TRUCKEE TAHOE AIRPORT
Pavement Evaluation Study
Pavement Maintenance/Management Plan (PMMP)

PREPARED FOR
TRUCKEE TAHOE AIRPORT DISTRICT

PREPARED BY

BRANDLEY ENGINEERING

JULY 2021

TRUCKEE TAHOE AIRPORT
PAVEMENT EVALUATION STUDY
PAVEMENT MAINTENANCE / MANAGEMENT PLAN (PMMP)

Prepared for
Truckee Tahoe Airport District, Truckee, California

Prepared by:
Brandley Engineering, Inc.

July 2021

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PAVEMENT MAINTENANCE/MANAGEMENT PLAN

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CHAPTER 1. INTRODUCTION

1-1 History

The Truckee Tahoe Airport was originally constructed in the early 1960s and consisted of approximately 5,500 feet of Runway 11-29, associated taxiways, aprons, and hangar development. In the mid-1960s Runway 2-20 was constructed from Runway 11-29 to the north end. In the early 1970s extensions were constructed to both runways. Aprons, hangars, and other building facilities were constructed as needed beginning in the early 1960s.

Many of the pavements at this airport are 15-30 years old and have been subjected to significant traffic. Several pavements have been reconstructed in the past 10 years due to the recommended rehabilitation and maintenance schedules developed in the 2011 Pavement Maintenance Management Plan. In recent times the airport has been used extensively by larger propeller-driven aircraft and the business jet aircraft. All pavements at the airport are flexible pavements, of which the surface consists of a bituminous surface course. These pavements have been subjected to significant traffic and severe environmental conditions including large daily temperature changes, fairly hot weather in the summer and cold in the winter, snow, and rain. Significant surface distress is evident in the form of thermal cracking, weathering, and some raveling. There has been little evidence of deep-seated distress. In an effort to control cracking developing from thermal stresses, a joint pattern has been installed in many of the pavements on the airport and all asphaltic pavements newly constructed or reconstructed since 2012 used polymer modified asphalt without a joint pattern.

1-2 Airport Layout

The Truckee Tahoe Airport consists of two perpendicular runways with associated taxiways, aircraft parking aprons, and aircraft hangar developments. There is terminal and administration building, tee hangars, executive box hangars, an emergency medical service helicopter apron, and an aircraft wash rack on the airport. An Airport Layout and Pavement Segment Identification Plan is included as Plate No. 1-1. This plan shows the existing facilities at the airport.

1-3 Need for Study

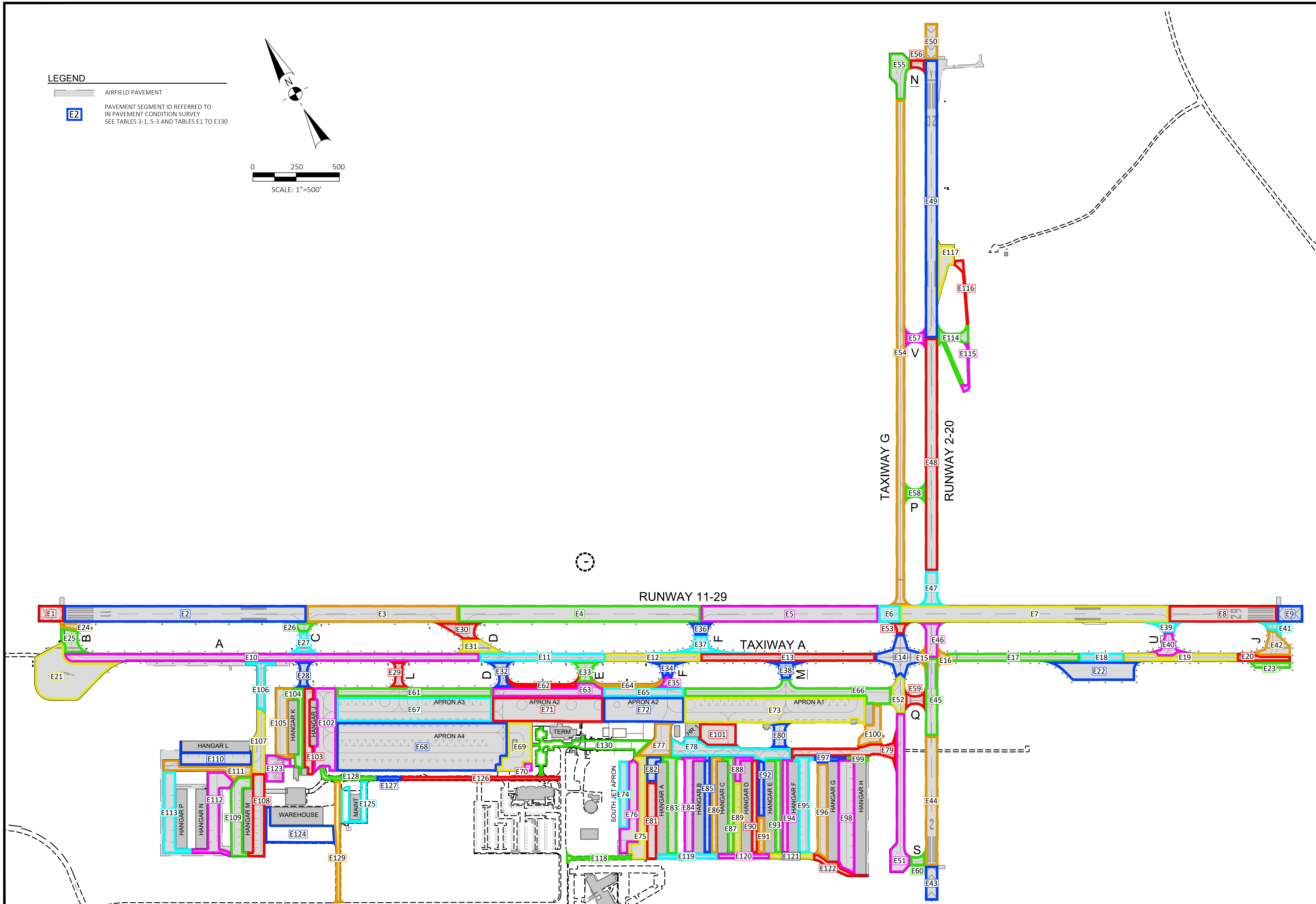
It is necessary to establish a Pavement Maintenance Management Plan (PMMP) that will identify and schedule reconstruction and maintenance of facilities within the necessary timeframe and provide adequate and timely maintenance or rehabilitation of all pavements so as to allow safe operation of all aircraft. The PMMP must take into consideration available funding each year.

There are two major distress types that develop at an airport. One is deep-seated distress and the second is surface distress. Deep-seated distress is caused by repetitive loading and development of stresses in the subgrade materials and subsoils that lead to a fatigue-type failure of these materials. When these materials fail, there is a corresponding complete failure of the materials in the pavement section and it becomes necessary to completely reconstruct these failed sections. These type failures show up as rutting and severe alligator cracking in the surface of the pavement.

Surface distress is not only caused by the deep-seated failures, but also by age, traffic, and environmental conditions. The older pavements shrink and become brittle, which leads to surface cracking, raveling, and spalling. Environmental factors such as large temperature changes each day, freezing, snow, snow removal, and rain all cause thermal cracking, raveling, and spalling. Freezing conditions can also cause frost-heave in the winter months and significant loss of strength during the spring thaw due to super-saturation of the base and subgrade materials. Traffic also contributes to surface distress.

A detailed pavement evaluation study has been conducted at Truckee Tahoe Airport that identifies and quantifies the distress that has developed in the pavement sections and evaluates and determines the time and type of maintenance that is required and the time and type of reconstruction, strengthening, or overlays that are required to maintain the quality, reliability, and aesthetic characteristics necessary for the safe operation of the airport. All pavement elements on the airport were evaluated in this study.

Brandley Engineering, Inc. has conducted these studies and the results of these studies are included in this report.



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TRUCKEE TAHOE AIRPORT
2020 PAVEMENT MANAGEMENT PLAN
AIRPORT LAYOUT & PAVEMENT SEGMENT IDENTIFICATION

DATE	4/15/2021
DRAWN	KDC
CHECKED	DB
FILE	4004-20.areas
SCALE	1"=500'
PLATE No.	1-1

CHAPTER 2. DATA COLLECTION

Significant data has been collected for the development of this Pavement Maintenance Management Plan (PMMP). All previous pavement management study reports were reviewed and data that were applicable to this study were extracted from these reports and used in this program. All previous test information, including geotechnical data, were gathered and reviewed. A testing and inspection program was developed and new data from the new test program were accumulated. A summarization of the data collected is provided in this chapter. A detailed reporting of the test program and data collected are included in Appendices A, B, C, D and E.

2-1 Geotechnical Studies

Geotechnical studies were conducted during the design of each of the major pavement areas at the airport. These data have been accumulated and are summarized in this section of the report and included in detail in Appendix A.

Detailed geotechnical studies are required before an airport or a portion thereof is designed. These studies are necessary to determine the type of soil on which the pavement sections are to be constructed, including the character and strength of these soils. With the heavy aircraft business jet (40,000+ pounds) operating at this airport, detailed soils data are required to a depth of at least 10 feet. Uniformity of stratification, location and fluctuation of groundwater table are also important information. Soils data developed include uniformity of the stratification, soil classification, soil density, soil moisture content, soil strength, consolidation characteristics, and the location of groundwater table.

A detailed geotechnical study was conducted at the airport in 1971 by the office of Reinard W. Brandley, Consulting Airport Engineer. This study included excavation of a series of test pits in the pavement sections themselves and drilling a series of test holes in the infield adjacent to the pavement. These test pits and test holes were located on Runway 11-29, Runway 2-20, Taxiway A, and a portion of the general aviation apron. Field in-place California Bearing Ratio (CBR) tests were conducted in the test pits on various layers of the base course and subgrade and samples were obtained from all test holes and test pits and submitted to the laboratory for classification, strength, and consolidation characteristics of the soils. Additional geotechnical studies have been performed by the office of Reinard W. Brandley, Consulting Airport Engineer for specific projects throughout the airfield which consisted of drilling a series of test holes and performing laboratory testing on the soils samples including soil classification and strength. The results of these studies are summarized in Appendix A including test hole logs and soil classification tests.

A second geotechnical study was conducted by Stantec in 2007. The Stantec test program consisted of excavating a series of test pits on Runway 11-29 and drilling a series of test holes adjacent to Runway 11-29 and in the area of the proposed new construction of the West Hangar and Warehouse Area. The logs of the borings for the Stantec testing program were presented as individual boring logs.

Additional geotechnical data has been collected for specific construction projects and has also been summarized in this report. Even though some of this geotechnical data is up to 50 years old, it is still valid as that is a very short time in respect to geologic structures. The underlying soil conditions at the airport have not significantly changed unless a construction project has changed the makeup of the soils and pavement sections.

For this report these logs were transferred into soil profiles and are included in Appendix A. Stantec also conducted a series of classification tests on the soil samples obtained, and these data are also included in Appendix A.

In general, it was found that the surface soils to depths ranging from 5 to 10 feet consisted of silty sand and gravels with cobbles and, in some cases, sandy clays. These materials were underlain by cleaner materials consisting of silty fine to coarse sands and cobbles. The surface soils to a depth of 4 feet in all areas were fairly loose and soft; whereas, the soils below a depth of 4 feet were very firm and compact. No groundwater was encountered in any of the test holes to the explored depth. Reinard W. Brandley, Consulting Airport Engineer (now Brandley Engineering, Inc.) conducted various field and laboratory California Bearing Ratio (CBR) tests in 1971 which indicated these native subgrade soils under the existing pavements have a CBR of 7.

2-2 Existing Pavement Sections

The existing pavement sections throughout the airport were evaluated based on the study of original construction drawings, reconstruction and maintenance drawings, test pits and test holes excavated, previous reports, and F.A.A. files.

In general, all existing pavements are comprised of F.A.A. standard AC Marshall mix design materials. Many of the pavements are a good quality product but some show signs of distress and failure. The existing aggregate base course consists mainly of a well-graded crushed aggregate base course with a maximum size of ¾ inch to 1½ inch depending on location.

Existing pavement sections at the location of each test hole included in Appendix A are the sections that existed at the time the test holes were drilled and do not necessarily represent existing conditions. Existing pavement sections shown in this section of the report represent current condition.

The current thickness of each layer of Portland cement concrete, asphalt pavement, aggregate base, or aggregate subbase is shown, wherever it is known, in Appendix E, Tables E1 through E130. In general, the existing pavement sections are as shown in Table 2-1.

Table 2-1
Truckee Tahoe Airport - Existing Pavement Sections

Item	Section Thickness - inches					
	Portland Cement Concrete (PCC)*	Asphalt Surface Course (AC)*	Cement Treated Base Course (CTB)*	Aggregate Base Course (AB)*	Aggregate Subbase Course (ASB)*	Total*
Runway 11-29	-	3-4	-	8	0-5	12-16
Taxiways A, B, C, D, F, U, & J	-	3-4	-	4-8	0-11	11-18
Runway 2-20	-	4-6	-	5-8	-	10-12
Taxiways G, N, V, P, Q, & S	-	4	-	3-6	5-8	9-12
Aprons A1, A2, & A3	-	3-4	-	6	-	9-10
Apron A4	-	3	-	9	-	12
Wash Rack	6	-	-	8	-	14
South Jet Apron	-	3	-	6	8	17
Taxilane R	-	4	-	6	5	15
Hangars A-H	-	2-3	0-6	5-18	0-8	9-21
Hangars J-K	-	3	12	-	-	15
Hangars L, M, N, P, T/L T	-	3-5	-	6-10	0-8	9-17
Gliderport	-	3	-	6	-	9
Chandelle Way	-	3	-	7	-	10
Aviation Way	-	3	-	8	-	11

* See Table 5-3 in Chapter 5 of this report for Section Thickness of Individual Segments of Each Pavement Item

2-3 Falling Weight Deflectometer (FWD) Tests

The heavy-duty falling weight deflectometer (FWD) as manufactured by Dynatest Corporation is capable of applying dynamic loads to the pavement of up to 50,000 pounds on a 12 or 18-inch diameter plate. This FWD measures the deflections of the surface of the pavement not only under the center of the plate, but at various locations out to 7 feet from the center of the plate. The shape and magnitude of the deflection bowl caused at the surface of the pavement under the applied loads can thus be determined. These FWD tests can be conducted fairly quickly, generally 20 to 30 tests per hour. Therefore, enough tests can be conducted to determine the uniformity and relative strength of the pavement in each element of the airport, together with the size and shape of the deflection bowl at the surface of the pavement under load.

At the Truckee Tahoe Airport, FWD tests were conducted using a 12-inch diameter plate, on each side of the runway centerline in the wheel path at a spacing of 200 feet. The locations of the tests were staggered so that test results are available at 100-foot intervals. One row of tests at 200-foot spacing was conducted on all taxiways, approximately 10 feet off centerline. On all aprons tests were conducted on a grid of approximately 100-foot by 100-foot. On all other areas such as hangar areas, FWD tests were conducted in the wheel path of the taxilane at a spacing of approximately 100 feet.

The FWD tests not only measure the deflection obtained under each test, but also measure the load that was applied to the pavement. Even though the height of fall of the weights remains the same for each test, the actual load applied to the pavement varies somewhat depending on the resistance to load. In order to compare the test results, all deflections obtained were normalized to the deflections under loads of 10, 20, and/or 30 kips (1 kip = 1,000 lbs). The results of the falling weight deflectometer tests showing center plate deflections are included in Appendix B, Plates B1 through B11. The center plate deflections for each element of the airport were also plotted as profiles and these data are included in Appendix B, Plates B12 through B94.

The measured surface deflections under the FWD tests varied somewhat from one location to another on the airport. These test results indicate that the pavement section materials, subgrade and/or subsoils have variable strengths throughout the airport.

The basic soil parameters that are utilized in the Fatigue Analysis to determine pavement life are Modulus of Elasticity, Poisson's Ratio, and element thickness. The magnitude of deflection and shape of the deflection bowl on the surface of the pavement under load can be used with the computer program for calculations of stresses, strains, and deflections on multi-layer systems to back calculate the soil parameter of Modulus of Elasticity. The data developed from all of the falling weight deflectometer tests were utilized to back calculate Modulus of Elasticity of each layer of the pavement section, and the subsoils located below the pavement section. The results of these back calculated values of Modulus of Elasticity of each layer analyzed are included in Appendix E, Tables E1 through E130.

A comparison of Modulus of Elasticity values of the subgrade soils throughout the airport were determined based on the 2011 and 2019 test programs. The results of the comparison of select pavement sections are shown in Chapter 5, Table 5-1. The Modulus of Elasticity of the subgrade soils was generally the same or slightly less in the 2019 test program than in the 2011 test program.

2-4 Pavement Condition Survey (Surface Distress)

Pavement condition surveys were conducted on all pavements at the Truckee Tahoe Airport to determine the type of distress and degree of distress that has occurred on each pavement element and the general character of the pavement.

A standard test method for pavement condition surveys is included in ASTM D 5340-11, *Standard Test Method for Airport Pavement Condition Index Surveys*. ASTM D 5340-11 recommends a detailed survey on a 10%± sample of the pavement and a cursory survey of the total area. The pavement condition surveys conducted by our office include a detailed survey of the entire area (100%) of the section. In the pavement condition survey, a detailed assessment of the pavement surface is conducted, as described in Appendix C.

The Pavement Condition Index (PCI) and pavement condition description were determined for each section of pavement. This information is included in Appendices C and E of this report. The data for each segment are included in Tables C1 through C62 and Tables E1 through E130. Pavement condition determinations are based on visual observations and can vary significantly based on the experience and judgment of the Engineer doing the inspection.

The ASTM Standard provides a relationship between Pavement Condition Index (PCI) and visual pavement rating. On Plates No. 2-1 thru 2-3 the rating system is indicated as a color legend and the rating of each segment of pavement is indicated by color. The PCI of each segment is also indicated adjacent to each segment of the pavement. It will be noted that in 2020 most pavements show a “good” to “very good” condition, yet some only show “poor” to “fair” conditions. These “poor” pavements are showing considerable distresses on the surface including weathering and block cracking. As a result of the surface conditions on some of the pavements, some rehabilitation is recommended earlier than the forecast remaining life of the pavement. The Pavement Condition Index is based solely on the surface condition and surface distresses and does not necessarily reflect the condition or life of the pavement from a deep-seated failure basis.

Pavement condition surveys (PCI) were conducted in 2011, 2013, and 2020. The PCI of each segment of pavement is shown on Plate 2-1 for 2011, Plate 2-2 for 2013, and Plate 2-3 for 2020 The results of this study are summarized in Chapter 5, Table 5-3. The results of this comparison study show that the PCI of any sections that did not have any rehabilitation completed since 2011 have decreased and the sections that had rehabilitation projects completed have increased in PCI. This data indicates that some of the old pavements are experiencing significant surface distress and will require significant surface treatment earlier than deep-seated distress treatment is required.

2-5 Forecast Traffic

Traffic forecasts for each runway and taxiway complex and aprons were furnished by the Truckee Tahoe Airport and Airport Control Tower and used to evaluate the distribution of traffic at this airport. The Master Plan forecast data was updated in June 2021 and included the type aircraft currently operating at the airport, along with the annual number of operations of each aircraft type. The preferred operations forecast method of “Turbine Regression Method Forecast” was utilized. Growth rates for each type of aircraft were derived from the updated Aviation Activity Forecasts. The growth rates used were 1% for piston aircraft, 3% for turboprop aircraft, 6% for jet aircraft weighing less than 24,000 lbs., 3% for jet aircraft weighing between 24,000 and 72,000 lbs., and 6% for the heavier jet aircraft weighting more than 72,000 lbs.

Table No. 2-2 (located at the end of this chapter) lists the 2021 annual operations for aircraft utilizing the airport for each runway and includes their maximum loading weight and gear configuration. It should be noted that some of the larger jets cannot operate at their published maximum take-off weight at Truckee due to runway length, density altitude, and operational restrictions. These aircraft have been grouped into 15 aircraft/vehicle groups. Each group represents the average aircraft characteristics of maximum loading weight and gear type for the different classifications of aircraft that utilize the airport pavements. Snow removal equipment and delivery trucks are included in groups 12 thru 15 and used on the appropriate pavement sections.

In evaluating airfield pavements for deep-seated distress, it is the number of coverages of each wheel on each aircraft over a given point of pavement that contributes to the deep-seated distress on or near that section of pavement. The distribution of aircraft traffic on each pavement section of the airport is a function of:

- Wind direction, which dictates which runway is used
- Landing length requirement of each aircraft and takeoff length requirement of each aircraft
- Destination on the airport of each aircraft type.
- Distribution of traffic on a given pavement section.

For this evaluation, data was provided by the Airport showing how many operations utilized each of the 4 runway ends at the airport. The runway utilized by each aircraft is a function of the size and weight of the aircraft, wind direction, destination of the aircraft on the airfield, and air traffic control tower preferences.

When an aircraft lands on a runway, only the heavier aircraft generally use the full length of runway. Intermediate and smaller size aircraft exit the runway at the appropriate cross taxiway. The taxiways that are used by aircraft are dependent upon the location at which the aircraft take off and land as well as the destination of the arriving aircraft on the airport.

For this evaluation it was assumed that 90 percent of the jet traffic uses Runway 11-29 and 10 percent uses Runway 2-20. Of the 90 percent of jet traffic that use Runway 11-29, 90 percent land and take off on Runway 29 and only 10 percent use Runway 11. Of the 10 percent of jet trafficthat use Runway 2-20, 80 percent land and take off on Runway 20 and only 20 percent land and take off on Runway 2. This traffic distribution is changing now that the aircraft control tower has been operating at the airport and more traffic is starting to utilize Runway 2-20. The shift in traffic has been accounted for in the updated traffic forecast data.

Based on the aircraft characteristics, the runway use dictated by wind direction, and the destination of aircraft on the airport, the current annual operations of each aircraft have been evaluated to best represent the actual traffic that occurs on each segment of pavement. The traffic forecast to occur on each segment is defined as “Traffic Index.” A total of 28 traffic indexes were evaluated and used for this study. On several pavement sections, such as the cross taxiways, hangar areas and aprons, the entire amount of traffic from a pavement complex was initially utilized even though the actual traffic experienced on these pavements will likely be lower. This higher level of traffic was not further reduced in some areas if the pavement life on these pavements exceeded 20 years even with the higher than expected traffic levels. All pavements that showed less than 20 years of remaining life were further analyzed with a traffic index that represented their actual forecast traffic. The number of annual operations and estimated average annual growth rates for each aircraft group and each traffic index are indicated in Table No. 2-2. These traffic indexes were utilized in the evaluation of all pavements for deep-seated distress.

Since the business jet traffic at Truckee Tahoe Airport has increased significantly over the past 10 years and the national fleet is increasing, there is a possibility that the number of operations of larger aircraft using the airport will increase more than what has been forecast. In order to evaluate the effect that this potential increased traffic would have, an additional set of traffic indexes was prepared and used in the Fatigue Analysis studies. With these “enhanced” traffic indexes the number of operations of the large aircraft (those with maximum takeoff weight in excess of 48,000 pounds) was doubled. These “Enhanced Traffic” Indexes are the same as the forecast traffic, but the aircraft in Aircraft Groups 8, 9, 10, and 11 were doubled during the “Enhanced Traffic” evaluations. The Fatigue Analysis was conducted using both the forecast traffic and the traffic with the large aircraft operations doubled.

Using the traffic index and the total annual operations, the number of operations on a given segment of the airport can be estimated. Each operation does not travel over the same spot on a pavement and, therefore, the number of coverages on the pavement section will be less than the total operations for each traffic index. The distribution of traffic on each section is a function of the aircraft type, the gear type, the wind conditions, and the skill of the pilot. There is generally a fairly wide distribution of traffic on a runway, whereas, on a taxiway the traffic is more concentrated. On the aprons the traffic generally follows specified taxilane markings, but only a fraction of the total aircraft operate on each section of apron. Different factors are applied to the operations estimated for a given section of the airport to convert operations to coverages. Coverages are used in the Fatigue Analysis for remaining pavement life calculations.

The traffic index used for various segments of each pavement is indicated on Plate No. 2-4.

2-6 Frost Action

The natural soils at the Truckee Tahoe Airport are susceptible to frost action because of the gradation of these materials. When soils freeze, if the level of frost penetration remains stable for a significant period of time, water is drawn to the freezing layer and this water accumulates and freezes in the form of ice lenses, which cause the soils above that level to heave. When the frost penetrates deeper, the process is repeated and additional ice lenses are formed. In a frost-susceptible soil with deep penetration of frost, numerous ice lenses will form and significant heave will occur.

When these soils thaw in the spring, they thaw from the top and from the bottom. Generally, about two-thirds of the thawing occurs from the surface and one-third from the bottom. Until the total section thaws, that portion above the remaining frozen layer is temporarily super-saturated because of the melting of the ice lenses. The remaining frozen soil creates an impervious layer so the excess pore water cannot dissipate. This produces a much weaker pavement section during this period. It is important to determine the depth of frost penetration at the Truckee Tahoe Airport and to develop methods to accommodate the decreased strength of subsoils during spring thaw if necessary.

Experience at other airports in the Sierra Nevada Mountains indicates that frost penetration under a dark colored pavement is significantly less than that indicated by the freezing index; whereas, the frost penetration under a white reflective painted surface can be greater than that indicated by the freezing index.

Observations and thermocouple data at the Lake Tahoe Airport indicates that the depth of frost penetration under wide white painted pavement can be as much as 60 inches, whereas the depth of frost penetration under black pavement surfaces ranges from 12 to 16 inches. It is recommended at the Truckee Tahoe Airport that all pavement markings be “zebra” striping using 6” maximum width painted sections and 6” minimum black unpainted sections. Frost free materials should be used for all pavement sections to within 20 inches of the surface.

Black pavements absorb the sun’s heat and white painted surfaces reflect the sun’s rays. Zebra striping patterns on painted surfaces as used at the Truckee Tahoe Airport will generally create a condition where the depth of frost penetration will be fairly shallow. Some distress in some pavements in the hangar rows that experience more shade have shown some signs of frost heave in the past. Currently these sections have been reconstructed with frost-free aggregate base course and are no longer exhibiting frost heave. It is important that the zebra striping patterns continue to be used at Truckee Tahoe Airport.

A general relationship has been developed to indicate the depth of frost penetration as it relates to freezing index. Freezing index is defined as an accumulation of the deviation in degrees Fahrenheit from 32º F for each day. The relationship between freezing index and time for the winter of 2010/11 at the Truckee Tahoe Airport is indicated on Plate No. 2-5 in the Freezing Index graph. Also in Plate No. 2-5 the theoretical depth of frost penetration is indicated for the winter of 2010/11. Theoretical depth of frost penetration has been plotted under the FAA Theoretical Frost Penetration Depth graph

In order to determine the depth of frost penetration at Truckee Tahoe Airport a series of thermocouples were installed at various depths below the pavement surface on a section of Runway 11-29 located west of Taxiway G. Gauges were installed at depths of every 6 inches beginning at the depth of 6 inches and extending to 5 feet below the pavement surface. These gauges were installed on February 9, 2011 and then replaced with permanent gauges during the 2012 reconstruction of Runway 11-29. The existing temperature data at each gauge were recorded hourly starting after installation. The results of these readings are shown on the Runway 11-29 Ground Temperature chart on Plate No. 2-5. Air temperature during that same period was also recorded and is also shown on Plate No. 2-5.

After February 9, 2011, there was never a time when any of the soil or base materials below a depth of 6 inches reached a temperature of 32º F. In several instances during the night the temperature of the soil at a depth of 6 inches approached 32º F but always rose during the daytime.

While there was no frost penetration under the pavements at Truckee Tahoe Airport after February 9, 2011, it is likely that there will be some frost penetration at sometime in the winter. These gauges have been left in place and are scheduled to be monitored. During the collection of data for the 2020 Pavement Management Plan we requested data from the temperature gauges, and it was learned that the battery had corroded and failed. At this time the data has not been able to be recovered from the datalogger. All data presented in this report is based on the original data collected between 2011 and 2013. During the month of January 2013 there were approximately 20 days that there were freezing temperatures in the base rock 6” below the surface, but the frost never penetrated to the temperature gauge located 12” below the surface.

Mitigation measures should be considered as required, depending on the whether depth of frost penetration ever becomes prevalent. These mitigation measures could include thickening pavement sections to support the heavy aircraft loadings during the spring thaw or restricting use of the airport by the heavier aircraft during the short period of spring thaw.

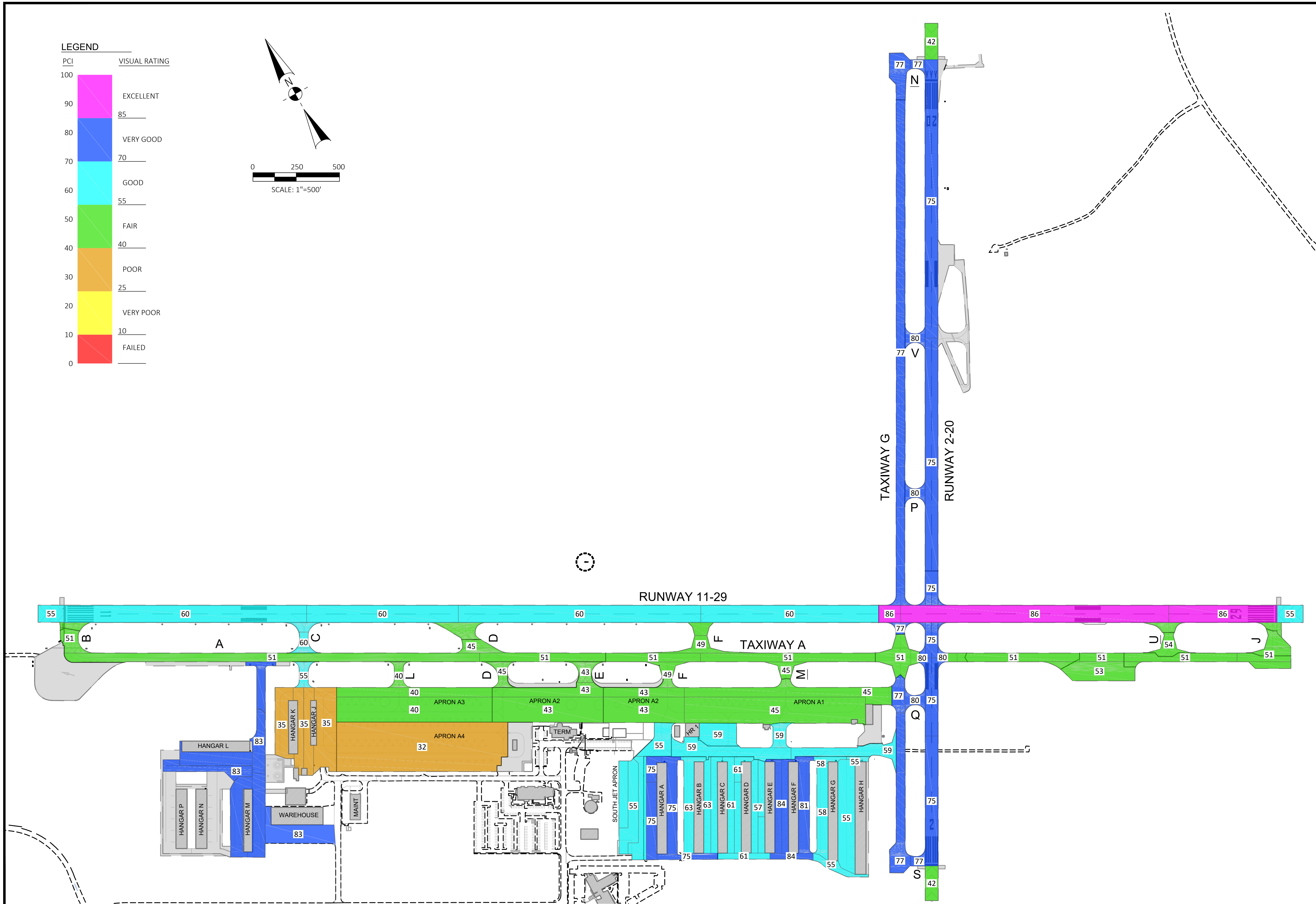
TABLE No. 2-2 - Traffic Index Summary - Truckee Tahoe Airport

Aircraft Group	Typical Aircraft Type	Aircraft Max Loading (lbs)	Gear Configuration	2021 Annual Operations	Annual Growth Rate	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14
						Traffic Index (Forecast Annual Aircraft Operations in 2021)													
1	Piston	5,500	Single	20,000	1%	15,000	7,500	18,000	3,750	3,750	6,000	3,000	3,000	1,500	2,000	2,000	6,000	10,000	2,000
2	Turboprop	12,000	Single	7,900	3%	5,925	2,963	7,110	1,482	1,481	2,370	1,185	1,185	593	3,000	3,000	3,000	1,000	5,000
3	Jet	15,000	Single	840	6%	764	382	840	191	153	76	38	38	19	84	504	84	-	168
4	Jet	18,000	Single	880	6%	801	400	880	200	160	79	40	40	20	88	528	88	-	176
5	Jet	20,000	Dual	1,200	6%	1,092	546	1,200	273	218	108	54	54	27	120	720	120	-	240
6	Jet	24,000	Dual	600	3%	546	273	600	137	109	54	27	27	14	60	360	60	-	120
7	Jet	36,000	Dual	650	3%	592	296	650	148	118	59	29	29	15	65	390	65	-	130
8**	Jet	48,000	Dual	750	3%	683	341	750	171	137	68	34	34	17	75	450	75	-	150
9**	Jet	72,000	Dual	120	6%	120	60	120	30	-	-	-	-	-	10	108	10	-	-
10**	Jet	84,000	Dual	120	6%	120	60	120	30	-	-	-	-	-	10	108	10	-	-
11**	Jet	96,000	Dual	100	6%	100	50	100	25	-	-	-	-	-	5	90	5	-	-
12	Plow Trucks	40,000	Single	-	0%	200	200	200	200	200	200	200	200	200	200	200	200	50	120
13	Snow Blowers	50,000	Single	-	0%	120	120	120	120	120	120	120	120	120	60	60	60	20	40
14	Automobile	4,000	Single	-	2%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	Delivery Trucks	38,000	Dual Axle	-	2%	-	-	-	-	-	-	-	-	-	-	-	-	-	-

** - Denotes an Aircraft Group that has operations doubled in the "Enhanced Traffic" analysis.

Aircraft Group	Typical Aircraft Type	Aircraft Max Loading (lbs)	Gear Configuration	2021 Annual Operations	Annual Growth Rate	T15	T16	T17	T18	T19	T20	T21	T22	T23	T24	T25	T26	T27	T28
						Traffic Index (Forecast Annual Aircraft Operations in 2021)													
1	Piston	5,500	Single	20,000	1%	9,000	10,000	1,000	500	500	500	1,500	3,000	-	-	-	-	-	-
2	Turboprop	12,000	Single	7,900	3%	5,000	5,000	-	750	500	500	500	-	-	-	-	-	-	-
3	Jet	15,000	Single	840	6%	-	320	-	20	50	50	100	-	-	-	-	-	-	-
4	Jet	18,000	Single	880	6%	-	360	-	20	20	20	20	-	-	-	-	-	-	-
5	Jet	20,000	Dual	1,200	6%	-	750	-	-	300	100	300	-	-	-	-	-	-	-
6	Jet	24,000	Dual	600	3%	-	550	-	-	-	-	-	-	-	-	-	-	-	-
7	Jet	36,000	Dual	650	3%	-	200	-	-	-	-	-	-	-	-	-	-	-	-
8**	Jet	48,000	Dual	750	3%	-	200	-	-	-	-	-	-	-	-	-	-	-	-
9**	Jet	72,000	Dual	120	6%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10**	Jet	84,000	Dual	120	6%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11**	Jet	96,000	Dual	100	6%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	Plow Trucks	40,000	Single	-	0%	80	200	120	120	120	120	120	-	400	80	80	80	80	200
13	Snow Blowers	50,000	Single	-	0%	20	120	-	-	5	-	5	-	240	20	20	20	20	120
14	Automobile	4,000	Single	-	2%	-	-	-	-	-	-	-	-	-	110,000	10,000	100,000	18,000	-
15	Delivery Trucks	38,000	Dual Axle	-	2%	-	-	-	-	-	-	-	-	-	-	4,000	2,000	-	-

** - Denotes an Aircraft Group that has operations doubled in the "Enhanced Traffic" analysis.



TRUCKEE TAHOE AIRPORT
2020 PAVEMENT MANAGEMENT PLAN
PAVEMENT CONDITION INDEX (2011)

BRANDLEY ENGINEERING
6125 KING ROAD, SUITE 201 · LOOMIS, CA 95650 · (916) 652.4725

DATE	4/15/2021
DRAWN	KDC
CHECKED	DB
FILE	4004-20.2-1.PCI11
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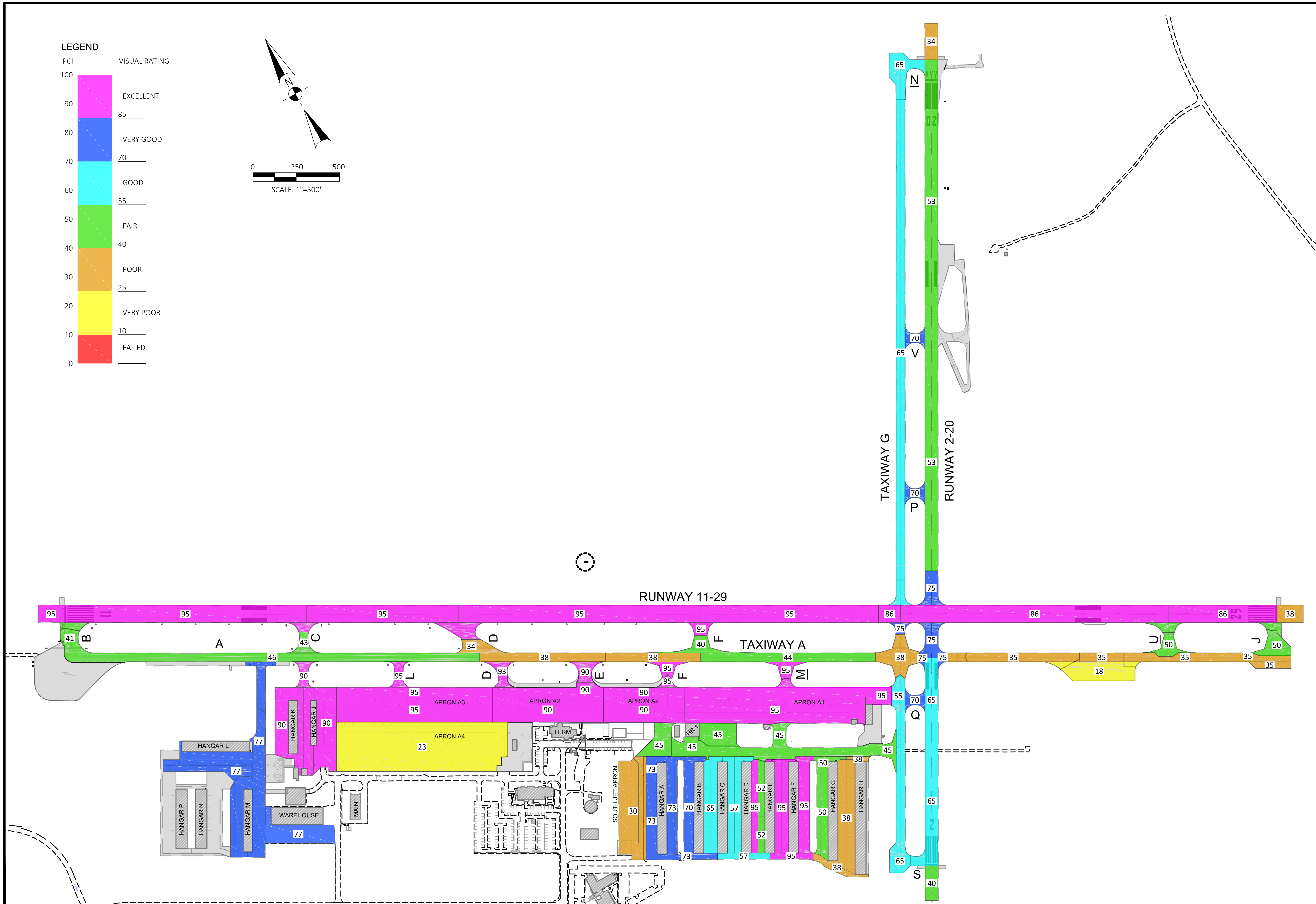
PLATE No.	2-1



BRANDLEY
ENGINEERING
6125 KING ROAD, SUITE 201 · LOOMIS, CA 95650 · (916) 652.4725

TRUCKEE TAHOE AIRPORT
2020 PAVEMENT MANAGEMENT PLAN
PAVEMENT CONDITION INDEX (2013)

DATE	4/15/2021
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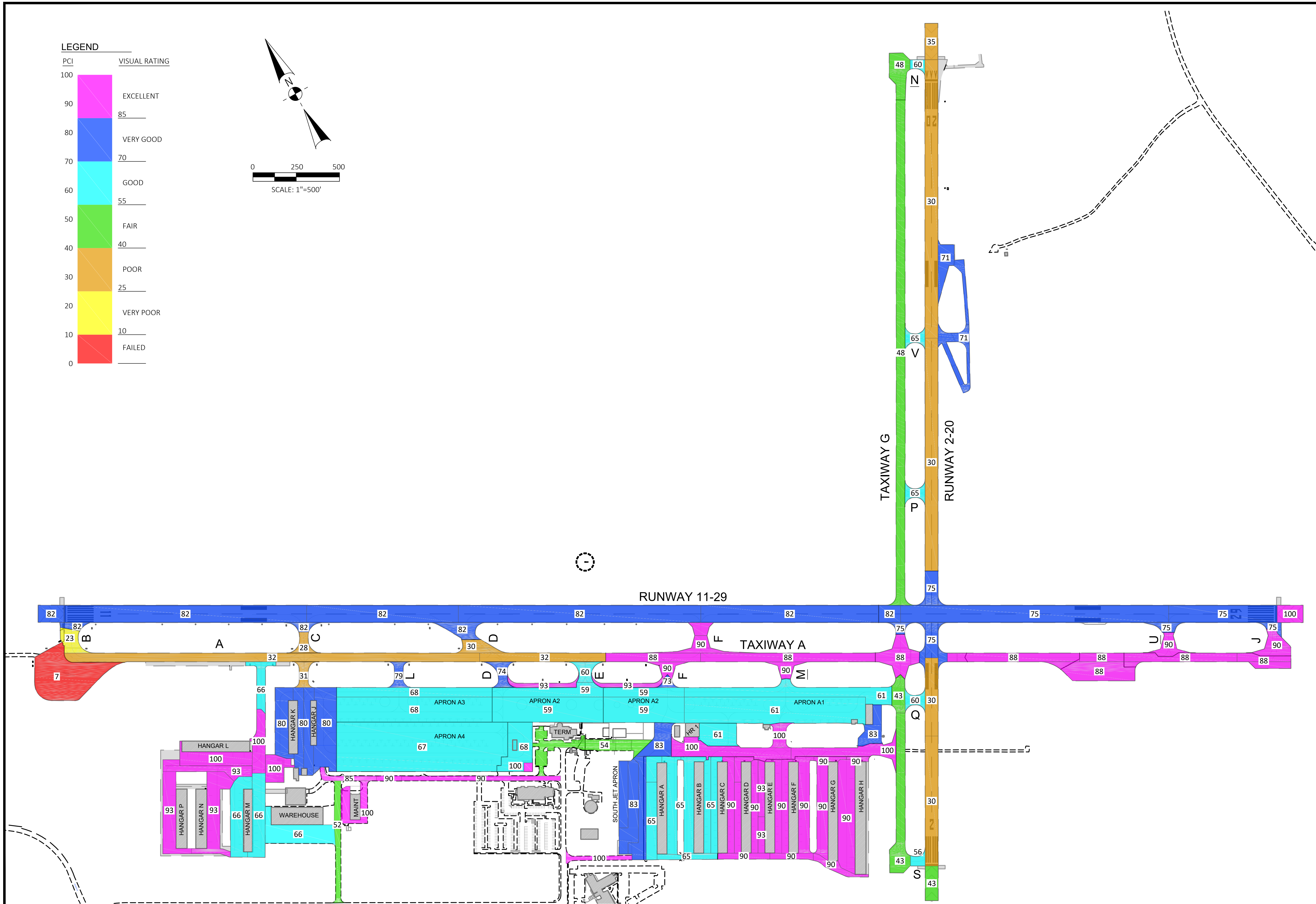

TRUCKEE TAHOE AIRPORT

2020 PAVEMENT MANAGEMENT PLAN

PAVEMENT CONDITION INDEX (2020)

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DATE	4/15/2021
DRAWN	KDC
CHECKED	DB
FILE	4004-20.2-3.PCI
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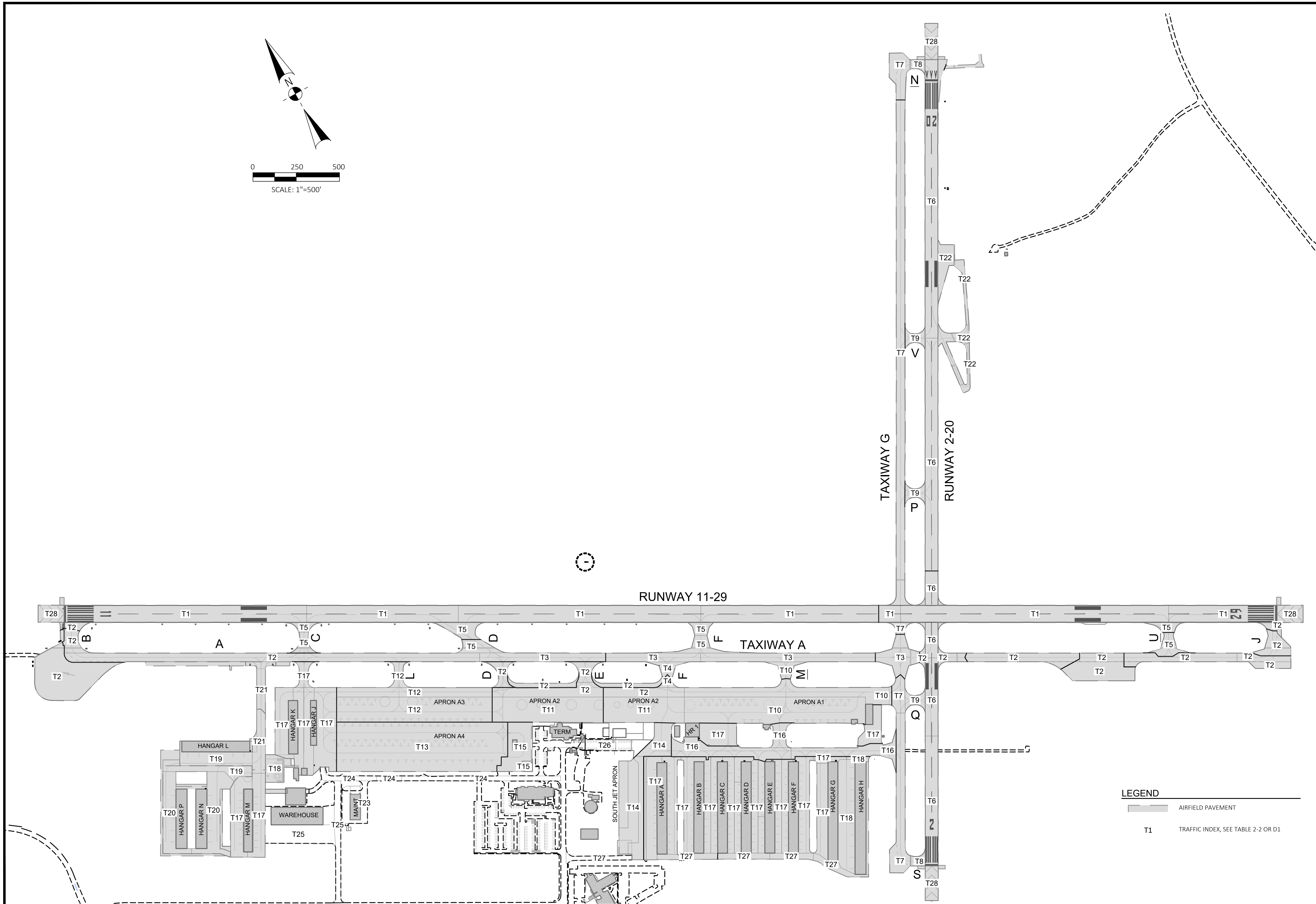
PLATE No.	2-3



BRANDLEY ENGINEERING
6125 KING ROAD, SUITE 201 · LOOMIS, CA 95650 · (916) 652.4725

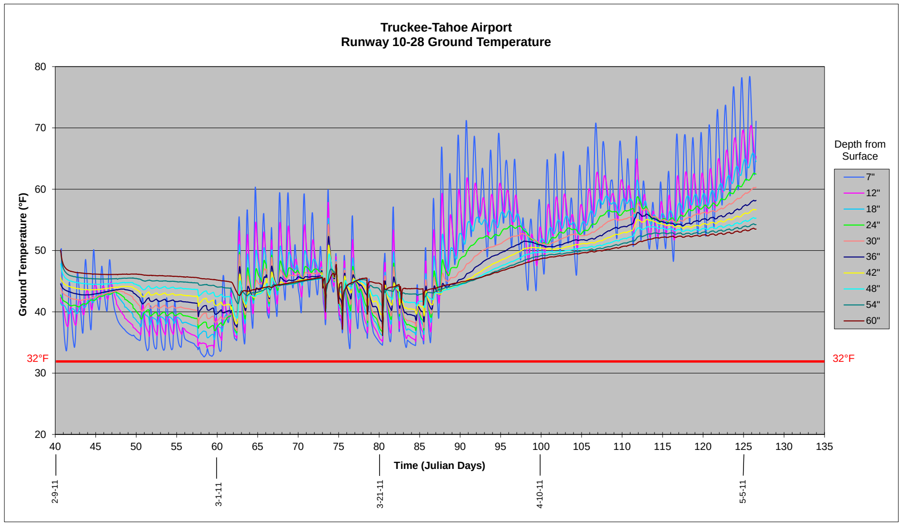
TRUCKEE TAHOE AIRPORT
2020 PAVEMENT MANAGEMENT PLAN

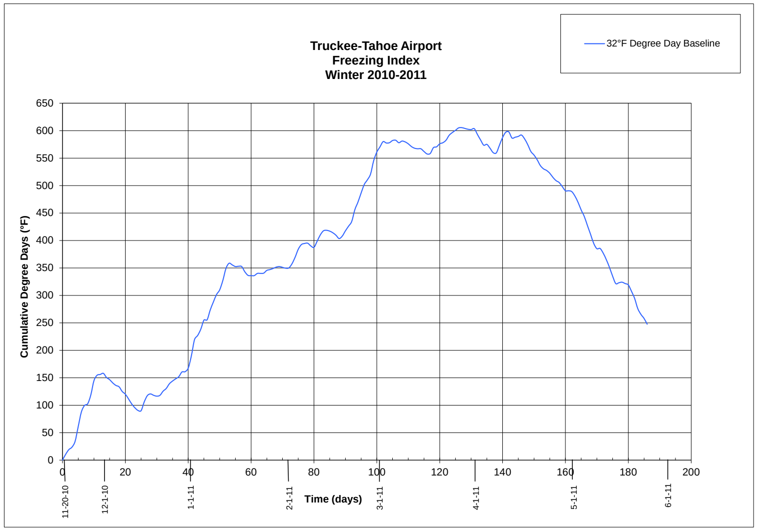
TRAFFIC DISTRIBUTION - TRAFFIC INDEX

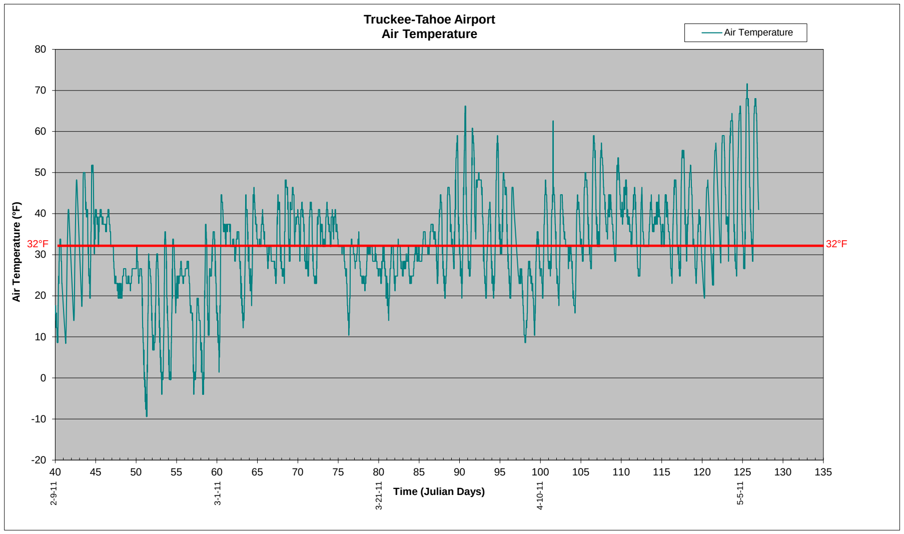
DATE	4/15/2021
DRAWN	KDC
CHECKED	DB
FILE	4004-20.2-4.Traffic
SCALE	1"=500'
PLATE No.	2-4

PLATE NO. 2-5 - FROST PENETRATION STUDY

Data Collection: February 9 -May 5, 2011







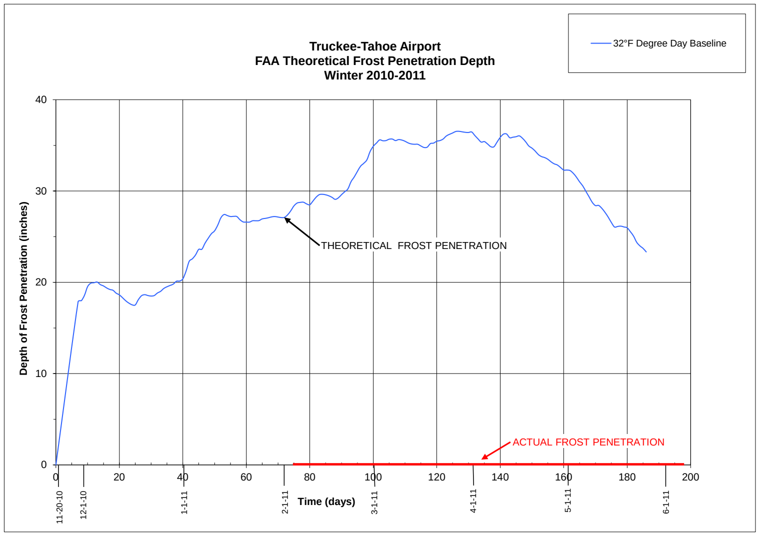


PLATE NO. 2-5
FROST PENETRATION STUDY

CHAPTER 3. PAVEMENT CLASSIFICATION NUMBER (PCN)

3-1 Method of Calculating PCN

More than 50 years ago the European Airport Systems, particularly the United Kingdom, developed a standard method known as Aircraft Classification Number/Pavement Classification Number (ACN/PCN) method of pavement strength rating information. FAA has long resisted using this standard, but has now adopted it as an international standard to facilitate the exchange of pavement strength rating information.

With this method of evaluation, the airfield pavements are assigned a Pavement Classification Number (PCN), which is dependent on the pavement section and soil strength and represents the strength and bearing capacity of the pavement section. PCN is a number that expresses the load-carrying capacity of a pavement for specified operations. The aircraft manufacturers have developed an Aircraft Classification Number (ACN), which represents the relative effect of an aircraft at a given configuration on a pavement structure. This system has been developed such that aircraft with a given ACN number can safely operate on pavements that have PCN values equal to or greater than the ACN value of the aircraft. It has, therefore, become necessary to develop and report PCN values for all pavements, particularly on commercial airports.

The Federal Aviation Administration has developed Advisory Circular (AC) 150/5335-5C, *Standardized Method of Reporting Airport Pavement Strength - PCN.* In AC 150/5335-5C FAA sets forth various methods for determining PCN on airport pavements. This Advisory Circular has been used to develop PCN values for the various pavement sections at Truckee Tahoe Airport.

There are several methods for determining PCN Values for a pavement section that are suggested, including the following:

1. COMFAA Computer Program

2. Use the ACN of the most critical aircraft that is successfully using the airport and assume the PCN is the same as that critical ACN value.

3. Knowing the existing pavement sections and characteristics of the subgrade soils and each pavement section layer, determine the design aircraft weight allowed on the pavement section with each landing gear configuration. The bearing capacity of the pavement sections with flexible pavements is determined by the California Bearing Ratio Method and for pavement sections with rigid pavements the Westergaard Design Method is used. Once the load bearing capacity of the section is determined, FAA has developed a series of tables that are included in AC 150/5335-5C, Appendix F as Tables F-1, F-2, F-3, and F-4, which provide the relationship

between PCN and aircraft gross weight. A different set of tables is used for flexible pavement sections and for rigid pavement sections. Once the maximum allowable aircraft gross weight for each gear type is determined, then the representative PCN can be taken from these tables.

At the Truckee Tahoe Airport, the COMFAA program was tested. It was found that the results obtained were very erratic and did not represent the aircraft load carrying capacity of the pavements and no further effort was made to utilize the computer program.

The use of the ACN value of the critical aircraft successfully using the airport as the PCN value of the pavement is somewhat arbitrary and is not considered to accurately depict the strength of the pavement sections. This method was not utilized in this study.

The technical method for determining the PCN determines the strength of the pavement sections based on thickness and quality of the various pavement layers used and the subgrade strength. For flexible pavements the California Bearing Ratio (CBR) of subgrade method was utilized and for rigid pavements the Modulus of Subgrade Reaction (K) was utilized. The K factor utilized was the K factor at the top of the base course, which is larger than the K factor of the subgrade materials. With this method of design and evaluation the maximum aircraft load that can be utilized on each pavement section can be calculated for single gear aircraft, dual gear aircraft, dual tandem gear aircraft, and double dual tandem gear aircraft. Dual tandem and double dual tandem gear aircraft were not evaluated for this study as they do not operate at the Truckee Tahoe Airport.

3-2 Evaluation

The PCN values are determined separately for each pavement section on the airport and indicated in the report based on pavement type, subgrade strength category, allowable tire pressure, and method used for determining the PCN. The pavement codes for reporting the PCN are as follows:

Pavement Type

Pavement Type	Code
Flexible	F
Rigid	R

Subgrade Strength (Flexible Pavement)

Subgrade CBR	Code
≥ 13	A
8 to 13	B
4 to 8	C
≤ 4	D

Rigid Pavements - K	
K	Code
≥ 442	A
221 to 442	B
92 to 221	C
≤ 92	D

Tire Pressure	
Psi	Code
≥ 254 (No Limit)	W
181 to 254	X
73 to 180	Y
≤ 73	Z

Method of Analysis	
Method	Code
Technical	T
Using Aircraft	U

A typical listing of a PCN value will, therefore, be PCN = 25/F/B/Y/T, where

F = Flexible Pavement
B = Subgrade CBR 8 to 13
Y = Tire pressure 73 to 180 psi
T = Technical method of calculation.

3-3 Calculated PCN Values

There are numerous pavement sections at the Truckee Tahoe Airport – mostly flexible pavements and one rigid pavement (wash rack). Some are original construction and others are reconstructed or overlaid sections. A detailed study has been conducted to determine the pavement sections existing at this time at Truckee Tahoe Airport. These data are summarized in Table No. 3-1 for all pavements at the airport. Using these pavement sections and either the CBR or Westergaard method of design, the airplane gross weight allowed on these pavements for single gear aircraft and dual gear aircraft has been determined and is included on Table No. 3-1 for each of the pavement sections.

An Airport Diagram showing the layout of the airfield pavements and Segment ID for each section of pavement analyzed is shown on Plate No. 3-1.

Utilizing these data the PCN for each pavement section, both flexible and rigid, has been determined using Tables F-1 through F-4 of AC 150/5335-5C, Appendix F.

Summary of PCN Values

Section	PCN
Runway 11-29 & Associated Taxiways	10 F/C/Y/T
Runway 2-20 & Associated Taxiways	7 F/C/Y/T
Aprons A1-A3	6-10 F/B/Y/T
Apron A4	11 F/B/Y/T
South Jet Apron	11 F/C/Y/T
Hangars A-F	3-5 F/C/Y/T
Hangars G-H	22 F/C/Y/T
Hangars J-K	20 F/B/Y/T
Hangars L, N, P	21 F/B/Y/T

The calculated bearing capacity reported for each individual pavement segment is based on 1,200 departures per year of an aircraft with the weight and gear configuration listed, the subgrade strength, and the pavement section material strengths and thicknesses. The weakest portion of a pavement complex is the controlling element. Truckee does not have 1,200 departures per year of the heavier jet aircraft. With smaller numbers of departures, the allowable bearing capacity of a particular pavement may be higher than that shown in Table 3-1 which was based on 1,200 annual departures. The Board asked for the current Bearing Capacities of each pavement complex at the airport. This calculation has been performed based on the weakest section of each runway along with the forecast traffic and weights of all aircraft currently using the airport as follows:

(Legend: *50 S, 80 D* = 50,000 lb. aircraft Single Gear, 80,000 lb. aircraft Dual Gear)

Runway 11-29

1. 32 S, 42 D (based on 1,200 annual departure calculation, as noted in Table 3-1)
2. 50 S, 80 D (based on current traffic using the runway, also matches 2011 & 2014 PMMP) – Represented by a PCN of 20 F/C/Y/T

Runway 2-20

1. 25 S, 30 D (based on 1,200 annual departure calculation, as noted in Table 3-1)
2. 35 S, 50 D (based on current traffic using the runway, also matches 2011 & 2014 PMMP) – Represented by a PCN of 13 F/C/Y/T.

Recommended to use bearing capacity limits of 50/80 (PCN 20 F/C/Y/T) for Runway 11-29 & 35/50 (PCN 13 F/C/Y/T) for Runway 2-20.

It should be noted that Appendix E of AC 150/5335-5C includes section E.1.2 regarding reporting allowable gross weights. The last sentence of this section notes "Local experience can be considered to report a lower weight, but higher weights are not recommended." Based on this notation, it is justified to identify these entire pavement complexes with a lower bearing capacity in order to protect the pavements based on local conditions, even though the individual pavement sections might show a calculated bearing capacity greater than the 50/80 for Runway 11-29 or greater than 35/50 for Runway 2-20. Local conditions at Truckee create significant damage to pavements that many airports do not experience. These local conditions include large daily temperature swings, freeze/thaw cycles, snow and ice cycles, snow removal operations, etc. These must be accounted for and provide justification to maintain the current bearing capacities for the pavements even if the calculated bearing capacity might be higher in the future due to a pavement reconstruction or new pavement construction.

When a pavement is reconstructed the bearing capacity of that pavement would need to be recalculated. It should be noted that when pavements at the Truckee Tahoe Airport are reconstructed under future federally funded projects, the calculated bearing capacity will increase. If a project is federally funded, the pavement design must conform to the minimum standards in the latest version of Advisory Circular 150/5320-6. This advisory circular sets forth the pavement section design requirements and includes minimum pavement section layer thickness requirements. The existing subgrade has a CBR of 7 (see Chapter 2 of the PMMP) which currently requires a minimum pavement section of: 6" of Aggregate Subbase Course, 6" of Aggregate Base Course, and 3" or 4" of Asphalt Surface Course. This means that the minimum thickness of pavement section on top of the subgrade for any reconstructed section or new pavement section will be 15" to 16". This is thicker than the existing total pavement section of 12" on the east end of Runway 11-29 and the majority of Runway 2-20. Based on the pavement design requiring a thicker pavement section than the existing section, the calculated bearing capacity will increase, but it is still recommended and justified to maintain the existing bearing capacities based on the local conditions at the Truckee Tahoe Airport.

This PCN information should be added to the Airport Master Record, FAA Form 5010, for the Truckee Tahoe Airport.

Table 3-1
Pavement Sections and Pavement Classification Number (PCN)
Truckee Tahoe Airport

Pavement Segment ID (See Plate 3-1)	Element	Station (See Plate 5-2)	Existing Pavement Section - inches								Existing Modulus of Elasticity (E) - ksi							Subgrade Strength		Bearing Capacity - Kips (for 1,200 annual Departures) (1 Kip = 1,000 lbs.)		PCN - Flexible or Rigid Section - (F or R) / (C or D) / Y / T			Pavement Classification Number PCN	Element
			PCC	AC	CTB	AB	ASB	Subgrade	Subsoil	Total Section	PCC	AC	CTB	AB	ASB	Subgrade	Subsoil	Estimated CBR	Subgrade Category	SW	DW	SW	DW	Use		
E1	Runway 11 Blast Pad	-1+50 to 0+00	-	3	-	8	5	48	S.I.	16	-	250	-	70	30	25	40	17	A	75	125	25	27	25	25 F/A/Y/T	Runway 11 Blast Pad
E2	Runway 11-29	0+00 to 14+25	-	3	-	8	5	48	S.I.	16	-	350	-	80	50	20	40	13	B	75	125	25	27	25	25 F/B/Y/T	Runway 11-29
E3	Runway 11-29	14+25 to 23+00	-	3	-	8	5	48	S.I.	16	-	350	-	80	50	20	25	13	B	75	125	25	27	25	25 F/B/Y/T	Runway 11-29
E4	Runway 11-29	23+00 to 37+00	-	3	-	8	5	48	S.I.	16	-	350	-	80	50	20	25	13	B	75	125	25	27	25	25 F/B/Y/T	Runway 11-29
E5	Runway 11-29	37+00 to 47+00	-	3	-	8	5	48	S.I.	16	-	350	-	80	50	20	25	13	B	30	40	11	10	10	10 F/B/Y/T	Runway 11-29
E6	Runway 11-29	47+00 to 48+75	-	4	-	8	-	48	S.I.	12	-	300	-	60	-	12	20	8	C	32	42	12	10	10	10 F/C/Y/T	Runway 11-29
E7	Runway 11-29	48+75 to 64+25	-	4	-	8	-	48	S.I.	12	-	300	-	60	-	12	20	8	C	32	42	12	10	10	10 F/C/Y/T	Runway 11-29
E8	Runway 11-29	64+25 to 70+00	-	4	-	8	-	48	S.I.	12	-	300	-	60	-	12	20	8	C	32	42	12	10	10	10 F/C/Y/T	Runway 11-29
E9	Runway 29 Blast Pad*	70+00 to 71+50	-	4	-	8	-	48	S.I.	12	-	300	-	60	-	12	20	8	C	32	42	12	10	10	10 F/C/Y/T	Runway 29 Blast Pad*
E10	Taxiway A	0+00 to 24+00	-	3	-	8	-	48	S.I.	11	-	250	-	65	-	12	30	8	C	28	32	10	9	9	9 F/C/Y/T	Taxiway A
E11	Taxiway A	24+00 to 31+25	-	3	-	8	-	48	S.I.	11	-	250	-	65	-	12	30	8	C	28	32	10	9	9	9 F/C/Y/T	Taxiway A
E12	Taxiway A	31+25 to 36+75	-	3	-	4	11	48	S.I.	18	-	200	-	60	50	15	30	10	B	75	110	25	24	24	24 F/B/Y/T	Taxiway A
E13	Taxiway A	36+75 to 47+00	-	3	-	4	11	48	S.I.	18	-	200	-	60	50	15	30	10	B	75	110	25	24	24	24 F/B/Y/T	Taxiway A
E14	Taxiway A	47+00 to 49+50	-	3	-	4	10	S.I.	-	17	-	350	-	80	60	40	-	27	A	75	110	25	24	24	24 F/A/Y/T	Taxiway A
E15	Taxiway A	49+50 to 49+75	-	6	-	6	-	48	S.I.	12	-	200	-	40	-	12	20	8	C	32	42	12	10	10	10 F/C/Y/T	Taxiway A
E16	Taxiway A	50+50 to 51+00	-	6	-	6	-	48	S.I.	12	-	200	-	40	-	12	20	8	C	32	42	12	10	10	10 F/C/Y/T	Taxiway A
E17	Taxiway A	51+00 to 58+75	-	3	-	4	11	48	S.I.	18	-	250	-	50	30	15	20	10	B	75	110	25	24	24	24 F/B/Y/T	Taxiway A
E18	Taxiway A	58+75 to 61+25	-	3	-	4	10	48	S.I.	17	-	300	-	60	40	20	25	13	B	75	140	n/a	30	30	30 F/B/Y/T	Taxiway A
E19	Taxiway A	61+25 to 67+75	-	3	-	4	11	48	S.I.	18	-	250	-	50	30	15	20	10	B	75	110	25	24	24	24 F/B/Y/T	Taxiway A
E20	Taxiway A	67+75 to 71+00	-	3	-	4	11	48	S.I.	18	-	275	-	55	35	10	25	7	C	50	75	19	22	22	22 F/C/Y/T	Taxiway A
E21	Taxiway B Runup	Runup Apron	-	3	-	8	-	48	S.I.	11	-	150	-	25	-	10	30	7	C	25	25	9	n/a	9	9 F/C/Y/T	Taxiway B Runup
E22	Taxiway U Runup	Runup Apron	-	3	-	4	10	48	S.I.	17	-	200	-	40	20	12	25	8	C	60	75	23	22	22	22 F/C/Y/T	Taxiway U Runup
E23	TW J Runup	Runup Apron	-	3	-	4	11	48	S.I.	18	-	275	-	55	35	10	25	7	C	50	75	19	22	22	22 F/C/Y/T	TW J Runup
E24	Taxiway B	0+00 to 0+50	-	3	-	8	-	48	S.I.	11	-	350	-	80	-	30	40	20	A	75	110	n/a	27	27	27 F/A/Y/T	Taxiway B
E25	Taxiway B	0+50 to 1+75	-	3	-	8	-	48	S.I.	11	-	350	-	50	-	15	35	10	B	35	50	10	10	10	10 F/B/Y/T	Taxiway B
E26	Taxiway C	0+00 to 0+60	-	3	-	8	-	48	S.I.	11	-	350	-	80	-	18	30	12	B	45	60	15	13	13	13 F/B/Y/T	Taxiway C
E27	Taxiway C	0+60 to 1+75	-	4	-	8	-	48	S.I.	12	-	250	-	50	-	15	25	10	B	40	55	12	11	11	11 F/B/Y/T	Taxiway C
E28	Taxiway C (south)	0+25 to 1+75	-	3	-	12	-	48	S.I.	15	-	250	-	50	-	13	30	9	B	52	75	18	18	18	18 F/B/Y/T	Taxiway C (south)

Table 3-1 (continued)
Pavement Sections and Pavement Classification Number (PCN)
Truckee Tahoe Airport

Pavement Segment ID (See Plate 3-1)	Element	Station (See Plate 5-2)	Existing Pavement Section - inches								Existing Modulus of Elasticity (E) - ksi							Subgrade Strength		Bearing Capacity - Kips (for 1,200 annual Departures) (1 Kip = 1,000 lbs.)		PCN - Flexible or Rigid Section - (F or R) / (C or D) / Y / T			Pavement Classification Number PCN	Element
			PCC	AC	CTB	AB	ASB	Subgrade	S.I.	Total Section	PCC	AC	CTB	AB	ASB	Subgrade	S.I.	Estimated CBR	Subgrade Category	SW	DW	SW	DW	Use		
E29	Taxiway L	0+25 to 1+75	-	3	-	6	-	48	S.I.	9	-	300	-	70	-	20	30	13	B	35	52	10	10	10	10 F/B/Y/T	Taxiway L
E30	Taxiway D	0+00 to 1+00	-	3	-	8	-	48	S.I.	11	-	350	-	80	-	25	30	17	A	70	90	24	22	22	22 F/A/Y/T	Taxiway D
E31	Taxiway D	1+00 to 1+75	-	3	-	8	-	48	S.I.	11	-	250	-	60	-	15	20	10	B	35	50	10	10	10	10 F/B/Y/T	Taxiway D
E32	Taxiway D (south)	0+25 to 1+75	-	4	-	6	-	48	S.I.	10	-	350	-	70	-	20	25	13	B	35	52	10	10	10	10 F/B/Y/T	Taxiway D (south)
E33	Taxiway E	0+25 to 1+50	-	4	-	6	-	48	S.I.	10	-	350	-	80	-	20	25	13	B	35	52	10	10	10	10 F/B/Y/T	Taxiway E
E34	Taxiway F (south)	0+25 to 1+00	-	3	-	4	10	48	S.I.	17	-	300	-	70	50	20	25	13	B	75	140	n/a	30	30	30 F/B/Y/T	Taxiway F (south)
E35	Taxiway F (south)	1+00 to 1+75	-	3	-	8	-	48	S.I.	11	-	250	-	60	-	10	25	7	B	25	25	6	6	6	6 F/B/Y/T	Taxiway F (south)
E36	Taxiway F	0+00 to 0+75	-	3	-	4	10	48	S.I.	17	-	300	-	50	35	20	30	13	B	75	140	n/a	30	30	30 F/B/Y/T	Taxiway F
E37	Taxiway F	0+75 to 1+75	-	3	-	4	10	48	S.I.	17	-	300	-	70	50	25	35	17	A	75	190	n/a	46	46	46 F/A/Y/T	Taxiway F
E38	Taxiway M	0+25 to 1+25	-	3	-	4	10	48	S.I.	17	-	300	-	75	40	15	30	10	B	75	100	25	24	24	24 F/B/Y/T	Taxiway M
E39	Taxiway U	0+00 to 0+50	-	3	-	8	-	48	S.I.	11	-	300	-	75	-	15	25	10	B	35	50	10	10	10	10 F/B/Y/T	Taxiway U
E40	Taxiway U	0+50 to 2+00	-	3	-	4	10	48	S.I.	17	-	300	-	75	40	15	25	10	B	75	100	25	24	24	24 F/B/Y/T	Taxiway U
E41	Taxiway J	0+00 to 0+50	-	3	-	8	-	48	S.I.	11	-	300	-	75	-	20	30	13	B	47	65	15	14	14	14 F/B/Y/T	Taxiway J
E42	Taxiway J	0+50 to 2+00	-	3	-	4	10	48	S.I.	17	-	300	-	75	40	17	23	11	B	75	110	25	24	24	24 F/B/Y/T	Taxiway J
E43	Blast Pad RW 2	-2+00 to 0+00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						F/-/Y/T	Blast Pad RW 2
E44	Runway 2-20	0+00 to 7+50	-	6	-	6	-	48	S.I.	12	-	150	-	30	-	10	20	7	C	25	30	9	n/a	9	9 F/C/Y/T	Runway 2-20
E45	Runway 2-20	7+50 to 12+00	-	6	-	6	-	48	S.I.	12	-	200	-	40	-	12	20	8	C	32	42	12	10	10	10 F/C/Y/T	Runway 2-20
E46	Runway 2-20	12+00 to 14+00	-	4	-	8	-	48	S.I.	12	-	300	-	60	-	12	20	8	C	32	42	12	10	10	10 F/C/Y/T	Runway 2-20
E47	Runway 2-20	15+00 to 17+00	-	4	-	8	-	48	S.I.	12	-	300	-	60	-	12	20	8	C	32	42	12	10	10	10 F/C/Y/T	Runway 2-20
E48	Runway 2-20	17+00 to 30+50	-	5	-	5	-	48	S.I.	10	-	250	-	50	-	12	20	8	C	25	25	9	n/a	9	9 F/C/Y/T	Runway 2-20
E49	Runway 2-20	30+50 to 46+54	-	5	-	5	-	48	S.I.	10	-	250	-	50	-	12	20	8	C	25	25	9	n/a	9	9 F/C/Y/T	Runway 2-20
E50	Blast Pad RW 20	46+54 to 48+60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						F/-/Y/T	Blast Pad RW 20
E51	Taxiway G	-0+40 to 9+00	-	6	-	6	-	48	S.I.	12	-	150	-	30	-	10	20	7	C	25	30	9	n/a	9	9 F/C/Y/T	Taxiway G
E52	Taxiway G	9+00 to 11+00	-	6	-	6	-	48	S.I.	12	-	150	-	30	-	10	20	7	C	25	30	9	n/a	9	9 F/C/Y/T	Taxiway G
E53	Taxiway G	13+50 to 14+25	-	4	-	8	-	48	S.I.	12	-	300	-	60	-	12	20	8	C	32	42	12	10	10	10 F/C/Y/T	Taxiway G
E54	Taxiway G	15+25 to 44+50	-	5	-	5	-	48	S.I.	10	-	350	-	80	-	15	25	10	B	30	40	8	7	7	7 F/B/Y/T	Taxiway G
E55	Taxiway G	44+50 to 47+25	-	6	-	6	-	48	S.I.	12	-	200	-	40	-	15	30	10	B	40	55	12	11	11	11 F/B/Y/T	Taxiway G

Table 3-1 (continued)
Pavement Sections and Pavement Classification Number (PCN)
Truckee Tahoe Airport

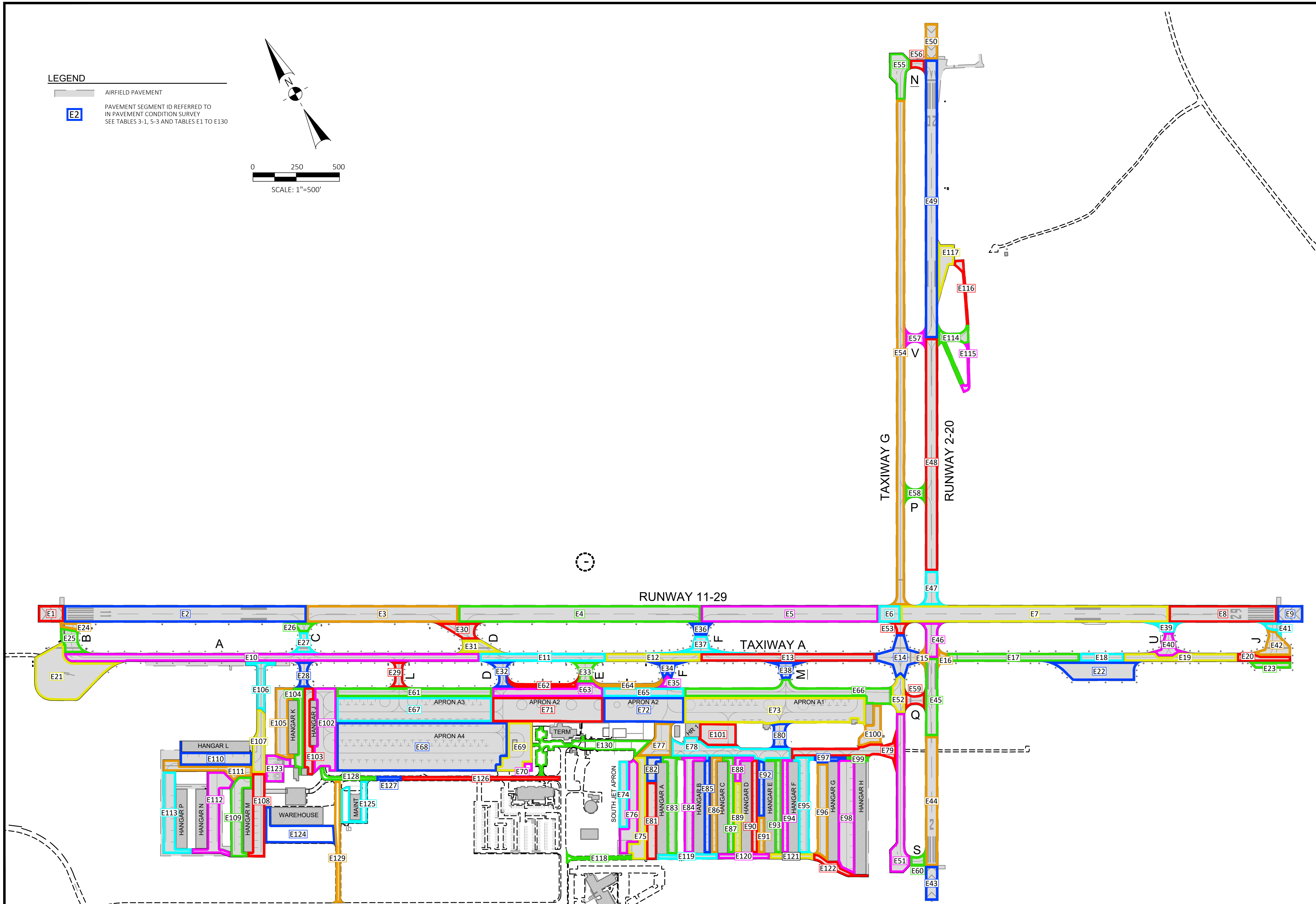
Pavement Segment ID (See Plate 3-1)	Element	Station (See Plate 5-2)	Existing Pavement Section - inches								Existing Modulus of Elasticity (E) - ksi							Subgrade Strength		Bearing Capacity - Kips (for 1,200 annual Departures) (1 Kip = 1,000 lbs.)		PCN - Flexible or Rigid Section - (F or R) / (C or D) / Y / T			Pavement Classification Number PCN	Element
			PCC	AC	CTB	AB	ASB	Subgrade	S.I.	Total Section	PCC	AC	CTB	AB	ASB	Subgrade	S.I.	Estimated CBR	Subgrade Category	SW	DW	SW	DW	Use		
E56	Taxiway N	0+00 to 1+00	-	6	-	6	-	48	S.I.	12	-	300	-	70	-	15	30	10	B	40	55	12	11	11	11 F/B/Y/T	Taxiway N
E57	Taxiway V	0+00 to 1+25	-	3	-	6	-	48	S.I.	9	-	200	-	30	-	7	20	5	C	8	n/a	3	n/a	3	3 F/C/Y/T	Taxiway V
E58	Taxiway P	0+00 to 1+25	-	3	-	6	-	48	S.I.	9	-	250	-	60	-	10	20	7	C	15	n/a	5	n/a	5	5 F/C/Y/T	Taxiway P
E59	Taxiway Q	0+00 to 1+25	-	3	-	6	-	48	S.I.	9	-	250	-	60	-	8	20	5	C	8	n/a	3	n/a	3	3 F/C/Y/T	Taxiway Q
E60	Taxiway S	0+00 to 1+00	-	6	-	6	-	48	S.I.	12	-	300	-	70	-	12	20	8	C	32	42	12	10	10	10 F/C/Y/T	Taxiway S
E61	Taxilane Q (Ramp)	T/L Q 24+50 to 37+00 (Apron A3)	-	3	-	6	-	S.I.	-	9	-	350	-	70	-	25	-	17	A	45	60	13	12	12	12 F/A/Y/T	Taxilane Q (Ramp)
E62	Taxilane Q (Ramp)	Apron A2 (north expansion)	-	3	-	6	8	48	S.I.	17	-	300	-	60	40	12	25	8	C	60	75	23	22	22	22 F/C/Y/T	Taxilane Q (Ramp)
E63	Taxilane Q (Ramp)	T/L Q 16+25 to 25+50 (Apron A2)	-	4	-	6	-	48	S.I.	10	-	350	-	70	-	20	25	13	B	35	52	10	10	10	10 F/B/Y/T	Taxilane Q (Ramp)
E64	Taxilane Q (Ramp)	Apron A2 (north expansion)	-	3	-	6	8	48	S.I.	17	-	350	-	75	60	15	25	10	B	75	100	25	24	24	24 F/B/Y/T	Taxilane Q (Ramp)
E65	Taxilane Q (Ramp)	T/L Q 12+50 to 16+25 (Apron A2)	-	4	-	6	-	48	S.I.	10	-	250	-	60	-	22	30	15	A	44	60	13	12	12	12 F/A/Y/T	Taxilane Q (Ramp)
E66	Taxilane Q (Ramp)	T/L Q 0+50 to 12+50 (Apron A1)	-	4	-	6	-	48	S.I.	10	-	200	-	40	-	12	20	8	C	25	25	9	n/a	9	9 F/C/Y/T	Taxilane Q (Ramp)
E67	Apron A3	Apron A3	-	3	-	6	-	48	S.I.	9	-	150	-	30	-	20	25	13	B	35	52	10	10	10	10 F/B/Y/T	Apron A3
E68	Apron A4	Apron A4	-	3	-	9	-	48	S.I.	12	-	250	-	50	-	15	25	10	B	40	55	12	11	11	11 F/B/Y/T	Apron A4
E69	Fuel Island	Self Serve Fuel Island	-	3	-	9	-	48	S.I.	12	-	250	-	50	-	12	25	8	C	32	42	12	10	10	10 F/C/Y/T	Fuel Island
E70	Wash Rack*	Concrete Wash Rack	6	-	-	8	-	48	S.I.	14	3,000*	-	-	75*	-	12*	25*	8	C	40	55	13	14	13	13 R/C/Y/T	Wash Rack*
E71	Apron A2	Apron A2 (west)	-	3.5	-	6	-	48	S.I.	10	-	350	-	70	-	13	20	9	B	27	32	7	6	6	6 F/B/Y/T	Apron A2
E72	Apron A2	Apron A2 (east)	-	3.5	-	6	-	48	S.I.	10	-	200	-	40	-	13	25	9	B	27	32	7	6	6	6 F/B/Y/T	Apron A2
E73	Apron A1	Apron A1	-	3.5	-	6	-	48	S.I.	10	-	150	-	30	-	10	20	7	C	15	n/a	5	n/a	5	5 F/C/Y/T	Apron A1
E74	South Jet Apron	All	-	3	-	6	8	48	S.I.	17	-	350	-	75	50	15	30	10	B	75	100	25	24	24	24 F/B/Y/T	South Jet Apron
E75	South Jet Apron	All	-	3	-	6	8	48	S.I.	17	-	200	-	40	20	8	20	5	C	35	45	13	11	11	11 F/C/Y/T	South Jet Apron
E76	South Jet Apron	All	-	3	-	6	8	48	S.I.	17	-	250	-	50	40	12	25	8	C	60	75	23	22	22	22 F/C/Y/T	South Jet Apron
E77	South Jet Apron Connector	All	-	3	-	6	8	48	S.I.	17	-	250	-	50	40	12	25	8	C	60	75	23	22	22	22 F/C/Y/T	South Jet Apron Connector
E78	Taxilane R	6+50 to 13+50	-	4	-	6	5	48	S.I.	15	-	350	-	60	30	15	20	10	B	60	80	21	20	20	20 F/B/Y/T	Taxilane R
E79	Taxilane R	0+00 to 6+50	-	4	-	6	5	48	S.I.	15	-	250	-	40	20	10	15	7	C	40	55	15	14	14	14 F/C/Y/T	Taxilane R
E80	Taxiway M	All	-	4	-	6	5	48	S.I.	15	-	250	-	40	20	10	15	7	C	40	55	15	14	14	14 F/C/Y/T	Taxiway M

Table 3-1 (continued)
Pavement Sections and Pavement Classification Number (PCN)
Truckee Tahoe Airport

Pavement Segment ID (See Plate 3-1)	Element	Station (See Plate 5-2)	Existing Pavement Section - inches								Existing Modulus of Elasticity (E) - ksi							Subgrade Strength		Bearing Capacity - Kips (for 1,200 annual Departures) (1 Kip = 1,000 lbs.)		PCN - Flexible or Rigid Section - (F or R) / (C or D) / Y / T			Pavement Classification Number PCN	Element
			PCC	AC	CTB	AB	ASB	Subgrade	S.I.	Total Section	PCC	AC	CTB	AB	ASB	Subgrade	S.I.	Estimated CBR	Subgrade Category	SW	DW	SW	DW	Use		
E81	Hangar A (west)	All	-	3	-	6	-	48	S.I.	9	-	250	-	50	-	10	15	7	C	15	n/a	5	n/a	5	5 F/C/Y/T	Hangar A (west)
E82	Hangar A (west)	All	-	3	-	6	-	48	S.I.	9	-	350	-	70	-	12	20	8	C	20	n/a	7	n/a	7	7 F/C/Y/T	Hangar A (west)
E83	Hangar A (east)	All	-	3	-	6	-	48	S.I.	9	-	200	-	40	-	12	15	8	C	20	n/a	7	n/a	7	7 F/C/Y/T	Hangar A (east)
E84	Hangar B (west)	All	-	3	-	6	-	48	S.I.	9	-	250	-	50	-	8	20	5	C	8	n/a	3	n/a	3	3 F/C/Y/T	Hangar B (west)
E85	Hangar B (east)	All	-	3	-	6	-	48	S.I.	9	-	250	-	50	-	12	20	8	C	20	n/a	7	n/a	7	7 F/C/Y/T	Hangar B (east)
E86	Hangar C (west)	All	-	3	-	6	-	48	S.I.	9	-	250	-	50	-	10	20	7	C	15	n/a	5	n/a	5	5 F/C/Y/T	Hangar C (west)
E87	Hangar C (east)	All	-	2	-	7	-	48	S.I.	9	-	150	-	30	-	10	20	7	C	15	n/a	5	n/a	5	5 F/C/Y/T	Hangar C (east)
E88	Hangar D (west)	All	-	2	-	7	-	48	S.I.	9	-	150	-	30	-	10	20	7	C	15	n/a	5	n/a	5	5 F/C/Y/T	Hangar D (west)
E89	Hangar D (west)	All	-	2	-	7	-	48	S.I.	9	-	250	-	50	-	10	15	7	C	15	n/a	5	n/a	5	5 F/C/Y/T	Hangar D (west)
E90	Hangar D (east)	All	-	3	-	6	-	48	S.I.	9	-	250	-	50	-	10	20	7	C	15	n/a	5	n/a	5	5 F/C/Y/T	Hangar D (east)
E91	Hangar E (west)	All	-	3	6	-	-	48	S.I.	9	-	200	100	-	-	15	25	10	B	25	n/a	6	n/a	6	6 F/B/Y/T	Hangar E (west)
E92	Hangar E (west)	All	-	3	6	-	-	48	S.I.	9	-	150	80	-	-	8	20	5	C	8	n/a	3	n/a	3	3 F/C/Y/T	Hangar E (west)
E93	Hangar E (east)	All	-	3	-	18	-	48	S.I.	21	-	250	-	50	-	8	35	5	C	50	65	19	17	17	17 F/C/Y/T	Hangar E (east)
E94	Hangar F (west)	All	-	3	-	6	-	48	S.I.	9	-	250	-	50	-	8	20	5	C	8	n/a	3	n/a	3	3 F/C/Y/T	Hangar F (west)
E95	Hangar F (east)	All	-	3	-	6	-	48	S.I.	9	-	250	-	50	-	15	20	10	B	25	n/a	6	n/a	6	6 F/B/Y/T	Hangar F (east)
E96	Hangar G (west)	All	-	3	6	-	8	48	S.I.	17	-	250	500	-	40	15	25	10	B	75	100	25	24	24	24 F/B/Y/T	Hangar G (west)
E97	Hangar G (west)	All	-	3	6	-	8	48	S.I.	17	-	150	100	-	20	15	20	10	B	75	100	25	24	24	24 F/B/Y/T	Hangar G (west)
E98	Hangar G/H	All	-	3	6	-	8	48	S.I.	17	-	200	400	-	40	12	25	8	C	60	75	23	22	22	22 F/C/Y/T	Hangar G/H
E99	Hangar G/H	All	-	3	-	6	8	48	S.I.	17	-	150	-	60	20	8	15	5	C	35	45	13	11	11	11 F/C/Y/T	Hangar G/H
E100	EAA Hangar	All	-	3	-	3	8	48	S.I.	14	-	350	-	75	50	10	15	7	C	35	50	13	12	12	12 F/C/Y/T	EAA Hangar
E101	Hangar 1 Ramp	All	-	3	-	5	9	48	S.I.	17	-	250	-	50	30	10	25	7	C	50	60	19	15	15	15 F/C/Y/T	Hangar 1 Ramp
E102	Hangar J (east)	All	-	3	12	-	-	48	S.I.	15	-	200	100	-	-	15	30	10	B	60	80	21	20	20	20 F/B/Y/T	Hangar J (east)
E103	Hangar J (west)	All	-	3	12	-	-	48	S.I.	15	-	350	200	-	-	15	30	10	B	60	80	21	20	20	20 F/B/Y/T	Hangar J (west)
E104	Hangar K (east)	All	-	3	12	-	-	48	S.I.	15	-	350	200	-	-	20	35	13	B	75	110	25	24	24	24 F/B/Y/T	Hangar K (east)
E105	Hangar K (west)	All	-	3	12	-	-	48	S.I.	15	-	300	100	-	-	20	28	13	B	75	110	25	24	24	24 F/B/Y/T	Hangar K (west)

Table 3-1 (continued)
Pavement Sections and Pavement Classification Number (PCN)
Truckee Tahoe Airport

Pavement Segment ID (See Plate 3-1)	Element	Station (See Plate 5-2)	Existing Pavement Section - inches								Existing Modulus of Elasticity (E) - ksi							Subgrade Strength		Bearing Capacity - Kips (for 1,200 annual Departures) (1 Kip = 1,000 lbs.)		PCN - Flexible or Rigid Section - (F or R) / (C or D) / Y / T			Pavement Classification Number PCN	Element
			PCC	AC	CTB	AB	ASB	Subgrade	S.I.	Total Section	PCC	AC	CTB	AB	ASB	Subgrade	S.I.	Estimated CBR	Subgrade Category	SW	DW	SW	DW	Use		
E106	Taxilane T	0+00 to 3+00	-	5	-	10	-	48	S.I.	15	-	250	-	60	-	12	35	8	C	45	65	17	17	17	17 F/C/Y/T	Taxilane T
E107	Taxilane T*	3+00 to 6+75	-	5	-	10	-	48	S.I.	15	-	250	-	60	-	12	35	8	C	45	65	17	17	17	17 F/C/Y/T	Taxilane T*
E108	Hangar M (east)	All	-	4	-	10	-	48	S.I.	14	-	250	-	60	-	12	35	8	C	45	65	17	17	17	17 F/C/Y/T	Hangar M (east)
E109	Hangar M (west)	All	-	3	-	6	-	48	S.I.	9	-	350	-	80	-	10	25	7	C	15	n/a	5	n/a	5	5 F/C/Y/T	Hangar M (west)
E110	Hangar L*	All	-	4	-	10	-	48	S.I.	14	-	350	-	100	-	20	30	13	B	70	100	24	24	24	24 F/B/Y/T	Hangar L*
E111	Hangar L	All	-	3	-	6	8	48	S.I.	17	-	300	-	60	30	13	30	9	B	67	85	24	21	21	21 F/B/Y/T	Hangar L
E112	Hangar N	All	-	3	-	6	8	48	S.I.	17	-	350	-	75	30	13	30	9	B	67	85	24	21	21	21 F/B/Y/T	Hangar N
E113	Hangar P	All	-	3	-	6	8	48	S.I.	17	-	250	-	50	30	13	30	9	B	67	85	24	21	21	21 F/B/Y/T	Hangar P
E114	Gliderport	All	-	3	-	6	-	48	S.I.	9	-	250	-	60	-	8	25	5	C	8	n/a	3	n/a	3	3 F/C/Y/T	Gliderport
E115	Gliderport	All	-	3	-	6	-	48	S.I.	9	-	150	-	30	-	5	20	3	D	6	n/a	3	n/a	3	3 F/D/Y/T	Gliderport
E116	Gliderport	All	-	3	-	6	-	48	S.I.	9	-	150	-	30	-	6	20	4	D	6	n/a	3	n/a	3	3 F/D/Y/T	Gliderport
E117	Gliderport	All	-	3	-	6	-	48	S.I.	9	-	250	-	60	-	6	25	4	D	6	n/a	3	n/a	3	3 F/D/Y/T	Gliderport
E118	Road - Hangars A-H*	0+00 to 4+50	-	4	-	5	-	48	S.I.	9	-	100	-	30	-	10	18	7	C	15	n/a	5	n/a	5	5 F/C/Y/T	Road - Hangars A-H*
E119	Road - Hangars A-H	5+25 to 8+75	-	3	-	6	-	48	S.I.	9	-	250	-	50	-	12	20	8	C	20	n/a	7	n/a	7	7 F/C/Y/T	Road - Hangars A-H
E120	Road - Hangars A-H	8+75 to 11+75	-	2	-	7	-	48	S.I.	9	-	200	-	30	-	12	25	8	C	20	n/a	7	n/a	7	7 F/C/Y/T	Road - Hangars A-H
E121	Road - Hangars A-H	11+75 to 14+25	-	2	-	7	-	48	S.I.	9	-	250	-	50	-	20	30	13	B	35	52	10	10	10	10 F/B/Y/T	Road - Hangars A-H
E122	Road - Hangars A-H	14+25 to 18+00	-	3	6	-	8	S.I.	-	17	-	200	300	-	40	40	-	27	A	75	200	n/a	50	50	50 F/A/Y/T	Road - Hangars A-H
E123	Med Services Apron*	All	-	4	-	6	8	48	S.I.	18	-	350*	-	75*	40*	12*	35*	8	C	65	85	25	25	25	25 F/C/Y/T	Med Services Apron*
E124	Warehouse	All	-	3	-	7	-	48	S.I.	10	-	350	-	75	-	13	20	9	B	27	32	7	6	6	6 F/B/Y/T	Warehouse
E125	Maintenance Building*	All	-	4	-	7	-	48	S.I.	11	-	200	-	50	-	10	25	7	C	25	25	9	n/a	9	9 F/C/Y/T	Maintenance Building*
E126	Chandelle Way	0+00 to 9+00	-	3	-	7	-	48	S.I.	10	-	300	-	75	-	15	25	10	B	30	40	8	7	7	7 F/B/Y/T	Chandelle Way
E127	Chandelle Way	9+00 to 10+50	-	3	-	7	-	48	S.I.	10	-	200	-	50	-	13	25	9	B	27	32	7	6	6	6 F/B/Y/T	Chandelle Way
E128	Chandelle Way	10+50 to 13+75	-	3	-	7	-	48	S.I.	10	-	350	-	75	-	13	20	9	B	27	32	7	6	6	6 F/B/Y/T	Chandelle Way
E129	Aviation Way	All	-	3	-	8	-	48	S.I.	11	-	350	-	100	-	12	25	8	C	28	32	10	9	9	9 F/C/Y/T	Aviation Way
E130	Terminal Parking and Road	All	-	3	-	8	-	48	S.I.	11	-	250	-	60	-	15	20	10	B	35	50	10	10	10	10 F/B/Y/T	Terminal Parking and Road



BRADLEY ENGINEERING

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TRUCKEE TAHOE AIRPORT
2020 PAVEMENT MANAGEMENT PLAN
PAVEMENT SEGMENT IDENTIFICATION - PCN

DATE	4/15/2021
DRAWN	KDC
CHECKED	DB
FILE	4004-20.areas
SCALE	1"=500'
PLATE No.	3-1

CHAPTER 4. ANALYSIS AND EVALUATION

4-1 Distress Mode

There are two major distress types that lead to failure and/or deterioration of an airfield pavement. These are deep-seated distress and surface distress.

Deep-seated distress is distress in the lower sections of the pavement section and the subgrade and subsoil beneath the pavement section and is caused by repeated stresses induced by aircraft movement on the surface of the pavement. Deep-seated distress can lead to complete failure of the pavement section, foundation soils, or both.

Surface distress is caused by traffic, age, and environmental factors including temperature, temperature changes, moisture, and frost action. Surface distress causes deterioration of the surface pavement layer including cracking, spalling, raveling, bleeding, and shoving. These distresses can be caused by deep-seated distress or surface distress caused by load, environmental factors, and quality of pavement, or a combination of the factors.

4-2 Deep-Seated Distress

A pavement does not suddenly fail under load unless it is grossly overloaded. Load limits for infrequent use need to be applied to the pavements to avoid collapse of the aircraft through the pavement section. The failures that generally occur are fatigue-type failures where distresses develop to a point that rutting and accompanying failure of the pavement section occurs. It is important in developing a Pavement Maintenance/Management Plan (PMMP) to determine the time at which failure of the section caused by deep-seated distress will begin to occur under forecast loadings. Several methods have been developed over the past 70 years for utilizing a Fatigue Analysis methodology to forecast remaining life of pavements under forecast loads. The degree of success has been varied depending on the method used. The BRANDLEY Fatigue Analysis methodology has a successful 60-year performance record, showing a 90 to 95 percent accuracy in predicting remaining pavement life. FAA’s FAARFIELD methodology, as detailed in this chapter, has not proven to provide accurate forecasts of remaining pavement section life. The BRANDLEY Fatigue Analysis methodology is utilized in this study.

4-2.1 Back Calculated Modulus of Elasticity

Prior to the development of the computer, it was not possible to calculate stresses, strains, and deflections under loaded pavement sections at various depths in a section using a multi-layered system. As a result, the early methods of fatigue analysis utilized deflections of pavement surface, subgrade surface, or other locations measured under full-scale load tests as the failure criteria. With the development of the computer, it was possible to calculate stresses, strains and deflections at the surface and all depths below in a multi-layer system. The basic soils and pavement parameters that were necessary for this computation are Modulus of Elasticity, Poisson's Ratio, and thickness of each layer in the system.

With the development of the heavy-duty falling weight deflectometer equipment and the heavy-duty vibratory load test equipment, it became possible to measure deflections of the pavement surface under load and to establish the size and shape of the deflection bowl caused by the applied loads. Using the deflection bowl data and the computer program for multi-layer systems, it is possible to back calculate values of Modulus of Elasticity for each layer of the system. Poisson's Ratio is not a critical parameter and values of Poisson's Ratio can be adequately estimated for each type material in each layer. As a result of this development, full-scale load tests are no longer required, and the basic soil parameters can be developed from the results of heavy-duty falling weight deflectometer tests or vibratory load tests along with pavement section thickness data.

Modulus of Elasticity and Poisson's Ratio of each layer and the thickness of each layer of the pavement section, the subgrade materials, and various layers of subsoil were obtained in this study and utilized with the Brandley Fatigue Analysis.

4-2.2 Forecast Traffic

Forecast traffic, including type aircraft, type gear, operating load, annual operations, and distribution on the pavement, is a parameter that must be utilized in any fatigue analysis. This data must be converted to coverages, which is the number of wheels per year crossing a given point on the pavement. The forecast traffic at Truckee Tahoe Airport for each pavement section is included as the Traffic Index for each section of pavement in Table No. 2-2. These traffic indexes represent the total operations of each category of aircraft on each section of pavement. For input into the Brandley Fatigue Analysis methodology, these operations are converted to coverages to represent the distribution of aircraft tires on the pavement section in each segment.

4-2.3 Existing Pavement Sections

Thickness and type of material of each pavement section and each layer of subgrade and subsoil under the pavement section are important factors to input into any fatigue analysis. The pavement section data for each pavement section are included in Appendix E.

4-2.4 Considered Rehabilitation Sections

Fatigue Analysis methodology not only provides a forecast remaining pavement life under forecast traffic for a given pavement section, but can also forecast extended pavement life after different rehabilitation or reconstruction processes have taken place. It is, therefore, important to not only evaluate the existing pavement sections for forecasted remaining life, but to apply feasible rehabilitation methods to the existing pavement sections and calculate forecast extended life due to the rehabilitation process. It is important to prepare this evaluation for different rehabilitation processes that would be feasible at this airport in order to prepare a cost-benefit analysis to evaluate the most acceptable rehabilitation program for the pavement section. A series of rehabilitation processes that are considered feasible for this airport have been prepared and are included in Table No. 4-1. Where applicable, each of these rehabilitation procedures was evaluated using the Fatigue Analysis Methodology and selected based on a cost-benefit analysis.

4-2.5 Fatigue Analysis – Deep-Seated Distress

4-2.5.1 <u>BRANDLEY Fatigue Analysis – Remaining Life Analysis</u>

In 1948, as research for a doctoral thesis at Harvard University Graduate School of Engineering, Reinard W. Brandley developed the BRANDLEY Fatigue Analysis method of evaluating airfield pavements. This Fatigue Analysis was developed using full-scale load tests conducted by the Corps of Engineers near the end of World War II on various airports for the purpose of developing design criteria for pavements to serve the larger military aircraft that were being developed. The failure criterion that was used in this analysis was limiting subgrade deflection under design traffic. Measured deflections were used at that time since the computer had not been developed and the stresses, strains, and deflections in multi-layered systems could not be calculated. This Fatigue Analysis methodology and failure criteria has been utilized on many airports. However, the method of determining deflections of the surface of the subgrade has changed from direct measurement to calculating these deflections using layer thicknesses and the Modulus of Elasticity and Poisson's Ratio of each layer, which have been back calculated from the data obtained from the falling weight deflectometer tests. From the Fatigue Analysis, forecasts of remaining pavement life, so far as deep-seated distress is concerned, were calculated for each pavement section.

Since the original research was conducted on flexible pavements, it was anticipated that a separate failure criterion would be required for rigid pavement sections. Experience and comparison with actual performance show that the failure criteria used for flexible pavements is the same for rigid pavements and there was no change required in the failure criteria.

A comparison of forecast pavement life and time for failure under the forecast traffic over the past 60 years has shown excellent correlation between forecast life and actual time to failure. The forecast life has always been within 90 to 110 percent of the actual life of the section when actual traffic on the section was the same as that used in the analysis.

Plate 4-1 shows the remaining life of the pavements expected to fail under deep-seated distress in the subgrade layer using the forecast traffic. The remaining life analysis for the subgrade layer is the critical item for the areas of pavement that have less than 20 years of remaining life. Plate 4-2 shows the remaining life of the pavements expected to fail under deep-seated distress in the subgrade layer using the “enhanced traffic”. The “enhanced traffic” indexes provide information on how the remaining pavement life changes if the number of aircraft operations of aircraft greater than 48,000 lbs. is double that of the “forecast traffic.”

The remaining life data shown is for “forecast” or “enhanced” traffic on each section. If traffic varies from forecast, then remaining life of the section subjected to the new traffic can be re-calculated using existing data obtained in this study for Modulus of Elasticity and thickness of each layer of the pavement section.

Any analysis that showed a remaining pavement life of a section of more than 20 years has been indicated as 20+ years. Other factors such as weathering, maintenance, etc., over a 20-year period can have a significant influence on the performance of a pavement. It is recommended that a complete reevaluation of pavement performance, including falling weight deflectometer testing and Fatigue Analysis, be conducted every 10 years to evaluate unforeseen changes and to update the recommended maintenance and rehabilitation schedules.

4-2.5.2 FAARFIELD Airport Pavement Design – Remaining Life Analysis

The FAA has recently developed a program called “FAARFIELD” to design and evaluate airfield pavements, including a remaining life analysis. A comparative study of the BRANDLEY Fatigue

Analysis and the FAARFIELD systems was made on some airport pavements that have actually failed after they had been tested. In this analysis the same traffic, pavement section, Modulus of Elasticity values, and Poisson's Ratio values for each layer were used in both the BRANDLEY Fatigue Analysis and the FAARFIELD analysis. At each location Air Traffic Control Tower records indicated that the forecast traffic for aircraft type and operation matched the actual traffic experienced. The results of this study are tabulated below:

Airport	Facility	Forecast Remaining Life (Years) (Deep-Seated Distress Only)		Actual Life*
		BRANDLEY	FAARFIELD	
Sacramento International Airport	Runway 16L-34R	5	0.25	5.1
Stockton Metropolitan Airport	Runway 11-29	6 to 8	22	7
Nashville International Airport	Existing Apron Taxiway	3	0.1	3
Truckee-Tahoe Airport	Runway 11-29 (East)	16	1	10+**

*Number of years to actual failure.
**This section of the runway performed under forecast loading for 8 to 10 years with no sign of deep-seated distress. According to FAARFIELD it should have had structural failure 7 to 9 years earlier. This 2020 study indicates this section is forecast for failure in 2029.

A few select areas of pavement at Truckee Tahoe Airport were selected and analyzed with both the BRANDLEY Fatigue Analysis and with FAARFIELD for this study. The summary of the results are tabulated below for comparison purposes:

Pavement Element	Station	Forecast Remaining Life (Years) (Deep-Seated Distress Only)	
		BRANDLEY	FAARFIELD
Runway 11-29 (west)	23+00 to 37+00	57	2,490
Runway 11-29 (east)	48+75 to 64+25	11	4
Taxiway A	0+00 to 24+00	9	3
Runway 2-20	17+00 to 30+50	36	150
Taxiway G	9+00 to 11+00	45	101
Apron A1	See Plate 5-1 & 5-2	14	0.5
Apron A2 (west)	See Plate 5-1 & 5-2	6	1.6
Hangar C (east)	See Plate 5-1 & 5-2	47	11
Warehouse	See Plate 5-1 & 5-2	10	2

Due to the long, accurate performance record of the BRANDLEY Fatigue Analysis methodology and the large discrepancies with the FAARFIELD method and short performance record of FAARFIELD, all maintenance and rehabilitation recommendations in this report are based on data obtained from the BRANDLEY analysis.

A detailed fatigue analysis was conducted using each type of rehabilitation and overlay considered appropriate and the extended pavement life was calculated. Taking this extended life for each section into account, the recommended pavement maintenance program was prepared. The recommended pavement rehabilitation method used was based on a cost-benefit analysis, construction timing and difficulties, and availability of funding.

Several recommended rehabilitation procedures for deep-seated distress with estimated unit costs for each procedure are presented in Table 4-1. The rehabilitation plan for the next 20-year period to protect against deep-seated distress only is included in Table No. 4-2.

4-3 Surface Distress

4-3.1 Pavement Condition Index (PCI)

Surface distress in the pavements is not necessarily caused by deep-seated distress, nor does it forecast when the pavement section will fail. Surface distress generally is caused by inadequate quality of the pavement materials, traffic, age, and/or environmental factors such as temperature, moisture, and temperature changes between day and night and summer and winter. These defects show up as cracking, raveling, weathering, swelling, rutting, and PCC slab shattering. Rutting can be caused by deep-seated distress and failure of the section or associated with flushing or shoving of an asphalt mix.

The pavement condition is determined by visual inspection of the surface of the pavement as described previously. A Pavement Condition Index (PCI) can be determined for each segment to indicate the degree of distress. A typical plot of PCI vs. Time is included as Plate No. 4-3. On this plate a typical pavement index plot for asphalt concrete pavement and for Portland cement concrete pavement is shown. In both diagrams the PCI gradually decreases with time and when it reaches a certain point, it decreases at a much faster rate. The gradual decreasing portion of the curve indicates surface distress only. The sharp break off is generally caused by deep-seated distress. There is no way to predict when the deep-seated distress or failure of the section is going to occur using only the PCI and, therefore, it is not possible to predict with only the PCI when major rehabilitation or reconstruction will be required. If one waits until the PCI vs. Time curve shows deep-seated distress at the sharp break off, then failure has already occurred and it is not possible to extend the life of the section by overlays or adding to the surface of the existing pavement section. As a result, the Pavement Condition Index (PCI) cannot be successfully used to predict deep-seated distresses and failures but is effective in determining when surface rehabilitation and repairs are necessary.

Surface distress results in deterioration of the surface course. This distress shows up as cracks in the pavement, including transverse cracking, longitudinal cracking, block cracking, map cracking, secondary cracking, raveling, weathering, patching, or damage to the surface caused by jet blast or oil and chemical spillage. Each of these deficiencies can be treated so as to provide safe operation of the airport, but with time it will become more cost effective to completely rehabilitate or reconstruct the section. The timing of repair of cracks or other defects will be a function of cost benefit and availability of funds.

The typical rehabilitation procedures recommended for surface distress at the Truckee Tahoe Airport are shown in Table No. 4-3.

The new and old Pavement Condition Index values for each segment of pavement are presented in this report. The results of the updated study not only identify surface defects, but changes in PCI values of each pavement section since the original study. It is noted that the PCI increased dramatically on all sections rehabilitated in since 2011 and decreased in all other sections.

4-3.2 Thermal Stresses

Surface cracking can be caused by thermal stresses in the pavement. These stresses are created by large changes in temperature of the pavement from day to night and summer to winter. Over time these temperature variations combined with the oil in the asphalt becoming old and brittle can cause cracking of an asphalt pavement. With airports in the higher altitudes of the Sierra Nevada Mountain Range, large temperature changes occur between night and day and summer and winter. These large temperature changes cause thermal stresses to build up in the asphalt pavement section, which generally results in cracking of the pavements, both longitudinal and transverse. Early cracking will be transverse cracks at 500-to-800-foot centers. Additional cracks will then form in between and ultimately it will end up with a block cracking at 15-to-20-foot centers. If not sealed, these cracks will become wider each year and, in some instances, have been observed to be 3 to 5 inches wide.

Recently a polymer-modified asphalt has been developed that provides an asphalt pavement that will withstand or delay thermal cracking. Experience has been limited and has shown no thermal cracking in the pavement after 10 to 12 years from the time that it was placed. All new pavements at Truckee Tahoe Airport should be constructed using the polymer-modified asphalt.

Performance of new pavements using polymer-modified asphalt has been limited to 12 to 14 years. It is not known whether or not thermal cracking will occur in these pavements after that time, so in the PMMP an item to install a joint system after approximately 14 years has been included but will only be used if needed.

Sealing of the cracks in flexible pavement sections is an important maintenance procedure since it resists spalling or raveling of the pavement immediately adjacent to the cracks and inhibits the entry of storm water into the underlying aggregate base course. It is recommended that all cracks to be sealed be prepared for sealing by routing a section to provide a depth to width ratio of the sealant of no more than 1 to 1. This will also require the installation of a backer rod below the sealant to keep the sealant from filling the bottom section of the crack. The sealant should include a “Band Aid” on the top of the pavement over the seal extending 1-inch minimum beyond the edge of the prepared repair on each side of the crack. The thickness of the “Band Aid” should be 1/8”. A typical section of a crack seal repair is shown on Plate 4-4.

A surface sealant on the asphalt pavement should be considered when the weathering and development of fine cracks has developed to a point that it has a detrimental effect on the life of the pavement and the surface condition. This sealant can consist of Reclamite, slurry seal, an SS1h fog seal or other suitable materials as determined by the engineer at the time of a surface sealing project.

4-4 Frost Action

Frost action can cause significant heaving of pavement sections and distress during the spring thaw due to trapping of water within the base course above the frozen layer.

If the frost line penetrates and remains for a significant period of time in a frost-susceptible soil, frost-heave will occur, which is caused by the formation of ice lenses at the bottom of the frozen layer. This heave can have a serious effect on rideability of the pavement until it melts and the surface returns to approximately the same elevation as before the frost. During the spring thaw the frozen soil and ice lenses will thaw and the soil above the remaining frozen layer will become super-saturated, which will decrease the strength of this material.

Instrumentation installed on February 9, 2011, has shown that there was no frost penetration after that time deeper than 6 inches below the surface of the pavement, which would not cause a serious problem with the strength of the section during spring thaw. The sensors are still in place, but have had a failure in the datalogger, thus new data has not been collected. It is anticipated to correct the datalogger problem and collect additional data in the future.

Based on past experience it is expected that frost may penetrate up to depths of 10 to 15 inches provided zebra striping is used for all marking. With a 15-inch depth of frost penetration there would be little effect on the strength of the pavement section during the spring thaw. However, if frost penetrates deeper, there would be a weakened condition during the spring thaw. If that weakened condition occurs due to depth of frost penetration, then the effect can be mitigated during the spring thaw period by:

- Placing a thicker pavement section, which will support the heavier aircraft.
- Using Frost-Free materials in the aggregate base subbase course layers.
- Restricting the size of aircraft that can use the airport during this period.

The spring thaw would normally be a fairly short period of time.

Pavements at the Truckee Tahoe Airport have not shown any signs of frost heave, except for a few hangar rows where the buildings provide shade on the pavements and therefore the surface does not warm up and thaw the underlying pavement section materials. All surface marking should be painted using zebra striping patterns to minimize differences in depth of frost heave in pavement areas needing painted sections. Zebra striping should be designed so the maximum width of the painted section is 6 inches and the minimum width of the black unpainted or painted section is 6 inches.

If the depth of frost penetration never exceeds 16”, then no load restrictions would be required on the pavements at any time. If the depth of frost penetration extends below 16”, load restrictions should be applied whenever the depth of thawing as measured from the surface of the pavement exceeds 12” and should remain in place until seven days after the thermocouples indicate that all of the frozen sections of pavement and subsoil have completely thawed.

Depth of frost penetration during the winters of 2011-2012 and 2012-2013 at the thermocouple gauges under Runway 11-29 show that the maximum depth of frost penetration was 6 to 10 inches for short durations (20 days or less).

TABLE NO. 4-1

TRUCKEE TAHOE AIRPORT

PAVEMENT REHABILITATION PROCEDURES
DEEP-SEATED DISTRESS

Code	Rehabilitation Method	
A1	Reconstruct Section (Taxiway A)	
	Pulverize Existing AC & AB, Recompact as minimum of 8" ASB	
	New Section - Existing AC and AB as ASB	11"
	AB - Crushed Aggregate Base (4" New)	4"
	AC - Asphalt Pavement (4" New)	4"
	Total Thickness	19"
	Cost per square foot	$11.20
A2	Reconstruct Section, Raise Existing Grade + Lighting (Runway 2-20)	
	Pulverize Existing AC & AB, Recompact as minimum of 8" ASB	
	New Section - Existing AC and AB as ASB	10"
	AB - Crushed Aggregate Base (6" New)	6"
	AC - Asphalt Pavement (4" New)	4"
	Total Thickness	20"
	Cost per square foot	$12.70
A3	Reconstruct Section, Maintain Existing Grades (Aprons)	
	Pulverize 8" of Existing AC and AB, excavate and stockpile for use as ASB	
	Excavate 10" to new Subgrade	
	New Section - Existing AC and AB as ASB	8"
	AB - Crushed Aggregate Base (6" New)	6"
	AC - Asphalt Pavement (4" New)	4"
	Total Thickness	18"
	Cost per square foot	$11.50
A4	Reconstruct Section, Groove Runway, Raise Lights (Runway 11-29 East)	
	Pulverize Existing AC & AB, Recompact as minimum of 8" ASB	
	New Section - Existing AC and AB as ASB	12"
	AB - Crushed Aggregate Base (4" New)	4"
	AC - Asphalt Pavement (4" New)	4"
	Total Thickness	20"
	Cost per square foot	$11.50

Notes:
1. Costs indicated are based on 2021 prices and do not include any costs other than the pavement section itself.
2. AC = Asphalt Surface Course, AB = Aggregate Base Course, ASB = Aggregate Subbase Course

TABLE NO. 4-1 (continued)

TRUCKEE TAHOE AIRPORT

PAVEMENT REHABILITATION PROCEDURES
DEEP-SEATED DISTRESS

Code	Rehabilitation Method	
A5	Reconstruct Section, Maintain Existing Grades (Warehouse)	
	Pulverize 6" of Existing AC and AB, excavate and stockpile for use as ASB	
	Excavate 9" to new Subgrade	
	New Section - Existing AC and AB as ASB	6"
	AB - Crushed Aggregate Base (6" New)	6"
	AC - Asphalt Pavement (3" New)	3"
	Total Thickness	15"
	Cost per square foot	$10.00
B1	Reconstruct Section, Relocate Taxiway, Lighting (Taxiway G)	
	Pulverize Existing AC & AB, Excavate for reuse as ASB.	
	Excavate subgrade for new pavement section.	
	New Section - Existing AC and AB as ASB	8"
	AB - Crushed Aggregate Base (6" New)	6"
	AC - Asphalt Pavement (4" New)	4"
	Total Thickness	18"
	Cost per square foot	$14.50
B2	New Pavement Section for all aircraft traffic	
	Excavate subgrade for new pavement section (18").	
	Excavate subgrade for new pavement section.	
	New Section – ASB – Aggregate Subbase Imported (6" New)	8"
	AB - Crushed Aggregate Base (6" New)	6"
	AC - Asphalt Pavement (4" New)	4"
	Total Thickness	18"
	Cost per square foot	$13.00

Notes:
1. Costs indicated are based on 2021 prices and do not include any costs other than the pavement section itself.
2. AC = Asphalt Surface Course, AB = Aggregate Base Course, ASB = Aggregate Subbase Course

TABLE NO. 4-2
TRUCKEE TAHOE AIRPORT
REHABILITATION PLAN - DEEP-SEATED DISTRESS

Estimated Date of Rehabilitation	Element	Station	Remaining Life (Years) from 2020	Estimated Year of Failure	Recommended Rehabilitation Code*	Recommended Rehabilitation Description
2021	Taxiway A	0+00 to 24+00	9	2029	A1	Reconstruction
2021	Taxiway A	24+00 to 31+25	4	2024	A1	Reconstruction
2021	Taxiway B Runup	See Plates 5-1 & 5-2	7	2027	A1	Reconstruction (with Taxiway A)
2021	Taxiway B	0+50 to 1+75	12	2032	A1	Reconstruction (with Taxiway A)
2023	Taxiway V	0+00 to 1+25	9	2029	A2	Reconstruction (with Runway 2-20)
2023	Taxiway Q	0+00 to 1+25	16	2036	A2	Reconstruction (with Runway 2-20)
2024	Apron A2	See Plates 5-1 & 5-2	6	2026	A3	Reconstruction
2024	Taxiways D(south), E, & F(south)	See Plates 5-1 & 5-2	10	2030	A3	Reconstruction (with Apron A2)
2024	Taxilane Q	12+50 to 25+50	10-11	2030-2031	A3	Reconstruction (with Apron A2)
2026	Runway 11-29 (East)	47+00 to 70+00	11	2031	A4	Reconstruction and Groove Runway
2026	Taxiway A	49+50 to 49+75 50+50 to 51+00	10	2030	A4	Reconstruction (with Runway 11-29 (East))
2026	Taxiway J	0+00 to 0+50	20	2040	A4	Reconstruction (with Runway 11-29 (East))
2029	Apron A1	See Plates 5-1 & 5-2	14	2034	A3	Reconstruction
2029	Warehouse	See Plates 5-1 & 5-2	10	2030	A5	Reconstruction
2032	Aviation Way	See Plates 5-1 & 5-2	13	2033	A5	Reconstruction
2038	Taxiway L	0+25 to 1+75	21	2041	A3	Reconstruction (with Apron A3)

* - See Table 4-1 or 4-3 for Rehabilitation Code details.

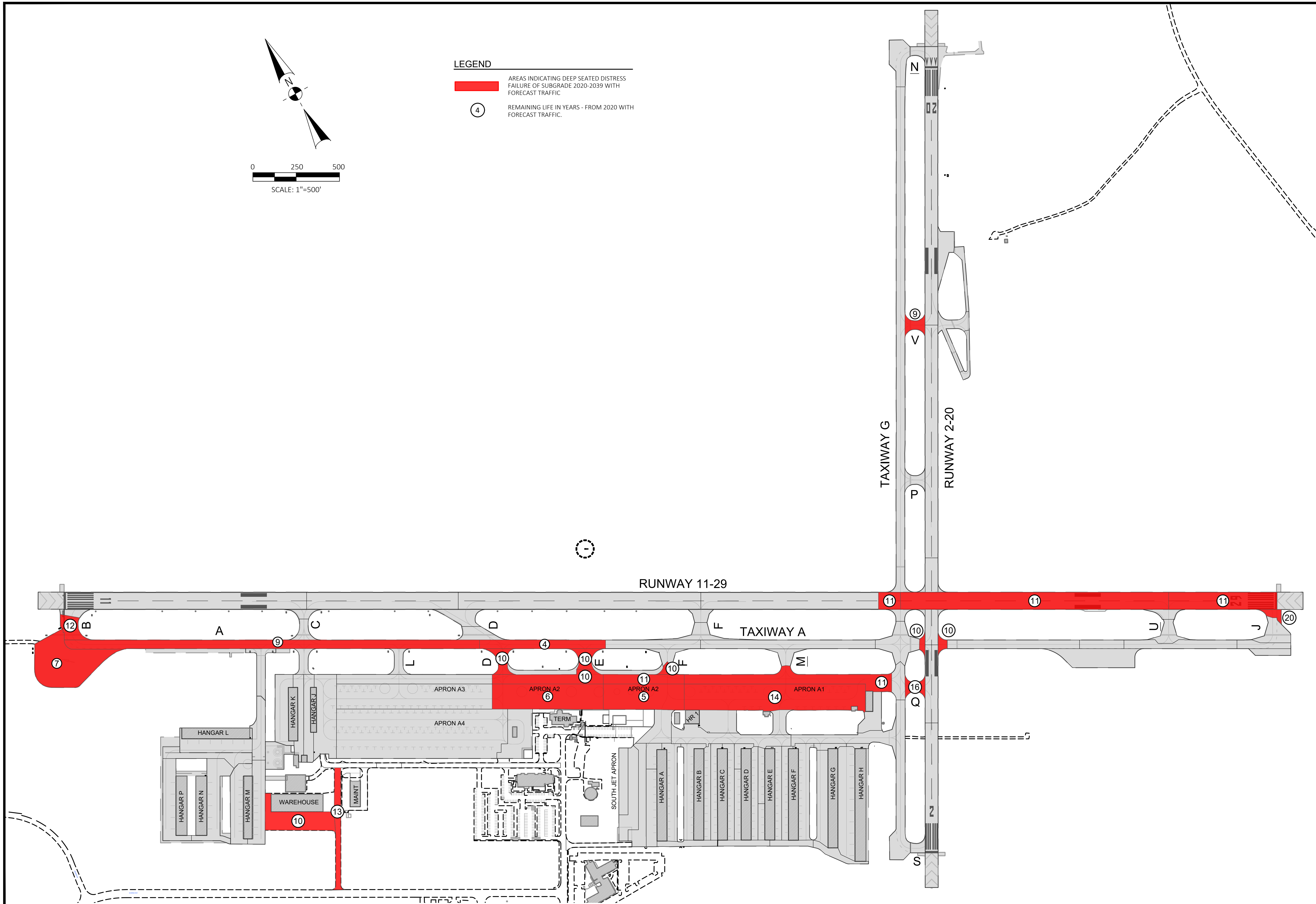
NOTE: Rehabilitation of pavement sections should be scheduled a minimum of 2 to 3 years before estimated date of failure.

TABLE NO. 4-3

TRUCKEE TAHOE AIRPORT

PAVEMENT REHABILITATION PROCEDURES
SURFACE DISTRESS

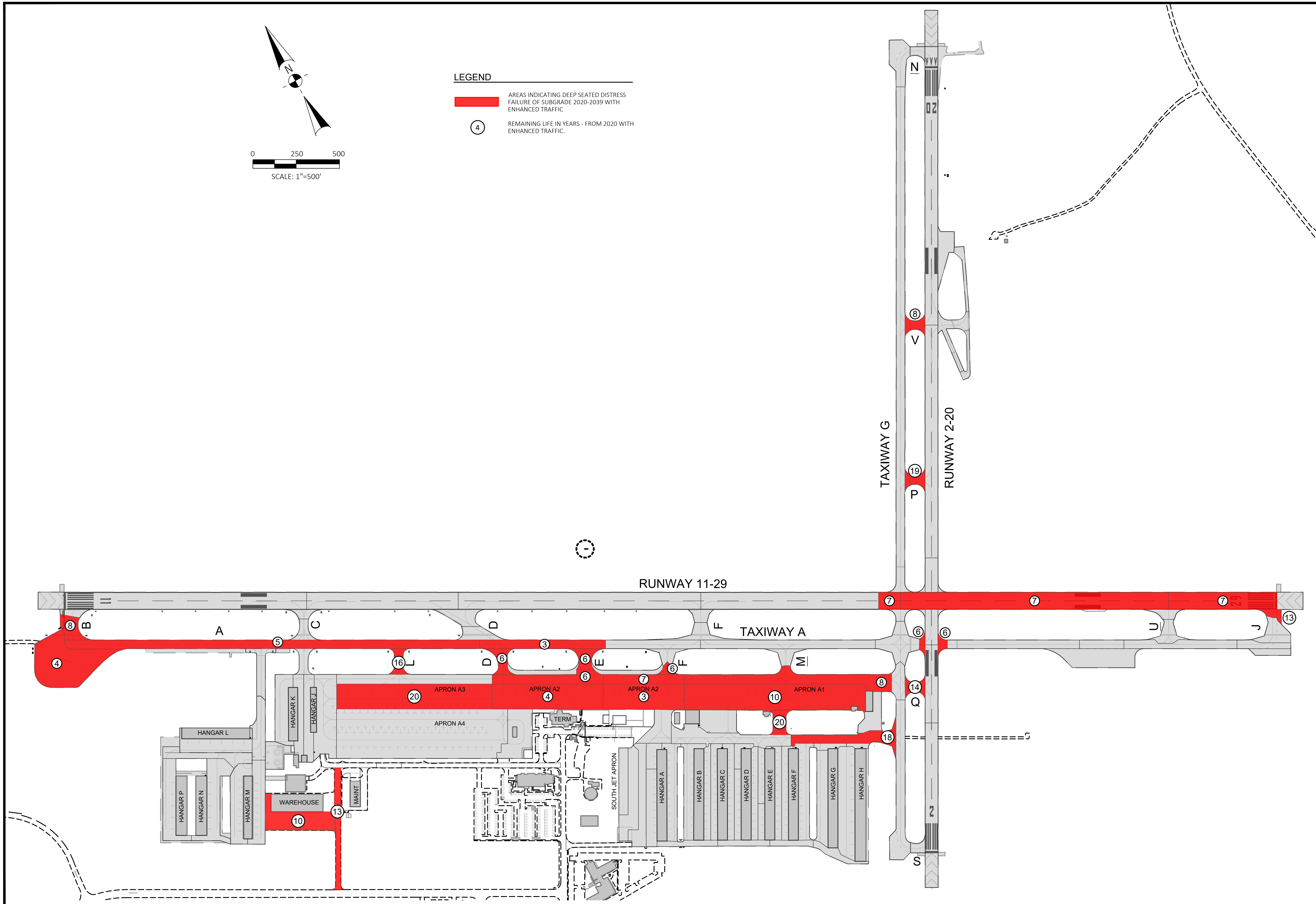
Code	Rehabilitation Method	Estimated Unit Costs
C2	Mill and Fill (2" AC) - Remove and Replace AC Surface	$3.25/sq. ft.
C3	Mill and Fill (3" AC) - Remove and Replace AC Surface	$4.50/sq. ft.
C4	Mill and Fill (4" AC) - Remove and Replace AC Surface	$5.50/sq. ft.
D2	Remove and Replace 2” Existing AC and Recompact Existing AB	$3.75/sq. ft.
D3	Remove and Replace 3” Existing AC and Recompact Existing AB	$5.00/sq. ft.
D4	Remove and Replace 4” Existing AC and Recompact Existing AB	$6.00/sq. ft.
E	Crack Repair, Seal Existing Cracks and Joints	$2.00/ln. ft. of crack
F	New Seal Coat – Slurry Seal, Reclamite, Fog Seal, etc.	$1.60/sq. ft.
G1	Saw & Seal New AC Joints – 15’ Joint Spacing	$0.55/sq. ft. of pavement
G2	Saw & Seal New AC Joints – 12.5’ Joint Spacing	$0.70/sq. ft. of pavement
H1	Joint Reseal/Rehabilitation – 25’ Joint Spacing	$0.45/sq. ft. of pavement
H2	Joint Reseal/Rehabilitation – 15’ Joint Spacing	$0.65/sq. ft. of pavement
H3	Joint Reseal/Rehabilitation – 12.5’ Joint Spacing	$0.70/sq. ft. of pavement
H4	Rehabilitate PCC Joints (Joint Seal and Spall Repair)	$5.00/ln. ft. Joint Seal $10/ln. ft. Spall Repair
J	Remark Airfield Pavements	$1.50/sq. ft of marking



BRANDLEY ENGINEERING
6125 KING ROAD, SUITE 201 · LOOMIS, CA 95650 · (916) 652.4725

TRUCKEE TAHOE AIRPORT
2020 PAVEMENT MANAGEMENT PLAN
DEEP SEATED DISTRESS - FATIGUE ANALYSIS (FORECAST TRAFFIC)

DATE	7/12/2021
DRAWN	KDC
CHECKED	DB
FILE	2004-20.4-1.Distress
SCALE	1"=500'
PLATE No.	4-1



TRUCKEE TAHOE AIRPORT

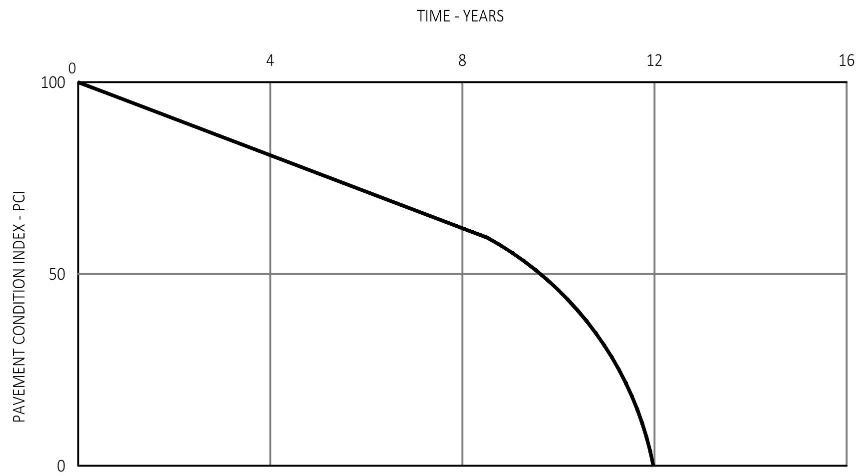
2020 PAVEMENT MANAGEMENT PLAN

DEEP SEATED DISTRESS - FATIGUE ANALYSIS (ENHANCED TRAFFIC)

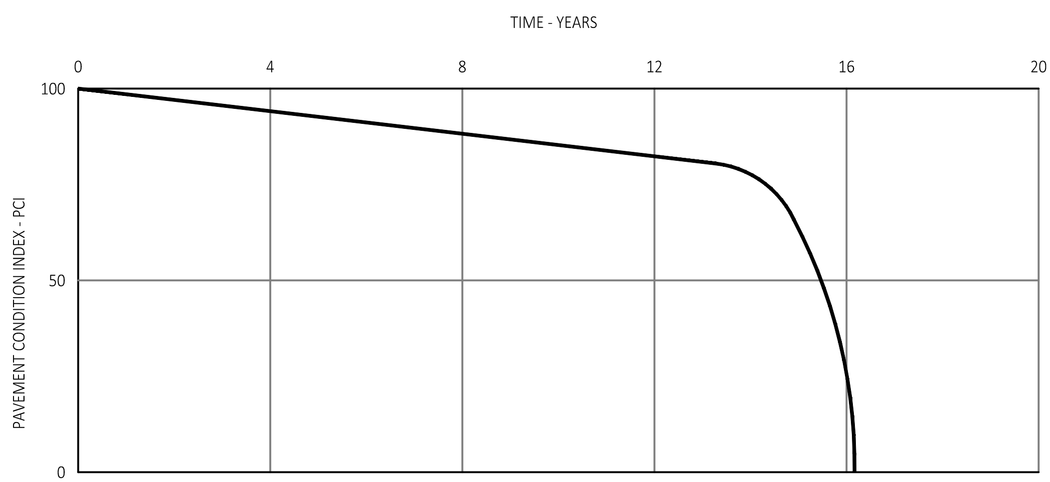
BRANDLEY ENGINEERING
6125 KING ROAD, SUITE 201 · LOOMIS, CA 95650 · (916) 652.4725

DATE	7/12/2021
DRAWN	KDC
CHECKED	DB
4004-20.4-2.DistressBE	
SCALE	1"=500'
PLATE No.	4-2

NOTE:
THESE GRAPHS DEPICT AN EXAMPLE OF HOW PCI CHANGES OVER TIME. ACTUAL TIME OF FAILURE IS DEPENDENT ON EXISTING PAVEMENT SECTION AND SUBGRADE STRENGTH/CONDITION. TIME INDICATED ON THESE CHARTS IS A TYPICAL EXAMPLE, SEE REMAINING LIFE OF EACH PAVEMENT SECTION DUE TO DEEP SEATED DISTRESS FOR ESTIMATED TIME OF FAILURE OF SPECIFIC PAVEMENT SECTIONS ON THE AIRPORT.

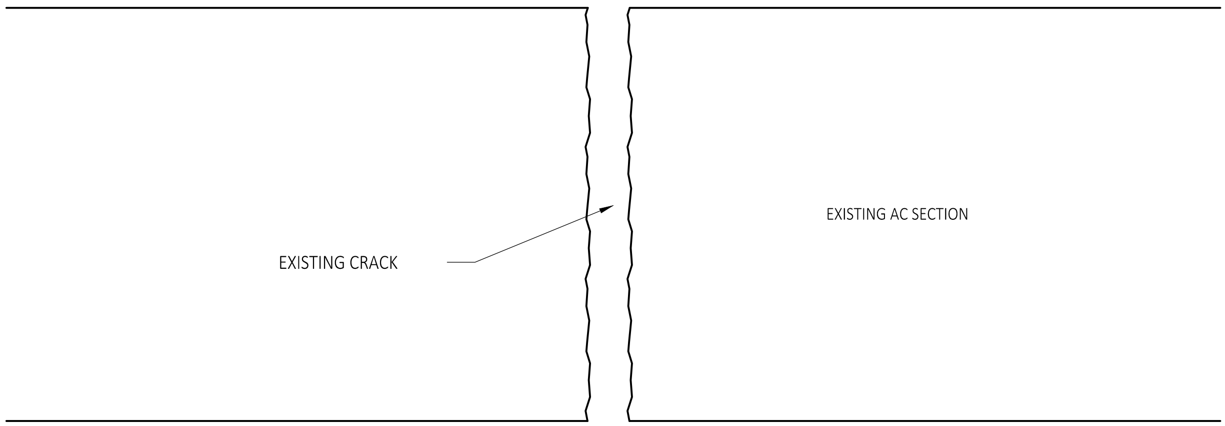


ASPHALT CONCRETE PAVEMENT SECTION
PCI VS. TIME - RELATIONSHIP

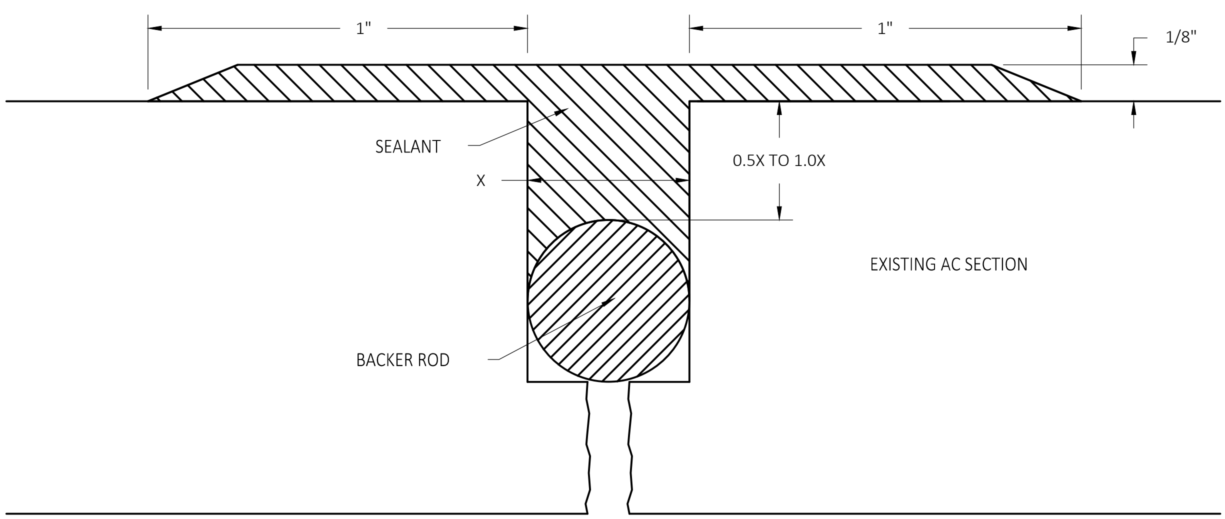


PORTLAND CEMENT CONCRETE PAVEMENT SECTION
PCI VS. TIME - RELATIONSHIP

TRUCKEE TAHOE AIRPORT TRUCKEE, CALIFORNIA	PAVEMENT EVALUATION PCI vs TIME	BRANDLEY ENGINEERING



EXISTING CRACK IN PAVEMENT



TYPICAL SEALED CRACK

TRUCKEE TAHOE AIRPORT TRUCKEE, CALIFORNIA	PAVEMENT EVALUATION TYPICAL CRACK SEAL REHABILITATION	BRANDLEY ENGINEERING

CHAPTER 5. CONCLUSIONS AND REHABILITATION PLAN & SCHEDULE

5-1 General

Even with the success of the BRANDLEY Fatigue Analysis methodology in predicting remaining pavement life, pavement performance beyond 20 years cannot be accurately forecast due to unknown factors including weather, traffic, maintenance, and surface defects. Even beyond 10 years the forecast performance is somewhat questionable due to the same variables. It is, therefore, recommended that the rehabilitation plan be developed for a 20-year period but it should be updated periodically based on ongoing surveys and analyses. It is recommended that pavement condition surveys, which visually identify surface defects, be conducted annually by a general visual observation of all pavements and every 5 years using a detailed survey and determination of Pavement Condition Index (PCI). It is also recommended that detailed falling weight deflectometer testing and new fatigue analyses be conducted on a 10-year interval and the remaining life of the pavement based on deep-seated distress be evaluated and the rehabilitation program adjusted as necessary.

Rehabilitation of pavements to correct deep-seated distress problems should be performed 2 to 4 years before the forecast failure of the pavement has occurred. If one waits until the pavement section has failed due to deep-seated distress, then the strength of the subgrade and subsoils and the strength and quality of the existing base and pavement materials will have decreased. It will not be feasible to strengthen the section and extend the life of the section by the placement of reasonable overlays or additional thicknesses of the pavement section. Once a deep-seated failure has occurred, it will be necessary to reconstruct the entire pavement section.

Often the surface distress of a pavement section becomes severe before a failure due to deep-seated distress occurs. In these cases, it is generally more feasible from a cost-benefit, performance, and aesthetic standpoint to rehabilitate or reconstruct the section earlier than forecast due to deep-seated distresses.

Rehabilitation of the pavement section to correct surface distress problems can consist of patching, sealing of the cracks, application of a seal coat, or milling and replacing the asphalt surface. The timing for each of these treatments will be based on cost-benefit analysis, safety, rideability, and aesthetic conditions. The rehabilitation type and schedule to correct problems caused by surface distress is determined by engineering judgment, taking into consideration the cost-benefit, operational problems, and visual perception. The schedule for rehabilitation to correct surface distress issues is flexible, but timing of rehabilitation to correct deep-seated distress must be scheduled to occur no later than 2 to 4 years before the forecast time of failure.

If a pavement section is grossly overloaded, there is a risk that the pavement will be overstressed to a point that the landing gear will punch through the pavement. To protect against this happening, a load limit should be established, even for infrequent use. A different load limit is required for single wheel and dual wheel geared aircraft. The PCN values presented in Chapter 3 of this report represent adequate load limit values for each gear type assuming 1,200 departures per year.

A previous PMMP was prepared for the Truckee Tahoe Airport in 2011, with a PCI update in 2013. All the airport pavements were tested and analyzed in the 2011 Pavement Evaluation Study and in this 2020 Pavement Maintenance Management Program. A summary of a representative selection of pavement section quality changes from 2011 to 2020 is shown in Table No. 5-1. This table also shows the test data for other areas on the airport that were tested in both programs and the changes in surface data (Pavement Condition Index), existing Modulus of Elasticity of AC, AB, Subgrade and Subsoils, and the forecast date of deep-seated distress failure. This historical data shows a comparison of the pavements and how they have been deteriorating over time. Several pavement sections had been rehabilitated or mill and filled and had their life extended. It should be noted that the traffic, especially that of the larger jets, increased significantly more than was anticipated by the 2011 PMMP. This large increase in traffic represents the biggest impact on the life of the pavement sections and deterioration of the surface. The Modulus of Elasticity appeared to slightly increase for some pavement sections, this is explained due to the 2019 testing being performed in October vs the 2011 testing performed in May. The slightly colder temperatures make the surface appear artificially stiffer than when tested in warmer temperatures. This was accounted for in all remaining life calculations.

5-2 Special Rehabilitation Recommendations

As a result of this PMMP, there are several special design recommendations that have been suggested and it is highly recommended that they be adopted for new pavements and rehabilitated pavements at Truckee Tahoe Airport. These design recommendations, together with background information, are presented herewith.

5-2.1 Flexible Pavements (Bituminous Surface Course)

In recent years, research conducted by the Highway Research Board produced a SuperPave mix design methodology for Hot Mixed Asphalt (HMA). With this methodology they established that a 0.45 power curve on grading analysis plots would be a critical curve to use to establish idealized gradation for aggregates used in the asphalt mix design. The 0.45 power curve represents the gradation that will produce the highest density finished product possible with the aggregate being used, but the air voids are near zero and the mix is subject to flushing if the gradation of the aggregate lies on the 0.45 power curve. The further the combined gradation of the mix deviates from the 0.45 power curve, either on the fine side or the coarse side, the higher the air voids become. Research has shown that if the combined gradation of the aggregate is on the fine side of the 0.45 power curve, Marshall stabilities will generally range from 2,000 to 2,400 pounds, which still meet the F.A.A. Marshall mix design requirements. However, if the combined gradation is held on the coarse side of the 0.45 power curve, the Marshall stability rises to 3,500 to 5,000 pounds and the mix is much more stable. Care must be exercised to make sure the gradation is not too coarse to avoid raveling of the pavement.

The coarser mix has enough fines in it that the air voids meet specification requirements and the surface is smooth and filled with fines, but after rolling the surface a few of the upper portions of the stones in the aggregate are visible at the surface. The coarser mix is also sufficiently stable that breakdown rolling can be started right behind the paving machine without allowing the mix to cool, which makes it easier and less expensive to obtain specified compaction. Both gradations on the coarse side and the fine side of the 0.45 power curve fall within the FAA limits for Marshall mix design.

With the coarser mix the asphalt content is decreased by approximately 0.5 percent and the required compaction effort is decreased significantly. As a result, the unit cost of both the coarse and fine mixes is approximately the same and a far superior product is obtained by using the coarse mix. This coarse mix will deter the shoving of the asphalt materials and subsequent decrease in Modulus of Elasticity of the asphalt and underlying materials. It is highly recommended that the SuperPave mix design procedures be used and that the gradation be on the coarse side of the 0.45 power curve on all flexible pavements placed on this airport.

Several of the apron pavements on the airport are exhibiting small ruts or depressions in the parking circles where the larger jets are parked. Special testing was performed in these areas to determine the cause of this issue. It was found that the existing pavement section layers exhibited similar strength to all other surrounding areas and the test data did not indicate that there was an imminent failure of the subgrade or pavement section materials.

A review of the pavement section materials on these apron sections revealed that the asphalt binder utilized in the latest mill and fill projects was a PG 64-28 PM. FAA has recently provided guidance that areas serving slow moving aircraft weighing less than 100,000 lbs. should receive 2 grade bumps of the high temperature grade. This means that all future apron areas at the Truckee Tahoe Airport should utilize a PG 76-28 PM oil. This oil will make the asphalt layer stiffer during the warmer summer temperatures, but it will still maintain the desired flexibility and strength during the cold winter months. The lower graded PG 64-28 PM binder appears to be the likely cause of the small ruts/depressions in the parking circles. These need to be monitored and may need a surface replacement if they become more severe before the recommended rehabilitation of these pavements.

5-2.2 AC Surface Rehabilitation vs. AC Mill & Fill

Typically, a surface rehabilitation will consist of only a mill and fill of the existing asphalt surface, but with underlying aggregate base courses that have lower than anticipated modulus of elasticities, a different type of surface rehabilitation has been recommended for many of these pavements. It is recommended that when these pavements are rehabilitated for surface distress that a surface reconstruction be completed, consisting of removing the existing AC surface course, scarifying and recompacting the underlying aggregate base course to 100% relative compaction, and then placing a new bituminous surface course.

This type of pavement rehabilitation is recommended in areas where existing finished grades must be maintained as they currently exist as well as on pavements that have an existing joint pattern sawed and sealed in the asphalt surface. It is necessary to remove the old, sawed and sealed surface so that the existing joints will not reflect through the new surface course. In rehabilitation areas where finished grades can be raised, then the AC and upper 3 inches of AB can be pulverized and recompacted in place to a relative compaction of 100% and the new aggregate base and bituminous surface course placed as needed.

An alternate rehabilitation would consist of a 2 to 3-inch asphalt mill and fill instead of the full surface reconstruction. This type of rehabilitation would consist of milling off the top 2 to 3-inches of the existing asphalt section and placing 2 to 3-inches of new bituminous surface course. This type of rehabilitation is not the preferred rehabilitation for pavements with weaker base course layer for several reasons. The underlying base course materials would not be recompacted in this type of rehabilitation, which would lead to future deterioration of the asphalt surface course. The up-front cost is slightly less than the recommended surface reconstruction but the life-cycle cost of this will be significantly higher, since this type of rehabilitation is likely to only provide 10 to 12 years of additional pavement life at which time a surface reconstruction would still need to occur. The modulus of elasticity of the existing aggregate base course materials in some pavement sections is lower than would normally be anticipated. This is likely an indicator that the quality of these materials has deteriorated somewhat over time. They have likely become saturated and loose from traffic and/or water infiltration into the pavement sections. These aggregate base course materials will need to be scarified and recompacted or replaced with high-quality base course materials during any rehabilitation work in the future once the surface course has been removed. For these reasons, all surface rehabilitation recommendations for pavements with weak existing aggregate base courses are to perform the surface reconstruction at the appropriate times and the recommended maintenance projects shown are based on the surface reconstruction being completed. If the airport chooses to perform the AC mill and fill alternative rehabilitation on these pavements, the estimated maintenance schedule after that project will need to be modified significantly from what is shown in this report.

On pavement sections where the underlying pavement section is still strong and has adequate remaining life, the mill and fill rehabilitation option is an appropriate rehabilitation, provided there are not significant cracks or joints that would reflect through the top surface course.

5-2.3 Sawing New Joints in Pavements with Polymer Modified Asphalt

The polymer modified asphalt binders that have been used on all projects on the airport since 2012 allow the asphalt pavements to be placed and remain in service without thermal expansion/contraction joints installed in the asphalt. This is great for snow removal operations as well as for the rideability of the pavements. These modified asphalt binders provide added “flexibility” in the oil that allow the asphalt surface to slightly expand and contract with the drastic temperature changes that occur at the Truckee Tahoe Airport. Over time, these pavements will slowly lose some of their flexibility as the asphalt ages and becomes more and more brittle. At some point, it is anticipated that a crack pattern will begin to develop. When this occurs, a new joint pattern at approximately 15’ spacing should be saw cut and sealed in these pavements. It is anticipated that this joint pattern will need to be installed approximately 14 to 16 years after the pavement is placed. The rehabilitation schedule for all pavements is showing a placeholder for a saw and seal of new joints at 14 years after the initial asphalt surface course is placed. Each of these pavements needs to be monitored for early crack development to determine if the joint installation project should be moved forward or delayed.

5-2.4 Resealing of Joints

All asphalt surface course pavements that have existing joint patterns cut in them must have the joint sealant maintained in order to preserve the life of the pavement section. Joint rehabilitation and sealing projects are scheduled every 5 years for these jointed pavements. It is important to keep all joints and cracks sealed so that the rain and snow melt runs off of the pavements and not down into the underlying base course and subgrade layers. If the precipitation gets under the pavement section, the underlying materials become saturated, lose strength, and are further weakened by the heavy aircraft that pass over pavements in a saturated state. If this occurs, the expected life of the pavement could be drastically decreased. By maintaining the joint sealant in a good condition, these pavements can be properly protected.

5-2.5 Seal Coats

Some of the existing asphaltic concrete pavements at this airport are old and the surface is weathered. Newly constructed pavements will also weather over time and will become more and more brittle as they age. In areas that are not specified to be reconstructed good maintenance practice consists of providing a seal coat to the surface of the pavement every five to ten years. The seal coat recommended is Reclamite, SS1h, or a Type I Slurry Seal, or approved equal. With older pavements the Reclamite would be more effective since it tends to restore the plastic characteristics of the asphalt better than the other seals. A representative for a Reclamite or a similar rejuvenating seal should be consulted for determining the proper type of application to be used prior to designing a project that uses this material. Slurry seals can be good seal coats, but due to the frequency of snow removal operations, slurry seals are not typically recommended for this airport.

Seal coats are not an option for pavements that are already severely cracked and deteriorating, they are merely a surface protectant / rejuvenation.

5-2.6 Replacing Asphalt Surface Course

Many of the older hangar pavements and pavements that do not support the larger jet aircraft have a remaining pavement section life of more than 20 years. Even though the subgrade life is adequate, the surface does not always last as long. The harsh environmental elements and snow removal operations cause surface distresses that will require the replacement of these asphalt surfaces. This type of project has been recommended for several hangar areas, the glider pavements, roads, parking lots.

The terminal parking lot is scheduled to have the asphalt surface replaced in 2033. This project could be delayed if the airport desired to do so. The surface will likely still be in relatively good condition in 2033, but as it is the entrance to the terminal building, it is anticipated that it would be beneficial to remove and replace the asphalt surface rather than try to maintain pavement joints that will start to open up during this timeframe.

5-2.7 Taxiway A (West), B, C, and D Reconstruction

This project was designed and bid in 2020 and will be constructed in 2021. The timing of this project was originally based on the 2011 PMMP and adjusted based on the increased traffic and distresses observed on these pavements since the 2011 PMMP. The data from this report confirms the need to reconstruct these pavements at this time as they would fail in 2024.

5-2.8 Runway 2-20 Reconstruction

Runway 2-20 has adequate pavement section life beyond 20 years, but the surface is deteriorating quickly. The recommended reconstruction has been based on the surface distresses and the widening and cracking of the existing jointed pavement.

The airport Master Plan shows widening this runway to 100’ and extending the runway to the south so that it would incentivize more jet traffic with a higher level of safety in an attempt to move more of the traffic from 11-29 to 2-20. This widening and extension are beyond the scope of this report and recommended rehabilitation schedule as they are not existing pavements at this time that need to be maintained. The Airport Layout Plan Narrative provides the justification and need for these projects, but if they are going to be constructed it would be ideal to construct them with the Runway 2-20 reconstruction project. The widening would be particularly critical to perform with the runway reconstruction, the extension has more flexibility to be completed at a later date if desired.

5-2.9 Apron Reconstruction Projects

All of the apron pavements that serve the large jets (Aprons A1, A2, and A3) are under-designed for this size aircraft. These pavement sections have only 9” of total pavement section thickness, and a total pavement section of approximately 18” is needed to support the forecast aircraft fleet mix. While they can support some operations of heavy aircraft, they will need to be reconstructed to provide the proper life and performance based on the forecast traffic. Apron A2 is the most heavily used by the larger jets, which explains why its remaining pavement life is only 5-6 years.

The reconstruction of these aprons will need to include the use of the “grade bumped” asphaltic concrete oil of PG 76-28 PM to support the heavier jet aircraft in the current forecast on hot summer days.

5-2.10 Runway 11-29 East

The eastern portion of Runway 11-29 indicates that there is only 11 years of remaining life in the subgrade. These pavements were originally reconstructed in 2008 and are scheduled for reconstruction in 2026. It appears as though there will only be 18 years between reconstructions. Although this is less than the 20 years of life that the pavement section was originally designed for, the amount of traffic that has occurred and is forecast to occur is significantly higher than the traffic that was originally anticipated in the original design and the 2011 PMMP evaluation, and this pavement will have performed for more than 20 years' worth of aircraft traffic operations.

This portion of Runway 11-29 includes the intersection with Runway 2-20 as well as with Runway 2-20 where Taxiway A crosses. All of these pavements will need to be reconstructed during this upcoming project. Special considerations will need to be taken into account to try to minimize the impact of the runway intersection being closed so that disruptions to the airport can be minimized. These considerations can be to phase the project, displace the Runway 29 threshold temporarily, require 24/7 work schedules that are driven by a short construction time-frame, or a combination of the aforementioned items. A cost-benefit analysis that takes into account the cost of the airport or runway closures to the local community will need to be undertaken prior to the design of this project to determine the most effective construction design and schedule.

5-2.11 Runway 11-29 West

This portion of Runway 11-29 was reconstructed in 2012. It has a remaining life of greater than 20 years, but the surface of the pavement is showing some signs of wear and the grooves in the pavement are slowly wearing down. It has been observed that the snow removal operations are the primary cause of the distresses. Adjustments to the snow removal operations are being made where possible. This PMMP is recommending to perform a 2" AC Mill and Fill in 2027 (15 years after reconstruction) to resurface the pavement and construct new grooves. It is not feasible to re-cut the existing grooves, therefore the surface course must be replaced. A new joint pattern is also scheduled to be saw cut during this project.

An alternate to this project would be to remove and replace the entire 3" of asphalt, recompact the existing base course and place 3" to 4" of a new surface course. This alternate project would be more expensive than the mill and fill with new joints, but it would not require joints to be cut in the pavement which will save on future maintenance projects and damage to the joint sealant by snow removal operations. This alternate is something that the airport could consider as the timing of this project nears depending on the available funding at the time.

5-2.12 Apron A4 and Hangar 1 Surface Cracking

The Apron A4 and Hangar 1 apron were reconstructed in 2014. It was noted during the visual inspection of these pavements that there is significant block cracking beginning to occur in these pavements. These cracks are very fine and the airport maintenance crews have begun to seal these cracks to preserve the life of the pavements. It is very early in the life of these pavements to be seeing this type of distress.

The strength of the pavement sections and remaining life are good and the pavements have more than 20 years of structural life remaining. The only problem with them is the surface and the cracking. Based on the data obtained from the 2019 testing program associated with this PMMP, the only explanation for this cracking is that these projects were constructed at the same time and with the same construction materials. Good Quality Control and Quality Assurance was performed on the project, but it appears that there must be an underlying problem with the asphalt materials. It is possible that a lesser quality batch of asphalt binder could have been utilized. It may have met the minimum specifications, but it is possible that it doesn't have as much "flexibility" as the other polymer modified binders that have been used on the field. This could cause cracking based on thermal stresses.

Another consideration that could have caused the early cracking on Apron A4 is an excessive amount of moisture from the snow that is piled and stored on this apron during the winter. While, this could reduce the strength of the apron, Hangar 1 does not have this same snow storage variable, yet it is exhibiting the exact same distresses making it unlikely that the snow storage is creating the problem.

These distresses are not causing a structural problem at this time. As long as the cracking is sealed and properly maintained, the pavement will still perform properly. It is recommended in the rehabilitation schedules to remove and replace the AC surface in 2031, which is still 17 years after initial construction, in order to maintain the integrity and strength of the underlying pavement section layers.

5-2.13 2020 New Construction Projects, Completed After 2019 Test Program

The Runway 29 Blast Pad, Wash Rack, Med Services Apron, Maintenance Building Pavement, and a portion of the Hangar Road A-H were either newly reconstructed or had a mill and fill performed in 2020 after the FWD testing had been completed in late 2019. These areas are depicted on Plates 5-1 and 5-2 and have some *s in the data tables showing the "assumed" theoretical values of some portions of the data. The data collection and testing for this pavement maintenance management program was collected during the fall of 2019 prior to the construction of these pavements. Thus, the existing pavement section, modulus of elasticity values, pavement condition index, pavement condition number, remaining pavement life, and other associated indices are shown in the tables and calculations of this report based on theoretical values for new pavement section materials and subgrade characteristics of the underlying materials at the time of testing.

5-2.14 Airfield Pavement Repainting

Routine remarking of the pavements is necessary every 2 to 3 years due to weathering and damage to the existing markings due to snow removal operations. A 3-year rotating marking schedule has been developed for the airport maintenance staff and the airport is enacting this plan starting in 2021. The airport was broken into 3 approximately equal areas of pavement markings so that the average annual cost of this remarking program is under $150,000 per year. The airfield remarking projects are not included in the cost tables or rehabilitation schedules but needs to be accounted for in the pavement management and maintenance budgets. All recommended rehabilitation projects include marking of the associated pavements, this work would be deducted from the annual remarking projects as necessary.

5-3 Recommended Rehabilitation Schedule

The BRANDLEY Fatigue Analysis was used to determine the remaining life of the existing pavements and the recommended maintenance and rehabilitation schedules based on the forecast aircraft operations at the airport.

Taking into consideration the timing required for rehabilitation of sections that have a forecast remaining life less than 20 years and requirements to correct surface defects caused by surface distress, a rehabilitation schedule has been prepared for each pavement item. The timing of complete rehabilitation of the section on those areas that are not forecast to fail within the 20-year period due to deep-seated distress was based on engineering judgment. Consideration was given to the requirements to maintain a good operational surface, to be cost effective, and to spread out the work in such a manner as to maintain a reasonably uniform annual cost of rehabilitation. The anticipation of receiving Federal grant funding to do major projects was also taken into consideration.

Based on this method of timing of rehabilitation or repair, the recommended rehabilitation schedule has been included in detail for each individual segment of pavement in Appendix E, Tables E1 through E130. Using this information, a maintenance and rehabilitation schedule has been prepared showing the recommended projects for each year that maintenance or rehabilitation work is scheduled within the next 20 years and is summarized in Table No. 5-2. These maintenance schedules have also been shown on the Rehabilitation Schedule maps, Plates No. 5-3 through 5-7. With each of these schedules, assumptions have been made as to when Federal funding would be available, and the maintenance schedules have been adjusted to include these major projects during those periods provided any delayed maintenance or reconstruction would not have a significant effect on the remaining life and performance of the pavement section.

The maintenance work recommended to correct surface distress is based on engineering judgment. The timing should be adjusted each year based on availability of funds and the results of the annual surface inspection. The schedule for rehabilitation and reconstruction required to correct deep-seated distresses must be adhered to since the timing established is 2 to 4 years before failure of the section is anticipated. Rehabilitation at earlier dates is acceptable.

Several of the pavement sections show a pavement life, based on deep-seated distress, in excess of 20 years with forecast traffic. While most of these pavements show a long life, the life of the pavement surface is likely significantly less. Many of these pavements are old, brittle, and weathered from environmental and other surface distresses. In order to maintain a good surface and protect the underlying portion of the pavement section from damage, a surface rehabilitation should be considered for each of the pavements that do not require a full structural rehabilitation. As a result, the majority of the airfield pavements have a recommendation for surface rehabilitation in the future. The timing of this rehabilitation can vary based on the operations, needs, and budget.

Rehabilitation schedules based on deep-seated distress could change in the future if the traffic experienced at the airport is significantly different than the forecast traffic utilized in this report. If the actual traffic varies, particularly with the heavier jet aircraft, the same FWD data and pavement section characteristics can be utilized with the actual traffic realized at the airport. An updated remaining life can be recalculated based on actual traffic realized at a future date if necessary and the rehabilitation plan altered to meet the new requirements.

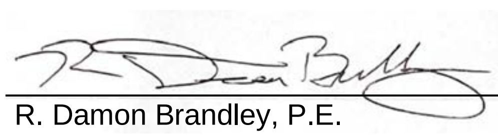
All costs shown in this analysis are construction costs only and are based on 2021 prices. These costs are for construction only and do not include engineering design, quality assurance testing, resident engineering, or administrative costs. Engineering and administrative costs ranging from 20% to 30% of construction costs need to be added for each project and adjustments made for inflation for each year.

As an aid in preparing this report, Table No. 5-3 entitled, “Summary of Existing Conditions and Rehabilitation Requirements” was prepared. This table should be useful to Operations and Maintenance staff as it summarizes all of the information that was compiled, analyzed, and/or recommended in this report for each pavement section on the airfield. 24”x36” sized copies of Table 5-3 are included in the sleeve of the binder of each report as the smaller tables in the body of this report have relatively small text.

Disclaimer

The recommendations presented in this report are based on the results of tests conducted. Soil borings were spaced to represent typical subsurface conditions and falling weight deflectometer (FWD) tests were spaced at approximately 200 feet. While it is unlikely, it is possible that significantly different conditions exist between the location of the test holes and FWD test locations that could lead to pavement distress occurring later or earlier than forecast.

Delays in maintenance, changes in the forecast traffic, and changes in environmental conditions from those assumed in this study can also have a significant effect on the recommended schedule for maintenance and rehabilitation. It is recommended that visual inspections be conducted annually, detailed pavement condition surveys be conducted every five years, and FWD tests and Fatigue Analysis studies be conducted every 10 years. As a result of these inspections, tests and evaluations, the maintenance and rehabilitation schedule should be adjusted, as necessary.



R. Damon Brandley, P.E.

Table 5-1
Summary of Pavement Section Changes from 2011 to 2020
Truckee Tahoe Airport

Pavement Segment ID (2020) (See Plate 5-1)	Element	Station (2020) (See Plate 5-2)	Pavement Surface Data (PCI) 2011 PCI	2013 PCI	2020 PCI	Modulus of Elasticity (E) - ksi 2011 AC / AB	2020 AC / AB	2011 Subgrade/ Subsoil	2020 Subgrade/ Subsoil	Remaining Pavement Life - Years from 2020: Fatigue Analysis (Brandley) 2011 Remaining Life / Anticipated Date of Failure- Subgrade (Forecast Traffic)	Fatigue Analysis (Brandley) 2020 Remaining Life / Anticipated Date of Failure- Subgrade (Forecast Traffic)	Comments
E7	Runway 11-29	48+75 to 64+25	86	86	75	250 / 40	300 / 60	10 / 25	12 / 20	18 years, Failure in 2029	11 years, Failure in 2031	Significant Jet Traffic Increase, Subsoil Strength Decrease
E11	Taxiway A	24+00 to 31+25	51	38	32	250 / 30	250 / 65	15 / 25	15 / 30	20+ years, Failure in 2031+	4 years, Failure in 2024	Significant Jet Traffic Increase
E21	Taxiway B Runup	Runup Apron	-	22	7	n/a	150 / 25	n/a	12 / 25	n/a	7 years, Failure in 2027	Significant Jet Traffic Increase
E25	Taxiway B	0+50 to 1+75	51	41	23	250 / 30	350 / 50	15 / 30	18 / 30	20+ years, Failure in 2031+	12 years, Failure in 2032	Significant Jet Traffic Increase
E32	Taxiway D (south)	0+25 to 1+75	45	93	74	350 / 80	350 / 70	15 / 25	20 / 25	20+ years, Failure in 2031+	10 years, Failure in 2030	Significant Jet Traffic Increase
E33	Taxiway E	0+25 to 1+50	43	90	60	350 / 80	350 / 80	15 / 25	20 / 25	20+ years, Failure in 2031+	10 years, Failure in 2030	Significant Jet Traffic Increase
E44	Runway 2-20	0+00 to 7+50	75	65	30	250 / 40	150 / 30	12 / 25	12 / 20	20+ years, Failure in 2031+	20+ years, Failure in 2040+	Increase in Traffic, AB & AC Strength Decrease
E49	Runway 2-20	30+50 to 46+54	75	53	30	350 / 70	250 / 50	11/25	12 / 20	20+ years, Failure in 2031+	20+ years, Failure in 2040+	Increase in Traffic, AB & AC Strength Decrease
E52	Taxiway G	9+00 to 11+00	77	55	43	250 / 40	150 / 30	12 / 25	12 / 20	20+ years, Failure in 2031+	20+ years, Failure in 2040+	Increase in Traffic, AB & AC Strength Decrease
E57	Taxiway V	0+00 to 1+25	80	70	65	100 / 20	200 / 30	7 / 25	10 / 20	21 years, Failure in 2032	9 years, Failure in 2029	Traffic Increase, Subsoil Strength Decrease
E72	Apron A2	Apron A2 (east)	43	90	59	250 / 70	200 / 40	20 / 25	10 / 20	16 years, Failure in 2027	5 years, Failure in 2025	Significant Jet Traffic Increase, AC, AB, Subsoil Strength Decrease
E73	Apron A1	Apron A1	45	95	61	250 / 70	150 / 30	20 / 25	15 / 30	11 years, Failure in 2022	14 years, Failure in 2034	2011 PMMP assumed too much Jet Traffic, AC, AB, Subsoil Strength Decrease
E83	Hangar A (east)	All	75	73	65	250 / 20	200 / 40	10 / 25	8 / 20	20+ years, Failure in 2031+	20+ years, Failure in 2040+	AC, AB, Subsoil Strength Decrease
E87	Hangar C (east)	All	61	57	90	250 / 70	150 / 30	20 / 25	10 / 20	20+ years, Failure in 2031+	20+ years, Failure in 2040+	AC, AB, Subsoil Strength Decrease

Annual Rehabilitation Schedule

TABLE NO. 5-2 (page 1 of 4)

TRUCKEE TAHOE AIRPORT

MAINTENANCE AND REHABILITATION SCHEDULE (2021-2040)

(BASED ON ANNUAL TOTAL PROJECT SCHEDULES)

Required for Deep Seated Distress

Estimated - Surface Distress

Year	Element (Segment ID)	Station	2020 PCI	Recommended Rehabilitation Code	Recommended Rehabilitation Description	Estimated Construction Cost
2021	Taxiway A (E10-E11)	0+00 to 31+25	32	A1	Reconstruct Section	$ 1,760,000
	Taxiways B, C, D, & T (E21, E24-E28,E30-E31, E106)	See Plates 5-1 & 5-2	34-44	A1	Reconstruct Section, Remove Taxiway C	$ 1,925,000
					2021 Total Cost	**$ 3,685,000**
2022	No Scheduled Projects					$ -
					2022 Total Cost	**$ -**
2023	Runway 2-20 and Blast Pads (E43-E45)	-2+00 to 12+00	30-43	A2	Reconstruct Section	$ 1,334,000
	Runway 2-20 and Blast Pads (E48-E50)	17+00 TO 48+60	30-35	A2	Reconstruct Section	$ 3,011,000
	Taxiways N, V, P, Q, & S (E56-E60)	See Plates 5-1 & 5-2	56-65	A2	Reconstruct Section	$ 448,000
	Gliderport (E114-E117)	See Plates 5-1 & 5-2	71	H1	Reseal Joints and Cracks	$ 24,000
	Warehouse (E124)	See Plates 5-1 & 5-2	66	H3	Reseal Joints and Cracks	$ 33,000
	Chandelle Way (E126-E127)	0+00 to 10+50	90	H2	Reseal Joints and Cracks	$ 20,000
	Aviation Way (E129)	See Plates 5-1 & 5-2	52	H3	Reseal Joints and Cracks	$ 17,000
	Terminal Parking and Road (E130)	See Plates 5-1 & 5-2	54	F, G1	New Joints, Seal Coat	$ 105,000
					2023 Total Cost	**$ 4,992,000**
2024	Apron A2 (E71-E72)	See Plates 5-1 & 5-2	59	A3	Reconstruct Section	$ 1,868,000
	Taxiways D, E, F, & Q (E32-E35, E63, E65)	See Plates 5-1 & 5-2	59-90	A3	Reconstruct Section	$ 1,151,000
	Taxiway Q (Apron Expansion) (E62, E64)	See Plates 5-1 & 5-2	93	D3	Remove/Replace 3" AC, Recompact AB	$ 104,000
	Wash Rack (E70)	See Plates 5-1 & 5-2	100*	H4	Reseal PCC Joints	$ 2,000
	Hangars J & K (E102-E105)	See Plates 5-1 & 5-2	80	H3	Reseal Joints and Cracks	$ 96,000
					2024 Total Cost	**$ 3,221,000**
2025	Apron A4 (E68)	See Plates 5-1 & 5-2	67	E	Crack Repair, Seal Cracks	$ 81,000
	Fuel Island (E69)	See Plates 5-1 & 5-2	68	G2, H1	Saw & Seal Supplemental Joints, Reseal Joints	$ 49,000
	Hangars A, B, & C (E81-E86)	See Plates 5-1 & 5-2	65	D3	Remove/Replace 3" AC, Recompact AB	$ 761,000
	Road Hangars A-H (E119)	5+25 to 8+75	65	D3	Remove/Replace 3" AC, Recompact AB	$ 59,000
	Hangar 1 Ramp (E101)	See Plates 5-1 & 5-2	61	E	Crack Repair, Seal Cracks	$ 8,000
	Hangar M (E108-E109)	See Plates 5-1 & 5-2	66	D4	Remove/Replace 4" AC, Recompact AB	$ 412,000
	Chandelle Way (E128)	10+50 to 13+75	85	D3	Remove/Replace 3" AC, Recompact AB	$ 52,000
					2025 Total Cost	**$ 1,422,000**
2026	Runway 11-29 (E6-E8)	47+00 to 70+00	75-82	A4	Reconstruct Section, Groove Runway	$ 2,646,000
	Taxiways A, U, & J (E15, E16, E39, E41)	See Plates 5-1 & 5-2	75	A4	Reconstruct Section	$ 213,000
	Runway 2-20 (E46-E47)	See Plates 5-1 & 5-2	75	A4	Reconstruct Section	$ 377,000
	Hangars D, E, & F (E90, E93-E95)	See Plates 5-1 & 5-2	90	F, G1	New Joints, Seal Coat	$ 220,000
					2026 Total Cost	**$ 3,456,000**

Notes:
1. For Rehabilitation Code details see Tables 4-1 and 4-3.
2. See Plates 5-1 and 5-2 for Stationing Controls and Pavement Segment Identification
3. See Plates 5-3 through 5-7 for Rehabilitation Schedule Maps
4. All crack repair and joint seal projects include re-marking of all pavements included in the project.
5. Approximate $150,000 annual airfield marking projects are not included in this table. These additional annual projects remark all airfield markings every 3 years.

Annual Rehabilitation Schedule

TABLE NO. 5-2 (continued) (page 2 of 4)
TRUCKEE TAHOE AIRPORT
MAINTENANCE AND REHABILITATION SCHEDULE (2021-2040)
(BASED ON ANNUAL TOTAL PROJECT SCHEDULES)

Required for Deep Seated Distress
Estimated - Surface Distress

Year	Element	Station	2020 PCI	Recommended Rehabilitation Code	Recommended Rehabilitation Description	Estimated Construction Cost
2027	Runway 11-29 (E1-E5)	-1+50 to 47+00	82	C2, G1	2" AC Mill & Fill, Groove Runway, New Joints	$ 1,843,000
	Apron A3 (E67)	See Plates 5-1 & 5-2	68	D3	Remove/Replace 3" AC, Recompact AB	$ 650,000
	Taxiways L & Q (E29, E61)	See Plates 5-1 & 5-2	68-79	D3	Remove/Replace 3" AC, Recompact AB	$ 293,000
	EAA Hangar (E100)	See Plates 5-1 & 5-2	83	F, G1	New Joints, Seal Coat	$ 41,000
					2027 Total Cost	**$ 2,827,000**
2028	Taxiway G (E14, E51-E55)	See Plates 5-1 & 5-2	43-88	B1	Relocate and Reconstruct Taxiway	$ 4,077,000
	Gliderport (E114-E117)	See Plates 5-1 & 5-2	71	D3	Remove/Replace 3" AC, Recompact AB	$ 262,000
	Chandelle Way (E126-E127)	0+00 to 10+50	90	F, H2	Reseal Joints and Cracks, Seal Coat	$ 74,000
	Aviation Way (E129)	See Plates 5-1 & 5-2	52	H3	Reseal Joints and Cracks	$ 18,000
	Terminal Parking and Road (E130)	See Plates 5-1 & 5-2	54	H2	Reseal Joints and Cracks	$ 32,000
					2028 Total Cost	**$ 4,463,000**
2029	Apron A1 (E73)	See Plates 5-1 & 5-2	61	A3	Reconstruct Section	$ 1,813,000
	Taxiways M & Q (E38, E66)	See Plates 5-1 & 5-2	61-90	A3	Reconstruct Section	$ 985,000
	Wash Rack (E70)	See Plates 5-1 & 5-2	100*	H4	Reseal PCC Joints	$ 2,000
	Hangars J & K (E102-E105)	See Plates 5-1 & 5-2	80	F, H3	Reseal Joints and Cracks, Seal Coat	$ 345,000
	Warehouse (E124)	See Plates 5-1 & 5-2	66	A5	Reconstruct Section	$ 468,000
					2029 Total Cost	**$ 3,613,000**
2030	Taxiway A (E12-E13)	31+25 to 47+00	88	F, G1	New Joints, Seal Coat	$ 168,000
	Taxiway A (E17-E20)	51+00 to 71+00	88	F, G1	New Joints, Seal Coat	$ 203,000
	Taxiways F, U, & J (E22, E23, E36, E37, E40, E42)	See Plates 5-1 & 5-2	88-90	F, G1	New Joints, Seal Coat	$ 235,000
	Fuel Island (E69)	See Plates 5-1 & 5-2	68	H3	Reseal Joints and Cracks	$ 30,000
	South Jet Apron (E74-E77)	See Plates 5-1 & 5-2	83	F, G1	New Joints, Seal Coat	$ 246,000
	Hangars G & H (E96-E99)	See Plates 5-1 & 5-2	90	F, G1	New Joints, Seal Coat	$ 229,000
	Road Hangars A-H (E122)	14+25 to 18+00	90	F, G1	New Joints, Seal Coat	$ 25,000
					2030 Total Cost	**$ 1,136,000**
2031	Apron A4 (E68)	See Plates 5-1 & 5-2	67	D3	Remove/Replace 3" AC, Recompact AB	$ 1,389,000
	Hangars C, D, & E (E87-E89, E91-E92)	See Plates 5-1 & 5-2	90-93	F, G1	New Joints, Seal Coat	$ 146,000
	Hangars D, E, & F (E90, E93-E95)	See Plates 5-1 & 5-2	90	H2	Reseal Joints and Cracks	$ 66,000
	Road Hangars A-H (E120-E121)	See Plates 5-1 & 5-2	90	F, G1	New Joints, Seal Coat	$ 42,000
	Hangar 1 Ramp (E101)	See Plates 5-1 & 5-2	61	D3	Remove/Replace 3" AC, Recompact AB	$ 138,000
					2031 Total Cost	**$ 1,781,000**

Notes:
1. For Rehabilitation Code details see Tables 4-1 and 4-3.
2. See Plates 5-1 and 5-2 for Stationing Controls and Pavement Segment Identification
3. See Plates 5-3 through 5-7 for Rehabilitation Schedule Maps
4. All crack repair and joint seal projects include re-marking of all pavements included in the project.
5. Approximate $150,000 annual airfield marking projects are not included in this table. These additional annual projects remark all airfield markings every 3 years.

TABLE NO. 5-2 (continued) (page 3 of 4)
TRUCKEE TAHOE AIRPORT
MAINTENANCE AND REHABILITATION SCHEDULE (2021-2040)
(BASED ON ANNUAL TOTAL PROJECT SCHEDULES)

Annual Rehabilitation Schedule

Required for Deep Seated Distress
Estimated - Surface Distress

Year	Element	Station	2020 PCI	Recommended Rehabilitation Code	Recommended Rehabilitation Description	Estimated Construction Cost
2032	Runway 11-29 (E1-E5)	-1+50 to 47+00	82	H2	Reseal Joints and Cracks	$ 316,000
	EAA Hangar (E100)	See Plates 5-1 & 5-2	83	H2	Reseal Joints and Cracks	$ 12,000
	Hangars L, N, & P (E111-113)	See Plates 5-1 & 5-2	93	F, G1	New Joints, Seal Coat	$ 239,000
	Aviation Way (E129)	See Plates 5-1 & 5-2	52	A5	Reconstruct Section	$ 238,000
					2032 Total Cost	**$ 805,000**
2033	Taxilane R & Taxiway M (E78-E80)	See Plates 5-1 & 5-2	100	F, G1	New Joints, Seal Coat	$ 216,000
	Chandelle Way (E126-E127)	0+00 to 10+50	90	H2	Reseal Joints and Cracks	$ 23,000
	Terminal Parking and Road (E130)	See Plates 5-1 & 5-2	54	D3	Remove/Replace 3" AC, Recompact AB	$ 245,000
					2033 Total Cost	**$ 484,000**
2034	Wash Rack (E70)	See Plates 5-1 & 5-2	100*	H4	Reseal PCC Joints	$ 2,000
	Hangars J & K (E102-E105)	See Plates 5-1 & 5-2	80	H3	Reseal Joints and Cracks	$ 116,000
	Road Hangars A-H (E118)	See Plates 5-1 & 5-2	20 / 100*	F, G1	New Joints, Seal Coat	$ 22,000
	Med Services Apron (E123)	See Plates 5-1 & 5-2	100*	F, G1	New Joints, Seal Coat	$ 41,000
	Maintenance Building (E125)	See Plates 5-1 & 5-2	39 / 100*	F, G1	New Joints, Seal Coat	$ 49,000
					2034 Total Cost	**$ 230,000**
2035	Runway 29 Blast Pad (E9)	70+00 to 71+50	21 / 100*	F, G1	New Joints, Seal Coat	$ 32,000
	Taxiway A (E10-E11)	0+00 to 31+25	32	F, G1	New Joints, Seal Coat	$ 338,000
	Taxiways B, C, & D (E21, E24-E27,E30-E31)	See Plates 5-1 & 5-2	23-82	F, G1	New Joints, Seal Coat	$ 333,000
	Taxiway A (E12-E13)	31+25 to 47+00	88	H2	Reseal Joints and Cracks	$ 51,000
	Taxiway A (E17-E20)	51+00 to 71+00	88	H2	Reseal Joints and Cracks	$ 61,000
	Taxiways F, U, & J (E22, E23, E36, E37, E40, E42)	See Plates 5-1 & 5-2	88-90	H2	Reseal Joints and Cracks	$ 71,000
	Fuel Island (E69)	See Plates 5-1 & 5-2	68	F, H3	Reseal Joints and Cracks, Seal Coat	$ 97,000
	South Jet Apron (E74-E77)	See Plates 5-1 & 5-2	83	H2	Reseal Joints and Cracks	$ 74,000
	Hangars G & H (E96-E99)	See Plates 5-1 & 5-2	90	H2	Reseal Joints and Cracks	$ 70,000
	Road Hangars A-H (E122)	14+25 to 18+00	90	H2	Reseal Joints and Cracks	$ 7,000
	Taxilane T & Hangar L (E106, E107, E110)	See Plates 5-1 & 5-2	66 / 100*	F, G1	New Joints, Seal Coat	$ 162,000
					2035 Total Cost	**$ 1,296,000**
2036	Hangars C, D, E, & F (E87-E95)	See Plates 5-1 & 5-2	90-93	H2	Reseal Joints and Cracks	$ 118,000
	Road Hangars A-H (E120-E121)	See Plates 5-1 & 5-2	90	H2	Reseal Joints and Cracks	$ 13,000
					2036 Total Cost	**$ 131,000**

Notes:
1. For Rehabilitation Code details see Tables 4-1 and 4-3.
2. See Plates 5-1 and 5-2 for Stationing Controls and Pavement Segment Identification
3. See Plates 5-3 through 5-7 for Rehabilitation Schedule Maps
4. All crack repair and joint seal projects include re-marking of all pavements included in the project.
5. Approximate $150,000 annual airfield marking projects are not included in this table. These additional annual projects remark all airfield markings every 3 years.

TABLE NO. 5-2 (continued) (page 4 of 4)
TRUCKEE TAHOE AIRPORT
MAINTENANCE AND REHABILITATION SCHEDULE (2021-2040)
(BASED ON ANNUAL TOTAL PROJECT SCHEDULES)

Annual Rehabilitation Schedule

Project Timing - Required for Deep Seated Distress
Project Timing - Estimated for Surface Distress

Year	Element	Station	2020 PCI	Recommended Rehabilitation Code	Recommended Rehabilitation Description	Estimated Construction Cost
2037	Runway 11-29 (E1-E5)	-1+50 to 47+00	82	H2	Reseal Joints and Cracks	$ 350,000
	Runway 2-20 and Blast Pads (E43-E45)	-2+00 to 12+00	30-43	F, G1	New Joints, Seal Coat	$ 226,000
	Runway 2-20 and Blast Pads (E48-E50)	17+00 TO 48+60	30-35	F, G1	New Joints, Seal Coat	$ 510,000
	Taxiways N, V, P, Q, & S (E56-E60)	See Plates 5-1 & 5-2	56-65	F, G1	New Joints, Seal Coat	$ 76,000
	EAA Hangar (E100)	See Plates 5-1 & 5-2	83	H2	Reseal Joints and Cracks	$ 14,000
	Hangars L, N, & P (E111-113)	See Plates 5-1 & 5-2	93	H2	Reseal Joints and Cracks	$ 72,000
					2037 Total Cost	**$ 1,248,000**
2038	Apron A3 (E67)	See Plates 5-1 & 5-2	68	A3	Reconstruct Section	$ 1,494,000
	Taxiways L & Q (E29, E61)	See Plates 5-1 & 5-2	68-79	A3	Reconstruct Section	$ 675,000
	Apron A2 (E71-E72)	See Plates 5-1 & 5-2	59	F, G1	New Joints, Seal Coat	$ 349,000
	Taxiways D, E, F, & Q (E32-E35, E63, E65)	See Plates 5-1 & 5-2	59-90	F, G1	New Joints, Seal Coat	$ 216,000
	Taxiway Q (Apron Expansion) (E62, E64)	See Plates 5-1 & 5-2	93	F, G1	New Joints, Seal Coat	$ 45,000
	Taxilane R & Taxiway M (E78-E80)	See Plates 5-1 & 5-2	100	H2	Reseal Joints and Cracks	$ 66,000
	Chandelle Way (E126-E127)	0+00 to 10+50	90	D3	Remove/Replace 3" AC, Recompact AB	$ 148,000
					2038 Total Cost	**$ 2,993,000**
2039	Wash Rack (E70)	See Plates 5-1 & 5-2	100*	H4	Reseal PCC Joints	$ 2,000
	Hangars A, B, & C (E81-E86)	See Plates 5-1 & 5-2	65	F, G1	New Joints, Seal Coat	$ 327,000
	Road Hangars A-H (E118)	See Plates 5-1 & 5-2	20 / 100*	H2	Reseal Joints and Cracks	$ 7,000
	Road Hangars A-H (E119)	5+25 to 8+75	65	F, G1	New Joints, Seal Coat	$ 25,000
	Hangars J & K (E102-E105)	See Plates 5-1 & 5-2	80	D3	Remove/Replace 3" AC, Recompact AB	$ 683,000
	Hangar M (E108-E109)	See Plates 5-1 & 5-2	66	F, G1	New Joints, Seal Coat	$ 161,000
	Med Services Apron (E123)	See Plates 5-1 & 5-2	100*	H2	Reseal Joints and Cracks	$ 12,000
	Maintenance Building (E125)	See Plates 5-1 & 5-2	39 / 100*	H2	Reseal Joints and Cracks	$ 15,000
	Chandelle Way (E128)	10+50 to 13+75	85	F, G1	New Joints, Seal Coat	$ 22,000
					2039 Total Cost	**$ 1,254,000**
2040	Runway 11-29 (E6-E8)	47+00 to 70+00	75-82	F, G1	New Joints, Seal Coat	$ 494,000
	Runway 2-20 (E46-E47)	See Plates 5-1 & 5-2	75	F, G1	New Joints, Seal Coat	$ 71,000
	Taxiways A, U, & J (E15, E16, E39, E41)	See Plates 5-1 & 5-2	75	F, G1	New Joints, Seal Coat	$ 39,000
	Runway 29 Blast Pad (E9)	70+00 to 71+50	21 / 100*	H2	Reseal Joints and Cracks	$ 10,000
	Taxiway A (E10-E13)	0+00 to 47+00	32-88	H2	Reseal Joints and Cracks	$ 159,000
	Taxiway A (E17-E20)	51+00 to 71+00	88	H2	Reseal Joints and Cracks	$ 67,000
	Taxiways B, C, & D (E21, E24-E27,E30-E31)	See Plates 5-1 & 5-2	23-82	H2	Reseal Joints and Cracks	$ 102,000
	Taxiways F, U, & J (E22, E23, E36, E37, E40, E42)	See Plates 5-1 & 5-2	88-90	H2	Reseal Joints and Cracks	$ 77,000
	Fuel Island (E69)	See Plates 5-1 & 5-2	68	D3	Remove/Replace 3" AC, Recompact AB	$ 212,000
	South Jet Apron (E74-E77)	See Plates 5-1 & 5-2	83	H2	Reseal Joints and Cracks	$ 83,000
	Hangars G & H (E96-E99)	See Plates 5-1 & 5-2	90	H2	Reseal Joints and Cracks	$ 76,000
	Road Hangars A-H (E122)	14+25 to 18+00	90	H2	Reseal Joints and Cracks	$ 8,000
	Taxilane T & Hangar L (E106, E107, E110)	See Plates 5-1 & 5-2	66 / 100*	H2	Reseal Joints and Cracks	$ 49,000
					2040 Total Cost	**$ 1,447,000**

Notes:
1. For Rehabilitation Code details see Tables 4-1 and 4-3.
2. See Plates 5-1 and 5-2 for Stationing Controls and Pavement Segment Identification
3. See Plates 5-3 through 5-7 for Rehabilitation Schedule Maps
4. All crack repair and joint seal projects include re-marking of all pavements included in the project.
5. Approximate $150,000 annual airfield marking projects are not included in this table. These additional annual projects remark all airfield markings every 3 years.

Table 5-3
Summary of Existing Conditions and Rehabilitation Requirements
Truckee Tahoe Airport

Pavement Segment ID (See Plate 5-1)	Element	Station (See Plate 5-2)	Construction Record: Original	Construction Record: Reconstruct	Construction Record: Latest Overlay	FWD Data: Load (kips)	FWD Data: Deflection Range (mils)	FWD Data: Deflection Used (mils)	Pavement Surface Data: 2011 PCI	2013 PCI	2020 PCI	Pavement Rating	Pavement Condition Number PCN	Existing Pavement Section - inches: PCC	AC	CTB	AB	ASB	Subgrade	Subsoil	Existing Modulus of Elasticity (E) - ksi: PCC	AC	CTB	AB	ASB	Subgrade	Subsoil	Traffic Index	Remaining Pavement Life - Years from 2020: Fatigue Analysis (Brandley) Remaining Life - Subgrade (Forecast Traffic)	Fatigue Analysis (Brandley) Remaining Life - Subgrade (Enhanced Traffic)	Recommended Rehabilitation and Maintenance (Project Timing - Required for Deep Seated Distress / Project Timing - Estimated for Surface Distress): 2021-2025	2026-2030	2031-2035	2036-2040	Element
E1	Runway 11 Blast Pad	-1+50 to 0+00		1986, 2012		30	25-46	46	55	95	82	Very Good	25 F/A/Y/T	-	3	-	8	5	48	S.I.	-	250	-	70	30	25	40	T28	20+	20+		2027 - 2" AC Mill & Fill, Groove, Saw & Seal Joints	2032 - Reseal Joints & Cracks	2037 - Reseal Joints & Cracks	Runway 11 Blast Pad
E2	Runway 11-29	0+00 to 14+25	1963	1986, 2012		30	23-32	32	60	95	82	Very Good	25 F/B/Y/T	-	3	-	8	5	48	S.I.	-	350	-	80	50	20	40	T1	20+	20+		2027 - 2" AC Mill & Fill, Groove, Saw & Seal Joints	2032 - Reseal Joints & Cracks	2037 - Reseal Joints & Cracks	Runway 11-29
E3	Runway 11-29	14+25 to 23+00	1963	1986, 2012		30	32-36	36	60	95	82	Very Good	25 F/B/Y/T	-	3	-	8	5	48	S.I.	-	350	-	80	50	20	25	T1	20+	20+		2027 - 2" AC Mill & Fill, Groove, Saw & Seal Joints	2032 - Reseal Joints & Cracks	2037 - Reseal Joints & Cracks	Runway 11-29
E4	Runway 11-29	23+00 to 37+00	1963	1986, 2012		30	30-36	36	60	95	82	Very Good	25 F/B/Y/T	-	3	-	8	5	48	S.I.	-	350	-	80	50	20	25	T1	20+	20+		2027 - 2" AC Mill & Fill, Groove, Saw & Seal Joints	2032 - Reseal Joints & Cracks	2037 - Reseal Joints & Cracks	Runway 11-29
E5	Runway 11-29	37+00 to 47+00	1963	1986, 2012		30	27-36	36	60	95	82	Very Good	10 F/C/Y/T	-	3	-	8	5	48	S.I.	-	350	-	80	50	20	25	T1	20+	20+		2027 - 2" AC Mill & Fill, Groove, Saw & Seal Joints	2032 - Reseal Joints & Cracks	2037 - Reseal Joints & Cracks	Runway 11-29
E6	Runway 11-29	47+00 to 48+75	1963	1986, 2008		30	47-56	62	86	86	82	Very Good	10 F/C/Y/T	-	4	-	8	-	48	S.I.	-	300	-	60	-	12	20	T1	11	7		2026 - Reconstruction, Groove		2040 - New Joints, Seal Coat	Runway 11-29
E7	Runway 11-29	48+75 to 64+25	1963	1986, 2008		30	38-63	62	86	86	75	Very Good	10 F/C/Y/T	-	4	-	8	-	48	S.I.	-	300	-	60	-	12	20	T1	11	7		2026 - Reconstruction, Groove		2040 - New Joints, Seal Coat	Runway 11-29
E8	Runway 11-29	64+25 to 70+00	1971	1986, 2008		30	38-59	62	86	86	75	Very Good	10 F/C/Y/T	-	4	-	8	-	48	S.I.	-	300	-	60	-	12	20	T1	11	7		2026 - Reconstruction, Groove		2040 - New Joints, Seal Coat	Runway 11-29
E9	Runway 29 Blast Pad*	70+00 to 71+50		1986, 2020		30	57-86	62	55	38	21 / 100*	Very Poor/ Excellent*	10 F/C/Y/T	-	4	-	8	-	48	S.I.	-	300	-	60	-	12	20	T28	20+	20+			2035 - New Joints, Seal Coat	2040 - Reseal Joints & Cracks	Runway 29 Blast Pad*
E10	Taxiway A	0+00 to 24+00	1963	1986		20	26-42	42	51	46	32	Poor	9 F/C/Y/T	-	3	-	8	-	48	S.I.	-	250	-	65	-	12	30	T2	9	5	2021 - Reconstruction		2035 - New Joints, Seal Coat	2040 - Reseal Joints & Cracks	Taxiway A
E11	Taxiway A	24+00 to 31+25	1963	1986		20	23-49	42	51	38	32	Poor	9 F/C/Y/T	-	3	-	8	-	48	S.I.	-	250	-	65	-	12	30	T3	4	3	2021 - Reconstruction		2035 - New Joints, Seal Coat	2040 - Reseal Joints & Cracks	Taxiway A
E12	Taxiway A	31+25 to 36+75	1963	1986, 2016		20	27-32	32	51	38	88	Excellent	24 F/B/Y/T	-	3	-	4	11	48	S.I.	-	200	-	60	50	15	30	T3	20+	20+		2030 - New Joints, Seal Coat	2035 - Reseal Joints & Cracks	2040 - Reseal Joints & Cracks	Taxiway A
E13	Taxiway A	36+75 to 47+00	1963	1986, 2016		20	24-30	32	51	44	88	Excellent	24 F/B/Y/T	-	3	-	4	11	48	S.I.	-	200	-	60	50	15	30	T3	20+	20+		2030 - New Joints, Seal Coat	2035 - Reseal Joints & Cracks	2040 - Reseal Joints & Cracks	Taxiway A
E14	Taxiway A	47+00 to 49+50	1963	1986, 2016		20	17-26	19	51	38	88	Excellent	24 F/A/Y/T	-	3	-	4	10	S.I.	-	-	350	-	80	60	40	-	T3	20+	20+		2028 - Relocate & Reconstruction			Taxiway A
E15	Taxiway A	49+50 to 49+75	1963	1986, 2008		20	46	42	80	75	75	Very Good	10 F/C/Y/T	-	6	-	6	-	48	S.I.	-	200	-	40	-	12	20	T2	10	6		2026 - Reconstruction		2040 - New Joints, Seal Coat	Taxiway A
E16	Taxiway A	50+50 to 51+00	1963	1986, 2008		20	53	42	80	75	75	Very Good	10 F/C/Y/T	-	6	-	6	-	48	S.I.	-	200	-	40	-	12	20	T2	10	6		2026 - Reconstruction		2040 - New Joints, Seal Coat	Taxiway A
E17	Taxiway A	51+00 to 58+75	1963	1986, 2016		20	34-43	36	51	35	88	Excellent	24 F/B/Y/T	-	3	-	4	11	48	S.I.	-	250	-	50	30	15	20	T2	20+	20+		2030 - New Joints, Seal Coat	2035 - Reseal Joints & Cracks	2040 - Reseal Joints & Cracks	Taxiway A
E18	Taxiway A	58+75 to 61+25	1963	1986, 2016		20	30	30	51	35	88	Excellent	30 F/B/Y/T	-	3	-	4	10	48	S.I.	-	300	-	60	40	20	25	T2	20+	20+		2030 - New Joints, Seal Coat	2035 - Reseal Joints & Cracks	2040 - Reseal Joints & Cracks	Taxiway A
E19	Taxiway A	61+25 to 67+75	1963	1986, 2016		20	29-37	36	51	35	88	Excellent	24 F/B/Y/T	-	3	-	4	11	48	S.I.	-	250	-	50	30	15	20	T2	20+	20+		2030 - New Joints, Seal Coat	2035 - Reseal Joints & Cracks	2040 - Reseal Joints & Cracks	Taxiway A
E20	Taxiway A	67+75 to 71+00	1963	1986, 2016		20	36-46	46	51	35	88	Excellent	22 F/C/Y/T	-	3	-	4	11	48	S.I.	-	275	-	55	35	10	25	T2	20+	20+		2030 - New Joints, Seal Coat	2035 - Reseal Joints & Cracks	2040 - Reseal Joints & Cracks	Taxiway A
E21	Taxiway B Runup	Runup Apron	1963	1986		20	41-83	68	-	22	7	Failed	9 F/C/Y/T	-	3	-	8	-	48	S.I.	-	150	-	25	-	10	30	T2	7	4	2021 - Reconstruction		2035 - New Joints, Seal Coat	2040 - Reseal Joints & Cracks	Taxiway B Runup
E22	Taxiway U Runup	Runup Apron	1963	1986, 2016		20	35-48	48	53	18	88	Excellent	22 F/C/Y/T	-	3	-	4	10	48	S.I.	-	200	-	40	20	12	25	T2	20+	20+		2030 - New Joints, Seal Coat	2035 - Reseal Joints & Cracks	2040 - Reseal Joints & Cracks	Taxiway U Runup
E23	TW J Runup	Runup Apron	1963,	1986, 2016		20	40-59	46	51	35	88	Excellent	22 F/C/Y/T	-	3	-	4	11	48	S.I.	-	275	-	55	35	10	25	T2	20+	20+		2030 - New Joints, Seal Coat	2035 - Reseal Joints & Cracks	2040 - Reseal Joints & Cracks	TW J Runup
E24	Taxiway B	0+00 to 0+50	1963	1986		30	27-44	26	51	41	82	Very Good	27 F/A/Y/T	-	3	-	8	-	48	S.I.	-	350	-	80	-	30	40	T2	20+	20+	2021 - Reconstruction		2035 - New Joints, Seal Coat	2040 - Reseal Joints & Cracks	Taxiway B
E25	Taxiway B	0+50 to 1+75	1963	1986		30	46-74	70	51	41	23	Very Poor	10 F/B/Y/T	-	3	-	8	-	48	S.I.	-	350	-	50	-	15	35	T2	12	8	2021 - Reconstruction		2035 - New Joints, Seal Coat	2040 - Reseal Joints & Cracks	Taxiway B
E26	Taxiway C	0+00 to 0+60	1963	1995, 2012		30	44-49	44	60	95	82	Very Good	13 F/B/Y/T	-	3	-	8	-	48	S.I.	-	350	-	80	-	18	30	T5	20+	20+	2021 - Reconstruction		2035 - New Joints, Seal Coat	2040 - Reseal Joints & Cracks	Taxiway C
E27	Taxiway C	0+60 to 1+75	1963	1995		30	56-74	63	60	43	28	Poor	11 F/B/Y/T	-	4	-	8	-	48	S.I.	-	250	-	50	-	15	25	T5	20+	20+	2021 - Reconstruction		2035 - New Joints, Seal Coat	2040 - Reseal Joints & Cracks	Taxiway C
E28	Taxiway C (south)	0+25 to 1+75	1963	1995	2012	30	22-60	60	55	90	31	Poor	18 F/B/Y/T	-	3	-	12	-	48	S.I.	-	250	-	50	-	13	30	T17	20+	20+	2021 - Remove Taxiway				Taxiway C (south)
E29	Taxiway L	0+25 to 1+75		1993	2013	20	28-43	43	40	95	79	Very Good	10 F/B/Y/T	-	3	-	6	-	48	S.I.	-	300	-	70	-	20	30	T12	20+	16		2027 - Remove & Replace AC		2038 - Reconstruction	Taxiway L
E30	Taxiway D	0+00 to 1+00	1963	1986, 2012		30	29-41	41	45	95	82	Very Good	22 F/A/Y/T	-	3	-	8	-	48	S.I.	-	350	-	80	-	25	30	T5	20+	20+	2021 - Reconstruction		2035 - New Joints, Seal Coat	2040 - Reseal Joints & Cracks	Taxiway D
E31	Taxiway D	1+00 to 1+75	1963	1986		30	46-59	60	45	34	30	Poor	10 F/B/Y/T	-	3	-	8	-	48	S.I.	-	250	-	60	-	15	20	T5	20+	20+	2021 - Reconstruction		2035 - New Joints, Seal Coat	2040 - Reseal Joints & Cracks	Taxiway D
E32	Taxiway D (south)	0+25 to 1+75		1986	2012	30	47-60	60	45	93	74	Very Good	10 F/B/Y/T	-	4	-	6	-	48	S.I.	-	350	-	70	-	20	25	T2	10	6	2024 - Reconstruction			2038 - New Joints, Seal Coat	Taxiway D (south)
E33	Taxiway E	0+25 to 1+50	1963	1986, 2016		30	39-47	47	43	90	60	Good	10 F/B/Y/T	-	4	-	6	-	48	S.I.	-	350	-	80	-	20	25	T2	10	6	2024 - Reconstruction			2038 - New Joints, Seal Coat	Taxiway E
E34	Taxiway F (south)	0+25 to 1+00	1963	2016		30	35-37	37	49	95	90	Excellent	30 F/B/Y/T	-	3	-	4	10	48	S.I.	-	300	-	70	50	20	25	T4	20+	20+	2024 - Reconstruction			2038 - New Joints, Seal Coat	Taxiway F (south)
E35	Taxiway F (south)	1+00 to 1+75	1963	1986, 2012		30	32-69	69	49	95	73	Very Good	6 F/B/Y/T	-	3	-	8	-	48	S.I.	-	250	-	60	-	10	25	T4	10	6	2024 - Reconstruction			2038 - New Joints, Seal Coat	Taxiway F (south)
E36	Taxiway F	0+00 to 0+75	1963	1986, 2016		30	57-53	53	49	95	90	Excellent	30 F/B/Y/T	-	3	-	4	10	48	S.I.	-	300	-	50	35	20	30	T5	20+	20+		2030 - New Joints, Seal Coat	2035 - Reseal Joints & Cracks	2040 - Reseal Joints & Cracks	Taxiway F
E37	Taxiway F	0+75 to 1+75	1963	1986, 2016		30	27-35	35	49	40	90	Excellent	46 F/A/Y/T	-	3	-	4	10	48	S.I.	-	300	-	70	50	25	35	T5	20+	20+		2030 - New Joints, Seal Coat	2035 - Reseal Joints & Cracks	2040 - Reseal Joints & Cracks	Taxiway F
E38	Taxiway M	0+25 to 1+25		2016		30	45-46	46	45	95	90	Excellent	24 F/B/Y/T	-	3	-	4	10	48	S.I.	-	300	-	75	40	15	30	T10	20+	20+		2029 - Reconstruction			Taxiway M
E39	Taxiway U	0+00 to 0+50	1971	1986, 2008		30	54-59	59	54	50	75	Very Good	10 F/B/Y/T	-	3	-	8	-	48	S.I.	-	300	-	75	-	15	25	T5	20+	20+		2026 - Reconstruction		2040 - New Joints, Seal Coat	Taxiway U
E40	Taxiway U	0+50 to 2+00	1971	1986, 2016		30	48-51	51	54	50	90	Excellent	24 F/B/Y/T	-	3	-	4	10	48	S.I.	-	300	-	75	40	15	25	T5	20+	20+		2030 - New Joints, Seal Coat	2035 - Reseal Joints & Cracks	2040 - Reseal Joints & Cracks	Taxiway U
E41	Taxiway J	0+00 to 0+50	1971	1986, 2008		30	43-45	45	51	50	75	Very Good	14 F/B/Y/T	-	3	-	8	-	48	S.I.	-	300	-	75	-	20	30	T2	20	13		2026 - Reconstruction		2040 - New Joints, Seal Coat	Taxiway J
E42	Taxiway J	0+50 to 2+00	1971	1986, 2016		30	35-48	48	51	50	90	Excellent	24 F/B/Y/T	-	3	-	4	10	48	S.I.	-	300	-	75	40	17	23	T2	20+	20+		2030 - New Joints, Seal Coat	2035 - Reseal Joints & Cracks	2040 - Reseal Joints & Cracks	Taxiway J
E43	Blast Pad RW 2	-2+00 to 0+00				20	45-64	n/a	42	40	43	Fair	F/-/Y/T	-	-	-	-	-	-	-	-	-	-	-	-	-	-	T28	-	-	2023 - Reconstruction			2037 - New Joints, Seal Coat	Blast Pad RW 2
E44	Runway 2-20	0+00 to 7+50	1973	1994		20	31-52	49	75	65	30	Poor	9 F/C/Y/T	-	6	-	6	-	48	S.I.	-	150	-	30	-	10	20	T6	20+	20+	2023 - Reconstruction			2037 - New Joints, Seal Coat	Runway 2-20
E45	Runway 2-20	7+50 to 12+00	1965	1994		20	38-42	42	75	65	30	Poor	10 F/C/Y/T	-	6	-	6	-	48	S.I.	-	200	-	40	-	12	20	T6	20+	20+	2023 - Reconstruction			2037 - New Joints, Seal Coat	Runway 2-20
E46	Runway 2-20	12+00 to 14+00	1965	1994, 2008		30	38-42	62	75	75	75	Very Good	10 F/C/Y/T	-	4	-	8	-	48	S.I.	-	300	-	60	-	12	20	T6	20+	20+		2026 - Reconstruction		2040 - New Joints, Seal Coat	Runway 2-20
E47	Runway 2-20	15+00 to 17+00	1965	1994, 2008		30	37-42	62	75	75	75	Very Good	10 F/C/Y/T	-	4	-	8	-	48	S.I.	-	300	-	60	-	12	20	T6	20+	20+		2026 - Reconstruction		2040 - New Joints, Seal Coat	Runway 2-20
E48	Runway 2-20	17+00 to 30+50	1965	1994		20	30-42	42	75	53	30	Poor	9 F/C/Y/T	-	5	-	5	-	48	S.I.	-	250	-	50	-	12	20	T6	20+	20+	2023 - Reconstruction			2037 - New Joints, Seal Coat	Runway 2-20
E49	Runway 2-20	30+50 to 46+54	1965	1994		20	28-42	42	75	53	30	Poor	9 F/C/Y/T	-	5	-	5	-	48	S.I.	-	250	-	50	-	12	20	T6	20+	20+	2023 - Reconstruction			2037 - New Joints, Seal Coat	Runway 2-20
E50	Blast Pad RW 20	46+54 to 48+60				20	30-95	95	42	34	35	Poor	F/-/Y/T	-	-	-	-	-			-	-	-	-	-	-	-	T28	-	-	2023 - Reconstruction			2037 - New Joints, Seal Coat	Blast Pad RW 20

* - This pavement was constructed after all testing was completed for this pavement evaluation study. Values indicated with an * are expected values of PCI or Modulus of Elasticity after construction.

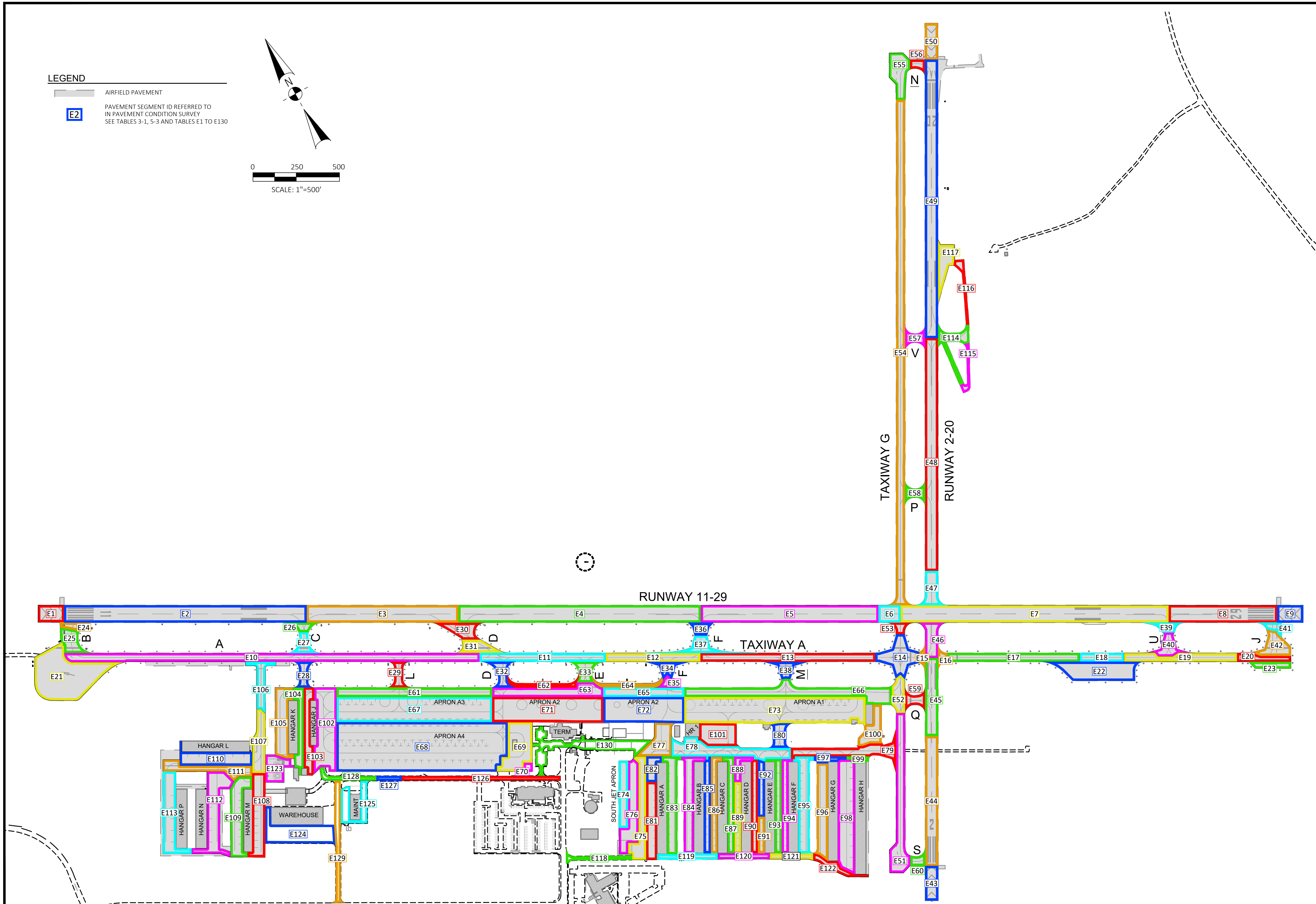
Pavement Segment ID (See Plate 5-1)	Element	Station (See Plate 5-2)	Construction Record: Original	Construction Record: Reconstruct	Construction Record: Latest Overlay	FWD Data: Load (kips)	FWD Data: Deflection Range (mils)	FWD Data: Deflection Used (mils)	Pavement Surface Data: 2011 PCI	2013 PCI	2020 PCI	Pavement Rating	Pavement Condition Number PCN	Existing Pavement Section - inches: PCC	AC	CTB	AB	ASB	Subgrade	Subsoil	Existing Modulus of Elasticity (E) - ksi: PCC	AC	CTB	AB	ASB	Subgrade	Subsoil	Traffic Index	Remaining Pavement Life - Years from 2020: Fatigue Analysis (Brandley) Remaining Life - Subgrade (Forecast Traffic)	Fatigue Analysis (Brandley) Remaining Life - Subgrade (Enhanced Traffic)	Recommended Rehabilitation and Maintenance (Project Timing - Required for Deep Seated Distress / Project Timing - Estimated for Surface Distress): 2021-2025	2026-2030	2031-2035	2036-2040	Element
E51	Taxiway G	-0+40 to 9+00	1972	1994		20	37-78	56	77	65	43	Fair	9 F/C/Y/T	-	6	-	6	-	48	S.I.	-	150	-	30	-	10	20	T7	20+	20+		2028 - Relocate & Reconstruction			Taxiway G
E52	Taxiway G	9+00 to 11+00	1972	1994		20	29-32	56	77	55	43	Fair	9 F/C/Y/T	-	6	-	6	-	48	S.I.	-	150	-	30	-	10	20	T7	20+	20+		2028 - Relocate & Reconstruction			Taxiway G
E53	Taxiway G	13+50 to 14+25	1972	1994, 2008		30	42	62	77	75	75	Very Good	10 F/C/Y/T	-	4	-	8	-	48	S.I.	-	300	-	60	-	12	20	T7	20+	20+		2028 - Relocate & Reconstruction			Taxiway G
E54	Taxiway G	15+25 to 44+50	1984	1994		30	19-40	44	77	65	48	Fair	7 F/B/Y/T	-	5	-	5	-	48	S.I.	-	350	-	80	-	15	25	T7	20+	20+		2028 - Relocate & Reconstruction			Taxiway G
E55	Taxiway G	44+50 to 47+25	1984	1994		20	32-38	38	77	65	48	Fair	11 F/B/Y/T	-	6	-	6	-	48	S.I.	-	200	-	40	-	15	30	T7	20+	20+		2028 - Relocate & Reconstruction			Taxiway G
E56	Taxiway N	0+00 to 1+00				20	28-31	31	77	65	60	Good	11 F/B/Y/T	-	6	-	6	-	48	S.I.	-	300	-	70	-	15	30	T8	20+	20+	2023 - Reconstruction			2037 - New Joints, Seal Coat	Taxiway N
E57	Taxiway V	0+00 to 1+25		1994		20	60-85	84	80	70	65	Good	3 F/C/Y/T	-	3	-	6	-	48	S.I.	-	200	-	30	-	7	20	T9	9	8	2023 - Reconstruction			2037 - New Joints, Seal Coat	Taxiway V
E58	Taxiway P	0+00 to 1+25		1994		20	46-57	57	80	70	65	Good	5 F/C/Y/T	-	3	-	6	-	48	S.I.	-	250	-	60	-	10	20	T9	20+	19	2023 - Reconstruction			2037 - New Joints, Seal Coat	Taxiway P
E59	Taxiway Q	0+00 to 1+25	1973	1999		20	27-57	57	80	70	60	Good	3 F/C/Y/T	-	3	-	6	-	48	S.I.	-	250	-	60	-	8	20	T9	16	14	2023 - Reconstruction			2037 - New Joints, Seal Coat	Taxiway Q
E60	Taxiway S	0+00 to 1+00				20	30-33	33	77	65	56	Good	10 F/C/Y/T	-	6	-	6	-	48	S.I.	-	300	-	70	-	12	20	T8	20+	20+	2023 - Reconstruction			2037 - New Joints, Seal Coat	Taxiway S
E61	Taxilane Q (Ramp)	T/L Q 24+50 to 37+00 (Apron A3)		1993	2013	30	35-51	50	40	95	68	Good	12 F/A/Y/T	-	2.5	-	6	-	S.I.	-	-	350	-	70	-	25	-	T12	20+	20+		2027 - Remove & Replace AC		2038 - Reconstruction	Taxilane Q (Ramp)
E62	Taxilane Q (Ramp)	Apron A2 (north expansion)	2016			30	32-51	45	-	-	93	Excellent	22 F/C/Y/T	-	3	-	6	8	48	S.I.	-	300	-	60	40	12	25	T2	20+	20+	2024 - Remove & Replace AC			2038 - New Joints, Seal Coat	Taxilane Q (Ramp)
E63	Taxilane Q (Ramp)	T/L Q 16+25 to 25+50 (Apron A2)		1999	2012	30	33-50	47	43	90	59	Good	10 F/B/Y/T	-	3.5	-	6	-	48	S.I.	-	350	-	70	-	20	25	T2	10	6	2024 - Reconstruction			2038 - New Joints, Seal Coat	Taxilane Q (Ramp)
E64	Taxilane Q (Ramp)	Apron A2 (north expansion)	2016			30	38-41	40	-	-	93	Excellent	24 F/B/Y/T	-	3	-	6	8	48	S.I.	-	350	-	75	60	15	25	T2	20+	20+	2024 - Remove & Replace AC			2038 - New Joints, Seal Coat	Taxilane Q (Ramp)
E65	Taxilane Q (Ramp)	T/L Q 12+50 to 16+25 (Apron A2)		1999	2013	20	20-34	32	43	90	59	Good	12 F/A/Y/T	-	3.5	-	6	-	48	S.I.	-	250	-	60	-	22	30	T2	11	7	2024 - Reconstruction			2038 - New Joints, Seal Coat	Taxilane Q (Ramp)
E66	Taxilane Q (Ramp)	T/L Q 0+50 to 12+50 (Apron A1)			2013	20	32-66	55	45	95	61	Good	9 F/C/Y/T	-	3.5	-	6	-	48	S.I.	-	200	-	40	-	12	20	T10	11	8		2029 - Reconstruction			Taxilane Q (Ramp)
E67	Apron A3	Apron A3		1999	2013	30	34-77	77	40	95	68	Good	10 F/B/Y/T	-	2.5	-	6	-	48	S.I.	-	150	-	30	-	20	25	T12	20+	20		2027 - Remove & Replace AC		2038 - Reconstruction	Apron A3
E68	Apron A4	Apron A4	1965	1999, 2014		20	35-72	65	32	23	67	Good	11 F/B/Y/T	-	3	-	9	-	48	S.I.	-	250	-	50	-	15	25	T13	20+	20+	2025 - Crack Seal		2031 - Remove & Replace AC		Apron A4
E69	Fuel Island	Self Serve Fuel Island		2010		20	34-52	46	-	-	68	Good	10 F/C/Y/T	-	3	-	9	-	48	S.I.	-	250	-	50	-	12	25	T15	20+	20+	2025 - Supplemental Joints	2030 - Reseal Joints, Seal Coat	2035 - Reseal Joints & Cracks	2040 - Remove & Replace AC	Fuel Island
E70	Wash Rack*	Concrete Wash Rack	2020			n/a		n/a	-	-	100*	Excellent	13 R/C/Y/T	6	-	-	8	-	48	S.I.	3,000*	-	-	75*	-	12*	25*	T15	20+	20+	2024 - Reseal Joints	2029 - Reseal Joints	2034 - Reseal Joints	2039 - Reseal Joints	Wash Rack*
E71	Apron A2	Apron A2 (west)		1999	2012	30	27-65	65	43	90	59	Good	6 F/B/Y/T	-	3.5	-	6	-	48	S.I.	-	350	-	70	-	13	20	T11	6	4	2024 - Reconstruction			2038 - New Joints, Seal Coat	Apron A2
E72	Apron A2	Apron A2 (east)		1999	2013	20	33-60	55	43	90	59	Good	6 F/B/Y/T	-	3.5	-	6	-	48	S.I.	-	200	-	40	-	13	25	T11	5	3	2024 - Reconstruction			2038 - New Joints, Seal Coat	Apron A2
E73	Apron A1	Apron A1			2013	20	34-72	60	45	95	61	Good	5 F/C/Y/T	-	3.5	-	6	-	48	S.I.	-	150	-	30	-	10	20	T10	14	10		2029 - Reconstruction			Apron A1
E74	South Jet Apron	All		1991, 2016		20	21-29	29	55	30	83	Very Good	24 F/B/Y/T	-	3	-	6	8	48	S.I.	-	350	-	75	50	15	30	T14	20+	20+		2030 - New Joints, Seal Coat	2035 - Reseal Joints & Cracks	2040 - Reseal Joints & Cracks	South Jet Apron
E75	South Jet Apron	All		1991, 2016		20	35-54	53	55	30	83	Very Good	11 F/C/Y/T	-	3	-	6	8	48	S.I.	-	200	-	40	20	8	20	T14	20+	20+		2030 - New Joints, Seal Coat	2035 - Reseal Joints & Cracks	2040 - Reseal Joints & Cracks	South Jet Apron
E76	South Jet Apron	All		1999, 2016		20	16-36	37	55	30	83	Very Good	22 F/C/Y/T	-	3	-	6	8	48	S.I.	-	250	-	50	40	12	25	T14	20+	20+		2030 - New Joints, Seal Coat	2035 - Reseal Joints & Cracks	2040 - Reseal Joints & Cracks	South Jet Apron
E77	South Jet Apron Connector	All	1991	2016		20	31-37	37	55	45	83	Very Good	22 F/C/Y/T	-	3	-	6	8	48	S.I.	-	250	-	50	40	12	25	T14	20+	20+		2030 - New Joints, Seal Coat	2035 - Reseal Joints & Cracks	2040 - Reseal Joints & Cracks	South Jet Apron Connector
E78	Taxilane R	6+50 to 13+50		2019		30	38-55	55	59	45	100	Excellent	20 F/B/Y/T	-	4	-	6	5	48	S.I.	-	350	-	60	30	15	20	T16	20+	20+			2033 - New Joints, Seal Coat	2038 - Reseal Joints & Cracks	Taxilane R
E79	Taxilane R	0+00 to 6+50		2019		30	52-71	71	59	45	100	Excellent	14 F/C/Y/T	-	4	-	6	5	48	S.I.	-	250	-	40	20	10	15	T16	20+	18			2033 - New Joints, Seal Coat	2038 - Reseal Joints & Cracks	Taxilane R
E80	Taxiway M	All		2016		30	61-94	71	59	45	100	Excellent	14 F/C/Y/T	-	4	-	6	5	48	S.I.	-	250	-	40	20	10	15	T16	20+	20			2033 - New Joints, Seal Coat	2038 - Reseal Joints & Cracks	Taxiway M
E81	Hangar A (west)	All		2001		20	49-58	58	75	73	65	Good	5 F/C/Y/T	-	3	-	6	-	48	S.I.	-	250	-	50	-	10	15	T17	20+	20+	2025 - Remove & Replace AC			2039 - New Joints, Seal Coat	Hangar A (west)
E82	Hangar A (west)	All		2001		20	42-45	45	75	73	65	Good	7 F/C/Y/T	-	3	-	6	-	48	S.I.	-	350	-	70	-	12	20	T17	20+	20+	2025 - Remove & Replace AC			2039 - New Joints, Seal Coat	Hangar A (west)
E83	Hangar A (east)	All		2001		20	42-58	58	75	73	65	Good	7 F/C/Y/T	-	3	-	6	-	48	S.I.	-	200	-	40	-	12	15	T17	20+	20+	2025 - Remove & Replace AC			2039 - New Joints, Seal Coat	Hangar A (east)
E84	Hangar B (west)	All		2001		20	40-68	62	63	70	65	Good	3 F/C/Y/T	-	3	-	6	-	48	S.I.	-	250	-	50	-	8	20	T17	20+	20+	2025 - Remove & Replace AC			2039 - New Joints, Seal Coat	Hangar B (west)
E85	Hangar B (east)	All		1999		20	33-68	58	63	65	65	Good	7 F/C/Y/T	-	3	-	6	-	48	S.I.	-	250	-	50	-	12	20	T17	20+	20+	2025 - Remove & Replace AC			2039 - New Joints, Seal Coat	Hangar B (east)
E86	Hangar C (west)	All		1999		20	22-59	58	63	65	65	Good	5 F/C/Y/T	-	3	-	6	-	48	S.I.	-	250	-	50	-	10	20	T17	20+	20+	2025 - Remove & Replace AC			2039 - New Joints, Seal Coat	Hangar C (west)
E87	Hangar C (east)	All		1999, 2017		20	48-73	72	61	57	90	Excellent	5 F/C/Y/T	-	2	-	7	-	48	S.I.	-	150	-	30	-	10	20	T17	20+	20+			2031 - New Joints, Seal Coat	2036 - Reseal Joints & Cracks	Hangar C (east)
E88	Hangar D (west)	All		1999, 2017		20	55-89	89	61	57	90	Excellent	5 F/C/Y/T	-	2	-	7	-	48	S.I.	-	150	-	30	-	10	20	T17	20+	20+			2031 - New Joints, Seal Coat	2036 - Reseal Joints & Cracks	Hangar D (west)
E89	Hangar D (west)	All		1999, 2017		20	44-68	68	61	57	90	Excellent	5 F/C/Y/T	-	2	-	7	-	48	S.I.	-	250	-	50	-	10	15	T17	20+	20+			2031 - New Joints, Seal Coat	2036 - Reseal Joints & Cracks	Hangar D (west)
E90	Hangar D (east)	All		1982, 2012		20	35-50	50	57	95	90	Excellent	5 F/C/Y/T	-	3	-	6	-	48	S.I.	-	250	-	50	-	10	20	T17	20+	20+		2026 - New Joints, Seal Coat	2031 - Reseal Joints & Cracks	2036 - Reseal Joints & Cracks	Hangar D (east)
E91	Hangar E (west)	All		1982, 2017		20	39-41	43	57	52	93	Excellent	6 F/B/Y/T	-	3	6	-	-	48	S.I.	-	200	100	-	-	15	25	T17	20+	20+			2031 - New Joints, Seal Coat	2036 - Reseal Joints & Cracks	Hangar E (west)
E92	Hangar E (west)	All		1982, 2017		20	42-58	58	57	52	93	Excellent	3 F/C/Y/T	-	3	6	-	-	48	S.I.	-	150	80	-	-	8	20	T17	20+	20+			2031 - New Joints, Seal Coat	2036 - Reseal Joints & Cracks	Hangar E (west)
E93	Hangar E (east)	All		1982, 2012		20	37-55	42	84	95	90	Excellent	17 F/C/Y/T	-	3	-	18	-	48	S.I.	-	250	-	50	-	8	35	T17	20+	20+		2026 - New Joints, Seal Coat	2031 - Reseal Joints & Cracks	2036 - Reseal Joints & Cracks	Hangar E (east)
E94	Hangar F (west)	All		1982, 2012		20	53-69	68	84	95	90	Excellent	3 F/C/Y/T	-	3	-	6	-	48	S.I.	-	250	-	50	-	8	20	T17	20+	20+		2026 - New Joints, Seal Coat	2031 - Reseal Joints & Cracks	2036 - Reseal Joints & Cracks	Hangar F (west)
E95	Hangar F (east)	All		1986, 2012		20	30-46	45	81	95	90	Excellent	6 F/B/Y/T	-	3	-	6	-	48	S.I.	-	250	-	50	-	15	20	T17	20+	20+		2026 - New Joints, Seal Coat	2031 - Reseal Joints & Cracks	2036 - Reseal Joints & Cracks	Hangar F (east)
E96	Hangar G (west)	All		1986, 2016		30	23-38	38	58	50	90	Excellent	24 F/B/Y/T	-	3	6	-	8	48	S.I.	-	250	500	-	40	15	25	T17	20+	20+		2030 - New Joints, Seal Coat	2035 - Reseal Joints & Cracks	2040 - Reseal Joints & Cracks	Hangar G (west)
E97	Hangar G (west)	All		1986, 2016		30	60-62	62	58	50	90	Excellent	24 F/B/Y/T	-	3	6	-	8	48	S.I.	-	150	100	-	20	15	20	T17	20+	20+		2030 - New Joints, Seal Coat	2035 - Reseal Joints & Cracks	2040 - Reseal Joints & Cracks	Hangar G (west)
E98	Hangar G/H	All		1999, 2016		30	28-43	43	55	38	90	Excellent	22 F/C/Y/T	-	3	6	-	8	48	S.I.	-	200	400	-	40	12	25	T18	20+	20+		2030 - New Joints, Seal Coat	2035 - Reseal Joints & Cracks	2040 - Reseal Joints & Cracks	Hangar G/H
E99	Hangar G/H	All		1999, 2016		30	82	82	55	38	90	Excellent	11 F/C/Y/T	-	3	-	6	8	48	S.I.	-	150	-	60	20	8	15	T18	20+	20+		2030 - New Joints, Seal Coat	2035 - Reseal Joints & Cracks	2040 - Reseal Joints & Cracks	Hangar G/H
E100	EAA Hangar	All		2013		20	30-47	47	n/a	100	83	Very Good	12 F/C/Y/T	-	3	-	3	8	48	S.I.	-	350	-	75	50	10	15	T17	20+	20+		2027 - New Joints, Seal Coat	2032 - Reseal Joints & Cracks	2037 - Reseal Joints & Cracks	EAA Hangar
E101	Hangar 1 Ramp	All		2014		20	26-47	43	59	45	61	Good	15 F/C/Y/T	-	3	-	5	9	48	S.I.	-	250	-	50	30	10	25	T17	20+	20+	2025 - Crack Seal		2031 - Remove & Replace AC		Hangar 1 Ramp

* - This pavement was constructed after all testing was completed for this pavement evaluation study. Values indicated with an * are expected values of PCI or Modulus of Elasticity after construction.

Pavement Segment ID (See Plate 5-1)	Element	Station (See Plate 5-2)	Construction Record: Original	Construction Record: Reconstruct	Construction Record: Latest Overlay	FWD Data: Load (kips)	FWD Data: Deflection Range (mils)	FWD Data: Deflection Used (mils)	Pavement Surface Data: 2011 PCI	Pavement Surface Data: 2013 PCI	Pavement Surface Data: 2020 PCI	Pavement Surface Data: Pavement Rating	Pavement Condition Number PCN	Existing Pavement Section - inches: PCC	AC	CTB	AB	ASB	Subgrade	Subsoil	Existing Modulus of Elasticity (E) - ksi: PCC	AC	CTB	AB	ASB	Subgrade	Subsoil	Traffic Index
E102	Hangar J (east)	All		2012		30	20-42	42	35	90	80	Very Good	20 F/B/Y/T	-	3	12	-	-	48	S.I.	-	200	100	-	-	15	30	T17
E103	Hangar J (west)	All		2012		30	17-47	32	35	90	80	Very Good	20 F/B/Y/T	-	3	12	-	-	48	S.I.	-	350	200	-	-	15	30	T17
E104	Hangar K (east)	All		2012		30	15-26	26	35	90	80	Very Good	24 F/B/Y/T	-	3	12	-	-	48	S.I.	-	350	200	-	-	20	35	T17
E105	Hangar K (west)	All		2012		30	18-31	31	35	90	80	Very Good	24 F/B/Y/T	-	3	12	-	-	48	S.I.	-	300	100	-	-	20	28	T17
E106	Taxilane T	0+00 to 3+00	2004			30	38-42	48	83	77	66	Good	17 F/C/Y/T	-	5	-	10	-	48	S.I.	-	250	-	60	-	12	35	T21
E107	Taxilane T*	3+00 to 6+75	2004		2020	30	39-57	48	83	77	66 / 100*	Good / Excellent*	17 F/C/Y/T	-	5	-	10	-	48	S.I.	-	250	-	60	-	12	35	T21
E108	Hangar M (east)	All	2004			30	38-42	48	83	77	66	Good	17 F/C/Y/T	-	4	-	10	-	48	S.I.	-	250	-	60	-	12	35	T17
E109	Hangar M (west)	All	2004			30	54-70	70	83	77	66	Good	5 F/C/Y/T	-	3	-	6	-	48	S.I.	-	350	-	80	-	10	25	T17
E110	Hangar L*	All	2004		2020	30	27-38	33	83	77	66 / 100*	Good / Excellent*	24 F/B/Y/T	-	4	-	10	-	48	S.I.	-	350	-	100	-	20	30	T19
E111	Hangar L	All	2018			30	32-68	61	-	-	93	Excellent	21 F/B/Y/T	-	3	-	6	8	48	S.I.	-	300	-	60	30	13	30	T19
E112	Hangar N	All	2018			30	42-51	51	-	-	93	Excellent	21 F/B/Y/T	-	3	-	6	8	48	S.I.	-	350	-	75	30	13	30	T20
E113	Hangar P	All	2018			30	39-58	58	-	-	93	Excellent	21 F/B/Y/T	-	3	-	6	8	48	S.I.	-	250	-	50	30	13	30	T20
E114	Gliderport	All		2004		20	40-65	65	-	-	71	Very Good	3 F/C/Y/T	-	3	-	6	-	48	S.I.	-	250	-	60	-	8	25	T22
E115	Gliderport	All		2004		20	91-99	99	-	-	71	Very Good	3 F/D/Y/T	-	3	-	6	-	48	S.I.	-	150	-	30	-	5	20	T22
E116	Gliderport	All		2004		20	91-110	110	-	-	71	Very Good	3 F/D/Y/T	-	3	-	6	-	48	S.I.	-	150	-	30	-	6	20	T22
E117	Gliderport	All		2004		20	38-64	64	-	-	71	Very Good	3 F/D/Y/T	-	3	-	6	-	48	S.I.	-	250	-	60	-	6	25	T22
E118	Road - Hangars A-H*	0+00 to 4+50		1992, 2020		20	48-71	51	-	-	20 / 100*	Very Poor/ Excellent*	5 F/C/Y/T	-	4	-	5	-	48	S.I.	-	100	-	30	-	10	18	T27
E119	Road - Hangars A-H	5+25 to 8+75		2001		20	21-56	56	75	73	65	Good	7 F/C/Y/T	-	3	-	6	-	48	S.I.	-	250	-	50	-	12	20	T27
E120	Road - Hangars A-H	8+75 to 11+75		2001		20	43-60	60	61	57	90	Excellent	7 F/C/Y/T	-	2	-	7	-	48	S.I.	-	200	-	30	-	12	25	T27
E121	Road - Hangars A-H	11+75 to 14+25		1999, 2017		20	38-60	62	84	95	90	Excellent	10 F/B/Y/T	-	2	-	7	-	48	S.I.	-	250	-	50	-	20	30	T27
E122	Road - Hangars A-H	14+25 to 18+00		2016		30	18-25	23	55	38	90	Excellent	50 F/A/Y/T	-	3	6	-	8	S.I.	-	-	200	300	-	40	40	-	T27
E123	Med Services Apron*	All	2020			n/a		n/a	-	-	100*	Excellent	25 F/C/Y/T	-	4	-	6	8	48	S.I.	-	350*	-	75*	40*	12*	35*	T18
E124	Warehouse	All		2004		30	32-38	38	83	77	66	Good	6 F/B/Y/T	-	3	-	7	-	48	S.I.	-	350	-	75	-	13	20	T25
E125	Maintenance Building*	All		2004		20	30-54	52	-	-	39 / 100*	Poor/ Excellent*	9 F/C/Y/T	-	4	-	7	-	48	S.I.	-	200	-	50	-	10	25	T23
E126	Chandelle Way	0+00 to 9+00		2011		20	32-38	38	-	-	90	Excellent	7 F/B/Y/T	-	3	-	7	-	48	S.I.	-	300	-	75	-	15	25	T24
E127	Chandelle Way	9+00 to 10+50		2011		20	45	45	-	-	90	Excellent	6 F/B/Y/T	-	3	-	7	-	48	S.I.	-	200	-	50	-	13	25	T24
E128	Chandelle Way	10+50 to 13+75		2011		20	29-38	38	-	-	85	Excellent	6 F/B/Y/T	-	3	-	7	-	48	S.I.	-	350	-	75	-	13	20	T24
E129	Aviation Way	All		2004		30	32-51	51	-	-	52	Fair	9 F/C/Y/T	-	3	-	8	-	48	S.I.	-	350	-	100	-	12	25	T25
E130	Terminal Parking and Road	All		2011		20	22-62	38	-	-	54	Fair	10 F/B/Y/T	-	3	-	8	-	48	S.I.	-	250	-	60	-	15	20	T26

Pavement Segment ID	Remaining Pavement Life - Years from 2020: Fatigue Analysis (Brandley) Remaining Life - Subgrade (Forecast Traffic)	Fatigue Analysis (Brandley) Remaining Life - Subgrade (Enhanced Traffic)	Recommended Rehabilitation and Maintenance (Project Timing - Required for Deep Seated Distress; Project Timing - Estimated for Surface Distress): 2021-2025	2026-2030	2031-2035	2036-2040	Element
E102	20+	20+	2024 - Reseal Joints & Cracks	2029 - Reseal Joints, Seal Coat	2034 - Reseal Joints & Cracks	2039 - Remove & Replace AC	Hangar J (east)
E103	20+	20+	2024 - Reseal Joints & Cracks	2029 - Reseal Joints, Seal Coat	2034 - Reseal Joints & Cracks	2039 - Remove & Replace AC	Hangar J (west)
E104	20+	20+	2024 - Reseal Joints & Cracks	2029 - Reseal Joints, Seal Coat	2034 - Reseal Joints & Cracks	2039 - Remove & Replace AC	Hangar K (east)
E105	20+	20+	2024 - Reseal Joints & Cracks	2029 - Reseal Joints, Seal Coat	2034 - Reseal Joints & Cracks	2039 - Remove & Replace AC	Hangar K (west)
E106	20+	20+	2021 - Reconstruction		2035 - New Joints, Seal Coat	2040 - Reseal Joints & Cracks	Taxilane T
E107	20+	20+			2035 - New Joints, Seal Coat	2040 - Reseal Joints & Cracks	Taxilane T*
E108	20+	20+	2025 - Remove & Replace AC			2039 - New Joints, Seal Coat	Hangar M (east)
E109	20+	20+	2025 - Remove & Replace AC			2039 - New Joints, Seal Coat	Hangar M (west)
E110	20+	20+			2035 - New Joints, Seal Coat	2040 - Reseal Joints & Cracks	Hangar L*
E111	20+	20+			2032 - New Joints, Seal Coat	2037 - Reseal Joints & Cracks	Hangar L
E112	20+	20+			2032 - New Joints, Seal Coat	2037 - Reseal Joints & Cracks	Hangar N
E113	20+	20+			2032 - New Joints, Seal Coat	2037 - Reseal Joints & Cracks	Hangar P
E114	20+	20+	2023 - Reseal Joints & Cracks	2028 - Remove & Replace AC			Gliderport
E115	20+	20+	2023 - Reseal Joints & Cracks	2028 - Remove & Replace AC			Gliderport
E116	20+	20+	2023 - Reseal Joints & Cracks	2028 - Remove & Replace AC			Gliderport
E117	20+	20+	2023 - Reseal Joints & Cracks	2028 - Remove & Replace AC			Gliderport
E118	20+	20+			2034 - New Joints, Seal Coat	2039 - Reseal Joints & Cracks	Road - Hangars A-H*
E119	20+	20+	2025 - Remove & Replace AC			2039 - New Joints, Seal Coat	Road - Hangars A-H
E120	20+	20+			2031 - New Joints, Seal Coat	2036 - Reseal Joints & Cracks	Road - Hangars A-H
E121	20+	20+			2031 - New Joints, Seal Coat	2036 - Reseal Joints & Cracks	Road - Hangars A-H
E122	20+	20+		2030 - New Joints, Seal Coat	2035 - Reseal Joints & Cracks	2040 - Reseal Joints & Cracks	Road - Hangars A-H
E123	20+	20+			2034 - New Joints, Seal Coat	2039 - Reseal Joints & Cracks	Med Services Apron*
E124	10	10	2023 - Reseal Joints & Cracks	2029 - Reconstruction			Warehouse
E125	20+	20+			2034 - New Joints, Seal Coat	2039 - Reseal Joints & Cracks	Maintenance Building*
E126	20+	20+	2023 - Reseal Joints & Cracks	2028 - Reseal Joints, Seal Coat	2033 - Reseal Joints & Cracks	2038 - Remove & Replace AC	Chandelle Way
E127	20+	20+	2023 - Reseal Joints & Cracks	2028 - Reseal Joints, Seal Coat	2033 - Reseal Joints & Cracks	2038 - Remove & Replace AC	Chandelle Way
E128	20+	20+	2025 - Remove & Replace AC			2039 - New Joints, Seal Coat	Chandelle Way
E129	13	13	2023 - Reseal Joints & Cracks	2028 - Reseal Joints & Cracks	2032 - Reconstruction		Aviation Way
E130	20+	20+	2023 - New Joints, Seal Coat	2028 - Reseal Joints & Cracks	2033 - Remove & Replace AC		Terminal Parking and Road

* - This pavement was constructed after all testing was completed for this pavement evaluation study. Values indicated with an * are expected values of PCI or Modulus of Elasticity after construction.

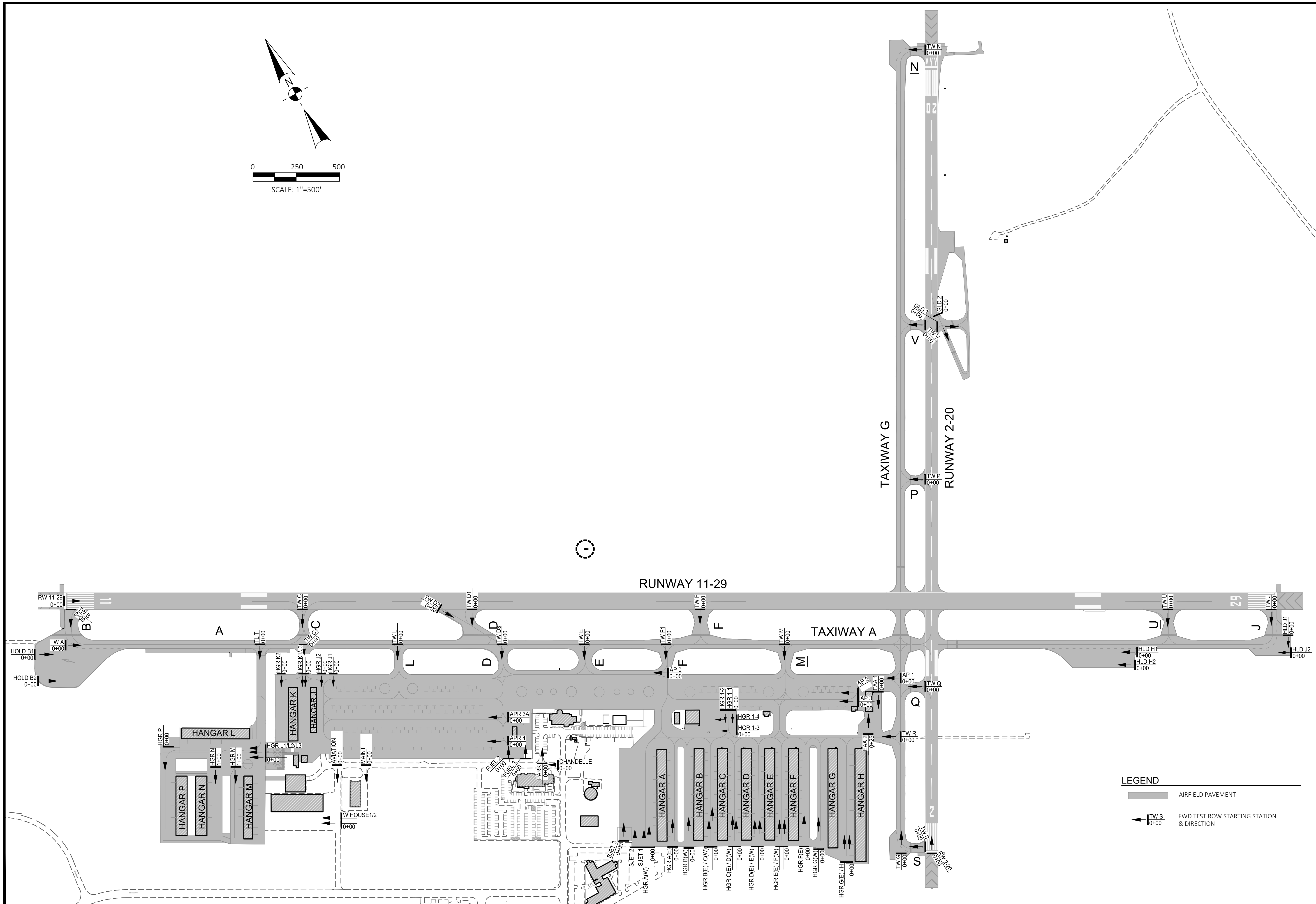


TRUCKEE TAHOE AIRPORT
2020 PAVEMENT MANAGEMENT PLAN

PAVEMENT SEGMENT IDENTIFICATION

BRANDLEY ENGINEERING
6125 KING ROAD, SUITE 201 · LOOMIS, CA 95650 · (916) 652.4725

DATE	4/15/2021
DRAWN	KDC
CHECKED	DB
FILE	4004-20.areas
SCALE	1"=500'
PLATE No.	5-1



6125 KING ROAD, SUITE 201 · LOOMIS, CA 95650 · (916) 652.4725

BRANDLEY ENGINEERING

TRUCKEE TAHOE AIRPORT

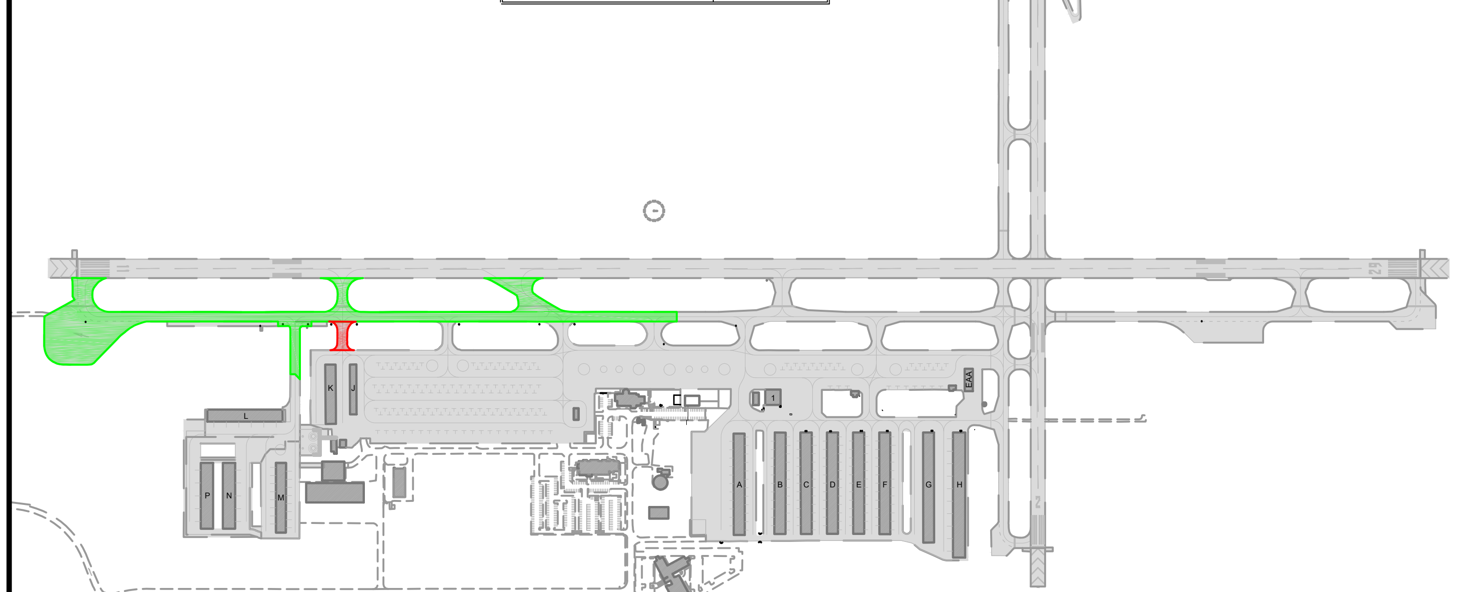
2020 PAVEMENT MANAGEMENT PLAN

STATION CONTROL PLAN - FWD TESTS

DATE	4/15/2021
DRAWN	KDC
CHECKED	DB
FILE	4004-20.fwd-sta
SCALE	1"=500'
PLATE	5-2

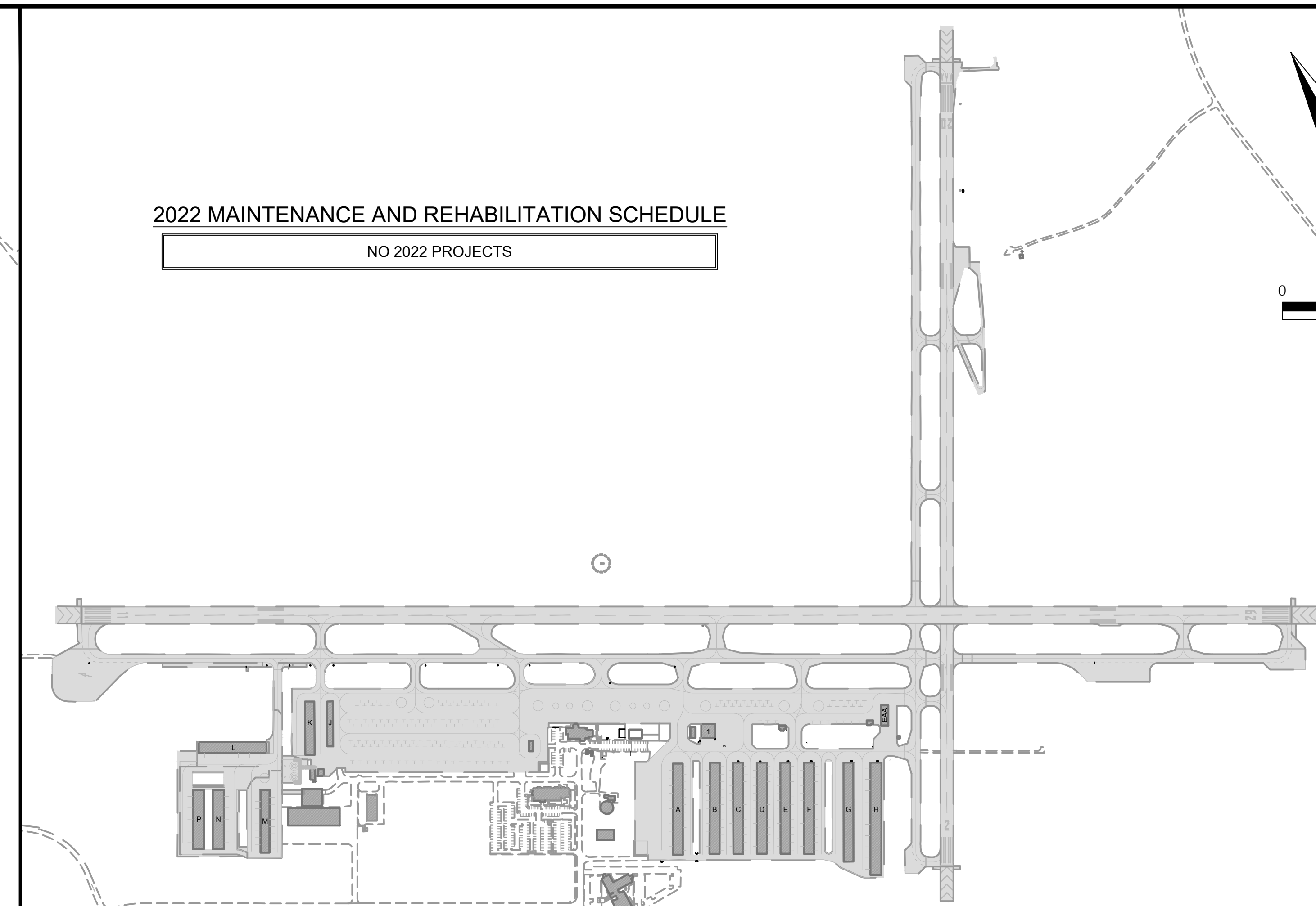
2021 MAINTENANCE AND REHABILITATION SCHEDULE

HATCH	AREA	PROJECT	COST
(green)	TAXIWAYS A (WEST), B, C, D, T (NORTH)	RECONSTRUCTION	$3,685,000
(red)	TAXIWAY C (SOUTH)	REMOVE TAXIWAY	
		TOTAL 2021 PROJECTS	$3,685,000



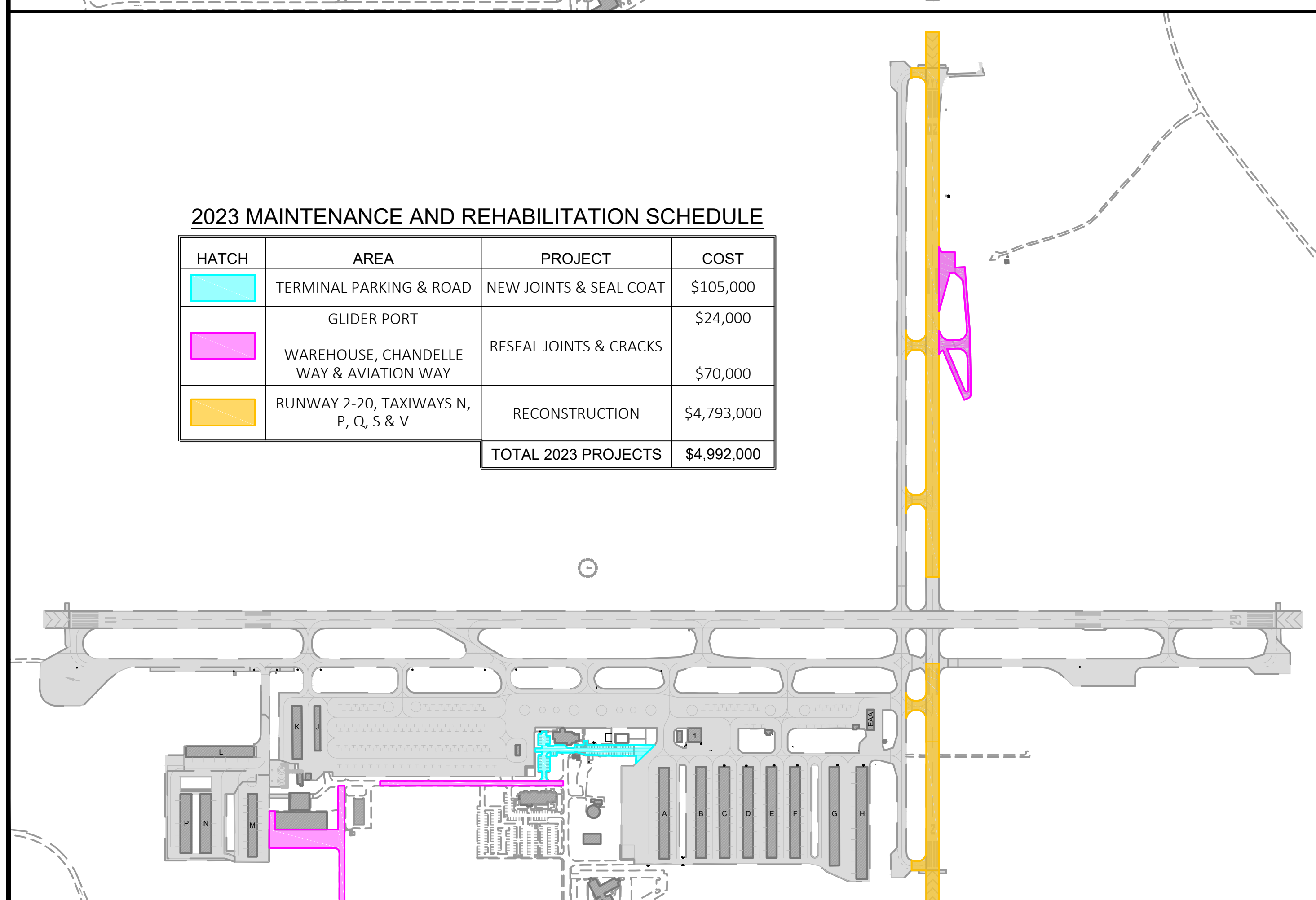
2022 MAINTENANCE AND REHABILITATION SCHEDULE

NO 2022 PROJECTS



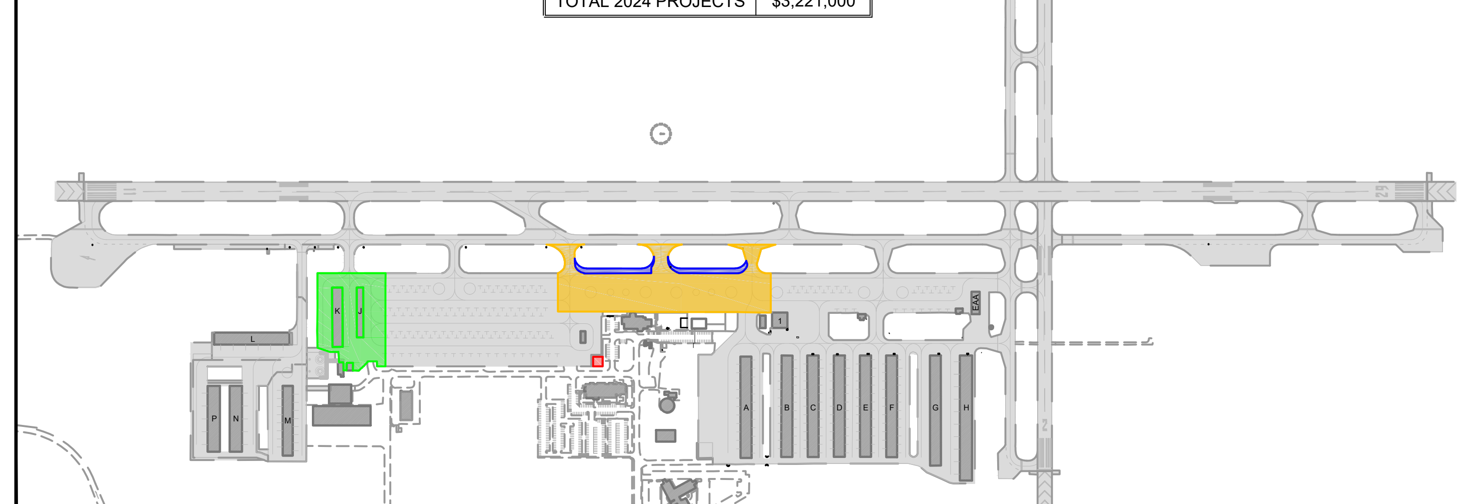
2023 MAINTENANCE AND REHABILITATION SCHEDULE

HATCH	AREA	PROJECT	COST
(cyan)	TERMINAL PARKING & ROAD	NEW JOINTS & SEAL COAT	$105,000
(magenta)	GLIDER PORT	RESEAL JOINTS & CRACKS	$24,000
	WAREHOUSE, CHANDELLE WAY & AVIATION WAY		$70,000
(yellow)	RUNWAY 2-20, TAXIWAYS N, P, Q, S & V	RECONSTRUCTION	$4,793,000
		TOTAL 2023 PROJECTS	$4,992,000



2024 MAINTENANCE AND REHABILITATION SCHEDULE

HATCH	AREA	PROJECT	COST
(red)	WASH RACK	RESEAL PCC JOINTS	$2,000
(green)	HANGARS J & K	RESEAL JOINTS & CRACKS	$96,000
(yellow)	APRON A2, TAXIWAYS D (SOUTH), E, F (SOUTH) & TAXILANE Q	RECONSTRUCTION	$3,019,000
(blue)	TAXIWAY Q	REMOVE & REPLACE AC	$104,000
		TOTAL 2024 PROJECTS	$3,221,000



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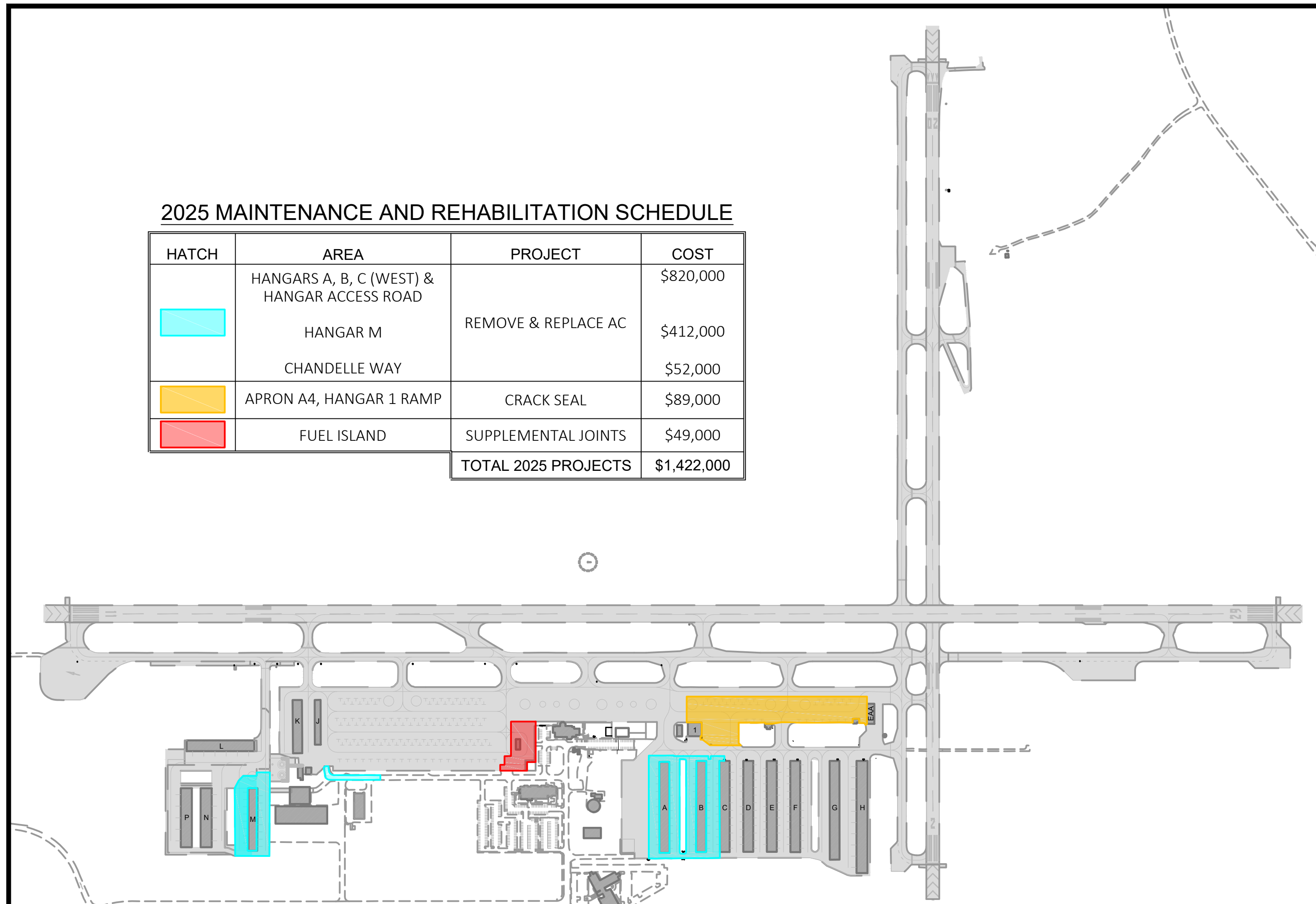
TRUCKEE TAHOE AIRPORT
2020 PAVEMENT MANAGEMENT PLAN
REHABILITATION SCHEDULE 2021-2024

DATE	4/15/2021
DRAWN	KDC
CHECKED	DB
FILE	4004-20.5.Rehab
SCALE	1"=1000'
PLATE No.	5-3

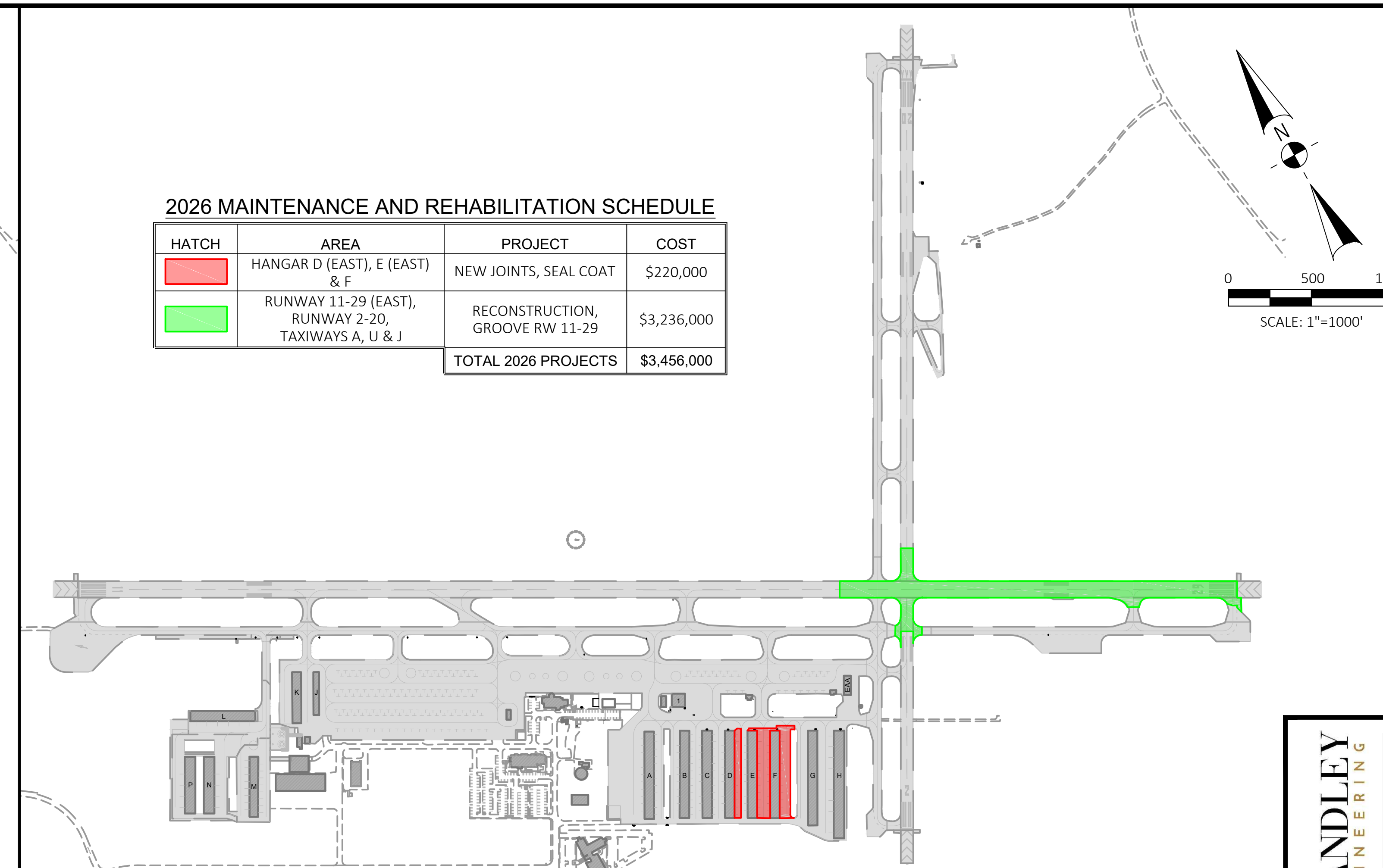
2025 MAINTENANCE AND REHABILITATION SCHEDULE

HATCH	AREA	PROJECT	COST
(cyan)	HANGARS A, B, C (WEST) & HANGAR ACCESS ROAD	REMOVE & REPLACE AC	$820,000
	HANGAR M		$412,000
	CHANDELLE WAY		$52,000
(yellow)	APRON A4, HANGAR 1 RAMP	CRACK SEAL	$89,000
(red)	FUEL ISLAND	SUPPLEMENTAL JOINTS	$49,000
		TOTAL 2025 PROJECTS	$1,422,000



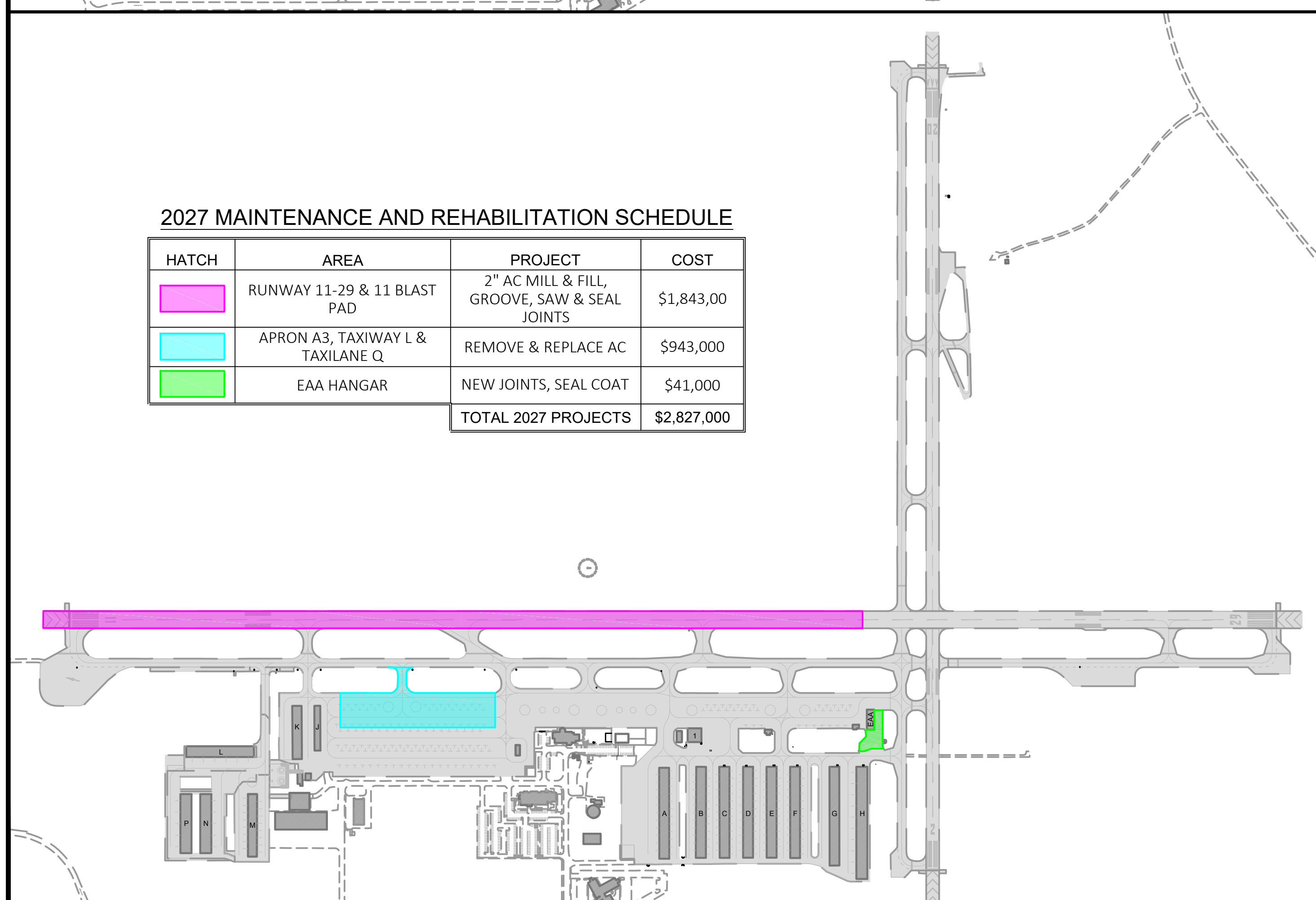
2026 MAINTENANCE AND REHABILITATION SCHEDULE

HATCH	AREA	PROJECT	COST
(red)	HANGAR D (EAST), E (EAST) & F	NEW JOINTS, SEAL COAT	$220,000
(green)	RUNWAY 11-29 (EAST), RUNWAY 2-20, TAXIWAYS A, U & J	RECONSTRUCTION, GROOVE RW 11-29	$3,236,000
		TOTAL 2026 PROJECTS	$3,456,000



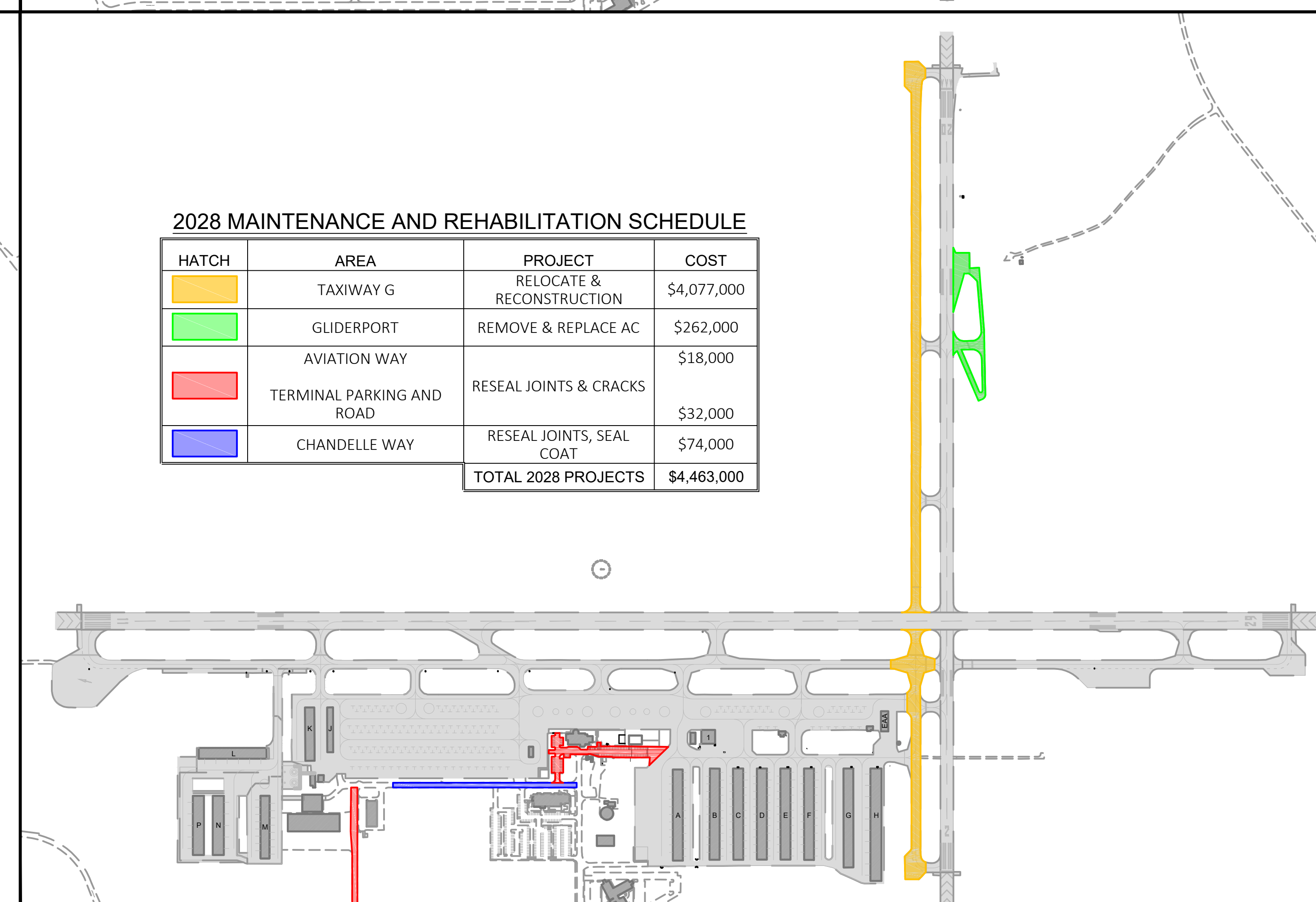
2027 MAINTENANCE AND REHABILITATION SCHEDULE

HATCH	AREA	PROJECT	COST
(magenta)	RUNWAY 11-29 & 11 BLAST PAD	2" AC MILL & FILL, GROOVE, SAW & SEAL JOINTS	$1,843,00
(cyan)	APRON A3, TAXIWAY L & TAXILANE Q	REMOVE & REPLACE AC	$943,000
(green)	EAA HANGAR	NEW JOINTS, SEAL COAT	$41,000
		TOTAL 2027 PROJECTS	$2,827,000



2028 MAINTENANCE AND REHABILITATION SCHEDULE

HATCH	AREA	PROJECT	COST
(yellow)	TAXIWAY G	RELOCATE & RECONSTRUCTION	$4,077,000
(green)	GLIDERPORT	REMOVE & REPLACE AC	$262,000
(red)	AVIATION WAY	RESEAL JOINTS & CRACKS	$18,000
	TERMINAL PARKING AND ROAD		$32,000
(blue)	CHANDELLE WAY	RESEAL JOINTS, SEAL COAT	$74,000
		TOTAL 2028 PROJECTS	$4,463,000



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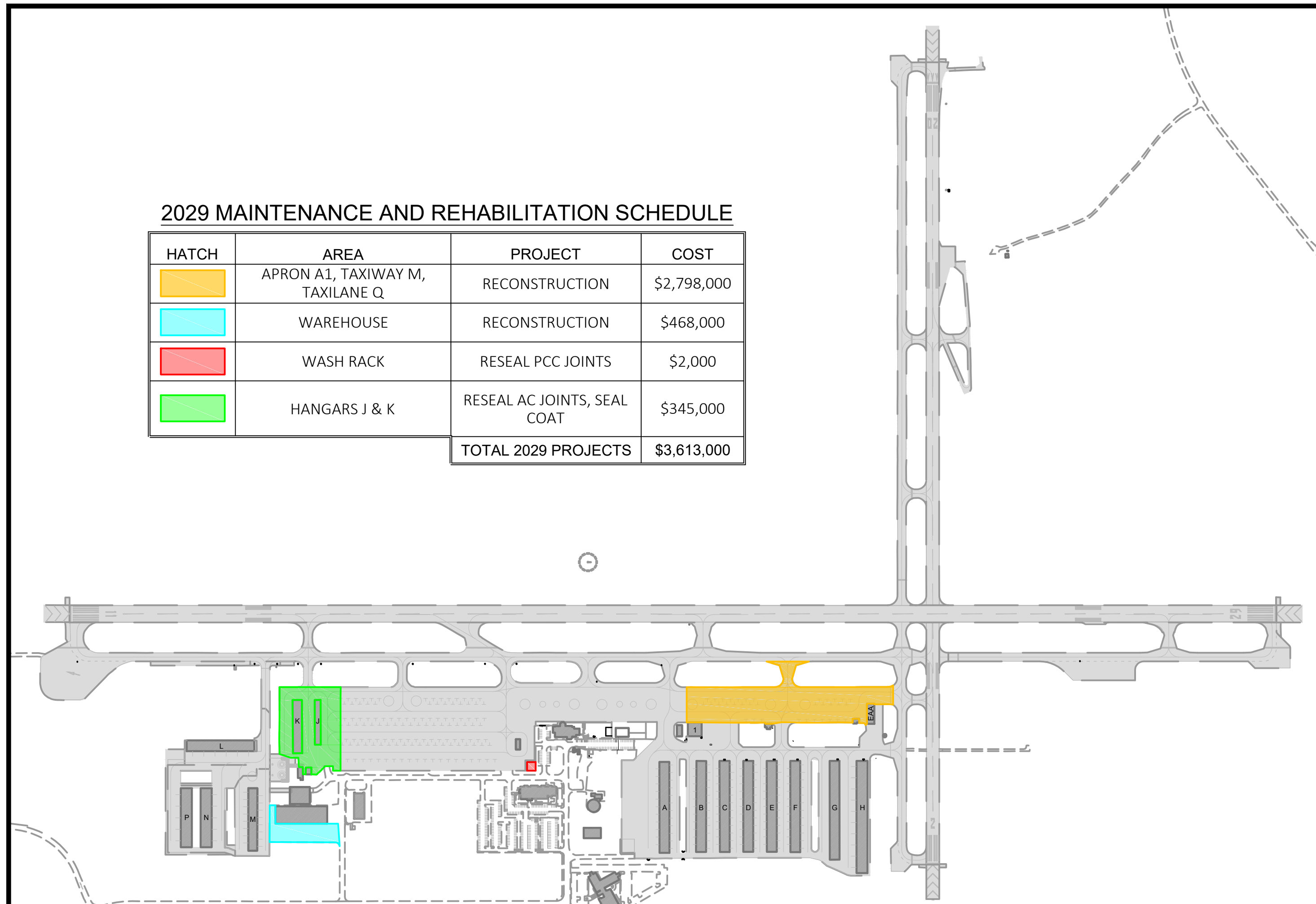
TRUCKEE TAHOE AIRPORT

2020 PAVEMENT MANAGEMENT PLAN

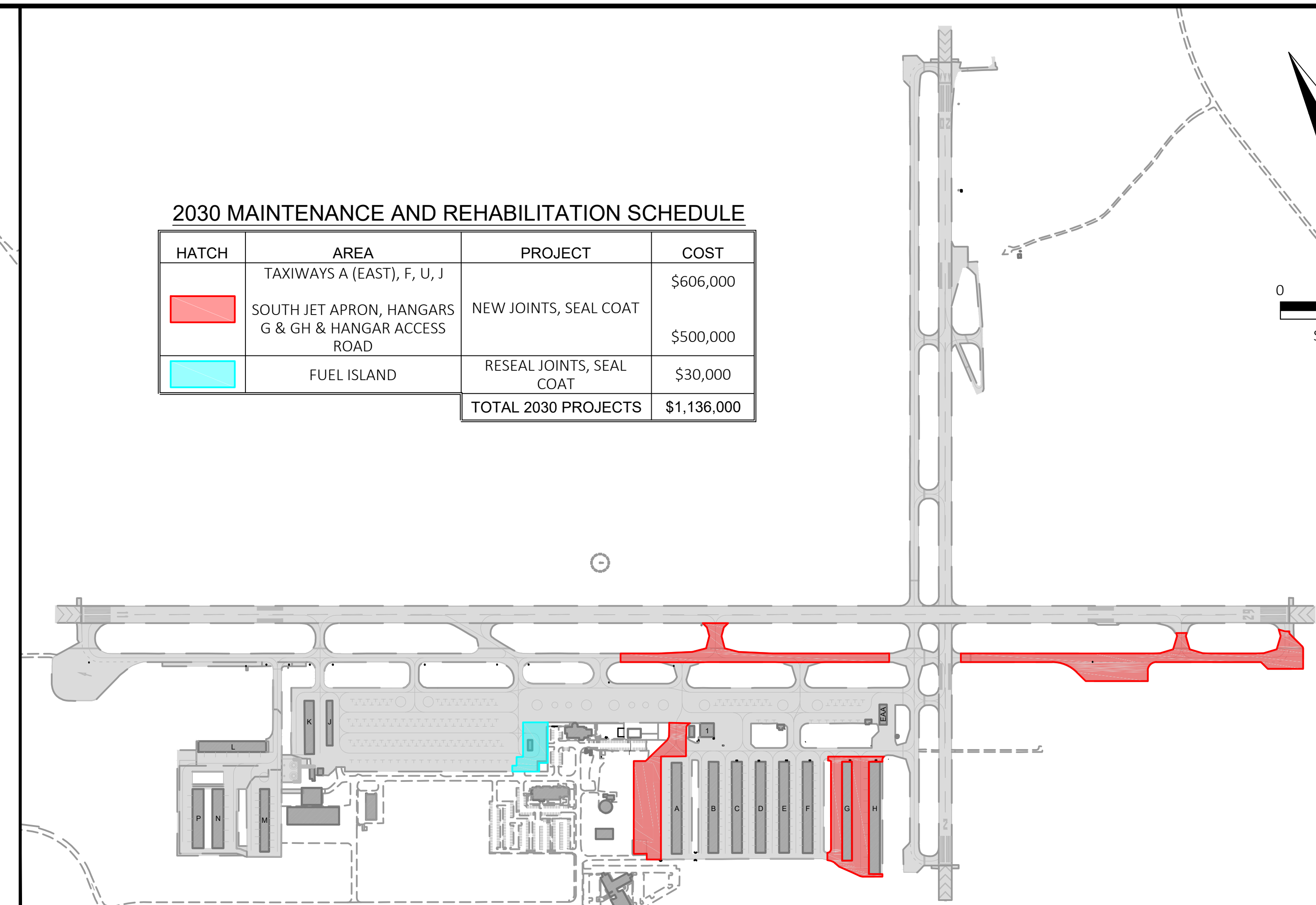
REHABILITATION SCHEDULE 2025-2028

DATE	4/15/2021
DRAWN	KDC
CHECKED	DB
FILE	4004-20.5.Rehab
SCALE	1"=1000'
PLATE No.	5-4



2029 MAINTENANCE AND REHABILITATION SCHEDULE

HATCH	AREA	PROJECT	COST
(yellow)	APRON A1, TAXIWAY M, TAXILANE Q	RECONSTRUCTION	$2,798,000
(cyan)	WAREHOUSE	RECONSTRUCTION	$468,000
(red)	WASH RACK	RESEAL PCC JOINTS	$2,000
(green)	HANGARS J & K	RESEAL AC JOINTS, SEAL COAT	$345,000
		TOTAL 2029 PROJECTS	$3,613,000



2030 MAINTENANCE AND REHABILITATION SCHEDULE

HATCH	AREA	PROJECT	COST
(red)	TAXIWAYS A (EAST), F, U, J	NEW JOINTS, SEAL COAT	$606,000
	SOUTH JET APRON, HANGARS G & GH & HANGAR ACCESS ROAD		$500,000
(cyan)	FUEL ISLAND	RESEAL JOINTS, SEAL COAT	$30,000
		TOTAL 2030 PROJECTS	$1,136,000

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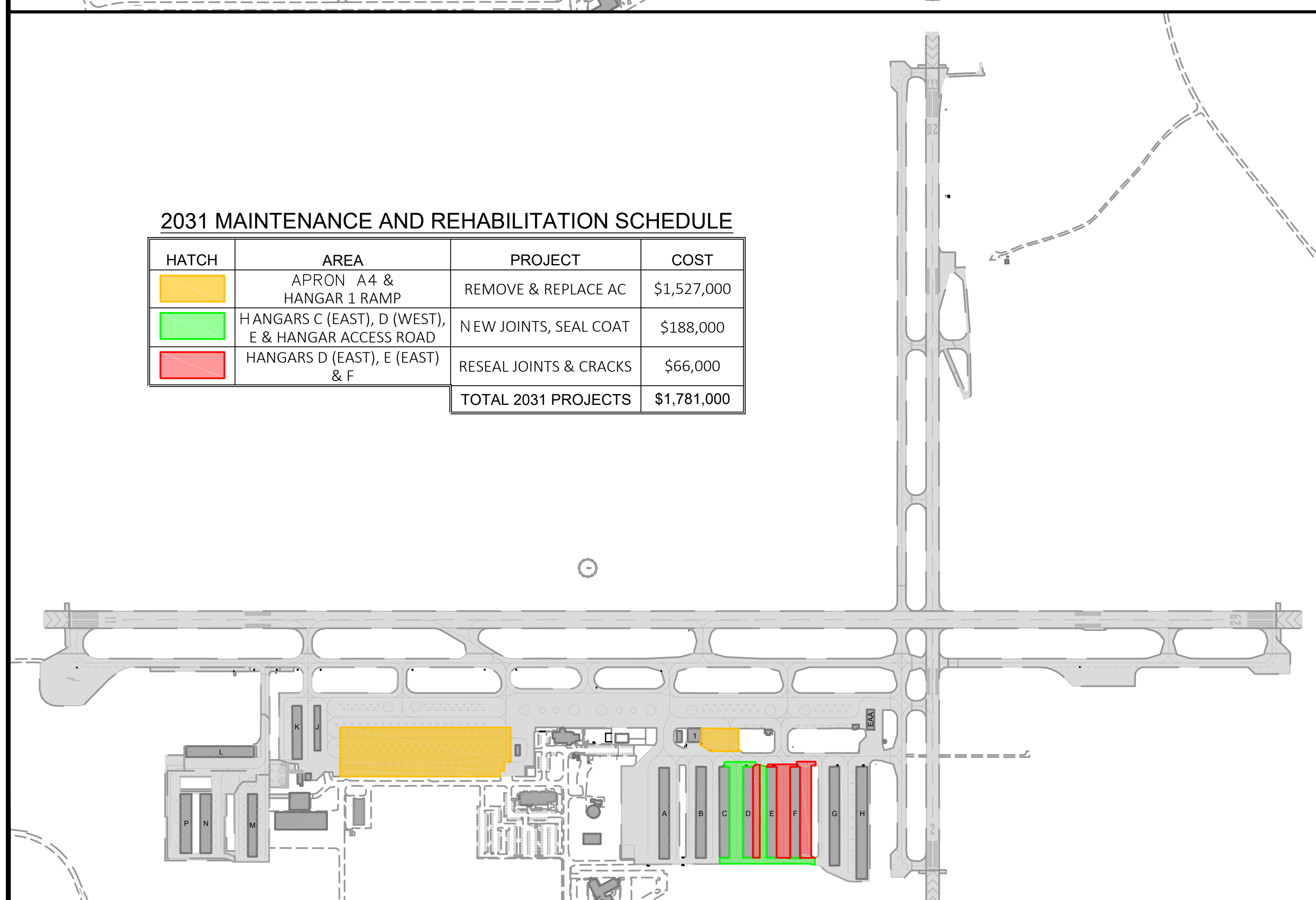
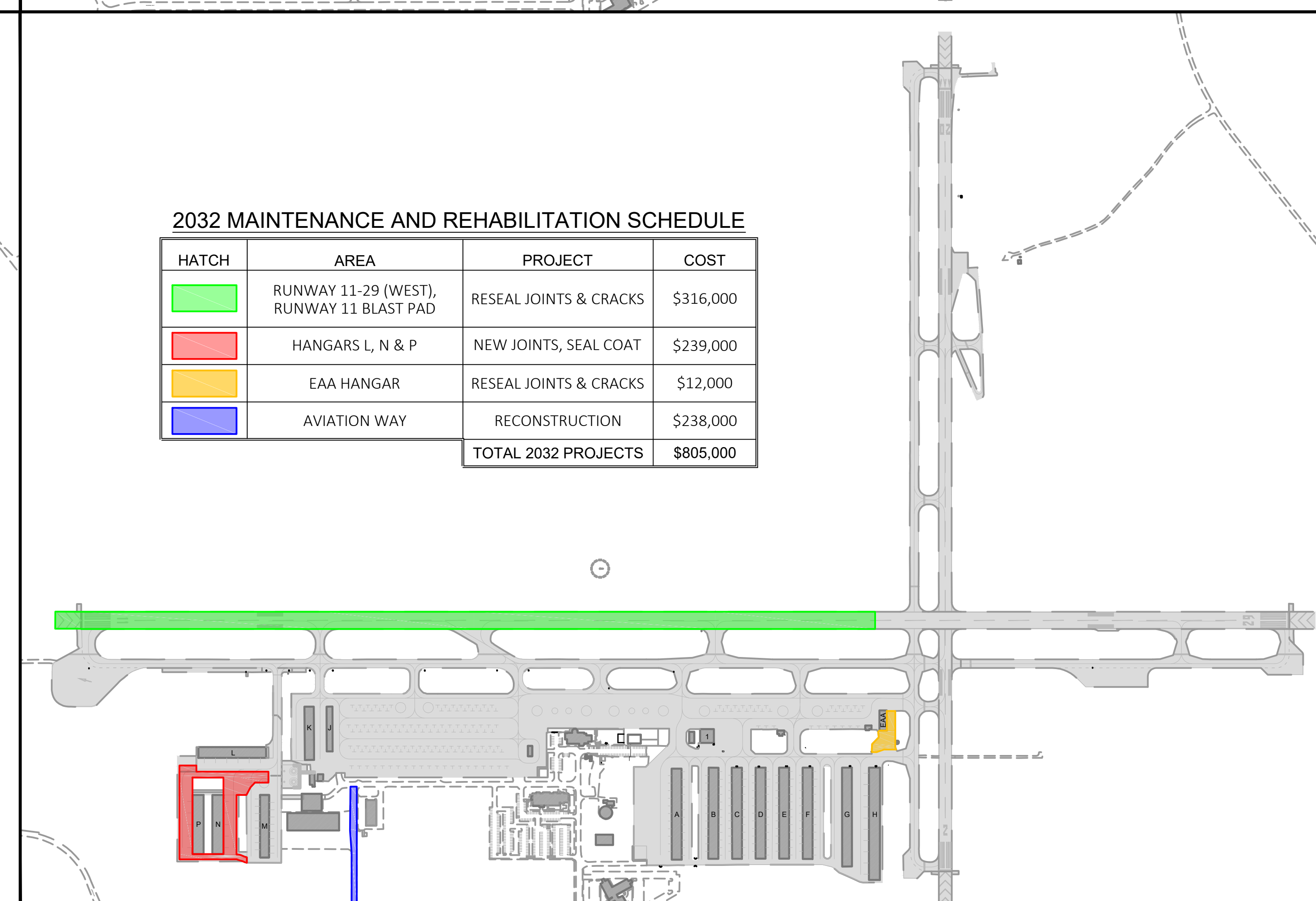
SCALE: 1"=1000'



2031 MAINTENANCE AND REHABILITATION SCHEDULE

HATCH	AREA	PROJECT	COST
(yellow)	APRON A4 & HANGAR 1 RAMP	REMOVE & REPLACE AC	$1,527,000
(green)	HANGARS C (EAST), D (WEST), E & HANGAR ACCESS ROAD	NEW JOINTS, SEAL COAT	$188,000
(red)	HANGARS D (EAST), E (EAST) & F	RESEAL JOINTS & CRACKS	$66,000
		TOTAL 2031 PROJECTS	$1,781,000



2032 MAINTENANCE AND REHABILITATION SCHEDULE

HATCH	AREA	PROJECT	COST
(green)	RUNWAY 11-29 (WEST), RUNWAY 11 BLAST PAD	RESEAL JOINTS & CRACKS	$316,000
(red)	HANGARS L, N & P	NEW JOINTS, SEAL COAT	$239,000
(yellow)	EAA HANGAR	RESEAL JOINTS & CRACKS	$12,000
(blue)	AVIATION WAY	RECONSTRUCTION	$238,000
		TOTAL 2032 PROJECTS	$805,000

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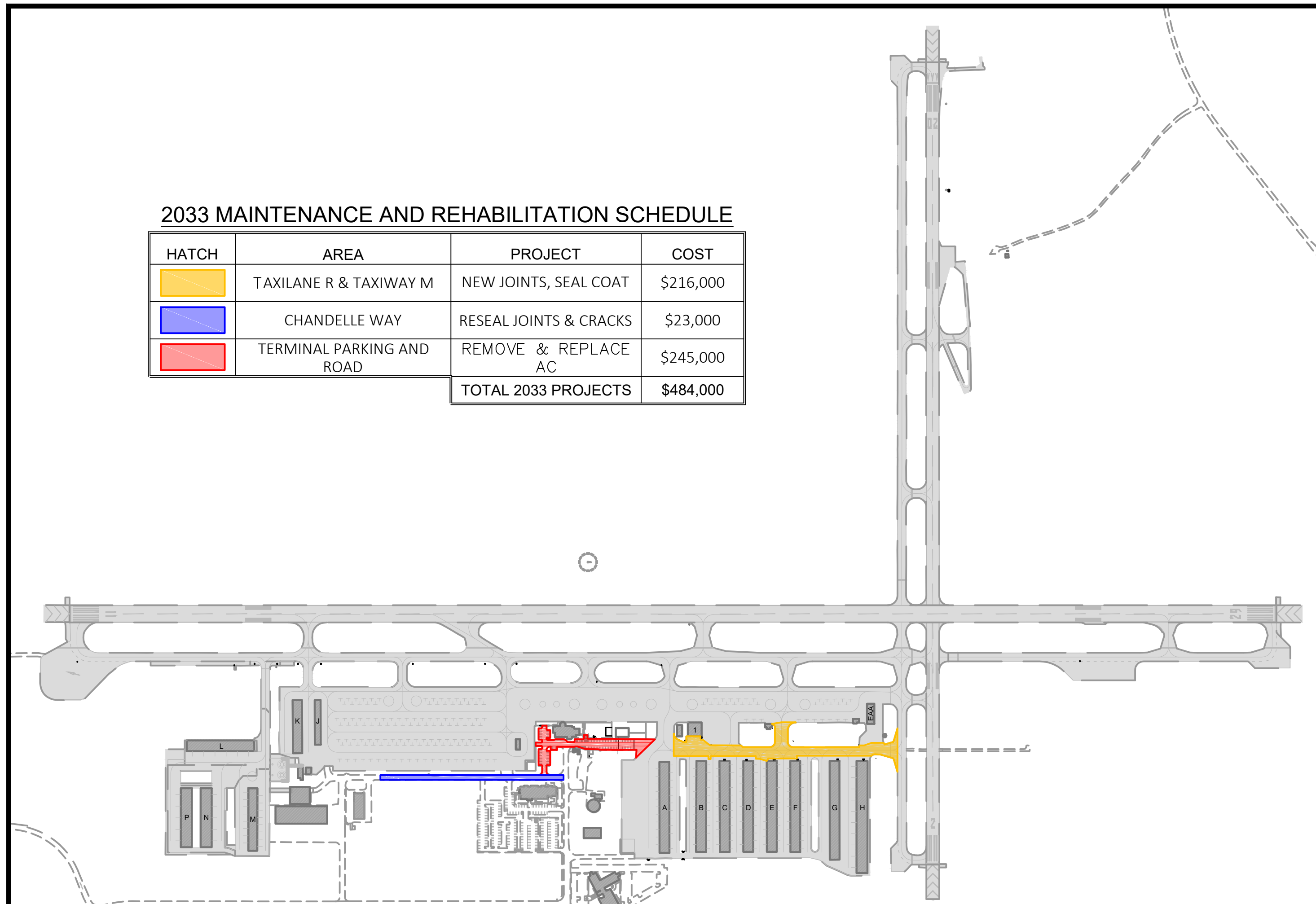
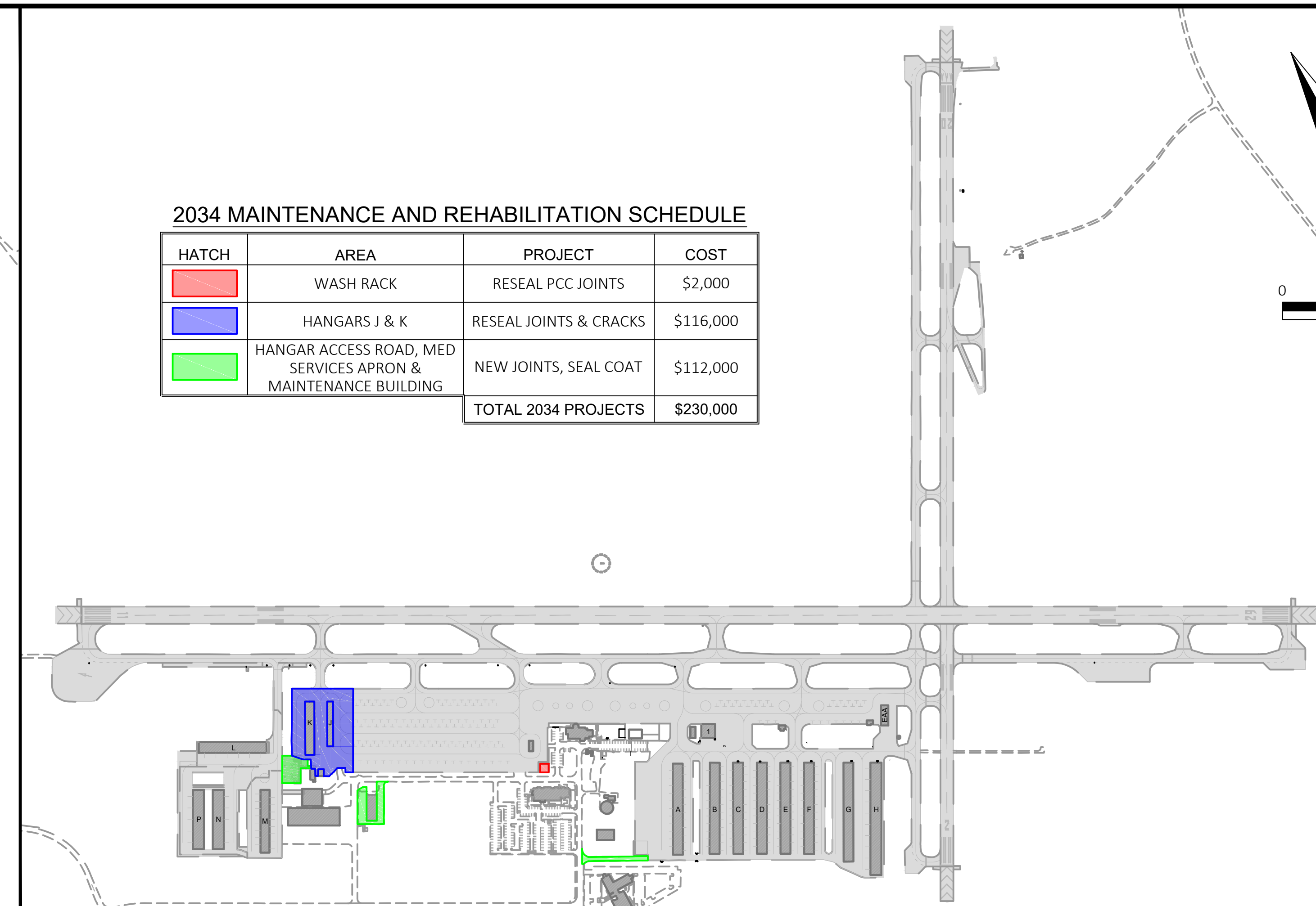
TRUCKEE TAHOE AIRPORT
2020 PAVEMENT MANAGEMENT PLAN
REHABILITATION SCHEDULE 2029-2032

DATE	4/15/2021
DRAWN	KDC
CHECKED	DB
FILE	4004-20.5.Rehab
SCALE	1"=1000'
PLATE No.	5-5



2033 MAINTENANCE AND REHABILITATION SCHEDULE

HATCH	AREA	PROJECT	COST
(yellow)	TAXILANE R & TAXIWAY M	NEW JOINTS, SEAL COAT	$216,000
(blue)	CHANDELLE WAY	RESEAL JOINTS & CRACKS	$23,000
(red)	TERMINAL PARKING AND ROAD	REMOVE & REPLACE AC	$245,000
		TOTAL 2033 PROJECTS	$484,000



2034 MAINTENANCE AND REHABILITATION SCHEDULE

HATCH	AREA	PROJECT	COST
(red)	WASH RACK	RESEAL PCC JOINTS	$2,000
(blue)	HANGARS J & K	RESEAL JOINTS & CRACKS	$116,000
(green)	HANGAR ACCESS ROAD, MED SERVICES APRON & MAINTENANCE BUILDING	NEW JOINTS, SEAL COAT	$112,000
		TOTAL 2034 PROJECTS	$230,000

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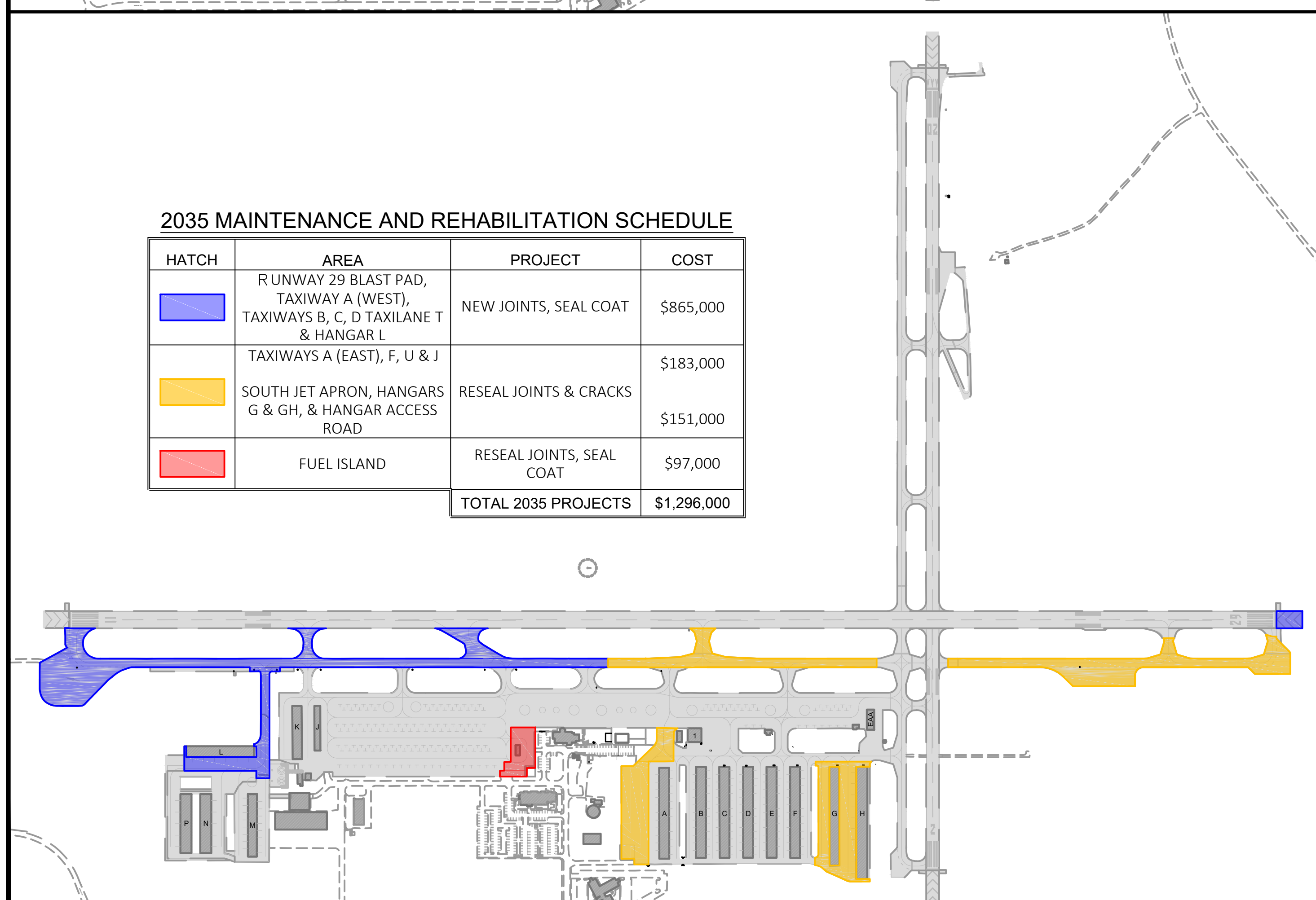
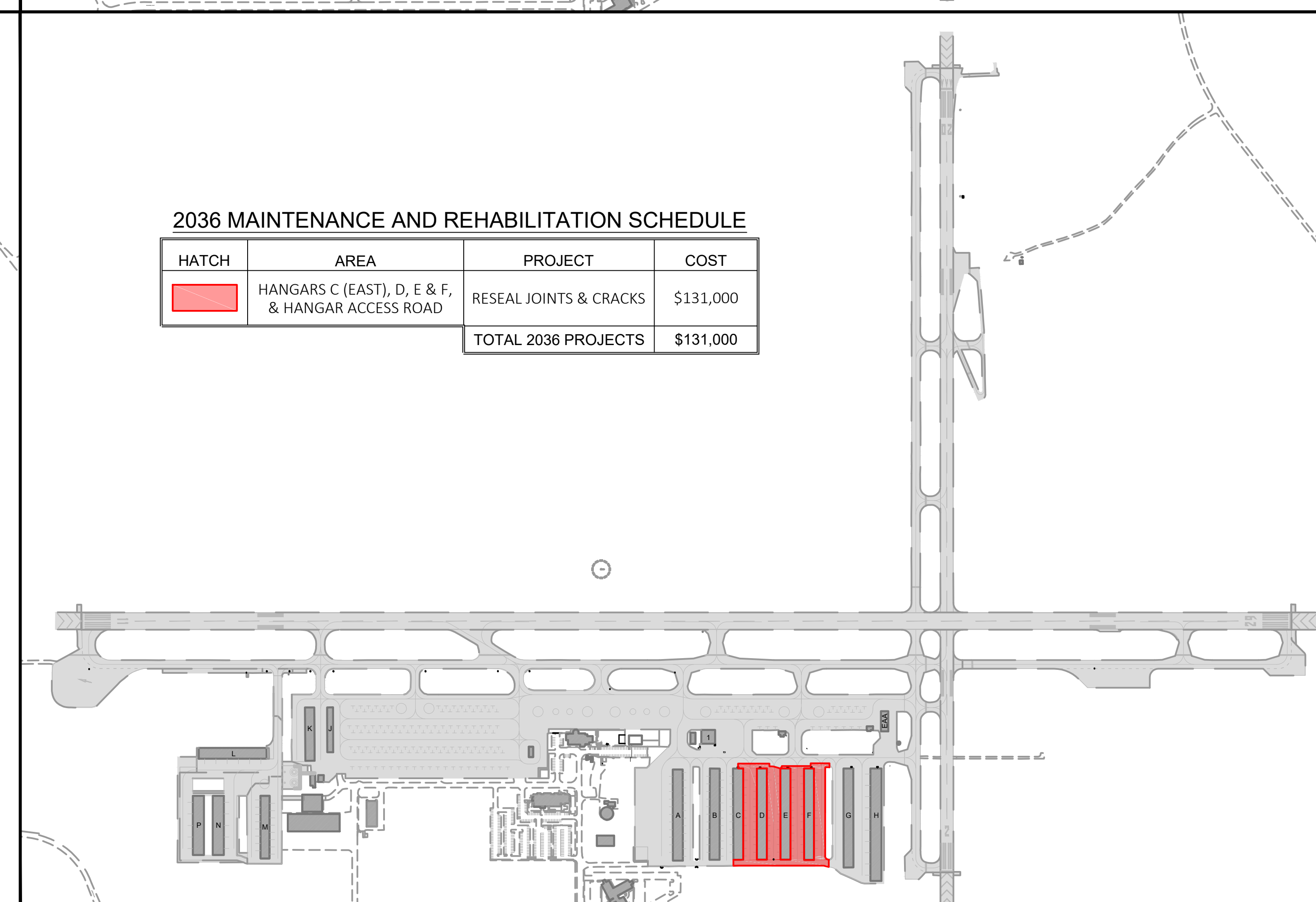
SCALE: 1"=1000'



2035 MAINTENANCE AND REHABILITATION SCHEDULE

HATCH	AREA	PROJECT	COST
(blue)	RUNWAY 29 BLAST PAD, TAXIWAY A (WEST), TAXIWAYS B, C, D TAXILANE T & HANGAR L	NEW JOINTS, SEAL COAT	$865,000
(yellow)	TAXIWAYS A (EAST), F, U & J	RESEAL JOINTS & CRACKS	$183,000
	SOUTH JET APRON, HANGARS G & GH, & HANGAR ACCESS ROAD		$151,000
(red)	FUEL ISLAND	RESEAL JOINTS, SEAL COAT	$97,000
		TOTAL 2035 PROJECTS	$1,296,000



2036 MAINTENANCE AND REHABILITATION SCHEDULE

HATCH	AREA	PROJECT	COST
(red)	HANGARS C (EAST), D, E & F, & HANGAR ACCESS ROAD	RESEAL JOINTS & CRACKS	$131,000
		TOTAL 2036 PROJECTS	$131,000

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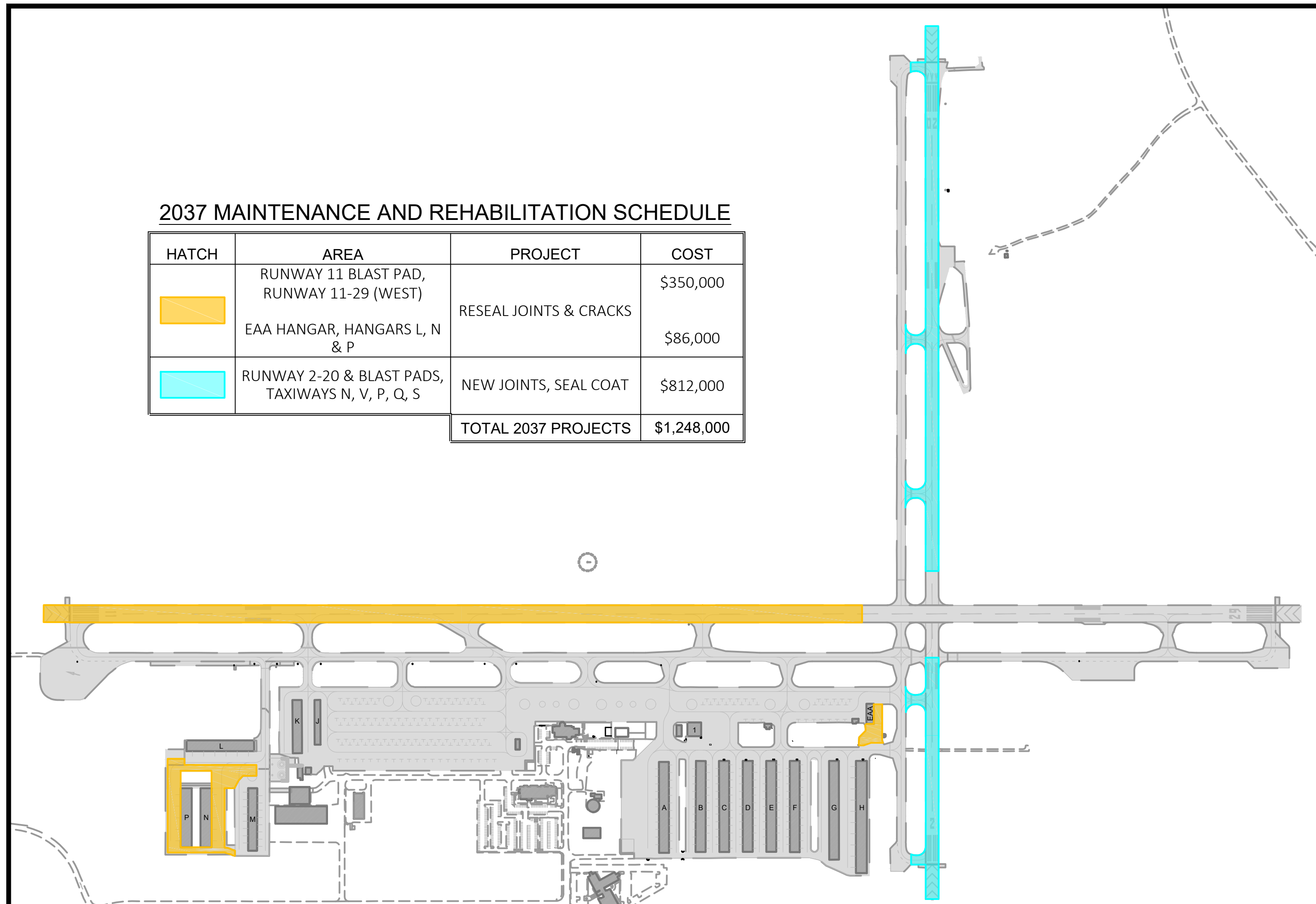
TRUCKEE TAHOE AIRPORT

2020 PAVEMENT MANAGEMENT PLAN

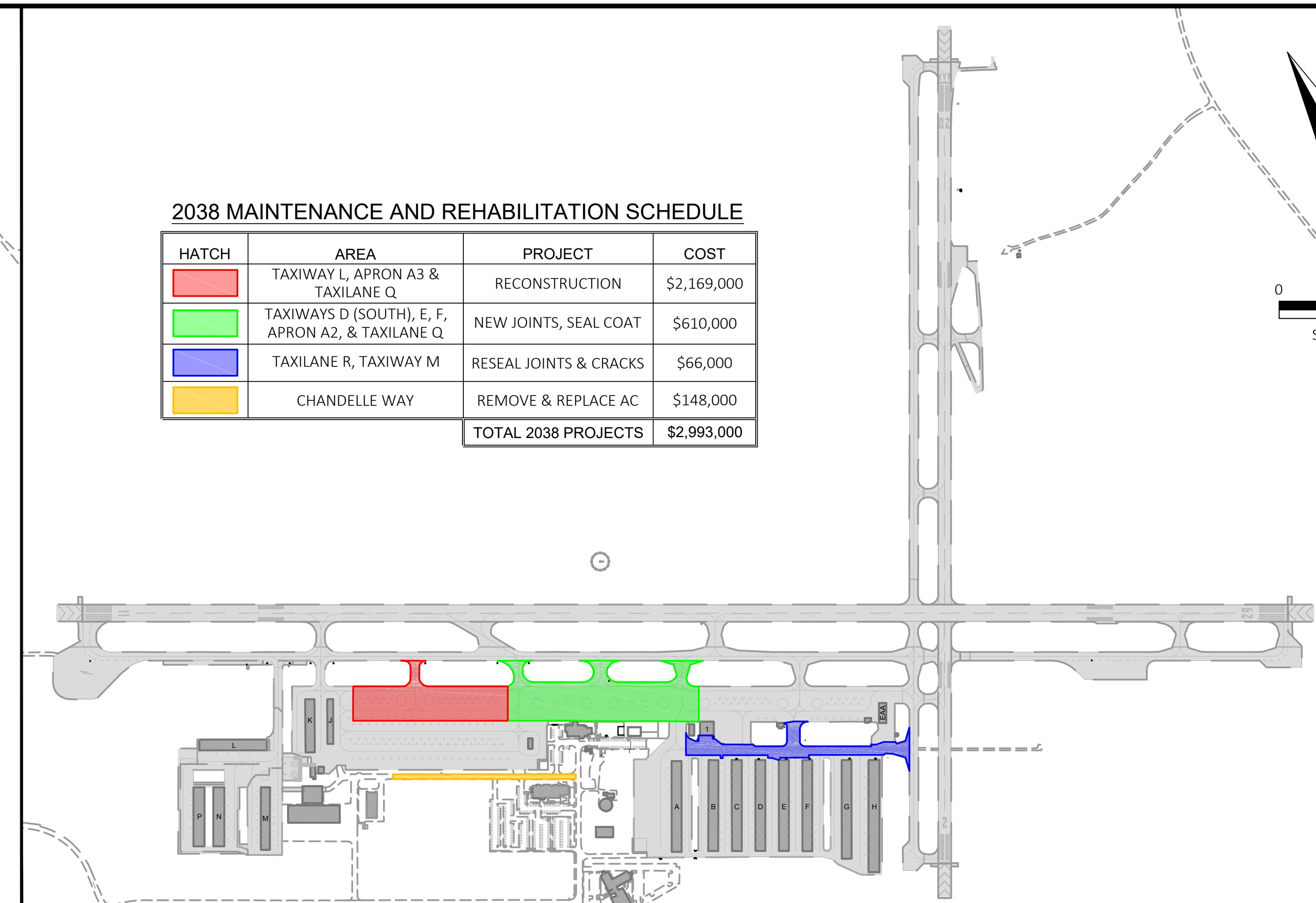
REHABILITATION SCHEDULE 2033-2036

DATE	4/15/2021
DRAWN	KDC
CHECKED	DB
FILE	4004-20.5.Rehab
SCALE	1"=1000'
PLATE No.	5-6



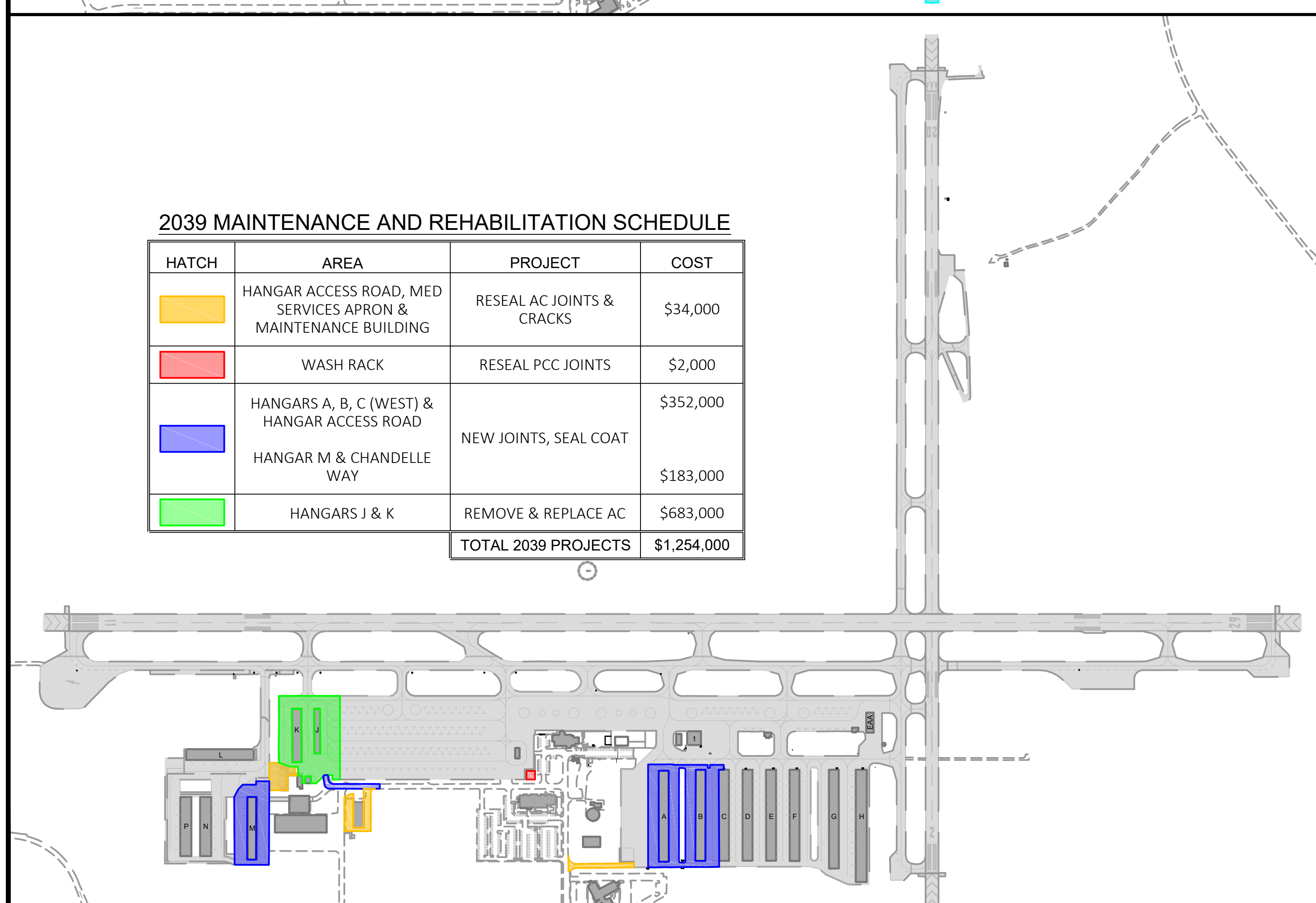
2037 MAINTENANCE AND REHABILITATION SCHEDULE

HATCH	AREA	PROJECT	COST
(yellow)	RUNWAY 11 BLAST PAD, RUNWAY 11-29 (WEST)	RESEAL JOINTS & CRACKS	$350,000
	EAA HANGAR, HANGARS L, N & P		$86,000
(cyan)	RUNWAY 2-20 & BLAST PADS, TAXIWAYS N, V, P, Q, S	NEW JOINTS, SEAL COAT	$812,000
		TOTAL 2037 PROJECTS	$1,248,000



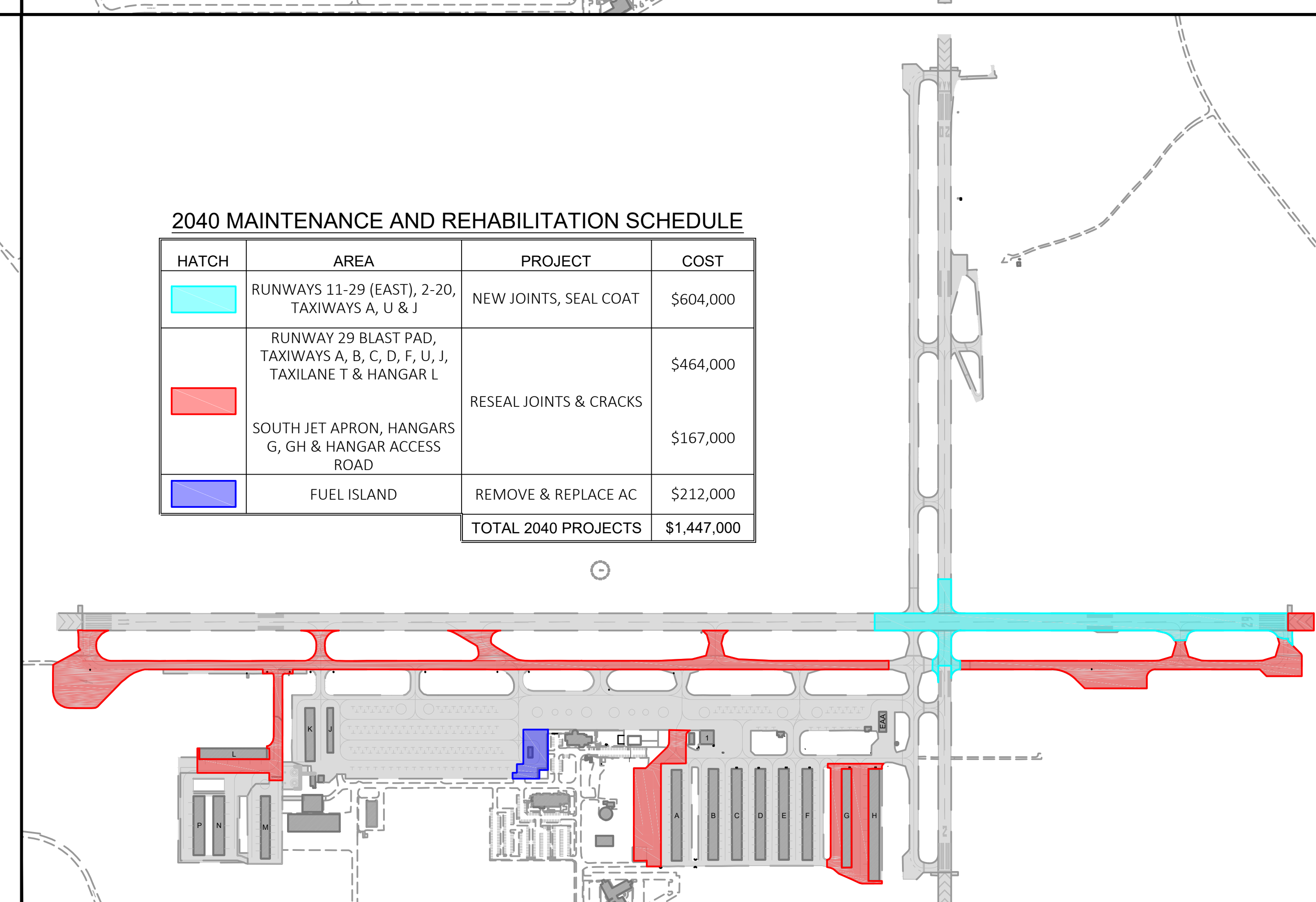
2038 MAINTENANCE AND REHABILITATION SCHEDULE

HATCH	AREA	PROJECT	COST
(red)	TAXIWAY L, APRON A3 & TAXILANE Q	RECONSTRUCTION	$2,169,000
(green)	TAXIWAYS D (SOUTH), E, F, APRON A2, & TAXILANE Q	NEW JOINTS, SEAL COAT	$610,000
(blue)	TAXILANE R, TAXIWAY M	RESEAL JOINTS & CRACKS	$66,000
(yellow)	CHANDELLE WAY	REMOVE & REPLACE AC	$148,000
		TOTAL 2038 PROJECTS	$2,993,000



2039 MAINTENANCE AND REHABILITATION SCHEDULE

HATCH	AREA	PROJECT	COST
(yellow)	HANGAR ACCESS ROAD, MED SERVICES APRON & MAINTENANCE BUILDING	RESEAL AC JOINTS & CRACKS	$34,000
(red)	WASH RACK	RESEAL PCC JOINTS	$2,000
(blue)	HANGARS A, B, C (WEST) & HANGAR ACCESS ROAD	NEW JOINTS, SEAL COAT	$352,000
	HANGAR M & CHANDELLE WAY		$183,000
(green)	HANGARS J & K	REMOVE & REPLACE AC	$683,000
		TOTAL 2039 PROJECTS	$1,254,000



2040 MAINTENANCE AND REHABILITATION SCHEDULE

HATCH	AREA	PROJECT	COST
(cyan)	RUNWAYS 11-29 (EAST), 2-20, TAXIWAYS A, U & J	NEW JOINTS, SEAL COAT	$604,000
(red)	RUNWAY 29 BLAST PAD, TAXIWAYS A, B, C, D, F, U, J, TAXILANE T & HANGAR L	RESEAL JOINTS & CRACKS	$464,000
	SOUTH JET APRON, HANGARS G, GH & HANGAR ACCESS ROAD		$167,000
(blue)	FUEL ISLAND	REMOVE & REPLACE AC	$212,000
		TOTAL 2040 PROJECTS	$1,447,000

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TRUCKEE TAHOE AIRPORT
2020 PAVEMENT MANAGEMENT PLAN
REHABILITATION SCHEDULE 2037-2040

DATE	4/15/2021
DRAWN	KDC
CHECKED	DB
FILE	4004-20.5.Rehab
SCALE	1"=1000'
PLATE No.	5-7