# City of Glendale, Arizona

# Pavement Management Program

## Current Year Plan (FY 2014)

## and

## Five-Year Plan (FY 2015-2019)


# EXECUTIVE

# SUMMARY

# REPORT

**December 2013**

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# EXECUTIVE SUMMARY REPORT

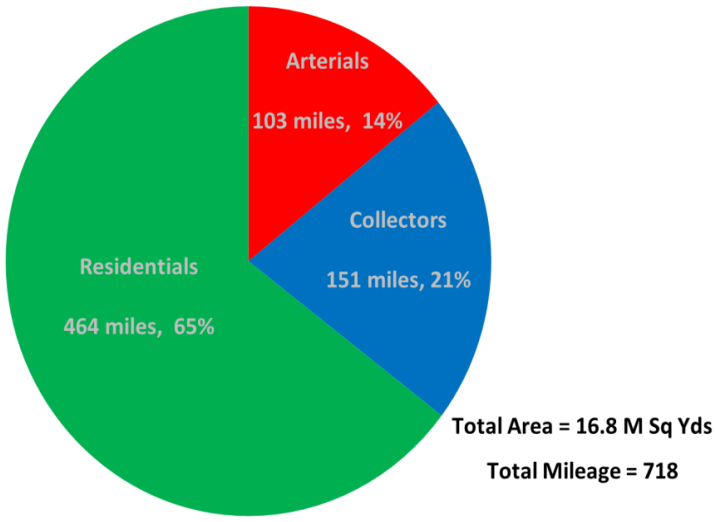
## BACKGROUND

The City of Glendale has 103 miles of arterial roadways (urban and rural arterials) plus an additional 615 miles of residential roadways (residential, minor collectors, and major collectors) encompassing over 16.8 million square yards of asphalt surfacing (Figure 1).

At a replacement cost fast approaching $1 million per mile, plus the cost of right of way improvements, the city has roughly $1 billion invested in the paved roadway network.

A pavement management program identifies objectives to establish design and maintenance standards, prioritizes maintenance treatments, models long-term maintenance activities to obtain maximum pavement life, and ultimately protects the investment already made in the roadway system.

**Figure 1: Glendale Roadway Network**




Preservation of existing road and street systems has become a major activity for municipal, state and federal governments. A shortage of funds to maintain street systems exists at all the levels of government. Funds that have been designated for pavement preservation must therefore be used as effectively as possible. The key to a successful pavement management program is to develop a reasonably accurate performance model of the roadway, and then identify the optimal timing and strategies for cost effective rehabilitation of the street network.

A comprehensive pavement management study was conducted by Infrastructure Management Services, LLC (IMS) with the goal to assess the condition of the roadway system and to determine pavement treatment activities for immediate and long-term needs. The study collected information on roadway surface conditions, roughness evaluations, distress assessments and traffic classification surveys to determine traffic impacts on all arterial and residential streets. In addition, structural analysis testing was conducted on arterial roads.

## GENERAL PRINCIPLES OF PAVEMENT MANAGEMENT

Pavement management is the process of planning, budgeting, funding, designing, constructing, monitoring, evaluating, maintaining, and rehabilitating the pavement network to provide maximum benefits from the available funds. A pavement management system is a set of tools or methods that

assists decision makers in finding optimum strategies for providing and maintaining pavement in a serviceable condition over a given time period.

The condition of a street is affected by a number of factors, including:

- Surface Condition (roughness, cracking, etc.)
- Moisture Intrusion and Drainage (street profile, cross section, storm sewer)
- Sub-grade strength and conditions
- Traffic characteristics and loading
- Pavement Age
- Prior Maintenance (overlays, micro resurfacing, crack filling, seal coating, patching)

Each of the above listed factors contributes to the overall condition and lifecycle of the street system.

As shown in Figure 2, streets that are repaired when they are in good condition will cost less over their lifetime than streets that are allowed to deteriorate to a poor condition and are then in need of reconstruction. A $1 investment after 40% lifespan is much more effective than deferring maintenance until heavier overlays or reconstruction is required just a few years later.

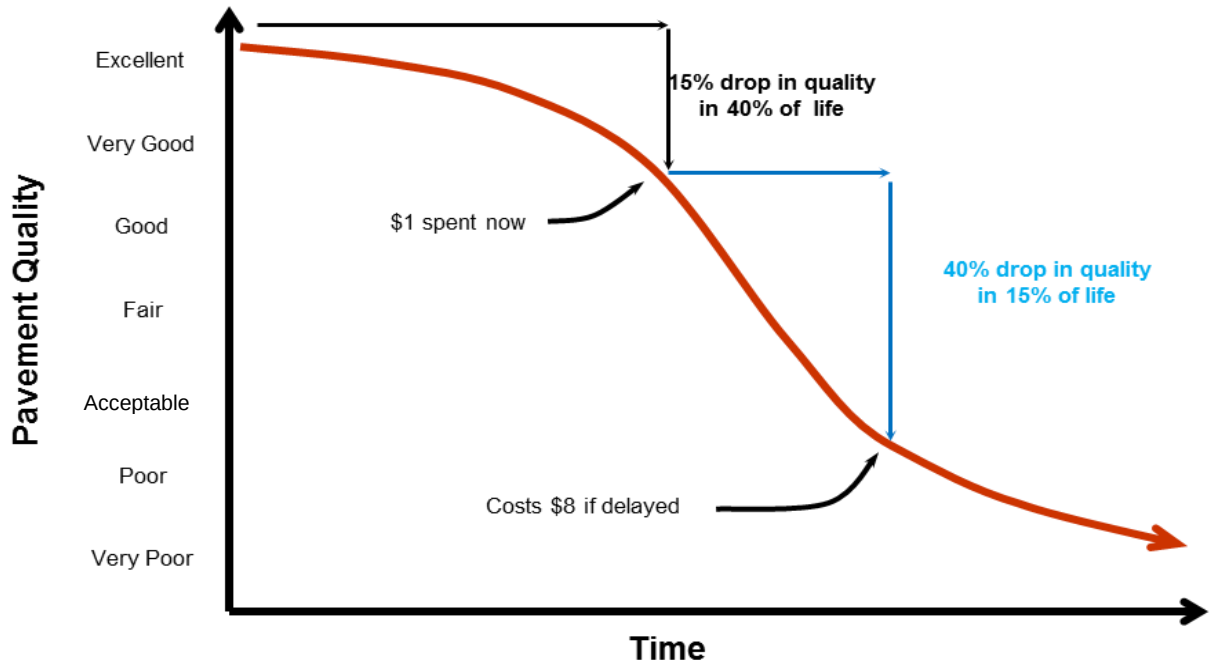



**Figure 2: Pavement Deterioration and Life Cycle Costs**

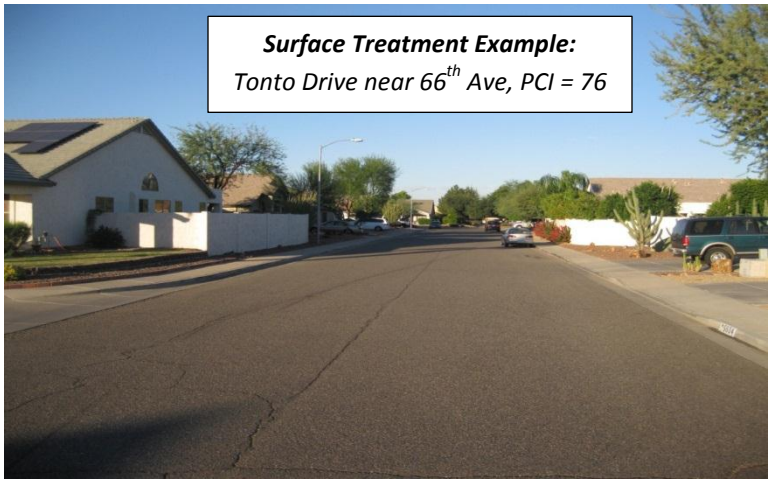
Without an adequate routine pavement maintenance program, streets require more frequent reconstruction, thereby costing millions of extra dollars. Over time, pavement quality drops until the pavement condition becomes unacceptable.

## PAVEMENT TREATMENT DESCRIPTIONS

A variety of pavement maintenance techniques are used to preserve city streets and the cost for each treatment can vary significantly. The following is a description of each maintenance treatment by the least expensive to most expensive, and the potential benefits of the treatment.

*Surface Treatments*

Various surface treatments provide for the installation of a thin surface coating, typically an oil emulsion and small aggregate rock to reseal the pavement surface. This allows for an extension of the pavement surface life by minimizing the effects of the sun and weather on the existing asphalt material and re-establishing a wearing surface. Surface treatments are typically either a fog seal or a slurry seal on residential or collector streets, and a microsurface seal on arterial roadways. Microsurface seals are very similar to slurry seal with the exception of the size of the aggregate and resulting thickness of the treatment.



***Surface Treatment Example:***
*Tonto Drive near 66th Ave, PCI = 76*

*Overlay*

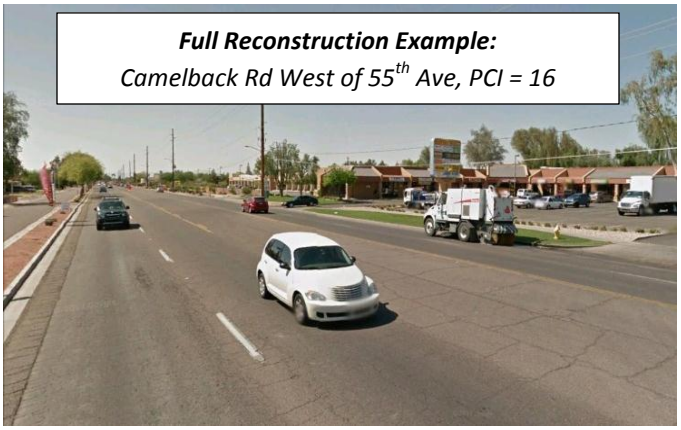
An overlay provides for the addition of another layer of asphalt type material or rubberized asphalt pavement on the existing roadway. This can be performed either through the removal and replacement of a 1 to 2-inch thick layer to maintain the current surface elevations or by placing an additional layer of pavement on top of the existing surface. An overlay of this thickness extends the life of the roadway by adding additional material to the surface, reestablishing the cross slope of the road to promote drainage and creating a smooth driving surface.

*Surface Reconstruction*

Surface reconstruction provides for full depth overlay, typically 3-5 inches, by removing the existing pavement in place and replacing it with new asphalt. The existing pavement is ground up and blended into the aggregate base, and the new pavement is installed to restore the proper cross slope and provide a stronger roadway section. This process is typically less expensive than full reconstruction and is usually only done on arterial roadways where the depth of the asphalt is much thicker than residential roadways.

*Full Reconstruction*

Full reconstruction provides for the removal of the existing roadway and the rebuilding of the road from the sub-grade through the pavement surface. Sub-grade correction consists of the removal of unsuitable materials, backfill with granular materials, aggregate base, and new asphalt pavement. This method is typically applied in areas where the pavement is showing significant areas of major distress and where it is unlikely that a surface reconstruction will properly repair the street.



***Full Reconstruction Example:***
*Camelback Rd West of 55th Ave, PCI = 16*

## PAVEMENT CONDITION RATINGS & TREATMENTS

As part of the Pavement Management study, the arterial and residential pavement conditions were evaluated and assigned a value from 1 to 100 based on surface distress, roughness, and structural assessment. This value is known as the Pavement Condition Index (PCI). The following figure (Figure 3) illustrates the PCI range and corresponding maintenance treatment shown on the pavement condition versus time curve.

**Figure 3: PCI Range and Maintenance Treatments**

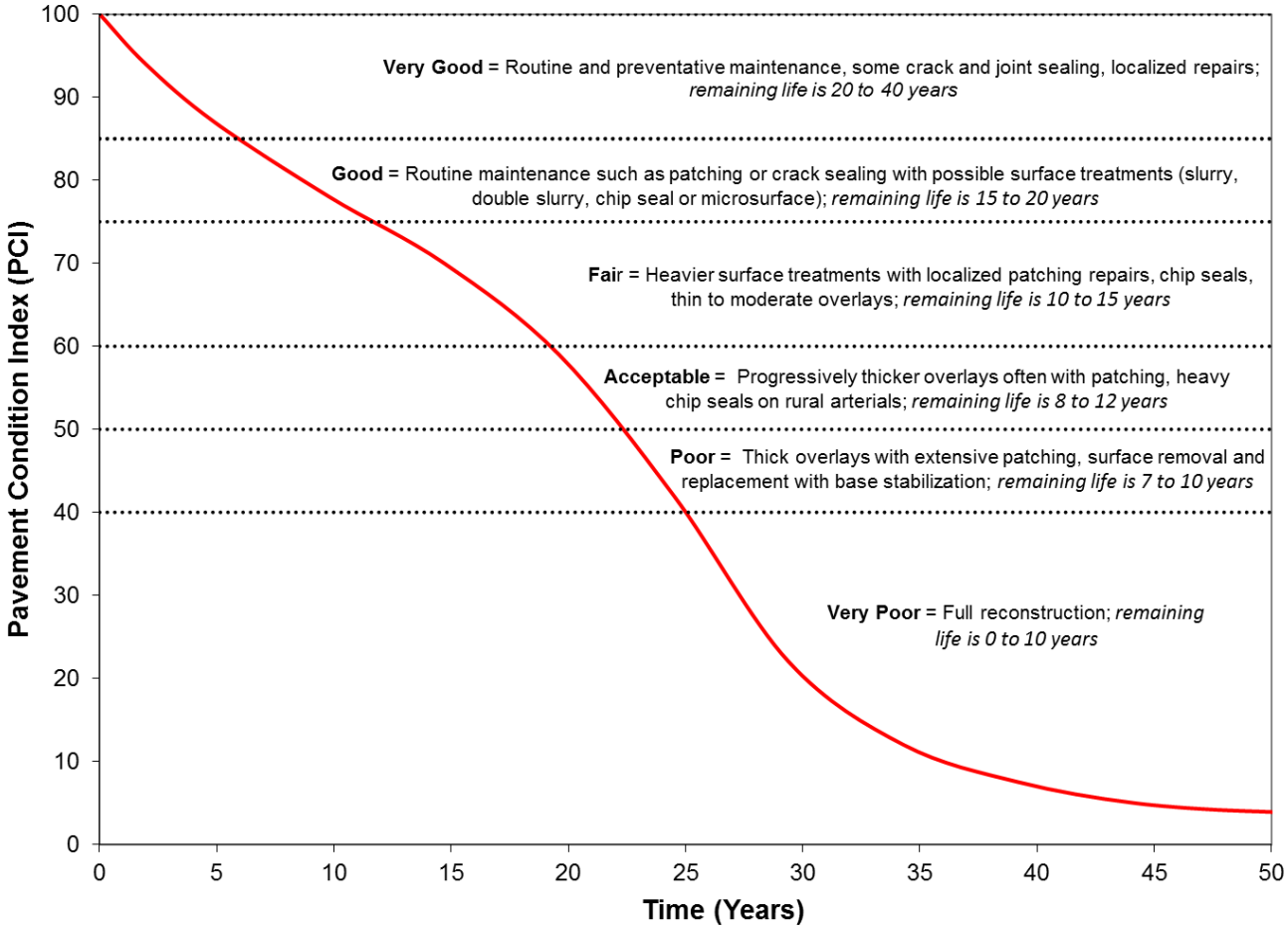



Figure 3 also identifies the remaining life related to each pavement condition category (i.e., very good, good, fair, acceptable, poor, and very poor). Streets in very good condition will last up to 40 years depending on the timeframe, quality of construction, and routine maintenance activities. Whereas, very poor streets only have up to 10 years of service life, which requires timely planned reconstruction before complete failure of the pavement occurs. Lastly, maintenance costs increase significantly depending on the current pavement condition and selected treatment technique. A maintenance cost comparison between pavement condition categories identifies costs ranging from $50,000 to $70,000 per mile for good condition streets, from $250,000 to $650,000 per mile for acceptable condition streets, and from $1 million to $2 million per mile for streets having very poor pavement condition. This shows that very poor streets have approximately a four-fold greater maintenance cost as compared to acceptable streets.

## ROADWAY NETWORK CONDITION AND FINDINGS

At the time of the last field survey in 2009, the network overall average PCI was 73 (i.e., the average of all arterials, collectors and residential streets). Furthermore, the arterial network had an average PCI of 72 and the residential network had an average PCI of 73. Nationwide the average PCI score for similar cities to Glendale, Arizona is 65 to 70.

***Glendale's current 2013 network overall average PCI is 72.*** The arterial network has an average PCI of 71 and the residential network has an average PCI of 73. Although the 2013 network average is higher than the national average for similar cities, this PCI rating places the overall street network into the ***"fair"*** *category* for describing the overall pavement condition.

As shown in Figure 4 below, 13 percent (or 93 miles), of the total street network can be considered in very good condition with a PCI score greater than 85. These streets are in like new condition and only require routine maintenance. Nationwide, the amount of roadways falling into this category is about 15 percent, so this value is below the national average. Roughly 32 percent (or 230 miles) of the street network falls into the good category; these are roads that benefit the most from preventative maintenance techniques such as a microsurface treatment, slurry seals, and localized repairs. If left untreated these roadways will drop in quality to become heavy surface treatment or overlay candidates.

**Figure 4: Current 2013 Network Pavement Condition**

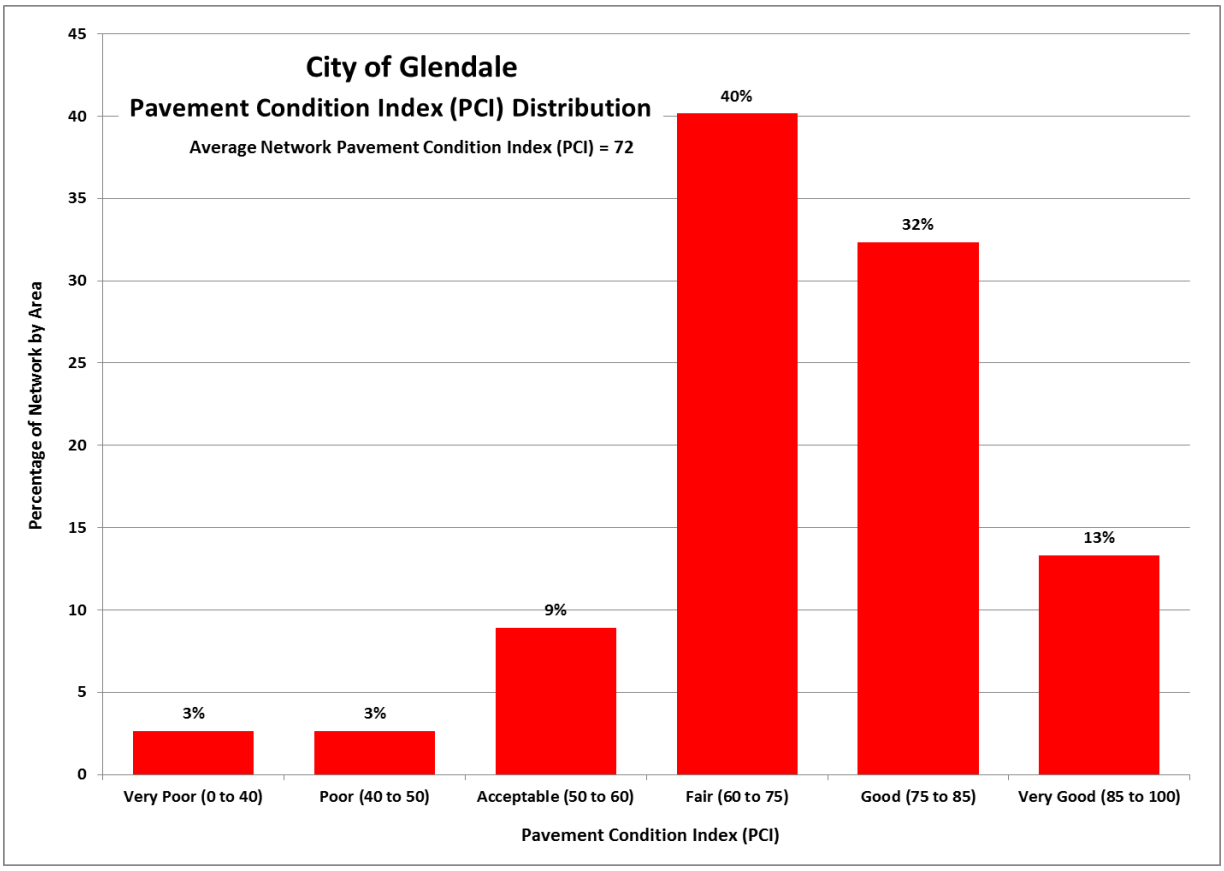



Figure 4 also shows that 40 percent (or 287 miles) of the streets are rated as fair and are candidates for heavy surface treatment rehabilitation and thin overlays. Nine percent (or 65 miles) of the street network can be considered as acceptable, representing candidates for progressively thicker overlay rehabilitation

or concrete panel replacements. If left untreated, they will decline rapidly into reconstruction candidates. The remaining 6 percent (or 43 miles) of the network is rated as poor or very poor condition, meaning these roadways have failed or are past the point for an overlay or surface based rehabilitation to be an effective treatment. Streets in poor or very poor condition will require progressively heavier or thicker forms of rehabilitation (i.e., surface reconstruction, deep patch and paving) or total reconstruction.

Because of the declining and/or limited allocation of funds to Glendale's pavement management program over the past several years (since 2009), the applied maintenance treatments have not kept pace with the aging of the street network. As streets in Glendale continue to receive only routine preventative maintenance treatments, as well as experience deferred maintenance or rehabilitation due to lack of funding, the percentage of poor and very poor conditions streets will increase as these streets fast approach or reach the end of their service life.

## ANNUAL FUNDING AND BUDGET ANALYSIS

### ANNUAL FUNDING LEVELS FOR FISCAL YEARS 2014 THROUGH 2019

The pavement management analysis provided in this report for fiscal years (FY) 2014 through 2019 is based on the current funding levels as well as proposed additional bond funding. Available funding of $2 million dollars per year for pavement management improvements comes from the half-cent transportation sales tax of the Glendale Onboard (GO) Program and this funding is scheduled to run through FY 2031. The $2 million in GO funding is programmed annually into Glendale's Pavement Management capital improvement plan (CIP).

For FY 2014, $5.25 million is budgeted for roadway maintenance in Glendale, which includes $2 million in Pavement Management CIP funding (GO Program), a Glendale City Council approved one-time supplemental of $3 million in Highway User Revenue Fund (HURF), and $250,000 in Community Development Block Grant (CDBG) funds. The funding in FY 2014 currently is programmed to pay for street network improvements on residential roadways (residential, minor collectors, and major collectors) only. Furthermore, the sale of HURF bonds is proposed, which would be made possible due to the retirement of current debt service in FY 2015 and would allow for approximately $28 million in HURF funding to be available for pavement management. For FY 2015 and FY 2016, the proposed plan is to use the $2 million in annual Pavement Management CIP funding (GO Program, plus the $28 million in HURF bond funding for arterial and residential/collector streets in Glendale. For FY 2017 through FY 2019, the $2 million annually of GO Program funding is programmed in the Pavement Management CIP for surface treatments to residential streets in the city. The current annual funding levels are outlined in the following table:

| Year | Base ($M) | Additional ($M) | CDBG ($M) | Bond ($) | Less Additional Work ($M) | Annual Budget ($M/yr) |
|---|---|---|---|---|---|---|
| 2014 | 2.00 | 3.00 | 0.25 | 0.00 | 1.35 | 3.90 |
| 2015 | 2.00 | 0.00 | 0.00 | 14.00 | 3.60 | 12.40 |
| 2016 | 2.00 | 0.00 | 0.00 | 14.00 | 3.60 | 12.40 |
| 2017 | 2.00 | 0.00 | 0.00 | 0.00 | 0.50 | 1.50 |
| 2018 | 2.00 | 0.00 | 0.00 | 0.00 | 0.50 | 1.50 |
| 2019 | 2.00 | 0.00 | 0.00 | 0.00 | 0.50 | 1.50 |
| Totals | 12.00 | 3.00 | 0.25 | 28.00 | 10.05 | 33.20 |

The Annual Budget column (in the table above) provides the construction costs related directly to the placement of pavement on the streets. Whereas, the Less Additional Work column represents the indirect administrative costs such as engineering design and construction administration services, construction inspection and testing services, and internal costs for finance and engineering contract administration services, as well as the Arts Fund contribution (1% of construction cost). These two columns combined (Less Additional Work plus Annual Budget) provide the total amount of funding available for each fiscal year from FY 2014 through FY 2019.

**BUDGET ANALYIS MODELS**

The following section of this report presents the analysis results on four budget models for the pavement management program. These models are illustrated in Figure 5 below. The X axis highlights the annual budget, while the Y axis plots the five-year network post-rehabilitation PCI value (i.e., the network average PCI assuming all rehabilitations have been completed according to plan). The diagonal blue line is the analysis results. The models can be described as the following:

1. **Do Nothing Model** – this model identifies the effect of spending no capital for 5 years. It is depicted on Figure 5 where the diagonal blue line intersects the Y axis. After 5 years, the Do Nothing option results in a PCI drop from 72 to a 63.
2. **Current Budget Model** – this model identifies the resultant network PCI at a $2.0M annual budget or funding level. After 5 years, the $2.0 million option results in a PCI drop from 72 to 64.5.
3. **Five-Year Plan Model** – this model identifies the resultant network PCI with the $28M in bond funding distributed over 2 years starting in 2015. This model also assumes a base of $2 million per year from 2015 through 2019 that is currently received in CIP funding (GO Program) for annual street maintenance. After 5 years, the Proposed Bond option results in a PCI rating of 68.

4. **Steady State Model** – this model identifies the required annual budget to maintain Glendale's current network average PCI at 72. The steady state option requires that:

***The annual budget needed to maintain the current 2013 PCI at 72 = $13 Million***

As part of the budget analysis, an upper limit of spending (or a "Fix All" budget) was calculated in order to calibrate the four budget models. The Fix All budget expends $208 million. Assuming this funding is initially spent in the first year the PCI would increase to 89 and would taper off to a PCI rating of 84 in five years.

**Figure 5: Budget Models and Network PCI Ratings**

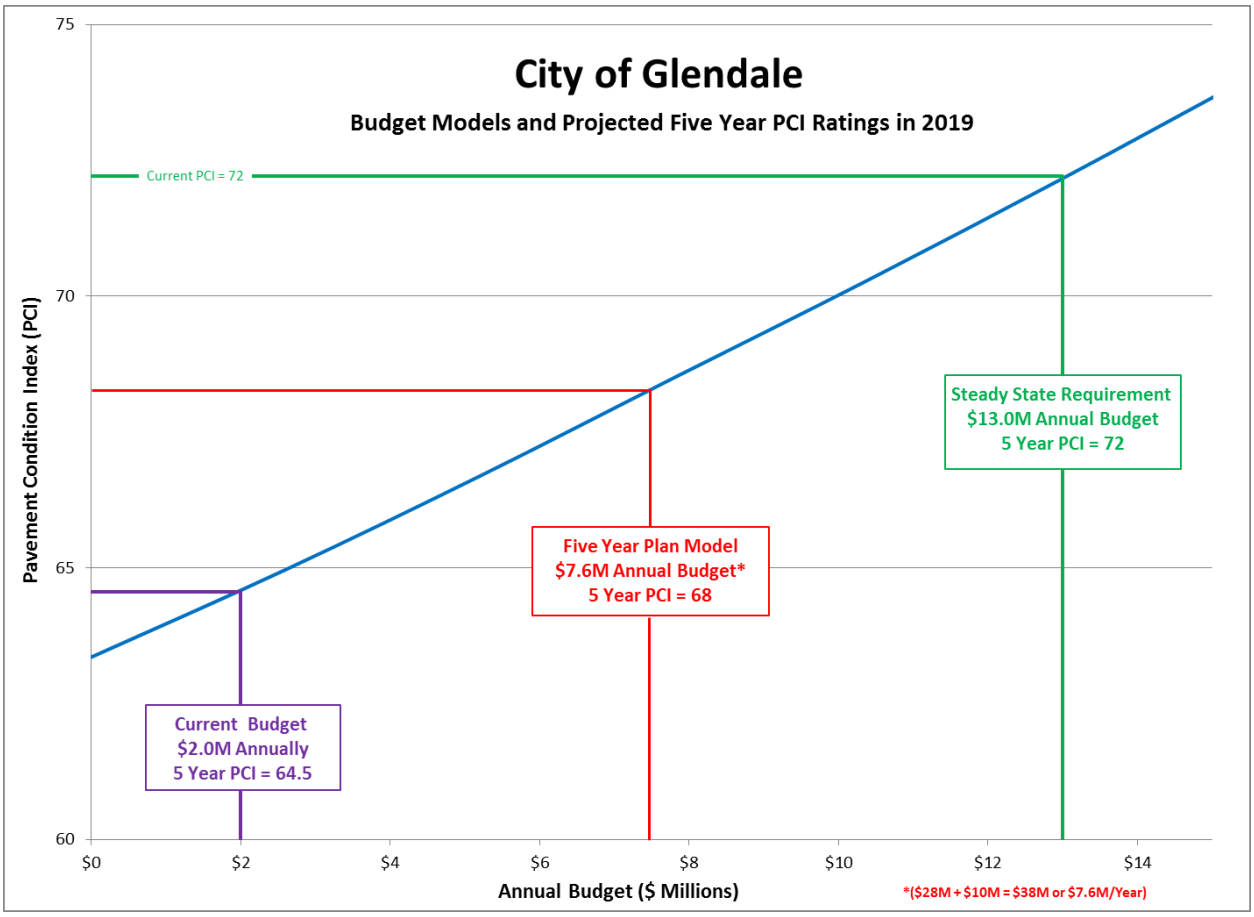



Figure 5 may also be used to identify the impact to the street network of other budget levels; based on the chart you can also select any particular dollar amount ($6.0 M, $10.0M, or $12.0M, for example) to identify the resulting network PCI at each funding level. Alternatively, Figure 5 may also be used to identify the required budget to achieve a specific target PCI within five years. For example, selecting a network average target PCI of 70 would require an annual budget of $10 million.

By 2019, even with the investment of the $28 million bond funds applied to roadway rehabilitation, the amount of streets rated below a PCI rating of 50 (or classified in "poor" or "very poor" condition) is expected to double to 13 percent (or 93 miles). The biggest increase will be seen in the major roadway network (103 total miles) where close to one quarter (or 26 miles) of the arterial roadways will be classified as poor or very poor. This causes a greater funding concern due to the much higher rehabilitation cost for arterials streets as compared to residential streets. For instance, the cost to rehabilitate a collector/residential street is approximately half the cost to rehabilitate an arterial street in all categories as a residential street is typically one half to one third the width of an arterial roadway.

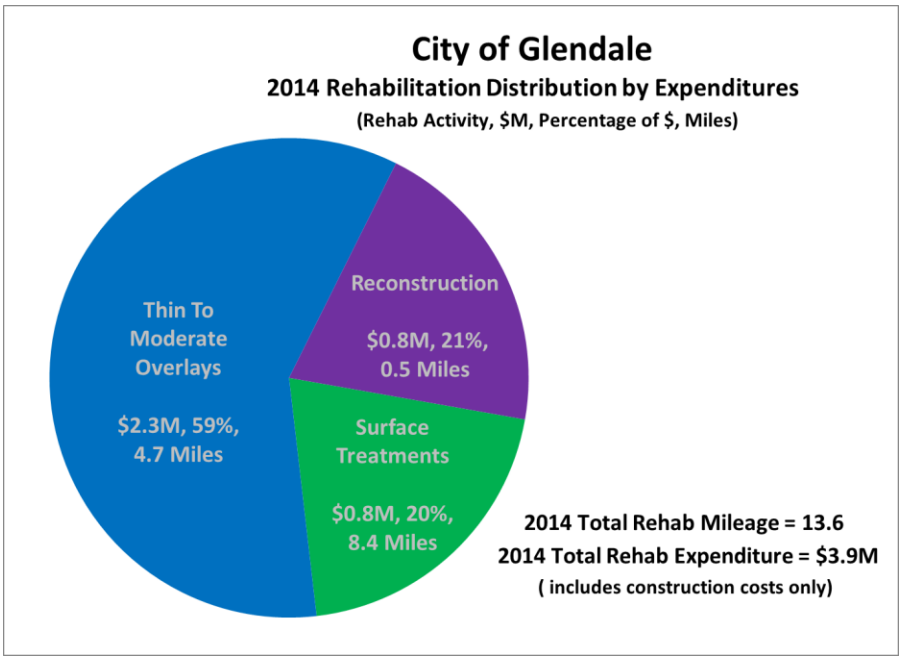
## PROPOSED REHABILITATION PLANS

The general methodology for developing the proposed rehabilitation plans for Glendale's street network is based on current PCI ratings, functional classification and strength, and the funding available for roadway maintenance. A slightly different approach was used for the Current Year Plan (FY 2014) in comparison to the Five-year Plan (FY 2015 through 2019). The methodologies are described below in more detail. The selection of roadways and the proposed pavement maintenance work to be performed in each year is located in Appendix A of this executive summary report.

### CURRENT YEAR PLAN (FY 2014)

The approach for developing the current year rehabilitation plan was to select residential roadways (residential, minor collectors, and major collectors) only for pavement improvements during FY 2014. This plan was developed with previous City Council feedback and input related to community priorities and needs. The methodology to identify streets involved selecting the lowest rated streets that could be rehabilitated, ranking in order based on the PCI from lowest to highest, selecting the type of pavement treatment required, and determining how much could be completed based on available funding within the current fiscal year. Figure 6 displays the costs, percentages, and miles associated with each type of rehabilitation activity proposed for the current year plan. Figure 6 further identifies a significant trend in costs versus miles for the rehabilitation activities. For instance, reconstruction work consumes a similar percentage of the available funding for only 0.5 miles rehabilitated as compared to 8.4 miles of streets that will receive surface treatments.

**Figure 6: Current Year (FY 2014) Plan Rehabilitation Summary**




Based on this approach, a grand total investment of $5.25 million, which includes both construction ($3.9 million) and administrative overhead costs ($1.35 million), will allow for roughly 13 miles of surface and overlay treatments and one-half mile of residential/collector reconstruction work. Additionally, in FY 2014 the city will reconstruct a little over a half-mile of roadway at the Bethany Home Frontage Road, from 61st Avenue to 66th Avenue, and the 67th Avenue Frontage Road, from Keim Drive to Rose Lane using the

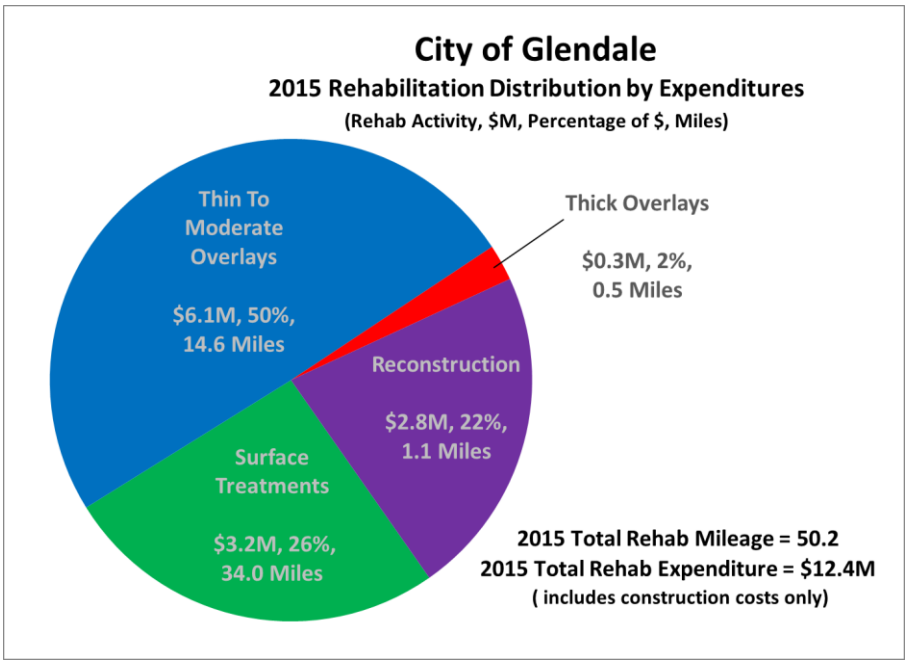
$250,000 in CDBG funds and $200,000 from the GO Program. The GO Program funded portion of this project is included in the total annual budget funding for FY 2014.

**FIVE-YEAR PLAN (FY 2015 THROUGH FY 2019)**

The approach for developing the five-year rehabilitation plan involved prioritizing and selecting both arterial and residential streets for pavement improvements. The methodology used included assigning the appropriate rehabilitation activity (or pavement treatment) to all street segments in the roadway network first, and then the critical streets having the highest cost of deferral were selected followed by less critical streets having a lower incremental cost of deferral. For example, the cost of an arterial thick overlay is $18.50/yd2 increasing to $40.00/yd2 if deferred resulting in an incremental cost of $21.50/yd2, while the cost to defer a thin overlay to a moderate overlay is only $3.00/yd2. Thus a critical thick overlay is assigned a higher priority (lower sequence) than a thin overlay. Under this approach, the streets were ranked from lowest to highest PCI after selecting the type of required pavement treatment or rehabilitation activity.

The effect of utilizing this methodology for the five-year plan is to develop the most cost effective rehabilitation strategy that maximizes pavement life. Figures 7 and 8 displays the costs, percentages, and miles associated with each type of pavement treatment proposed for the five-year (FY 2015 through FY 2019) plan.

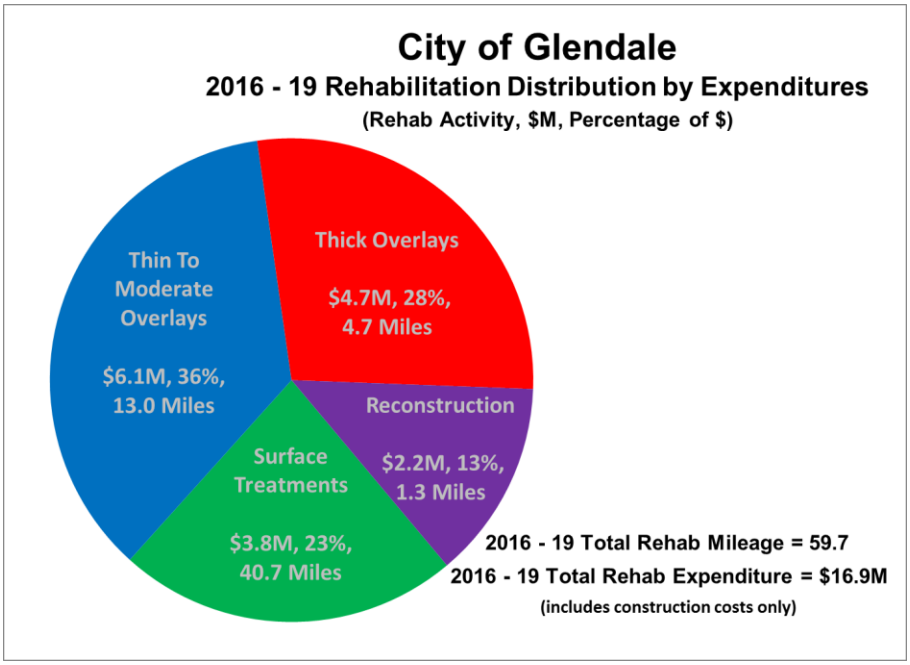
**Figure 7: FY 2015 Plan Rehabilitation Summary**




Based on this approach, part of the recommended plan is to spread the HURF bond funding equally over years 2015 and 2016 ($14 million each). The other funding available for street rehabilitation during each of the five years, 2015 through 2019, includes the $2 million in annual Pavement Management CIP funding. The $32 million investment in 2015 and 2016 (funded mostly through the $28 million HURF bond), will allow for roughly 94 miles of surface and overlay treatments and 2.4 miles of reconstruction work. For the remaining $6 million to be spent from 2017 through 2019, slightly less than 14 miles of residential streets could be maintained for this investment. Therefore, the grand total investment for the five-year plan includes approximately $29 million in construction costs and $9 million in administrative

overhead costs for a total amount of $38 million to be expended on roughly 110 miles (50.2 miles in 2015 and 59.7 miles in 2016 through 2019) of Glendale's street network.

**Figure 8: FY 2016 - 2019 Plan Rehabilitation Summary**




Figures 7 and 8 further identify the trend already shown in Figure 6 (above) and related to the greater costs versus smaller number of miles for the more intensive rehabilitation activities (thick overlays and reconstruction) as compared to the less intensive pavement treatments (surface or thin to moderate overlays). Overall, this shows the importance of developing detailed rehabilitation plans in order to effectively prioritize pavement treatment activities and to avoid millions of extra or unnecessary street rehabilitation costs.

## SUMMARY AND RECOMMENDATIONS FOR COUNCIL GUIDANCE

As outlined in this pavement management analysis, it is planned to spend $5.25 million to complete the Current Year Plan (FY 2014), which focuses on residential street rehabilitation and improvement activities. This current year plan was developed with previous City Council feedback and input related to community priorities and needs.

The Five-Year Plan (FY 2015 through 2019) provides a proposed program to complete street network improvements across all roadway types (residential, arterials, collectors, etc.); funding sources for these improvements includes HURF bond funding in the amount of $28 million spread equally ($14 million each) during years 2015 and 2016 as well as an additional $2 million in HURF funding during each of the five years. Although a larger amount of spending is proposed during FY 2015 and 2016 than what traditionally has been spent during previous fiscal years, additional funding will eventually be needed to have an effective program for on-going maintenance to properly repair the city's roadways and to extend the useful life of this city asset.

Lastly, the Pavement Management Report provided by IMS to the City of Glendale identifies a number of recommendations to be considered by the City Council. The recommendations for which policy guidance is sought are the following:

1. Move forward with the $28.0 million bond option; it is also recommended to spend this funding over a two-year period in FY 2015 and FY 2016.

2. Adopt a policy statement identifying the desired overall pavement condition rating and establishing a maximum percentage for streets allowed to have a PCI rating lower than 50 (or classified in "poor" or "very poor" condition); recommended targets include maintaining the current network profile at or above a PCI rating of 72 for 5 years and establishing a maximum percentage of 12 percent (12%) for streets with PCI rating lower than 50.

   **An annual budget of at least $13 Million is required to achieve this goal.**

3. Review annually the comprehensive plan of proposed rehabilitation strategies and unit rates, which can have considerable effects on the finalized construction program placed out for bid; all costs are in constant 2013 dollars, so no allowances have been made for annual inflation or fluctuations in rehabilitation costs.

4. Complete an updated field survey assessment and analysis of pavement conditions for Glendale's entire street network in FY 2014, which will provide current field data to assist with future short and/or long-range planning efforts related to the pavement management program.

5. Incorporate budget allowances for network growth into annual pavement management program. As the city expands or increases the amount of paved roads, increased budgets will be required. No allowance has been made for routine maintenance activities such as crack sealing, sweeping, striping or patching. These costs are assumed to be outside the pavement management costs and will affect the network performance if not completed.

6. Increase annual funding for compliance with the Americans with Disabilities Act (ADA), which is required on all roadway rehabilitation projects. An increased level of funding will be necessary should the city elect to become fully ADA compliant.

## Appendix A

## Summary Map of Rehabilitation Plans for FY 2014, FY 2015, and FY 2016 - FY 2019