quality control process, he performs cross-checks of data in the PMP database. He also regularly performs quality control checks of field collected data and pavement maintenance history to ensure that PMP databases are accurate and up-to-date. During this process, he also generates detailed reports, which are necessary to perform his cross-checks of the collected data.

His field experience and expertise is an added benefit to agencies during field training. Listed below are a collection of agencies for which Mr. Escobedo has performed condition inspections, all together they easily account for over 6,000 centerline miles of roads and streets.

PROJECT EXPERIENCE

Pavement Management Surveys | Engineering Field Technician

- Ada County, Idaho
- **Agoura Hills**
- **Anaheim**
- Antioch
- Bakersfield
- Bell
- **Buena Park**
- **Camarillo**
- **Chula Vista**
- **Commerce**
- **Corona**
- **Cudahy**
- **Dana Point**
- Davis
- East Bay Regional Park District
- **El Centro**
- El Cerrito
- Elk Grove
- Fairfield
- Fremont
- **Fullerton**
- Hayward
- Hillsborough
- Humboldt County
- Inyo County
- **La Habra**
- Lake County
- **Lake Forest**
- **Lemon Grove**
- Marin County
- Martinez
- Mendocino County
- Milpitas
- **Mission Viejo**
- Mono County
- Mountain View
- Newark
- **Orange County**
- **Palm Springs**
- Redwood City
- Rogue River National Forest
- **San Clemente**
- **San Dimas**
- San Ramon
- Santa Cruz County
- **Santa Maria**
- **Seal Beach**
- Siskiyou County
- South Lake Tahoe
- Stanislaus County
- **Stanton**
- **Thousand Oaks**
- **Torrance**
- Tulare
- Tuolumne County
- **Tustin**
- Umpqua National Forest
- Vallejo
- **Vernon**
- **Vista**
- Walnut Creek
- **West Covina**
- West Sacramento

Projects included various forms of surveys for pavement distress data collection, this may have included walking, windshield, and/or semi-automated.

CERTIFICATE OF ACHIEVEMENT

This is to certify that

Francisco Escobedo

has completed the requirements of the

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

Certificate valid until Sep 29 2017

Serial no: 1013

Sui Tan, StreetSaver Program Manager
Metropolitan Transportation Commission

StreetSaver

David Bivins

Senior Field Technician

Education

Civil Engineering Courses
San Francisco State University, 1994
AutoCAD Advanced Course
CAD Masters, Walnut Creek, CA, 1997

Registrations and Certifications

OCTA PAVER™ Certification, 2018
MTC StreetSaver® Certification 2017

Mr. Bivins has over 15 years of experience as a pavement management technician. As a senior technician, his experience extends beyond data collection for pavement distresses. Mr. Bivins is one of NCE's most experienced distress collectors and a primary choice for working with and training of our clients in field data collection activities.

Mr. Bivins performs all functions relating to data collection using paper forms or a tablet. As part of the quality control process, he performs cross-checks of data in the PMP database. He has performed quality control checks of field collected data and pavement maintenance history to ensure that PMP databases are accurate and up-to-date. During this process, Mr. Bivins also generates detailed reports, which are needed to help perform his cross-checks of the collected data.


CERTIFICATE OF ACHIEVEMENT

This is to certify that

David Bivins

has completed the requirements of the

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

Certificate valid until Sep 29 2017

Serial no: 1009

Sui Tan, StreetSaver Program Manager
Metropolitan Transportation Commission

StreetSaver

His field experience and expertise is an added benefit to agencies during field training. Having performed data collection for agencies all over the State of California, Mr. Bivins has a depth of experience related to pavement types and conditions from performing condition surveys on more than 15,000 centerline miles of roads and streets. In addition, Mr. Bivins is proficient and certified by MTC. He attends annual in-house training and assists in training local agencies on distress identification and collection procedures.

PROJECT EXPERIENCE

Pavement Management Surveys | Senior Field Technician

- Ada County, ID
- Alameda County
- Albany
- **Buena Park**
- Campbell
- **Chula Vista**
- Citrus Heights
- Danville
- East Bay Regional Park District
- Elk Grove
- Fairfield
- Folsom
- Fremont
- **Fullerton**
- Hayward
- Humboldt County
- Inyo County
- Lafayette
- Lake County
- Los Gatos
- Mammoth Lakes
- Marin County
- Mendocino County
- **Mission Viejo**
- Modesto
- Newark
- Orinda
- Pebble Beach
- Placer County
- San Bruno
- San Mateo County
- Santa Barbara County
- Santa Cruz
- Santa Cruz County
- Santa Rosa
- Stanislaus County
- **Stanton**
- **Torrance**
- West Sacramento

Ken Huisman's Resume

märker geospatial llc

Ken brings more than 25 years of experience in the pavement and infrastructure management consulting industry. Over the course of Ken's career, he has provided many aspects of infrastructure management to government agencies across North America. During this time, Ken has supervised the creation of large and complex public pavement infrastructure and Geographical Information Systems (GIS) databases for many municipal, state, and federal projects.

Throughout Ken's career, he has developed an extensive portfolio in providing Pavement Management Program (PMP) services and is proficient with most off the shelf pavement management programs 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:

- ✓ Participate in the Federal Highway Administration (FHWA) on the Long term Pavement Performance (LTPP) program
- ✓ Served and helped over 220+ local government public works agencies
- ✓ Aided ten (10) state and provincial governments on pavement management projects
- ✓ Involved with some of the earlier high-speed pavement profiling equipment provided in the industry
- ✓ Led the Jefferson Parish, Louisiana Public Works department to a confirmed settlement of $100,000,000 with FEMA over funding of repairs for roads flooded during Hurricane Katrina.

Ken has provided valued service to many government agencies throughout North America including:

Cities and Counties

- ✓ City of Anaheim, CA
- ✓ City of Auburn, WA
- ✓ City of Augusta, GA
- ✓ City of Austin, TX
- ✓ City of Bend, OR
- ✓ City of Beverly Hills, CA
- ✓ City of Calgary, CAN
- ✓ City of Cheyenne, WY
- ✓ City of Colorado Springs, CO
- ✓ City of Detroit, MI
- ✓ City of Fort Lauderdale, FL
- ✓ City of Fort Worth, TX
- ✓ City of Honolulu, HI
- ✓ City of Kansas City, KS
- ✓ City of Milwaukee, WI
- ✓ City of Napa, CA
- ✓ City of Newport Beach, CA
- ✓ City of Norfolk, VA
- ✓ City of Ottawa, CAN
- ✓ City of Pekin, IL
- ✓ City of Phoenix, AZ
- ✓ City of Pittsburg, PA
- ✓ City of Sacramento, CA
- ✓ City of Salem, OR
- ✓ City of San Diego, CA
- ✓ City of Topeka, KS
- ✓ City of Toronto, CAN
- ✓ City of Vancouver, CAN
- ✓ County of Adams, CO
- ✓ County of Clackamas, OR
- ✓ County of Clark, NV
- ✓ County of Columbia, GA
- ✓ County of Honolulu, HI
- ✓ County of Los Angeles, CA
- ✓ County of Maricopa, AZ
- ✓ County of Oakland, MI
- ✓ County of Onondaga, NY
- ✓ County of Orange, CA
- ✓ County of Rio Blanco, CO
- ✓ County of San Diego, CA
- ✓ County of Santa Cruz, CA
- ✓ County of Weld, CO

States and Provinces

- ✓ Arizona DOT
- ✓ Alberta Transportation, Canada
- ✓ BC Ministry of Transportation, CAN
- ✓ California DOT (CalTrans)
- ✓ New Jersey DOT
- ✓ New York DOT
- ✓ Ontario Ministry of Transportation, CAN
- ✓ Oregon DOT
- ✓ Saskatchewan Highways & Infrastructure, CAN
- ✓ Tennessee DOT

Ken is a graduate of the School of Engineering at Georgian College in Canada. He spent 17+ years of his career with Stantec Consulting working his way up to Senior Associate before founding Mission Geographic in 2007, now known as Marker Geospatial, a firm dedicated to providing public works users and decision makers with a variety of innovative and useful infrastructure asset management tools.

In summary, Ken's experience with various operation management software technologies together with data collection and GIS mapping services—such as infrastructure asset inventories, condition assessments, GIS field infrastructure mapping, and 3D reality capture using LiDAR, has made him a great resource for all of the clients that he works with.

Appendix B – Sample QC Plan

The subsequent pages contain a sample QC Plan for the City's reference.

NCE

Collaboration. Commitment. Confidence.℠

PAVEMENT MANAGEMENT SYSTEM
QC PLAN

2016/2017

CITY OF LAKE FOREST

Fountain Valley, CA
9550 Warner Ave., Suite 370
Fountain Valley, CA 92708

www.ncenet.com

Engineering & Environmental Services

TABLE OF CONTENTS

1. Introduction

When performing data collection in any field, the need for quality control is paramount. This need for quality data is essential for accurate planning, analysis and design. NCE's "Quality Assurance Management Plan" (QAMP) affirms that:

> *"NCE is dedicated to achieving technical and management excellence and to delivering professional engineering and environmental services that meet or exceed our clients' needs. NCE's Quality Control (QC) Program is designed to achieve these goals. This QA Management Plan (QAMP) describes NCE's QA Program, which is based on four principles: client satisfaction, employee participation, problem prevention, and continuous quality improvements."*

NCE's QAMP establishes minimum quality standards for performance and procedures for assuring that our clients receive quality service. It requires the participation of employees at every level. It encourages project managers and technical staff to take pride in their work and responsibility for ensuring that the work is done correctly the first time. The program is designed to reduce the incidence of problems related to quality and results in implementation, where necessary, of corrective actions and modification of work procedures to minimize the incidence of future problems.

NCE has also prepared detailed and specific Quality Control Plans for projects, and the most notable example is for the **Long Term Pavement Performance (LTPP) – Western Regional Support Contract** for the Federal Highway Administration. This is a 150 page document that covers data collection on highways, including deflection, profile, pavement distresses, traffic, maintenance and rehabilitation history, materials testing and sampling as well as a document control.

1.1. Objectives

This document constitutes a formal Quality Control Plan (QCP) for the City of Lake Forest. The focus is on data collection issues as part of the pavement management update.

Specifically, it is intended for the 2016/2017 Pavement Management Update. The focus is on the collection of network-level pavement distress data (defined by NCHRP Synthesis 401 *Quality Management of Pavement Data Collection,* as "Network-level data collection involves collection of large quantities of pavement condition data, which is often converted to individual condition indices or aggregated into composite condition indices.")

1.2. Structure

The following components are addressed in this QCP:

- Condition inspection procedures used
- Accuracy required for data collection
- Inspector qualifications and experience
- Safety

2. Quality Control Plan

2.1. Condition Inspection Procedures

The governing document in performing condition inspections for the City of Lake Forest is ASTM D6433-11 *"Standard Practice for Roads and Parking Lots Pavement Condition Index (PCI) Surveys."* Both asphalt concrete (AC) and Portland cement concrete (PCC) pavements are included in this protocol. The following distresses are collected for each pavement type.

Asphalt Concrete (AC) Pavements

1. Alligator (fatigue) cracking
2. Bleeding
3. Block cracking
4. Bumps and sags
5. Corrugation
6. Depression
7. Edge cracking
8. Joint reflection cracking
9. Lane/Shoulder drop off
10. Longitudinal and transverse cracking
11. Patching and utility cut patching
12. Polished aggregate
13. Potholes
14. Railroad crossing
15. Rutting
16. Shoving
17. Slippage cracking
18. Swell
19. Weathering
20. Raveling

Portland Cement Concrete (Jointed)

1. Blowup/Buckling
2. Corner breaks
3. Divided slab
4. Durability ("D") cracking
5. Faulting
6. Joint seal damage
7. Lane/shoulder drop off
8. Linear cracking
9. Patching (large) and utility cuts
10. Patching (small)
11. Polished aggregate
12. Popouts
13. Pumping
14. Punchout
15. Railroad crossing
16. Scaling, map cracking and crazing
17. Shrinkage cracks
18. Spalling (corner)
19. Spalling (joint)

Any exceptions to the above procedures will be discussed with the City before any inspections are performed. These are usually related to distresses or situations that are not covered in the manuals. Examples include slippage cracks, roller check marks or edge cracking on streets with no curbs and gutters. Others include the use of seals or open-graded asphalt concrete mixes. Any modifications will be documented and submitted to the City for approval.

All distress or condition inspections are performed as semi-automated inspections, and the entire pavement is inspected. Field crews are typically composed of a two-person crew traveling in a van. Crew will collect and record visual distresses using equipment installed in the van.

The data will be summarized into sample units and entered into the StreetSaver database. The size of the sample unit will be 2,500± 1,000 square feet as per ASTM D6433 protocols. In addition, the sample units will match the existing management sections set up in the StreetSaver database.

Before the actual inspection work begins the NCE team will perform two Field QC Steps. These are outlined as follows:

Step 1: Calibration

The first steps in this process is having NCE's Project Manager, Marker Geospatial's field manager and a field technician meet in the field, and drive a few roads and review some of the variety of pavement conditions that exist in the City of Lake Forest. This is a valuable exercise to calibrate or synchronize the team's view of the various distresses and ensure a consistent product.

Step 2: Quality Control

The QC team conducted an independent review of the pavement condition data collected on the County's and Cities' pavement networks. Since semi-automated distress data collection is different from the StreetSaver's walking protocols, this is required to ensure that the pavement data collected is consistent with those protocols.

Up to 40 pavement sites were selected for quality control purposes. They included a range of:

- Pavement Types (AC or PCC)
- Functional Classifications
- Pavement condition or age

The sites will be located in:

- City of Lake Forest – 10 sites
- City of Dana Point – 10 sites
- County of Orange – 20 sites

An independent NCE technician will be selecting the 40 sites and performing a detailed walking inspection. The semi-automated team will then perform a blind test on these sites (they will not know the location of these sites) and the results compared.

Acceptability Criteria

The types and severities of the distresses must be the same and quantities within ±10% of each other. If corrections are required on more than 10% of the calibration sites, then an additional four sites will be selected and compared. This will continue until more than 95% of the calibration sites meet the acceptability criteria.

2.2. Accuracy Required For Data Collection

The accuracy required for data collection has two components, both of which are further described in the following paragraphs.

- Re-inspections
- PCI comparisons with past inspections

2.2.1 Re-Inspection "Check"

At least five percent of all inspections are randomly re-inspected by other team members. A different inspector will review these sites and determine the revised pavement distress measurements. If the initial inspection is determined to be inaccurate, the original inspector is given refresher training before being allowed to continue with any further inspections. Should the data be inaccurate for a certain day, all the data for that day will be re-inspected following refresher training to ensure accuracy.

Acceptability Criteria

At the time of re-inspection, the actual distresses will be re-inspected and verified, and any corrections made, if necessary. Distress types and severities must be the same and re-measured quantities within ±10% of the original measured quantity.

If corrections are required on more than 10% of the re-inspected sample units, then an additional 5% will be re-inspected. This will continue until all more than 95% of the re-inspected sections meet the acceptability criteria.

2.2.2 PCI Comparison with Past Inspections

As another level of quality control, the new PCIs are compared with the previous PCIs. If they differ by more than ±10 PCI points, these sections are automatically flagged for further investigation.

If PCI Increases 10 Points:

The section is investigated to see if a maintenance and rehabilitation event has occurred since the last inspection, but which has not been recorded. This can only be resolved with feedback from the City. Typically, it may include activities such as:

- Crack sealing activities – changes medium or high severity cracking to low severity
- Patching activities - alligator cracking that has been removed and patched, so that the resultant PCI is increased.
- Surface seals
- Overlay

Therefore, an up-to-date maintenance and rehabilitation history file in the StreetSaver database is desirable, both for historical accuracy as well as to provide additional quality control.

If PCI –Decreases 10 Points

The section is checked to see if the average deterioration rate (usually 3 to 4 points per year) is exceeded. If the drop in PCI is within the range of what is acceptable, no further action is required. If the drop is more than the acceptable range, a re-inspection will be performed. The default performance curves in the pavement management software form the basis for what is acceptable.

2.3. Inspectors' Qualifications and Experience

All NCE's inspectors are required to attend formal training on condition distress inspections. For example, any of NCE's inspectors working on the LTPP project are required to attend a week-long training workshop every year to maintain their certifications. The Regional Transportation Commission (RTC) of Washoe County

requires inspectors to be calibrated prior to performing any work using the ASTM D6433 protocols (also known as the pavement management inspections).

For pavement management (or ASTM D6433) inspections, NCE's technicians underwent the OCTA technician certification exercise held in December 2015 and the internal training during May 2016.

Similarly, in agencies that use the StreetSaver system, NCE's inspectors attend the distress training conducted by the Metropolitan Transportation Commission (MTC). After the formal training, they work with an experienced inspector before they are allowed to work on their own. Within the first month of working on their own, up to 20% of their work is checked weekly. Any necessary corrections are made immediately.

Finally, NCE conducts a one-day training and calibration workshop for all NCE staff involved with data collection. This is conducted once a year.

Inspector Name	Date of ASTM D-6433 Training	Training Conducted by:
Narut Leehacharoenkul	May 17, 2016	Lisa K. Senn
Franc Escobedo	November 1, 2015	Lisa K. Senn
David Bivins	May 17, 2016	Lisa K. Senn
Meiling Cai	May 17, 2016	Lisa K. Senn

Resumes of technicians utilized on this project are included in Appendix A.

3. Safety Procedures

NCE administers a health and safety program in compliance with the Nevada Occupational Safety and Health Act (Section 618.383) and Cal OSHA Title VIII, Section 3203. The program is documented in NCE's *Workplace Safety Program Manual.*

Generally, the safety procedures include:

- Inspectors to wear a Class 2 safety vest at all times;
- Flashing beacon on all vehicles utilized for inspections; and
- Stopped vehicles to be parked at locations away from moving traffic (e.g. nearby parking, shoulders etc.).

On streets where there is a high volume of traffic or high speeds, additional measures may be necessary, such as:

- Inspections to occur during off-peak periods or on weekends;
- Additional inspector to watch out for traffic; and
- Traffic flaggers in extreme cases.

In extreme cases where it is not possible to walk on the pavement surface, inspections will be performed from sidewalks or raised medians. However, this is extremely rare for city or county roads/streets; this is most often encountered on state highways, and lane closures are the most likely option at this point.

All NCE inspectors are required to annually update their online safety programs as administered by “Click Safety”. Class Taken are:

- C2 Cal PPE
- C2 Workzone Traffic Control
- C2 Workzone Traffic Safety Tips
- G2 Cal/OSHA Heat Illness

Appendix A

Resumes of Field Inspectors

Narut Leehacharoenkul, EIT
Staff Engineer

Mr. Leehacharoenkul has engineering project experience including pavement management budget analyses using both MicroPAVER and StreetSaver software, pavement condition survey QA/QC inspection, asset management using EarthMine, and AutoCAD Civil 3D. Narut interned in Bangkok in the summer of 2012 assisting the field engineer document various phases of construction. Mr. Leehacharoenkul worked at the City of Stanton as an engineering intern from February to August 2013.

Pavement Management

Mr. Leehacharoenkul is responsible for updating the analysis and quality control of pavement distress data, updating maintenance and rehabilitation decision trees and the treatment unit costs, and the development of budget scenarios and summary reports. His clients include the following cities and counties:

Buena Park	Highland	San Clemente
Camarillo	La Habra	San Gabriel
Commerce	Lake Forest	Santa Barbara County
Corona	Mission Viejo	Seal Beach
Dana Point	Manhattan Beach	Stanton
Diamond Bar	Orange County	Thousand Oaks
Fullerton		Torrance

Representative Projects

FY 2015 Measure M Street Resurfacing and Reconstruction | ***Staff Engineer***
Berkeley, California

The project included the pavement Reconstruction and Resurfacing of over 39 streets or over 6 miles of arterials, collector, and residential streets. Mr. Leehacharoenkul prepared civil sheet design and layout for the 15 resurfacing streets as well as the design of several pages of curb ramp, striping, and construction details. Additional responsibilities included collecting field data such as ADA curb ramps, base repairs, and existing conditions of the streets.

County of Orange | ***GIS Specialist***
Orange County, California

Mr. Leehacharoenkul worked closely with Cartegraph who is contracted data collection for roads and non-pavement asset collection. His primary job was to catalog assets for the City of Lake Forest from EarthMine imagery to ArcMap 10.1. The assets included curb & gutter, striping, storm drains, street lights, traffic signals and curb pain. In addition, he was the lead communicating with the subconsultant and meeting with City contacts and setting up EarthMine viewer for use with ArcMap.

Education
B.S. Civil Engineering (Transportation System Engineering), 2012
University of California – Irvine
Women's Transportation Seminar 2012

Registrations and Certifications
Engineer in Training–CA #144653

Affiliations
ASCE
UCI Thai Club President 2010 - 2012

Joined NCE
2013

Total Years of Experience
2 Years

Mission Viejo | ***Staff Engineer***
Mission Viejo, California

The City switched from MicroPAVER software to MTC's StreetSaver software in 2014. Mr. Leehacharoenkul assisted with the conversion and verified the accuracy of the data. As part of the project, the maintenance and rehabilitation (M&R) decision tree was updated with new treatments and unit costs re-evaluated prior to performing any budgetary analyses.
In addition, the City's projected 20-year pavement budget was analyzed and a 7-year work plan prepared. Numerous custom reports were prepared for the City, and finally, an executive summary was submitted to OCTA for compliance with the Measure M program.

Stanton | ***Engineering Intern***
Stanton, California

Mr. Leehacharoenkul prepared documents for Measure M2 Eligibility submittal package to receive funding from OCTA. Collaborated with the Finance Department on completing Mitigation Fee Program. Organized a 7-year Capital Project Improvements Plan. Helped to develop an Evacuation Plans for the City Hall and City Corporate Yard. Updated and reorganized the City's record retention data. He is also very familiar with the City's and MUTCD standards. He calculated and updated the City's pavement PCI level as part of the Pavement Management Program.

Italian-Thai Development PLC | ***Engineering Intern***
Bangkok Thailand

Bangkok Bridges Reparation Project – Renovating, rebuilding and reinforcing 28 bridges around the outskirts of Bangkok. Assisted in construction drawings and maps. Conducted field surveys, tabulated and plotted field data. Materials and workmanship inspection. Compiled reports, cost calculations, material inventory, prepared presentation for project manager.

Collaboration. Commitment. Confidence.℠

Franc Escobedo
Engineering Field Technician

Mr. Franc Escobedo has over 15 years of experience as a pavement management technician for NCE. He has performed numerous pavement condition inspections throughout California, Idaho, and Washington. He experience includes distress collection across various Pavement Management Systems including the Metropolitan Transportation Commission StreetSaver, MicroPAVER, Cartegraph, and Hansen systems.

Additionally, Mr. Escobedo has completed both the OCTA MicroPAVER and MTC "Distress Identification" courses for both Asphalt Concrete and Portland Cement Pavements and now assists with the training of agency staff on both courses.

Mr. Escobedo performs all activities relating to pavement data collection using hardcopy forms or tablets. As part of the quality control process, he performs cross-checks of data in the PMS database. He also regularly performs quality control checks of field collected data and pavement maintenance history to ensure that PMS databases are accurate and up-to-date. During this process, he also generates detailed reports, which are necessary to perform his cross-checks of the collected data.

His field experience and expertise is an added benefit to agencies during field training. Having performed data collection for agencies all over the State of California, there isn't a lot he hasn't seen. Listed below are a collection of agencies for which Mr. Escobedo has performed condition inspections, all together they easily account for over 6,000 centerline miles of roads and streets.

Education
Computer Operations Program
Computer Learning Center, Los Angeles, CA, 1983-84
Network Engineering & Administrative Program
Computer Learning Center, Anaheim, CA, 1997
Certified Network Administration
Computer Learning Center, Anaheim, CA 1997

Representative Projects

Pavement Management Inspections | *Engineering Field Technician*

Ada County, Idaho	Agoura Hills	Anaheim	Antioch
Bell	Buena Park	Camarillo	Chula Vista
Corona	Cudahy	Dana Point	Davis
Fairfield	Fullerton	Humboldt County	Inyo County
La Habra	Lake Forest	Lemon Grove	Marin County
Martinez	Mendocino County	Milpitas	Mission Viejo
Mono County	Newark	Orange County	San Dimas
San Ramon	Santa Maria	Seal Beach	Stanislaus County
Stanton	Thousand Oaks	Torrance	Tulare
Tuolumne County	Tustin	Vernon	Vista
Walnut Creek	West Covina	West Sacramento	

Projects included various forms of inspections for pavement distress data collection, this may have included walking, windshield, and/or semi-automated.

Meiling Cai
Field Technician

Ms. Cai has worked with NCE upon her graduation from the University of California-Irvine. She has performed pavement condition inspections throughout California and Idaho. Her experience includes distress collection across various pavement management systems.

Representative Projects

Pavement Management System and Update | ***Field Technician***
City of Whittier, California

NCE provided the PMP implementation of 195 centerline miles. NCE performed the following tasks: Conversion of old pavement inventory into the StreetSaver® database; review of inventory data; performed condition inspections; PCI calculation; import of M&R history records; review of M&R strategies and costs; determine the funding needs of the road network; completion of multiple funding scenarios, linkage of the database to GIS, City staff training, and provided technical support.

Pavement Management Plan Updates | ***Field Technician***
City of La Habra, California

NCE is providing a comprehensive pavement condition inspection of the City's streets and alleys in order to prepare the 2015 update report to the Orange County Transportation Authority. Updates include the Pavement Condition Index, treatment, unit costs, and cost of all segments of the City's streets.

Pavement Management Plan Updates | ***Field Technician***
City of Manhattan Beach, California

NCE updated the City's Pavement Management Program including inspection/evaluation of approximately 120 centerline miles of paved streets, review and recommendation of revisions to the current pavement management strategies and costs as well as the preparation of a final Pavement Management Program report.

Pavement Management Plan Updates | ***Field Technician***
City of El Centro, California

NCE developed the City's Pavement Management System including detailed inspection and evaluation of the City's streets and recommendations for maintenance methodologies and pavement treatment options.

Pavement Management Updates | ***Field Technician***
City of Whittier, California

NCE is converting the City's old pavement management database to StreetSaver™ software. The City has approximately 210 centerline miles of streets comprised of both asphalt concrete and portland cement concrete pavements. NCE recently performed condition inspections as per ASTM D6433 distress protocols.

Education
B.S., Civil Engineering, 2014
University of California-Irvine

Joined NCE
2015

Total Years of Experience
1 year

David Bivins
Senior Engineering Technician

Mr. Bivins has over 15 years of experience as a pavement management technician. As a senior technician, his experience extends beyond data collection for pavement distresses. Mr. Bivins is one of NCE's most experienced distress collectors and a primary choice for working with and training of our clients in field data collection activities.

Mr. Bivins performs all functions relating to data collection using paper forms or a tablet. As part of the quality control process, he performs cross-checks of data in the PMS database. He has performed quality control checks of field collected data and pavement maintenance history to ensure that PMS databases are accurate and up-to-date. During this process, Mr. Bivins also generates detailed reports, which are needed to help perform his cross-checks of the collected data.

His field experience and expertise is an added benefit to agencies during field training. Having performed data collection for agencies all over the State of California, Mr. Bivins has a depth of experience related to pavement types and conditions from performing condition surveys on more than 15,000 centerline miles of roads and streets. In addition, Mr. Bivins is proficient and certified in the two most popular distress identification procedures – PAVER and StreetSaver. He attends annual in-house training and assists in training local agencies on distress identification and collection procedures.

Education
Civil Engineering Courses
San Francisco State University, 1994
AutoCAD Advanced Course
CAD Masters, Walnut Creek, CA, 1997

Registrations and Certifications
MTC StreetSaver Rater Certification Program (expires September 2017)

Joined NCE
2011

Total Years of Experience
15 years

Representative Projects

Pavement Management

Pavement Management System Updates | *Senior Field Technician*
Various Cities and Counties, CA

Projects included various forms of surveys for pavement distress data collection, this may have included walking, windshield, and/or semi-automated.

- Ada County, ID
- Alameda County
- Albany
- Buena Park
- Campbell
- Chula Vista
- Citrus Heights
- Danville
- Davis
- East Bay Regional Park District
- Elk Grove
- Fairfield
- Folsom
- Fremont
- Fullerton
- Hayward
- Humboldt County
- Inyo County
- Lafayette
- Lake County
- Los Gatos
- Mammoth Lakes
- Marin County
- Mendocino County
- Mission Viejo
- Modesto
- Newark
- Orinda
- Pebble Beach
- Placer County
- San Bruno
- San Mateo County
- Santa Barbara County
- Santa Cruz
- Santa Cruz County
- Santa Rosa
- Stanislaus County
- Stanton
- Torrance
- West Sacramento

Appendix C – Sample Work

The subsequent pages contain a redacted sample report from the City of Buena Park for the City's reference.

City of Buena Park
6650 Beach Blvd.,Buena Park, CA 90621

Final Report

2016 Pavement Management Program Update

June 2016

NCE
Fountain Valley, CA
9550 Warner Avenue, Suite 370
Fountain Valley, CA 92708
Tel: (714) 848-8897

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City of Buena Park
Pavement Management Plan
2016 Update

Final Report

Submitted to:

City of Buena Park
Public Works Department
6650 Beach Boulevard
Buena Park, CA 90622

June 2016

Table of Contents

List of Tables

List of Figures

EXECUTIVE SUMMARY

The City of Buena Park (City) performs biennial updates of its Pavement Management Plan (PMP) to assist policy makers in making decisions for road maintenance as well as complying with the Orange County Transportation Authority (OCTA)'s Measure M2 Program. This report summarizes findings from the 2016 PMP Update.

The City is responsible for the maintenance and repair of approximately 191.3 centerline miles of pavements, which includes 61 miles of Master Plan of Arterial Highways (MPAH), and 130.3 miles of local roads with a total replacement cost of $301.6 million. The City in the past used the PAVER Pavement Management System (PMS) software, but converted to the StreetSaver™ software in 2016. The MPAH roads were the only roads inspected in this update.

The City monitors pavement conditions by collecting pavement distresses in compliance with ASTM D6433-11[1] and as outlined by OCTA in the "Countywide Pavement Management Plan Guidelines", Chapter 2[2]. Table 1 below summarizes the network's Pavement Condition Index (PCI) breakdown by functional classification.

Table 1: Network PCI Breakdown

Functional Class	Pavement Area (sf)	Centerline Mileage	Weighted Average PCI
MPAH	11,383,315	61.0	78
Local	22,639,854	130.3	79
Total	**34,023,169**	**191.3**	**79**

The current weighted average (by area) PCI[3] of the City of Buena Park is 79. Overall, 73% of the City's road network area is in the "Very Good" and "Good" condition categories, approximately 26% of the roads are in the "Fair" and "Poor" condition categories, with 1% in the "Very Poor" category.

Table 2 is a summary of the current network condition by condition category.

[1] ASTM. "ASTM D6433-11." Standard Practice for Roads and Parking Lots Pavement Condition Index Inspections
[2] OCTA. "Pavement Management Plan Guidelines." *Countywide Pavement Management Plan Guidelines Manual*. January 2016
[3] The weighted average PCI is a result of multiplying the area of each road section by the PCI of that section, totaling all sections together and then dividing by the total of the network areas or functional classification.

Table 2: Current Pavement Network Condition

Condition Category	PCI Range	Network	Area of Pavement (sf)		Centerline Mileage of Network		
			FC	Percentage	FC	Total	Percentage
Very Good	86-100	MPAH	4,347,725	12.8%	23.7	34.8	18.2%
		Local	2,048,258	6.0%	11.0		
Good	75-85	MPAH	2,416,381	7.1%	13.1	108.2	56.5%
		Local	16,010,279	47.1%	95.1		
Fair	60-74	MPAH	3,357,921	9.9%	17.6	36.6	19.1%
		Local	3,587,353	10.5%	18.9		
Poor	41-59	MPAH	1,063,568	3.1%	5.6	9.9	5.2%
		Local	848,708	2.5%	4.4		
Very Poor	0-40	MPAH	197,720	0.6%	1.0	1.9	1.0%
		Local	145,256	0.4%	0.8		
		Total	**34,023,169**	**100.0%**	**191.3**	**191.3**	**100.0%**

Measure M2 grant funding for arterial, intersection, and freeway/arterial improvements include an incentive for successful implementation of a PMP. The incentive is a 10% reduction in local matching fund requirements if either of the following conditions apply:

a) Show measurable improvement of paved road conditions during the previous reporting period defined as an overall weighted (by area) average system improvement of one PCI point with no reduction in the overall weighted (by area) average PCI in the MPAH or local road categories;

or -

b) Have road pavement conditions for the overall network during the previous reporting period within the highest 20% of the scale for road pavement conditions in conformance with OCTA Ordinance No.3, defined as a PCI of 75 or higher.

The City meets requirement (b) noted in the preceding paragraph by maintaining the average network PCI above 75 as required by OCTA. The City will remain eligible for the 10% reduction in local matching fund requirement.

The following four budget scenarios were performed as part of this report.

Scenario 1: Current Funding Level ($18.30 M) – The projected current funding level for the next seven years is $18.30 million which is significantly lower than the $28.61 showed in the 2014 report. This funding scenario results in a five-point drop in the network PCI from 79 to 74 by the end of the analysis period. By fiscal year 2022/23, the deferred maintenance will increase from $22.13 million to $38.71 million.

Scenario 2: Maintain Network PCI at 75 ($21.25 M) – This scenario shows that it will take $21.25 million to maintain the PCI at 75, which will keep the City eligible for Measure M2 funding. The deferred maintenance will increase from $22.13 million to $40.94 million.

Scenario 3: Maintain Current Network PCI at 79 ($31.53 M) – To maintain the current network PCI of 79, the City will need to spend $31.53 million over the next seven years. The deferred maintenance will decrease to $20.27 million.

Scenario 4: Increase Network PCI by 1 Point ($35.05 M) – A total budget of $35.05 million is needed to increase the network PCI to 80 and maintain it at that level over the next seven years. The deferred maintenance will decrease to $17.75 million over the analysis period.

CONCLUSION

The City has a road system that is in overall “Good” condition with 73% of the network in “Very Good” and “Good” condition categories and a network average PCI of 79. Approximately 26% of the City’s road network currently falls into “Fair” and “Poor” conditions, and 1% in the “Very Poor” category. Based on the pavement condition, the City has met OCTA’s requirement for receiving a 10% reduction in the local matching fund by maintaining the overall network PCI above 75.

The estimated annual budget is $18.30 million over the next seven years which is expected to decrease the network PCI to 74. This would mean the City would **not** be eligible for future Measure M2 funding by FY 2021/22, when the PCI drops below 75.

RECOMMENDATIONS

Therefore, NCE recommends that the City consider the following:

- Increase current funding level to a minimum of $21.25 million over the next seven years, as recommended in Scenario 2, in order to maintain a PCI of 75 that would allow the City to remain eligible for Measure M2 funding.

- Monitor construction costs and develop strategies to capitalize on any cost savings that may occur.

- Update the Pavement Management Plan as required by OCTA to ensure that Measure M2 funds are not jeopardized.

- Review and update the maintenance and rehabilitation (M&R) decision tree and the associated unit costs to reflect current construction methods as well as to keep the budget analysis results accurate. At the same time, all M&R construction activities should be updated in the City's database biennially.

- Consider rehabilitation alternatives that "stretch the maintenance dollar" such as cold-in-place recycling (CIR), full depth reclamation (FDR), or micro-surfacing.

BACKGROUND

The City is responsible for the maintenance and repair of approximately 191.3 centerline miles of pavements, which includes 61 miles of MPAH, and 130.3 miles of local roads with a total replacement cost of $301.6 million. The City used PAVER Pavement Management System (PMS) software in the past, but converted to StreetSaver™ in 2016. This update collected pavement distresses using the ASTM D6433-11[1] method as described by OCTA in the "Countywide Pavement Management Plan Guidelines", Chapter 2[2]. The MPAH roads were the only roads inspected in this update.

A Pavement Management Plan (PMP) is a tool designed to assist cities and counties to answer typical questions such as:

- What does the City's pavement network consist of? How many miles of roads are in a jurisdiction? What is the total pavement area of these roads?
- What is the existing condition of the pavement network? Is this an acceptable level for the City? If not, what is an acceptable level? How much additional funding is needed to achieve an acceptable level? How much is needed to maintain it at this level?
- How will the condition of the pavement network respond over time under existing funding levels?
- What maintenance strategies are needed to maintain or improve current pavement conditions?
- What maintenance activities or treatments have occurred in the past on any given road?
- What impact would either additional funding, or a decrease in funding, have on the condition of the overall pavement network?
- What are the maintenance priorities under different budget constraints?

PURPOSE

The biennial update of the PMP is an eligibility requirement of the Measure M2 plan, as administered by OCTA. Appendix A of this report contains the Agency Submittal Checklist which indicates the location of required information. Appendix B contains the PMP certification required by OCTA and Appendix C contains the Quality Assurance/Quality Control (QA/QC) Plan developed by NCE for this project.

Prior to the 2016 update, the City converted to the StreetSaver™ software to better meet the goals and objectives established by the City. This update included an inspection of the City's MPAH network, and updating the database with M&R activities that occurred in the past two years (see Appendix E.) In addition, pavement treatment policies and unit costs were reviewed and updated.

The purpose of this report is to assist policy makers in utilizing the results of the StreetSaver™ software. Specifically, this report links the PMP recommended repair plan costs to the City's budget alternatives to improve overall M&R strategies of the City's MPAH and local roads. It also maximizes the return from expenditures by:

- Implementing a multi-year road rehabilitation and maintenance plan;
- Developing a preventive maintenance plan; and
- Selecting the most cost effective repairs.

This report assists the City with identifying M&R priorities specific to the City's needs. It examines the overall condition of the road network and highlights options for improving the current network-level PCI. These options are developed by conducting "what-if" analyses using the StreetSaver™ software. By varying the budget amounts available for pavement maintenance and repair, the impact of different funding strategies on the City's roads over the next seven years was determined.

NETWORK PAVEMENT CONDITION

A pavement condition inspection of the City's pavement MPAH roads was conducted in January 2016 using the ASTM D6433-11[1] protocols. The City was not required to inspect the local roads this year since they were last inspected in 2011. After the inspections were completed, the pavement condition data was entered into the StreetSaver™ database and a PCI calculated for each road section.

The PCI is a measurement of pavement grade or condition that ranges from 0 to 100. A newly constructed or rehabilitated road should have a PCI of 100, while a failed road has a PCI of 40 or less. Table 3 below shows the PCI range for each of condition category, which is outlined by OCTA in the "Countrywide Pavement Management Plan Guidelines", Chapter 2.3[2]. Figure 1 includes photos that illustrate the different PCIs.

Table 3: Pavement Condition Categories by PCI

Condition Category	PCI Range
Very Good	86-100
Good	75-85
Fair	60-74
Poor	41-59
Very Poor	0-40

The City's overall PCI for their pavement network is 79, which is in the "Good" condition category. Table 4 summarizes the condition of the pavement network in the City and shows that the MPAH roads cover approximately 33% of the network area, with the remainder composed of local roads. Detailed section inventory and PCI reports are included in Appendix D.

Figure 1: Photos of Pavements with Different PCIs

Table 4: Pavement Network Summary

Functional Class	Centerline Miles	# of Sections	Pavement Area (sf)	% of Total Pavement Area	Weighted Average PCI
MPAH	61.0	262	11,383,315	33%	78
Local	130.3	801	22,639,854	67%	79
Total	**191.3**	**1,063**	**34,023,169**	**100%**	**79**

Table 5 provides a more detailed breakdown of the network by condition category. As can be seen, a majority, 73%, of the network is in the “Very Good” to “Good” condition, 26% in the “Fair” to “Poor” condition, and with 1% in “Very Poor” condition.

Table 5: Pavement Condition Summary

Condition Category	PCI Range	Network	Area of Pavement (sf)		Centerline Mileage of Network		
			FC	Percentage	FC	Total	Percentage
Very Good	86-100	MPAH	4,347,725	12.8%	23.7	34.8	18.2%
		Local	2,048,258	6.0%	11.0		
Good	75-85	MPAH	2,416,381	7.1%	13.1	108.2	56.5%
		Local	16,010,279	47.1%	95.1		
Fair	60-74	MPAH	3,357,921	9.9%	17.6	36.6	19.1%
		Local	3,587,353	10.5%	18.9		
Poor	41-59	MPAH	1,063,568	3.1%	5.6	9.9	5.2%
		Local	848,708	2.5%	4.4		
Very Poor	0-40	MPAH	197,720	0.6%	1.0	1.9	1.0%
		Local	145,256	0.4%	0.8		
		Total	**34,023,169**	**100.0%**	**191.3**	**191.3**	**100.0%**

A graphical representation of the percent area for each functional classification breakdown by PCI ranges is shown below in Figure 2.

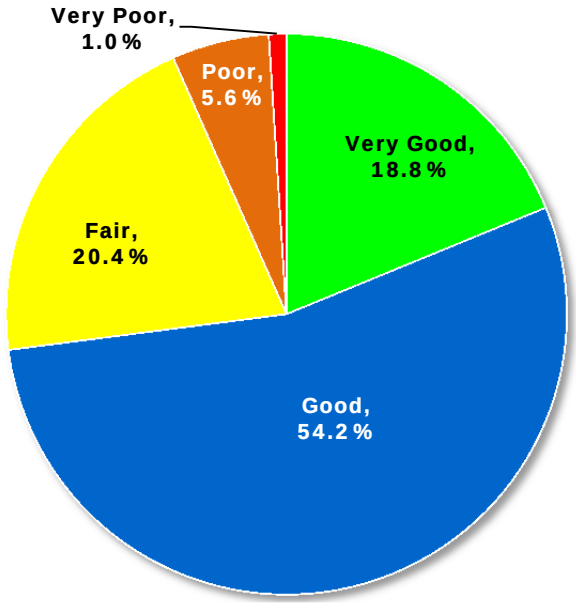

Figure 2: Network Condition Breakdown (Percent by Area)

Table 6 shows an eight point drop in the network PCI from 87 in 2014 to 79, which is significant. The current funding projections indicate that the annual budget has dropped from approximately $4 million to $1.1 in 2016. This reduction in the annual budget occurred since the last update in 2014. The result of the reduction saw the overall PCI's. Note too that the local roads have not been inspected since 2011, and the prediction models in StreetSaver are based on the last inspection date. To comply with OCTA's requirements, both MPAH and local networks will need to be re-inspected in 2018.

Table 6: Historical PCI

Year	2012	2014	2016
PCI	87*	87*	79**

* PCI report using PAVER
** PCI report using StreetSaver™

MEASURE M2 COMPLIANCE

The Measure M Regional Capacity Plan - which provides Measure M2 grant funding for arterial, intersection, and freeway/arterial improvements, includes an incentive for successful implementation of a PMP. The incentive is a 10% reduction in local matching fund requirements if either of the following conditions apply:

a) Show measurable improvement of paved road conditions during the previous reporting period defined as an overall weighted (by area) average system improvement of one PCI point with no reduction in the overall weighted (by area) average PCI in the MPAH or local road categories;

or -

b) Have road pavement conditions for the overall network during the previous reporting period within the highest 20% of the scale for road pavement conditions in conformance with OCTA Ordinance No.3, defined as a PCI of 75 or higher.

The City's weighted (by area) PCI rating meets requirements (b) noted in the preceding paragraph with the average network PCI of 79, four points above the 75 required by OCTA. The City will remain eligible for the 10% reduction in local matching fund requirements for the next biennial cycle.

COST TO REPAIR ROADS

The cost to repair and maintain a road depends on its current PCI and functional classification. StreetSaver™ has a unique decision tree that allows different repair types and costs to be assigned to each combination of the functional classification, surface type and condition category.

Based on the City's M&R decision tree, the road sections with PCIs in the "Very Good" condition category do not require maintenance treatments. Approximately 18.8% of the entire network is in this category. For roads in the "Good" category, it costs very little to apply preventive maintenance treatments such as crack seal and rubberized emulsion aggregate slurry (REAS), which can extend the life of a pavement by correcting minor faults and reducing further deterioration. Preventive maintenance treatments are typically applied to local roads before pavement deterioration has become severe and cost approximately $2.50 per square yard. Approximately 54.2% of the City's local roads would benefit from these relatively inexpensive, life-extending treatments.

Pavements in the "Fair" condition shows some form of distress or wear that require more than a life-extending treatment. At this point, a well-designed pavement will reach 75% of its life. Under this pavement condition, the road surface may require an asphalt rubber hot mix (ARHM) overlay or dig-out repairs (2 inches) prior to an ARHM overlay, which typically cost $18.15-20.25 per square yard for MPAH and $12.75-$14.70 per square yard for locals. Table 5 indicates that 20.4% of the City's road network falls into the "Fair" condition category.

After 75% of its life, pavement condition falls into the "Poor" category. The quality of the pavement has dropped by about 40%. Depending on the pavement condition, it may require dig-out repairs (4 inches) prior to an ARHM overlay, which costs $45.35 per square yard for MPAH and $35.25 per square yard for locals. For the 2016 update, about 5.6% of the network falls under the "Poor" condition.

The final PCI range is 0-40 or "Very Poor" condition. Pavements in this category are near the end of their service life and often exhibit severe forms of distress such as potholes, rutting and extensive cracking, etc. At this stage, reconstruction could be an option when budget allows. This treatment can be funded under the M2 competitive grant program. It costs $95.25 per square yard for MPAH and $72.00 per square yard for locals. Based on the information in Table 5, 1% of the City's road network falls into this PCI range.

Figure 3 demonstrates that pavement maintenance follows the old colloquial saying of "*pay now, or pay more later*." As can be seen, by allowing pavements to deteriorate, roads that once cost only $2.50 per square yard to seal may soon cost upwards of $95.25 per square yard for reconstruction.

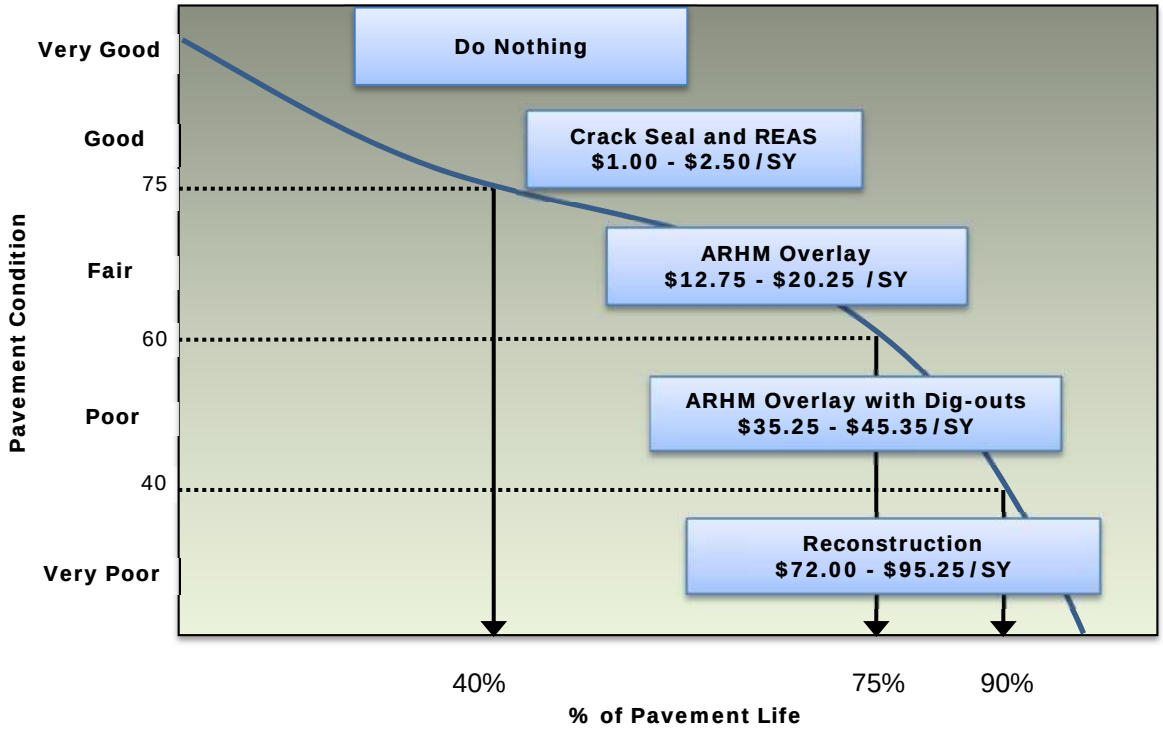

Figure 3: Cost to Maintain Pavement over Time

One of the key elements of a pavement management repair strategy is to keep roads in the "Good" to "Fair" categories from deteriorating. This is particularly true for roads in the "Fair" range, because they are at the point where pavement deterioration accelerates if left untreated.

The City's pavement maintenance strategies include seals, overlays and reconstruction. Since a large percentage of the pavements are in the "Good" condition, it is important to preserve them. Crack sealing, one of the least expensive treatments, can keep the moisture out of the pavements and prevent the aggregate base from premature failure. Life-extending surface seals, such as a REAS is a cost-effective treatment for keeping pavements in good condition.

BUDGET NEEDS

Based on the principle that it costs less to maintain roads in good condition than bad, the StreetSaver™ program strives to develop an M&R strategy that will improve the overall condition of the network to an optimal PCI level. The optimal PCI level is dependent upon the City's M&R policies as defined in the decision tree.

The first step in developing a cost-effective maintenance and rehabilitation strategy is to determine, assuming unlimited revenues, the maintenance "needs" of the network. The unconstrained budget needs module estimates maintenance needs over the next seven years will be approximately $47.85 million, most of which would be spent in the first year. If the City follows that strategy, the citywide average network PCI will increase to 84 by FY 2022/2023. If, however, no maintenance is applied over the next seven years, the roads will deteriorate, and the network PCI will drop to 67. Table 7 below shows the level of expenditures suggested, assuming an unconstrained budget.

Table 7: Summary of Results from an Unconstrained Needs Analysis

Fiscal Year	Network	16/17	17/18	18/19	19/20	20/21	21/22	22/23	Total
Budget Needs ($M)	**Network**	22.13	6.91	5.67	6.30	3.36	2.13	1.35	**47.85**
Rehabilitation ($M)	**MPAH**	10.06	5.21	3.21	3.80	0.83	1.96	1.25	26.32
	Local	8.39	1.57	2.11	2.39	2.43	0.04	0.00	16.93
Preventive Maintenance ($M)	**MPAH**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Local	3.68	0.13	0.35	0.11	0.10	0.13	0.10	4.60
PCI with Treatment	**MPAH**	88	87	86	86	85	84	83	N/A
	Local	89	87	87	87	86	85	84	N/A
	Network	**89**	**87**	**87**	**87**	**86**	**85**	**84**	N/A
PCI without Treatment	**Network**	**79**	**77**	**75**	**73**	**71**	**69**	**67**	N/A

Of the $47.85 million in needs shown in Table 7, $4.60 million (approximately 10%) is earmarked for preventive maintenance. $43.25 million or approximately 90% is allocated for the more costly rehabilitation treatments on the MPAH ($26.32 million) and local roads ($16.93 million). In addition, the first year requires expenditures of $22.13 million or 46% of the total needs.

The expenditures of this scenario reflect "front loading" of maintenance repairs as deferring treatments will cost more later. However, very few agencies are able to fund all maintenance treatments in the first year. Nonetheless, this analysis helps to define the M&R work required and unfunded backlog for the next step. The roads in "Poor" to "Very Poor" condition that require the more costly repairs will be among those selected in the first year. Once these treatments are completed, those roads may not require another treatment during the analysis period.

FUNDING FOR PAVEMENT MAINTENANCE

Currently, the City expects to receive a total of $18.30 million in the Capital Improvement Project (CIP) budget which is significantly lower than the $28.61 million projected from the 2014 update. Table 8 below shows the City's estimated pavement maintenance budget for the next seven years.

Table 8: Pavement Maintenance Budget for FY 2016/2017 to 2022/2023

Fiscal Year	16/17	17/18	18/19	19/20	20/21	21/22	22/23	Total
Estimated Budget ($M)	2.50	1.85	2.50	2.85	2.85	2.85	2.90	18.30

BUDGET SCENARIOS

Having determined the maintenance needs of the road network, the next step in developing a cost-effective M&R strategy is to conduct several "*what-if analyses*". Using the budget scenario module, the impacts of various budget "scenarios" can be evaluated. The StreetSaver™ program projects the effects of the different scenarios on PCI and deferred maintenance. By examining the effects on these indicators, the advantages and disadvantages of different funding levels and maintenance strategies become clear. The following scenarios were performed for this report.

Scenario 1: Current Funding Level ($18.30 M) – The projected current funding level for the next seven years is $18.30 million which is significantly lower than the $28.61 showed in the 2014 report. This funding scenario results in a five-point drop in the network PCI from 79 to 74 by the end of the analysis period. By fiscal year 2022/23, the deferred maintenance will increase from $22.13 million to $38.71 million. Appendix F shows the projected PCI and Appendix G shows the 7-year work plan under this funding scenario.

Scenario 2: Maintain Network PCI at 75 ($21.25 M) – This scenario shows that it will take $21.25 million to maintain the PCI at 75, which will keep the City eligible for Measure M2 funding. The deferred maintenance will increase from $22.13 million to $40.94 million.

Scenario 3: Maintain Current Network PCI at 79 ($31.53 M) – To maintain the current network PCI of 79, the City will need to spend $31.53 million over the next seven years. The deferred maintenance will decrease to $20.27 million.

Scenario 4: Increase Network PCI by 1 Point ($35.05 M) – A total budget of $35.05 million is needed to increase the network PCI to 80 and maintain it at that level over the next seven years. The deferred maintenance will decrease to $17.75 million over the analysis period.

Both Scenarios 3 and 4 are included for compliance with OCTA "Countywide Pavement Management Plan Guidelines", Chapter 3[2], 5d. Finally, note that an inflation factor of 3% was used for the analysis.

SCENARIO 1: CURRENT FUNDING LEVEL ($18.30 M)

The City's current projected CIP budget is $18.3 million for the next seven years. As can be seen below, this funding scenario results in an five-point drop in the network PCI to 74. By FY 2022/2023, 54.9% of the network will be in the "Very Good" and "Good" conditions, 42.1% in the "Fair" and "Poor" conditions, and 2.9% in the "Very Poor" condition category. The deferred maintenance will increase from $22.13 million to $38.71 million by FY 2022/2023. Table 9 and Figure 4 show the result of this scenario. Noted that the PCI will drop below 75 by FY 2021/22.

Table 9: Summary of Results for Scenario 1

Fiscal Year	Before Work	16/17	17/18	18/19	19/20	20/21	21/22	22/23	Total
Budget ($M)	N/A	2.50	1.85	2.50	2.85	2.85	2.85	2.90	18.30
Rehabilitation ($M)	N/A	2.20	1.55	2.20	2.55	2.55	2.55	2.60	16.20
Preventive Maintenance ($M)	N/A	0.30	0.30	0.30	0.30	0.30	0.30	0.30	2.10
Deferred Maintenance ($M)	22.13	17.77	20.26	23.73	26.50	26.96	28.19	38.71	N/A
PCI (Network)	78	80	78	77	76	76	75	74	N/A
PCI (MPAH)	79	80	79	78	76	76	74	73	N/A
PCI (Local)	**79**	**80**	**79**	**77**	**76**	**76**	**75**	**74**	N/A

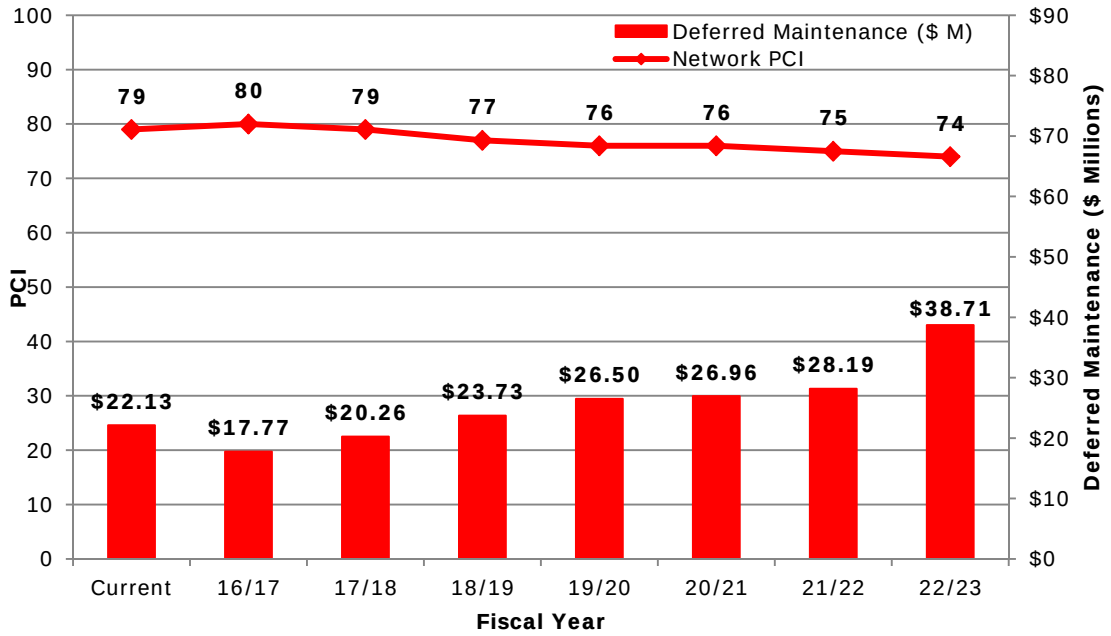

Figure 4: PCI vs. Deferred Maintenance for Scenario 1

SCENARIO 2: MAINTAIN PCI AT 75 ($21.25 M)

This scenario indicated that $21.25 million is required to maintain the PCI at 75, which will keep the City eligible for Measure M2 funding. By FY 2022/2023, 58.3% of the network will be in the "Very Good" and "Good" categories, 38.8% will fall under "Fair" and "Poor" categories, and 2.9% in the "Very Poor" category. The deferred maintenance will increase to $40.94 million. The results are illustrated in Table 10 and Figure 5.

Table 10: Summary of Results for Scenario 2

Fiscal Year	Before Work	16/17	17/18	18/19	19/20	20/21	21/22	22/23	Total
Budget ($M)	N/A	1.47	0.81	1.41	3.00	3.68	5.19	5.69	21.25
Rehabilitation ($M)	N/A	1.44	0.79	1.40	2.62	3.10	4.16	4.52	18.04
Preventive Maintenance ($M)	N/A	0.03	0.02	0.01	0.38	0.58	1.03	1.17	3.21
Deferred Maintenance ($M)	22.13	18.80	22.12	25.79	30.01	32.75	34.12	40.94	N/A
PCI (Network)	79	79	77	76	75	75	75	75	N/A

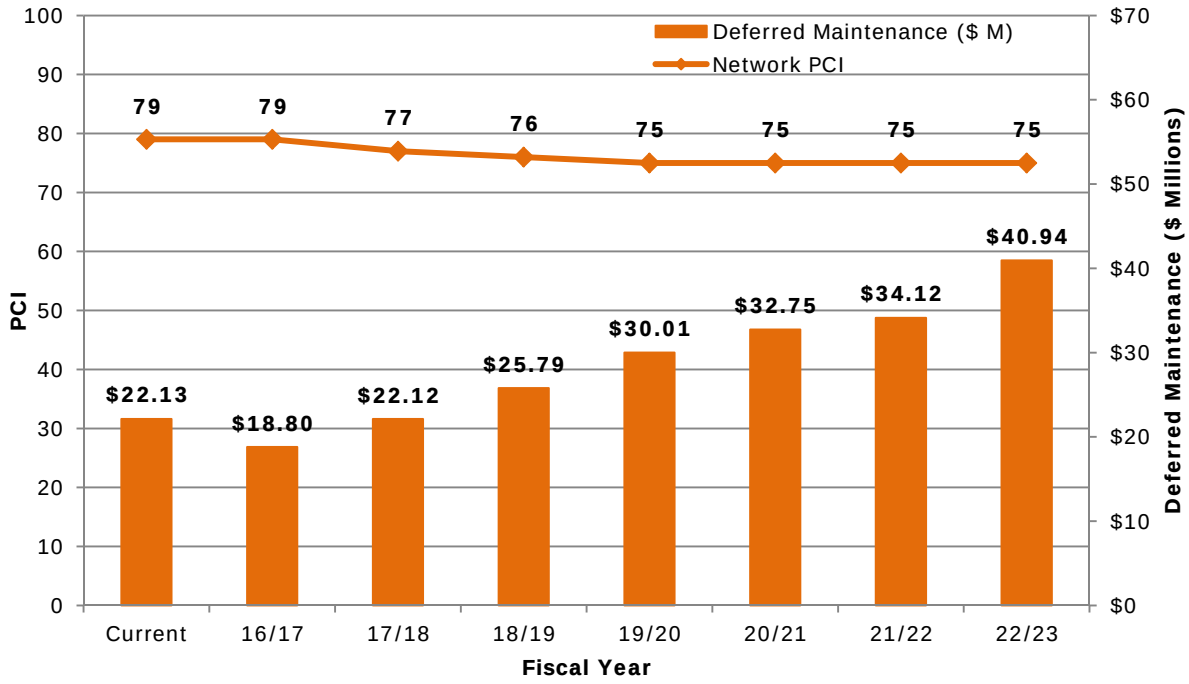

Figure 5: PCI vs. Deferred Maintenance for Scenario 2

SCENARIO 3: MAINTAIN CURRENT PCI AT 79 ($31.53 M)

The City will need a total of $31.53 million to maintain the PCI at 79 over the next seven years. By FY 2022/2023, 83.7% of the network will be within the "Very Good" to "Good" categories, 13.3% will fall under "Fair" and "Poor" categories, and approximately 2.9% in the "Very Poor" condition category. The deferred maintenance will decrease to $20.27 million by FY 2022/2023. The results are illustrated in Table 11 and Figure 6.

Table 11: Summary of Results for Scenario 3

Fiscal Year	Before Work	16/17	17/18	18/19	19/20	20/21	21/22	22/23	Total
Budget ($M)	N/A	1.47	3.20	4.41	6.00	4.58	5.18	6.69	31.53
Rehabilitation ($M)	N/A	1.45	2.71	3.81	5.15	4.01	4.49	5.71	27.33
Preventive Maintenance ($M)	N/A	0.02	0.49	0.60	0.85	0.57	0.69	0.98	4.20
Deferred Maintenance ($M)	22.13	18.80	19.72	21.57	22.23	21.45	20.13	20.27	N/A
PCI (Network)	79	79	79	79	79	79	79	79	N/A

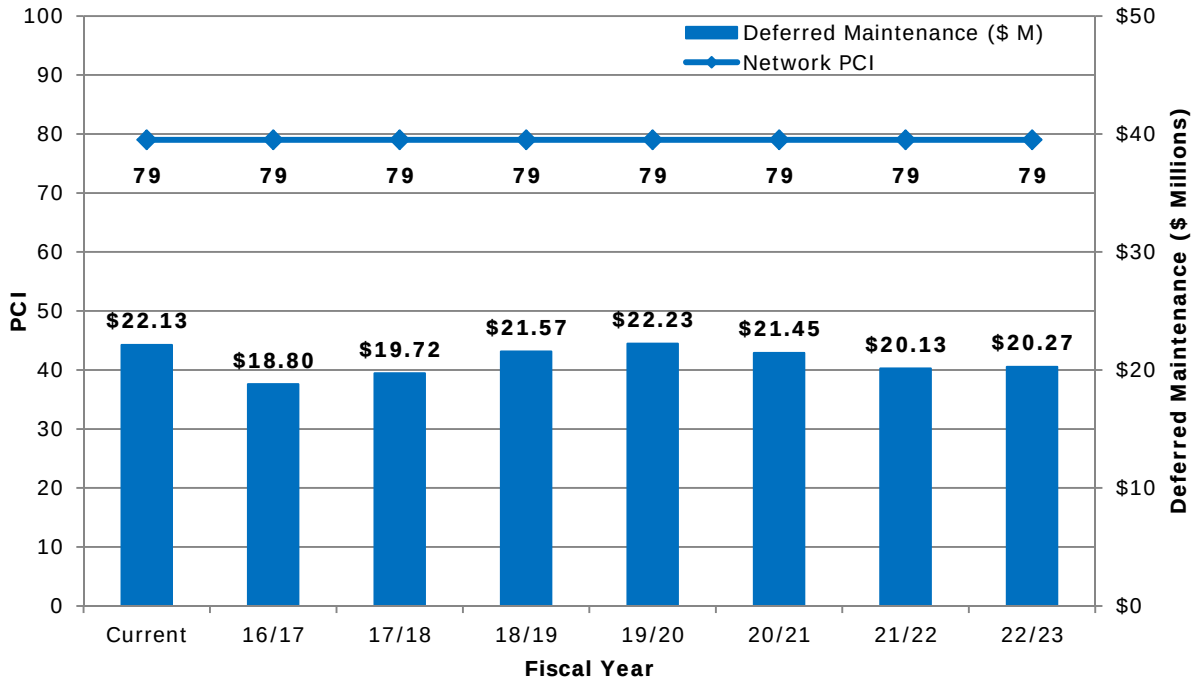

Figure 6: PCI vs. Deferred Maintenance for Scenario 3

SCENARIO 4: INCREASE PCI BY 1 POINT ($35.05 M)

Approximately $35.05 million over the next seven years will increase the current network PCI by one point. At the end of FY 2022/2023, 87.8% of the network will be in the "Very Good" and "Good" categories, 9.3% fall in the "Fair" and "Poor" categories, and 2.9% in the "Very Poor" condition. The deferred maintenance will decrease from $22.13 million to $17.75 million by FY 2022/2023. The results are illustrated in Table 12 and Figure 7.

Table 12: Summary of Results for Scenario 4

Fiscal Year	Before Work	16/17	17/18	18/19	19/20	20/21	21/22	22/23	Total
Budget ($M)	N/A	2.47	4.21	5.41	5.50	4.58	5.69	7.19	35.05
Rehabilitation ($M)	N/A	2.31	3.69	4.81	4.94	4.16	5.09	6.38	31.38
Preventive Maintenance ($M)	N/A	0.16	0.52	0.60	0.56	0.42	0.60	0.81	3.67
Deferred Maintenance ($M)	22.13	17.80	18.03	19.07	19.38	18.56	16.13	17.75	N/A
PCI (Network)	79	80	80	80	80	80	80	80	N/A

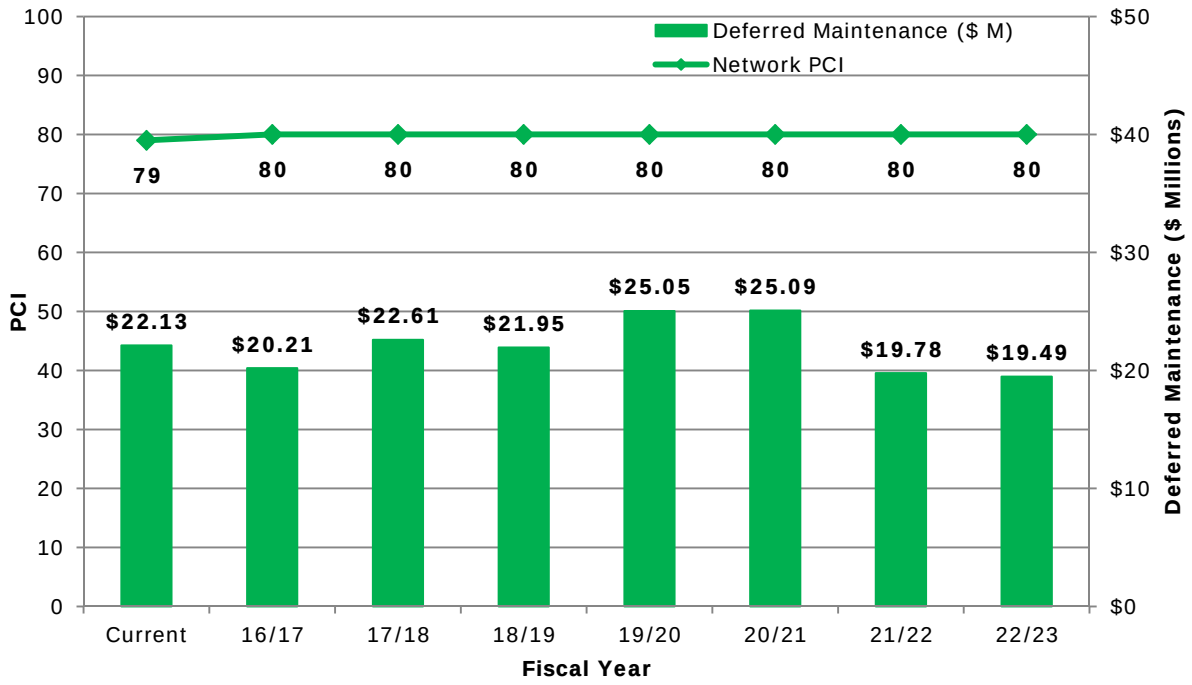

Figure 7: PCI vs. Deferred Maintenance for Scenario 4

SUMMARY

In Scenario 1, the City's projected seven-year CIP budget of $18.30 million will drop the PCI to 74 by FY 2022/2023, which will jeopardize the 10% local matching funds. Scenario 2 reflects the funding level that will maintain the PCI at 75 and allow the City to remain eligible for Measure M2 funding. Scenario 3 shows that the City requires a total of $31.53 million to maintain the current network PCI at 79 over next seven years. If the City wishes to increase the network PCI by one point (80), approximately $35.05 million is needed over the next seven years.

Scenarios 1 and 2 show the significant increases in deferred maintenance. Figure 8 compares the PCI levels from different budget scenarios, and Figure 9 illustrates the change in deferred maintenance over time.

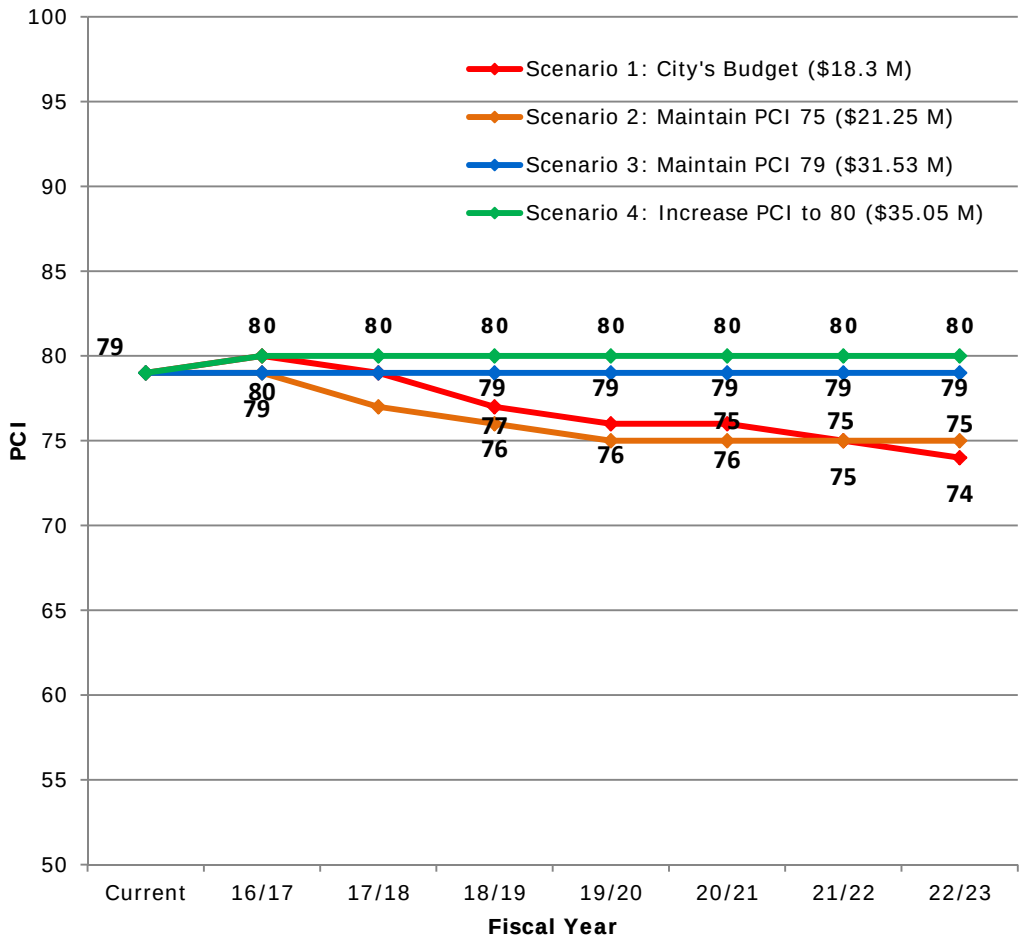

Figure 8: Projected PCIs by Scenario by Year

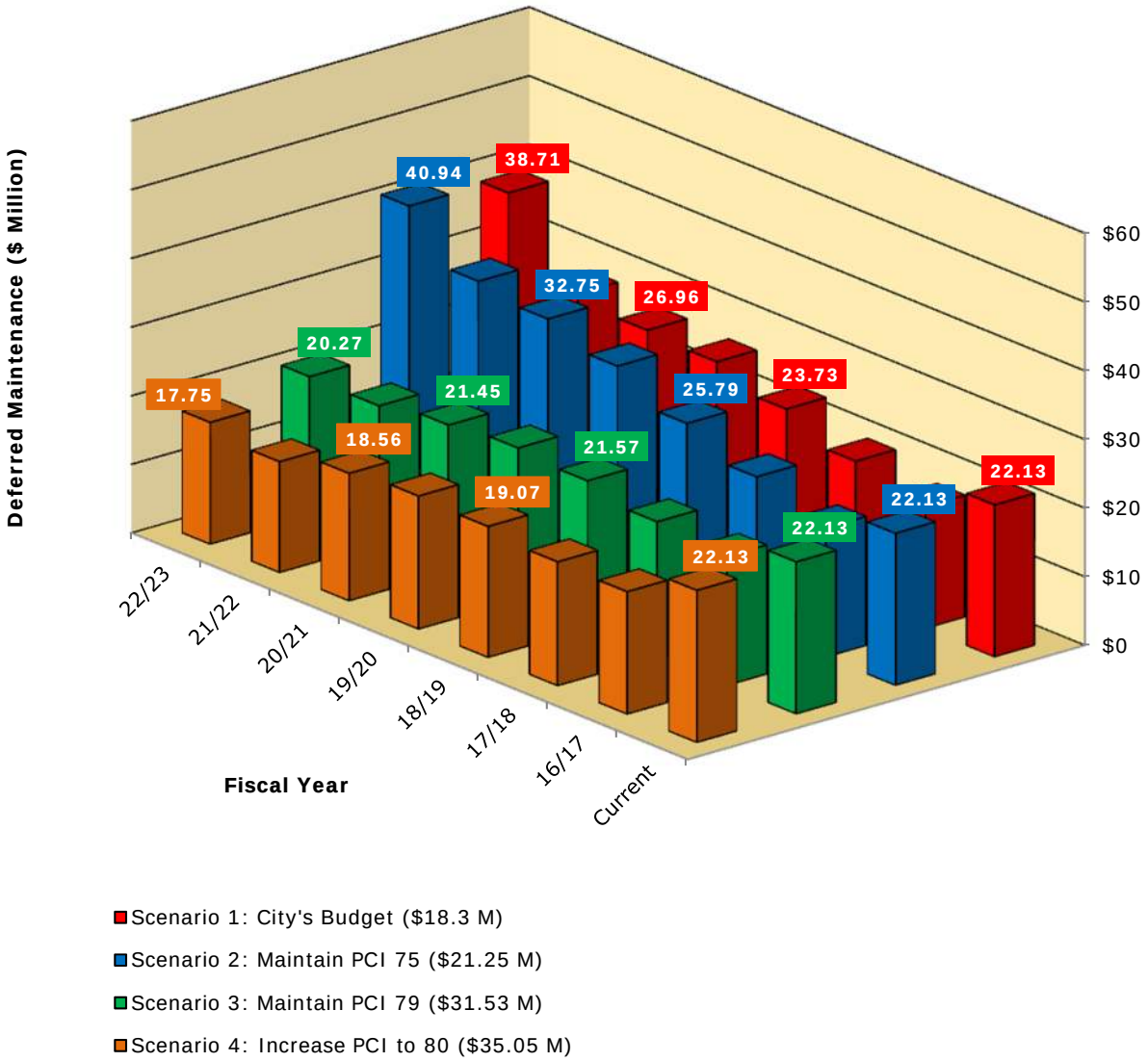

Figure 9: Deferred Maintenance by Scenario by Year

CONCLUSION

The City has a road system that is in overall "Good" condition with 73% of the network in "Very Good" and "Good" condition categories and a network average PCI of 79. Approximately 26% of the City's road network currently falls into "Fair" and "Poor" conditions, and 1% in the "Very Poor" category. Based on the pavement condition, the City has met OCTA's requirement for receiving a 10% reduction in the local matching fund by maintaining the overall network PCI above 75.

The estimated annual budget is $18.30 million over the next seven years which is expected to decrease the network PCI to 74. This would mean the City would **not** be eligible for future Measure M2 funding by FY 2021/22, when the PCI drops below 75.

RECOMMENDATIONS

Therefore, NCE recommends that the City consider the following:

- Increase current funding level to a minimum of $21.25 million over the next seven years, as recommended in Scenario 2 as this will maintain a PCI of 75 and allow the City to remain eligible for Measure M2 funding.
- Monitor construction costs and develop strategies to capitalize on any cost savings that may occur.
- Update the Pavement Management Plan as required by OCTA to ensure that Measure M2 funds are not jeopardized.
- Review and update the maintenance and rehabilitation (M&R) decision tree and the associated unit costs to reflect current construction methods as well as to keep the budget analysis results accurate. At the same time, all M&R construction activities should be updated in the City's database biennially.
- Consider rehabilitation alternatives that "stretch the maintenance dollar" such as cold-in-place recycling (CIR), full depth reclamation (FDR), micro-surfacing.

Appendix A

Agency Submittal Checklist

ORANGE COUNTY TRANSPORTATION AUTHORITY
Pavement Management Plan
Agency Submittal Checklist

Local Agencies must submit the following to OCTA			Page(s) in PMP	Submitted
1.	Pavement management program certification (See Appendix A)		Appendix B	
2.	Quality Assurance/Quality Control plan (See Appendix B and Section 2.4)		Appendix C	
3.	Pavement Management data files in a form useable by OCTA (See Section 2.8)		CD	
4.	Average (weighted by area) Pavement Condition Index for:			
	i.	Entire pavement network	Page 1	
	ii.	Master Plan of Arterial Highways (MPAH) roadways	Page 1	
	iii.	Local Streets	Page 1	
5.	Projected PCI under existing funding levels over the next seven years for:			
	i.	Entire Pavement network	Appendix G	
	ii.	MPAH roadways	Appendix G	
	iii.	Local streets	Appendix G	
6.	Seven-year plan for road maintenance and rehabilitation based on current and projected budget, identifying street sections selected for treatment. Specific data to be submitted are:			
	i.	Street name	Appendix F	
	ii.	Limits of work	Appendix F	
	iii.	Lengths, widths	Appendix F	
	iv.	Pavement areas:		
		1. Each street	Appendix F	
		2. Total area for local streets	Appendix F	
		3. Total area for MPAH roadways	Appendix F	
		4. Total area for entire public streets network	Appendix F	
	v.	Functional classifications (i.e., MPAH or local street)	Appendix F	
	vi.	PCI and most recent date of inspection (See Section 2.2)	Appendix F	
	vii.	Type of treatment	Appendix F	
	viii.	Cost of treatment	Appendix F	
	ix.	Year of treatment	Appendix F	
7.	Alternative funding levels required to:			
	i.	Maintain existing average network PCI	Page 18	
	ii.	To improve average network PCI	Page 19	
8.	Backlog by year of unfunded pavement rehabilitation, restoration, reconstruction, and maintenance needs.		Page 13	
9.	Centerline mileage for MPAH, local streets, and total network.		Page 1	
10.	Percentage of total network in each of the five condition categories based in centerline miles.		Page 2	

Appendix B

Pavement Management Plan Certification

Pavement Management Plan Certification

The City of Buena Park certifies that it has a Pavement Management Plan in conformance with the criteria stated in the Orange County Transportation Authority Ordinance No. 3. This ordinance requires that a Pavement Management Plan be in place and maintained to qualify for allocation of revenues generated from renewed Measure M (M2).

The plan was developed by Nichols Consulting Engineers, Chtd. * using StreetSaver, a pavement management system, conforming to American Society for Testing and Materials (ASTM) Standard D6433, and contains, at a minimum, the following elements:

- Inventory of MPAH and local routes reviewed and updated biennially. The last update of the inventory was completed on January, 2016 for Arterial (MPAH) streets and February, 2011 for local streets.

- Assessment of pavement condition for all routes in the system, updated biennially. The last field review of pavement condition was completed May, 2016

- Percentage of all sections of pavement needing:
  Preventive Maintenance 54.2%, Rehabilitation 26%, Reconstruction 1%

- Budget needs for preventative maintenance, rehabilitation and/or reconstruction of deficient sections of pavement for:
  Current biennial period $29.04 million, Following biennial period $11.97 million

- Funds budgeted or available for Preventative Maintenance, Rehabilitation and/or Reconstruction.
  Current biennial period $4.35 million, Following biennial period $5.36 million

- Backlog by year of unfunded pavement rehabilitation, restoration, and reconstruction needs.

- The Pavement Management Plan is consistent with countywide pavement condition assessment standards as described in the OCTA Countywide Pavement Management Plan Guidelines adopted by the OCTA Board of Directors.

* An electronic copy of the Pavement Management Plan with Micro Paver or StreetSaver compatible files has been or will be submitted with the certification statement.

A copy of this certification is being provided to the Orange County Transportation Authority.

Submitted by:

David Jacobs, P.E., L.S.
Name (Print)

City of Buena Park
Jurisdiction

Signed

6/29/2016
Date

Director of Public Works
Title

Appendix C

QA / QC Plan

(Redacted for Proposal)

Appendix D

Average (weighted by area) PCI for:

i. Network Summary
ii. MPAH Network by Name
iii. Local Network by Name
iv. MPAH Network by PCI
v. Local Network by PCI

(Only First Page of Report Included)

City of Buena Park
2016 PMP Update
PCI Listing - Summary

Functional Class	Centerline Miles	# of Sections	Pavement Area (sf)	% of Total Pavement Area	Weighted Average PCI
MPAH	61.0	262	11,383,315	33%	78
Local	130.3	801	22,639,854	67%	79
Total	**191.3**	**1,063**	**34,023,169**	**100%**	**79**

MPAH / Local	Street Name	Section ID	From	To	Length (ft)	Width (ft)	Area (sf)	FC	Surface Type	# of Lanes	Current PCI	Date Inspected
MPAH	Artesia Boulevard WB	01	Dale St.	Indiana St.	1,480	30	44,400	A	A	2	85	1/22/2016
MPAH	Artesia Boulevard WB	02	Indiana	Stanton	1,160	30	34,800	A	A	2	83	1/22/2016
MPAH	Artesia Boulevard WB	03	Stanton	Beach	1,328	30	39,840	A	O	2	93	1/22/2016
MPAH	Artesia Boulevard WB	04	Beach	Western	1,280	30	38,400	A	A	2	94	1/22/2016
MPAH	Artesia Boulevard WB	05	Western	Rostrata Ave	781	30	23,430	A	A	2	94	1/22/2016
MPAH	Artesia Boulevard WB	06	Rostrata Ave	I5 NB Offramp	830	44	36,520	A	A	3	94	1/22/2016
MPAH	Artesia Boulevard WB	07	I5 NB Offramp	Knott Ave	1,066	51	54,366	A	A	2	80	1/22/2016
MPAH	Artesia Boulevard EB	01	Valley View	Industry Cir (W)	1,082	40	43,280	A	A	3	89	1/22/2016
MPAH	Artesia Boulevard EB	02	Industry Cir (W)	Altura	2,161	40	86,440	A	A	2	84	1/22/2016
MPAH	Artesia Boulevard EB	03	Altura Blvd.	Knott Ave.	2,107	40	84,280	A	A	3	73	1/22/2016
MPAH	Artesia Boulevard EB	04	Knott Ave.	I5 NB Offramp	1,066	51	54,366	A	A	3	90	1/22/2016
MPAH	Artesia Boulevard EB	05	I5 NB Offramp	Rostrata Ave	830	44	36,520	A	A	3	94	1/22/2016
MPAH	Artesia Boulevard EB	06	Rostrata Ave	Western Ave	781	30	23,430	A	A	2	94	1/22/2016
MPAH	Artesia Boulevard EB	07	Western	Beach	1,280	30	38,400	A	A	2	94	1/22/2016
MPAH	Artesia Boulevard EB	08	Beach Blvd.	Stanton Ave.	1,328	30	39,840	A	O	2	93	1/22/2016
MPAH	Artesia Boulevard EB	09	Stanton Ave.	Indiana St. (E)	1,330	30	39,900	A	A	2	75	1/22/2016
MPAH	Artesia Boulevard EB	10	Indiana St.	Dale St.	915	30	27,450	A	A	2	92	1/22/2016
MPAH	Ball Road	01	Valley View	Brenda	1,060	18	19,080	A	A	1	94	1/22/2016
MPAH	Ball Road	02	Brenda	Holder	1,570	13	20,410	A	A	1	94	1/22/2016
MPAH	Ball Road EB	01	Holder	ECL	600	34	20,520	A	A	2	80	1/22/2016
MPAH	Ball Road WB	01	ECL	Holder	1,180	34	40,120	A	A	2	82	1/22/2016
MPAH	Beach Boulevard NB	01	SCL	Crescent Ave	1,400	45	63,000	A	A	4	67	1/21/2016
MPAH	Beach Boulevard NB	02	Crescent Ave	La Palma Ave	2,800	47	131,600	A	A	4	59	1/21/2016
MPAH	Beach Boulevard NB	03	La Palma Ave	Azalea Dr	2,600	45	117,000	A	A	4	60	1/21/2016
MPAH	Beach Boulevard NB	04	Azalea Dr	SR 91 FWY	815	50	40,750	A	A	3	70	1/21/2016
MPAH	Beach Boulevard NB	05	SR 91 FWY	Orangethorpe Ave	1,060	50	53,000	A	A	3	67	1/21/2016
MPAH	Beach Boulevard NB	06	Orangethorpe Ave	9th St	2,310	40	92,400	A	A	3	91	1/21/2016
MPAH	Beach Boulevard SB	01	9th St	Orangethorpe Ave	2,310	40	92,400	A	A	3	76	1/21/2016
MPAH	Beach Boulevard SB	02	Orangethorpe Ave	SR 91 FWY	1,060	50	53,000	A	A	3	74	1/21/2016
MPAH	Beach Boulevard SB	03	SR 91 FWY	Azalea Dr	815	50	40,750	A	A	3	67	1/21/2016
MPAH	Beach Boulevard SB	04	Azalea Dr	La Palma Ave	2,600	45	117,000	A	A	4	65	1/21/2016
MPAH	Beach Boulevard SB	05	La Palma Ave	Crescent Ave	2,800	45	126,000	A	A	4	62	1/22/2016
MPAH	Beach Boulevard SB	06	Crescent Ave	SCL	1,400	45	63,000	A	A	4	59	1/21/2016
MPAH	Cerritos Avenue WB	01	ECL	Holder	660	28	18,480	A	C	2	55	1/19/2016
MPAH	Cerritos Avenue WB	02	Holder	Diane	860	28	24,080	A	A	2	58	1/19/2016
MPAH	Cerritos Avenue WB	03	Diane	WCL	1,520	28	42,560	A	A	2	50	1/19/2016
MPAH	Commonwealth Avenue EB	01	Auto Center Drive	Beach	1,090	38	41,420	A	A	2	85	1/19/2016

Appendix E

Work History

Name	Section ID	From	To	FC	Length (ft)	Width (ft)	Area (sf)	Treatment	Treatment Date
La Palma Avenue WB	03	Stanton	Beach	A	1,250	41	51,250	MILL AND THIN OVERLAY	7/8/2014
Valley View Street NB	12	Caballero	Artesia	A	2,500	40	100,000	ARHM Overlay	8/1/2014
Aragon Circle	01	Orangethorpe	End	R	1,380	48	66,240	ARHM Overlay	9/1/2014
Descanso Circle	01	W. End	Descanso Avenue	R	360	50	18,000	ARHM Overlay	9/1/2014
Maple Drive	01	Locust	End	R	410	25	10,250	ARHM Overlay	11/1/2014
Knollwood Court	01	Pebble Beach	End	R	120	36	4,320	ARHM Overlay	11/1/2014
Alley	01	S. End	Maple	R	1,100	20	22,000	ARHM Overlay	11/1/2014
Pebble Beach Drive	01	St Andrews	End	R	590	36	21,240	ARHM Overlay	11/1/2014
Maple Drive	02	Stanton	Locust	R	790	37	29,230	ARHM Overlay	11/1/2014
Bach Circle	01	Beethoven	End	R	240	32	7,680	ARHM Overlay	11/1/2014
Brahms Circle	01	Beethoven	End	R	240	32	7,680	ARHM Overlay	11/1/2014
Alley	14	Dale	E. End	R	850	20	17,000	ARHM Overlay	11/1/2014
Schubert Circle	01	Handel	End	R	760	32	24,320	ARHM Overlay	11/1/2014
Verdi Drive	01	Handel	Whitaker	R	810	32	25,920	ARHM Overlay	11/1/2014
Beethoven Drive	01	Verdi	Schubert	R	820	32	26,240	ARHM Overlay	11/1/2014
Chopin Drive	01	Verdi	Schubert	R	820	32	26,240	ARHM Overlay	11/1/2014
Handel Drive	01	Verdi	Dale	R	1,012	36	36,432	ARHM Overlay	11/1/2014
Dale Frontage	04	Planetary	End	R	250	26	6,500	SLURRY SEAL	6/1/2015
Beach Blvd Fr	01	Cameron Dr	Elliot Green	R	1,350	24	32,400	SLURRY SEAL	6/1/2015
Dale Frontage	05	Venus	S. End	R	600	26	15,600	SLURRY SEAL	6/1/2015
Mercury Drive	01	Crescent	End	R	1,200	36	43,200	SLURRY SEAL	9/1/2015
Mango Way	01	Lime	Mulberry	R	950	25	23,750	SLURRY SEAL	9/1/2015
Mulberry Avenue	01	Lime	Maple	R	1,000	25	25,000	SLURRY SEAL	9/1/2015
Larch Circle	01	Locust	End	R	410	25	10,250	SLURRY SEAL	9/1/2015
Lime Circle	01	Locust	E. End	R	410	25	10,250	SLURRY SEAL	9/1/2015
Linden Circle	01	Locust	End	R	410	25	10,250	SLURRY SEAL	9/1/2015
Planetary Drive	01	Mercury	Dale	R	1,090	36	39,240	SLURRY SEAL	9/1/2015
Cameron Drive	01	Beach	Country Club	R	2,280	36	82,080	SLURRY SEAL	9/1/2015
Jupiter Drive	01	Mars	End	R	370	33	12,210	SLURRY SEAL	9/1/2015
Neptune Drive	01	Mars	Dale	R	510	36	18,360	SLURRY SEAL	9/1/2015
Polaris Drive	01	Mars	End	R	320	33	10,560	SLURRY SEAL	9/1/2015
Venus Drive	01	Mars	Dale	R	560	32	17,920	SLURRY SEAL	9/1/2015
Galaxy Circle	01	Mercury	End	R	650	36	23,400	SLURRY SEAL	9/1/2015
Saturn Drive	01	Planetary	End	R	380	33	12,540	SLURRY SEAL	9/1/2015
Argyle Drive	01	Beach	Cameron	R	2,030	36	73,080	SLURRY SEAL	9/1/2015
Fox Hills Avenue	01	Country Club	Somerset	R	1,270	32	40,640	SLURRY SEAL	9/1/2015
Somerset Drive	01	Country Club	Kenwood	R	530	33	17,490	SLURRY SEAL	9/1/2015
Somerset Drive	02	Fox Hills	St Andrews	R	1,100	32	35,200	SLURRY SEAL	9/1/2015
Burlingame Drive	02	Malvern	Oakmont	R	750	32	24,225	SLURRY SEAL	9/1/2015
St Andrews Avenue	03	Sunnybrook	Los Coyotes	R	650	37	24,050	SLURRY SEAL	9/1/2015
Locust Drive	01	Crescent	Maple	R	1,120	37	41,440	SLURRY SEAL	9/1/2015
Lime Circle	02	Mulberry	Locust	R	470	25	11,750	SLURRY SEAL	9/1/2015
Mars Drive	01	Neptune	Venus	R	260	32	8,320	SLURRY SEAL	9/1/2015
Mars Drive	02	Planetary	Neptune	R	750	36	27,000	SLURRY SEAL	9/1/2015
Fox Hills Avenue	04	Somerset	Los Coyotes	R	1,270	32	40,640	SLURRY SEAL	9/1/2015

Name	Section ID	From	To	FC	Length (ft)	Width (ft)	Area (sf)	Treatment	Treatment Date
Sunnybrook Avenue	02	Somerset	St Andrews	R	710	32	22,720	SLURRY SEAL	9/1/2015
Franklin Street	02	Rostrata	Western	R	710	36	25,560	ARHM Overlay	1/1/2016
Fillmore Drive	03	Western	Grand	R	1,240	27	33,480	ARHM Overlay	1/1/2016
Franklin Street	03	Western	Beach	R	1,280	37	47,360	ARHM Overlay	1/1/2016
Jackson Way	02	Western	Grand	R	1,250	33	41,250	ARHM Overlay	1/1/2016
				Total Square Feet Repaired			1,401,757		

Functional Classification Definations	
A	Arterials
R	Residentials

Appendix F

Projected PCI under Existing Funding Levels over the Next Seven Years

i. Network Summary
ii. MPAH Network by Name
iii. Local Network by Name

(Only First Page of Report Included)

City of Buena Park
2016 PMP Update
Projected PCI - Summary

Functional Classification	Current	16/17	17/18	18/19	19/20	20/21	21/22
MPAH	78	80	78	77	76	76	75
Local	79	80	79	78	76	76	74
Network PCI	**79**	**80**	**79**	**77**	**76**	**76**	**75**

City of Buena Park
2016 PMP Update
Projected PCI - Summary

22/23
74
73
74

MPAH / Local	Street Name	Section ID	From	To	Length (ft)	Width (ft)	Area (sf)	Current PCI	Projected PCI						
									16/17	17/18	18/19	19/20	20/21	21/22	22/23
MPAH	Artesia Boulevard EB	01	Valley View	Industry Cir (W)	1,082	40	43,280	89	88	86	84	82	79	77	75
MPAH	Artesia Boulevard EB	02	Industry Cir (W)	Altura	2,161	40	86,440	84	85	83	81	79	77	74	72
MPAH	Artesia Boulevard EB	03	Altura Blvd.	Knott Ave.	2,107	40	84,280	73	72	70	68	100	91	89	87
MPAH	Artesia Boulevard EB	04	Knott Ave.	I5 NB Offramp	1,066	51	54,366	90	90	89	87	86	84	83	82
MPAH	Artesia Boulevard EB	05	I5 NB Offramp	Rostrata Ave	830	44	36,520	94	94	91	88	86	84	82	79
MPAH	Artesia Boulevard EB	06	Rostrata Ave	Western Ave	781	30	23,430	94	93	90	87	85	83	81	79
MPAH	Artesia Boulevard EB	07	Western	Beach	1,280	30	38,400	94	93	90	87	85	83	81	79
MPAH	Artesia Boulevard EB	08	Beach Blvd.	Stanton Ave.	1,328	30	39,840	93	92	89	87	85	84	82	81
MPAH	Artesia Boulevard EB	09	Stanton Ave.	Indiana St. (E)	1,330	30	39,900	75	74	72	70	68	100	91	89
MPAH	Artesia Boulevard EB	10	Indiana St.	Dale St.	915	30	27,450	92	91	88	86	84	82	79	77
MPAH	Artesia Boulevard WB	01	Dale St.	Indiana St.	1,480	30	44,400	85	84	82	80	78	76	74	71
MPAH	Artesia Boulevard WB	02	Indiana	Stanton	1,160	30	34,800	83	83	80	78	76	74	72	69
MPAH	Artesia Boulevard WB	03	Stanton	Beach	1,328	30	39,840	93	92	89	87	85	84	82	81
MPAH	Artesia Boulevard WB	04	Beach	Western	1,280	30	38,400	94	93	90	87	85	83	81	79
MPAH	Artesia Boulevard WB	05	Western	Rostrata Ave	781	30	23,430	94	93	90	87	85	83	81	79
MPAH	Artesia Boulevard WB	06	Rostrata Ave	I5 NB Offramp	830	44	36,520	94	93	90	87	85	83	81	79
MPAH	Artesia Boulevard WB	07	I5 NB Offramp	Knott Ave	1,066	51	54,366	80	79	76	73	70	100	91	89
MPAH	Ball Road	01	Valley View	Brenda	1,060	18	19,080	94	93	90	88	85	83	81	79
MPAH	Ball Road	02	Brenda	Holder	1,570	13	20,410	94	93	90	88	85	83	81	79
MPAH	Ball Road EB	01	Holder	ECL	600	34	20,520	80	81	78	76	74	72	70	67
MPAH	Ball Road WB	01	ECL	Holder	1,180	34	40,120	82	83	80	78	76	74	72	69
MPAH	Beach Boulevard NB	01	SCL	Crescent Ave	1,400	45	63,000	67	68	100	91	89	87	85	83
MPAH	Beach Boulevard NB	02	Crescent Ave	La Palma Ave	2,800	47	131,600	59	60	57	55	52	49	46	43
MPAH	Beach Boulevard NB	03	La Palma Ave	Azalea Dr	2,600	45	117,000	60	100	91	89	87	85	83	82
MPAH	Beach Boulevard NB	04	Azalea Dr	SR 91 FWY	815	50	40,750	70	71	69	66	64	61	100	91
MPAH	Beach Boulevard NB	05	SR 91 FWY	Orangethorpe Ave	1,060	50	53,000	67	68	66	63	61	58	100	91
MPAH	Beach Boulevard NB	06	Orangethorpe Ave	9th St	2,310	40	92,400	91	92	100	91	89	87	85	83
MPAH	Beach Boulevard SB	01	9th St	Orangethorpe Ave	2,310	40	92,400	76	77	100	91	89	87	85	83
MPAH	Beach Boulevard SB	02	Orangethorpe Ave	SR 91 FWY	1,060	50	53,000	74	75	73	71	68	66	100	91
MPAH	Beach Boulevard SB	03	SR 91 FWY	Azalea Dr	815	50	40,750	67	68	66	63	61	58	100	91
MPAH	Beach Boulevard SB	04	Azalea Dr	La Palma Ave	2,600	45	117,000	65	100	91	89	87	85	83	82
MPAH	Beach Boulevard SB	05	La Palma Ave	Crescent Ave	2,800	45	126,000	62	63	61	58	55	52	49	46
MPAH	Beach Boulevard SB	06	Crescent Ave	SCL	1,400	45	63,000	59	60	57	55	52	49	46	43
MPAH	Cerritos Avenue WB	01	ECL	Holder	660	28	18,480	55	56	54	51	48	45	42	39
MPAH	Cerritos Avenue WB	02	Holder	Diane	860	28	24,080	58	59	57	54	51	49	46	43
MPAH	Cerritos Avenue WB	03	Diane	WCL	1,520	28	42,560	50	51	48	45	42	39	35	31
MPAH	Commonwealth Avenue EB	01	Auto Center Drive	Beach	1,090	38	41,420	85	84	82	80	78	76	74	71
MPAH	Commonwealth Avenue EB	02	Beach	Stanton	1,240	40	49,600	67	66	64	61	59	56	53	50
MPAH	Commonwealth Avenue EB	03	Stanton	Indiana	1,290	40	51,600	88	87	85	83	81	79	76	74
MPAH	Commonwealth Avenue EB	04	Indiana	Dale	1,320	40	52,800	77	77	75	73	71	68	100	91
MPAH	Commonwealth Avenue EB	05	Dale St	ECL	880	32	28,366	84	85	83	81	79	77	74	72
MPAH	Commonwealth Avenue WB	01	Dale	Indiana	1,320	40	52,800	75	75	73	71	68	100	91	89

Appendix G

Seven-Year Plan for Road Maintenance and Rehabilitation based on Current and Projected Budget

i. MPAH Network
ii. Local Network

(Only First Page of Report Included)

MPAH / Local	Street Name	Section ID	From	To	Length (ft)	Width (ft)	Area (sf)	Current PCI	Date Inspected	Treatment	Treatment Cost	Treatment Year
MPAH	Beach Boulevard NB	03	La Palma Ave	Azalea Dr	2600	45	117000	60	1/21/2016	4" ARHM OVERLAY W/ DIGOUTS	$ 650,000	2016
MPAH	Beach Boulevard SB	04	Azalea Dr	La Palma Ave	2600	45	117000	65	1/21/2016	4" ARHM OVERLAY W/ DIGOUTS	$ 650,000	2016
MPAH	Crescent Avenue WB	07	Knott Ave	San Pablo	1440	26	37440	67	1/20/2016	2" ARHM OVERLAY	$ 75,504	2016
MPAH	Crescent Avenue WB	09	Holder	San Carlos	1570	24	37680	67	1/20/2016	2" ARHM OVERLAY	$ 75,988	2016
MPAH	Dale Avenue NB	05	Carnation	N CDS	1420	30	42600	66	12/11/2015	2" ARHM OVERLAY	$ 85,910	2016
MPAH	Holder Street NB	02	Myra	Ball	1020	18	18360	67	1/27/2016	2" ARHM OVERLAY W/ DIGOUTS	$ 41,310	2016
MPAH	La Mirada Boulevard WB	01	Beach	Alondra	1700	40	68000	71	1/18/2016	2" ARHM OVERLAY	$ 137,133	2016
MPAH	La Palma Avenue EB	06	Knott	El Monte	1350	40	54000	67	1/14/2016	2" ARHM OVERLAY	$ 108,900	2016
MPAH	Orangethorpe Avenue WB	04	Stanton	Beach	1270	50	63500	70	1/19/2016	2" ARHM OVERLAY	$ 128,058	2016
MPAH	Valley View Street NB	11	Orangethorpe	Caballero	2650	40	106000	48	1/15/2016	4" ARHM OVERLAY W/ DIGOUTS	$ 588,889	2016
MPAH	Valley View Street SB	06	Los Ranchos	Lincoln	1480	40	59200	65	1/15/2016	2" ARHM OVERLAY W/ DIGOUTS	$ 133,200	2016
MPAH	Beach Boulevard NB	01	SCL	Crescent Ave	1400	45	63000	67	1/21/2016	2" ARHM OVERLAY W/ DIGOUTS	$ 141,750	2017
MPAH	Beach Boulevard NB	06	Orangethorpe Ave	9th St	2310	40	92400	91	1/21/2016	4" ARHM OVERLAY W/ DIGOUTS	$ 513,333	2017
MPAH	Beach Boulevard SB	01	9th St	Orangethorpe Ave	2310	40	92400	76	1/21/2016	4" ARHM OVERLAY W/ DIGOUTS	$ 513,333	2017
MPAH	Crescent Avenue EB	02	Valley View Ave	San Carlos	980	24	23520	67	1/20/2016	2" ARHM OVERLAY W/ DIGOUTS	$ 52,920	2017
MPAH	Knott Avenue NB	09	Caballero	Eighth	1411	34	47974	68	1/26/2016	2" ARHM OVERLAY W/ DIGOUTS	$ 107,942	2017
MPAH	Knott Avenue SB	02	Eighth	Caballero	1411	34	47974	72	1/26/2016	2" ARHM OVERLAY	$ 96,748	2017
MPAH	La Palma Avenue WB	06	El Monte	Knott	1350	40	54000	67	1/14/2016	2" ARHM OVERLAY W/ DIGOUTS	$ 121,500	2017
MPAH	Valley View Street NB	03	Lincoln	Los Ranchos	1480	44	65120	67	1/14/2016	2" ARHM OVERLAY W/ DIGOUTS	$ 146,520	2017
MPAH	Valley View Street SB	05	Crescent	Los Ranchos	1200	40	48000	67	1/15/2016	2" ARHM OVERLAY W/ DIGOUTS	$ 108,000	2017
MPAH	Crescent Avenue WB	10	San Carlos	Valley View	980	24	23520	71	1/20/2016	2" ARHM OVERLAY W/ DIGOUTS	$ 52,920	2018
MPAH	Knott Avenue SB	03	Caballero	Orangethorpe	1500	40	60000	73	1/26/2016	2" ARHM OVERLAY	$ 121,000	2018
MPAH	La Palma Avenue WB	07	Knott	La Fiesta	1350	37	49950	71	1/14/2016	2" ARHM OVERLAY W/ DIGOUTS	$ 112,388	2018
MPAH	Orangethorpe Avenue EB	08	Beach	Stanton	1270	52	66040	73	1/19/2016	2" ARHM OVERLAY	$ 133,181	2018
MPAH	Orangethorpe Avenue EB	09	Stanton	Indiana	930	30	27900	74	1/19/2016	2" ARHM OVERLAY	$ 56,265	2018
MPAH	Rosecrans Avenue EB	01	Emery Ranch Rd	700' E/O Signal @ County Park	2338	40	93520	39	1/18/2016	4" ARHM OVERLAY W/ DIGOUTS	$ 519,556	2018
MPAH	Stanton Avenue SB	10	Page St	Larkspur	1951	30	58530	71	1/13/2016	2" ARHM OVERLAY W/ DIGOUTS	$ 131,693	2018
MPAH	Valley View Street SB	01	Orangethorpe	Trinidad	1690	36	60840	69	1/15/2016	2" ARHM OVERLAY W/ DIGOUTS	$ 136,890	2018
MPAH	Artesia Boulevard EB	03	Altura Blvd.	Knott Ave.	2107	40	84280	73	1/22/2016	2" ARHM OVERLAY W/ DIGOUTS	$ 189,630	2019
MPAH	Dale Street SB	10	La Palma	Buena Park Downtown (S)	950	35	33250	73	12/12/2015	2" ARHM OVERLAY W/ DIGOUTS	$ 74,813	2019
MPAH	La Palma Avenue EB	03	San Rafael	San Marino	1530	37	56610	74	1/14/2016	2" ARHM OVERLAY W/ DIGOUTS	$ 127,373	2019
MPAH	Orangethorpe Avenue WB	01	W/Edge I5 Overpass	Kass Dr	446	41	18286	77	1/19/2016	2" ARHM OVERLAY	$ 36,877	2019
MPAH	Orangethorpe Avenue WB	08	Knott	Sandburg	1830	50	91500	72	1/18/2016	2" ARHM OVERLAY W/ DIGOUTS	$ 205,875	2019
MPAH	Stanton Avenue NB	01	SCL	Crescent	1280	39	49920	80	1/13/2016	4" ARHM OVERLAY W/ DIGOUTS	$ 277,333	2019
MPAH	Stanton Avenue NB	15	Beach	Stanton	150	31	4650	80	1/13/2016	2" ARHM OVERLAY	$ 9,378	2019
MPAH	Stanton Avenue SB	14	Crescent	Beach	1280	39	49920	69	1/13/2016	4" ARHM OVERLAY W/ DIGOUTS	$ 277,333	2019
MPAH	Stanton Avenue SB	15	Stanton	Beach	150	39	5850	75	1/13/2016	4" ARHM OVERLAY W/ DIGOUTS	$ 32,500	2019
MPAH	Valley View Street NB	06	San Ysidro Cir	La Palma Ave	750	35	26250	71	1/15/2016	2" ARHM OVERLAY W/ DIGOUTS	$ 59,063	2019
MPAH	Artesia Boulevard EB	09	Stanton Ave.	Indiana St. (E)	1330	30	39900	75	1/22/2016	2" ARHM OVERLAY W/ DIGOUTS	$ 89,775	2020
MPAH	Artesia Boulevard WB	07	I5 NB Offramp	Knott Ave	1066	51	54366	80	1/22/2016	2" ARHM OVERLAY W/ DIGOUTS	$ 122,324	2020
MPAH	Commonwealth Avenue WB	01	Dale	Indiana	1320	40	52800	75	1/15/2016	2" ARHM OVERLAY W/ DIGOUTS	$ 118,800	2020
MPAH	Crescent Avenue EB	08	Western	Beach	1960	32	62720	59	1/20/2016	4" ARHM OVERLAY W/ DIGOUTS	$ 348,444	2020
MPAH	Crescent Avenue EB	09	Beach	Stanton	500	34	17000	39	1/20/2016	4" ARHM OVERLAY W/ DIGOUTS	$ 94,444	2020
MPAH	Crescent Avenue EB	10	Stanton	Mercury	1470	32	47040	70	1/20/2016	4" ARHM OVERLAY W/ DIGOUTS	$ 261,333	2020

Per the RFP requirements, NCE's fee proposal which includes staffing and estimated hours and our team's hourly rate sheets, are enclosed under separate cover in a sealed envelope.

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FY 2017/18

Task Description	Hourly Breakdown by Personnel					Direct Costs	Total Cost
	Lisa Senn Project Mgr ($150/hr)	Margot Yapp QC/QA Mgr ($225/hr)	Narut Leehacharoenkul Project Engr ($130/hr)	Field Technicians ($95/hr)	Clerical ($70/hr)		
1. Kickoff & Progress Meetings	16		12			$ 340	**$ 4,300**
3. Update Maintenance & Rehabilitation History	2		16			$ 120	**$ 2,500**
4. Pavement Condition Surveys	4	4	8	64	4	$ 18,300	**$ 27,200**
5. Budgetary Analysis	8	4	40			$ 100	**$ 7,400**
6. Final Report & OCTA Submittal	4	2	16		8	$ 310	**$ 4,000**
Totals	**34**	**10**	**92**	**64**	**12**	**$ 19,170**	**$ 45,400**
Optional Tasks							
2. Software Needs Assessment	8	4	8			$ 245	**$ 4,144**
Database Conversion						$ 16,831	**$ 16,831**
Software License (estimated)						$ 2,925	**$ 2,925**
7. GIS Linking	4		32		8	$ 3,080	**$ 8,400**
Totals	**12**	**4**	**40**		**8**	**$ 23,080**	**$ 32,300**

Assumptions:

Task 1 includes 1 kickoff mtg and two additional progress meetings.

Task 2 includes database conversion if software other than PAVER is selected. A one-year software license is included.

Task 3 assumes that M&R history data for 2016 & 2017 will be entered.

Task 4 assumes all MPAH and 1/3 of locals. Approximate total for project = 150 centerline miles

Task 5 assumes Budget Scenarios as outlined by OCTA's M2 Guidelines will be performed.

Direct costs include subconsultant, travel, reproduction etc.

FY 2018/19

Task Description	Hourly Breakdown by Personnel					Direct Costs	Total Cost
	Lisa Senn Project Mgr ($155/hr)	Margot Yapp QC/QA Mgr ($230/hr)	Narut Leehacharoenkul Project Engr ($134/hr)	Field Technicians ($97/hr)	Clerical ($72/hr)		
1. Kickoff & Progress Meetings	4		4			$ 344	**$ 1,500**
Totals	**4**		**4**				**$ 1,500**

Assumptions:

Task 1 includes 1 meeting.

An annual escalation of 3% is included.

FY 2019/20

Task Description	Hourly Breakdown by Personnel					Direct Costs	Total Cost
	Lisa Senn Project Mgr ($160/hr)	Margot Yapp QC/QA Mgr ($235/hr)	Narut Leehacharoenkul Project Engr ($138/hr)	Field Technicians ($100/hr)	Clerical ($74/hr)		
1. Kickoff & Progress Meetings	16		12			$ 360	**$ 4,576**
3. Update Maintenance & Rehabilitation History	2		16			$ 127	**$ 2,655**
4. Pavement Condition Surveys	4	4	8	64	4	$ 19,414	**$ 28,794**
5. Budgetary Analysis	8	4	40			$ 106	**$ 7,846**
6. Final Report & OCTA Submittal	4	2	16		8	$ 329	**$ 4,239**
Totals	**34**	**10**	**92**	**64**	**12**	**$ 20,338**	**$ 48,112**

Assumptions:

Task 1 includes 1 kickoff mtg and two additional progress meetings.

Task 3 assumes that M&R history data for 2018 & 2019 will be entered.

Task 4 assumes all MPAH and 1/3 of locals. Approximate total for project = 150 centerline miles

Task 5 assumes Budget Scenarios as outlined by OCTA's M2 Guidelines will be performed.

Direct costs include subconsultant, travel, reproduction etc.

SCHEDULE OF CHARGES 2017 – PAVEMENT MANAGEMENT PROJECTS

PROFESSIONAL SERVICES

Principal	$225/hour
Associate	$195/hour
Senior	$150/hour
Project	$130/hour
Staff	$115/hour

TECHNICAL SERVICES

Senior Construction Manager*	$130/hour
Senior Designer	$135/hour
Senior Technician/Construction Inspector*	$120/hour
CAD Technician	$110/hour
Senior Field Scientist	$115/hour
Field Scientist	$95/hour
Project Administrator	$95/hour
Field/Engineering Technician	$90/hour
Technical Word Processing	$80/hour
Clerical	$70/hour

CONTRACT LABOR

From time to time, NCE retains outside professional and technical labor on a temporary basis to meet peak workload demands. Such contract labor will be charged at regular Schedule charges.

LITIGATION SUPPORT

Expert testimony in depositions, hearings, mediations, and trials will be charged at 300% of the above rates.

EQUIPMENT

Plotter Usage	(separate fee schedule)
Truck	$100/day
Automobile	IRS Standard Mileage Rate+15%
Falling Weight Deflectometer Testing	$3,500/Day
Coring	$4,500/Day
Environmental Equipment	(separate fee schedule)

OUTSIDE SERVICES

Rental of equipment not ordinarily furnished by NCE and all other costs such as special printing, photographic work, travel by common carrier, subsistence, subcontractors, etc. ..... cost+15%

COMMUNICATION/ REPRODUCTION

In-house costs for long-distance telephone, faxing, postage, printing and copying ..... project labor charges x 5%

TERMS

Billings are payable upon presentation and are past due 30 days from invoice date. A finance charge of 1.5% per month, or the maximum amount allowable by law, will be charged on past-due accounts. NCE makes no warranty, either expressed or implied, as to its findings, recommendations, specifications, or professional advice except that they are prepared and issued in accordance with generally accepted professional practice.

*Rate will be adjusted for prevailing wages required on Public Works projects in the State of California.

märker geospatial
Schedule of Charges 2017

The list of hourly rates for all proposed Marker Geospatial project staff may be used for any additional work outside this scope. Fees will include all direct and indirect costs.

Professional and Technical Services

Staff Categories		Rates
Profession Associate / Technical Advisor	PA	$145
Project Manager	PM	$120
Staff Engineer	SE	$115
GIS/Software/Technical Specialist	TS	$100
Data/Program Analyst	DA	$95
GIS / CAD Technician	GC	$90
Field / Survey Technician	FT	$80
Administration / Clerical	AD	$55

Field Services Resources

Automated Pavement Inspection /LiDAR Mapping $3,500/Day

Field Inventory Road right-of-way Surveys $1,200/Day
(inventory mapping / condition assessments)

Terms

These rates will hold valid for remainder of 2016 and the entire 2017 calendar year. A cost of living increase will be applied to rates for each accumulative year. Outside services and consultants and/or any additional onsite expense include costs + 15%.

Billings are payable upon presentation of invoice and are due 30 days from invoice date. Accounts over 30 days past invoice date will be subject to a monthly service charge of 1.5% (18% per year) on the unpaid balance.

Please note there will be a 3% cost of living increase to the rates for years 2018, and 2019.