

## TECHNICAL MEMORANDUM

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Date: 9/30/2019  
To: Kristine Cai, Fresno COG  
From: Margot Yapp, Lisa Senn, and Sharlan Montgomery Dunn  
Subject: Fresno Regional Analysis  
Job #: 992.01.55

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### Background

Historically, the Fresno Council of Governments' (COG) sixteen member jurisdictions have employed a variety of approaches to determine what pavement treatments to perform and where to apply them. While some of these jurisdictions have used pavement management programs (PMPs), others have employed more traditional reactive approaches.

In 2018, Nichols Consulting Engineers Chtd. (NCE) assisted nine Fresno COG member jurisdictions in implementing their PMPs using StreetSaver<sup>®</sup>, a pavement management decision-support tool developed by the Metropolitan Transportation Commission. All Fresno COG jurisdictions now use PMPs, and all but one use StreetSaver<sup>®</sup> to help manage their network (the City of Clovis uses Cartegraph). Since 92% of the countywide road system utilizes StreetSaver<sup>®</sup>, Fresno COG obtained a regional license to StreetSaver so that all databases could be aggregated for NCE to perform regional funding analyses.

This memorandum presents the results of the budget needs and funding analyses for all the cities and the unincorporated county. These analyses illustrate the effects of various funding scenarios on pavement condition and deferred maintenance over a 20-year period. These results can be used to communicate important trends to decision makers and the public, which is of particular importance as Measure C, the local half-cent sales tax, comes up for renewal in 2027.

### Countywide Street/Road Inventory

Fresno COG's member jurisdictions maintain approximately 6,303 centerline miles of streets and roads. The majority of the countywide network (89.6%) is composed of asphalt concrete pavements. Of the remaining portion, approximately 519 miles (8.7%) are surface treated roads managed by Fresno County, 1.6% are gravel roads, and less than 1% are concrete roads. Table 1 summarizes the countywide network by jurisdiction. Although gravel sections are included in the databases, they were not included in the analyses.

The analyses performed were based on the most recent StreetSaver<sup>®</sup> databases as of July 25<sup>th</sup>, 2019. Changes to the individual jurisdiction's databases made after this date are not reflected in the regional analyses. Table 1<sup>1</sup> also indicates which jurisdictions had some pending inspections or maintenance

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<sup>1</sup> See Column 6 *Pending Inspections* and Column 7 *Pending Treatments*.

treatments, resulting in uncalculated pavement condition indices (PCI), at the time the analyses were performed. Sections with pending PCI calculations were still included in the analyses; however, the current PCI estimates for those sections were based on the previous inspection or treatment. Essentially, the pending PCI calculations were ignored in the analyses.

The PCI is a measure of the pavement condition and ranges from zero to 100. A newly constructed road has a PCI of 100, while a failed road has a PCI of 25 or less. A pavement's condition is affected by the environment, traffic loads and volumes, construction materials, and age. **The PCI for the countywide network is 60.** This value is an area-weighted calculation.

**Table 1. Countywide Summary Statistics**

Jurisdiction	Paved Centerline Miles	No. of Sections	Paved Area (sf)	Gravel Area (sf)	Pending Inspections	Pending Treatments	2019 PCI
Clovis	440.8	Unknown	80,760,142	Unknown	NA	NA	69
Coalinga*	48.4	290	10,646,081	9,396	No	No	59
Firebaugh*	20.6	169	4,316,818	87,758	No	No	47
Fowler*	37.5	251	7,876,435	0	No	No	52
Fresno (City)	1,785.90	19,663	352,267,897	0	No	No	58
Fresno (County)	3,418.60	8,453	431,406,278	421,761	No	No	60
Huron*	11.2	128	2,375,491	674,234	No	No	64
Kerman	59.9	560	12,123,651	0	Yes	No	68
Kingsburg*	49.1	332	9,842,248	24,792	Yes	Yes	64
Mendota*	27.1	260	5,837,844	336,119	No	No	42
Orange Cove*	33.6	195	6,224,126	310,952	No	No	44
Parlier	37	341	8,052,546	0	No	No	64
Reedley	93.3	1,101	18,529,343	46,400	No	No	50
San Joaquin*	14.1	95	2,892,939	44,636	No	No	24
Sanger	146	711	28,216,217	0	No	No	67
Selma*	80.2	542	17,283,576	37,840	No	No	59
<b>Countywide</b>	<b>6,303</b>	<b>33,091</b>	<b>998,651,632</b>	<b>1,993,888</b>	<b>-</b>	<b>-</b>	<b>60</b>

\*Included in NCE's 2018 Pavement Management Implementation Scope.

**The entire local street/road network replacement cost is estimated to be \$5 billion.** This can be viewed as the value of the pavement network and is the amount needed to reconstruct the entire pavement network. It does not include related infrastructure assets such as sidewalks, signals, markings, or signs.

As shown in Table 2, a few jurisdictions have some streets or roads that do not have any PCI data, and these total approximately 170 miles. Of this, approximately 5 miles were constructed after 2016. Since these streets were constructed relatively recently, the PCI projections for these streets are likely adequate for analysis purposes. However, approximately 160 miles were constructed in 1990 or earlier. Much of this mileage is managed by Fresno County, but it only represents 2% of the County's network. In contrast, the City of Sanger's 66 miles without PCI data represent a significant portion (45.2%) of their network. Sections missing survey data were still included in the analyses, but the current PCI estimates

were based on the construction date. Considering many of these sections are nearing 30 years old, the estimated PCIs are likely inaccurate. Therefore, the analysis results may not be as reliable for jurisdictions, such as Sanger and Kerman, that are missing current PCI data for significant portions of their networks.

**Table 2. Jurisdictions with No PCI Data**

Jurisdiction	Streets without PCI Data (miles)	% of Network without PCI Data
Fresno City	18.0	1.0
Fresno County	68.1	2.0
Sanger	66.0	45.2
Parlier	0.4	1.2
Reedley	0.3	0.4
Kerman	17.4	29.0
<b>Total</b>	<b>170.3</b>	<b>2.7</b>

## Decision Tree and Treatment Unit Costs

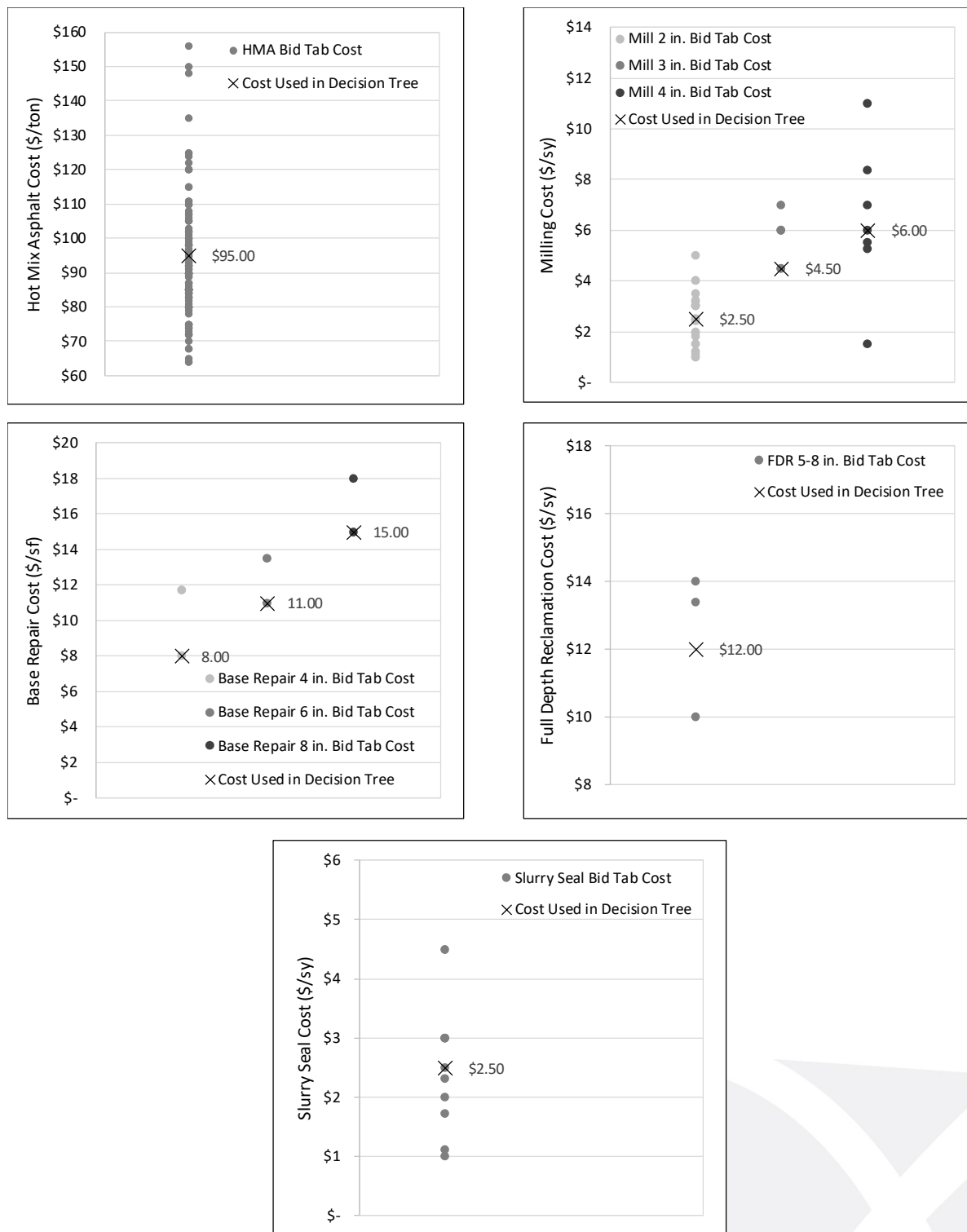
A decision tree represents a strategy for assigning pavement maintenance and rehabilitation (M&R) treatments to candidate management sections. Typically, decision trees are grouped by functional classification, and include treatments for each pavement condition category, as well as corresponding unit costs. Decision support tools, such as StreetSaver®, are programed to use decision trees and unit costs to perform budget scenarios that optimize the use of available funds when assigning treatments to pavement sections.

Each jurisdiction with a StreetSaver® license can create and use a custom decision tree as part of its PMP. However, since a few cities, including the City of Fresno and County of Fresno, had decision trees that had not been recently updated, NCE developed a regional decision tree so that all cost assumptions were consistent with recent construction costs.

The treatments selected for the regional decision tree were based on 1) decision trees developed by NCE as part of the 2018 PMP implementation scope, and 2) decision trees reported by other Fresno COG member jurisdictions in the 2018 Statewide needs assessment<sup>2</sup>. The unit costs were estimated using bid tabs from local and neighboring jurisdictions including the City of Fresno, Fresno County, Mendota, Huron, Orange Cove, Sacramento County, and Madera County. Figure 1 shows the paving-related costs obtained from these jurisdictions. If there were several bid tab costs, the average was used; however, if there were very few bid tab costs, the lowest cost was used. No bid tabs included cold-in-place recycling, so the costs were based on agencies outside the County.

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<sup>2</sup> California Statewide Local Streets and Roads Needs Assessment, NCE, October.2018



**Figure 1. Paving-Related Bid Tabs and Decision Tree Costs**

Table 3 presents the decision tree developed for the regional analyses. The estimated costs include typical costs associated with paving projects such as upgrades to comply with the American Disability Act, striping, and traffic control, as well as an additional 15% for engineering design.

**Table 3. Regional Decision Tree**

Functional Class	Condition Category (PCI)	Treatment	Estimated Unit Cost (\$/yd <sup>2</sup> )
Arterial	I - Excellent (86-100)	Do Nothing	\$ -
	I - Very Good (70-85)	Crack Seal	\$ 2.00
	II - Fair, Non-Load Related (50-69)	Thin Overlay	\$ 18.00
	III - Fair, Load Related (50-69)	Overlay w/Base Repair	\$ 33.00
	IV - Poor (25-49)	Cold-in-Place Recycling w/Overlay	\$ 46.00
	V - Failed (0-24)	Full Depth Reclamation w/Overlay	\$ 56.00
Collector	I - Excellent (86-100)	Do Nothing	\$ -
	I - Very Good (70-85)	Crack Seal	\$ 2.00
	II - Fair, Non-Load Related (50-69)	Slurry Seal	\$ 4.00
	III - Fair, Load Related (50-69)	Overlay w/Base Repair	\$ 30.00
	IV - Poor (25-49)	Cold-in-Place Recycling w/Overlay	\$ 37.00
	V - Failed (0-24)	Full Depth Reclamation w/Overlay	\$ 44.00
Residential	I - Excellent (86-100)	Do Nothing	\$ -
	I - Very Good (70-85)	Crack Seal	\$ 2.00
	II - Fair, Non-Load Related (50-69)	Slurry Seal	\$ 4.00
	III - Fair, Load Related (50-69)	Slurry Seal w/Base Repair	\$ 10.00
	IV - Poor (25-49)	Overlay w/Base Repair	\$ 34.00
	V - Failed (0-24)	Full Depth Reclamation w/Overlay	\$ 42.00

## Funding Sources

The Fresno COG member jurisdictions obtain pavement funding from five primary sources.

**The Highway User Tax Account (HUTA)** is the California State per-gallon tax on gasoline and diesel fuels. This tax has been the primary source of funding for road maintenance throughout the state for many years. However, the rise of alternative fuels, electric vehicles, and more efficient gasoline-powered vehicles has led to reduced gas consumption and is therefore projected to be a declining revenue source.

**The Road Maintenance and Rehabilitation Act (RMRA or SB1)**, passed in 2017, created a new state revenue source funded by an additional per gallon gas tax as well as a new vehicle-registration tax. This funding source is expected to provide Fresno COG member jurisdictions more than \$13 million per year for road maintenance.

**Measure C** is a half-cent sales tax passed by Fresno County voters in 1986. This source of revenue provided approximately \$1 billion during the first 20 years (Measure C I) for road and street maintenance and construction, and \$1.4 billion during the reauthorization period from 2007 to 2026 (Measure C II) for multimodal transportation improvements. The current measure (Measure C II) was extended in 2006 and will sunset in 2027. A minimum of 15% of the Measure C II funding goes to local street and road maintenance.

**Local Transportation Fund (LTF)** is a statewide 0.25 cent general sales tax. It provides for transit planning and operation for public transit operators. Local governments receive LTF funds for street and road improvements when there are no unmet transit needs that are deemed reasonable to meet in the areas.

**Surface Transportation Block Grant (STBG)** is a federal funding source that provides flexible funds for states and local jurisdictions. The STBG can be used to fund a variety of projects including highways, bridges, public roads, pedestrian and bicycle infrastructure, and transit. Because of its flexibility, STBG has served different purposes over time. Due to the high roadway maintenance needs in the Fresno region in recent years, local jurisdictions in Fresno region have chosen to focus on street and road maintenance with STBG funding. The Regional STBG program is competitive and the funding for each jurisdiction may vary from year to year.

## Funding Analyses

Four funding scenarios were selected for analysis to determine the impact of Measure C on 1) the countywide condition of streets and roads and on 2) the deferred maintenance (the M&R not performed due to insufficient funding) and to determine the funding needed to maintain the current condition of the countywide network.

**Scenario 1:** Measure C renewal passes in 2027 and 15% is allocated to pavement maintenance;

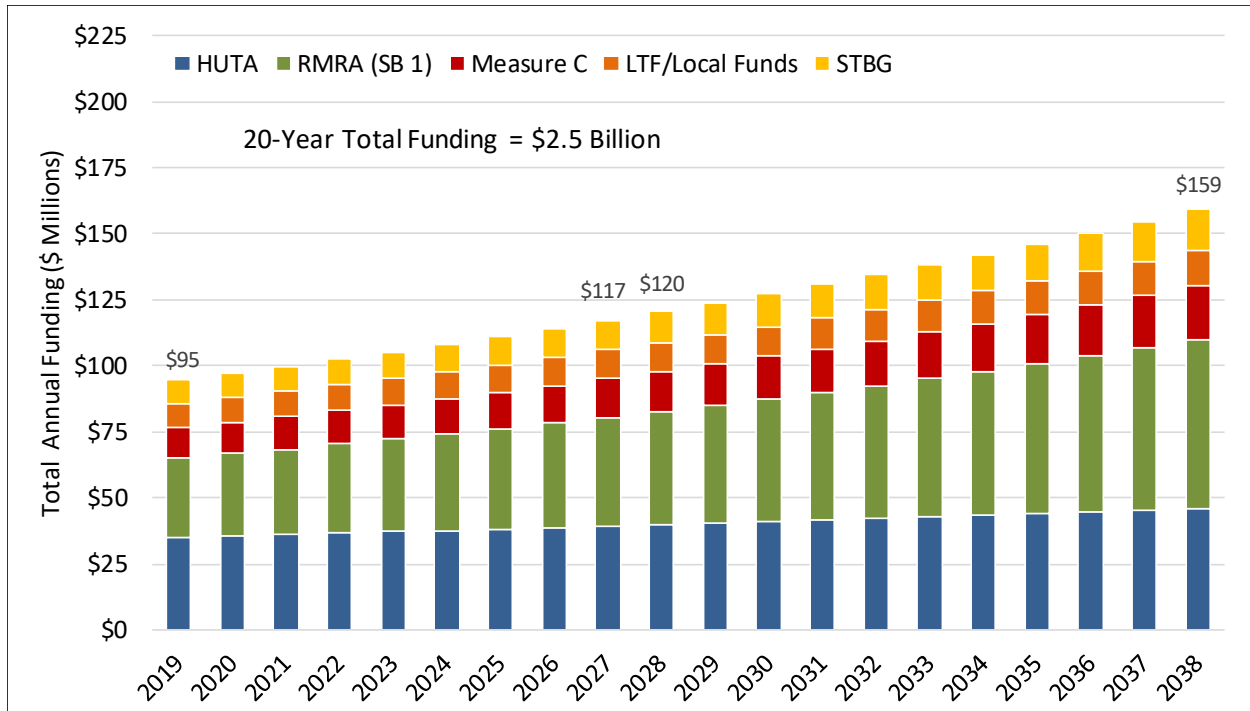
**Scenario 2:** Measure C renewal passes in 2027 and 25% is allocated to pavement maintenance;

**Scenario 3:** Measure C renewal sunsets in 2027 and is not renewed; and

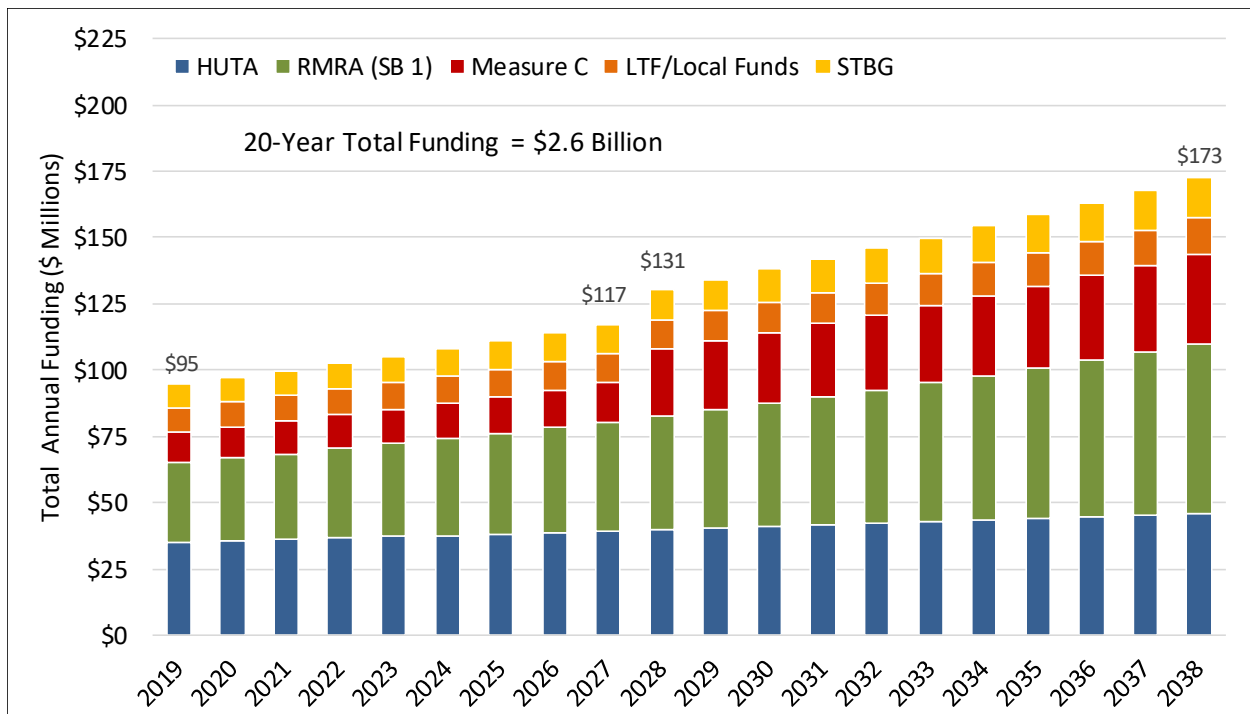
**Scenario 4:** Funding required to maintain the current pavement network at a PCI of 60

The total funding for each jurisdiction and each funding source was projected using corresponding estimated annual growth rates for an analysis period of 20 years. The projected regional funding for each scenario is shown in Figures 2 to 5. The total 20-year funding for Scenarios 1, 2, 3, and 4 are \$2.5 billion, \$2.6 billion, \$2.3 billion, and \$3.0 billion, respectively.





**Figure 2. Scenario 1 Funding Assuming Measure C is Renewed in 2027 (15%)**



**Figure 3. Scenario 2 Funding Assuming Measure C is Renewed in 2027(25%)**

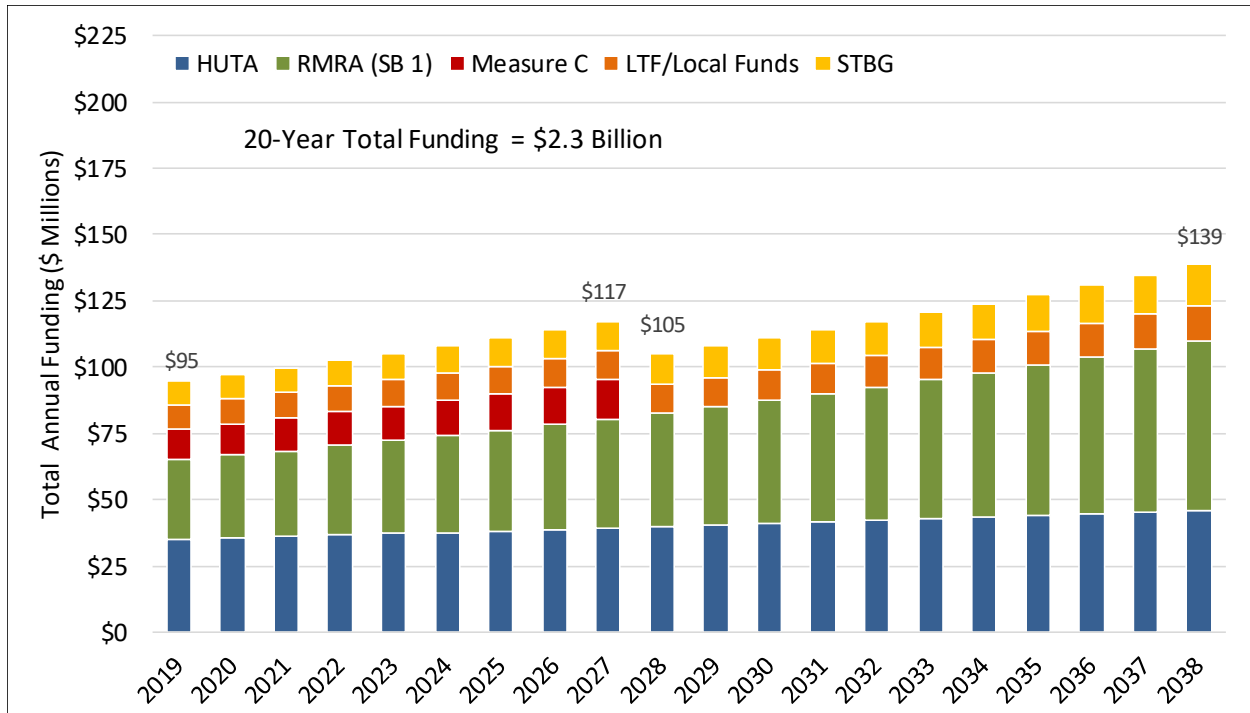


Figure 4. Scenario 3 Funding Assuming Measure C Sunsets in 2027

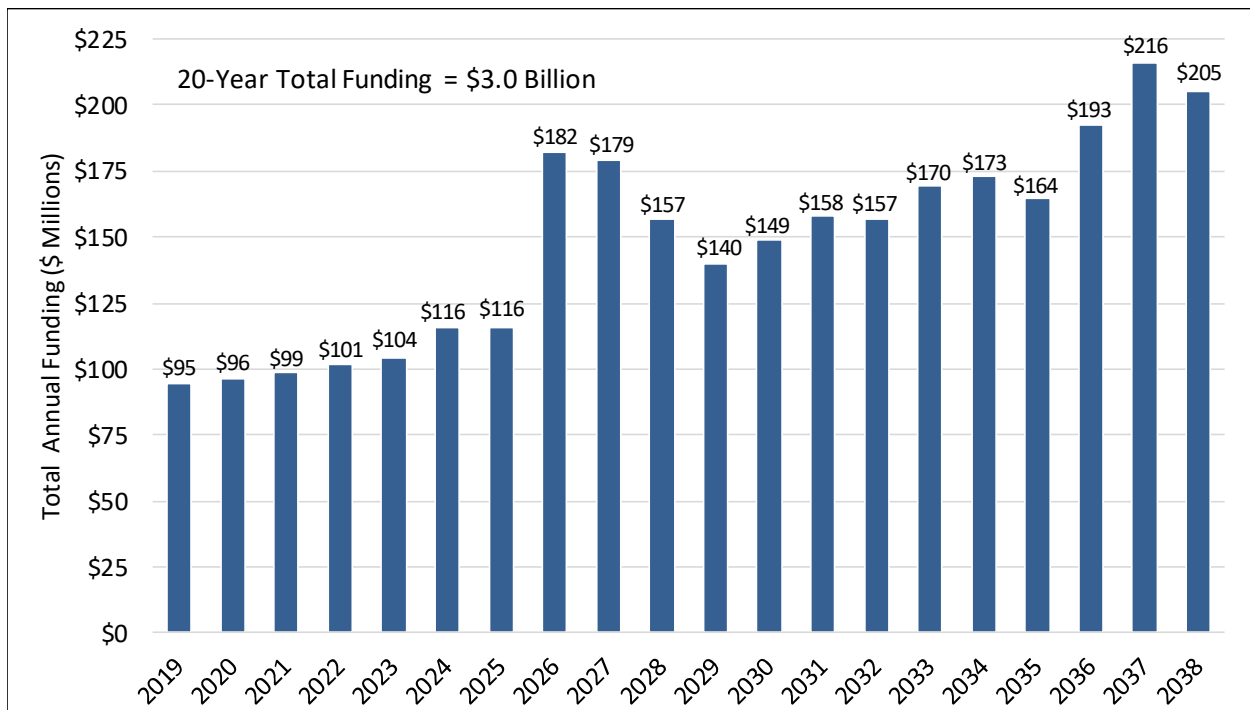


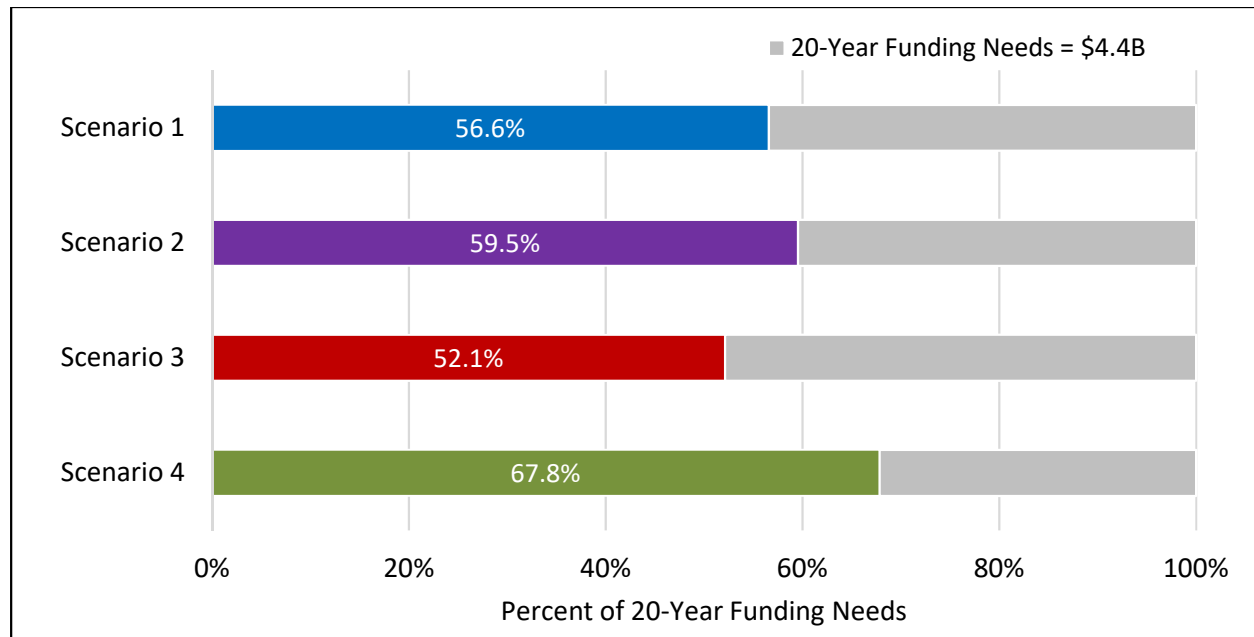
Figure 5. Scenario 4 Funding to Maintain Countywide PCI at 60



## Budget Needs Analysis

A budget needs analysis was performed to identify the funding required to perform all M&R treatments at the optimal time. For all jurisdictions, except Clovis, this was done using the regional StreetSaver® license. For the City of Clovis, the budget needs were estimated using a database for a jurisdiction of similar size and average condition. These estimates were then added to the results obtained from the regional analysis to obtain the countywide estimated budget needs.

**The 20-year budget needs for the region is estimated to be \$4.4 billion.** Figure 6 shows the percent of 20-year funding needs met by each scenario. Overall, Scenarios 1, 2, 3, and 4 meet 56.6%, 59.5%, and 52.1%, and 67.8% respectively, of the 20-year budget needs.



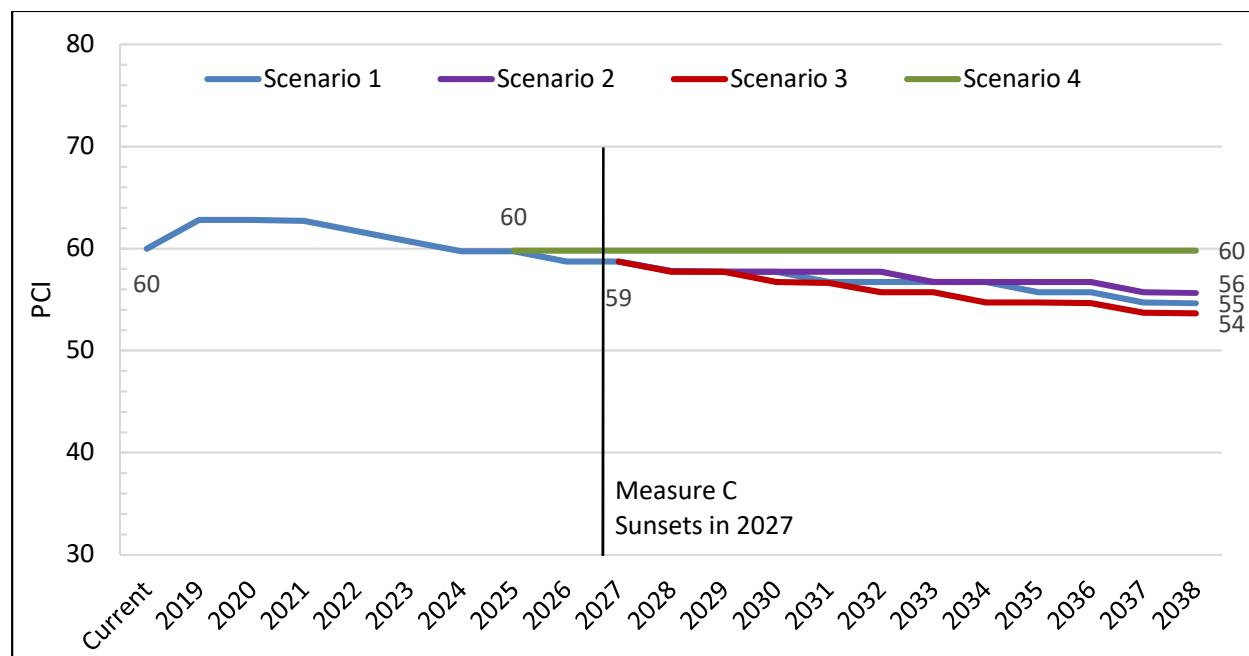
**Figure 6. Percent of 20-Year Funding Needs Met by Each Scenario**

## Results of Funding Scenarios

As with the budget needs analysis, the four funding scenarios were performed using the regional StreetSaver® license and a simulated database to represent the City of Clovis.

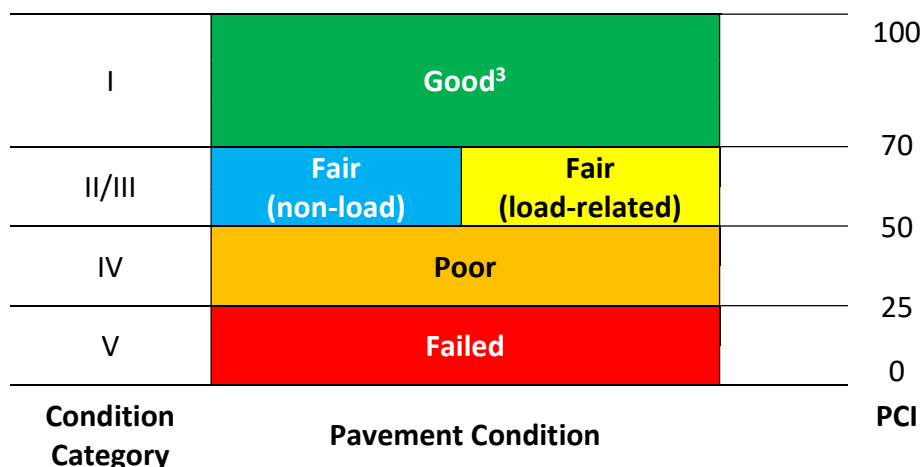
Figure 7 graphically shows the change in PCI over time for each scenario. The first three scenarios follow the same trend until 2027 when Measure C sunsets. After that, if Measure C is renewed with 15% allocated towards pavement maintenance (Scenario 1), then the PCI will fall to 55 by 2038. If Measure C is renewed with 25% allocated towards pavement maintenance (Scenario 2), then the network will show a slightly improved PCI of 56 by 2038. If Measure C is not renewed in 2027 (Scenario 3), then the network will deteriorate at a slightly higher rate, resulting in a PCI of 54 By 2038. Essentially, there are small improvements as more money from Measure C is allocated to pavement maintenance. For the first seven years, the current funding will be enough to maintain the network PCI at or above the current

PCI of 60. After that, approximately \$38 million per year in additional funding (relative to Scenario 1) will be required to maintain the network at a PCI of 60.



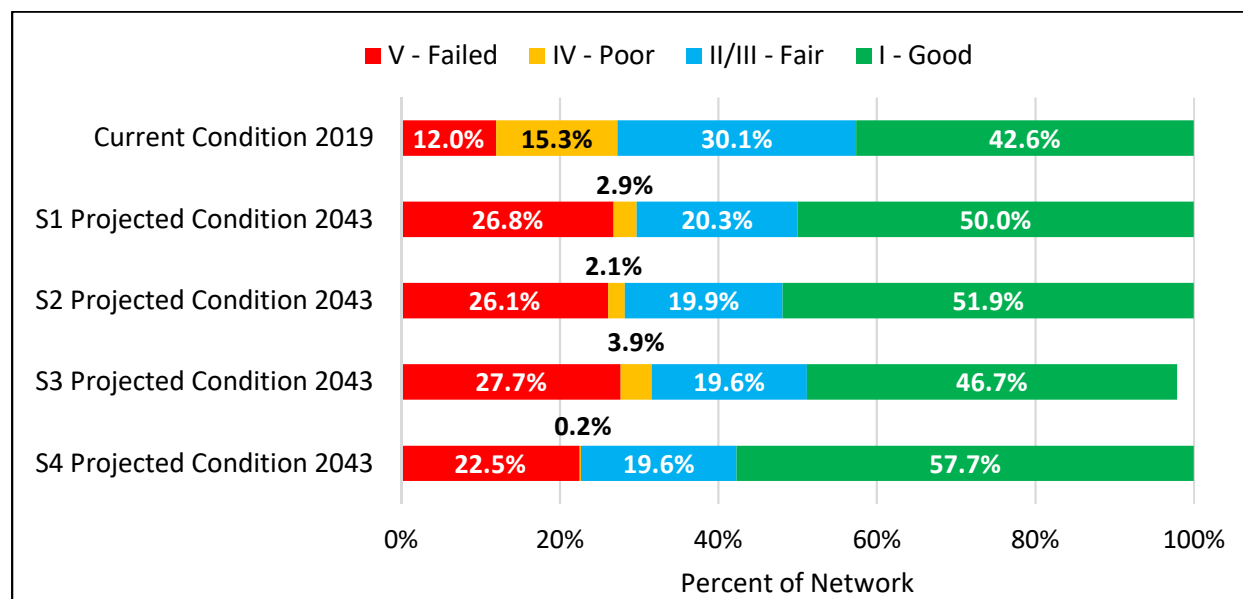
**Figure 7. Pavement Condition Index Over Time for Each Scenario**

The PCI scale may be divided into five condition categories as shown in Figure 8. Pavements in Fair condition are divided into two categories representing roads with primarily non-load-related distresses or load-related distresses. Categories I and II have primarily non-load-related distresses (e.g., weathering), and Categories III - V have primarily load-related distresses (e.g., fatigue cracking). Since the failure mechanisms for load-related distresses are quite different from non-load-related distresses, the treatments used to address them are different, as are their associated costs. Generally, roads with load-related distress are more expensive to repair.



**Figure 8: Pavement Condition Categories by PCI**

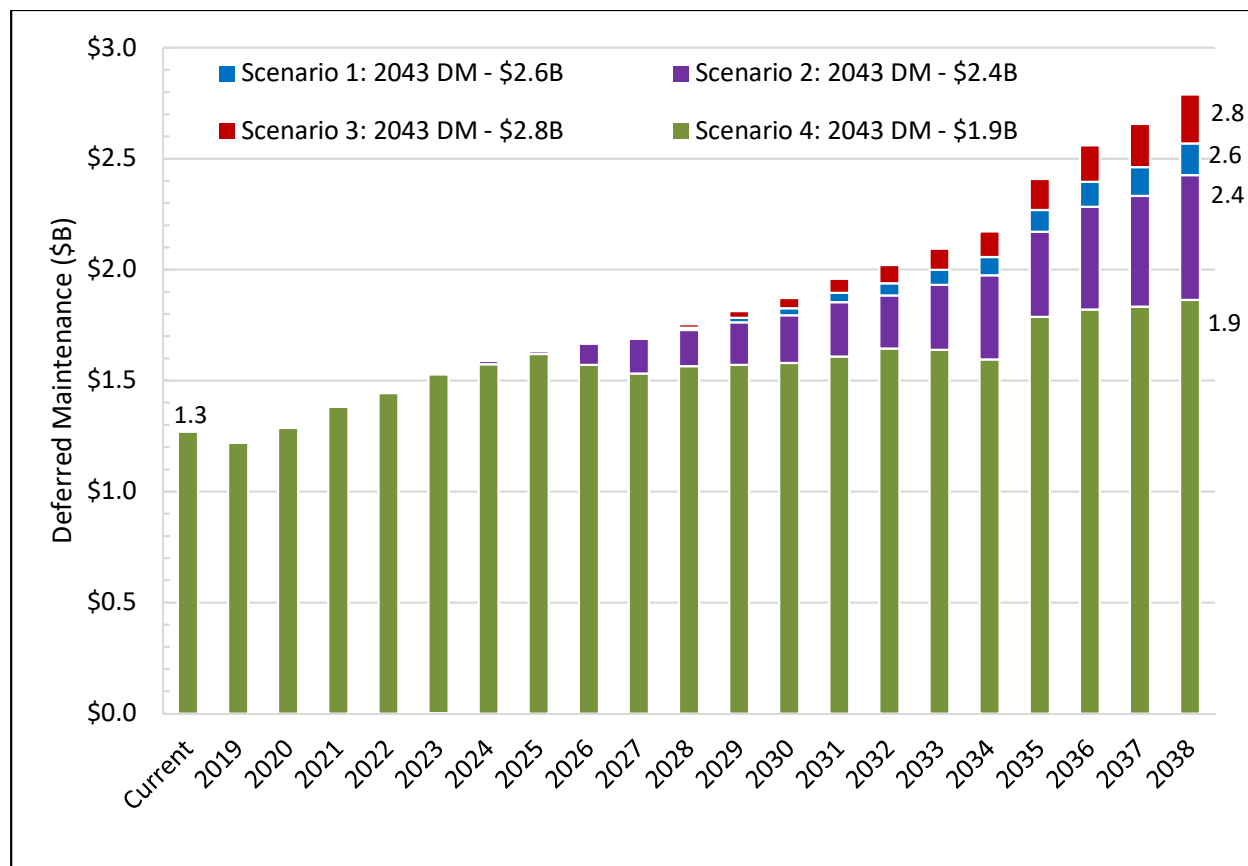
Figure 9 shows the current condition of the countywide network by condition category compared to the projected condition for each of the four scenarios. Currently, approximately 42.6 % of the countywide pavement network is in Good condition. About one-third of the network is in Fair condition, and approximately a quarter is in Poor or Failed condition. In the first three scenarios, the portion of the network in Good condition will increase, but the portion of the network in Poor and Failed condition will also increase. Only Scenario 4 will see an appreciable increase in the portion of network in good condition and a net decrease in the portion of the network in Poor and Failed condition.



**Figure 9. Current Pavement Network Condition Compared to Projected Condition**

<sup>3</sup> Note: the StreetSaver® "Maintenance and Rehabilitation Decision Tree" in Appendix A assigns different condition category titles from those provided in Figure 8.

Figure 10 illustrates the changes in deferred maintenance over time for each scenario. As with the PCI, the deferred maintenance for the first three scenarios is the same until 2027 when Measure C sunsets. After that, if Measure C is renewed with 15% allocated towards pavement maintenance (Scenario 1), then the deferred maintenance will be \$2.6 billion by 2038. In contrast, if Measure C is renewed and 25% is allocated to pavement maintenance (Scenario 2), the final deferred maintenance will be \$2.4 billion by 2038. If Measure C is not renewed (Scenario 3), the final deferred maintenance will be \$2.8 billion by 2038. If the network is maintained at the current PCI of 60, then the deferred maintenance will be \$1.9 billion by 2038.



**Figure 10. Deferred Maintenance Over Time for Each Scenario**

## Summary

In summary, the Fresno COG member jurisdictions have a substantial investment of \$5 billion in the pavement network. Overall, the countywide street and road network is in Fair condition, with a 2019 network PCI of 60. Of the 6,303 centerline miles in the county, approximately 42.6% are in Good condition while about a quarter are in Poor or Failed condition.

The analyses indicate that approximately \$4.4 billion needs to be spent on pavement maintenance and rehabilitation over the next 20 years to essentially repair all streets and roads and bring the network to a condition level where it can be maintained with on-going preventive maintenance. In the long run, this

strategy will save money by preventing future pavement deterioration to levels requiring more costly rehabilitation or reconstruction

The results of the first three scenarios indicate that the renewal and/or increase of Measure C will have a positive impact on the condition of the Countywide pavement network. Measure C has the potential to reduce the deterioration rate, resulting in a network PCI 2 points higher by 2038 and an increase in portion of network pavements in Good condition by 5.2%. However, the overall network condition will begin to decrease about the time Measure C comes up for renewal. Since the goal of pavement management is to provide users with a safe and functional pavement network without unduly increasing the future M&R needs, NCE recommends dedicating a greater percentage of Measure C revenue towards pavement maintenance and rehabilitation when it comes up for renewal in 2027.

