



Task Order 4-19
Pavement Management Plan

Companion Memorandum to:
Pavement Condition Assessment and Analysis Report

October 2019
City of Key West



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1. Purpose of Companion Memorandum

The objective of Task Order 4-19 was to develop a plan to significantly improve pavement condition in the City of Key West (City) at an optimal cost. We assessed current pavement condition and compared it to an analysis conducted in 2012. The end result is the development of an executable 5-Year Pavement Management Plan which identifies an appropriate allocation of funds to deliver the right maintenance to the City's streets at the right time.

The *Pavement Condition Assessment and Analysis Report* (PCAAR) provided by Infrastructure Management Services (IMS), dated October 2019, provides comprehensive and technical details regarding the data collection process and tools explored to create several 5-Year Plan Scenarios for the City. PCAAR analysis is contained in a spreadsheet which can be updated by the City to reflect adjustments to the PMP.

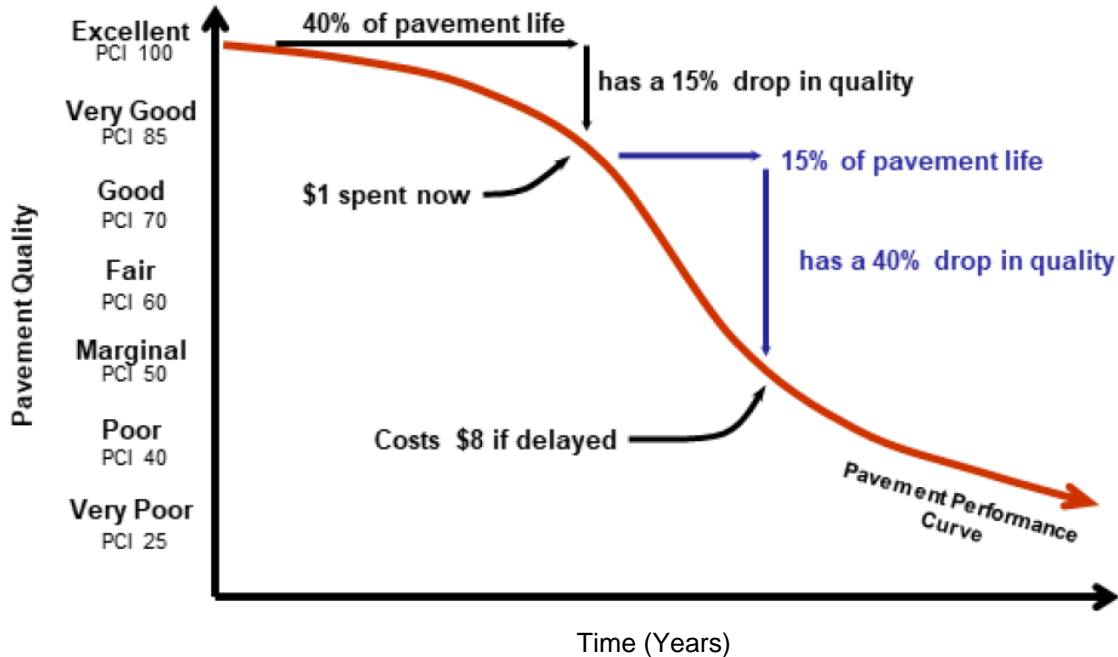
The analysis identified a large gap between historic funding levels and the funding required to maintain quality pavement surfaces. The purpose of this Companion Memorandum is to present in non-technical terms the critical findings and outline the basis for the 5-Year Plan Scenarios presented herein.

1.1 Pavement Lifecycle and Maintenance

Lifecycle costs include both initial construction costs and future upkeep costs over time. Pavement quality decreases over time based on several variables such as traffic volumes, weather conditions, and water intrusion. Pavement's useful life is approximately 15 to 20 years without applying preventative maintenance. After this time, pavement condition deteriorates rapidly, and the street ultimately becomes a failed street. Failed streets are the costliest to repair, requiring full reconstruction. The deterioration of pavement over time is shown graphically in **Figure 1**.

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Figure 1 : Pavement Deterioration and Life Cycle Costs



There are two general approaches to pavement maintenance:

- **Reactive Maintenance**

- Also known as “Worst first” the roadways with the lowest quality are selected first for rehabilitation.
- These rehabilitations are expensive to implement and tend to expend allocated budgets inefficiently. The overall quality of the network is difficult to improve since smaller areas can be rehabilitated in a given year.

- **Preventative Maintenance**

- Focuses on maintenance activity to extend the useful life of the pavement. Seal coats and micro surfacing are examples of preventative maintenance techniques that extend pavement life. These treatments seal the existing roadway surface and minimize water intrusion.
- Rehabilitate roadway segments before they require costlier treatments.
- Re-evaluate the roadway network every 5-years to track progress and adjust the plan.

2. Critical Elements of a Pavement Management Plan

A Pavement Management Plan (PMP) is based on thorough examination of the City's roadway network to implement a desirable level of serviceability in a cost-effective manner. There are three key elements of a PMP:

- Pavement Condition Index
- Construction Costs
- Paving Methodology & Strategies

Each element has been tailored for Key West roadways to establish the 5-Year Plan Scenarios and is discussed in further detail below.

2.1 Pavement Condition Index (PCI)

The Pavement Condition Index (PCI) is a numerical value between 0 to 100 and is used to indicate the general condition of pavement within a roadway segment. The PCI is based on a survey of the number and types of distresses in a pavement. A PCI of 100 represents a pavement in the best possible condition and a PCI of 0 represents a pavement in the worst possible condition.

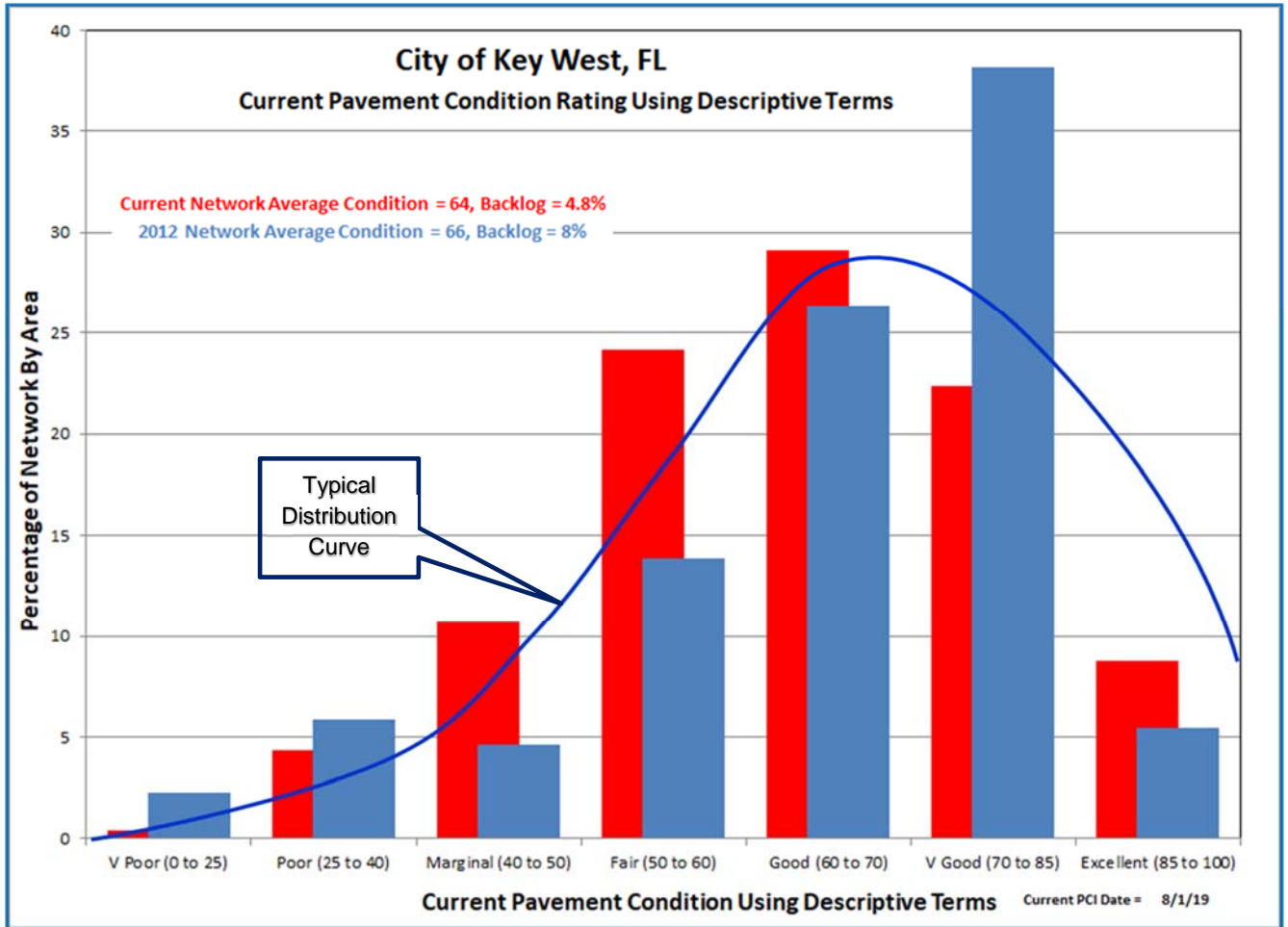
A PCI value of 63¹ has been assigned for the approximately 62.5 miles of roadway segments owned by the City of Key West. The PCI was calculated from surface conditions obtained during IMS' Laser Road Surface Testing. The strength of the pavement base was measured using deflection testing. All collection methods are detailed in the PCAAR and raw data was provided in a spreadsheet.

- The 2019 PCI values declined compared to the 2012 PCI values. This is graphically depicted in **Figure 2**. (PCAAR, Section 4.3)
- A high PCI value can be maintained with an inexpensive rehabilitation such as a thin overlay or slurry seal, whereas a low PCI value requires an expensive rehabilitation such as a thick overlay or full reconstruction.
- PCI values between 65 - 80 indicate networks with an ongoing pavement rehabilitation program.

1. IMS' analysis yielded an average PCI of 63 for Key West. Projects that have been constructed post-analysis or are currently under contract will increase the PCI to 64.

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Figure 2: 2012 Versus 2019 PCI Comparison



2.2 Construction Costs

Rehabilitation costs were estimated using a combination of recent project bids and national averages which were adjusted for Key West's unique conditions. Construction Costs include:

- Mobilization
- Asphalt pavement Milling & Resurfacing
- Manhole and Valve Adjustments
- Pavement Markings
- Traffic Control/ Detours
- Design Engineering
- Construction Engineering and Inspection (CEI)

Historically, unit rates increase over time; however, unit costs can vary and should be re-evaluated for their impact to the entire system. Additionally, the City can implement strategies to reduce costs by providing design and CEI in-house whenever possible and creating larger sized projects to attract more bidders. Additional bidders tend to yield overall lower prices.

2.3 City Paving Methodology, Goals and Strategies

Methodology of Roadway Selections:

- Priorities:
 - Functional classification (collector, local roads in Old Town, local roads all others)
 - Traffic Volumes (vehicle, bicycle, pedestrian)
 - PCI Score
 - Continuation of recently paved streets
- Group roadway segments in proximity to one another in order to maintain them more efficiently in the future.
- Distribute projects in an equitable manner so all neighborhoods within Key West receive continual improvements.
- At least every 5 years, the City should re-evaluate the roadway network to track progress and adjust the PMP.

Overall goals of the PMP:

1. Improve the City average PCI:
 - Desirable Avg. PCI between 70 and 75

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2. Reduce backlog (defined as roadways with PCI less than 40):
 - Ensure the % of “Very Poor” and “Poor” roadways does not increase
3. Reduce exterior stressors that accelerate deterioration:
 - Ensure Manholes and valve tops are level
 - Require proper backfill for utility cuts and repair trench failures
 - Fix surface settlements caused by pipe failure or water intrusion
4. Maintain streets that are in Good condition (PCI greater than 70) and extend their life:
 - Establish critical roadway projects for each year and then use remaining funds for maintenance and useful street life extension.

2.4 City Specific Strategies

City of Key West staff is also actively working on additional measures to improve the overall quality of the roadway network. Specific measures include, but are not limited to:

1. **Utility Coordination-** Work with Florida Keys Aqueduct Authority (FKAA) and the City of Key West Utilities Department to identify long term planning conflicts and modify schedules to allow utility cuts to occur prior to final paving.
2. **Multi-Agency Coordination-** Continue to coordinate and partner with Florida Department of Transportation (FDOT) and Monroe County to have their roadway segments within Key West rehabilitated.
3. **Roadway Construction Moratoriums** – Establish moratoriums as a method of protecting reconstructed or repaved roadways within the boundaries of the City. Any contractor that proposes roadway excavation within the moratorium time limit (~5-years) will be subject to an increased (~doubled) City permit fee and special City Restoration requirements (to be determined).

In addition, future paving projects should be coordinated with the recently adopted Bicycle/Pedestrian Master Plan and take advantage of opportunities to upgrade bicycle and pedestrian infrastructure.

3. 5-Year Plan Scenarios

Several budget scenarios were analyzed in the PCAAR (Section 5.3) to maximize the financial investment of the City. For this memorandum, four distinct budget scenarios are summarized in **Table 1**.

Table 1: Budget Scenarios (5-year)

Budget Scenario #	Annual Investment (5-Year Total)	Resulting 2024 PCI	Pros	Cons
1. Historical In PCAAR as "Current Key West Budget"	\$1.50 M (\$7.5)	PCI 61 (-3)	Maintains current funding levels.	Overall pavement quality would continue to decline.
2. Steady State PCI	\$2.16 M (\$10.8)	PCI 64 (0)	Keeps pace with the existing pavement condition.	Overall pavement quality is static and requires future expensive reactive maintenance.
3. Catch Up In PCAAR as "Recommended Budget"	\$3.26 M (\$16.3)	PCI 70 (+6)	Average pavement quality would elevate to high levels resulting in less expensive preventative maintenance.	Requires an increased funding investment.
4. Fix All	\$7.94 M (\$39.7)	PCI 89 (+15)	All pavement quality would elevate to high levels resulting in future cheaper preventative maintenance.	Requires a significant funding investment. Will result in many concurrent roadway construction projects. All streets would need to be repaved starting in 15 to 20 years requiring another significant capital outlay.

The analysis predicts that applying the historic funding level (Scenario #1) of \$1.5M/year for five years will result in an average PCI drop from 64 to 61. To maintain the existing average PCI at a steady state (Scenario #2) would require an increased investment to \$2.16M/year. The fix all budget (Scenario #4) would elevate the overall pavement condition to the highest level but comes at an expensive \$7.94M/year.

Scenario #3 was developed with the intention of increasing the average PCI to a desirable level of 70. The reward of this approach is that with careful project selections, rehabilitations will transition into the

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earlier years of the pavement life and in time shift from more expensive to less expensive rehabilitation requirements. A PCI of 70 for an entire roadway network is regarded as well above average. The PCAAR, Appendix B and C contain details for Scenario #3 indicating a “Selected Year” of rehabilitation for each roadway segment. This information is subject to change and all analysis is contained in a spreadsheet which can be updated by the City.

3.1 Post-Rehabilitation Conditions

Implementing the Scenario 3 “Catch Up” budget for five years will increase the PCI to 70 and allow the City to then fall into a steady state maintenance budget. Assuming a preventative maintenance program is successfully implemented and followed, the post-rehab annual costs are estimated at approximately \$2.2M (~\$2.5M in 2024 dollars assuming 3% inflation). It is important that the roadway network is re-surveyed after 5 years to assess progress and develop new budget estimates for the next paving cycle.

4. External Funding Sources & Other Considerations

When establishing long term-budgets and project prioritization, the City of Key West should consider applying for funding sources from state and national programs. While these programs may not be applicable to many of the standard paving rehabilitation projects outlined in the *Pavement Condition Assessment and Analysis Report* (PCAAR), the City could use these additional resources to supplement funding for their greater City Projects list. With this approach, external funding sources could affect the project prioritization of the standard paving rehabilitation projects.

The application process and requirements for state and national programs is derived from current information and therefore subject to change. Key features are outlined in **Table 2**. In most cases there is a lengthy application process before funding is approved and may come with significant conditions attached.

Table 2: External Funding Sources and Key Considerations

Title	Project Types	Funding	Notes
<p>1. Safe Routes to School (SRTS) Grants</p>	<p>Projects may include planning, design, and construction of infrastructure-related projects that will substantially improve the ability of students to walk and bicycle to public, private and tribal schools. Including:</p> <ul style="list-style-type: none"> • Pedestrian Facilities • Bicycle Facilities • Traffic Control Devices <p>Projects may indirectly benefit the general public; however, these constituencies cannot be the sole or primary beneficiaries.</p>	<p>The SRTS Program is 100 percent funded and is managed through the Florida Department of Transportation (FDOT) on a cost-reimbursement basis.</p>	<p>Design must be in accordance with all federal requirements. Requires LAP certification. Typically, Safety Audit is required as part of application process.</p>
<p>https://www.fdot.gov/safety/2A-Programs/Safe-Routes-StartingSRTS.shtm</p> <p>FHWA Pedestrian and Bicycle Funding Opportunities https://www.fhwa.dot.gov/environment/bicycle_pedestrian/funding/funding_opportunities.cfm</p>			

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Title	Project Types	Funding	Notes
<p>2. BUILD Transportation Grants</p> <p>Better Utilizing Investments to Leverage Development (BUILD)</p>	<p>Eligible projects for BUILD Transportation grants include, but are not limited to:</p> <p>(1) Highway, bridge, or other road projects eligible under title 23, United States Code;</p> <p>(2) public transportation projects eligible under chapter 53 of title 49, United States Code;</p> <p>(3) passenger and freight rail transportation projects;</p> <p>(4) port infrastructure investments (including inland port infrastructure and land ports of entry); and</p> <p>(5) intermodal projects.</p>	<p>For Rural projects (pop. < 200,000 in the 2010 census) the minimum award size is \$1 million. Max. award size is \$25 million.</p> <p>Grants may be used for up to 100% of project value in a rural area.</p>	<p>The recipient must pay project costs as they are incurred and submit to DOT requests for reimbursement. This means that the recipient must have access to sufficient non-BUILD funding sources to manage cash flow associated with the project.</p>
<p>https://www.transportation.gov/BUILDgrants</p>			
<p>3. TIFIA Loans</p> <p>Transportation Infrastructure Finance and Innovation Act (TIFIA)</p>	<p>Eligible projects include highway projects, passenger rail projects, transit and intermodal projects, private rail facilities providing public benefit to highway users, surface transportation infrastructure modifications necessary to facilitate direct intermodal transfer and access into and out of a port terminal, intelligent transportation systems (ITS), surface transportation projects eligible for Federal assistance under title 23 or chapter 53 of title 49 of the U.S. Code, international bridges and tunnels, and intercity passenger bus or rail facilities and vehicles.</p>	<p>\$10 M minimum for Transit-Oriented Development (TOD) Projects and local infrastructure projects;</p> <p>Exact terms are negotiated with USDOT.</p> <p><i>Note: Key West is likely excluded from TIFIA "Rural Project Initiative" because the City population is << than 150,000.</i></p>	<p>The applicant must demonstrate that the proposed project is part of the appropriate State Transportation Improvement Program (STIP) before the USDOT will select the project, issue a term sheet, and obligate funds.</p>
<p>https://www.transportation.gov/buildamerica/programs-services/tifia/eligibility</p>			
<p>4. Transportation Regional Incentive Program (TRIP)</p>	<p>State funds are available throughout Florida to provide incentives for local governments and the private sector to help pay for critically needed projects that benefit regional travel and commerce.</p>	<p>The Florida Department of Transportation (FDOT) will pay up to 50% of the non-federal share of project costs for public transportation facility projects.</p>	<p>Eligible partners must form a regional transportation area, pursuant to an interlocal agreement, and develop a regional transportation plan that identifies and prioritizes regionally significant facilities.</p>
<p>https://www.fdot.gov/programmanagement/lp/trip/default.shtm</p>			