



Final Report
2021/2022 Pavement Management Program Update
Karuk Tribe

February 2023



Richmond, CA

501 Canal Blvd., Suite I
Point Richmond, CA 94804



Karuk Tribe

Department of Transportation
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Orleans, CA 95556

The Humboldt County Association of Governments

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Prepared for:

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Executive Summary

The Humboldt County Association of Governments (HCAOG) is a Joint Powers Agency composed of the seven incorporated cities (Arcata, Blue Lake, Eureka, Ferndale, Fortuna, Rio Dell, Trinidad), and the County of Humboldt along with some tribes and rancherias. It is the designated Regional Transportation Planning Agency (RTPA) as well as the Service Authority for Freeway Emergencies (SAFE). As a part of this process, in 2021, HCAOG acquired the services of an engineering consultant, Nichols Consulting Engineers, Chtd. (NCE), to provide professional and technical services preparing pavement management program (PMP) updates for the county, the cities and tribes/rancherias under HCOAG.

This report summarizes the results of the 2022 update for the Karuk Tribe and its purpose is to help educate policy makers about the current condition of the pavement network and the impact of various funding scenarios on future network condition.

The Karuk Tribe's pavement network consists of 22.5 centerline miles of roads, which represents an investment of approximately \$20.3 million. In 2022, NCE collected pavement condition data using the Metropolitan Transportation Commission's (MTC) modified ASTM survey procedures. The survey data were entered into the StreetSaver[®] database, which the Tribe uses as a PMP decision-support tool.

Overall, the Tribe's pavement network is currently in "Fair" condition with an average pavement condition index (PCI) of 59. Approximately 41.9 percent of the network is in "Good" condition while 43.9 percent is in "Poor" condition.

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1 Introduction and Background

In 2021, the Humboldt County Association of Governments (HCAOG) solicited interest among its member agencies in participating in a collaborative region-wide pavement management program (PMP) update for the cities and the county. During North Coast Tribal Transportation Commission meeting in July 2022, the agencies have agreed to move forward with additional work of creating a separate database of tribal network system which would have the inventory of roads maintained by the tribes and rancherias. To complete the PMS update of tribal network, the scope of work included creating new StreetSaver® database, conducting inspections, updating decision tree, running budget need analysis and summarizing results.

The engineering consultant acquired to provide professional and technical services for the PMP updates in the Humboldt region was Nichols Consulting Engineers, Chtd. (NCE). The participating member agencies included the Cities of Arcata, Blue Lake, Eureka, Ferndale, Fortuna, Rio Dell, Trinidad, and the County of Humboldt and tribes/rancherias under HCAOG.

In general, PMPs are “designed to provide objective information and useful data for analysis so that... managers can make more consistent, cost effective, and defensible decisions related to the preservation of a pavement network.”¹

The goals of the 2022 update were to:

- Create new StreetSaver^(R) Database
- Perform pavement condition surveys,
- Update the maintenance and rehabilitation decision tree and associated costs,
- Perform analyses and determine funding needs, and
- Prepare a final PMP report documenting the results of the update.

NCE worked with MTC to create a new StreetSaver^(R) database for all tribes/rancherias. Information related to tribal roads which are overlapped in the County’s database was extracted to the new database. The overlapped tribal roads in the County’s database were not further inspected as they were surveyed in June 2022 as a part of 2022 HCAOG PMP update. To update the remaining network of the tribes/rancherias, NCE performed walking surveys using the Metropolitan

¹ AASHTO “Guidelines for Pavement Management Systems”. American Association of State Highway and Transportation Officials, Washington, DC, July 1990.

Transportation Commission's (MTC) modified² ASTM D6433³ survey procedures. Walking surveys were performed by one or two-person crews to record all pavement distresses on all residential/local roads. The surveys did not include non-pavement issues such as traffic, safety and road hazards, geometric issues, shoulders, sidewalks, curb and gutters, drainage issues, or immediate maintenance needs. All survey data were entered into the Tribe's StreetSaver[®] database, and pavement condition index (PCI) calculations were performed. NCE then met with agency staff and reviewed and updated the decision tree including maintenance and rehabilitation (M&R) strategies and treatment unit costs. A budget needs analysis was then performed for the road network.

This report answers the following questions for the Karuk Tribe:

- What does the tribal pavement network include?
- What is the current condition of the pavement network?
- What are the current M&R strategies for tribes/rancherias?
- How much funding is required to perform all needed M&R treatments over the next ten years?

² PCI Distress Identification Manuals (AC 4th Edition, PCC 3rd Edition), Metropolitan Transportation Commission, San Francisco, CA March 2016.

³ ASTM D6433-18 Standard Practice for Roads and Parking Lots Pavement Condition Index Surveys, ASTM International, West Conshohocken, PA, 2018, www.astm.org.

2 Network Summary

The Karuk tribe is responsible for maintaining approximately 22.5 centerline miles of roads (or 34 pavement sections) which includes 16.0 centerline miles under County's Indian Road Reservation (IRR) list. The network is composed mostly of asphalt concrete (AC) pavement and surface treated pavements. Table 1 summarizes the road network by functional classification.

Table 1. Network Summary Statistics

Functional Class	Number of Sections	Centerline Miles	Lane Miles	Network Area (%)
Collectors	6	5.6	11.2	34.4
Residential	19	9.4	19.1	37.0
Rural Minor Collector	9	7.5	16.1	28.6
Total	34	22.5	46.4	100

The road network replacement cost is estimated to be approximately \$20.3 million. This can be viewed as the value of the pavement network and is the amount needed to fund a reconstruction of the entire paved network.

It does not include related infrastructure assets such as sidewalks, signals, markings, signs, or storm drains.

3 Pavement Condition

Pavement condition is typically quantified using the pavement condition index (PCI), which ranges from 100 (best) to 0 (worst). Pavement condition is affected by the environment, traffic loads and volumes, construction materials, and age. Figure 1 shows examples of roads with varying PCIs.

The PCI scale is divided into four general condition categories. Pavements in "Good" condition have a PCI above 70, pavements in "Fair" condition have a PCI between 50 and 69, pavements in "Poor" condition have a PCI between 25 and 49, and finally pavements in "Failed" condition have a PCI below 25.



Figure 1. Examples of Roads with Different PCIs

A list of all sections in the network along with their attributes, including the PCI at the time of last inspection, is provided in Appendix A. For convenience, two versions are provided – one sorted alphabetically by road name and the other sorted by descending PCI.

3.1 PAVEMENT CONDITION INDEX

The current average PCI for Karuk tribal network is 59. This value is an area-weighted calculation performed in StreetSaver® and is based on the condition survey performed in 2022.

3.2 NETWORK CONDITION BREAKDOWN

Figure 2 breaks down the current tribal network PCI by functional classification. The average pavement condition for collectors is a PCI of 61, rural minor collectors have the lowest PCI of 48, while the average PCIs for residential is 67. Table 2 summarizes the tribal road network by condition category and functional classification. Approximately, 56.1 percent of the network is under “Good” to “Fair” condition.

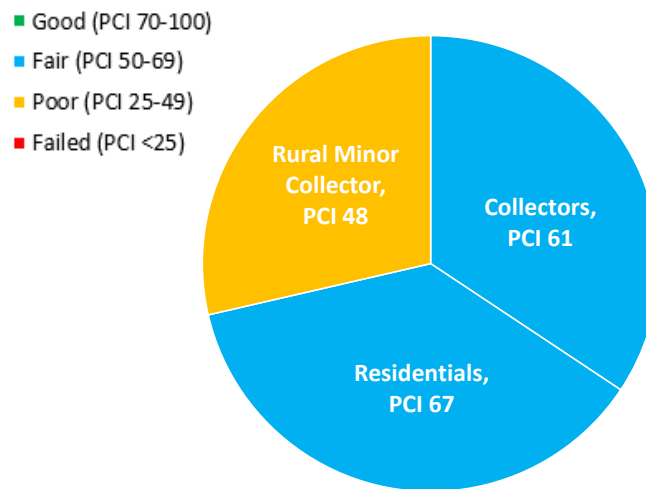


Figure 2. Network Condition Breakdown by Functional Classification

Table 2. Pavement Condition Breakdown by Functional Class

Condition Category	PCI Range	Collectors (%)	Rural Minor Collectors (%)	Residentials (%)	Entire Network (%)
Good	70-100	21.3	0.0	20.6	41.9
Fair	50-69	0.0	7.2	7.0	14.9
Poor	25-49	13.0	21.4	9.5	43.9
Failed	<25	0.0	0.0	0.0	0.0
Total	-	34.3	28.6	37.1	100.0

3.3 PCI COMPARISON WITH NEIGHBORING AGENCIES

Figure 3 shows the average network PCI of all cities and county, and Figure 4 shows a comparison of Karuk Tribe to the other HCAOG tribes as well as the statewide average PCI from the 2020 California Statewide Local Streets and Roads Needs Assessment⁴. As illustrated, the Tribe’s average network PCI is above the other HCAOG tribes but below the 2020 statewide average.

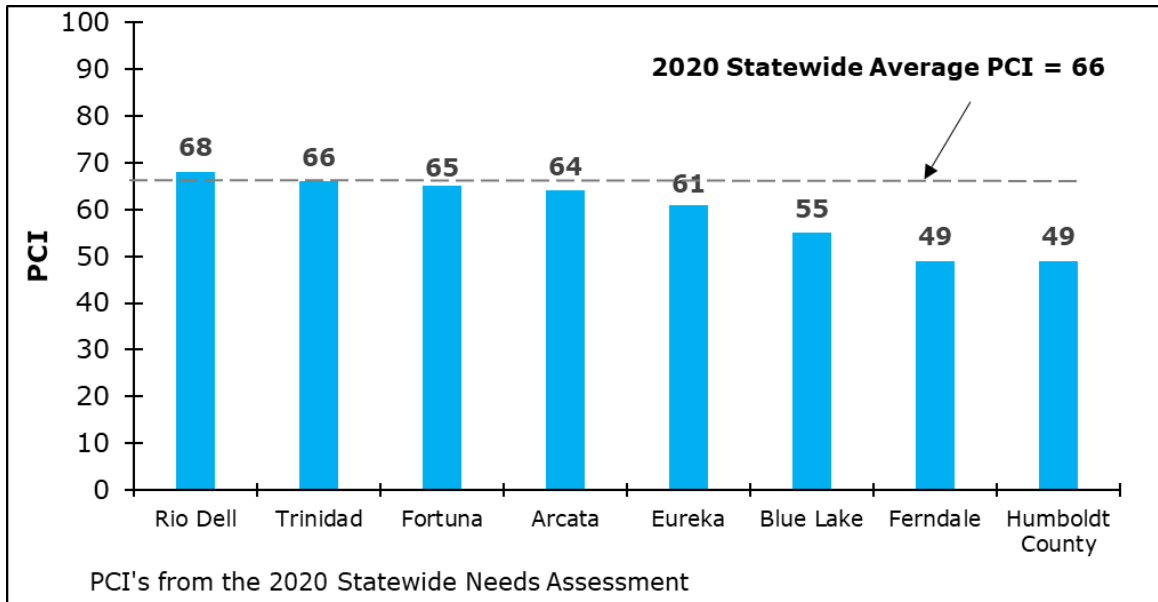


Figure 3. Comparison of Network PCI to Other HCAOG Agencies

⁴ "California Statewide Local Streets and Roads Needs Assessment 2020 Update". Nichols Consulting Engineers, Chtd., CA, 2021.

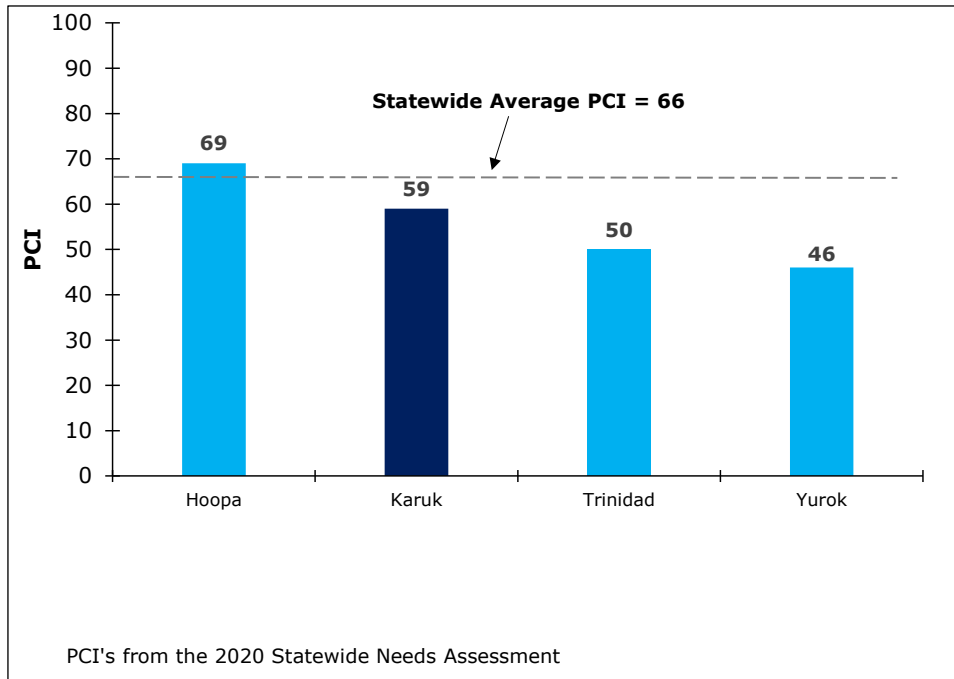


Figure 4. Comparison of Network PCI to Other HCAOG Tribes

4 Maintenance and Rehabilitation Strategies

The Tribe’s current M&R strategies include cost-effective preventive treatments. In general, crack seals or slurry seals will be applied to pavements in “Good” condition; pavements in “Fair” condition will receive a slurry seal or a chip seal; pavements in “Poor” and “Failed” condition will receive thick mill and HMA overlay. The Tribe’s M&R strategies are formalized into a decision tree⁵ (presented in Appendix B), which is instrumental in performing the budget needs analysis and budget scenarios.

Experience and research have shown that it costs much less to maintain pavement in good condition than to repair pavement that has already failed. Figure 5 shows treatment unit cost for residential. As shown in Figure 5, by allowing pavements to deteriorate, roads that once cost \$5.25/square yard (SY) to seal may soon cost \$49 to overlay. In other words, delaying repairs can significantly increase M&R costs. Note that a slurry seal can be placed on approximately 9 times as many lane miles as those requiring reconstruction.

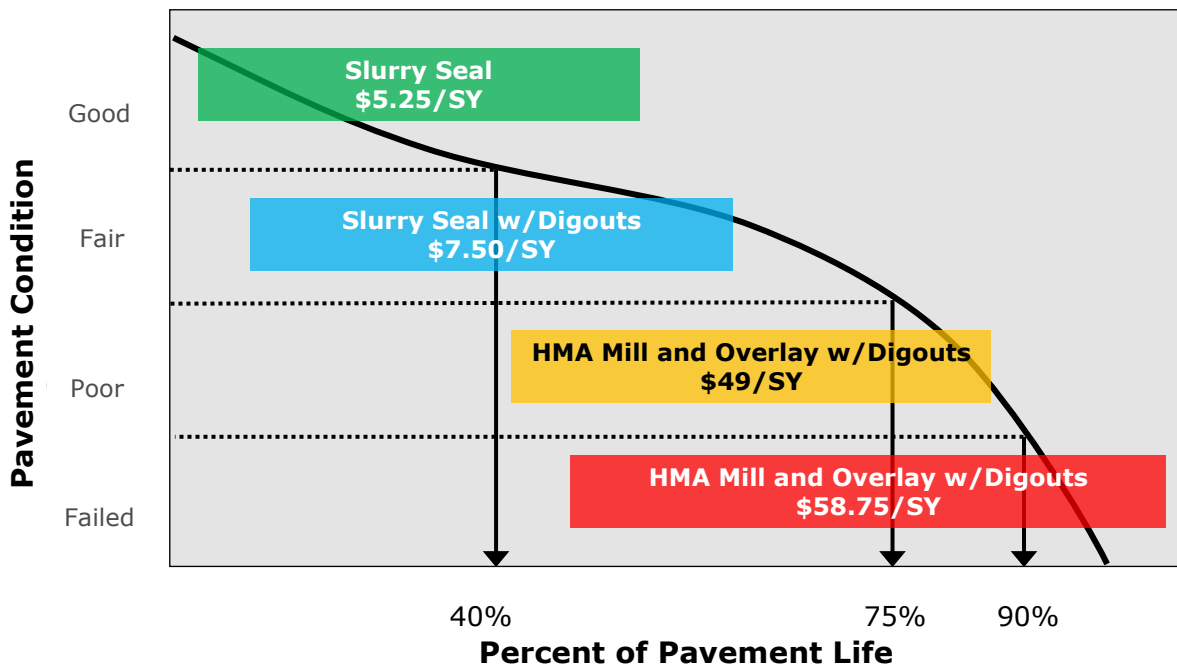


Figure 5. Costs of Maintaining Pavements Over Time

⁵ Note: The StreetSaver® “Maintenance and Rehabilitation Decision Tree” divides the “Fair” condition category to separate pavements with primarily non-load-related distresses (e.g., longitudinal cracking) from those with load-related distresses (e.g., fatigue cracking).

5 Budget Analyses

Based on the principle that it costs less to maintain roads in good condition than it does to repair those that have failed, cost-effective PMPs employ strategies that eliminate the deferred maintenance⁶ and then maintain the network with on-going preventive maintenance. Such strategies bring the network condition to an optimal PCI that can be maintained over time.

The first step in developing such a cost-effective strategy is to determine the total maintenance budget needs of the network.

The budget needs analysis is presented in the following subsections. The detailed results of the budget needs analysis are provided in Appendix C.

⁶ Deferred maintenance is M&R not performed due to insufficient funding.

5.1 BUDGET NEEDS ANALYSIS

The total budget needs for the network represents the cost associated with performing M&R treatments at the optimal time – optimal meaning the PCI is maximized and the cost is minimized – over the analysis period. This was done by performing a budget needs analysis in StreetSaver® with an inflation rate of four percent for an analysis period of ten years.

The results of the budget needs analysis are presented in Table 3. The total budget needs for Karuk Tribe for the next ten years is estimated to be \$7.2 million. Of the total budget needs, approximately \$3.04 million (42.3 percent) is devoted to preventive maintenance, while the rest is allocated for more costly rehabilitation and reconstruction treatments.

Table 3. Summary Results for Budget Needs Analysis

Year	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	Total
Budget Needs (\$M)	1.2	0.1	0.4	3.7	0.2	0.0	0.0	0.7	0.8	0.1	7.2
Treated PCI	77	68	67	80	79	74	72	78	78	73	NA
Untreated PCI	59	56	53	50	46	42	38	34	30	27	NA

If Tribe follows this ideal, cost-effective strategy, the average network PCI will immediately increase as a large amount of deferred maintenance is addressed in the first year, and then stabilize in the high-70s. This type of budget, that addresses all the deferred maintenance in the first year, is known as front-loaded. Alternatively, if no maintenance is performed over the next ten years, the network PCI will drop to 27 by 2032.

6 Conclusion and Recommendations

In summary, the Karuk Tribe has a substantial investment of \$20.3 million in the pavement network. Overall, the Tribe's roads are in "Fair" condition with a 2022 average network PCI of 59. Approximately 41.9 percent of the tribal road network is in "Good" condition and 43.9 percent is in "Poor" condition.

The analyses indicate that the Tribe needs to spend approximately \$7.2 million on maintenance and rehabilitation over the next ten years to optimally repair all pavement sections, thus bringing the network into a condition that can be maintained with on-going preventive maintenance. In the long run, this strategy will save the Tribe money by preventing future pavement deterioration to levels requiring rehabilitation or reconstruction.

Based on the data collected and the scenarios analyzed and presented in this report, NCE offers the following recommendations.

1. **Funding** - The primary goal of PMPs should be to offer users a safe and functional pavement network without unduly increasing the maintenance burden in the future. With that in mind, the recommended scenario for the Karuk Tribe is to allocate enough funding to reduce deferred maintenance and preserve the pavements in good condition. Having a strategy to balance preventive maintenance and rehabilitation will gradually improve the overall network PCI, increase the portion of the network in "Good" condition, decrease the portion of the network in "Poor" and "Failed" condition, and decrease to deferred.

To address the gap between the Tribe's existing funding and the recommended scenario, NCE recommends The Tribe pursue additional funding sources. Potential sources include:

Federal Funding Sources

- Bipartisan Infrastructure Investment and Jobs Act (IIJA)
- Regional Surface Transportation Program (RSTP)
- Surface Transportation Program (STP)
- Congestion Mitigation and Air Quality Improvement Program (CMAQ)
- Community Development Block Grants (CDBG)
- Highway Safety Improvement Program (HSIP)
- Federal Emergency Management Agency (FEMA)

State Funding Sources

- Active Transportation Program (ATP), which now includes the Bicycle Transportation Account (BTA) and Safe Routes to Schools (SR2S)
- State Transportation Improvement Program (STIP)
- AB 2766 (vehicle surcharge)

- Vehicle License Fees (VLF)
- CalRecycle grants
- State Water Resource Control Board
- Transportation Development Act (TDA)
- Traffic Safety Fund
- Transportation Uniform Mitigation Fee (TUMF)

Local/Regional Funding Sources

- Sales tax measures (Measure L)
 - Development impact fees
 - General funds
 - Various assessment districts (lighting, maintenance, flood control, community facilities)
 - Traffic impact fees
 - Utilities (e.g., stormwater, water, wastewater enterprise funds)
 - Parcel/property taxes
 - Vehicle registration fees
 - Vehicle code fines
2. **Pavement Management Strategies** – Since a significant portion of the Tribe’s roads are currently in “Good” condition (41.9 percent), it is important to maintain that condition to the extent possible. Preservation occurs when roads with PCIs higher than 70 receive treatments such as surface seals (slurry, chip, microsurfacing, etc.). Seals are relatively inexpensive treatments that prevent moisture ingress and thus preserve the integrity of the underlying base material. NCE recommends that the Tribe balance preventive maintenance with rehabilitation and reconstruction projects to preserve pavements in “Good” condition, improve pavements in “Poor” condition, and avoid increasing the deferred maintenance.
 3. **Reinspection Strategies** – In order to make appropriate management decisions based on current data, NCE recommends that the Tribe perform condition inspections on arterials and collectors every 2 years and on residential at least every 4 to 5 years. Additionally, since StreetSaver® and other prediction models do not yet take into account the effect of specialized materials such as asphalt-binders with rubber or polymers, the actual performance of tribe pavements may not be fully captured in the analysis models. For this additional reason, NCE recommends regular pavement condition surveys to ensure model accuracy and relevance.
 4. **M&R Decision Tree** – NCE recommends that the Tribe annually review and update the M&R treatment strategies and associated unit costs to reflect current construction techniques and changing costs. This will ensure that the results for the budget analyses are reliable and as accurate as possible.

Appendix A

SECTION DESCRIPTION INVENTORY

Section Description Inventory Report

This report lists a variety of section description information for each of the pavement sections under tribal network. It lists the road and section identifiers, limits, number of lanes, functional class, surface type, length, width, area, Inspected PCI, and PCI date.

All of the pavement sections are included in the report. Two versions of the report are provided. The first is sorted alphabetically by Road Name and Section ID and the second report is sorted by descending PCI. The field descriptions in this report are listed below:

COLUMN	DESCRIPTION
Street ID	Street Identification - A code up to ten characters/digits to identify the street. Generally, the street name is truncated to six characters. The Street ID should be unique for each street.
Section ID	Section Identification - A code up to ten characters/digits to identify the section number. The Section ID must be unique for each section of one street.
Street Name	Street Name - The name of the street as indicated by street signs in the field.
Begin Location	Beginning limit of the section.
End Location	Ending limit of the section.
# of Lanes	Number of travel lanes.
Functional Class (FC)	Functional Classification: L (Local), MaC/MiC (Major/Minor Collector), MiA/OPA (Minor/Other Principle Arterial), NCR (Non-County Road), RL/RMaC/RMiC/RMiA (Rural Local/Major Col/Minor Col/Minor Arterial)
Length (ft)	Length of the section in feet.
Width (ft)	Average width of the section in feet.
Area (sf)	Area of section in square feet.
Surface Type (ST)	Surface Type: A = Asphalt Concrete, G = Gravel, S = Surface Treated
PCI Date	The last inspection date or rehabilitation date.
PCI	Average PCI for the section. The value is based on the last inspection.

Section Description Inventory – Sorted by Road Name

Karuk Tribe - 2022 PMP Update
Section Description Inventory
Sorted by Road Name

Street ID	Section ID	Road Name	Begin Location	End Location	No. of Lanes	Functional Class	Surface Type	Length (ft)	Width (ft)	Area (sf)	County's IRR List	PCI Date	PCI
K-ASIRD	010	ASIP ROAD	KLAMATH RIVER HWY	HWY NORTH END	2	Residential/Local	AC	587	31	18,197	NO	11/22/2022	84
K-AXACT	010	AXAK COURT	BIG ROCK ROAD	EAST END	2	Residential/Local	AC	260	33	8,580	NO	11/22/2022	83
BASHRD	010	BARK SHANTY ROAD	ISHI PISHI RD	MM 0.86	2	Residential/Local	ST	4,540	12	54,480	YES	6/19/2022	51
K-BIGRRD	010	BIG ROCK ROAD	HWY 96	WEST END OF ROAD	2	Collector	AC	1,134	32	36,288	NO	11/22/2022	82
CACRRD	010	CAMP CREEK ROAD	SH096	END	2	Residential/Local	ST	1,267	17	21,539	YES	6/18/2022	67
K-CECRD	010	CEDAR CAMP ROAD	HWY 96	WEST END	1	Residential/Local	GRAVEL	19,008	12	228,096	NO	-	-
DREDRD	010	DREDGE ROAD	SH096	END	2	Residential/Local	ST	2,010	11	22,110	YES	6/19/2022	68
EPCRRD	010	EAST PEARCH CREEK ROAD	SH096	END	2	Residential/Local	ST	898	20	17,960	YES	6/18/2022	45
K-FORRD	010	FOREST ROAD 15 (EYEESEE RD)	HWY 96	NATUCKET ROAD	2	Collector	AC	11,088	24	266,112	NO	11/22/2022	73
ISPIRD	070B	ISHI PISHI ROAD	MM 6.20	MM 6.60	2	Rural Minor Collector	AC	2,112	14	29,568	YES	5/13/2022	64
ISPIRD	070C	ISHI PISHI ROAD	MM 6.60	END/ MM 7.53	2	Rural Minor Collector	ST	4,913	14	68,782	YES	5/13/2022	62
ISPIRD	070A	ISHI PISHI ROAD	MM 5.59	MM 6.20	2	Rural Minor Collector	ST	3,220	14	45,080	YES	5/13/2022	56
ISPIRD	020	ISHI PISHI ROAD	MM 0.29	MM 0.35	2	Rural Minor Collector	ST	317	11	3,487	YES	5/13/2022	51
ISPIRD	060	ISHI PISHI ROAD	MM 3.59	MM 5.59	2	Rural Minor Collector	ST	10,560	14	147,840	YES	5/13/2022	51
ISPIRD	050	ISHI PISHI ROAD	MM 1.59	MM 3.59	2	Rural Minor Collector	ST	10,560	14	147,840	YES	5/13/2022	47
ISPIRD	040	ISHI PISHI ROAD	MM 1.05	MM 1.59	2	Rural Minor Collector	ST	2,851	10	28,510	YES	5/13/2022	44
ISPIRD	030	ISHI PISHI ROAD	MM 0.35	MM 1.05	2	Rural Minor Collector	ST	3,696	17	62,832	YES	5/13/2022	40
ISPIRD	010	ISHI PISHI ROAD	SH096	MM 0.29	2	Rural Minor Collector	ST	1,531	23	35,213	YES	5/13/2022	38
K-KUYCT	010	KUYRAAK COURT	BIG ROCK ROAD	EAST END	2	Residential/Local	AC	250	33	8,250	NO	11/22/2022	85
K-LOCCRD	010	LOWER CAMP CREEK ROAD	HWY 96	NW END OF ROAD	1	Residential/Local	AC	1,056	12	12,672	NO	11/22/2022	50
K-LOTRD	010	LOWER TISHAWNIK ROAD	HWY 96	RIVER	1	Residential/Local	AC	1,032	10	10,320	NO	11/22/2022	86
K-OOSRD	010	OLD ORLEANS SCHOOL ROAD	RED CAP ROAD	EAST END	1	Residential/Local	ST	1,203	12	14,436	NO	11/22/2022	26
K-ELDLRD	010	PANAMNIK EDER'S LOOP ROAD (TOISHIIP) ELDER LOOP RD	BIG ROCK ROAD	BIG ROCK ROAD	2	Collector	AC	1,167	28	32,676	NO	11/22/2022	85
PLACDR	010	PLACER DRIVE	CAMP CR RD	END	2	Residential/Local	ST	1,141	17	19,397	YES	6/24/2022	77
RECARD	040	RED CAP ROAD	MM 2.43	MM 2.48	2	Residential/Local	ST	264	16	4,224	YES	6/16/2022	91
RECARD	010	RED CAP ROAD	SH096	MM 1.59	2	Residential/Local	ST	8,395	24	201,480	YES	6/16/2022	90
RECARD	060	RED CAP ROAD	MM 2.53	MM 2.73	2	Residential/Local	ST	1,056	16	16,896	YES	6/16/2022	85
RECARD	020	RED CAP ROAD	MM 1.59	MM 2.38	2	Residential/Local	ST	4,171	16	66,736	YES	6/16/2022	80
RECARD	070B	RED CAP ROAD	MM 4.23	MM 5.03 (NF)	2	Residential/Local	ST	4,224	12	50,688	YES	6/16/2022	80
RECARD	070A	RED CAP ROAD	MM 2.73	MM 4.23	2	Residential/Local	ST	7,920	12	95,040	YES	6/16/2022	62
RECARD	090	RED CAP ROAD	MM 5.03 (NF)	REDCAP CR RD	2	Residential/Local	ST	8,975	10	89,750	YES	6/25/2022	48
K-SHILN	010	SHIVSHANEEN LANE	RED CAP ROAD	SKUNK HOLLOW LN	1	Residential/Local	GRAVEL	600	12	7,200	NO	-	-
K-SHIWY	010	SHIVSHANEEN WAY	RED CAP ROAD	WEST END OF ROAD	1	Residential/Local	GRAVEL	600	15	9,000	NO	-	-
K-SLCRD	010	SLATE CREEK ROAD	HWY 96	WEST END	2	Collector	AC	10,560	20	211,200	NO	11/30/2022	39
K-UPSRD	010	UPPER SIMMS ROAD	EYEESEE ROAD	FOREST RD EAST END OF RD	2	Collector	AC	3,696	24	88,704	NO	11/22/2022	73
K-UPTRD	010	UPPER TISHAWNIK ROAD	HWY 96	NORTH END OF ROAD	1	Residential/Local	GRAVEL	528	12	6,336	NO	-	-
K-WPCRD	010	WEST PEARCH CREEK ROAD RED CAP ROAD (GOOGLE MAP)	HWY 96	END OF CALTRANS MAINTANCE STATION	2	Collector	ST	2,005	24	48,120	NO	11/22/2022	36
K-YITCT	010	YITHA COURT	BIG ROCK ROAD	EAST END	2	Residential/Local	AC	125	33	4,125	NO	11/22/2022	85

Section Description Inventory – Sorted by Descending PCI

Karuk Tribe - 2022 PMP Update
Section Description Inventory
Sorted by Descending PCI

Street ID	Section ID	Road Name	Begin Location	End Location	No. of Lanes	Functional Class	Surface Type	Length (ft)	Width (ft)	Area (sf)	County's IRR List	PCI Date	PCI
RECARD	040	RED CAP ROAD	MM 2.43	MM 2.48	2	Residential/Local	ST	264	16	4,224	YES	6/16/2022	91
RECARD	010	RED CAP ROAD	SH096	MM 1.59	2	Residential/Local	ST	8,395	24	201,480	YES	6/16/2022	90
K-LOTRD	010	LOWER TISHAWNIK ROAD	HWY 96	RIVER	1	Residential/Local	AC	1,032	10	10,320	NO	11/22/2022	86
K-KUYCT	010	KUYRAAK COURT	BIG ROCK ROAD	EAST END	2	Residential/Local	AC	250	33	8,250	NO	11/22/2022	85
K-ELDLRD	010	PANAMNIK EDER'S LOOP ROAD (TOISHIIP) ELDER LOOP RD	BIG ROCK ROAD	BIG ROCK ROAD	2	Collector	AC	1,167	28	32,676	NO	11/22/2022	85
RECARD	060	RED CAP ROAD	MM 2.53	MM 2.73	2	Residential/Local	ST	1,056	16	16,896	YES	6/16/2022	85
K-YITCT	010	YITHA COURT	BIG ROCK ROAD	EAST END	2	Residential/Local	AC	125	33	4,125	NO	11/22/2022	85
K-ASIRD	010	ASIP ROAD	KLAMATH RIVER HWY	HWY NORTH END	2	Residential/Local	AC	587	31	18,197	NO	11/22/2022	84
K-AXACT	010	AXAK COURT	BIG ROCK ROAD	EAST END	2	Residential/Local	AC	260	33	8,580	NO	11/22/2022	83
K-BIGRRD	010	BIG ROCK ROAD	HWY 96	WEST END OF ROAD	2	Collector	AC	1,134	32	36,288	NO	11/22/2022	82
RECARD	020	RED CAP ROAD	MM 1.59	MM 2.38	2	Residential/Local	ST	4,171	16	66,736	YES	6/16/2022	80
RECARD	070B	RED CAP ROAD	MM 4.23	MM 5.03 (NF)	2	Residential/Local	ST	4,224	12	50,688	YES	6/16/2022	80
PLACDR	010	PLACER DRIVE	CAMP CR RD	END	2	Residential/Local	ST	1,141	17	19,397	YES	6/24/2022	77
K-FORRD	010	FOREST ROAD 15 (EYEESEE RD)	HWY 96	NATUCKET ROAD	2	Collector	AC	11,088	24	266,112	NO	11/22/2022	73
K-UPSRD	010	UPPER SIMMS ROAD	EYEESEE ROAD	FOREST RD EAST END OF RD	2	Collector	AC	3,696	24	88,704	NO	11/22/2022	73
DREDRD	010	DREDGE ROAD	SH096	END	2	Residential/Local	ST	2,010	11	22,110	YES	6/19/2022	68
CACRRD	010	CAMP CREEK ROAD	SH096	END	2	Residential/Local	ST	1,267	17	21,539	YES	6/18/2022	67
ISPIRD	070B	ISHI PISHI ROAD	MM 6.20	MM 6.60	2	Rural Minor Collector	AC	2,112	14	29,568	YES	5/13/2022	64
ISPIRD	070C	ISHI PISHI ROAD	MM 6.60	END/ MM 7.53	2	Rural Minor Collector	ST	4,913	14	68,782	YES	5/13/2022	62
RECARD	070A	RED CAP ROAD	MM 2.73	MM 4.23	2	Residential/Local	ST	7,920	12	95,040	YES	6/16/2022	62
ISPIRD	070A	ISHI PISHI ROAD	MM 5.59	MM 6.20	2	Rural Minor Collector	ST	3,220	14	45,080	YES	5/13/2022	56
BASHRD	010	BARK SHANTY ROAD	ISHI PISHI RD	MM 0.86	2	Residential/Local	ST	4,540	12	54,480	YES	6/19/2022	51
ISPIRD	020	ISHI PISHI ROAD	MM 0.29	MM 0.35	2	Rural Minor Collector	ST	317	11	3,487	YES	5/13/2022	51
ISPIRD	060	ISHI PISHI ROAD	MM 3.59	MM 5.59	2	Rural Minor Collector	ST	10,560	14	147,840	YES	5/13/2022	51
K-LOCCRD	010	LOWER CAMP CREEK ROAD	HWY 96	NW END OF ROAD	1	Residential/Local	AC	1,056	12	12,672	NO	11/22/2022	50
RECARD	090	RED CAP ROAD	MM 5.03 (NF)	REDCAP CR RD	2	Residential/Local	ST	8,975	10	89,750	YES	6/25/2022	48
ISPIRD	050	ISHI PISHI ROAD	MM 1.59	MM 3.59	2	Rural Minor Collector	ST	10,560	14	147,840	YES	5/13/2022	47
EPCRRD	010	EAST PEARCH CREEK ROAD	SH096	END	2	Residential/Local	ST	898	20	17,960	YES	6/18/2022	45
ISPIRD	040	ISHI PISHI ROAD	MM 1.05	MM 1.59	2	Rural Minor Collector	ST	2,851	10	28,510	YES	5/13/2022	44
ISPIRD	030	ISHI PISHI ROAD	MM 0.35	MM 1.05	2	Rural Minor Collector	ST	3,696	17	62,832	YES	5/13/2022	40
K-SLCRD	010	SLATE CREEK ROAD	HWY 96	WEST END	2	Collector	AC	10,560	20	211,200	NO	11/30/2022	39
ISPIRD	010	ISHI PISHI ROAD	SH096	MM 0.29	2	Rural Minor Collector	ST	1,531	23	35,213	YES	5/13/2022	38
K-WPCRD	010	WEST PEARCH CREEK ROAD RED CAP ROAD (GOOGLE MAP)	HWY 96	END OF CALTRANS MAINTANCE STATION	2	Collector	ST	2,005	24	48,120	NO	11/22/2022	36
K-OOSRD	010	OLD ORLEANS SCHOOL ROAD	RED CAP ROAD	EAST END	1	Residential/Local	ST	1,203	12	14,436	NO	11/22/2022	26
K-CECRD	010	CEDAR CAMP ROAD	HWY 96	WEST END	1	Residential/Local	GRAVEL	19,008	12	228,096	NO	-	-
K-SHILN	010	SHIVSHANEEN LANE	RED CAP ROAD	SKUNK HOLLOW LN	1	Residential/Local	GRAVEL	600	12	7,200	NO	-	-
K-SHIWY	010	SHIVSHANEEN WAY	RED CAP ROAD	WEST END OF ROAD	1	Residential/Local	GRAVEL	600	15	9,000	NO	-	-
K-UPTRD	010	UPPER TISHAWNIK ROAD	HWY 96	NORTH END OF ROAD	1	Residential/Local	GRAVEL	528	12	6,336	NO	-	-

Appendix B

MAINTENANCE AND REHABILITATION DECISION TREE

Maintenance and Rehabilitation (M&R) Decision Tree

This report presents the current maintenance and rehabilitation decision tree that exists in the database. The decision tree forms the basis for all of the budgetary computations included in this report. ***Changes to the decision tree will make the results in the budget reports invalid.*** All pavement treatment unit costs relevant to the road types in the database were updated.

The decision tree lists the treatments and costs selected for preventive maintenance and rehabilitation activities. Each line represents a specific combination of functional classification and surface type.

The preventive maintenance portion of the report is identified as Condition Category I – Very Good. All preventive maintenance treatment listings are assigned only to sections in Condition Category I where the $PCI \geq 70$. Sections with PCI values less than 70 are assigned to treatments listed in Categories II through V.

In the preventive maintenance category ($PCI \geq 70$), a time sequence is used to identify the appropriate treatment and cost. Each preventive maintenance treatment description consists of three parts: 1) a CRACK treatment, 2) a SURFACE treatment, and 3) a RESTORATION treatment. These three parts allow the user to specify one of three different preventive maintenance treatments depending on the prior maintenance history of the section.

1. The CRACK treatment part can be used to specify the most frequent type of preventive maintenance activity planned (typically crack seals).
2. The SURFACE treatment part can be used to specify more extensive and less frequent preventive maintenance activities, such as chip seals or slurry seals. For example, a crack seal can be specified on a 3-year cycle with a slurry seal specified after 5 years.
3. The RESTORATION part can be used to specify a surface restoration treatment (such as an overlay) to be performed after a specified number of surface treatments. For example, after a certain number of successive slurry seals, an overlay can be specified instead of another slurry seal.

Rehabilitation treatments are assigned to sections in Condition Categories II through V (PCI less than 70). Each line is defined by a specific combination of functional classification, surface type, and condition category.

COLUMN	DESCRIPTION
Functional Class	Functional Classification identifying the branch
Surface	Surface Type identifying the branch number.
Condition Category	Condition Category (I through V).
Treatment Type	First Row (Crack Treatment) indicates localized treatment (e.g. crack sealing). Second Row (Surface Treatment) indicates surface treatment (e.g. slurry sealing). Third Row (Restoration Treatment) indicates surface restoration (e.g. overlay).
Treatment	Name of treatments from the "Treatment Descriptions" report.
Yrs. Between Crack Seals	First Row - number of years between successive treatment applications specified in the first row (i.e. CRACK treatment).



COLUMN	DESCRIPTION
Yrs. Between Surface Seals	Second Row - number of years between successive treatment applications specified in the second row (i.e. SURFACE treatment).
Number of Sequential Seals	Number of times that the treatment application in the second row (i.e. SURFACE treatment) will be performed prior to performing the treatment application in the third row.

Note that the treatments assigned to each section should not be blindly followed in preparing a road maintenance program. Engineering judgment and project level analysis should be applied to ensure that the treatment is appropriate and cost effective for the section.



Decision Tree

Printed: 1/24/2023



Functional Class	Surface	Condition Category	Treatment Type	Treatment	Cost/Sq Yd, except Seal Cracks in LF:	Yrs Between Crack Seals	Yrs Between Surface Seals	# of Surface Seals before Overlay
Arterial	AC	I - Very Good	Crack Treatment	SEAL CRACKS	\$2.50	3		
			Surface Treatment	SLURRY SEAL	\$5.50		6	
			Restoration Treatment	DO NOTHING	\$0.00			99
		II - Good, Non-Load Related		SLURRY SEAL W/DIGOUTS	\$9.88		6	
		III - Good, Load Related		CHIP SEAL W/DIGOUTS	\$12.75		6	
		IV - Poor		2.5" MILL AND OVERLAY W/DIGOUTS	\$79.50			
		V - Very Poor		2.5" MILL AND OVERLAY W/DIGOUTS	\$86.75			
	AC/AC	I - Very Good	Crack Treatment	SEAL CRACKS	\$2.50	7		
			Surface Treatment	SLURRY SEAL	\$5.50		6	
			Restoration Treatment	DO NOTHING	\$0.00			99
		II - Good, Non-Load Related		SLURRY SEAL W/DIGOUTS	\$9.88		6	
		III - Good, Load Related		CHIP SEAL W/DIGOUTS	\$12.75		6	
		IV - Poor		2.5" MILL AND OVERLAY W/DIGOUTS	\$79.50			
		V - Very Poor		2.5" MILL AND OVERLAY W/DIGOUTS	\$86.75			
	AC/PCC	I - Very Good	Crack Treatment	SEAL CRACKS	\$0.60	3		
			Surface Treatment	SINGLE CHIP SEAL	\$0.74		6	
			Restoration Treatment	MILL AND THICK OVERLAY	\$7.23			2
		II - Good, Non-Load Related		DOUBLE CHIP SEAL	\$1.52			
		III - Good, Load Related		HEATER SCARIFY & OVERLAY	\$5.95			
		IV - Poor		HEATER SCARIFY & OVERLAY	\$6.14			
		V - Very Poor		RECONSTRUCT SURFACE (AC)	\$14.00			
	PCC	I - Very Good	Crack Treatment	DO NOTHING	\$0.00	3		
			Surface Treatment	DO NOTHING	\$0.00		15	
			Restoration Treatment	DO NOTHING	\$0.00			99
		II - Good, Non-Load Related		DO NOTHING	\$1.11			
		III - Good, Load Related		DO NOTHING	\$1.51			
		IV - Poor		THICK AC OVERLAY(2.5 INCHES)	\$1.92			
		V - Very Poor		RECONSTRUCT STRUCTURE (AC)	\$14.00			

 Functional Class and Surface combination not used
 Selected Treatment is not a Surface Seal



Collector	AC	I - Very Good	Crack Treatment	SEAL CRACKS	\$2.50	4					
			Surface Treatment	SLURRY SEAL	\$5.50		7				
			Restoration Treatment	DO NOTHING	\$0.00			99			
			II - Good, Non-Load Related	SLURRY SEAL W/DIGOUTS	\$8.63		7				
			III - Good, Load Related	CHIP SEAL W/DIGOUTS	\$10.75		7				
		IV - Poor		2.5" MILL AND OVERLAY W/DIGOUTS	\$77.25						
			V - Very Poor		2.5" MILL AND OVERLAY W/DIGOUTS	\$82.25					
				AC/AC	I - Very Good	Crack Treatment	SEAL CRACKS	\$2.50	4		
						Surface Treatment	SLURRY SEAL	\$5.50		7	
						Restoration Treatment	DO NOTHING	\$0.00			99
II - Good, Non-Load Related	SLURRY SEAL W/DIGOUTS	\$8.63					7				
III - Good, Load Related	CHIP SEAL W/DIGOUTS	\$10.75				7					
		IV - Poor		2.5" MILL AND OVERLAY W/DIGOUTS	\$77.25						
			V - Very Poor		2.5" MILL AND OVERLAY W/DIGOUTS	\$82.25					
				AC/PCC	I - Very Good	Crack Treatment	SEAL CRACKS	\$2.50	4		
						Surface Treatment	SLURRY SEAL	\$5.50		7	
						Restoration Treatment	DO NOTHING	\$0.00			99
II - Good, Non-Load Related	SLURRY SEAL W/DIGOUTS	\$8.63					7				
III - Good, Load Related	CHIP SEAL W/DIGOUTS	\$10.75				7					
		IV - Poor		2.5" MILL AND OVERLAY W/DIGOUTS	\$77.25						
			V - Very Poor		2.5" MILL AND OVERLAY W/DIGOUTS	\$82.25					
				PCC	I - Very Good	Crack Treatment	DO NOTHING	\$0.00	9		
						Surface Treatment	DO NOTHING	\$0.00		15	
						Restoration Treatment	DO NOTHING	\$0.00			99
II - Good, Non-Load Related	DO NOTHING	\$1.11									
III - Good, Load Related	DO NOTHING	\$1.51									
		IV - Poor		THICK AC OVERLAY(2.5 INCHES)	\$1.92						
			V - Very Poor		THIN AC OVERLAY(1.5 INCHES)	\$7.47					

 Functional Class and Surface combination not used
 Selected Treatment is not a Surface Seal



Collector	ST	I - Very Good	Crack Treatment	DO NOTHING	\$0.00	9	
			Surface Treatment	DO NOTHING	\$0.00		15
			Restoration Treatment	DO NOTHING	\$0.00		99
		II - Good, Non-Load Related		SINGLE CHIP SEAL	\$6.50		7
		III - Good, Load Related		CHIP SEAL W/DIGOUTS	\$10.75		7
		IV - Poor		CHIP SEAL W/DIGOUTS	\$10.75		7
		V - Very Poor		3" REMOVE AND REPLACE W/HMA	\$80.25		

-  Functional Class and Surface combination not used
-  Selected Treatment is not a Surface Seal

Residential/Local	AC	I - Very Good	Crack Treatment	SEAL CRACKS	\$2.50	4		
			Surface Treatment	SLURRY SEAL	\$5.25		8	
			Restoration Treatment	DO NOTHING	\$0.00			99
		II - Good, Non-Load Related		SLURRY SEAL W/DIGOUTS	\$7.50		8	
		III - Good, Load Related		SLURRY SEAL W/DIGOUTS	\$8.75		8	
		IV - Poor		1.5" MILL AND OVERLAY W/DIGOUTS	\$49.00			
	V - Very Poor		2" MILL AND OVERLAY W/DIGOUTS	\$58.75				
	AC/AC	I - Very Good	Crack Treatment	SEAL CRACKS	\$2.50	4		
			Surface Treatment	SLURRY SEAL	\$5.25		8	
			Restoration Treatment	DO NOTHING	\$0.00			99
		II - Good, Non-Load Related		SLURRY SEAL W/DIGOUTS	\$7.50		8	
		III - Good, Load Related		SLURRY SEAL W/DIGOUTS	\$8.75		8	
		IV - Poor		1.5" MILL AND OVERLAY W/DIGOUTS	\$49.00			
	V - Very Poor		2" MILL AND OVERLAY W/DIGOUTS	\$58.75				
	AC/PCC	I - Very Good	Crack Treatment	SEAL CRACKS	\$2.50	4		
			Surface Treatment	SLURRY SEAL	\$5.25		8	
			Restoration Treatment	DO NOTHING	\$0.00			99
		II - Good, Non-Load Related		SLURRY SEAL W/DIGOUTS	\$7.50		8	
		III - Good, Load Related		SLURRY SEAL W/DIGOUTS	\$8.75		8	
		IV - Poor		1.5" MILL AND OVERLAY W/DIGOUTS	\$49.00			
	V - Very Poor		2" MILL AND OVERLAY W/DIGOUTS	\$58.75				
	PCC	I - Very Good	Crack Treatment	DO NOTHING	\$0.00	4		
			Surface Treatment	DO NOTHING	\$0.00		15	
			Restoration Treatment	DO NOTHING	\$0.00			99
		II - Good, Non-Load Related		DO NOTHING	\$1.11			
		III - Good, Load Related		DO NOTHING	\$0.00			
		IV - Poor		THICK AC OVERLAY(2.5 INCHES)	\$1.92			
	V - Very Poor		THICK AC OVERLAY(2.5 INCHES)	\$7.27				

 Functional Class and Surface combination not used
 Selected Treatment is not a Surface Seal

Residential/Local	ST	I - Very Good	Crack Treatment	DO NOTHING	\$0.00	9	
			Surface Treatment	DO NOTHING	\$0.00		15
			Restoration Treatment	DO NOTHING	\$0.00		99
		II - Good, Non-Load Related		SLURRY SEAL	\$5.25		8
		III - Good, Load Related		SLURRY SEAL W/DIGOUTS	\$8.75		8
		IV - Poor		CHIP SEAL W/DIGOUTS	\$26.25		8
		V - Very Poor		2.5" REMOVE AND REPLACE W/HMA	\$60.00		

-  Functional Class and Surface combination not used
-  Selected Treatment is not a Surface Seal

Appendix C

BUDGET NEED ANALYSIS RESULTS

Budget Needs Reports

The purpose of this section is to answer the question: *If the Tribe/Rancheria had all the money in the world, what sections should be fixed and how much will it cost?* Based on the Maintenance & Rehabilitation (M&R) decision tree and the PCIs of the sections, the program will then select a maintenance or rehabilitation action and compute the total costs over the analysis period. The Budget Needs represents the "ideal world" funding levels, while the Budget Scenario reports in the next section represent the most "cost effective" prioritization possible for the actual funding levels.

A budget needs analysis has been performed. The summary results from the analysis are provided. An interest rate of 4% and an inflation factor of 4% were used to project the costs for the analysis period. This report shows the total ten-year budget that would be required to meet the Tribe/Rancherias' standards as exemplified in the M&R decision tree.

Budget Needs reports included in this appendix are listed below:

- Projected PCI/Cost Summary
- Preventive Maintenance Treatment/Cost Summary
- Rehabilitation Treatment/Cost Summary

Needs - Projected PCI/Cost Summary

This report summarizes and projects the network PCI over the ten-year analysis period, both with and without treatments applied. It also reports the associated costs, which are based on the treatment unit costs presented in the M&R decision tree.

COLUMN	DESCRIPTION
Year	Year in the analysis period.
PCI Treated	Projected network average PCI with all needed treatments applied.
PCI Untreated	Projected network average PCI without any treatments applied.
PM Cost	Total preventive maintenance treatment cost.
Rehab Cost	Total rehabilitation treatment cost.
Cost	The budget required for each year in the analysis period to meet the Tribe/Rancherias' standard as shown on the M&R decision tree.
Total Cost	Total budget required over a ten-year period.

Needs - Projected PCI/Cost Summary

Interest: 4.00%

Inflation: 4.00%

Printed: 1/24/2023

Year	PCI Treated	PCI Untreated	PM Cost	Rehab Cost	Cost
2023	77	59	\$71,003	\$1,131,814	\$1,202,817
2024	68	56	\$0	\$100,090	\$100,090
2025	67	53	\$0	\$448,831	\$448,831
2026	80	50	\$0	\$3,726,956	\$3,726,956
2027	79	46	\$925	\$151,906	\$152,831
2028	74	42	\$87	\$0	\$87
2029	72	38	\$0	\$0	\$0
2030	78	34	\$57,331	\$623,157	\$680,488
2031	78	30	\$49,612	\$747,667	\$797,279
2032	73	27	\$11,986	\$76,639	\$88,625
		% PM	PM Total Cost	Rehab Total Cost	Total Cost
		2.65%	\$190,943	\$7,007,060	\$7,198,003

Needs - Preventive Maintenance Treatment/Cost Summary

This report summarizes each preventive maintenance treatment type, quantity of pavement affected, and total costs over the analysis period. It also summarizes the total quantities and costs over the next ten years.

COLUMN	DESCRIPTION
Treatment	Type of preventive maintenance treatments needed.
Year	Year in the analysis period (i.e. 2022, 2023, 2024, etc.).
Area Treated	Quantities in linear feet (Seal Cracks) or square yard (Slurry Seal).
Cost	Maintenance treatment cost.

Needs - Preventive Maintenance Treatment/Cost Summary

Interest: 4.00%

Inflation: 4.00%

Printed:
1/24/2023

Treatment	Year	Area Treated	Cost
SEAL CRACKS	2027	316.14 sq. yd.	\$925
	2028	28.59 sq. yd.	\$87
	2030	568.86 sq. yd.	\$1,871
	Total	913.58	\$2,883
SLURRY SEAL	2023	13,159.56 sq. yd.	\$71,003
	2030	7,662.67 sq. yd.	\$55,460
	2031	6,904.89 sq. yd.	\$49,612
	2032	1,604 sq. yd.	\$11,986
	Total	29,331.11	\$188,060
Total Quantity		30,244.69	\$190,943

Needs - Rehabilitation Treatment/Cost Summary

This report summarizes each rehabilitation treatment type, quantity of pavement affected, and total costs over the analysis period. It also summarizes the total quantities and costs over the next ten years.

COLUMN	DESCRIPTION
Treatment	Type of rehabilitation treatments needed.
Year	Year in the analysis period (i.e. 2022, 2023, 2024, etc.).
Area Treated	Quantities in square yard.
Cost	Rehabilitation treatment cost.

Needs - Rehabilitation Treatment/Cost Summary

Interest: 4.00%

Inflation: 4.00%

Printed: 1/24/2023

Treatment	Year	Area Treated	Cost
1.5" MILL AND OVERLAY W/DIGOUTS	2023	1,408 sq.yd.	\$68,992
	Total	1,408 sq.yd.	\$68,992
2.5" MILL AND OVERLAY W/DIGOUTS	2026	23,466.67 sq.yd.	\$2,171,138
	2031	3,285.33 sq.yd.	\$347,332
	Total	26,752 sq.yd.	\$2,518,469
2.5" REMOVE AND REPLACE W/HMA	2024	1,604 sq.yd.	\$100,090
	Total	1,604 sq.yd.	\$100,090
3" REMOVE AND REPLACE W/HMA	2026	16,240.56 sq.yd.	\$1,466,040
	Total	16,240.56 sq.yd.	\$1,466,040
CHIP SEAL W/DIGOUTS	2023	65,357.44 sq.yd.	\$981,920
	2025	14,864.89 sq.yd.	\$172,837
	2030	44,051 sq.yd.	\$623,157
	2032	5,008.89 sq.yd.	\$76,639
	Total	129,282.22 sq.yd.	\$1,854,553
SLURRY SEAL W/DIGOUTS	2025	29,568 sq.yd.	\$275,994
	2031	33,431 sq.yd.	\$400,336
	Total	62,999 sq.yd.	\$676,329
SLURRY SEAL	2023	15,409.89 sq.yd.	\$80,902
	2026	15,202.33 sq.yd.	\$89,778
	2027	24,733.33 sq.yd.	\$151,906
	Total	55,345.56 sq.yd.	\$322,586
Total Cost			\$7,007,060