



MEMORANDUM

Date: June 30, 2017

To: The Honorable Chair and Members
Pima County Board of Supervisors

From: C.H. Huckelberry
County Administrator

A handwritten signature in black ink, appearing to be "CHH", is written over the printed name "C.H. Huckelberry".

Re: **Transportation Advisory Committee**

As you know, my three appointments to the Transportation Advisory Committee (TAC) were ratified and approved by the Board of Supervisors on June 20, 2017.

The TAC consists of 13 members; each Board member will appoint two members. I encourage you to make your appointments as soon as possible, as the TAC has significant work to complete before making recommendations on local road repair and pavement rehabilitation scheduled to begin in November 2017.

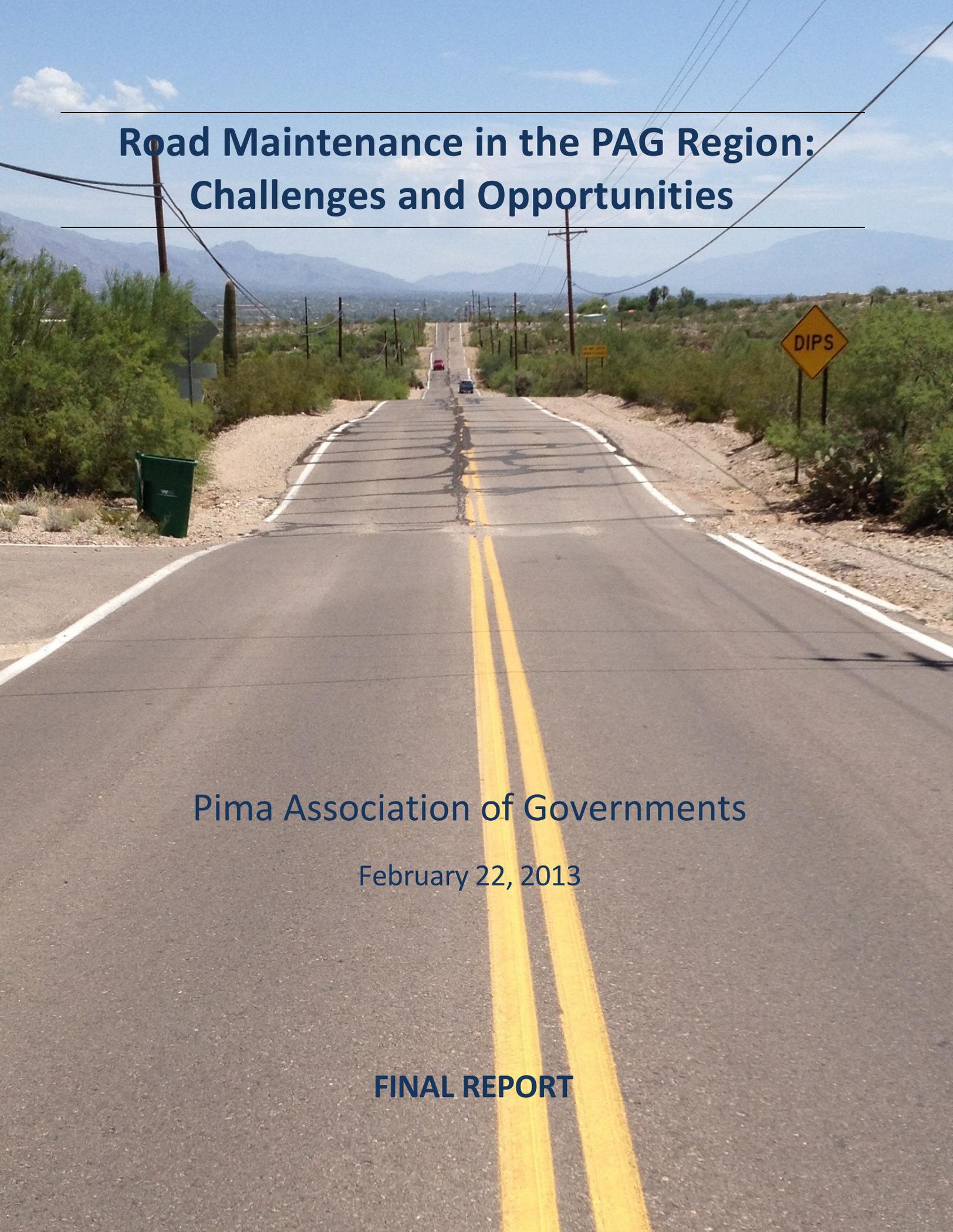
Given the deliberation process by the TAC and contracting procedures, it is important the TAC members be appointed and the Committee functioning by August 2017.

As background information, attached is a 2013 study commissioned by the Pima Association of Governments (PAG) regarding road maintenance in the PAG region. The report is a comprehensive review of road maintenance and funding, including in other states and jurisdictions. The report makes specific regional recommendations regarding road maintenance and concludes the largest obstacle to maintain roads is funding. The recently adopted County road property tax and the sales tax increase by the City of Tucson are steps in the right direction, although road repair obligations remain significantly underfunded.

CHH/anc

Attachment

c: Carmine DeBonis, Jr., Deputy County Administrator for Public Works
Nanette Slusser, Assistant County Administrator for Public Works
Priscilla Cornelio, Director, Transportation Department



Road Maintenance in the PAG Region: Challenges and Opportunities

Pima Association of Governments

February 22, 2013

FINAL REPORT

Road Maintenance in the PAG Region: Challenges and Opportunities

Pima Association of Governments

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Final Report

This document does not constitute a standard or specification.

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1: INTRODUCTION

Overview

This white paper has been prepared to address the current state of road maintenance in the region, with emphasis on effective strategies and funding availability. It describes current pavement management activities in the PAG region, the general condition of public streets, and proposes recommendations for a regional roadway maintenance program to be administered or facilitated by PAG. Examples of good and efficient pavement management techniques, both here and elsewhere, are provided. Current and potential funding sources are identified for this purpose, and general policy recommendations for budgeting, administration and implementation of a regional plan are provided. The bottom line is that road maintenance is currently underfunded which will cost us all much more in the long run. Additional analysis will be provided following direction from the Regional Council.

The PAG region includes almost 1 million residents in unincorporated Pima County and the communities of Tucson, Oro Valley, South Tucson, Marana, and Sahuarita, the Pascua Yaqui Tribe and the Tohono O’odham Nation. Due to severe funding constraints, road maintenance has slipped to the point that some roads are now beyond repair and need total reconstruction. Although some of the jurisdictions have done a better job than others at road maintenance, public outcry is for fewer potholes and smoother roads. This is common in today’s economy, yet the disrepair is also a disincentive to economic recovery.

Although PAG “owns” no roadways, they are involved in maintenance nonetheless. For instance, PAG has shown a leadership role by facilitating regionwide pavement condition data collection. The regional Pavement Management System (PMS) program does include assistance in the development of capital programs for pavement maintenance of individual jurisdictions at the

request of the jurisdiction. As an example, the Town of Oro Valley, with assistance from regional TDOT staff developed a 5 year capital program for pavement maintenance.¹

Further, the distribution of state and federal highway funds is facilitated through PAG's committee structure. PAG recognizes the need to enhance investment in road maintenance regionally, and to investigate strategies to optimize maintenance funding and programming. Their coordinating role can be expanded, as witnessed successfully in other regions, especially the San Francisco Bay area.

¹ See <http://www.orovalleyaz.gov/Assets/Pavement+Management+Presentation.pdf> which illustrates how a reasonable maintenance level minimizes overall maintenance costs.

2: ROAD MAINTENANCE IN THE REGION

All roads deteriorate over time due to environmental conditions and the volume and type of traffic using the roadway. Without proper maintenance, roadways wear out prematurely. The rate at which deterioration occurs is a function of these factors, as well as the nature and frequency of preventative maintenance (PM) activities.

Road maintenance can be defined as follows:

Road maintenance is broadly defined as work accomplished to preserve or extend the roadway's life until major rehabilitation or complete reconstruction is performed. Maintenance is classified by function as either routine or preventive. Preventive maintenance preserves rather than improve the capacity or strength of the pavement structure. In order for preventive maintenance to be effective, it should be applied to structurally sound pavement, before the pavement displays significant amount of environmental distress such as raveling, oxidation, and block cracking. Timely treatments prove to be the most cost effective. Routine maintenance more typically consists of pothole repair, patching, sweeping, sign repair and restriping, and storm damage mitigation.²

Why is Road Maintenance Important?

Investing in repair and preservation actively reduces the scale of future costs. According to the American Association of State Highway and Transportation Officials (AASHTO), every \$1 spent to keep a road in good condition avoids \$6-14 needed later to rebuild the same road once it has deteriorated significantly.³

²Adapted from "State of the System, Roadway Management System, FY 2011", Maricopa County

³ American Association of State Highway and Transportation Officials (AASHTO) and The Road Information Project. (2009). "Rough Roads Ahead: Fix Them Now or Pay for It Later."

<http://roughroads.transportation.org> , as cited in <http://www.smartgrowthamerica.org/documents/repair-priorities.pdf>

The value of pavement maintenance to a public works department and its jurisdiction is easily discerned. The safety of the traveling public, the economic benefit of a good road system and the life cycle costs of the pavement are the major considerations in establishing and maintaining a quality and cost-saving pavement management system.

Road maintenance emphasizes asset preservation, not upgrades. It is important from many perspectives. First and foremost is public safety, which declines as surface conditions degrade, road cleanliness diminishes, and the condition of traffic signs and markings fade. Properly timed maintenance decreases overall life cycle cost of the infrastructure investment, allowing more to be spent in the long run on capacity and upgrade projects. Roads in good condition have higher capacity, are quieter, safer for all users, and decrease pollution. The appendix contains a brief primer on pavement management authored by the Federal Highway Administration.⁴

From a landowner's view point, poorly maintained roads impact property values, which can have a deleterious impact on local property taxes. Poor roads discourage economic development, especially when developers have a choice of regions with better roads. From the road users' perspective, poorly maintained roads add to vehicle operating costs. AAA, AASHTO, and others claim that rough roads can add \$400 to \$750 per year to the cost of vehicle operation. Closer to home, data from a national report shows that Tucson area drivers pay \$288 more per year to operate their cars than Phoenix drivers, all because our roads have a lesser state of repair.⁵

In urban areas with a concentration of rough roads, extra vehicle operating costs are higher, and larger vehicles will see a greater increase in operating costs due to rough roads.⁶ According to a very recent report,⁷

⁴ Obtained from <http://www.fhwa.dot.gov/infrastructure/asstmgmt/pmprimer.pdf>

⁵ America's Roughest Rides and Strategies to make our Roads Smoother – September 2010, available at <http://www.tripnet.org/national-info-reports.php>

⁶ Transportation California, "Poor Road Quality Imposes Hidden Tax on California Motorists", 2004; *Rough Roads Ahead – Fix Them Now or Pay for it Later*, AASHTO, 2009.

⁷ NCHRP Report 720, *Estimating the Effects of Pavement Condition on Vehicle Operating Costs*, 2012

“Vehicle operating costs are part of the costs that highway agencies must consider when evaluating pavement-investment strategies. For conventional vehicles, these costs are related to fuel and oil consumption, tire wear, repair and maintenance, and depreciation; emerging vehicle technologies may involve other cost items. These costs depend on the vehicle class and are influenced by vehicle technology, pavement-surface type, pavement condition, roadway geometrics, environment, speed of operation, and other factors. “

An *Inside Tucson Business* opinion by former City of Tucson councilperson Carol West describes recent challenges the City of Tucson experienced. She stated that,

“For years, we have neglected the city’s infrastructure in favor of projects more visible to the public. This has been to our detriment. Rapid growth caused more focus on new public streets in suburban areas, leaving fewer dollars for midtown Tucson streets in need of maintenance and repair. Also, various utility companies cut streets to make repairs, and the pavement replacements sometimes are not up to city standards.”

“There have been suggestions the private sector voluntarily pay to repair some potholes. Others have thought about taking money from transit for street repairs. But some people who once drove to work are now helping to diminish wear-and-tear on local streets because they now ride Sun Tran.”

“Lessons for elected officials: neglecting infrastructure improvements hampers public safety on our streets...as the economy begins to turn around, neighborhood streets must be a priority.”⁸

⁸ http://www.insidetucsonbusiness.com/opinion/columnists/carol_west/potholes-r-us---city-s-street-management-plan/article_07047300-5117-51a0-b83d-4e1b903ebfad.html

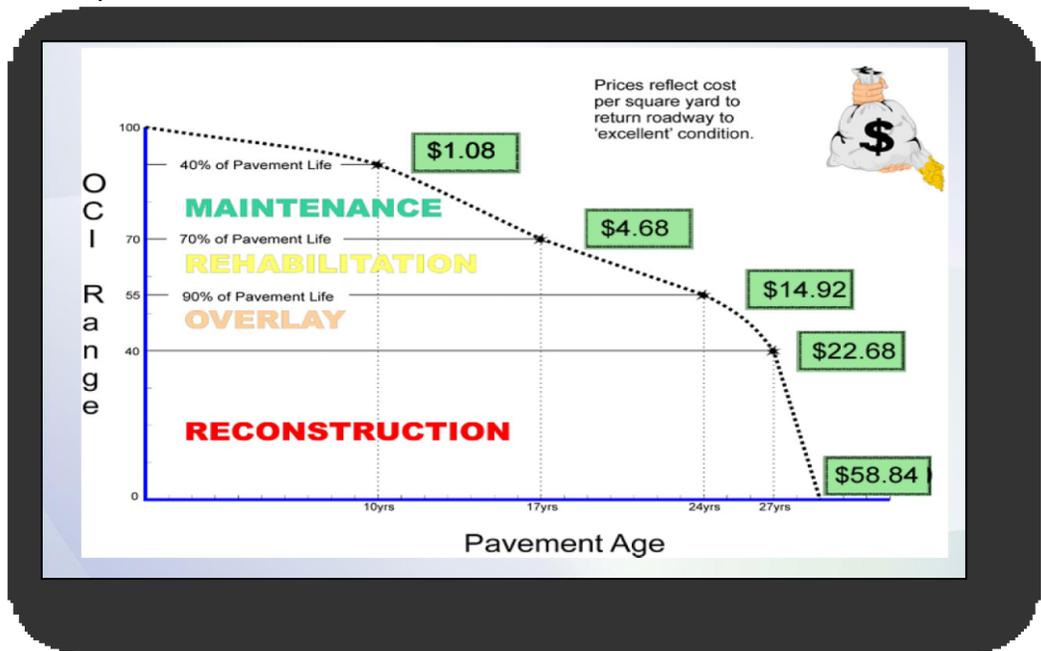
Current Status of Roadways

Road maintenance, reconstruction, and new construction projects compete for available funding. This competition is intensified by funding limitations resulting in part from the global economic downturn. Maintenance often is delayed until ride quality becomes unbearable, resulting in public outcry followed by governmental response.

Deferred maintenance is a false economy because “catch up” repairs are much more expensive than strategic investments. For instance, the cost to return asphaltic pavement to excellent condition rises exponentially over time. The chart at below shows that it costs about a fourth as

much to rehabilitate a ten year old facility as a 17 year old road and only about 2% as much as a 30 year old road.⁹

Tucson staff indicated that 25 percent of major



roadways and 55 percent of residential streets are failed or failing.¹⁰ Repairs would cost about \$850 million over the next ten years to bring these streets up to excellent condition. In response, the City asked voters to approve a \$100 million General Obligation bond program for road maintenance. Termed “Proposition 409”, it was narrowly approved by a 50.3% margin in the

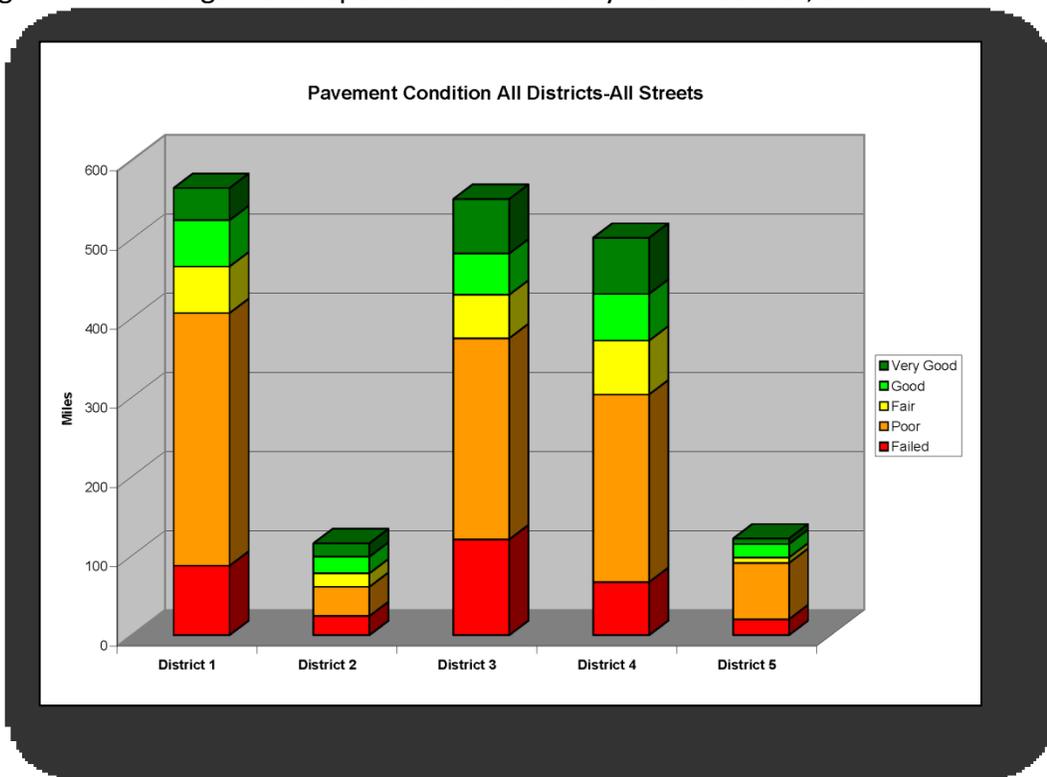
⁹ Source – RTA presentation to APWA, January 2012

¹⁰ Inside Tucson Business, referenced from http://www.insidetucsonbusiness.com/news/top_stories/more-than-half-of-tucson-streets-in-poor-condition-how/article_b66a4c5e-8a35-11e1-9494-0019bb2963f4.html

November 6, 2012 general election.¹¹ Tucson staff is now implementing the repair program through a bond oversight committee.

Pima County staff recently updated the pavement condition analysis of all County roads using historic data from 2009 through 2011. Findings were reported to the County Administrator, and they clearly show that 1,192

of 1,803 road miles (i.e., 66%) were in poor-to-failed condition.¹² The County Administrator subsequently transmitted a memorandum to the Board of Supervisors indicating that, “The condition of our paved highways is mixed to poor....we also have a significant number of arterial and collector



roadways that are in need of major maintenance and repair. In addition, most local paved streets have not had adequate maintenance in the last 10 years. Significant investments are necessary to keep our paved highway transportation system from deteriorating further.¹³

The City of South Tucson relies on limited funding for roadway maintenance because of its small area and population, but has received pavement improvements as a part of the 1997 Pima County Bond Program which specifically included South Tucson street repairs. Marana, Oro

¹¹ See <http://tucsoncitizen.com/community/2012/11/19/prop-409-bonds-for-city-street-improvement-passes-by-954-votes/>

¹² See <http://www.pima.gov/cob/e-agenda/04102012/Ra-6%20Late%20Material.pdf>

¹³ County Administrator BOS Memorandum, April 10, 2012; “Need for Increased Investment in Transportation and Highway Maintenance”

Valley, and Sahuarita also seem to have provided a higher level of maintenance, as discussed later in the report and as noted in response to a survey conducted for this study. Other jurisdictions, including Maricopa County, have managed to maintain their roadway system better because their funding position is stronger and they have consistently made maintenance a high priority.

Currently, each PAG jurisdiction determines its own needs. This can become obvious at a jurisdictional boundary where a road is in different state-of-repair on each side of the line. One way to remedy this would be to establish a regional process by which roadways can be evaluated for improvement, and then assigning priorities to improve roadways in a coordinated manner based on need.



PAG's Role in Roadway Maintenance and Data Collection

PAG's comprehensive regional planning program is implemented through its Overall Work Program (OWP). The OWP promotes efficient system management and operations, and emphasizes the preservation of the existing transportation system. The Regional Transportation Plan identifies and monitors resources available for maintenance and development of the regional transportation system including strategies for developing additional resources. This is

accomplished, in part through Task 92 – Regional Pavement Management and Systems Data. Task 92 is provided to the region as a “pass-through-funding” activity conducted by the City of Tucson. The PAG Regional Transportation Plan (RTP) specifically identifies ongoing requirements for annual average maintenance and operations (M&O) expenses as well as project specific requirements associated with the development of new or improved transportation facilities. The RTP includes maintenance of effort provisions in the financial constraint analysis. Increased levels of M&O also have been included in the mix of new expenditures evaluated in the Plan¹⁴

PAG has taken an assertive role in helping its member jurisdictions monitor pavement conditions. The PAG Roadway Maintenance program assists them by providing data and tools for assessing roadway conditions. Pavement data is collected for all federal-aid roadways and local streets within the region with the City of Tucson’s Automated Road Analyzer, or ARAN, van. The series 4300 van collects data at 15 mph, including ride quality, rutting, concrete pavement faulting, grade and cross-slope, real time video imagery, and road right-of-way features. Video logs are also integrated into the TDOT’s online map service for users to view. More information about the ARAN van housed and maintained by the City of Tucson is available at Transview.org/aran.¹⁵

The ARAN van is able to accomplish this by using a variety of sensors, a sub-meter global positioning system, video and machine visio



based on common standards such as the International Roughness Index (IRI), and Photographic Analysis of Asphalt Surfaces for Survey Evaluation Ratings (PA²S²ER) of distresses, based on

¹⁴ Source, PAG FY 2012-2013 Overall Work Program and Budget
¹⁵ Also see the manufacturer’s website: - <http://www.roadware.com/>

windshield surveys. The van has been used so far by all jurisdictions except for the Tohono O’odham nation. Jurisdictions can schedule use of the van according to established procedures.

Three TDOT staff members are committed to this program, and there is budget capacity for a fourth staff member. Staff collects the data, and coordinates the information for use by the jurisdictions. STP funding (pass-through money from PAG) pays for the program at about \$450,000 per year. There is a 5.7% City of Tucson matching amount.

The asset management software used by TDOT is “Cartegraph”, and all jurisdictions receive their pavement data through this program. Each jurisdiction has its own site license for the software. Other assets such as signs and signals can also be inventoried with this software.¹⁶

A new ARAN 9000 van was recently purchased by PAG for regional use. It will be utilized soon for limited data collection, and will be fully active in about a year. Both the original and the new vans will be available for data collection. Because of liability issues, a trained TDOT employee must operate the vans regardless of the jurisdiction to be evaluated.



Data collection is crucial to establishing a pavement management system. The FHWA

indicates that several cycles of data collections are needed to establish a condition trend line, which can then be used for cost effective maintenance investments.

¹⁶ For more information, see <http://www.cartegraph.com/index.php/solutions/pavementview>

Due to extreme funding limitations and other factors, there is a need to examine a more integrated and regionalized effort to preserve roads of all functional classification, including those corridors that cross jurisdictional boundaries. Since PAG already acts as a data clearinghouse and provider of transportation data, its continuing leadership role in pavement management is crucial. From PAG's website: "The Regional Pavement Management System provides PAG member agencies with the appropriate tools and data to assess the deterioration of publicly owned roadways and other roadway infrastructure. Accurate management of the multi-billion dollar roadway infrastructure is essential for allocating and optimizing the impact of available maintenance budgets."¹⁷ Although PAG does serve as a technical resource in pavement management for the region, it does not coordinate maintenance activities by and between its member jurisdictions.

Legal Authority and Duty for Road Maintenance in Arizona

Arizona municipalities and counties are empowered to plan, open, and maintain public streets pursuant to ARS §9-240 and ARS §11-251, respectively. The statutes further define funding options, including general obligation bonds, but there is no apparent mandate to maintain roads to a given performance standard. Instead, the presumption for adequate maintenance and safe conditions results from tort liability (law suits) and risk management practices. According to one source, the total dollar amount of claims against US highway agencies in a typical year is between \$50 billion and \$60 billion.¹⁸ This can be minimized by managing risk including preserving pavement conditions.

To minimize liability, transportation departments and elected officials must be aware of their duty to maintain the roadway systems in a condition reasonably safe for public travel by road users who are themselves exercising ordinary care. As a further condition for recovery it is

¹⁷Pima Association of Governments Regional Pavement Management, referenced at: <http://www.pagnet.org/Programs/TransportationPlanning/RegionalSafetyandOperations/RegionalPavementManagementSystem/tabid/365/Default.aspx>

¹⁸ "Tort Liability and Risk Management", in FHWA Course on Bicycle and Pedestrian Transportation, 1998

necessary to establish that the State or subordinate governmental agency had either actual or constructive notice of the defect and that they responded in a reasonable time to take remedial action. ¹⁹ Local jurisdictions, therefore, have a duty to effectively program and fund road maintenance, and to be ready to make prompt repairs when deficiencies become apparent.

¹⁹ Road Management and Engineering Journal; NCHRP 20-6, *Legal Problems Arising Out of Highway Programs*

3: BEST PRACTICES

There are abundant technical literature and software tools for asset management, including pavement management. The Federal Highway Administration has a website dedicated exclusively to this discipline, and they offer conferences and local courses for practitioners.²⁰ This is such an important topic across the country that the first national conference on pavement preservation was held late this summer in Nashville.²¹ Both the FHWA website and the conference discuss best practices, including regional partnerships in pavement management. In addition, scheduled sessions include topics such as flexible and rigid pavements; existing and innovative materials; communications and marketing; and short-term and long-term planning. Local agency delegates will be particularly interested in two sessions specially planned for them – “Best Local Agency Practices” and “Implementing a Local Agency Program”. Proceedings of the conference should be available by the end of the year.

More locally, several communities in Arizona have Pavement Management Systems (PMS) in place, through which pavement preservation, rehabilitation or reconstructions are prioritized, funded and scheduled based on adopted pavement condition criteria. Maricopa County, the City of Chandler and the City of Phoenix have well-established pavement management systems by which they regularly schedule maintenance activities to reduce the amount of roadway reconstruction.

Interestingly, most communities in the PAG region do have robust tools to manage pavement life-cycle costs. The City of Tucson, for example, began a sustainability program for this purpose a few years ago, but this program was discontinued due to dwindling, and reprioritization of funds. Pavement conditions have slipped due to lack of adequate funding, not lack of awareness.

²⁰ See for example <http://www.fhwa.dot.gov/asset/index.cfm>

²¹ See <http://nationalpavement2012.org>

Maricopa County

Maricopa County prepares a State of the System (SOS) report every year which documents the quality of roadway infrastructure and operational conditions of the County roadways. The most recent report is for FY 2011 and indicates that over 80% of the County's roadways were rated Excellent to Good on their Pavement Condition Rating (PCR), with less than 1% rated fair to poor.²²

According to the 2011 SOS report, "The Road Management Section evaluates pavement conditions for surface distress every 12-18 months for arterial roads and every other year for local roads. Half of the local roads are evaluated each year. The ratings range from 0 to 100 with 100 being a new pavement with no distress. The result allows for quantifying the overall pavement condition of the road network. "

MCDOT also evaluates roadways based on the International Roughness Index (IRI). MCDOT uses a Laser Road Profiler (LRP) equipped with triple (3) lasers, one in each wheel track and one in the mid-lane to collect IRI data. Annually the MCDOT Road Management Section collects the IRI for each arterial road segment with a length greater than a quarter of a mile. The IRI values are scored for each road segment on a scale from 1 to 500 with 500 representing an extremely rough road. IRI values are categorized by performance subgroups and the percentage of each group can be seen in Figure 2; IRI Ratings. MCDOT utilizes the PCR and IRI ratings to forecast preventive maintenance programs and Transportation Improvement Program (TIP) planning.

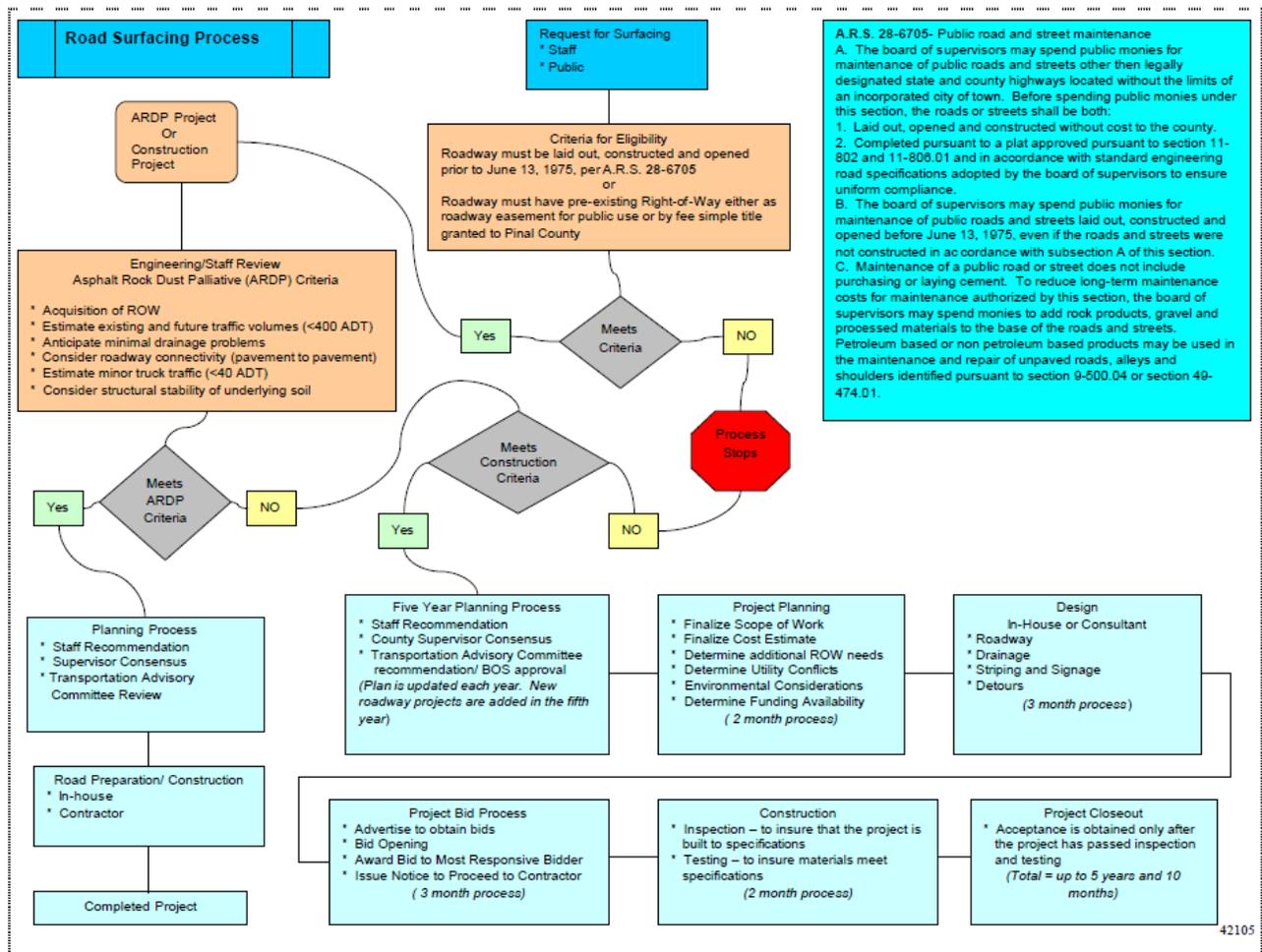
The Road Management Section collects most of the details for each arterial road segment. The sufficiency rating identifies how well each road segment compares to the MCDOT Roadway Design Manual (RDM) standards. Ratings for each category are combined per road segment and scored on a scale from 0 to 100, 100 representing a road in compliance with the RDM standards.

²² http://www.mcdot.maricopa.gov/technical/eng-manuals/2011_SOS_Report.pdf

The sufficiency ratings of arterial roads are updated only after major improvements or reconstruction of the road. New construction, widening, or significant improvement to the safety issues such as, bottleneck, drainage, vertical and horizontal sight distance are required to impact the rating.

Pinal County

Pinal County, through its Department of Public Works, maintains a transportation system of over 2,000 miles including established county highways, roads dedicated to the county through an approved plat, and non-standard public roads constructed prior to 1975. There are many unpaved roads (over half of all roads) throughout Pinal County, and typical roadway maintenance includes the application of dust palliative for dust control. Pinal County has a specific process for roadway surfacing projects.



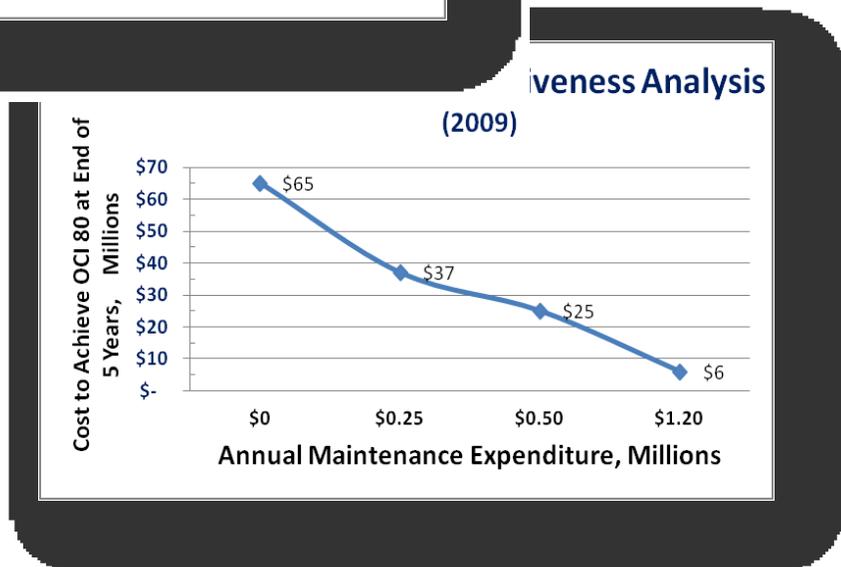
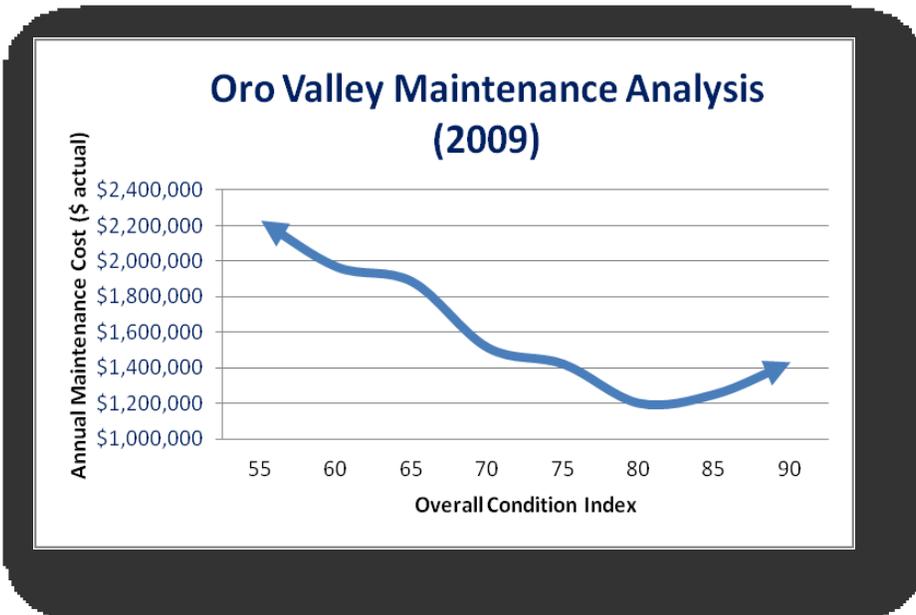
Source: Pinal County

Cities and Towns

Town of Oro Valley

Oro Valley staff conducted detailed analysis using ARAN van data and recommended an investment strategy to its Mayor and Council. The analysis showed that the optimal payment condition was achieved at an “Overall Condition Index” of 80. This was achievable with an average annual expense of \$1.2 million. If the roads were maintained at a lower level, costs increased and ride quality suffered. If maintained at a higher level, cost also would rise without a perceptible increase in pavement quality. Staff also determined the cost-to-cure after five years of lesser maintenance. For OCI 80, spending only \$500,000 per year results in a \$25 million cost-to-cure at the end of five years. If maintenance funding is eliminated entirely for

five years, the cost to cure is \$65 million. Because of the analysis and presentations to elected officials, the Town has invested regularly to maintain the recommended OCI 80 pavement condition.



Flagstaff

According to Flagstaff's website, "The Street Maintenance Program includes street overlay, chip seal and crack sealing construction to preserve and maintain existing asphalt street and parking lot pavements. The contract work also includes removal and replacement of curb returns and sidewalks at many locations on the streets overlaid to bring these streets into compliance with the Americans with Disabilities Act (ADA). Traffic signal detection modifications may be required where the work disturbs existing detection equipment. Utility adjustments and pavement marking are also included in the work.

The goal of the Street Maintenance Program is to use the available funds in the most efficient manner to lengthen the service life of the City street pavements and avoid costly pavement reconstruction. The ADA improvements provide improved access for disabled citizens and visitors along existing streets and provide compliance with Federal requirements.

Street Maintenance is responsible for the safe passage of all City-owned streets. The Street Section maintains 634 lane-miles of asphalt streets and 28 lane-miles of dirt roads. The City is not responsible for maintenance on state roadways, except for 89N from Fanning to Trails End and East Route 66 (behind the mall)."²³

Mesa

According to the official website of Mesa, Arizona, "The Pavement Management Program is an Information Management System, which allows the City to track the history, surface condition and distresses of every street in Mesa. Pavement condition surveys are performed each year on over 1,200 miles of streets. Information from the annual surveys identifies specific areas where various types of preventive maintenance treatment, such as slurry seal, acrylic seal or other sealcoats, can be applied. The surveys also identify areas requiring more aggressive rehabilitation projects like a rubberized asphalt overlay or partial reconstruction."

²³ <http://www.flagstaff.az.gov/index.aspx?NID=1518>

“Each year over 6,000,000 square yards of needed work is identified, prioritized and delegated. One goal is to establish a balanced treatment forecast plan for the street repair and preventive maintenance program that will help to maintain targeted pavement condition levels. These levels are based on a Pavement Condition Index (PCI) of 0 to 100, with 100 being excellent and 0 being failed. The PCI is calculated from data collected during the annual pavement condition survey. The City has been collecting pavement condition, inventory and maintenance history information on Mesa streets for over 18 years with details and quality of data improving with each year.”²⁴

Goodyear

The City utilizes a pavement management process that begins with assessing the condition and determining the PCI rating of each street. Ratings range from 0 to 100 (a perfect street has a 100 rating) and is established by considering several technical conditions. Each PCI rating indicates a specific type of "treatment" for each road.

There are three general categories of treatment: 1) seals, 2) overlays, and 3) reconstructions (the complete rebuilding of the pavement roadway). The City uses a Pavement Management System software to prioritize street needs and to determine the most efficient and effective use of funds. They decide what kind of treatment is used based on a number of factors, including street type, street use (i.e., number of lanes, total traffic volumes and heavy truck volumes), PCI rating and cost. The result of this analysis is a five-year list of roadways and treatment schedules that maximizes citywide pavement life using available and anticipated funding. Addressing the pavement needs with appropriate, less costly treatments can extend the lifespan of a roadway and postpone treatments that add cost.

The current average PCI rating for all City streets is 75. Maintaining this rating would require annual funding of \$2 million per year. The City focuses on the most cost-effective strategies to maintain the best pavement condition Citywide, based on the funds available.

²⁴ <http://mesaaz.gov/transportation/asphalt.aspx>

As the number of lane-miles of City streets increases and the street inventory ages, additional funding will be needed to maintain the average PCI rating. If funding is deferred, the cost of restoring the average PCI grows even larger, in proportion to the length of time that maintenance is postponed.

Bay Area Metropolitan Transportation Commission

The Metropolitan Transportation Commission (MTC), the regional MPO in the nine-county San Francisco Bay area, uses such a system for pavement management through their Regional Streets and Roads Program.²⁵ The MTC manages pavement improvements in 109 communities through their Regional Streets and Roads Program. Through their Regional Streets and Roads Program, the MTC has applied a regional process to managing pavement asset and prioritizing improvements since 1986. All participating jurisdictions rely on data from the “StreetSaver” decision making software program to assess pavement conditions within the MTC area. StreetSaver was developed by the MTC and is now in its ninth version.

According to the MTC, the benefits of using StreetSaver include the following²⁶:

- Local governments can predict the future condition of their pavement for different levels of funding and show the effects of under-funded road programs.
- StreetSaver works as an effective tool for local jurisdictions to both manage and generate street and road revenues.
- On a regional level, as more and more jurisdictions complete their pavement needs analysis using StreetSaver, MTC is able to document the Bay Area's needs and shortfalls and use the data to build support in the state Legislature for increased funding.
- Jurisdictions that have a PMS program in place will be ready to put any available new moneys to their most cost-effective use immediately.

A report on the program indicates that “It also allows for the setting of performance targets and the measuring of progress towards those targets. Further, the use of a common pavement management system by all Bay Area local jurisdictions allows MTC to monitor maintenance activities and credit local agencies that employ positive preventive maintenance strategies.” An

²⁵ Regional Asset Management Efforts and a Performance-Based Approach to Local Streets and Roads Funding Allocation, Romell, Metropolitan Transportation Commission, Oakland, California, Compendium of Papers from the First International Conference on Pavement Preservation, 2010.

²⁶ See <http://www.mtc.ca.gov/services/pmp>

additional report summarizes the PCI for all jurisdictions using a three-year moving average. This strategy could serve as an example to PAG on how it could coordinate regional data collection and analysis.²⁷

The true benefit of this program is that it consistently evaluates pavement conditions within its jurisdictions. Roadways in all participating cities, towns and counties are assessed by the program in a similar and coordinated fashion.

ADOT-FHWA Stewardship Agreement

In 2010, ADOT and the FHWA's Arizona Division entered an agreement regarding the stewardship of the federal-aid routes in the State.²⁸ Key elements of the agreement for maintenance include:

- Ensuring the federal-aid highway system is being adequately maintained by ADOT
- Both the STIP and TIP must include a financial plan to demonstrate adequate operations and maintenance of federal-aid highways
- Utilization of a Pavement Management System
- Implementation of an ADOT Quality Assurance Program
- Establishes a performance measure for 95% ride quality with "Present Service Rating" higher than 3.2.

The stated purpose of the agreement is to provide a roadmap to effectively manage all federal-aid routes in terms of programming, project delivery, operations and maintenance. It defines roles and responsibilities, outlines authorities, and most of all assures accountability.

²⁷ See http://www.mtc.ca.gov/library/pothole_report/Bay_Area_PCI-2006-10.pdf

²⁸ See <http://www.fhwa.dot.gov/azdiv/stew.pdf>

4: SURVEY AND LITERATURE SEARCH

On two occasions, PAG and CLA surveyed communities and counties in Arizona via “Survey Monkey”. They were first asked about pavement management, and the follow-up survey was directed more at funding strategies.

For the initial survey, the goal was to obtain an understanding of the use of pavement management practices and the state of pavement condition in selected jurisdictions. The questions included:

- Are your roads in better or worse physical condition today as measured by a pavement conditions index or other metric) than ten years ago?
- Briefly describe your Pavement Management System and major funding sources.
- Are life-cycle costs considered in estimating costs for roadway projects? Please describe.
- Does your agency/department include the consideration of life-cycle costs in SOQs/RFPs for roadway design and reconstruction projects?
- How are pavement preservation project priorities set in your jurisdiction? For example, are your roads in poorest condition dealt with first (through major overlays or reconstruction), or do you maintain good to fair roads to extend their lives first?
- What technical criteria does your jurisdiction use to evaluate pavement condition (e.g., Pavement Condition Index, International roughness Index)?
- What criteria or processes (if any) are used to distribute maintenance dollars?
- Has there been escalating pressure from the public and/or elected officials for your agency/department to improve roadway pavement conditions? Please explain.
- Is your budget for pavement preservation considered sufficient to maintain the standard set by your jurisdiction’s pavement preservation program?
- What are the greatest budgetary challenges to funding pavement preservation?
- Have you used HURF revenue bonds for the following: Roadway Maintenance, Construction Projects?
- Does your jurisdiction currently have HURF bond debt service?
- Besides HURF, what other funding sources are used for pavement preservation? Examples include construction sales tax, improvement districts, special assessments, impact fees, etc.
- What is the current outlook for pavement preservation funding for the next 20 years for your jurisdiction?

Agency Survey Summary

Thirteen surveys were returned out of twenty-two individuals polled. Representatives from the following jurisdictions responded to the survey (PAG member jurisdictions are shown in **bold**):

- **City of Tucson**
- **Pima County**
- **Town of Oro Valley**
- **Town of Marana**
- **City of South Tucson**
- Pinal County
- Santa Cruz County
- City of Tempe
- City of Chandler
- City of Mesa
- City of Glendale
- City of Scottsdale
- City of Yuma
- City of Flagstaff

A brief summary follows, and a more detailed listing of results is provided in Appendix B.

1. Eight of the thirteen respondents (61.5%) indicated that their roads were in worse condition now than ten years ago. Of the eight, two are in the PAG region (Tucson and Pima County). Reasons cited included funding cuts associated with the poor economy that constrained pavement maintenance activities. However, some of the remaining respondents said their roads are better now due to both their active pavement management programs and earmarked funding for roadway maintenance.
2. Regarding what roadways get attention first, most respondents indicated that they try to preserve good roads first, although one responded indicated that “the OCI ratings dictate what roads get treatment first”. Another indicates that “we take care of our best roads first unless there is a safety issue.”

Funding sources identified by the respondents included HURF, general funds, bond revenues, assistance from other jurisdictions, and dedicated portion of sales tax. Several of the respondents indicated that they had used HURF revenue bonds for maintenance (six) or construction projects (nine). Eight of the respondents said that they currently had HURF debt service associated with this.

3. Pavement condition measurements that were cited included the Pavement Condition Index (PCI), the Overall Condition Index (OCI), International Roughness Index (IRI), Pavement Quality Index (PQI) and Photographic Analysis of Asphalt Surfaces and Survey Evaluation Rating (PA²S²ER). A variety of software tools are used in their pavement management programs. These include Lucity, Miropaver, MicroPAV and Cartegraph.
4. A slight majority of the respondents (7 out of 13) indicated that life-cycle costs are considered in estimating costs for roadway projects. However, only 6 out of 13 said that they include the consideration of life cycle costs for project solicitations such as SOQs and RFPs.

5. The respondents mentioned several methods for allocating maintenance funds. These include applying the money to maintenance on high volume major streets, using the OCI ratings, projects that can be implemented by in-house labor, and from consultant advice.
6. Sixty-one percent of the respondents indicated that there has been increasing pressure from the public and/or public officials to improve pavement conditions.
7. Only one respondent indicated that there was sufficient funds to maintain the pavement system to standards (set by their jurisdictions), and most indicated that the greatest challenges for maintaining the system were the lack of money and the reallocation of state-provided revenue, typically provided for roadway improvements, to other uses. Responses to the question, "What is the current outlook for pavement preservation funding for the next 20 years for your jurisdiction?" were varied, although, as shown below, most indicated that the outlook was not positive.
 - If city sees increase in revenue, tax base, etc. may be able to implement program for time being rely on other funding sources to accomplish goals.
 - This is entirely dependent on the economy, so it's anyone's guess.
 - We have programmed \$2 million annually for expenditure.
 - Under funded
 - If the market and economy stabilizes the current sales tax will meet our needs, but the referendum expires in 20 years. If the economy and market do not turn around then we will need to re-evaluate how we approach our program.
 - Not very good. However, if the proposed \$100 million GO bond election passes in November 2012, it would fund next 5 years.
 - If we do not find consistent funding sources the long term outlook for our pavement management program is questionable.
 - There is a planned one time increase in rehabilitation funds for the next five years (FY 12/13 to FY 16/17). Maintenance funding will remain the same.
 - Bleak. The citizens will not accept another tax or fee to pay for government operations. The State must restore funding road maintenance funds.
 - Unless our funding is drastically improved our outlook is very very bleak.
 - About \$500K/yr

For the follow-up survey on funding, jurisdictions were asked the following questions:

"Earlier this year, we sent you a survey asking about your current pavement maintenance programs. As a follow up to this, PAG is seeking additional information to identify funding sources that transportation agencies use for pavement maintenance. Typical sources include general funds, Highway User Revenue Funds (HURF), transportation sales taxes, general obligation bonds, secondary property taxes, construction sales taxes, GO and revenue bonds, improvement districts, community facilities districts, and road taxes. You

probably are using some of these sources, and perhaps others you can tell us about.

We are hoping that you will be able to assist us in this effort by answering the following questions:

1. What funding sources does your agency/jurisdiction currently use to pay for roadway maintenance activities?
2. Which of these funding sources do you consider the most reliable, and why?
3. If you use general funds, approximately what percentage of your pavement maintenance expenditures are funded by your General Fund?
4. What is the breakdown of funding from other sources used for your pavement maintenance expenditures?"

Nine jurisdictions responded with a commitment that their responses would remain anonymous. All answered the first question and seven the second. Only two each provided responses to questions 3 and 4.

Question 1: Funding Sources used for Pavement Maintenance (Nine responses total):

HURF (8)
Construction Sales Tax (1)
Future Bond (1)
ADOT Overweight Vehicles Program (1)
Capital Construction Funds (1)
GO Bond Funding (2)
General Fund (1)
Sales Tax (3)
Secondary Property Tax (1)

Question 2: Most Reliable Funding Sources used for Pavement Maintenance (Seven responses total):

HURF (4)
Minimum Set By City Council from General Fund (1)
GO Bond Funding (1)
Secondary Property Tax (1)

Question 3: Percentage of General Funds used for Pavement Maintenance (Two responses):

\$300,000/year (1)
\$300K to \$400K/year (1)

Question 4: Breakdown of Funding (Two responses):

80% - HURF; Capital Construction Funds 20% (1)

60% - HURF; Sales Tax 40% (1)

The jurisdictions clearly rely heavily on HURF for pavement maintenance, with other funding sources varying by jurisdiction. Sales tax is used by three of the responding jurisdictions, and general obligation funding is applied by two others. Interestingly, of the seven jurisdictions that provided an answer to the questions of what funding source was the most reliable, HURF was only considered the most reliable by four, i.e., 57%.

Recent Research on Road Maintenance and Asset Management

Web-based research was conducted on road maintenance and asset management. A large number of web pages discuss pavement management, life-cycle cost studies of roadway-based assets, good practices in asset management and other related topics. For this project, we focused on the current accepted practices in the US, although there is extensive literature from Europe and Africa. One of the most important reports is discussed below. Other documents are listed in Appendix A – Suggested Reading.

AASHTO and TRB***NCHRP 688 – Determining Highway Maintenance Costs***

This 2010 report summarizes the actual costs to an agency for maintaining the roadways under its jurisdiction. Roadway maintenance costs typically include labor and materials, but agencies funding sources for maintenance services: Traditional, non-traditional (outsourcing, public-private partnerships), some of the elements making up the total agency cost of an activity associated with highway maintenance are not included or considered in budgeting evaluations.

Line Maintenance Costs

- Labor (wages, salaries, overtime, SS, Medicare, fringe benefits)
- Equipment (usually structured as rental rates for depreciation purposes)
- Material materials that are maintained in agency inventories or stockpiles, the use of materials fabricated in agency shops, or materials purchased specifically from outside vendors to complete a particular maintenance job
- Other (utility charges, private equipment rental, i.e., not part of the agency fleet and the sum of payments made to contractors to complete maintenance jobs in cases where

maintenance activities are delivered through a combination of agency and contractor resources.

Maintenance Agency Support Costs

- Program management and field supervision – staff responsible for managing the maintenance program (maintenance engineer, regional manager, other managers and supervisors).
- Program administration – office personnel, equipment and supplies
- Buildings, facilities and grounds – building leasing, rentals, depreciation, grounds maintenance, utilities, communications.
- Training – maintenance personnel at training and costs of providing training (sessions and materials).
- Material stores/inventory operations
- Fabrication shops and laboratories – signs, pavement materials testing

Enterprise Support Costs

In the same way that a maintenance program comprises line and support activities, the operations of a transportation agency comprise line and support programs and cost items. Typical agency line programs include construction, maintenance, safety, environmental protection/mitigation, and other investment and operations categories of work across different modes. These programs are supported by a number of enterprise support functions that typically include the following:

- Agency executive management;
- Planning, programming, and research;
- Financial accounting, budgeting, payroll, and procurement;
- Legal and audit divisions;
- Human resources;
- Information technology;
- Central office buildings, facilities, and grounds, including utilities and communications services;
- Shops, laboratories, and other support functions and cost items that have not already been included in the program support category; and
- Support of the DOT provided by external agencies (e.g., the state attorney general's office or the state auditor's office).

As with the program support costs, the key objectives regarding enterprise support costs are (1) to identify the complete set of enterprise support costs, and (2) to allocate an appropriate

share of these enterprise support costs to maintenance line costs to complete the cost determination process.

5: FUNDING FOR ROADWAY MAINTENANCE

Roadway maintenance funding is provided by federal, state and local agencies, through quasi-private improvement districts, and through development exactions. The sources are already well described in prior PAG studies, and in the Regional Transportation Plan. This section discusses recent changes that should be considered moving forward.

Federal Funds

As an MPO, PAG receives and programs federal funds allocated by programs defined in federal transportation legislation. Since 1991, there have been a series of sweeping changes in the allocation and allowable uses for federal funds. As a recipient of funds allocated by formula, the region has little influence over the amount available.

Federal transportation law changed very recently after substantial debate in Congress. “Moving Ahead for Progress in the 21st Century” was passed on June 29, 2012, one day prior to the expiration of SAFETEA-LU. Called MAP-21, the legislation preserves yet consolidates most of the prior programs. It includes notable cuts in some alternate mode programs.²⁹

Key elements of MAP-21 include:

- Establishes an outcome-driven approach that tracks performance and will hold states and MPOs such as PAG accountable for improving the conditions and performance of their transportation assets
- Reauthorizes the Federal-aid highway program at the current funding levels plus inflation—for two fiscal years
- Consolidates the number of Federal programs by two-thirds, from about 90 programs down to less than 30, to focus resources on key national goals and reduce duplicative programs
- Eliminates earmarks
- Expedites project delivery while protecting the environment
- Creates a new title called “America Fast Forward,” which strengthens the Transportation Infrastructure Finance and Innovation Program (TIFIA)

²⁹ See for example <http://www.thirteen.org/metrofocus/2012/07/the-federal-transportation-bill-and-new-york>

MAP-21 has a renewed emphasis on system preservation, maintenance, and fiscal accountability. Interestingly, MAP-21 emphasizes asset management and for the first time includes a definition of the term as “a strategic and systematic process of operating, maintaining, and improving physical assets, with a focus on both engineering and economic analysis based upon quality information, to identify a structured sequence of maintenance, preservation, repair, rehabilitation, and replacement actions that will achieve and sustain a desired state of good repair over the lifecycle of the assets at minimum practicable cost.” A fact sheet on MAP-21 is available on-line.³⁰ The legislation itself is available as well.³¹

Additional Federal funds were available under American Recovery and Reinvestment Act of 2009 (ARRA)³². In 2009, the federal government authorized the expenditure of over \$800 billion for improving infrastructure and various other purposes. Roughly \$50 billion was earmarked for transportation, of which \$27.5 billion went for highway and bridge projects. This program has not been extended.

State Funds

Our region relies primarily on major public funding sources and relies most heavily on Arizona’s Highway User Revenue Fund (HURF). This fund, which is constitutionally limited to roadway uses, is collected by the State, and then allocated to counties and municipalities by formula.³³ The State retains more than half the fund, some of which is provided to Phoenix and Tucson areas for limited access corridors. The charts below show how the \$1.2 billion in HURF revenue was allocated in the last fiscal year.

³⁰ See http://epw.senate.gov/public/index.cfm?FuseAction=Files.View&FileStore_id=6d1e2690-6bc7-4e13-9169-0e7bc2ca0098 and <http://www.govtrack.us/congress/bills/112/s1813>

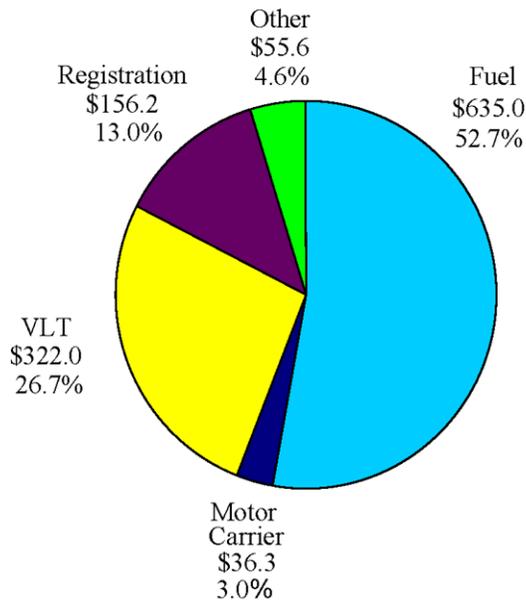
³¹ <http://www.gpo.gov/fdsys/pkg/BILLS-112s1813es/pdf/BILLS-112s1813es.pdf>

³² See Public Law 111-5.

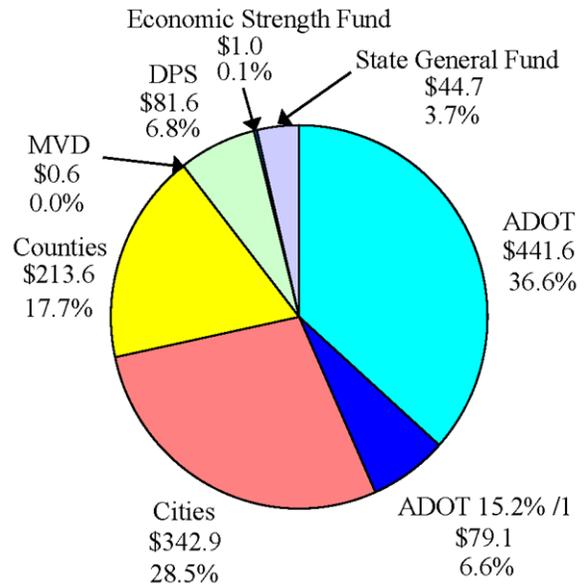
³³ Article 9, Section 14 of the Arizona Constitution

HURF Sources and Distribution, FY 2011 (\$1.2 Billion, total)

SOURCES



DISTRIBUTION



NOTES:
1. Represents ADOT's allocation of HURF for MAG and PAG regional projects.

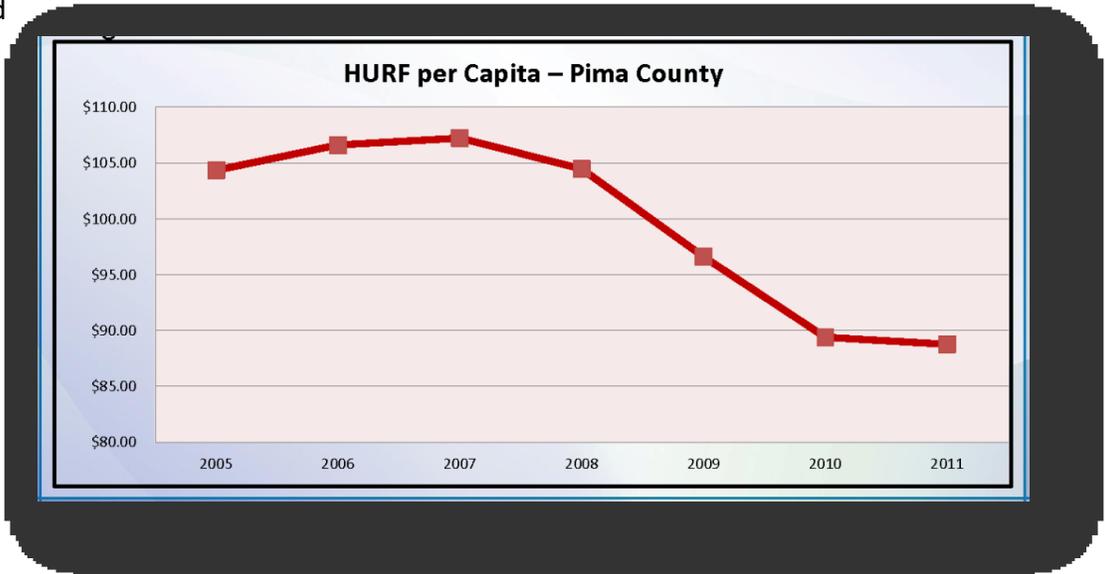
Each of the PAG members relies on their transportation or public works department to determine roadway maintenance needs and submit annual budget requests for approval by their elected officials. There is a recent trend to use local funds and bonds for road maintenance here and throughout the country, because funds from other sources are so limited.³⁴ Similar to federal funds, the region has little influence over these formula-based allocations.

The State of Arizona taxes motor vehicle fuels and collects a variety of fees for registration and operation of motor vehicles. These collections include gasoline and “use fuel” (i.e., diesel) taxes, motor carrier taxes, vehicle license taxes, motor vehicle registration fees, and other miscellaneous fees. Revenues are deposited in the Arizona Highway User Revenue Fund (HURF)

³⁴ “County to use general funds for roads”, tucsonnewsnow.com, 2012; “Proposition 409 for city street improvements”, <http://cms3.tucsonaz.gov/streetbonds>; “Taxes, bonds, car tab could pay for Tacoma street repair”, mynorthwest.com, 2012

and are then distributed to the cities, towns and counties and to the State Highway Fund. These taxes represent a primary source of revenues available to the state for highway construction, improvements and other related expenses. Prior analysis by CLA and others shows that buying power of HURF has declined appreciably due to inflation and the Legislature’s refusal to increase the state gas tax, among other reasons. The chart below shows in normalized dollars how the fund

generates about \$88 per capita now compared to about \$108 in 2007. This is an 18% decline in purchasing power. When assessed over a longer period, the decline in purchasing power is more than 50%.



Over the past several years, the Arizona legislature diverted some HURF revenue to the Arizona Department of Public Safety, and thus reducing the amount allocated to counties and municipalities. The recent trends in HURF distribution to PAG jurisdictions are shown in the chart below, using FY 2006/07 as the benchmark. HURF was increasing prior to the benchmark year, but afterwards it declines due in part to diminishing income, but mostly due to revenue diversion. This revenue decline has obvious implications on transportation projects at the local level, including maintenance projects.

HURF Bonds and Outstanding Debt Service

Bonds, sold to investors in a public market, are the chief mechanism used by municipalities to finance capital facilities. Such bonds are often called “municipal” bonds even though many are issued by state governments and special purpose districts. Through the State Transportation

Arizona HURF Diversion Analysis FY 2006/07 Benchmark (Pima County)

Arizona HURF - Distribution to Pima County and Municipalities within Pima County								
FY	Pima County	Marana	Oro Valley	South Tucson	Tucson	Sahuarita	Total	Cumulative Loss
2002/03	\$37,716,916	\$1,043,282	\$2,283,594	\$422,000	\$44,383,949	\$249,135	\$86,098,874	
2003/04	\$39,829,979	\$1,092,521	\$2,560,691	\$442,282	\$46,712,006	\$261,322	\$90,898,801	
2004/05	\$41,755,890	\$1,141,523	\$2,688,528	\$461,892	\$48,864,152	\$273,124	\$95,185,109	
2005/06	\$43,291,930	\$1,254,679	\$2,798,398	\$473,220	\$50,527,993	\$351,596	\$98,697,815	
2006/07	\$44,565,617	\$2,067,895	\$3,031,223	\$432,071	\$49,548,012	\$1,088,363	\$100,733,180	(Benchmark)
2007/08	\$44,060,131	\$2,035,849	\$3,002,828	\$429,747	\$48,966,864	\$1,067,285	\$99,562,705	(\$1,170,475)
2008/09	\$41,209,550	\$1,936,369	\$2,855,668	\$408,550	\$45,965,674	\$1,014,642	\$93,390,453	(\$7,342,727)
2009/10	\$38,739,414	\$1,808,963	\$2,667,797	\$381,679	\$43,086,356	\$947,901	\$87,632,109	(\$13,101,071)
2010/11	\$38,973,544	\$1,869,483	\$2,693,145	\$384,046	\$43,300,823	\$1,021,736	\$88,242,777	(\$12,490,403)
							Cumulative Decline Since FY 2006/07	(\$34,104,676)

Source: Office of Pima County Administrator

Board, counties and cities are authorized to issue HURF bonding if approved at a local election. In November 1997, a \$350 million HURF bond authorization was approved by Pima County voters, and this was applied to several capital improvements within Pima County, including some in the incorporated areas. As a result, there is existing debt service that reduces the availability of funds for pavement maintenance activities. Other communities and counties in the state have also pursued HURF bonding, and as a result are repaying the associated debt.

Local debt policies are useful in making decisions about paying for maintenance with either GO or revenue bonds. Bond advisors routinely recommend that jurisdictions adopt debt policies. Such principles should be written in a flexible enough way to allow for the under-funding of infrastructure during hard economic times, although from the public works perspective this might be seen as lack of commitment.³⁵

Local Funds

In contrast to federal and state funding, local funds authorized by statute and municipal charter are under the total control of local governments and the electorate. The types of funding available are mainly restricted to sales taxes and primary and secondary property taxes. A recent example is Tucson voters' approval of a property tax funded bond program for street repair. Local agencies cannot impose cents-per-gallon fuel taxes, a sales tax on fuel, and myriad other taxes and fees available in other parts of the country.

This section describes taxes and fees currently authorized by statute; however, many other options could become available if the State Legislature would pass implementing legislation. Additional options will be explored in more detail by staff upon direction of the Regional Council.

Current Local Funds for Transportation

Local funds dedicated to transportation in the PAG region include the RTA's ½¢ sales tax, Proposition 409 road repair revenues, and road impact fees collected by all jurisdictions except South Tucson and Sahuarita. A construction sales tax is levied in Oro Valley, Marana, and

³⁵ <http://www.lincolnst.edu/subcenters/teaching-fiscal-dimensions-of-planning/materials/elmer-bonds.pdf>

Sahuarita and can be used for maintenance if the Town Councils choose to do so. The City of Tucson briefly considered a CST, and Pima County is prohibited from its use. Both the City of Tucson and Pima County use some of their general funds for transportation, especially for transit operations, and occasionally for road maintenance.

Potential Local Funds for Transportation

At the local level, additional revenues for maintenance can be provided by further increasing sales and property taxes within statutory limits.

Pima County General Funds

Pima County currently spends about \$13 million on maintenance, all from HURF. The Board of Supervisors authorized some additional funding from reserve. This includes \$10 million this fiscal year and \$20 million next year.

Improvement Districts and Community Facility Districts

Improvement districts and community facility districts are special taxation districts allowed by statute. A fundamental difference is IDs usually are applied to existing development, whereas CFDs are applied to developing land during the planning process.

The laws for creating IDs are different for counties and municipalities, but both allow maintenance expenditures. The Districts, once formed, have a governing body which is usually the local elected body. ID projects are paid for by property owners of the district, either as a separate levy or as an additional line item on their property tax bill. Cities use IDs more than counties because of the comparative ease of implementation, frequently to add sidewalks and lighting, for maintenance, and to help pay for a portion of adjacent street widening.

In Pima County, for example, the Tucson Country Club Estates neighborhood created a paving and sewer improvement district formed in 1994 for reconstructing the streets, highways and sewers. Property owners spent \$4.27 million to improve their streets, highways and sewers. The County notes that this model is available to anyone who wishes to form an improvement

district. It requires a majority of the property owners within the district or the owners of 51 percent of the real property within the district to agree to pay for the work. To incentivize the use of improvements districts for street and highway improvements, the County could offer to fund a portion of the costs with the balance paid for by the district. A similar policy could be adopted in the municipalities.

6: RECOMMENDATIONS

Quantify Pavement Conditions in the Region

Using available data from the ARAN van and other resources, prepare an overview of pavement conditions in the region. Make this available for all jurisdictions to aid decision-making about transportation investments.

Recommendation: Provide a regional pavement condition overview, showing various metrics that track the condition of roadways in the region to help make informed investment decisions.

Continue to Investigate Maintenance Needs and Funding Options

This report identifies some of the administrative and funding challenges confronted by PAG members. One of the key issues is identifying funding needed for maintenance and then allocating enough funds during an economic downturn. Both the City of Tucson and Pima County are using general funds for maintenance, which can detract from competing services that must rely exclusively on general funds.

Accordingly, more detailed examinations of immediate, short-term, and long-term maintenance needs and funding is required. We noted during our research that several communities including Tacoma used a task force to examine the options, which also seems appropriate in our region. The RTA could be represented through its CART or TMC. This report and its supporting documents could be used as a resource and starting point for such a task force.

Recommendation: Using this report as a resource, establish a regional task force, perhaps through the PAG Management Committee or TPC, to prioritize maintenance funding options for implementation across the region.

Emphasize Life-Cycle Programming

MAP-21, the new federal transportation legislation emphasizes asset management and fiscal stewardship. The USDOT recognizes that one way to avoid pavement neglect is to integrate maintenance with capital programming and project design. Life-cycle programming for roadway preservation should be considered during the planning and design phase of new

roadways and major rehabilitation projects. Typical procedures for planning include designing the project based on established standards, but may not include the consideration of minimizing future maintenance costs. In general, design consultants are selected based on their project understanding, professional team, and estimated fee. Competing firms base their fees on the type of project, estimated number of plan sheets, standards required and experience. However, while creative in their proposals, they understand the competitiveness in the bid process. They may not propose solutions that maximize service life/minimize life cycle costs of a project, instead recommending less costly options that lower initial construction costs while increasing future operations and maintenance costs.

Recommendation: Integrate life-cycle planning and programming into PAG's procedures.

Set Aside Funding for Maintenance

There currently is no fixed minimum amount available for road maintenance. This can be accomplished and integrated into the annual TIP.

Recommendation: Through discussions with all PAG member jurisdictions, define a set-aside amount for pavement management in the TIP. This has been previously discussed as a potential strategy but not pursued further. If all jurisdictions support such a move, it has a higher likelihood of being supported through the committee process.

Expand In-House Resources in Pavement Management and Life-Cycle Programming

Due to the renewed emphasis in asset management and potential funding opportunities contained in MAP-21, we recommend that PAG emphasize its in-house resources in pavement management and life-cycle programming. This can be accomplished - in order of priority -- by providing further training to current staff, augmenting staff, or retaining outside assistance. A small in-house work group can be assigned to this topic.

Recommendation: In preparation for MAP-21, expand and emphasize in-house resources and establish an in-house workgroup tasked with pavement and asset management responsibilities. This can become a recurring element in PAG's annual Overall Work Program.

Involve PAG Members in Pavement Management Discussions

It is apparent that a continuing discussion with member jurisdictions will enhance pavement management regionally for the benefit of road users, property owners, businesses, and for improved economic competitiveness. PAG has a broad committee structure, so it is possible to rely on a subcommittee of the TPC or TIP to forward this issue. It is also advisable to conduct a PAG “ThinkTank” session(s) with senior management staff (for funding and prioritization issues) and technical staff (for tools, interagency planning, data, and resources) to address important questions such as:

1. How can PAG facilitate asset management, pavement management, and pavement preservation regionally to assist member jurisdictions?
2. What technical tools are needed at the local and MPO level to enhance pavement management?
3. How can agencies work together to minimize the cost labor, equipment, and materials?
4. What can be done to minimize tort liability associated with street maintenance?
5. What levels and types of funding are needed to obtain a higher standard of performance?
6. How can we better inform the public and elected officials about the challenges and needs of pavement management?

Recommendation: Continue regional discussion about pavement and asset management utilizing PAG’s “ThinkTank” program.

Regional Asset Management/Pavement Management Programming

PAG members manage their jurisdiction’s pavement in different ways. Because each relies on federal and state aid, in addition to local funds, there should be a common implementation system for pavement maintenance activities. The Metropolitan Transportation Commission (MTC), the MPO in Oakland, California, has applied a regional process to managing pavement asset and prioritizing improvements for many years. All participating jurisdiction rely on data from the STREETSAYER software program to assess pavement conditions within the MTC area. MAP-21 will likely include performance measures associated with roadway activity funding. There also appears to be an expansion of the National Highway System (NHS) which may affect pavement inventory and asset management activities, which can be addressed under this strategy.

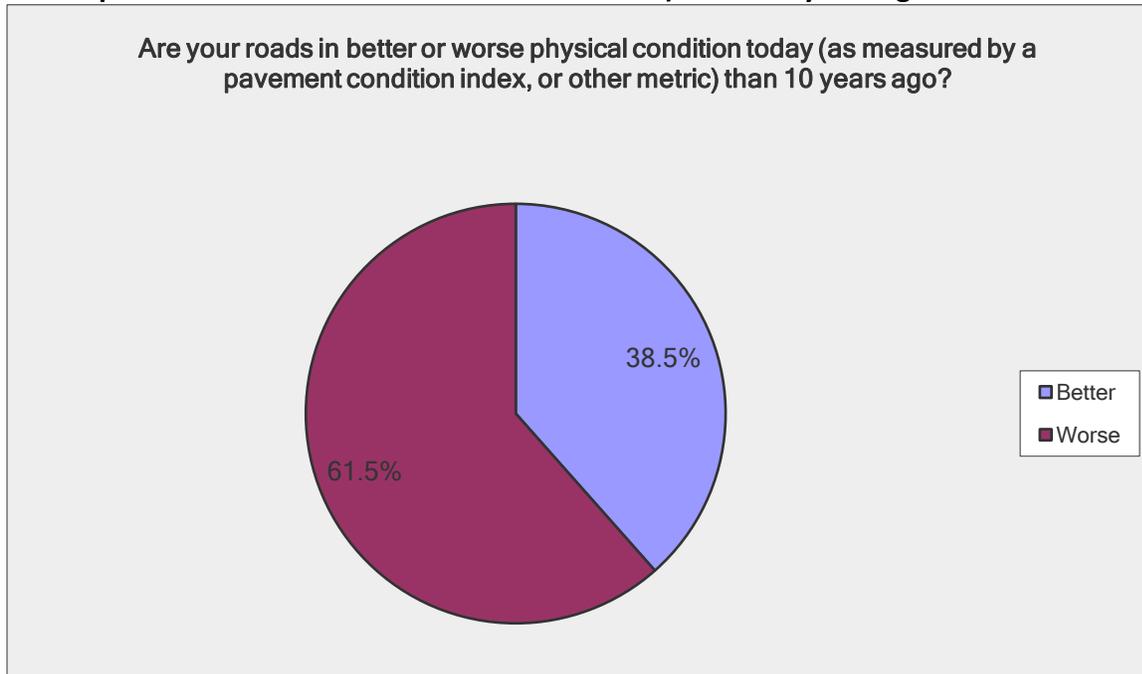
Recommendation: PAG staff should investigate the successes of the MTC and determine if MTC can be a model program for local adoption, and help support new opportunities under MAP-21.

Appendix A: Recommended Reading

1. Regional Asset Management Efforts and a Performance-Based Approach to Local Streets and Roads Funding Allocation, Theresa Romell and Sui Tan, *Metropolitan Transportation Commission, Oakland, California, United States*, Compendium of Papers from the First International Conference on Pavement Preservation, April 2010
http://www.techtransfer.berkeley.edu/icpp/papers/70_2010.pdf
2. State of the System Report FY 2012, Maricopa County, June 2012
<http://www.mcdot.maricopa.gov/technical/eng-manuals/2012-SOS-Report.pdf>
3. Asphalt Roadway Rehabilitation Alternatives, A Training Course, Publication Number FHWA-SA-97-048, FHWA
<http://isddc.dot.gov/OLPFiles/FHWA/013560.pdf>
4. Maximizing Customer Benefits as the Ultimate Goal of Pavement Management, Paper No. 42 for Presentation and Publication to, Fifth International Conference on Managing Pavements, Seattle, Washington, August 11-14, 2001
<http://pavementmanagement.org/ICMPfiles/2001016.pdf>
5. Evaluation of the Cost Benefits of Continuous Pavement Preservation Design Strategies Versus Reconstruction Final Report 491, K.L. Smith, L. Titus-Glover, M.I. Darter, H.L. Von Quintus, R.N. Stubstad, and J.P. Hallin, Applied Research Associates, September 2005, Prepared for Arizona Department of Transportation.
http://www.azdot.gov/TPD/ATRC/publications/project_reports/PDF/AZ491.pdf
6. Arizona State Senate Issue Brief, Highway Funding and Construction, December 20, 2010, State of Arizona
<http://www.azleg.gov/briefs/Senate/HIGHWAY%20FUNDING%20AND%20CONSTRUCTION.pdf>
7. Optimal Timing of Pavement Preventive Maintenance Treatment Applications, NCHRP Report 523, D.G. Peshkin, T.E. Hoerner, K.A. Zimmerman, 2004
http://onlinepubs.trb.org/Onlinepubs/nchrp/nchrp_rpt_523.pdf
8. Determining Highway Maintenance Costs, NCHRP Report 688, Cambridge Systematics, Inc., 2011
http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_688.pdf
9. Board of Supervisors Memorandum, Need for Increased Investment in Transportation and Highway Maintenance, April 10, 2012
http://www.pima.gov/administration/documents/pdfs/bos-increased.transportation.investment_20120328112303_785934.pdf

Appendix B – Survey Results

Are your roads in better or worse physical condition today as measured by a pavement conditions index or other metric) than ten years ago?



Eight of the thirteen respondents (61.5%) indicated that the roads were worse than over the last ten years. For those that responded “better”, the following comments were provided:

- Recent reconstruction and mill/overlay of all major roadways.
- On the whole they would have to be considered better because we have added so many new lane miles, mainly from private development.
- The Town of Marana has a robust and aggressive pavement preservation program. Although it is not fully funded, it is funded enough to keep up with the demand of needed preservation. Currently our OCI Town wide is about 79 out of 100
- We have had dedicated sales tax paired with a preventative maintenance program for the last 25 years.
- We have an active pavement management program and have rebuilt most of our arterial roads.

For those that responded “worse”, the following comments were provided:

- Have not had the available funding for repairs.
- Due to poor economics and budget shortfalls, there has been little money for pavement preservation.
- Chandler has approximately 2,000 lane miles of streets but current budget only allows preventative maintenance on 100 to 150 lane miles.
- Reduction in funding.

- Funding cuts have compromised our maintenance schedule.

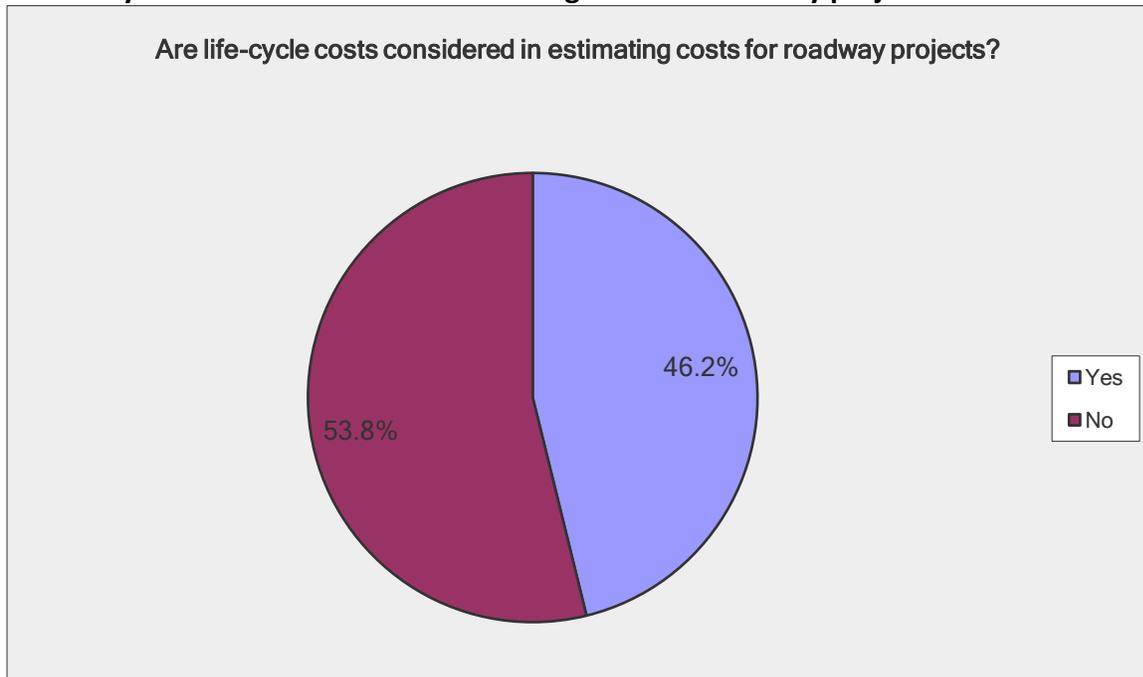
Briefly describe your Pavement Management Program and major funding sources.

- Assistance from PCDOT, COT. Funding- RTA, 12.6, PC Bond
- Currently, problem areas are identified with maintenance foremen and addressed. In the future we will use a PMS (Lucidity) that will be integrated with our GIS. The major funding source comes from our half-cent sales tax.
- We use Lucity as a software to aid in the management of the pavement. Our funding is mostly Highway User Revenue Funding.
- Most of our funding comes from the State allocation of HURF funds. We have revised and updated our pavement preservation program this year 2012 to include a maximum of 4 year rotation on all of our roads. Some roadway sections will get an increase in application rates than others.
- Our major funding sources are, Sales Tax and HURF. We utilize MicroPAV a custom version of the Micropaver software created by the Army Corps of Engineers. Mesa has been a staunch believer in preventative maintenance and cycle treatments relating to the right treatment for the right road at the right time to extend the life cycle of the county roadways.
- The City of Tucson's Pavement Management System (PMS) utilizes methods and philosophies developed by the Army Corps of Engineers (ACE). In particular, the publication Pavement Management for Airports, Roads, and Parking Lots by M. Y. Shahin has been the foundation of this program. Currently, pavement surfaces are rated using a combination of Pavement Condition Index (PCI) scores, International Roughness Index (IRI) measurements, and Photographic Analysis of Asphalt Surfaces and Survey Evaluation Rating (PA²S²ER). PCI inspections (ACE method of analyzing asphalt concrete conditions) are conducted on 10% of all asphalt concrete roadways by measuring and recording 19 different distresses at three severity levels. IRI is measured utilizing an ARAN (Automated Roadway Analyzer) van <http://transview.org/aran>. PA²S²ER is actually a modified version of the University of Wisconsin-Madison's PASER system <http://tic.engr.wisc.edu/Publications.lasso>, adapted to be a behind-the-windshield visual survey performed while collecting IRI data with the ARAN. All PCI and PA²S²ER condition data is stored within a historical database. This data has typically been used to track conditions of city streets over time. Major Streets and Routes are updated within the database on a three year cycle, and residential roadways are on a five year cycle. In addition to this data, PMS is tasked with satisfying local regional requirements stipulated by the Highway Performance Monitoring System (HPMS). The City's PMS program is grant funded: 94.3% Federal Highway Administration (FHWA) Surface Transportation Funding (STP) with a 5.7% City of Tucson local-match. It works in conjunction with Pima Associations of Governments (PAG), but is exclusively maintained by the City of Tucson. From PAG's website, "The Regional Pavement Management System provides PAG member agencies with the appropriate tools and data to assess the deterioration of publicly owned roadways and other roadway infrastructure.

Accurate management of the multi-billion dollar roadway infrastructure is essential for allocating and optimizing the impact of available maintenance budgets.” Major funding sources: Limited HURF and FHWA when available.

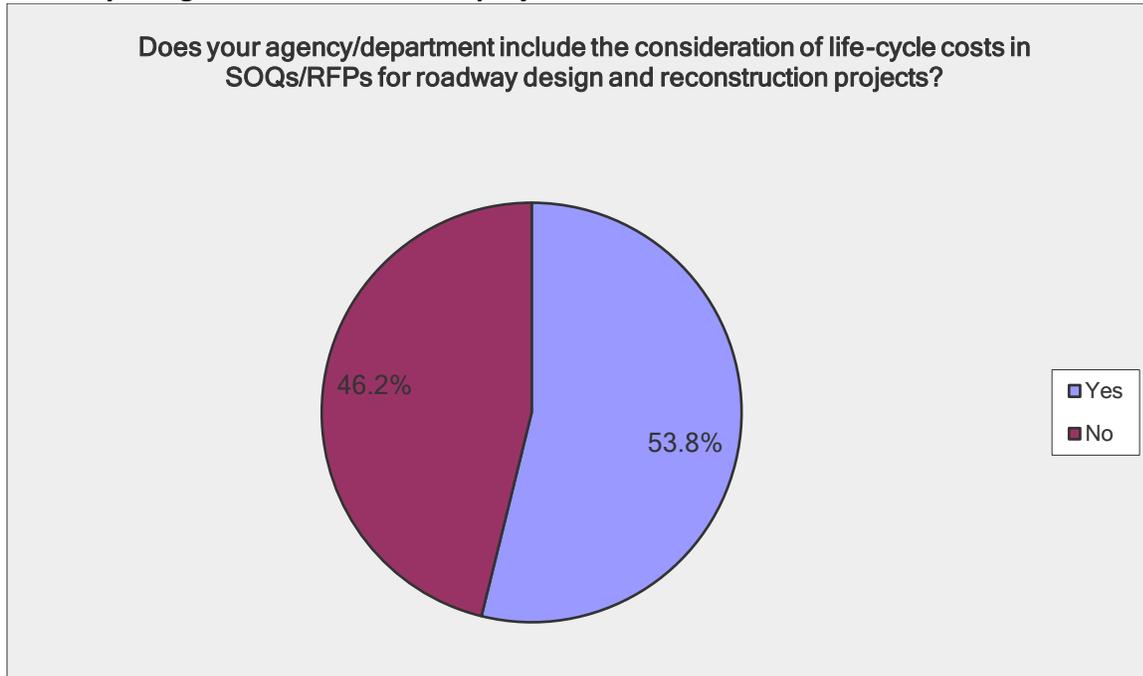
- We use Cartegraph pavement management software and have dedicated staff to manage the program. Our funding sources are construction sales tax and local HURF funds.
- Chandler uses crack seal, Tire Rubber Modified Surface Seal (TRMSS), Slurry Seal, Micro Surface and Mill and Overlay. Major funding sources are HURF, General Fund and Bond Revenue.
- Utilize traditional preventative maintenance measures. HURF only source.
- Our program consists primarily of preventative maintenance applications (seal coat, slurry, microseal, crack seal, chip seal, mill and overlay). CIP is funded primarily through our General Fund (bonds).
- PMP is currently being developed. HURF is the primary source.

Are life-cycle costs considered in estimating costs for roadway projects? Please describe.



- They will be once our PMS is fully online.
- See our pavement management preservation manual.
- Every Capital Improvement Project (CIP) that adds an asset has a maintenance component incorporated in the analysis of the life cycle cost to cover the increase in maintenance costs over the life cycle of the roadway.
- We attempt to budget for O&M costs as a part of our 5 Year Capital Improvement Program, but there are no funds to retain O&M costs in the program.
- We design our new roadways for a 20-year life cycle.
- Cheapest, longest lasting, and most effective treatment is used.

Does your agency/department include the consideration of life-cycle costs in SOQs/RFPs for roadway design and reconstruction projects?



How are pavement preservation project priorities set in your jurisdiction? For example, are your roads in poorest condition dealt with first (through major overlays or reconstruction), or do you maintain good to fair roads to extend their lives first?

- Maintain roads as much as possible
- We don't use just one, but a combination of strategies.
- We attempt to maintain the fair to good roads in a good condition and commit approx. 10% of the available funding to reconstruction.
- The OCI Ratings dictate what roads get treatment first.
- The City of Mesa believes in extending the life cycle of the roadway at the lowest cost possible by implementing preventative maintenance tools early in the life cycle to delay the need for major overlays and reconstruction. This can begin as early as year 2 or 3 of a new pavement with a minimal cost but extending the life cycle 5-10 years.
- The City of Tucson's Pavement Management System subscribes to the philosophy of keeping good roads good and applying the right treatment to the right road at the right time and right cost. However, due to limited resources and safety concerns, we are not always able to follow this approach.
- We take care of our best roads first unless there is a safety issue.
- Both. Chandler budgets for both pavement preservation and rehabilitation.
- 60% of funding is dedicated to roadways rated good or better. 40% of funding is dedicated to roadways rated poor to failed.

- We extend the better to fair roads as long as we can and hold the failed roads together until we get a windfall of money. Still waiting on the windfall.
- Priority is given to roads based on ADT's.

What technical criteria does your jurisdiction use to evaluate pavement condition (e.g., Pavement Condition Index, International roughness Index)?

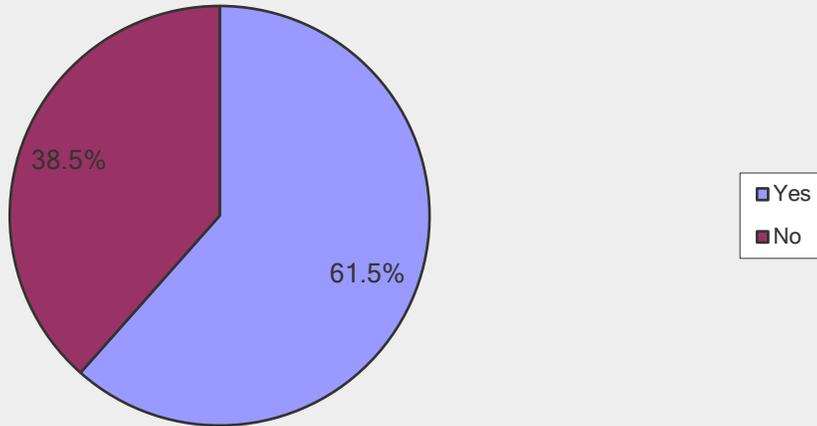
- PCI
- PCI
- Pavement Condition Index - Better known as "Overall Condition Index" (OCI)
- We currently utilize the Pavement Condition Index in accordance with ASTM D 6433.
- See #2 above. The City's PMS uses three types of technical criteria: Pavement Condition Index (PCI), IRI (International Roughness Index) and Photographic Analysis of Asphalt Surfaces and Survey Evaluation Rating (PA²S²ER).
- We use the USACOE pavement condition index.
- Chandler uses Pavement Quality Index (PQI) based on Stantec's RoadMatrix program. PQI (0 to 100) is a function of Ride Comfort, Surface Distress and Structural Adequacy.
- Staff utilizes Cartegraph Pavement Management software. PCI index are formatted within, types of treatments, history, etc.
- Pavement Quality Index (PQI)
- N/A

What criteria or processes (if any) are used to distribute maintenance dollars?

- We are currently implementing a Pavement Management System (Lucidity) to target areas and/or road types for future projects.
- See our pavement management preservation manual.
- We focus our in-house crew projects first, they represent the core functions of the city maintenance program. We then distribute the additional funding based on prioritization of need and overall roadway performance increase.
- Due to budget constraints and lack of a dedicated funding source the City is focusing maintenance dollars primarily on major streets that carry a lot of traffic and safety concerns. There have been efforts for maintenance prioritized by OCI, ADT, age, location, and design.
- We use the OCI, overall condition index, as a means to appropriate funds.
- See answer 5, all are coordinated with PCI.
- We hire a consultant who objectively evaluates the road using a specially designed vehicle. The condition is plugged into a software program that calculates the PQI>

Has there been escalating pressure from the public and/or elected officials for your agency/department to improve roadway pavement conditions? Please explain.

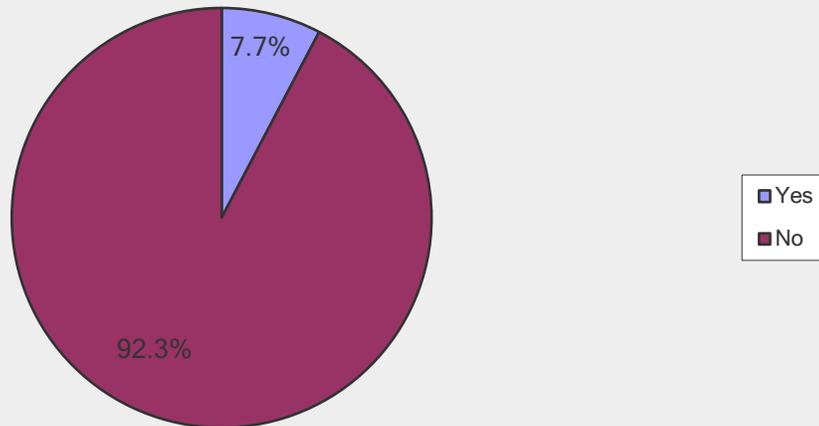
Has there been escalating pressure from the public and/or elected officials for your agency/department to improve roadway pavement conditions?



- recent improvements have kept public/elected officials satisfied
- Only to a small degree. The most pressure is to add capacity.
- Public Safety (police and fire) are the priorities.
- We have a great system. The Town of Marana keeps up on our roadway system, so that our constituents do not have to worry about calling in to complain about our roadway system condition.
- The pressure has been focused on economic development areas as opposed to areas that are not performing or in need based upon performance criteria.
- Currently, the City is in the process of soliciting a 5-year General Obligation bond that will allocate \$20 million per year towards roadway maintenance and rehabilitation. Please see the following link for more information:
<http://cms3.tucsonaz.gov/home/announcement/street-maintenance>.
- We have educated our elected officials on the importance of pavement management and have their support.
- Only from the public.

Is your budget for pavement preservation considered sufficient to maintain the standard set by your jurisdiction's pavement preservation program?

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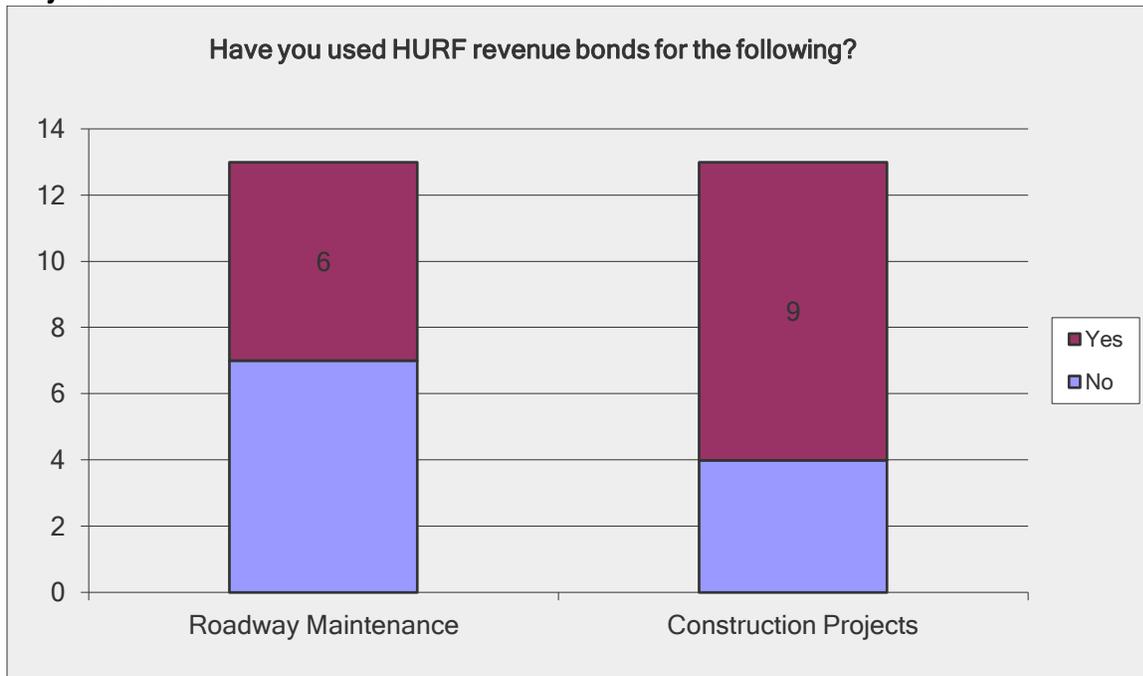
- minimal funding received to maintain standalone program
- For this year and the next yes, but future years no unless revenues increase.
- Even though we have a robust system in place, we are not fully funded. Our program currently is based upon a \$2 million a year investment. Currently the Town is only funding \$500,000 per year.
- With the decrease in sales tax revenue and HURF, we are still playing catch up to maintain the high quality of roads that Mesa has been expected to deliver. We however are adapting to this change and are attempting to maintain a high standard given the current condition of funding.
- We are responsible for maintaining 1,900 lane-miles of major streets of which 52% are in failed, poor, and fair condition and requires \$215 million to bring those streets to a good or better condition. There are 3,500 lane-miles of residential streets of which 86% are in failed, poor, and fair condition and requires over \$400 million to bring those streets to an acceptable level.
- With less construction sales tax revenue and the reduction of local HURF we have had to use our contingency funds to close the gap. This is not a sustainable practice in the near and long terms.
- Not even close. We need \$6-8 million annually and need a lump sum of approx \$50 million to get our streets to a PQI of 70.

What are the greatest budgetary challenges to funding pavement preservation?

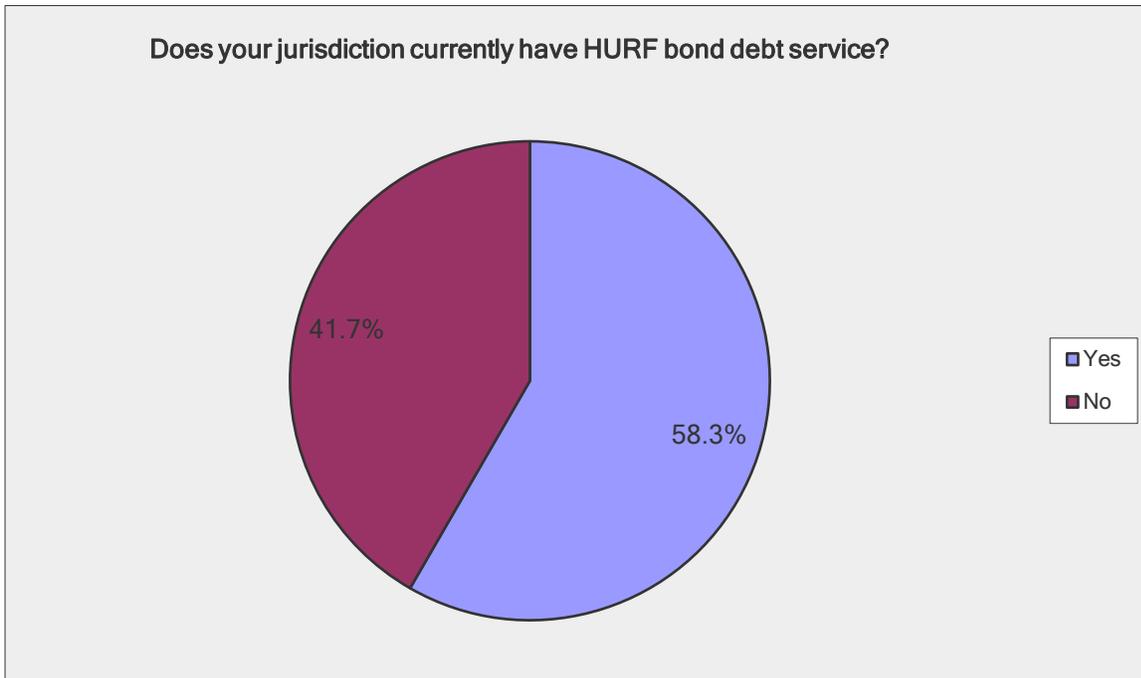
- With a small jurisdiction other priorities come to the forefront.

- Increasing oil and aggregate prices, additional lane-miles added to the system, and flat revenues.
- Competing with other needs for very little money
- Not enough money to cover all the expenses.
- Steady revenue sources and the cost benefit analysis.
- HURF funding to the City has declined 26% since 2008 and City General Fund revenues have dropped dramatically. A new funding source or sources must be identified.
- The poor economy and the HURF sweeps by the State Legislature.
- State of Arizona continues to sweep HURF away from the Cities and Towns to fund DPS.
- Getting elected officials and our Finance Department to understand how critical preventative maintenance is.
- HURF declining

Have you used HURF revenue bonds for the following: Roadway Maintenance, Construction Projects?



Does your jurisdiction currently have HURF bond debt service?



Those that responded indicated that there is a range from 10% to 33% of HURF Revenue is for debt service.

Besides HURF, what other funding sources are used for pavement preservation?

Examples include construction sales tax, improvement districts, special assessments, impact fees, etc.

- Half-cent sales tax.
- No other
- Transportation sales tax (left-over from past - prior to RTA)
- Sales Tax General Obligation Bonds/ Secondary Property Tax
- Limited City General Fund revenues which is generated primarily from sales taxes.
- Construction sales tax
- General Fund and Bond Revenues.
- 2% road tax.
- property tax, bonds
- none

What is the current outlook for pavement preservation funding for the next 20 years for your jurisdiction?

- If and when city sees increase in revenue, tax base, etc. may be able to implement program for time being rely on other funding sources to accomplish goals.

- This is entirely dependent on the economy, so it's anyone's guess.
- We have programmed \$2 million annually for expenditure.
- Under funded
- If the market and economy stabilizes the current sales tax will meet our needs, but the referendum expires in 20 years. If the economy and market do not turn around then we will need to re-evaluate how we approach our program.
- Not very good. However, if the proposed \$100 million GO bond election passes in November 2012, it would fund next 5 years.
- If we do not find consistent funding sources the long term outlook for our pavement management program is questionable.
- There is a planned one time increase in rehabilitation funds for the next five years (FY 12/13 to FY 16/17). Maintenance funding will remain the same.
- Bleak. The citizens will not accept another tax or fee to pay for government operations. The State must restore funding road maintenance funds.
- Unless our funding is drastically improved our outlook is very, very bleak.
- about \$500K/yr

Please provide any other comments or links to relevant documents. - Open-Ended Response

- <http://cms3.tucsonaz.gov/home/announcement/street-maintenance>.
- For every dollar spent on pavement management today saves \$6 to \$10 in the future.
- HURF was established for the maintenance of roadways. However, in 1999 the state passed a new law to fund the enforcement of traffic laws. Thus, relieving the states responsibility to fund DPS. Today, DPS is now fully funded by HURF.

FHWA PRIMER ON ROAD MAINTENANCE