TRUCKEE-TAHOE AIRPORT
Pavement Evaluation Study
Pavement Maintenance/Management Plan

PRESENTED TO
TRUCKEE TAHOE AIRPORT DISTRICT




PRESENTED BY
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NOVEMBER, 2011 (UPDATED DECEMBER 2014)

TRUCKEE TAHOE AIRPORT
PAVEMENT EVALUATION STUDY
PAVEMENT MAINTENANCE/MANAGEMENT PLAN

Prepared for
Truckee Tahoe Airport District, California

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DRAFT PAVEMENT EVALUATION STUDY AND
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TABLE OF CONTENTS

LIST OF TABLES

LIST OF PLATES

EXHIBITS

APPENDICES

PREFACE: 2014 UPDATE

This report presents an update of the original report submitted in November 2011 and includes records of maintenance and reconstruction programs performed in 2012, 2013, and 2014, the change in Pavement Condition Index of all pavements since 2011, and updated maintenance and reconstruction recommendations.

The original testing and management plan was conducted in 2011. A new pavement condition survey of all pavements, including determination of the Pavement Condition Index was conducted for this PMMP update in the Fall of 2013. The update did not include any supplemental FWD testing, Fatigue Analysis, Geotechnical updates, or frost action studies since these factors do not change appreciably in 3 to 6 years.

The runway designations of all four runways changed in 2012, this report has been updated to reflect these changes. Runway 10-28 changed to Runway 11-29 and Runway 1-19 changed to Runway 2-20.

Hangars H1, H2, and H3 have been renamed to Hangars A-H, Hangars J-K, and Hangars L-M, respectively, with their row names also corresponding to the hangar locations.

The updated or modified sections of the text of this report are identified with a vertical bar located in the margin of the report. The updated tables and plates do not have a vertical bar located in the margin as the majority of the tables and plates were updated.

CHAPTER 1. INTRODUCTION

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.

Major sections of the pavement at this airport are 40 to 50 years old and have been subjected to significant traffic. In recent times the airport has been used extensively by larger propeller-driven aircraft and the business jet aircraft. The easterly 2,600 feet of Runway 11-29 was reconstructed in 2008. The new pavement section used in this reconstruction project consisted of 4 inches of asphaltic concrete over 8 inches of aggregate base course. 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.

The pavements at this airport have reached a state where significant maintenance is required and it is anticipated that reconstruction of many of the pavements will be necessary within the next 20 years. Since funding for pavement maintenance is limited to the grants available from the Federal Aviation Administration and the California Division of Aeronautics and to local funds, it is necessary to establish a Pavement Maintenance and Management Program (PMMP) that will allow reconstruction of the facilities within the necessary timeframe and to provide adequate maintenance on all pavements so as to allow safe operation of all aircraft. This 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, then 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 throughout most of the year, freezing, snow, snow removal, and rain all cause thermal cracking, raveling, and spalling. Freezing conditions can also cause frostheave in the winter months and significant loss of strength during the spring thaw due to super-saturation of the base and subgrade materials.

A detailed pavement evaluation study has been conducted, which identifies and quantifies the distress that develops 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, rideability, and aesthetic characteristics required for the safe operation of the airport. All pavement elements on the airport were evaluated in this study, except the pavements within the glider parking area off the northern end of Runway 2-20. These studies have been conducted by the office of Reinard W. Brandley, Consulting Airport Engineer, and the results of these studies are included in this report.

CHAPTER 2. DATA COLLECTION

Significant data were collected for the development of the original pavement evaluation and Pavement Maintenance/Management Program. All previous test information available was gathered, a testing and inspection program was developed, and new data from the new test program were accumulated. New surface pavement condition survey data collected in 2013 has been added.

Weather data for the past several years were obtained from the Weather Bureau and gauges were installed at one location in Runway 11-29 in an effort to determine the actual depth of frost penetration at the Truckee Tahoe Airport. A summarization of the data collected is included in Appendices A, B, C, and D.

2-1 Geotechnical Studies

Before a Pavement Evaluation Study can be successfully completed, it is necessary that detailed data be available showing the character and strength of the existing soils at the site on which the pavement sections are constructed. 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. Soils data developed should include uniformity of stratification, soil classification, soil density, soil moisture content, and soil strength and consolidation characteristics.

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. The results of this study are summarized in Appendix A.

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. 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.

It will be noted that there is significant difference between the classification of the soils as shown on the soil profile sheets of the Brandley test program and the Stantec test program. An examination of the grading analysis and Atterberg limit tests conducted by both Brandley and Stantec shows that the soils are in fact the same materials but have been classified using a different basis. The Stantec classification was based mainly on gradation, and since the larger percentage of material in each sample was within the sand range, they were classified as "silty gravel with sand" or "clayey sand with gravel." In the Brandley study the soils were largely classified by the character of the fine materials as demonstrated by the Atterberg limit tests and the upper soils were classified as "sandy silts and gravels," some of which were clayey, and the materials at lower depths were classified as "silty fine to coarse sand and rock." The classification using the Atterberg limit tests as shown in the Brandley report more accurately identifies the performance characteristics of the soils under load.

In general, it was found that the surface soils to depths ranging from 5 to 10 feet consisted of sandy silts and gravels and, in some cases, sandy clays. These materials were underlain by 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 of 21 feet.

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 excavated, previous reports, and F.A.A. files. It has been reported that the bituminous surface course placed on the apron in the 1998 project came from Nevada sources that are reported to be of questionable quality. The areas on the airport where this pavement was placed using the Nevada aggregates included all aprons and the tee hangar taxilanes on both sides of Hangar Rows D, E, and F.

In general, all other existing pavements are F.A.A. Marshall mix design materials or California Highway Department specification materials. These pavements are a good quality product but are old, weathered, and somewhat brittle. The existing aggregate base course consists mainly of a well-graded crushed aggregate base course ranging in maximum size from 1 inch to 1½ inch depending on location. Both the aggregate base and pavement were obtained from local pits and quarries, except as noted above, which are high-quality materials.

The thickness of each layer of asphalt pavement or aggregate base is shown, wherever it is known, in Appendix C, Tables C-1 through C-72. In general, the pavement section on Runway 11-29 and associated taxiways consists of 3 to 4 inches of bituminous surface course underlain by 8 to 14 inches of aggregate base, for a total thickness of 11 to 17 inches. The pavement section for Runway 2-20 and associated taxiways consists of 5 to 6 inches of bituminous surface course over 6 to 8 inches of aggregate base course, for a total section ranging from 11 to 13 inches. The pavement section for the aprons and tee hangar taxilanes, except for the new West Hangar and Warehouse Area, generally consists of 3 inches of bituminous surface course underlain by 6 inches of aggregate base course. The pavement section for the West Hangar and Warehouse Area consists of 4 inches of bituminous surface course over 10 inches of aggregate base course. The section around the hangars consists of 3 inches of bituminous surface course over 6 inches of aggregate base course.

In this updated report the changes to pavement sections included in the maintenance and reconstruction projects performed in 2012 and 2013 have been added.

2-3 Falling Weight Deflectometer (FWD) Tests

The heavy-duty falling weight deflectometer 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 increments out to 7 feet from the centerline 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 of the load-carrying characteristics of the pavement in one element of the airport, together with the size and shape of the deflection bowl of the surface of the pavement under load.

At the Truckee-Tahoe Airport FWD tests were conducted 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 tests 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 200-foot by 200-foot. On all hangar taxilanes FWD tests were conducted in the wheel path of the taxilane at a spacing of approximately 200 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, 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, 25, and/or 30 kips. The results of the falling weight deflectometer tests showing center plate deflections are included in Appendix B, Plate No. B-1. A full-size copy of this drawing is located in the back pocket of this report. The center deflections for each element of the airport were also plotted as profiles and these data are included in Appendix B, Plates No. B-2 through B-41.

The basic soil parameters that are utilized in the Fatigue Analysis to determine pavement life are Modulus of Elasticity and Poisson's Ratio. The magnitude of deflection and shape of the deflection bowl of 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 parameters 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, of the upper 4 feet of subgrade soil, and of the subsoils located below 4 feet from the surface. The results of these back calculated values of Modulus of Elasticity of each layer analyzed are included in Appendix C, Tables No. C-1 through C-72. No additional FWD tests were conducted in the 2013 Update.

2-4 Pavement Condition Survey

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*. On the pavement condition surveys a detailed assessment of the pavement is conducted, which evaluates the following distresses:

- Alligator Cracking
- Bleeding
- Block Cracking
- Corrugation
- Depression
- Jet Blast
- Joint Reflection (PCC)
- Longitudinal and Transverse Cracking
- Oil Spillage
- Patching
- Polished Aggregate
- Raveling/Weathering
- Rutting
- Shoving from PCC
- Slippage Cracking
- Swell

The normal procedure is to divide the element into sample units. The sample units generally represent approximately 10 percent of the total pavement section. The type and severity of each airport pavement distress is assessed by visual inspection of the pavement sample units. The quantity of distress is measured and the distress data are used to calculate the Pavement Condition Index (PCI) of each sample unit. The process involves detailed inspection of sample units throughout the section, which covers approximately 10 percent of the total area of the pavement.

The office of Reinard W. Brandley deviates from this process in that the types of distress that are apparent in three or four representative samples of the section are evaluated in detail, which includes the worst case unit as well as the average unit. Generally there are only three or four of the distress types that are evident on the unit. After these have been determined, 100 percent of the pavement surface is surveyed to determine the severity and magnitude of distress for each type of distress that is occurring on that section of pavement. By this procedure the coverage of the survey is increased from the 10 percent included in the standard ASTM method to 100 percent. It is considered important to expand the survey in this manner so as to identify the worst-case conditions as well as the average and best case conditions.

The Pavement Condition Index (PCI) and pavement condition description were determined for each section of pavement. This information is included in Appendix C of this report. The data for each segment are included in Tables C-1 through C-72. Additional information is also included on these tables. Pavement condition determinations are based on visual observations and can vary significantly based on the experience and judgment of the Engineer.

The ASTM Standard provides a relationship between Pavement Condition Index (PCI) and pavement rating. On Plates No. 2-1a and 2-1b 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 2013 most pavements at the airport range from the "fair" to "excellent" condition. The South Jet Apron and Portions of Taxiway A are rated as "poor", and Apron A4 and run-up areas at Taxiways B and H are rated "very poor".

Pavement Condition Index (PCI) values for each section of pavement were determined in 2011. Updated PCI values for all pavement sections were determined in the 2013 update study, including new and existing sections. The original (2011) PCI values and updated (2013) PCI values are included in this updated report to show how much they have changed as a result of two more years of use or after rehabilitation or reconstruction of the pavement sections.

2-5 Forecast Traffic

Traffic forecasts furnished by the Truckee Tahoe Airport District were used to evaluate the pavements at this airport. These data included the type aircraft currently operating at the airport, along with the annual number of operations of that aircraft. They also included the forecast growth of use of these aircraft. In Table No. 2-1 the traffic data used are presented.

Table No. 2-1a lists the aircraft utilizing the airport and includes their maximum takeoff weight, empty weight, empty weight plus 60 percent of maximum fuel weight, and gear configuration. These aircraft have been grouped into 11 aircraft groups and each group has approximately the same aircraft characteristics of maximum takeoff weight and gear type.

In Table No. 2-1b the 2011 annual operations and the annual growth rate for each aircraft group are included.

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 the airport is a function of:

- Wind direction, which dictates which runways are used
- Landing length of each aircraft and takeoff length of each aircraft
- Destination on the airport.

For this evaluation it was assumed that 90 percent of the traffic uses Runway 11-29 and 10 percent uses Runway 2-20. Of the 90 percent 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 that use Runway 2-20, 90 percent land and take off on Runway 20 and only 10 percent land and take off on Runway 2.

When an aircraft lands on a runway, only the large 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 and the destination of the aircraft on the airport.

Based on the aircraft characteristics, the runway use dictated by wind, and the destination of aircraft on the airport, the annual operations of each aircraft have been evaluated to best represent the actual traffic that occurs on each segment. The traffic forecast to occur on each segment is defined as "Traffic Index." A total of 17 traffic indexes were evaluated. The number of annual operations for each aircraft group and each traffic index are indicated in Table No. 2-1c. This traffic index was utilized in the evaluation of pavements for deep-seated distress.

Since the business jet traffic at Truckee Tahoe Airport has increased significantly over the past few years and the national fleet is increasing, there is a possibility that the amount of larger aircraft using the airport will increase more than what has been forecast. In order to evaluate the effect that increased traffic would have, a new set of traffic indexes was prepared and used in the Fatigue Analysis studies. With the new traffic indexes the number of operations of the large aircraft (those with maximum takeoff weight in excess of 37,500 pounds) was doubled. The new traffic index with the doubling of the heavy aircraft operations has also been included in Table No. 2-1 as Table No. 2-1d. The traffic index designation is the same as with the existing forecasts except that a "1" has been added. For example, "A" is existing forecasts and "A1" is existing forecasts with double the number of aircraft weighing more than 37,500 pounds. The Fatigue Analysis was conducted using both the forecast traffic and the traffic with the large aircraft numbers 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 onto each section of apron. Different factors are applied to the operations estimated for a given section to convert operations to coverages. Coverages are used in the Fatigue Analysis for remaining pavement life calculations.

The traffic distribution used for various segments of the pavement is shown on Plate No. 2-2.

It has been assumed in the 2013 Update that the "Traffic Indexes" used in the original study (2011) will still apply.

2-6 Frost Action

The natural soils at the Truckee Tahoe Airport are highly susceptible to frost action because of the gradation of these materials and the access to ground moisture. 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.

At Lake Tahoe Airport in South Lake Tahoe, California, a 10-foot wide white painted threshold bar heaved 12 inches more than the adjacent black pavement in one short period of the winter. This was caused by frost action and differential depth of frost penetration under white-painted surfaces and dark surfaces. Exploration at Lake Tahoe Airport showed that the frost had penetrated to a depth of 45 inches under the white painted stripe and only 14 inches under the adjacent dark pavement.

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 frost layer is 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.

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 32° 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. 2-3 in the Freezing Index graph. Also in Plate No. 2-3 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.

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. 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. When the hole was drilled through the pavement for installation of the gauges, it was noted that there was no frost in any of the subgrade or subsoil materials that existed below a depth of 11 inches from the surface. 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. 2-3. Air temperature during that same period was also recorded and is also shown on Plate No. 2-3.

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 32° F. In several instances during the night the temperature of the soil at a depth of 6 inches approached 32° F but always rose during the daytime.

These data confirm information that the office of Reinard W. Brandley obtained from Lake Tahoe Airport 20 years ago. At the Lake Tahoe Airport the depth of frost penetration under a 10-foot wide solid white reflective painted surface extended to 45 inches. As an experiment a series of 6-inch wide black stripes were painted on this pavement to form a "zebra" pattern of 6-inch white and 6-inch black. Even in the middle of the winter the painting of these black stripes caused the frozen soil to melt and the surface of the runway, which had heaved 12 inches, to settle back to original grade. This research led to F.A.A. adoption of "zebra" striping as a standard for cold climate areas.

While there was no frost penetration under the pavements at Truckee Tahoe Airport after February 9, 2011, there probably will be some frost penetration at sometime in the winter. These gauges will be left in place through the winter of 2011/12 and depth of frost penetration will be recorded. Mitigation measures will be considered as required, depending on the depth of frost penetration. 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.

The frost penetration data observed during the winters of 2011-2012 and 2012-2013 showed little change from the data included in the original report. 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. There are no additional updates to the Frost Action section of the report.

TABLE No. 2-1 - TRAFFIC SUMMARY

TABLE No. 2-1a - Traffic Group Summary

Aircraft Group	Aircraft Type	Aircraft Empty (lbs)	Aircraft 60% Fuel (lbs)	Aircraft MTOW (lbs)	Gear Configuration
1	Beech Baron	4,190	4,930	5,424	Single
2	Conquest	6,210	8,439	9,925	Single
	Citation CJ1	6,160	8,704	10,400	Single
3	Raytheon Premier I	8,600	10,940	12,500	Single
	King Air 350	10,000	13,000	15,000	Single
	Citation CJ II Bravo	9,300	12,780	15,100	Single
	Lear 31	10,250	13,400	15,500	Dual
	Raytheon Hawker 400	10,550	14,000	16,300	Single
	Citation Ultra/Encore	9,900	13,938	16,630	Single
4	Citation Excel	12,550	17,020	20,000	Single
5	Lear 45	12,050	16,940	20,200	Dual
	Citation III	13,500	18,600	22,000	Dual
	Lear 60	14,750	20,000	23,500	Dual
6	Gulfstream 150	15,100	21,700	26,100	Dual
	Raytheon Hawker 800	16,100	23,240	28,000	Dual
	Citation Sovereign	20,800	26,500	30,300	Dual
	Raytheon Hawker 1000	17,220	25,488	31,000	Dual
7	Gulfstream 200	21,200	29,390	34,850	Dual
	Citation X	21,600	30,060	35,700	Dual
	Dessault Falcon 2000	19,700	29,360	35,800	Dual
8	Challenger 300	23,800	32,020	37,500	Dual
	Raytheon Hawker 4000	23,500	33,100	39,500	Dual
	Dassault Falcon 50 EX	20,200	31,900	39,700	Dual
	Dassault Falcon 2000EX	23,190	34,596	42,200	Dual
9	Dassault Falcon 900B	22,610	36,344	45,500	Dual
	Challenger 605	26,990	39,716	48,200	Dual
	Dassault Falcon 900EX	24,700	38,860	48,300	Dual
	Legacy	30,000	41,760	49,600	Dual
10	Gulfstream III	38,000	57,020	69,700	Dual
	Gulfstream IV	43,000	61,120	73,200	Dual
11	Gulfstream V	48,300	73,920	91,000	Dual
	Bombardier Global Express	52,000	79,600	98,000	Dual

Note: 60% Fuel Weight is the weight of the aircraft with 60% of the total fuel, passengers, and payload allowable.

TABLE No. 2-1b - Summary of Traffic Data for Truckee Tahoe Airport

	Aircraft Group	Aircraft MTOW (lbs)	Gear Type	2011 Operations	Annual Growth Rate
Small to Medium Aircraft	1	5,500	Single	16,746	0.70%
	2	10,000	Single	2,618	2.27%
	3	16,000	Single	2,654	2.90%
	4	20,000	Single	464	4.40%
	5	23,000	Dual	312	4.40%
	6	30,000	Dual	192	4.40%
	7	35,700	Dual	416	4.40%
Large Aircraft	8	42,000	Dual	58	4.32%
	9	49,000	Dual	98	4.27%
	10	73,000	Dual	50	3.65%
	11	94,000	Dual	72	3.30%
	Total 2011 Operations			*23,680*	

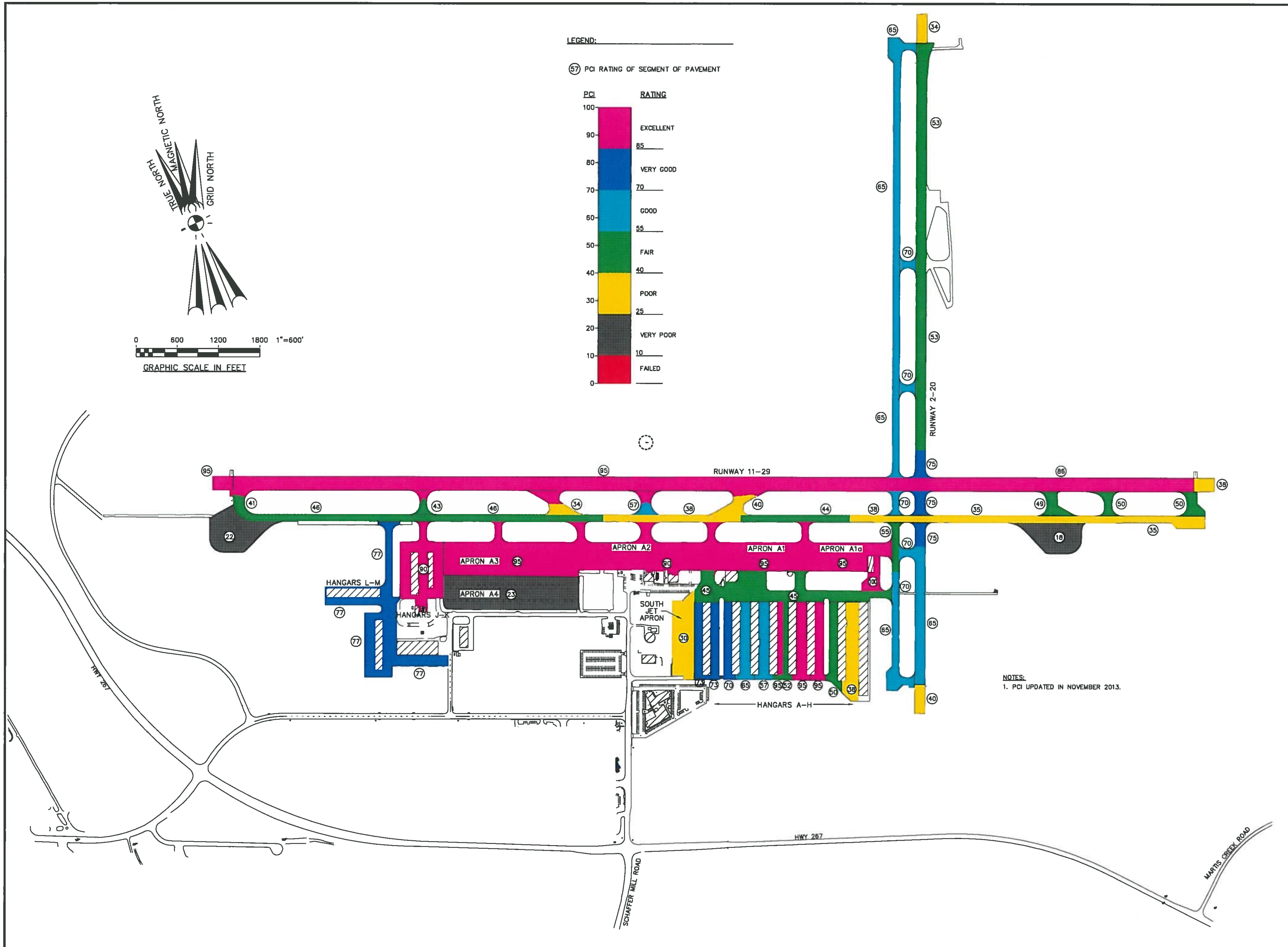
TABLE No. 2-1c - Summary of Traffic Indexes

	Aircraft Group	Traffic Index (Aircraft Operations in 2011)																
		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
Small to Medium Aircraft	1	4,521	8,206	13,732	2,512	6,029	8,708	6,866	3,014	1,507	1,172	5,024	6,698	6,698	5,024	1,675	1,675	3,349
	2	707	1,283	2,147	393	942	1,361	1,073	471	236	183	785	1,047	1,047	785	262	262	524
	3	717	1,300	2,176	398	955	1,380	1,088	478	239	186	796	1,062	1,062	796	265	265	531
	4	125	227	380	70	167	241	190	84	42	32	139	186	186	139	46	46	93
	5	84	153	256	47	112	162	128	56	28	22	94	125	125	94	31	31	62
	6	52	94	157	29	69	100	79	35	17	13	58	77	77	58	19	19	38
	7	112	204	341	62	150	216	171	75	37	29	125	166	166	125	42	42	83
Large Aircraft	8	31	49	50	21	27	30	24	5	5	3	-	26	53	-	6	-	17
	9	53	82	85	35	45	51	40	9	9	6	-	44	89	-	10	-	29
	10	27	42	44	18	23	26	21	5	5	3	-	23	46	-	-	-	15
	11	39	60	63	26	33	37	30	6	6	4	-	32	66	-	-	-	22
Total 2011 Operations		6,468	11,700	19,431	3,611	8,552	12,312	9,710	4,238	2,131	1,653	7,021	9,486	9,615	7,021	2,356	2,340	4,763
% Use of Small/Medium Aircraft		27%	49%	82%	15%	36%	52%	41%	18%	9%	7%	30%	40%	40%	30%	10%	10%	20%
% Use of Large Aircraft		54%	84%	87%	36%	46%	52%	41%	9%	9%	6%	0%	45%	91%	0%	10%	0%	30%

TABLE No. 2-1d - Summary of Enhanced Traffic Indexes

	Aircraft Group	Enhanced Traffic Index (Aircraft Operations in 2011 with Large Aircraft Operations Doubled)																
		A1	B1	C1	D1	E1	F1	G1	H1	I1	J1	K1	L1	M1	N1	O1	P1	Q1
Small to Medium Aircraft	1	4,521	8,206	13,732	2,512	6,029	8,708	6,866	3,014	1,507	1,172	5,024	6,698	6,698	5,024	1,675	1,675	3,349
	2	707	1,283	2,147	393	942	1,361	1,073	471	236	183	785	1,047	1,047	785	262	262	524
	3	717	1,300	2,176	398	955	1,380	1,088	478	239	186	796	1,062	1,062	796	265	265	531
	4	125	227	380	70	167	241	190	84	42	32	139	186	186	139	46	46	93
	5	84	153	256	47	112	162	128	56	28	22	94	125	125	94	31	31	62
	6	52	94	157	29	69	100	79	35	17	13	58	77	77	58	19	19	38
	7	112	204	341	62	150	216	171	75	37	29	125	166	166	125	42	42	83
Large Aircraft	8	62	98	100	42	54	60	48	10	10	6	-	52	106	-	12	-	34
	9	106	164	170	70	90	102	80	18	18	12	-	88	178	-	20	-	58
	10	54	84	88	36	46	52	42	10	10	6	-	46	92	-	-	-	30
	11	78	120	126	52	66	74	60	12	12	8	-	64	132	-	-	-	44
Total 2011 Operations		6,618	11,933	19,673	3,711	8,680	12,456	9,825	4,263	2,156	1,669	7,021	9,611	9,869	7,021	2,372	2,340	4,846
% Use of Small/Medium Aircraft*		27%	49%	82%	15%	36%	52%	41%	18%	9%	7%	30%	40%	40%	30%	10%	10%	20%
% Use of Large Aircraft*		54%	84%	87%	36%	46%	52%	41%	9%	9%	6%	0%	45%	91%	0%	10%	0%	30%

* - Percent use inidcates the percentage of different aircraft groups using an analyzed pavement element.



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ENGINEER OF RECORD

NO.	REVISIONS	BY	APR	DATE
1	2013 PMMP UPDATE	DB	RWB	1/30/14

TRUCKEE TAHOE AIRPORT

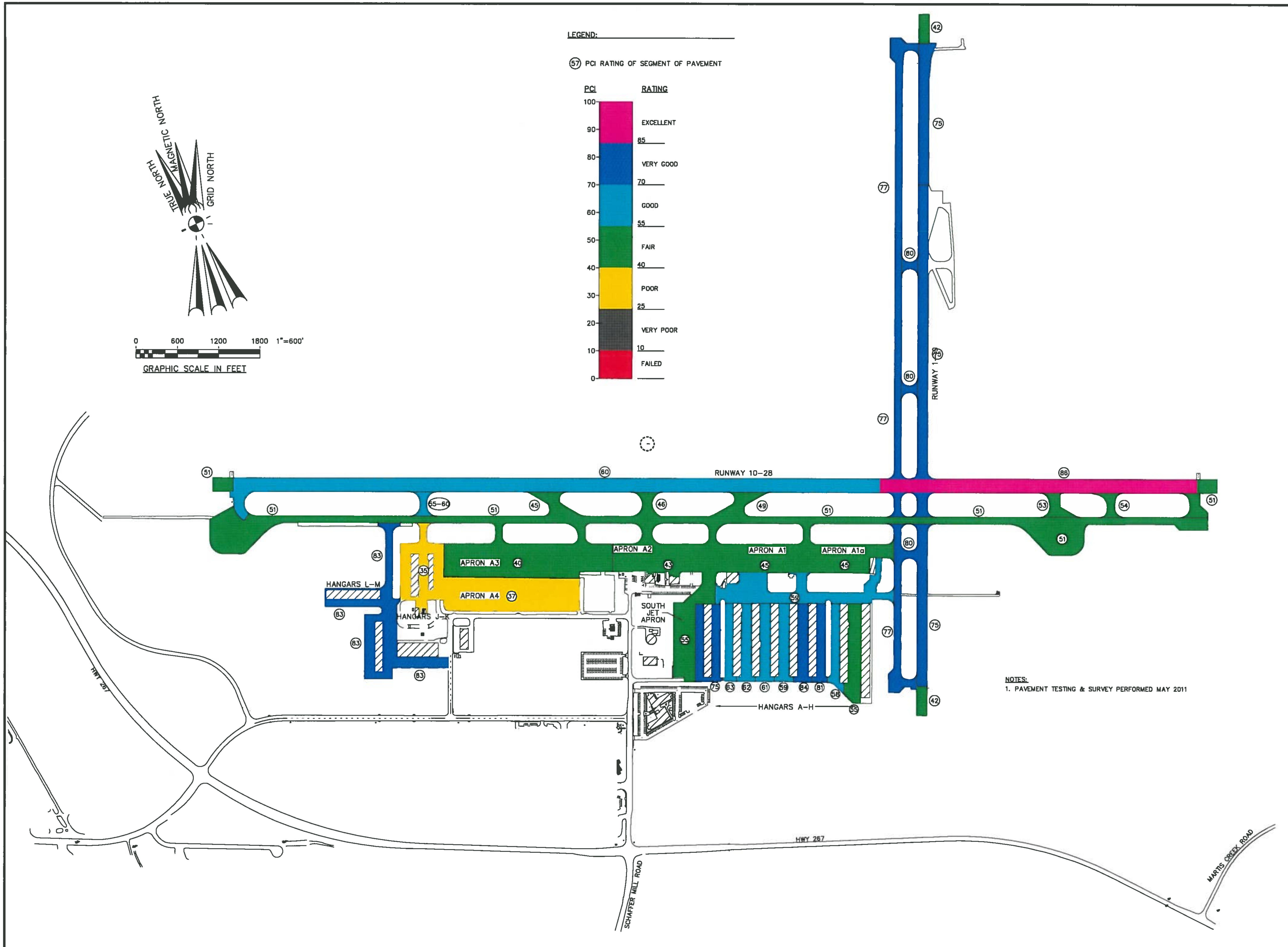
TRUCKEE, CALIFORNIA

PAVEMENT EVALUATION

2013 SURFACE DISTRESS PAVEMENT CONDITION INDEX (PCI)

DESIGN BY: DB
DRAWN BY: DB
CHK'D BY: RWB
DATE: JAN 30, 2014
CONTRACT No. -
PROJECT NO: 40.04-13
DWG FILE: PLATE 6
DRAWING SCALE: 1"=300'

SHEET NUMBER
PLATE NO. 2-1a



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ENGINEER OF RECORD

NO.	REVISIONS	BY	APPR	DATE

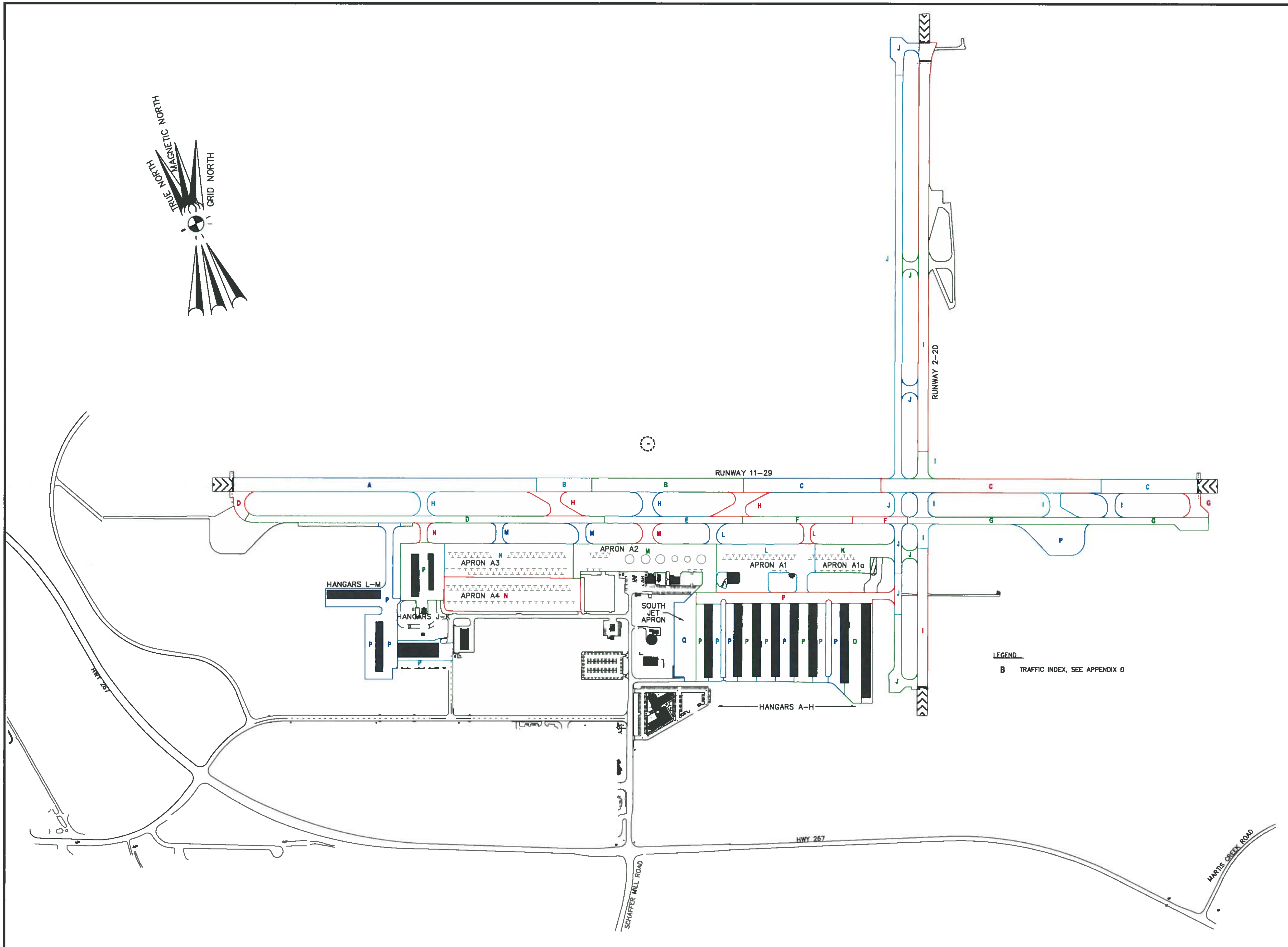
TRUCKEE TAHOE AIRPORT
TRUCKEE, CALIFORNIA

PAVEMENT EVALUATION

2011 SURFACE DISTRESS
PAVEMENT CONDITION INDEX (PCI)

DESIGN BY: RWB
DRAWN BY: KRC
CHK'D BY: RWB
DATE: SEPT. 28, 2011
CONTRACT No. -
PROJECT NO. 40.12
DWG FILE: PLATE 6
DRAWING SCALE: 1"=200'

SHEET NUMBER
PLATE NO. 2-1b



Reinard W. Brandley
CONSULTING AIRPORT ENGINEER

ENGINEER OF RECORD

NO.	REVISIONS	BY	APR	DATE

TRUCKEE TAHOE AIRPORT

TRUCKEE, CALIFORNIA

PAVEMENT EVALUATION

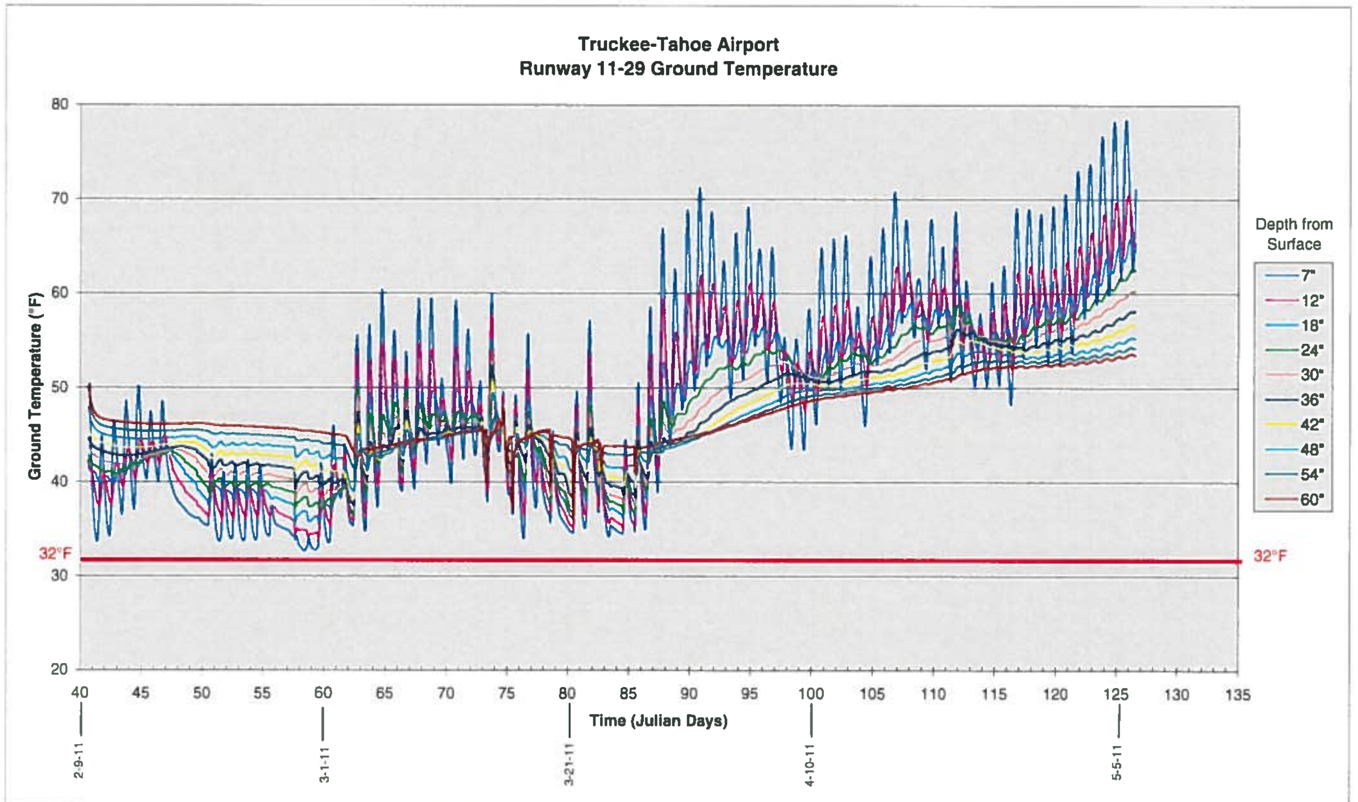
TRAFFIC DISTRIBUTION - TRAFFIC INDEX

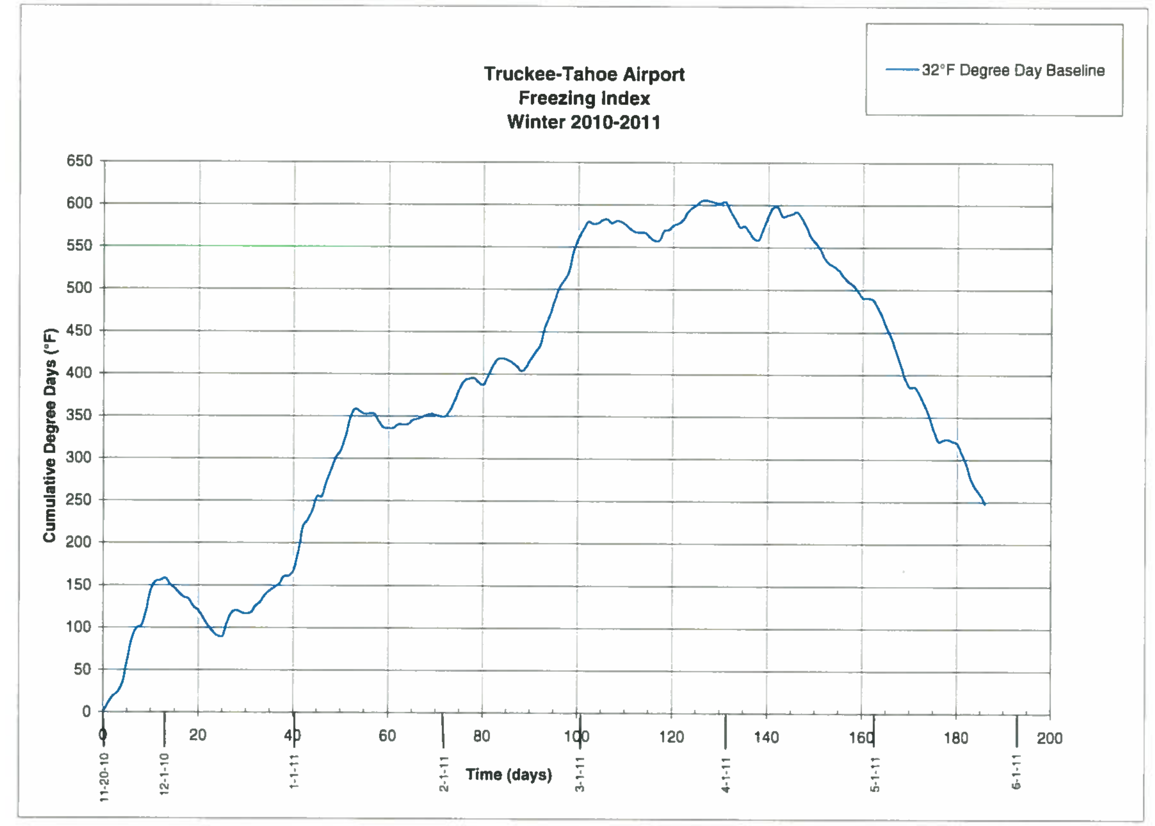
DESIGN BY: RWB
DRAWN BY: DB
CHK'D BY: RWB
DATE: SEPT. 28, 2011
CONTRACT No. -
PROJECT NO: 40.12
DWG FILE: PLATE 3
DRAWING SCALE: 1"=300'

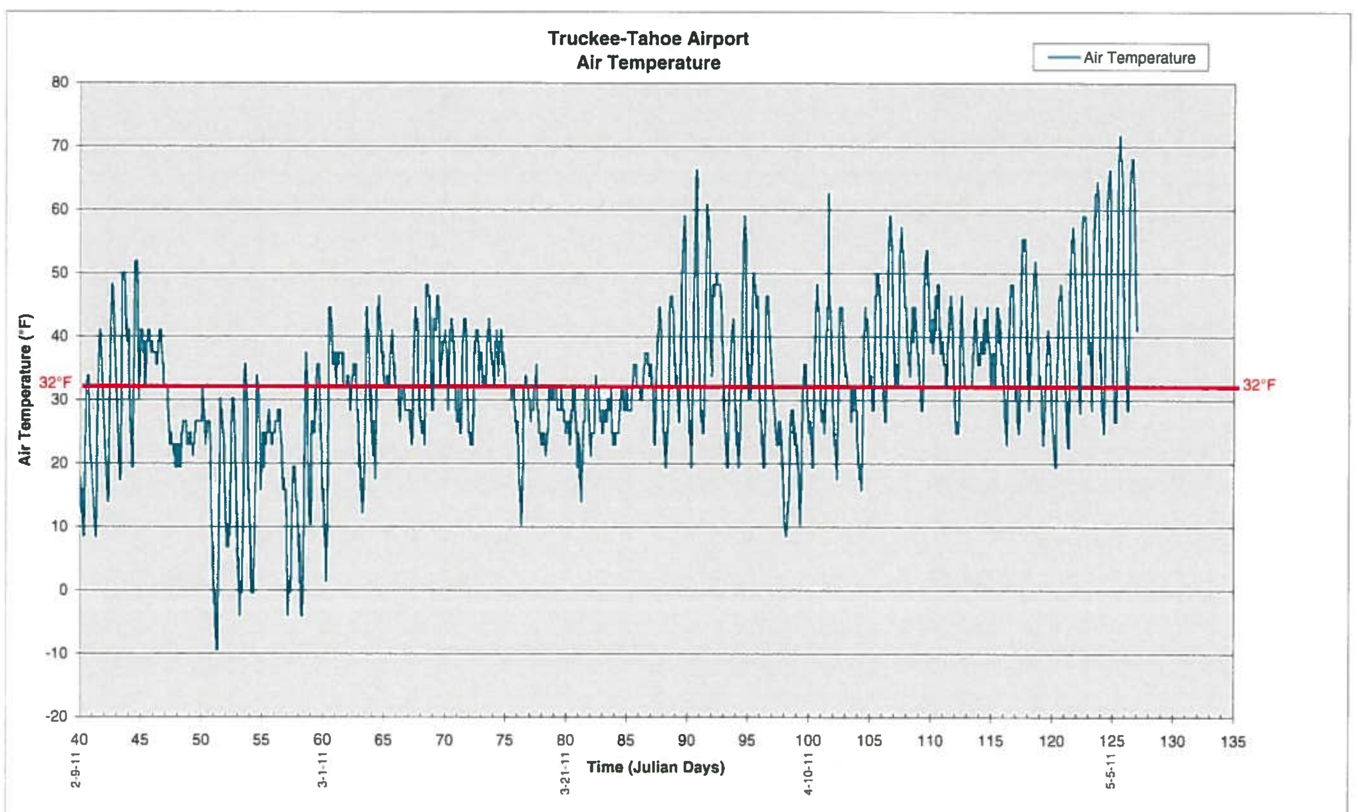
SHEET NUMBER
PLATE NO. 2–2

PLATE NO. 2-3 - FROST PENETRATION STUDY

Data Collection: February 9 -May 5, 2011







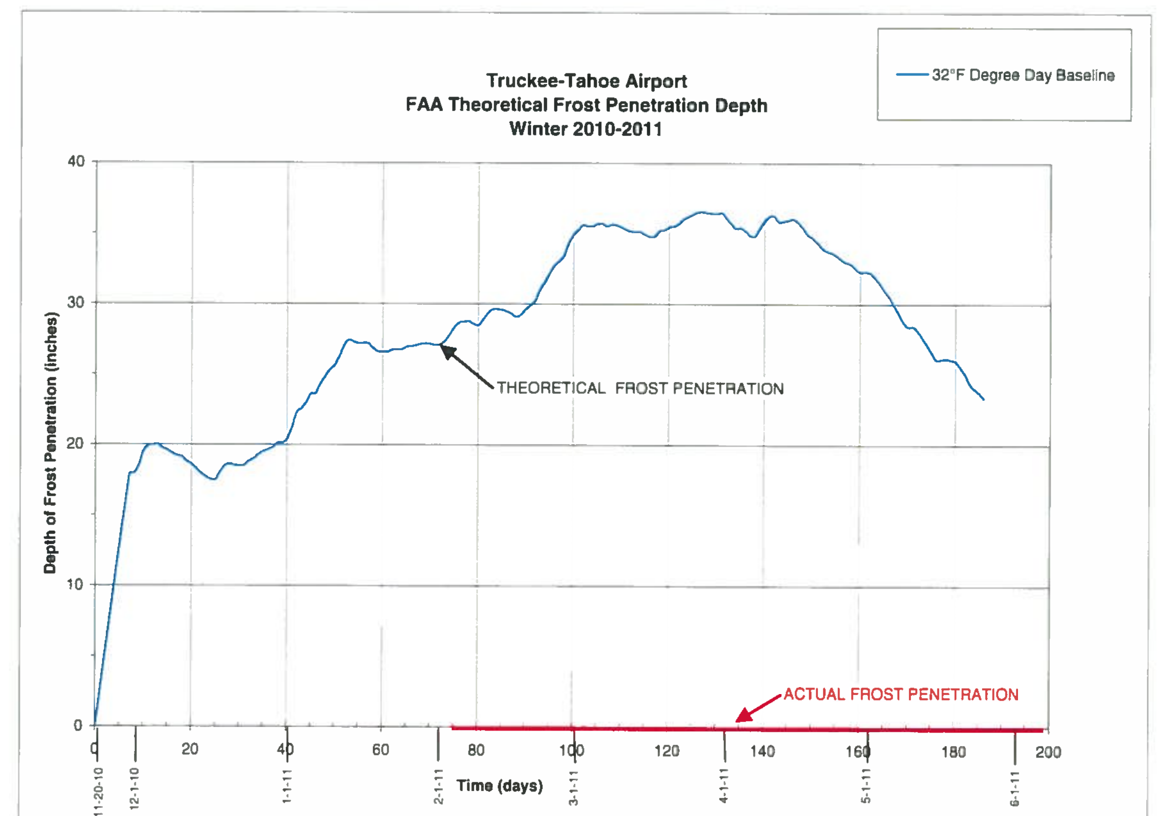


PLATE NO. 2-3
FROST PENETRATION STUDY

CHAPTER 3. ANALYSIS AND EVALUATION

3-1 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 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. Surface distress causes deterioration of the surface pavement layer including cracking, spalling, raveling, bleeding, and shoving.

3-2 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 System (PMMP) to determine the time at which failure of the section caused by deep-seated distress will occur under forecast loadings. Several methods have been developed over the past 60 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.

3-2.1 Back Calculated Modulus of Elasticity

Prior to the development of the computer, it was not possible to calculate stresses, strains, and deflections 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 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 a multi-layer system. The basic soils and pavement parameters that were necessary for this computation were Modulus of Elasticity and Poisson's Ratio 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 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.

These data for Modulus of Elasticity and Poisson's Ratio of each layer and the thickness of each layer including the pavement section, the subgrade materials, and various layers of subsoil can be developed and utilized in the Fatigue Analysis.

3-2.2 Forecast Traffic

Forecast traffic, including type aircraft, type gear, operating load, and distribution on the pavement, is a parameter that must be utilized in any fatigue analysis. These 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 in Table No. 2-1. These traffic indexes represent the total operations of each category of aircraft on each section of pavement. For input into the Fatigue Analysis methodology, these operations are converted to coverages to represent the distribution of aircraft tires on the pavement section in each segment.

3-2.3 Existing Pavement Sections

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

3-2.4 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 and forecast 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 make 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. 3-1. Where applicable, each of these rehabilitation procedures was evaluated using the Fatigue Analysis.

3-2.5 Fatigue Analysis – Deep Seated Distress

3-2.5.1 Brandley Fatigue Analysis – Remaining Life Analysis

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 load. Deflections were used at that time since the computer had not been developed and stresses and strains 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 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 airport and each pavement section.

Since the original research was conducted on flexible pavements, it was anticipated that a separate failure criteria 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 very good 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.

3-2.5.2 FAARFIELD Airport Pavement Design – Remaining Life Analysis

Within the last 2 to 3 years the Federal Aviation Administration has developed a fatigue analysis methodology similar to that developed by Reinard W. Brandley called the "FAARFIELD Airport Pavement Design." The FAARFIELD design utilizes the same traffic distribution, forecasts, pavement section thickness, and Modulus of Elasticity and Poisson's Ratio of each layer within the section as are used in the Brandley Fatigue Analysis. The only differences are the method of back calculating Modulus of Elasticity of each layer and the failure criteria. FAARFIELD uses limiting subgrade strain as the failure criteria.

In the Pavement Evaluation Study for the Truckee Tahoe Airport the same input information was used for evaluating each pavement section with the Brandley Fatigue Analysis and with the FAARFIELD design. By this method, direct comparison for forecast remaining life of the section was obtained using the Brandley Fatigue Analysis method and the F.A.A. FAARFIELD method. The actual remaining life of each section using both methods has been prepared and is included in Appendix C, Tables C-1 through C-72. The analyses were conducted for both methods using both the forecast traffic and the modified traffic where the number of operations for the heavier aircraft was doubled. On these tables a side-by-side comparison of remaining pavement life as determined using the Brandley Fatigue Analysis and the FAARFIELD Fatigue Analysis methods has been presented.

Normally, any forecast pavement life that is in excess of 20 years is reported as 20+ years since it is not possible to anticipate all changes in existing pavement conditions resulting from load, weather, maintenance methods, etc. In this report to show a direct comparison the actual calculated extended life has been included. However, for practical purposes forecast life beyond 20 years will require update every 10 years to take into consideration changes that occur.

It will be noted that there are extreme differences in forecast pavement life between the Brandley Fatigue Analysis and FAARFIELD design. In most cases FAARFIELD's forecast pavement life is much less than the Brandley Fatigue Analysis forecast pavement life, but in many instances the FAARFIELD forecast pavement life is significantly greater than the Brandley forecast pavement life. Noting these differences, a comparative study of the two systems was made on some airport pavements that actually failed after they had been tested. On 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)		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	New Apron Taxiway	3	0.2	3
Truckee-Tahoe Airport	Runway 11-29 Station 40+00	16	1	**

*Number of years to failure.
**This section of the runway has performed under forecast loading for the past 8 to 10 years with no sign of deep-seated distress. There is surface cracking of the asphalt pavement due to thermal stresses. According to FAARFIELD it should have failed 7 to 9 years ago.

The FAARFIELD method shows that the major portion of the airport requires rehabilitation within the next 20 years and it would have to be accomplished at an earlier date than that indicated by the Brandley Fatigue Analysis methodology. To demonstrate the difference in predicted performance, Plate No. 3-1 has been prepared, which indicates in color those areas on the airport that would be expected to fail due to deep-seated distress within a 20-year period using the Brandley Fatigue Analysis. The circled numbers at each section indicate the remaining life of each section that is anticipated to fail. Plate No. 3-2 has also been included, which shows those areas that would be expected to fail within 20 years using the FAARFIELD analysis. On this plate the number of years of life remaining in the pavement section are also included in the circled numbers above the item.

It will be noted that FAARFIELD methodology indicates a much larger area on the airport that is expected to fail within the 20 year period and the remaining life of each section is much less than that forecast by the Brandley Fatigue Analysis method.

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 recommendations in this report are based on data obtained from the Brandley analysis.

Similar fatigue analyses were conducted for each pavement section using the enhanced traffic indexes where the large business jet aircraft operations used were doubled those forecast. A significant decrease in remaining life is indicated with both methods of 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 cost-benefit analysis, construction timing and difficulties, and availability of funding.

The rehabilitation plan for the next 20-year period to protect against deep-seated distress only is included in Table No. 3-2.

All fatigue analyses referred to in this report were calculated in 2011 and included in the 2011 report. The test data and forecast performance of each section of pavement on the airport is the same as presented in the original 2011 report, except for the sections rehabilitated in 2012 and 2013.

The fatigue analysis methodology was utilized to evaluate and recommend the pavement sections that were used in the maintenance program. The updated estimated remaining life of the rehabilitated section of Runway 11-29 is shown in the corresponding table of each section of pavement. The remaining life of the western two-thirds of Runway 11-29 is now greater than 50 years based on Brandley Fatigue Analysis.

3-3 Surface Distress

3-3.1 Pavement Condition (PCI)

Surface distress in the pavements is not necessarily caused by deep-seated distress, nor does it forecast when the pavement will fail. Surface distress generally is caused by inadequate quality of the pavement materials, and/or environmental factors such as temperature, freezing and thawing, moisture, and temperature changes between day and night and summer and winter. These defects show up as cracking, patching, raveling, weathering, swell, and rutting. Rutting can be caused by deep-seated distress and failure of the section or associated with flushing 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. 3-3. 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 and, therefore, it is not possible to predict when major rehabilitation or reconstruction will be required. If one waits until the PCI vs. Time curve shows deep-seated distress by 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, which at Truckee Tahoe Airport is asphaltic concrete pavement. This distress shows up as cracks in the pavement, including transverse cracks, longitudinal cracks, 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 for surface distress are shown in Table No. 3-3.

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 2012 and 2013 and remained the same or decreased somewhat in all other sections.

3-3.2 Thermal Stresses

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.

In the 1980s the office of Reinard W. Brandley developed a method of sawing and sealing a joint pattern on airfield pavements in the Sierra Nevada Mountain regions to control the cracking caused by thermal stresses. This joint pattern started out at 25-foot centers, but intermediate cracks developed so the spacing was decreased to 12 to 15-foot centers depending on the location. This has proven to be successful. The main problem with the sawing and sealing of the joint pattern has been that it requires maintenance in the form of resealing the joints every 4 to 6 years. All joints need to be formed with a depth-to-width ratio of 0.5 to 1.0 and have a "band-aid" section on top of the pavement extending 1 inch each side of the joint in order to avoid bond failure of the joint seal.

Many of the pavements at Truckee Tahoe Airport have a joint pattern installed, but the spacing of the joints is 25 to 30-foot centers and in many instances intermediate cracks have developed. These joints are generally ⅛ to ¼ inch wide and 2 to 3 inches deep. The joints in the pavements placed in 2008 in the West Industrial and Hangar Area project (Hangar Area A3) have opened to a width of 1 to 1½ inches. It is noted that in several areas the seal has broken loose from the adjoining asphalt and that some secondary cracking is occurring adjacent to the joint. It is also noted that there are some intermediate cracks showing up between the joints. It is recommended that when and if the existing joints start to increase in width and the sealant fails, an intermediate joint pattern be established to provide a joint pattern no more than 15 feet by 15 feet and the existing joint seals be maintained in good condition.

In many areas there are no joints in the pavement and extensive cracking has occurred. It is not considered practical to install a joint system at this time in those pavements because of the number and extent of the existing cracking. When new pavements are placed at the airport, polymer-modified asphalt should be used in the mix. Based on experience, this should at least delay the start of any cracking due to thermal stresses, and may eliminate it. Installation of a jointing system is not recommended until cracking of the pavement begins. Careful inspection should be made of the new pavements each year and when transverse cracks form at regular intervals of 500 feet or less, a 15 x 15 foot joint pattern should be installed using the existing transverse crack as one of the joints. This will eliminate or delay further cracking due to thermal stresses.

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 11 to 13 years has been included but will only be used if needed.

In some areas existing cracks are now ¾ to 2 inches wide and in these cases the crack needs to be repaired. The repair should consist of saw cutting and removing the existing asphalt to a minimum width of 1 foot to remove all of the cracked material and then replacing it with polymer-modified asphalt compacted to at least 96 percent relative compaction. Prior to replacing the asphalt, the existing base course materials should be recompacted and a bituminous tack coat applied to the top of the base and the sides of the saw cut joints. To control any additional opening of the joint that may occur, a new joint should be sawed and sealed at the edge of the new crack repair.

In some areas, particularly in the apron tie down area, the surface of the pavement has weathered badly, some raveling has occurred, and there is extensive fine cracking. In these areas surface rehabilitation should consist of milling at least 2 inches, but no less than 75 percent of the thickness of the existing pavement, and replacing it with new polymer-modified asphalt. Consideration should be given to heater remixing the asphalt pavement remaining in place below the milled section to control reflective cracking.

A sealant on the surface of the 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 or an SS1h fog seal or other suitable materials.

3-4 Frost Action

If the frost line penetrates and remains for a significant period of time in a frost-susceptible soil, frostheave will occur, which is caused by the formation of ice lenses at the bottom edge 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. No data are available prior to February 9. The sensors will remain in place over the winter of 2011/2012 to monitor depth of frost penetration.

Based on past experience it is expected that frost may penetrate up to depths of 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 than that, 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, or
- Restricting the size aircraft that can use the airport to those having a maximum gross weight less than 40,000 pounds on dual gear.

The spring thaw would normally be a fairly short period of time. A final determination as to treatment due to frost action should be delayed until data have been accumulated this winter.

It may be advantageous to leave the thermocouple gauge in place and monitor the depth of frost penetration and rate of thawing in the spring if thicker pavement sections are not constructed so the timing of limiting operations of the heavier aircraft can be accurately established.

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. 3-1

TRUCKEE TAHOE AIRPORT

PAVEMENT REHABILITATION PROCEDURES
DEEP-SEATED DISTRESS

Code	Rehabilitation Method	
A	Pulverize and Remove Pavement Section and Reconstruct	
	New Section - ASB - Pulverized Existing AC & AB	8"
	AB - Crushed Aggregate Base (New)	4"
	AC - Asphalt Pavement (New)	3"
	Total Thickness	15"
	Cost per square foot	$5.20
B	Rehabilitate Existing Section - Option 1	
	New Section - ASB - Pulverize Existing AC & AB & Recompact	10"
	AB - Crushed Aggregate Base (New)	3"
	AC - Asphalt Pavement (New)	3"
	Total Thickness	16"
	Cost per square foot	$4.05
C	Rehabilitate Existing Section - Option 2	
	New Section - Place 2" Crushed Rock on Existing AC	12"
	Pulverize and Mix New Rock & Existing AC & AB and Recompact	
	AC - Asphalt Pavement (New)	3"
	Total Thickness	15"
	Cost per square foot	$3.75
D	Remove AC and Reconstruct	
	New Section - Remove Existing AC	
	Scarify and Recompact Existing AB	6"
	AC - Asphalt Pavement (New)	3"
	Total Thickness	9"
	Cost per square foot	$3.77
E	Strengthen Existing Section	
	New Section - Remove Existing AC	
	Scarify and Recompact Existing AB	8"
	Add AB - Aggregate Base (New)	3"
	AC - Asphalt Pavement (New)	3"
	Total Thickness	14"
	Cost per square foot	$4.70

Note: Costs indicated are based on 2011 prices and do not include any costs other than the pavement section itself.

TABLE NO. 3-2

TRUCKEE TAHOE AIRPORT

REHABILITATION PLAN - DEEP-SEATED DISTRESS

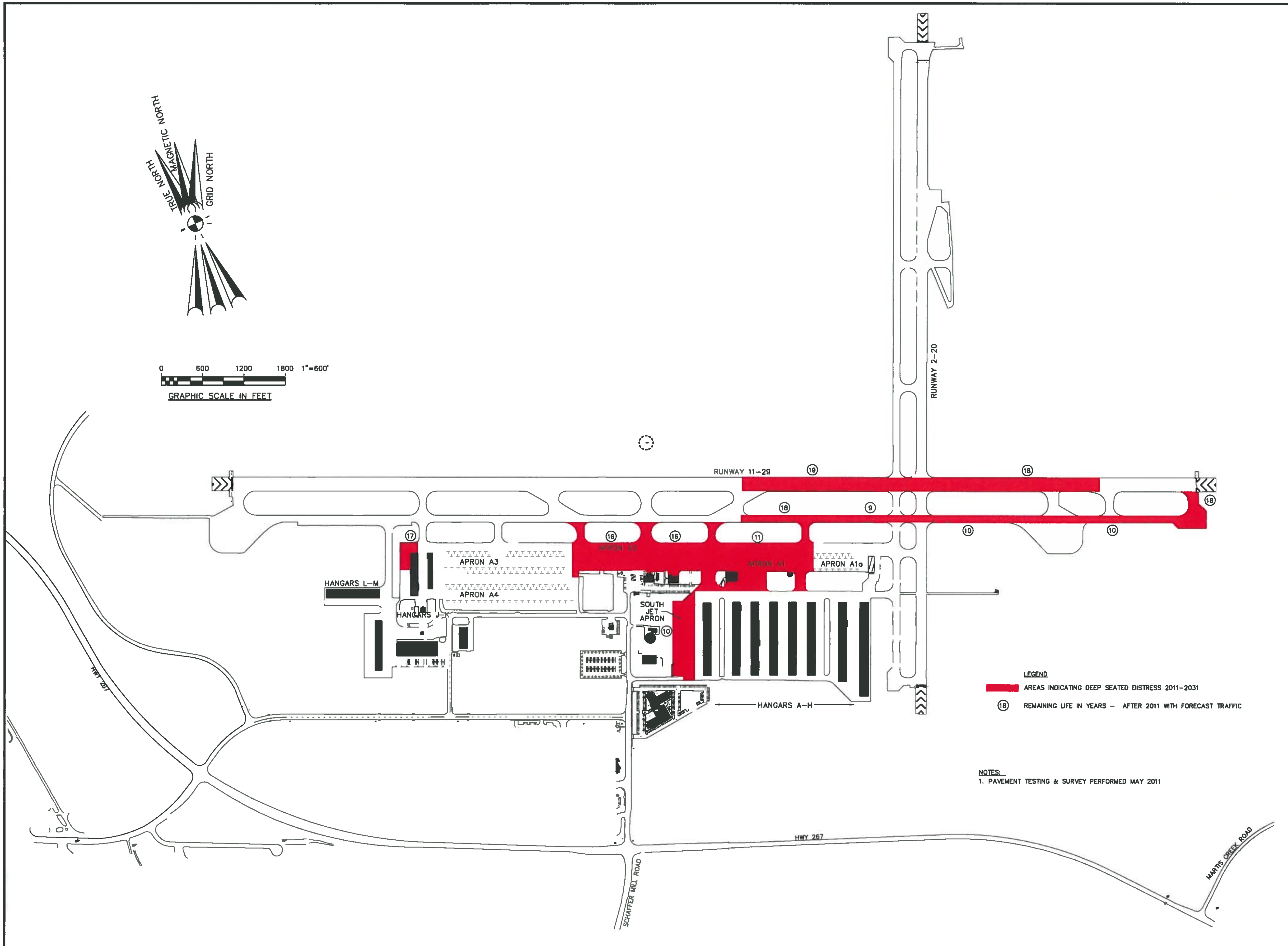
Year	Element	Station	Remaining Life (Years)	Estimated Year of Failure	Recommended Rehabilitation	
					Code	Description
2012	Hangars J-K		17	2028	A	Remove Existing & Reconstruct
2012	Runway 11-29	0+00 to 47+00	19-30	2029	A	Hump Removal Area - Remove and Reconstruct
		0+00 to 47+00	19-30	2029	C	Remaining Areas - Add Rock, Pulverize & Reconstruct
2026		47+00 to 70+00	18-30	2029	E	Remove 4" AC, Scar/Recomp Base, Add 4" AB, 3" AC
2021	Apron A1		11-38	2022	A	Remove Existing & Reconstruct - Includes T/W M
2025	Apron A2		16-44	2027	A	Remove Existing & Reconstruct
2020	South Jet Apron		10	2021	A	Remove Existing and Reconstruct
2024	Taxiway A, B, C, D	0+00 to 28+00	31-36	2042	B	Rehabilitate and Reconstruct - Includes T/Ws A, B, C, D
2018	Taxiway A, E, F, H, U, J	28+00 to 72+00	8-22	2019	B	Rehabilitate and Reconstruct - Includes T/Ws A, E, F, H, U, J

TABLE NO. 3-3

TRUCKEE TAHOE AIRPORT

PAVEMENT REHABILITATION PROCEDURES
SURFACE DISTRESS

Code	Rehabilitation Method	Estimated Unit Costs
F	Saw & Seal New Joints to Control Thermal Cracking	$3.50/ln. ft.
G	Crack Repair, Seal Existing Cracks and Joints and/or Remove and Patch AC	$18/sq. ft. for 3 1/2" AC
H	New Seal Coat - Fog Seal, Reclamite, etc.	$1.25/sq. yd.
I	Mill & Fill or Hot Recycle	$2.60/sq. ft.
J	Remark Pavements	$1.00/sq. ft.



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ENGINEER OF RECORD

NO.	REVISIONS	BY	APR	DATE

TRUCKEE TAHOE AIRPORT

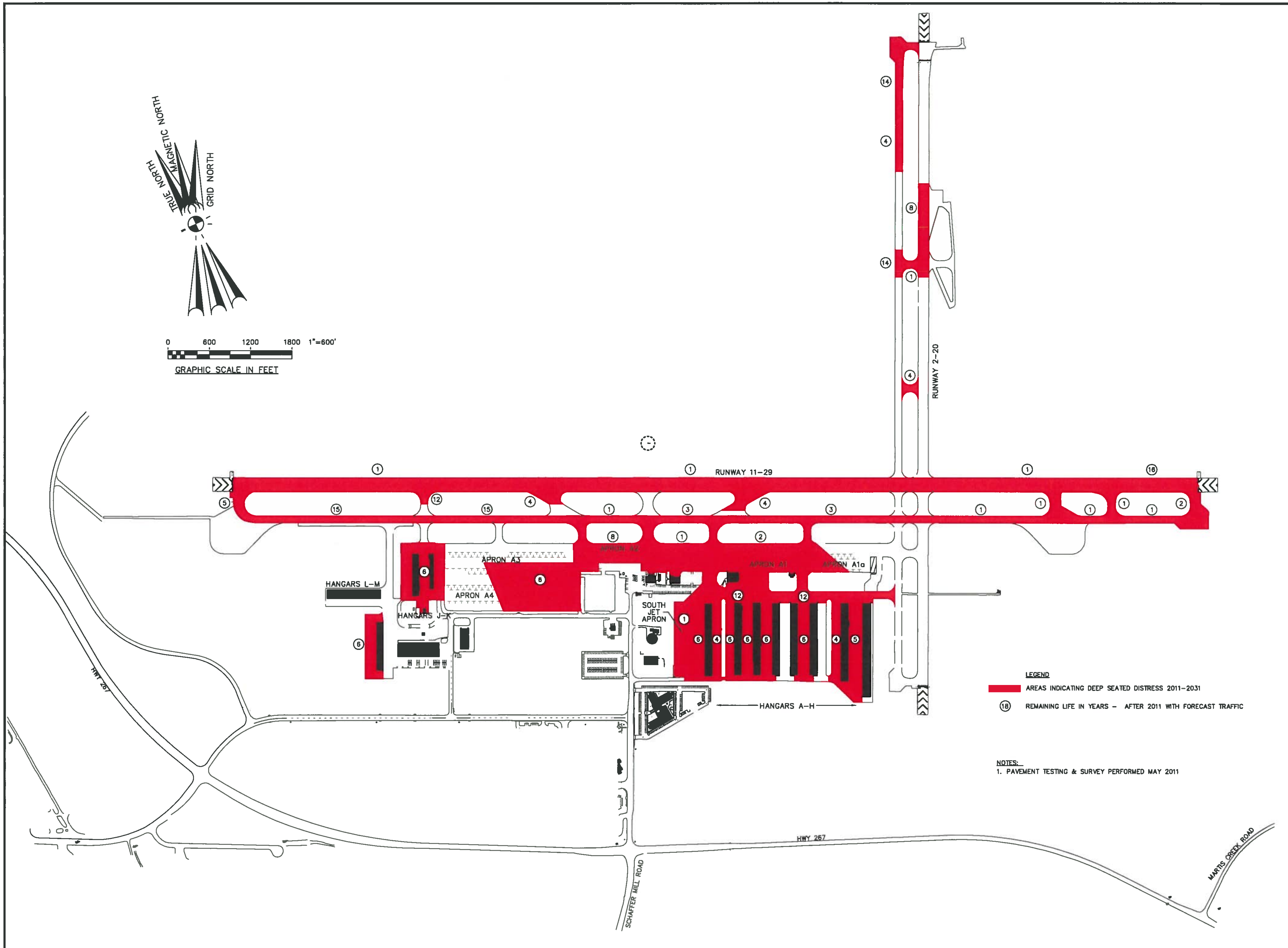
TRUCKEE, CALIFORNIA

PAVEMENT EVALUATION

DEEP SEATED DISTRESS - BRANDLEY FATIGUE ANALYSIS

DESIGN BY: RWB
DRAWN BY: DMB
CHK'D BY: RWB
DATE: SEPT. 28, 2011
CONTRACT No. -
PROJECT NO: 40.12
DWG FILE: PLATE 4
DRAWING SCALE: 1"=200'

SHEET NUMBER
PLATE NO. 3-1



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ENGINEER OF RECORD

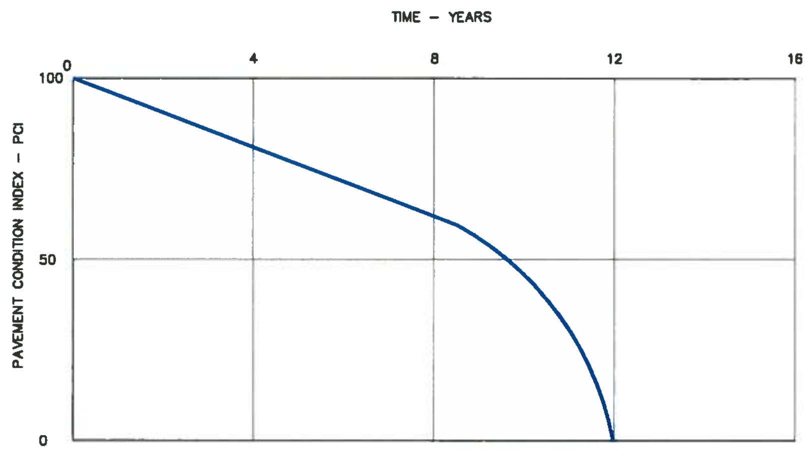
NO.	REVISIONS	BY	APR	DATE

TRUCKEE TAHOE AIRPORT
TRUCKEE, CALIFORNIA

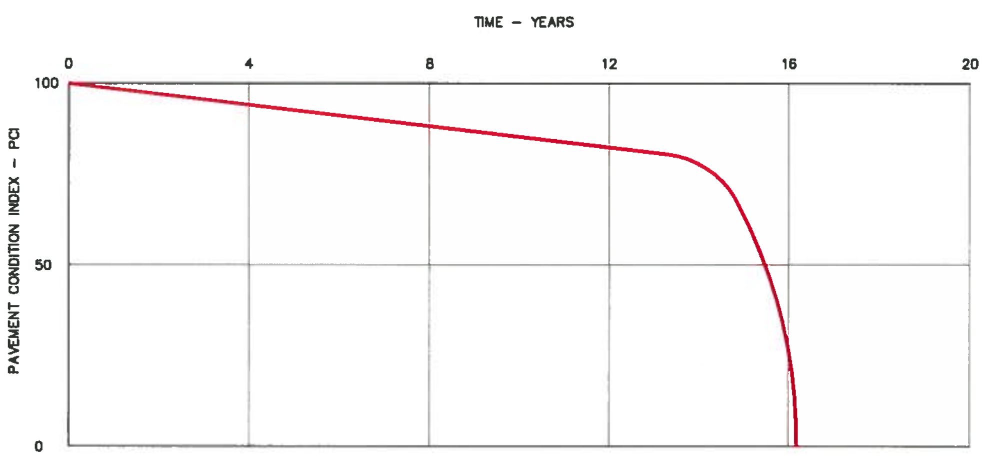
PAVEMENT EVALUATION
DEEP SEATED DISTRESS - FAARFIELD ANALYSIS

DESIGN BY: RWB
DRAWN BY: DMB
CHK'D BY: RWB
DATE: SEPT. 28, 2011
CONTRACT No. -
PROJECT NO: 40.12
DWG FILE: PLATE 5
DRAWING SCALE: 1"=200'

SHEET NUMBER
PLATE NO. 3-2



ASPHALT CONCRETE PAVEMENT SECTION
PCI VS. TIME - RELATIONSHIP



PORTLAND CEMENT CONCRETE PAVEMENT SECTION
PCI VS. TIME - RELATIONSHIP

DESIGN BY: RWB
DRAWN BY: DB
CHK'D BY: RWB
DATE: SEPTEMBER 20, 2011
CONTRACT No.
PROJECT NO: 40.12
DWG FILE: 40PWD2011
DRAWING SCALE: 1"=300'
SHEET NUMBER
PLATE NO. 3-3

TRUCKEE, TRUCKEE TAHOE AIRPORT CALIFORNIA

PAVEMENT EVALUATION

PCI vs. TIME

NO.	REVISION	BY	APR	DATE

ENGINEER OF RECORD

Reinard W. Brandley
CONSULTING AIRPORT ENGINEER

PLATE NO. 3-3

CHAPTER 4. REHABILITATION PLAN AND SCHEDULE

4-1 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, surface defects, and frost action. 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 that it 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 1 to 3 years before the forecast life 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 will be decreased and the strength and quality of the 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 overlays or additional thicknesses of the pavement section. Once a failure has occurred, it will be necessary to reconstruct the entire section.

If the surface distress becomes severe before the forecast remaining life due to deep-seated distress occurs, in many cases it will be more feasible from a cost-benefit analysis, performance, and aesthetic standpoint to rehabilitate or reconstruct the section earlier than forecast due to deep-seated distress.

Rehabilitation of the section to correct surface distress problems can consist of patching, sealing of the cracks, fog sealing, milling and replacement of asphalt. The timing for each of these will be based on cost-benefit analysis, 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 1 to 3 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 gear and for dual wheel gear aircraft.

4-2 Recommended Rehabilitation Schedule

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 made of 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 and State 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 in Appendix C, Tables C-1 through C-72 and has been summarized in Table No. 4-1. Using this information a maintenance and rehabilitation schedule has been prepared showing the recommended projects for each year within the next 20 years and is summarized in Table No. 4-2. These maintenance schedules have also been shown on the Rehabilitation Schedule maps, Plates No. 4-1 through 4-5. With each of these schedules assumptions have been made as to when Federal funding would be available, and the maintenance schedule has been adjusted to include these major projects during those periods.

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 1 to 3 years before failure of the section is anticipated. Rehabilitation at earlier dates is acceptable.

If the volume of the large airplanes increases more than forecast, the Fatigue Analysis indicates that pavements will fail due to deep-seated distress at a much earlier time and that more of the pavements will fail within the 20-year timeframe. If this traffic does increase, then an analysis should be performed to determine forecast remaining life with the new traffic index and the rehabilitation program for correcting deep-seated distress problems adjusted accordingly.

All costs shown in this analysis are construction costs only and are based on 2013 prices. Engineering and administrative costs need to be added and adjustments made for inflation for each year.

In order to minimize the risk of overstressing the existing pavements at Truckee Tahoe Airport to a point where an aircraft gear could punch through the pavement, it is recommended that the following load limits be established for the pavements:

Element	Gear Type	Maximum Load Limit – (x 1,000 lbs)	Allowable Bearing Capacity (x 1,000 lbs) - 100 Annual Departures	
			Existing (2011)	Rehabilitated (Future)
Runway 11-29 (West 5,000 ft) & Associated Taxiways	Dual Single	80 50	55 40	80 50
Runway 11-29 (East 2,000 ft) & Associated Taxiways	Dual Single	80 50	55 40	80 50
Runway 2-20 and Associated Taxiways	Dual Single	65 40	50 35	80 50
Aprons	Dual Single	50 35	35 25	80 50
Hangar Taxilanes	Dual Single	50 35	35 25	50 35

It is recommended that all future rehabilitation projects be designed such that the maximum design load-carrying capacity of all elements matches the anticipated use. Runway 11-29 and associated taxiways, the aprons and any taxilanes anticipated to serve the large business jet aircraft should be designed to support operation of the higher load limits. Runway 2-20 and associated taxiways should be designed to support operations of all general aviation aircraft and the lighter (under 65,000 pounds) business jet aircraft that use this runway during crosswind conditions. The tie down aprons and hangar taxilanes that only serve the light general aviation aircraft can be designed to support only these lighter weight aircraft.

For any new construction or rehabilitation work performed at the airport it is important that the contractor be required to provide quality materials placed in a professional manner. As a guide for specifications for this type of work, the requirements set forth in Exhibit 4-1 should be added to the F.A.A. standard specifications.

As an aid in preparing this report a table entitled, "Summary of Existing Conditions and Rehabilitation Requirements" was prepared. A full-size copy of this table designated Table No. 4-3 is included in the back pocket of this report. This table should be useful to Operations and Maintenance staff.

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 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.

The recommended rehabilitation and maintenance schedule for all sections of pavement at the Truckee Tahoe Airport have been updated based on the rehabilitations that have been performed since the original study in 2011 and the results of the updated pavement condition surveys and studies conducted in 2013.

R. Damon Brandley

TABLE NO. 4-1 (2014 PMMP Update)
TRUCKEE TAHOE AIRPORT
REHABILITATION PLAN

Required for Deep Seated Distress
Estimated - Surface Distress

Year	Element	Station	2011 PCI	2013 PCI	Recommended Rehabilitation Code	Recommended Rehabilitation Description	Estimated Construction Cost
RUNWAY 11-29 COMPLEX							
2026	Runway 11-29	0+00 to 47+00	50	95	F, H	Saw & Seal New Joints, Fog Seal	$ 595,000
2031					G	Crack Repair, Seal Cracks & Joints	$ 275,000
2017	Runway 11-29	47+00 to 70+00	80-85	86	F	Saw & Seal New Joints - Supplemental	$ 155,000
2022					G	Crack Repair, Seal Cracks and Joints	$ 156,000
2026					A or E	Reconstruct	$ 1,275,000
2018	Runway 11-29	East Blast Pad	55	38	D	Remove AC and Reconstruct	$ 82,000
2019	T/Ws A, B, C, D (Holding Apron)	0+00 to 28+00 (T/W A)	51	41-46	G	Crack Repair, Seal Cracks	$ 48,000
2024					B	Rehabilitate - Reconstruct	$ 1,256,000
2036					F, H	Saw & Seal New Joints, Fog Seal	$ -
2016	T/Ws A, F, H, U, J (Holding Apron)	28+00 to 72+00 (T/W A)	51	38-57	B	Rehabilitate - Reconstruct	$ 2,000,000
2031					F, H	Saw & Seal New Joints, Fog Seal	$ 145,000

Note: Pavement Maintenance Remarking Projects are not shown in this table. See Table 4-2

1 of 7

TABLE NO. 4-1 (2014 PMMP Update)
TRUCKEE TAHOE AIRPORT
REHABILITATION PLAN

Required for Deep Seated Distress
Estimated - Surface Distress

Year	Element	Station	2011 PCI	2013 PCI	Recommended Rehabilitation Code	Recommended Rehabilitation Description	Estimated Construction Cost
RUNWAY 2-20 COMPLEX							
2015	Runway 2-20	0+00 to 46+00	75	53-75	F,H	Saw & Seal New Joints - Supplemental, Reclaimite	$ 270,000
2022					C	Add Rock, Pulverize, Recompact + 3" AC	$ 1,970,000
2036					F, H	Saw & Seal New Joints, Fog Seal	$ -
2018	Runway 2-20 Blast Pads		42	34-40	D	Remove AC and Reconstruct	$ 142,000
2036					F, H	Saw & Seal New Joints, Fog Seal	$ -
2015	T/Ws G, V, P, Q	0+00 to 46+00	55	55-70	F,H	Saw & Seal New Joints - Supplemental, Reclaimite	$ 240,000
2022					C	Add Rock, Pulverize, Recompact + 3" AC	$ 1,480,000
2036					F, H	Saw & Seal New Joints, Fog Seal	$ -

Note: Pavement Maintenance Remarking Projects are not shown in this table. See Table 4-2

2 of 7

TABLE NO. 4-1 (2014 PMMP Update)
TRUCKEE TAHOE AIRPORT
REHABILITATION PLAN

Required for Deep Seated Distress
Estimated - Surface Distress

Year	Element	Station	2011 PCI	2013 PCI	Recommended Rehabilitation Code	Recommended Rehabilitation Description	Estimated Construction Cost
				APRONS			
2023	Apron A1		45	95	A	Remove and Reconstruct	$ 1,590,000
2036					F, H	Saw & Seal New Joints, Fog Seal	$ -
2026	Apron A1 (EAA Portion)	EAA Apron		100	F, H	Saw & Seal New Joints, Fog Seal	$ 24,000
2031					G	Crack Repair, Seal Cracks & Joints	$ 20,000
2025	Apron A2		40	95	A	Remove and Reconstruct	$ 1,465,000
2038					F, H	Saw & Seal New Joints, Fog Seal	
2015	South Jet Apron		55	30	A	Remove and Reconstruct	$ 845,000
2028					F, H	Saw & Seal New Joints, Fog Seal	$ 86,000
2021	Apron A3		37-40	95	D	Remove AC and Reconstruct	$ 1,207,000
2034					F, H	Saw & Seal New Joints, Fog Seal	$ -
2014	Apron A4		37-40	23	D	Remove AC and Reconstruct	$ 1,498,000
	(Includes Hangar 1 Apron added by change order during construction)						
2028					F, H	Saw & Seal New Joints, Fog Seal	$ 180,000

Note: Pavement Maintenance Remarking Projects are not shown in this table. See Table 4-2

3 of 7

TABLE NO. 4-1 (2014 PMMP Update)
TRUCKEE TAHOE AIRPORT
REHABILITATION PLAN

Required for Deep Seated Distress
Estimated - Surface Distress

Year	Element	Station	2011 PCI	2013 PCI	Recommended Rehabilitation Code	Recommended Rehabilitation Description	Estimated Construction Cost
HANGAR TAXILANES - HANGARS A-H							
2019	Hangars A-H Taxilane R		59		A	Reconstruct	$ 760,000
2018	Hangars A-H Row West A	0+00 to 6+00	75	73	G	Crack Repair, Seal Cracks & Joints	$ 18,750
2024					G, H	Crack Repair, Seal Cracks & Joints, Fog Seal	$ 23,750
2030					D	Remove AC and Reconstruct	$ 185,000
2018	Hangars A-H Row East A	0+00 to 6+00	75	73	G	Crack Repair, Seal Cracks & Joints	$ 18,750
2024					G, H	Crack Repair, Seal Cracks & Joints, Fog Seal	$ 23,750
2030					D	Remove AC and Reconstruct	$ 185,000
2018	Hangars A-H Row West B	0+00 to 6+00	63	70	G	Crack Repair, Seal Cracks & Joints	$ 18,750
2024					G, H	Crack Repair, Seal Cracks & Joints, Fog Seal	$ 23,750
2030					D	Remove AC and Reconstruct	$ 185,000
2018	Hangars A-H Row BC	0+00 to 6+00	63	65	G	Crack Repair, Seal Cracks & Joints	$ 18,750
2024					G, H	Crack Repair, Seal Cracks & Joints, Fog Seal	$ 23,750
2030					D	Remove AC and Reconstruct	$ 185,000

Note: Pavement Maintenance Remarking Projects are not shown in this table. See Table 4-2

TABLE NO. 4-1 (2014 PMMP Update)
TRUCKEE TAHOE AIRPORT
REHABILITATION PLAN

Required for Deep Seated Distress
Estimated - Surface Distress

Year	Element	Station	2011 PCI	2013 PCI	Recommended Rehabilitation Code	Recommended Rehabilitation Description	Estimated Construction Cost
	HANGAR TAXILANES - HANGARS A-H						
2017	Hangars A-H Row CD	0+00 to 6+00	61	57	D	Remove AC and Reconstruct	$ 195,000
2028					F	Saw & Seal New Joints	$ 30,000
2033					G	Crack Repair, Seal Cracks & Joints	$ -
2017	Hangars A-H Row DE	0+00 to 6+00	57	52-95	D	Remove AC and Reconstruct (East Half of Taxilane)	$ 195,000
2028					F	Saw & Seal New Joints	$ 30,000
2033					G	Crack Repair, Seal Cracks & Joints	$ -
2026	Hangars A-H Row EF	0+00 to 6+00	84	95	F, H	Saw & Seal New Joints, Fog Seal	$ 25,000
2031					G	Crack Repair, Seal Cracks & Joints	$ 21,000
2026	Hangars A-H Row East F	0+00 to 6+00	81	95	F, H	Saw & Seal New Joints, Fog Seal	$ 25,000
2031					G	Crack Repair, Seal Cracks & Joints	$ 21,000
2015	Hangars A-H Row West G	0+00 to 6+00	58	50	D	Remove AC and Reconstruct	$ 289,000
2027					F	Saw & Seal New Joints	$ 20,000
2015	Hangars A-H Row GH	0+00 to 7+00	55	38	D	Remove AC and Reconstruct	$ 578,000
2027					F	Saw & Seal New Joints	$ 40,000

Note: Pavement Maintenance Remarking Projects are not shown in this table. See Table 4-2

TABLE NO. 4-1 (2014 PMMP Update)
TRUCKEE TAHOE AIRPORT
REHABILITATION PLAN

Required for Deep Seated Distress
Estimated - Surface Distress

Year	Element	Station	2011 PCI	2013 PCI	Recommended Rehabilitation Code	Recommended Rehabilitation Description	Estimated Construction Cost
HANGAR TAXILANES - HANGARS J-K							
2020	Hangars J-K	0+00 to 4+00	35	90	F	Saw & Seal New Joints - Supplemental	$ 20,000
	Row West K						
2026					G, H	Crack Repair, Seal Cracks & Joints, Fog Seal	$ 26,000
2031					G	Crack Repair, Seal Cracks & Joints	$ 25,000
2020	Hangars J-K	0+00 to 4+00	35	90	F	Saw & Seal New Joints - Supplemental	$ 20,000
	Row JK						
2026					G, H	Crack Repair, Seal Cracks & Joints, Fog Seal	$ 26,000
2031					G	Crack Repair, Seal Cracks & Joints	$ 25,000
2020	Hangars J-K	0+00 to 4+00	35	90	F	Saw & Seal New Joints - Supplemental	$ 20,000
	Row East J						
2026					G, H	Crack Repair, Seal Cracks & Joints, Fog Seal	$ 26,000
2031					G	Crack Repair, Seal Cracks & Joints	$ 25,000

Note: Pavement Maintenance Remarking Projects are not shown in this table. See Table 4-2

TABLE NO. 4-1 (2014 PMMP Update)
TRUCKEE TAHOE AIRPORT
REHABILITATION PLAN

Required for Deep Seated Distress
Estimated - Surface Distress

Year	Element	Station	2011 PCI	2013 PCI	Recommended Rehabilitation Code	Recommended Rehabilitation Description	Estimated Construction Cost
HANGAR TAXILANES - HANGARS L-M - AND WAREHOUSE							
2015	Hangars L-M Taxilane T, Row East M	0+00 to 11+00	83	77	H	Reclaimite Seal	$ 6,500
2018					G	Crack Repair, Seal Cracks & Joints	$ 29,000
2023					G	Crack Repair, Seal Cracks & Joints	$ 23,500
2028					G, H	Crack Repair, Seal Cracks & Joints, Fog Seal	$ 36,250
2015	Hangars L-M Row West M	11+00 to 15+50	83	77	H	Reclaimite Seal	$ 6,500
2018					G	Crack Repair, Seal Cracks & Joints	$ 29,000
2023					G	Crack Repair, Seal Cracks & Joints	$ 23,500
2028					G, H	Crack Repair, Seal Cracks & Joints, Fog Seal	$ 36,250
2015	Hangars L-M Row South L	16+00 to 20+00	83	77	H	Reclaimite Seal	$ 6,500
2018					G	Crack Repair, Seal Cracks & Joints	$ 29,000
2023					G	Crack Repair, Seal Cracks & Joints	$ 23,500
2028					G, H	Crack Repair, Seal Cracks & Joints, Fog Seal	$ 36,250
2015	South of Warehouse Row wh	0+00 to 4+00	83	77	H	Reclaimite Seal	$ 6,500
2018					G	Crack Repair, Seal Cracks & Joints	$ 29,000
2023					G	Crack Repair, Seal Cracks & Joints	$ 23,500
2028					G, H	Crack Repair, Seal Cracks & Joints, Fog Seal	$ 36,250

Note: Pavement Maintenance Remarking Projects are not shown in this table. See Table 4-2

TABLE NO. 4-2 (2014 PMMP Update)
TRUCKEE TAHOE AIRPORT
MAINTENANCE AND REHABILITATION SCHEDULE

Required for Deep Seated Distress
Estimated - Surface Distress

Year	Element	Station	2011 PCI	2013 PCI	Recommended Rehabilitation Code	Recommended Rehabilitation Description	Estimated Construction Cost
2014	Apron A4 & Hangar 1 Apron	All	37-40	23	D	Remove AC and Reconstruct	$ 1,498,000
						2014 Total Cost	**$ 1,498,000**
2015	South Jet Apron	All	55	30	A	Remove and Reconstruct	$ 845,000
	Hangars A-H - Rows West G, GH	All	55-61	38-50	D	Remove AC and Reconstruct	$ 867,000
	Runway 2-20	0+00 to 46+00	75	53-75	F, H	Saw and Seal New Joints - Supplemental & Reclaimite	$ 270,000
	Taxiway G, V, P, Q	All	77	55-70	F, H	Saw and Seal New Joints - Supplemental & Reclaimite	$ 240,000
	Hangars L-M & Warehouse Area	All	83	77	H	Reclaimite Seal	$ 26,000
	All Airfield Pavements	All				Remark Airfield Pavements as Needed	$ 253,000
						2015 Total Cost	**$ 2,501,000**
2016	T/Ws A, F, H, U, J	28+00 to 72+00	51	38-57	B	Rehabilitate - Reconstruct	$ 2,000,000
						2016 Total Cost	**$ 2,000,000**
2017	Runway 11-29	47+00 to 70+00	80-85	86	F	Saw & Seal New Joints - Supplemental	$ 155,000
	Hangars A-H - Rows CD & DE(East)	All	55-61	52-57	D	Remove AC and Reconstruct	$ 390,000
	All Airfield Pavements	All				Remark Airfield Pavements as Needed	$ 250,000
						2017 Total Cost	**$ 795,000**
2018	R/W 2-20 Blast Pads	All	42	34-40	D	Remove AC and Reconstruct	$ 142,000
	R/W 11-29 East Blast Pad	All	55	38	D	Remove AC and Reconstruct	$ 82,000
	Hangars A-H - Rows West A, East A, West B, and BC	All	63-75	65-73	G	Crack Repair, Seal Cracks & Joints	$ 75,000
	Hangars L-M & Warehouse Area	All	83	77	G, H	Crack Repair, Seal Cracks & Joints, Fog Seal	$ 116,000
						2018 Total Cost	**$ 415,000**
2019	Hangars A-H - Taxilane R	All	59	45	A	Reconstruct	$ 760,000
	T/Ws A, B, C, D	0+00 to 28+00	51	41-46	G	Crack Repair, Seal Cracks	$ 48,000
	All Airfield Pavements	All				Remark Airfield Pavements as Needed	$ 340,000
						2019 Total Cost	**$ 1,148,000**
2020	Hangars J-K	All	35	90	F	Saw and Seal New Joints - Supplemental	$ 60,000
						2020 Total Cost	**$ 60,000**

1 of 3

TABLE NO. 4-2 (2014 PMMP Update)
TRUCKEE TAHOE AIRPORT
MAINTENANCE AND REHABILITATION SCHEDULE

Required for Deep Seated Distress
Estimated - Surface Distress

Year	Element	Station	2011 PCI	2013 PCI	Recommended Rehabilitation Code	Recommended Rehabilitation Description	Estimated Construction Cost
2021	Apron A3	All	37-40	95	D	Remove AC and Reconstruct	$ 1,207,000
	All Airfield Pavements	All				Remark Airfield Pavements as Needed	$ 380,000
						2021 Total Cost	**$ 1,587,000**
2022	Runway 2-20	All	75	53-75	C	Add Rock, Pulverize, Recompact + 3" AC	$ 1,970,000
	Taxiway G, V, P, Q	All	55	55-70	C	Add Rock, Pulverize, Recompact + 3" AC	$ 1,480,000
	Runway 11-29	47+00 to 70+00	80-85	86	G	Crack Repair, Seal Cracks & Joints	$ 156,000
						2022 Total Cost	**$ 3,606,000**
2023	Apron A1	All	45	95	A	Remove and Reconstruct	$ 1,590,000
	Hangars L-M & Warehouse Area	All	83	77	G	Crack Repair, Seal Cracks & Joints	$ 94,000
	All Airfield Pavements	All				Remark Airfield Pavements as Needed	$ 150,000
						2023 Total Cost	**$ 1,834,000**
2024	T/Ws A, B, C, D	0+00 to 28+00	51	41-46	B	Rehabilitate - Reconstruct	$ 1,256,000
	Hangars A-H - Rows West A, East A, West B, and BC	All	63-75	65-73	G, H	Crack Repair, Seal Cracks & Joints, Fog Seal	$ 95,000
						2024 Total Cost	**$ 1,351,000**
2025	Apron A2	All	40	95	A	Remove and Reconstruct	$ 1,465,000
	All Airfield Pavements	All				Remark Airfield Pavements as Needed	$ 340,000
						2025 Total Cost	**$ 1,805,000**
2026	Runway 11-29	0+00 to 47+00	50	95	F, H	Saw and Seal New Joints, Fog Seal	$ 595,000
	Runway 11-29	47+00 to 70+00	80-85	86	A or E	Reconstruct	$ 1,275,000
	Apron A1 (EAA Portion)	EAA Apron		100	F, H	Saw and Seal New Joints, Fog Seal	$ 24,000
	Hangars A-H - Rows EF, East F	All	55-84	95	F, H	Saw and Seal New Joints, Fog Seal	$ 50,000
	Hangars J-K	All	35	90	G, H	Crack Repair, Seal Cracks & Joints, Fog Seal	$ 78,000
						2026 Total Cost	**$ 2,022,000**
2027	Hangars A-H - Rows West G, GH	All	55-58	38-50	F	Saw & Seal New Joints	$ 60,000
	All Airfield Pavements	All				Remark Airfield Pavements as Needed	$ 120,000
						2027 Total Cost	**$ 180,000**

2 of 3

TABLE NO. 4-2 (2014 PMMP Update)
TRUCKEE TAHOE AIRPORT
MAINTENANCE AND REHABILITATION SCHEDULE

Required for Deep Seated Distress
Estimated - Surface Distress

Year	Element	Station	2011 PCI	2013 PCI	Recommended Rehabilitation Code	Recommended Rehabilitation Description	Estimated Construction Cost
2028	South Jet Apron	All	55	30	F, H	Saw and Seal New Joints, Fog Seal	$ 86,000
	Apron A4	All	37-40	23	F, H	Saw and Seal New Joints, Fog Seal	$ 180,000
	Hangars A-H - Rows CD, DE	All	57-61	52-57	F	Saw and Seal New Joints	$ 60,000
	Hangars L-M & Warehouse Area	All	83	77	G, H	Crack Repair, Seal Cracks & Joints, Fog Seal	$ 145,000
						2028 Total Cost	**$ 471,000**
2029	All Airfield Pavements	All				Remark Airfield Pavements as Needed	$ 360,000
						2029 Total Cost	**$ 360,000**
2030	Hangars A-H - Rows West A, East A, West B, and BC	All	63-75	65-73	D	Remove AC and Reconstruct	$ 740,000
						2030 Total Cost	**$ 740,000**
2031	Runway 11-29	0+00 to 47+00	50	95	G	Crack Repair, Seal Cracks & Joints	$ 275,000
	T/Ws A, F, H, U, J	28+00 to 72+00	51	38-57	F, H	Saw and Seal New Joints, Fog Seal	$ 145,000
	Apron A1 (EAA Portion)	EAA Apron		100	G	Crack Repair, Seal Cracks & Joints	$ 20,000
	Hangars A-H - Rows EF, East F	All	55-84	95	G	Crack Repair, Seal Cracks & Joints	$ 42,000
	Hangars J-K	All	35	90	G	Crack Repair, Seal Cracks & Joints	$ 75,000
	All Airfield Pavements	All				Remark Airfield Pavements as Needed	$ 240,000
						2031 Total Cost	**$ 797,000**

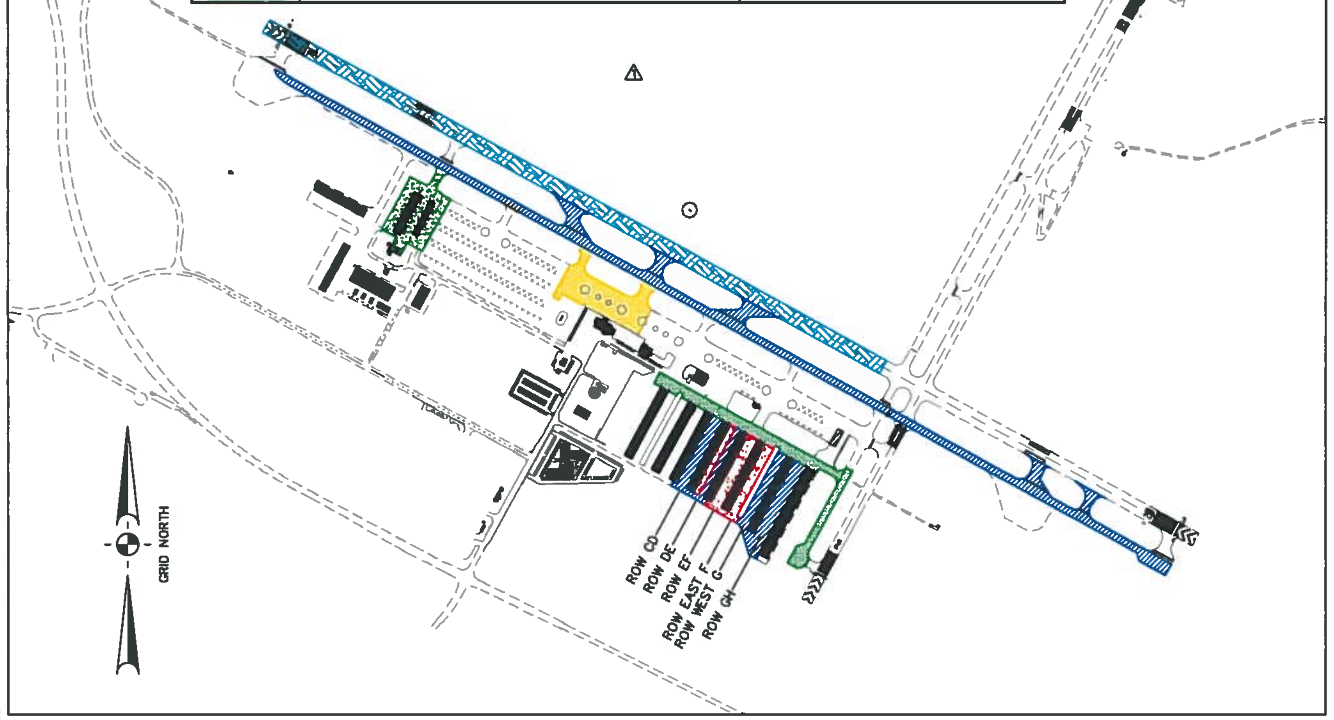
3 of 3

Table No. 4-3 (2014 PMMP Update)
Summary of Existing Conditions and Rehabilitation Requirements
Truckee Tahoe Airport

Pavement Segment ID	Element	Station	Construction Dates – Original	Construction Dates – Reconstruct	Construction Dates – Overlay	2011 - FWD Data – Load (kips)	2011 - FWD Data – Deflection Range (mils)	2011 - FWD Data – Deflection Used (mils)	2011 PCI	2013 PCI	2013 Pavement Rating	2011 - Existing Pavement Section - inches – AC	AB	ASB	Subgrade	Subsoil	2013 - Existing Pavement Section - inches – AC	AB	ASB	Subgrade	Subsoil	2011 - Existing Modulus of Elasticity (E) - ksi – AC	AB	ASB	Subgrade	Subsoil	2011 Traffic Index	Remaining Pavement Life - Years – Brandley – 2011 Subgrade Distress Std. Traffic	Brandley – 2013 Subgrade Distress Std. Traffic	Brandley – 2011 Subgrade Distress 2x 40k Jets	Brandley – 2013 Subgrade Distress 2x 40k Jets	FAARFIELD – 2011 Subgrade Distress Std. Traffic	FAARFIELD – 2011 Subgrade Distress 2x 40k Jets	Recommended Rehabilitation and Maintenance – 2014-2016	2017-2021	2022-2026	2027-2031	Element
C1	Runway 11-29 (West Blast Pad)	West Blast Pad		1986, 2012					55	95	Excellent																									2026 - New Joints, Fog Seal	2031 - Crack Repair	Runway 11-29 (West Blast Pad)
C2	Runway 11-29	0+00 to 22+00	1963	1986, 2012		25	43-88	75	60	95	Excellent	4	8	-	48	S.I.	3	14	-	48	S.I.	150	40	-	10	25	A	36	117	25	85	0.2	0.2			2026 - New Joints, Fog Seal	2031 - Crack Repair	Runway 11-29
C3	Runway 11-29	22+00 to 26+00	1963	1986, 2012		25	56-71	75	60	95	Excellent	4	8	-	48	S.I.	3	14	-	48	S.I.	150	40	-	10	25	B	25	87	17	63	0.9	0.4			2026 - New Joints, Fog Seal	2031 - Crack Repair	Runway 11-29
C4	Runway 11-29	26+00 to 37+00	1963	1986, 2012		25	63-93	80	60	95	Excellent	4	8	-	48	S.I.	3	14	-	48	S.I.	250	30	-	10	20	B	23	81	16	59	1.0	0.5			2026 - New Joints, Fog Seal	2031 - Crack Repair	Runway 11-29
C5	Runway 11-29	37+00 to 47+00	1963	1986, 2012		25	57-82	80	60	95	Excellent	4	8	-	48	S.I.	3	14	-	48	S.I.	250	30	-	10	20	C	19	70	12	52	1.0	0.5			2026 - New Joints, Fog Seal	2031 - Crack Repair	Runway 11-29
C6	Runway 11-29	47+00 to 63+00	1963	1986, 2008		25	37-68	65	86	86	Excellent	4	8	-	48	S.I.	4	8	-	48	S.I.	250	40	-	10	25	C	18		14		1.5	0.8	2017 - Supplemental Joints	2022 - Crack Repair, Fog Seal	2026 - Reconstruct		Runway 11-29
C7	Runway 11-29	63+00 to 70+00	1971	1986, 2008		25	37-63	52	86	86	Excellent	4	8	-	48	S.I.	4	8	-	48	S.I.	250	35	-	17	25	C	30		23		16	9	2017 - Supplemental Joints	2022 - Crack Repair, Fog Seal	2026 - Reconstruct		Runway 11-29
C8	Runway 11-29 (East Blast Pad)	East Blast Pad		1986					55	38	Poor																							2018 - Replace AC		2026 - Reconstruct		Runway 11-29 (East Blast Pad)
C9a	Taxiway A	0+00 to 2+00 (Taxiway B)	1963	1986		20	50-60	56	51	41	Fair	3	8	-	48	S.I.	3	8	-	48	S.I.	250	30	-	15	30	D	31		21		5	3		2019 - Crack Repair	2024 - Reconstruct		Taxiway A
C9b	Taxiway A	Taxiway B Holding Apron	1963	1986					X	22	Very Poor	3	8	-	48	S.I.	3	8	-	48	S.I.														2019 - Crack Repair	2024 - Reconstruct		Taxiway A
C10	Taxiway A	2+00 to 28+00	1963	1986		20	35-41	41	51	46	Fair	3	8	-	48	S.I.	3	8	-	48	S.I.	350	50	-	15	25	D	36		24		15	8		2019 - Crack Repair	2024 - Reconstruct		Taxiway A
C11	Taxiway A	28+00 ot 38+00	1963	1986		20	48-56	56	51	38	Poor	3	8	-	48	S.I.	3	8	-	48	S.I.	250	30	-	15	30	E	21		15		4	2	2016 - Reconstruct			2031 - New Joints, Fog Seal	Taxiway A
C12	Taxiway A	38+00 to 46+00	1963	1986		20	45-56	56	51	44	Fair	3	8	-	48	S.I.	3	8	-	48	S.I.	250	30	-	15	30	F	18		13		4	2	2016 - Reconstruct			2031 - New Joints, Fog Seal	Taxiway A
C13	Taxiway A	46+00 to 50+00	1963	1986		20	55-65	65	51	38	Poor	3	8	-	48	S.I.	3	8	-	48	S.I.	250	40	-	9	25	F	9		6		0.5	0.2	2016 - Reconstruct			2031 - New Joints, Fog Seal	Taxiway A
C14	Taxiway A	50+00 to 72+00	1963, 1971	1986		20	45-80	65	51	35	Poor	3	8	-	48	S.I.	3	8	-	48	S.I.	250	40	-	9	25	G	10		7		0.6	0.3	2016 - Reconstruct			2031 - New Joints, Fog Seal	Taxiway A
C15a	Taxiway C	0+00 to 0+50	1963	1995, 2012		20	50-52	52	60	95	Excellent	4	8	-	48	S.I.	3	8	-	48	S.I.	250	40	-	10	25	H	45		37		13	7			2026 - New Joints, Fog Seal	2031 - Crack Repair	Taxiway C
C15b	Taxiway C	0+50 to 2+00	1963	1995		20	50-52	52	60	43	Fair	4	8	-	48	S.I.	4	8	-	48	S.I.	250	40	-	10	25	H	45		37		13	7		2019 - Crack Repair	2024 - Reconstruct		Taxiway C
C16	Taxiway C	2+00 to 3+50 T/W to Hangar H2	1963	1995	2012	20	38-41	41	55	90	Excellent	4	8	-	48	S.I.	3	12	-	48	S.I.	350	60	-	12	25	H	65		53		65	41		2020 - New Joints, Fog Seal	2026 - Crack Repair, Fog Seal	2031 - Crack Repair	Taxiway C
C17a	Taxiway D	0+00 to 1+20	1963	1986, 2012		20	42-64	62	45	95	Excellent	3	8	-	48	S.I.	3	8	-	48	S.I.	250	30	-	11	25	H	30		25		4	2			2026 - New Joints, Fog Seal	2031 - Crack Repair	Taxiway D
C17b	Taxiway D	1+20 to 3+50	1963	1986		20	42-64	62	45	34	Poor	3	8	-	48	S.I.	3	8	-	48	S.I.	250	30	-	11	25	H	30		25		4	2		2019 - Crack Repair	2024 - Reconstruct		Taxiway D
C18	Taxiway D	1+50 to 4+50 T/W to Apron A2		1986	2012	20	35-39	39	45	93	Excellent	3	8	-	48	S.I.	3	8	-	48	S.I.	350	80	-	15	25	H	66		54		92	59			2025 - Reconstruct		Taxiway D
C19a	Taxiway E	0+00 to 0+80	1963	1986, 2012		20	31-39	39	46	95	Excellent	3	8	-	48	S.I.	3	8	-	48	S.I.	350	80	-	15	25	H	66		54		92	59					Taxiway E
C19b	Taxiway E	0+80 to 2+80	1963	1986		20	31-39	39	46	57	Good	3	8	-	48	S.I.	3	8	-	48	S.I.	350	80	-	15	25	H	66		54		92	59					Taxiway E
C20a	Taxiway F	0+00 to 0+30	1963	1986, 2012		20	51-63	62	49	95	Excellent	3	8	-	48	S.I.	3	8	-	48	S.I.	250	30	-	11	25	H	30		25		4	2			2026 - New Joints, Fog Seal	2031 - Crack Repair	Taxiway F
C20b	Taxiway F	0+30 to 3+50	1963	1986		20	51-63	62	49	40	Poor	3	8	-	48	S.I.	3	8	-	48	S.I.	250	30	-	11	25	H	30		25		4	2	2016 - Reconstruct			2031 - New Joints, Fog Seal	Taxiway F
C21	Taxiway F	3+50 to 4+50 T/W to Apron A2		1986	2012	20	40-42	42	49	95	Excellent	3	8	-	48	S.I.	3	8	-	48	S.I.	350	60	-	15	25	H	59		49		57	36			2025 - Reconstruct		Taxiway F
C22	Taxiway H	0+00 to 2+50	1963	1986		20	65-72	71	53	49	Fair	3	8	-	48	S.I.	3	8	-	48	S.I.	250	30	-	9	25	I	32		24		1.4	0.7	2016 - Reconstruct			2031 - New Joints, Fog Seal	Taxiway H
C23	Taxiway H	Holding Apron	1963			20	91-115	111	53	18	Very Poor	3	8	-	48	S.I.	3	8	-	48	S.I.	150	20	-	6	25	P	21		21		0.6	0.6	2016 - Reconstruct			2031 - New Joints, Fog Seal	Taxiway H
C24	Taxiway H	Holding Apron	1963			20	62-81	81	51	18	Very Poor	3	8	-	48	S.I.	3	8	-	48	S.I.	250	35	-	6	25	P	31		31		4	4	2016 - Reconstruct			2031 - New Joints, Fog Seal	Taxiway H
C25	Taxiway U	0+00 to 1+75	1971	1986		20	60-71	72	54	50	Fair	3	8	-	48	S.I.	3	8	-	48	S.I.	250	30	-	9	25	I	32		24		1.4	0.7	2016 - Reconstruct			2031 - New Joints, Fog Seal	Taxiway U
C26	Taxiway J	0+00 to 1+75	1971	1986		20	49-58	58	51	50	Fair	3	8	-	48	S.I.	3	8	-	48	S.I.	250	40	-	12	25	G	16		12		2.2	1.1	2016 - Reconstruct			2031 - New Joints, Fog Seal	Taxiway J
C27	Runway 2-20 (South Blast Pad)	South Blast Pad					45-70		42	40	Poor																							2018 - Replace AC		2022 - Reconstruct		Runway 2-20 (South Blast Pad)
C28	Runway 2-20	0+00 to 10+00	1973	1994		20	25-45	41	75	65	Good	6	6	-	48	S.I.	6	6	-	48	S.I.	250	40	-	12	25	I	145		114		58	36	2015 - Supplemental Joints, Reclamite		2022 - Reconstruct		Runway 2-20
C29	Runway 2-20	10+00 to 17+00	1965	1994, 2008		20	40-60	55	75	75	Very Good	6	6	-	48	S.I.	6	6	-	48	S.I.	250	25	-	8	25	I	87		68		8	5	2015 - Supplemental Joints, Reclamite		2022 - Reconstruct		Runway 2-20
C30	Runway 2-20	17+00 to 46+00	1965	1994		20	30-44	41	75	53	Fair	5	5	-	48	S.I.	5	5	-	48	S.I.	350	70	-	11	25	I	93		73		34	20	2015 - Supplemental Joints, Reclamite		2022 - Reconstruct		Runway 2-20
C31	Runway 2-20 (North Blast Pad)	North Blast Pad					50-60		42	34	Poor																							2018 - Replace AC		2022 - Reconstruct		Runway 2-20 (North Blast Pad)
C32	Taxiway G	0+00 to 6+00	1972	1994		20	30-51	51	77	65	Good	6	6	-	48	S.I.	6	6	-	48	S.I.	250	30	-	8	25	J	59		45		14	8	2015 - Supplemental Joints, Reclamite		2022 - Reconstruct		Taxiway G
C33	Taxiway G	6+00 to 9+00	1972	1994		20	62-66	66	77	70	Good	6	6	-	48	S.I.	6	6	-	48	S.I.	150	20	-	8	25	J	46		36		4	2	2015 - Supplemental Joints, Reclamite		2022 - Reconstruct		Taxiway G
C34	Taxiway G	9+00 to 15+00	1972	1994		20	20-39	39	77	55	Fair	6	6	-	48	S.I.	6	6	-	48	S.I.	250	40	-	12	25	J	97		76		76	49	2015 - Supplemental Joints, Reclamite		2022 - Reconstruct		Taxiway G
C35	Taxiway G	15+00 to 16+00	1972	1994, 2008		20	48-51	51	77	70	Good	6	6	-	48	S.I.	6	6	-	48	S.I.	250	20	-	8	25	J	59		45		14	8	2015 - Supplemental Joints, Reclamite		2022 - Reconstruct		Taxiway G
C36	Taxiway G	16+00 to 45+00	1984	1994		20	19-30	28	77	65	Good	5	5	-	48	S.I.	5	5	-	48	S.I.	350	100	-	20	25	J	122		97		359	246	2015 - Supplemental Joints, Reclamite		2022 - Reconstruct		Taxiway G
C37	Taxiway G	45+00 to 48+00	1984	1994		20	28-40	39	77	65	Good	6	6	-	48	S.I.	6	6	-	48	S.I.	250	40	-	12	25	J	97		76		76	49	2015 - Supplemental Joints, Reclamite		2022 - Reconstruct		Taxiway G
C38	Taxiway P	0+00 to 1+15		1994		20	52-59	58	80	70	Good	3	6	-	48	S.I.	3	6	-	48	S.I.	250	30	-	6	25	J	25		18		4	2	2015 - Supplemental Joints, Reclamite		2022 - Reconstruct		Taxiway P
C39	Taxiway V	0+00 to 1+15		1994		20	77-80	80	80	70	Good	3	6	-	48	S.I.	3	6	-	48	S.I.	100	20	-	7	25	J	21		15		0.9	0.4	2015 - Supplemental Joints, Reclamite		2022 - Reconstruct		Taxiway V
C40	Taxiway Q	Row a & b	1973	1999		20	<55	55	80	70	Good	3	6	-	48	S.I.	3	6	-	48	S.I.	250	40	-	15	25	K	46		46		21	21	2015 - Supplemental Joints, Reclamite		2022 - Reconstruct		Taxiway Q
C41a	Apron A1a	Row a & b	1973	1999	2013	20	<55	55	45	95	Excellent	3	6	-	48	S.I.	3-4	6	-	48	S.I.	250	40	-	15	25	K	46		46		21	21			2023 - Reconstruct		Apron A1a
C41b	Apron A1a	Row a & b	1973	1999	2013	20	55 - 70	70	45	95	Excellent	3	6	-	48	S.I.	3-4	6	-	48	S.I.	250	30	-	10	25	K	24		24		2	2			2023 - Reconstruct		Apron A1a
C41c	Apron A1a	EAA Apron		2013					X	100	Excellent	2	4	-	48	S.I.	3	3	8	48	S.I.	-	-	-	-	-										2026 - New Joints, Fog Seal	2031 - Crack Repair	Apron A1a
C42	Apron A1	Row a & b	1973	1999	2013	20	<40	40	45	95	Excellent	3	6	-	48	S.I.	3-4	6	-	48	S.I.	250	70	-	20	25	L	39		29		15	8			2023 - Reconstruct		Apron A1
C43	Apron A1	Row a & b	1973	1999	2013	20	40 - 55	55	45	95	Excellent	3	6	-	48	S.I.	3-4	6	-	48	S.I.	250	40	-	15	25	L	23		16		1.5	0.8			2023 - Reconstruct		Apron A1
C44	Apron A1	Row a & b	1973	1999	2013	20	55 - 70	70	45	95	Excellent	3	6	-	48	S.I.	3-4	6	-	48	S.I.	250	30	-	10	25	L	11		8		0.1	0.1			2023 - Reconstruct		Apron A1
C45	Apron A2	Row a & b		1999	2012, 2013	20	<32	32	43	90	Excellent	3	6	-	48	S.I.	3-4	6	-	48	S.I.	250	100	-	25	30	M	44		31		38	23			2025 - Reconstruct		Apron A2
C46	Apron A2	Row a & b		1999	2012, 2013	20	32 - 40	40	43	90	Excellent	3	6	-	48	S.I.	3-4	6	-	48	S.I.	250	70	-	20	25	M	28		19		8	4			2025 - Reconstruct		Apron A2
C47	Apron A2	Row a & b		1999	2012, 2013	20	40 - 55	55	43	90	Excellent	3	6	-	48	S.I.	3-4	6	-	48	S.I.	250	40	-	15	25	M	16		11		0.7	0.4			2025 - Reconstruct		Apron A2
C48	Apron A3	Row a, b, n, o		1999	2013	20	<32	32	40	95	Excellent	3	6	-	48	S.I.	2-3	6	-	48	S.I.	250	100	-	25	30	N	112		112		587	587		2021 - Reconstruct			Apron A3
C49	Apron A3	Row a, b, n, o		1999	2013	20	32 - 40	40	40	95	Excellent	3	6	-	48	S.I.	2-3	6	-	48	S.I.	250	70	-	20	25	N	75		75		114	114		2021 - Reconstruct			Apron A3
C50	Apron A3	Row a, b, n, o		1999	2013	20	40 - 55	55	40	95	Excellent	3	6	-	48	S.I.	2-3	6	-	48	S.I.	250	40	-	15	25	N	46		46		21	21		2021 - Reconstruct			Apron A3
C51	Apron A3	Row a, b, n, o		1999	2013	20	55 - 70	70	40	95	Excellent	3	6	-	48	S.I.	2-3	6	-	48	S.I.	250	30	-	10	25	N	24		24		2	2		2021 - Reconstruct			Apron A3
C52	Apron A4	Row n, o	1965	1999		20	<40	40	37	23	Very Poor	3	6	-	48	S.I.	3	6	-	48	S.I.	250	70	-	20	25	N	75		75		114	114	2014 - Reconstruct			2028 - New Joints, Fog Seal	Apron A4
C53	Apron A4	Row n, o	1965	1999		20	40 - 55	55	37	23	Very Poor	3	6	-	48	S.I.	3	6	-	48	S.I.	250	40	-	15	25	N	46		46		21	21	2014 - Reconstruct			2028 - New Joints, Fog Seal	Apron A4
C54	Apron A4	Row n, o	1965	1999		20	56 - 65	65	37	23	Very Poor	3	6	-	48	S.I.	3	6	-	48	S.I.	250	23	-	15	25	N	39		39		13	13	2014 - Reconstruct			2028 - New Joints, Fog Seal	Apron A4
C55	South Jet Apron	Taxilane R Sta. 16+00 - 20+00		1991		20	50-60	60	55	30	Poor	4	6	-	48	S.I.	4	6	-	48	S.I.	250	30	-	10	25	Q	10		7		0.8	0.4	2015 - Reconstruct			2028 - New Joints, Fog Seal	South Jet Apron
C56	Hangars A-H	Taxilane R		1994		20	50-62	62	59	45	Fair	3	8		48	S.I.	3	8	0	48	S.I.	250	30	-	11	25	O	52		47		27	23		2019 - Reconstruct			Hangars A-H
C57	Hangars A-H	Taxilane R		1994		20	65-72	71	59	45	Fair	3	8		48	S.I.	3	8	0	48	S.I.	250	30		9	25	O	41		36		12	11		2019 - Reconstruct			Hangars A-H
C58	Hangars A-H	Row West A		2001		20	42-81	70	75	73	Very Good	3	6	-	48	S.I.	3	6	-	48	S.I.	250	70	-	20	25	P	28		28		6	6		2018 - Crack Repair	2024 - Crack Repair, Fog Seal	2030 - Reconstruct	Hangars A-H
C59	Hangars A-H	Row East A		2001		20	70-92	80	75	73	Very Good	3	6	-	48	S.I.	3	6	-	48	S.I.	250	20	-	10	25	P	24		24		4	4		2018 - Crack Repair	2024 - Crack Repair, Fog Seal	2030 - Reconstruct	Hangars A-H
C60	Hangars A-H	Row West B		2001		20	58-81	70	63	70	Good	3	6	-	48	S.I.	3	6	-	48	S.I.	250	70	-	20	25	P	28		28		6	6		2018 - Crack Repair	2024 - Crack Repair, Fog Seal	2030 - Reconstruct	Hangars A-H
C61	Hangars A-H	Row BC		1999		20	39-75	70	63	65	Good	3	6	-	48	S.I.	3	6	-	48	S.I.	250	70	-	20	25	P	28		28		6	6		2018 - Crack Repair	2024 - Crack Repair, Fog Seal	2030 - Reconstruct	Hangars A-H
C62	Hangars A-H	Row CD		1999		20	55-90	70	61	57	Good	3	6	-	48	S.I.	3	6	-	48	S.I.	250	70	-	20	25	P	28		28		6	6		2017 - Reconstruct		2028 - New Joints	Hangars A-H
C63a	Hangars A-H	Row DE (West)		1982, 2012		20	40-60	60	57	95	Excellent	3	6	-	48	S.I.	3	6	-	48	S.I.	250	30	-	15	25	P	47		47		35	35			2026 - New Joints, Fog Seal	2031 - Crack Repair	Hangars A-H
C63b	Hangars A-H	Row DE (East)		1982		20	40-60	60	57	52	Fair	3	6	-	48	S.I.	3	6	-	48	S.I.	250	30	-	15	25	P	47		47		35	35		2017 - Reconstruct		2028 - New Joints	Hangars A-H
C64	Hangars A-H	Row EF		1982, 2012		20	40-75	70	84	95	Excellent	3	6	-	48	S.I.	3	6-18	-	48	S.I.	250	70	-	20	25	P	28		28		6	6			2026 - New Joints, Fog Seal	2031 - Crack Repair	Hangars A-H
C65	Hangars A-H	Row East F		1986, 2012		20	40-58	60	81	95	Excellent	3	6	-	48	S.I.	3	6-18	-	48	S.I.	250	30	-	15	25	P	47		47		35	35			2026 - New Joints, Fog Seal	2031 - Crack Repair	Hangars A-H
C66	Hangars A-H	Row West G		1986		20	58-80	80	58	50	Fair	3	6	-	48	S.I.	3	6	-	48	S.I.	250	20	-	10	25	P	24		24		4	4	2015 - Reconstruct			2027 - New Joints	Hangars A-H
C67	Hangars A-H	Row GH		1999		20	50-72	70	55	38	Poor	3	6	-	48	S.I.	3	6	-	48	S.I.	250	30	-	10	25	O	24		21		5	4	2015 - Reconstruct			2027 - New Joints	Hangars A-H
C68	Hangars J-K	Row East J		2012		20	57-70	70	35	90	Excellent	3	12	-	48	S.I.	3	12	-	48	S.I.	250	30	-	10	25	P	28		28		6	6		2020 - New Joints, Fog Seal	2026 - Crack Repair, Fog Seal	2031 - Crack Repair	Hangars J-K
C69	Hangars J-K	Row JK		2012		20	70-80	80	35	90	Excellent	3	12	-	48	S.I.	3	12	-	48	S.I.	250	20	-	10	25	P	24		24		4	4		2020 - New Joints, Fog Seal	2026 - Crack Repair, Fog Seal	2031 - Crack Repair	Hangars J-K
C70	Hangars J-K	Row West K		2012		20	80-90	90	35	90	Excellent	3	12	-	48	S.I.	3	12	-	48	S.I.	250	20	-	8	25	P	17		17		1.2	1.2		2020 - New Joints, Fog Seal	2026 - Crack Repair, Fog Seal	2031 - Crack Repair	Hangars J-K
C71	Hangars L-M	Taxilane T	2004			20	20-49	45	83	77	Very Good	4	10	-	48	S.I.	4	10	-	48	S.I.	250	40	-	12	25	P	157		157		345	345	2015 - Reclamite	2018 - Crack Repair, Fog Seal	2023 - Crack Repair	2028 - Crack Repair, Fog Seal	Hangars L-M
C72	Hangars L-M	Taxilane T	2004			20	50-75	70	83	77	Very Good	3	6	-	48	S.I.	3	6	-	48	S.I.	250	30	-	10	25	P	28		28		6	6	2015 - Reclamite	2018 - Crack Repair, Fog Seal	2023 - Crack Repair	2028 - Crack Repair, Fog Seal	Hangars L-M

Note: Routine remarking of the pavements is required every 2 to 3 years. The scheduled remarking is not shown in Appendix C or Table 4-3 due to space limitations, but it is included in the rehabilitation and maintenance schedules.

HATCH	AREA	PROJECT
	RUNWAY 11-29 (STA. 0+00 TO 47+00)	ADD ROCK, PULVERIZE, AND RECOMPACT
	T/Ws A, D, E, F, H & U, HANGARS A-H [ROWS CD, DE(EAST), WEST G, GH]	CRACK REPAIR, SEAL CRACKS
	APRON A2 (50% OF APRON)	MILL & FILL
	TAXIWAYS AT HANGARS J & K	REHABILITATE – RECONSTRUCT
	HANGARS A-H TAXILANES [ROWS DE(WEST), EF, EAST F]	REMOVED AND REPLACED AC
	TAXIWAY R, TAXIWAY G (SOUTH END)	CRACK REPAIR, SEAL CRACKS



2012 MAINTENANCE AND REHABILITATION COMPLETED PROJECTS

HATCH	AREA	PROJECT
	APRON A1 & A1a	MILL & FILL
	APRON A2 (50% OF APRON)	MILL & FILL
	APRON A3	MILL & FILL
	HANGARS L-M & WAREHOUSE AREA	SAW & SEAL NEW JOINTS – SUPPLEMENTAL
	HANGARS A-H [ROWS WEST A, EAST A, WEST B, BC]	SAW & SEAL NEW JOINTS – SUPPLEMENTAL
	EAA APRON	REMOVE AND RECONSTRUCT
	RUNWAY 2-20 & TAXIWAY G	RESEAL JOINTS
	ALL AIRFIELD PAVEMENTS	REMARK AIRFIELD PAVEMENTS AS NEEDED

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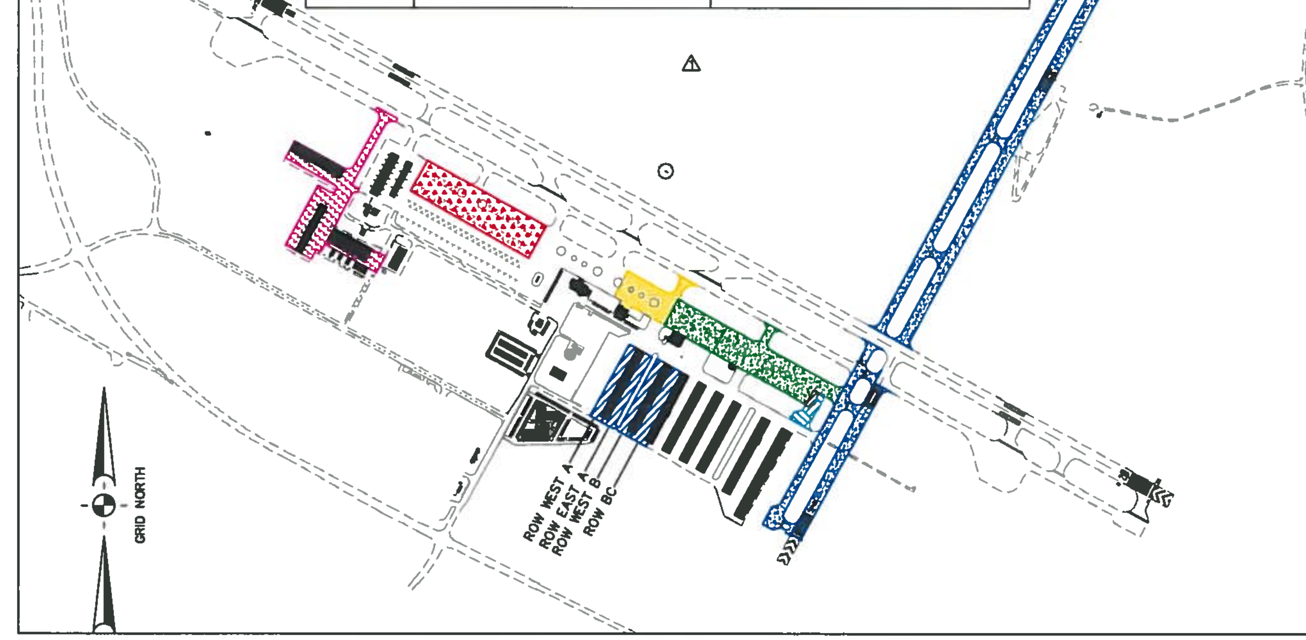
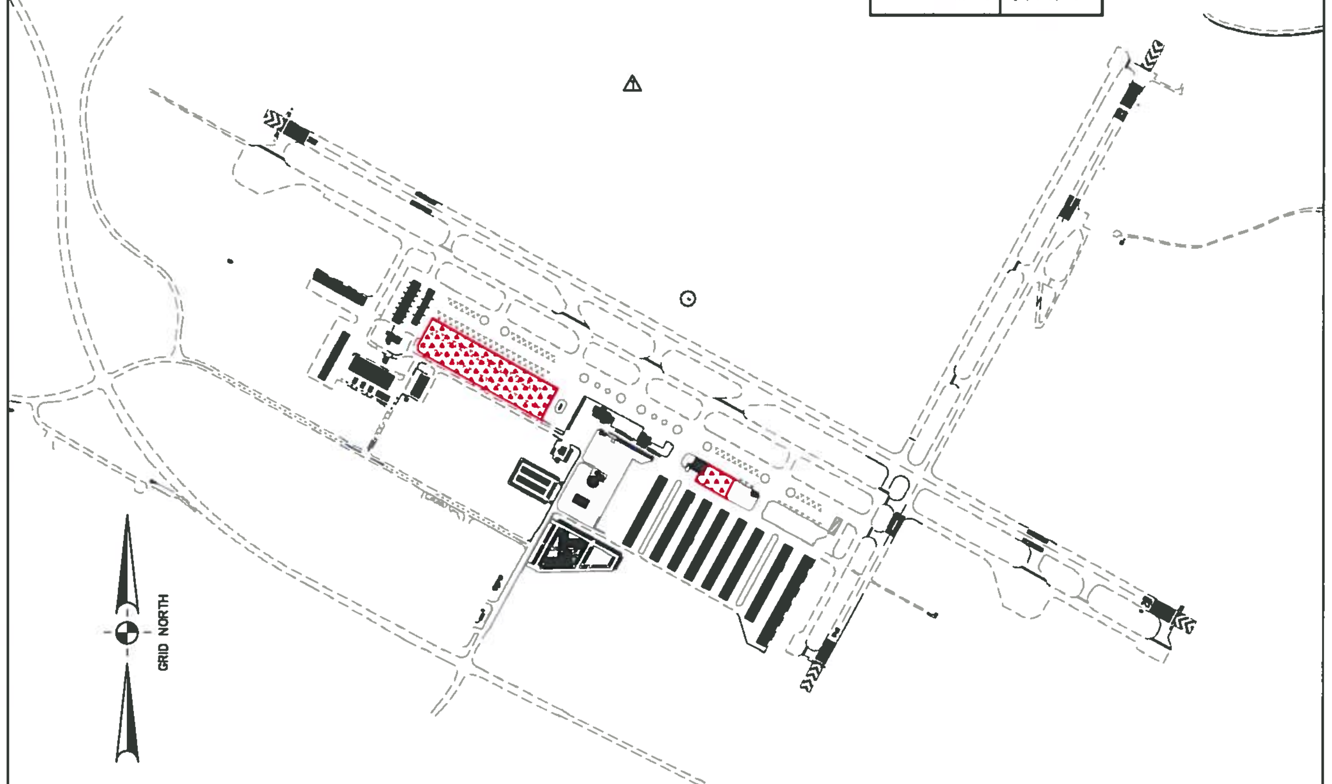


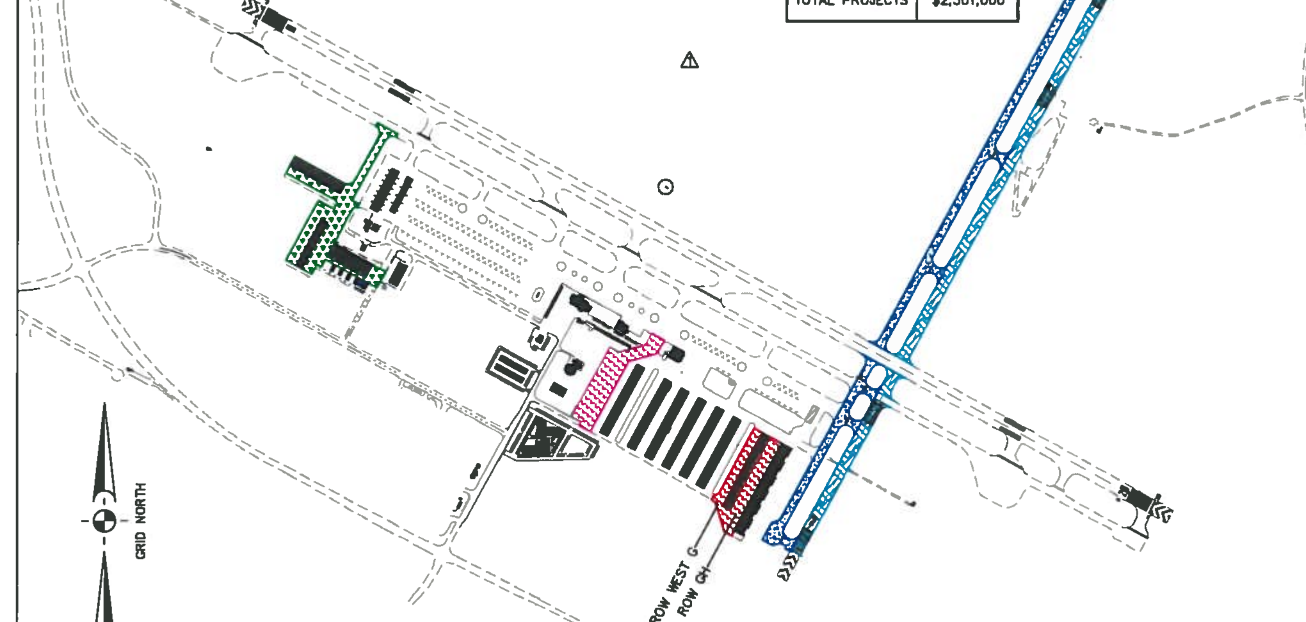
2013 MAINTENANCE AND REHABILITATION COMPLETED PROJECTS

HATCH	AREA	PROJECT	COST
	APRON A4 & HANGAR 1 APRON	REMOVE AC AND RECONSTRUCT	$1,498,000
		TOTAL PROJECTS	$1,498,000



2014 MAINTENANCE AND REHABILITATION COMPLETED PROJECTS

HATCH	AREA	PROJECT	COST
	SOUTH JET APRON	REMOVE AC AND RECONSTRUCT	$845,000
	HANGARS A-H – ROWS WEST G & GH	REMOVE AC AND RECONSTRUCT	$867,000
	RUNWAY 2-20 (STA. 0+00 TO 46+00)	SAW & SEAL NEW JOINTS – SUPPLEMENTAL RECLAIMITE SEAL	$270,000
	TAXIWAYS G, V, P, Q	SAW & SEAL NEW JOINTS – SUPPLEMENTAL RECLAIMITE SEAL	$240,000
	HANGARS L-M & WAREHOUSE AREA	RECLAIMITE SEAL	$26,000
	ALL AIRFIELD PAVEMENTS	REMARK AIRFIELD PAVEMENTS AS NEEDED	$253,000
		TOTAL PROJECTS	$2,501,000



2015 MAINTENANCE AND REHABILITATION SCHEDULE

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ENGINEER OF RECORD

NO.	REVISIONS	BY	APR	DATE
1	2013 PMMP UPDATE	DB	RWB	10/14

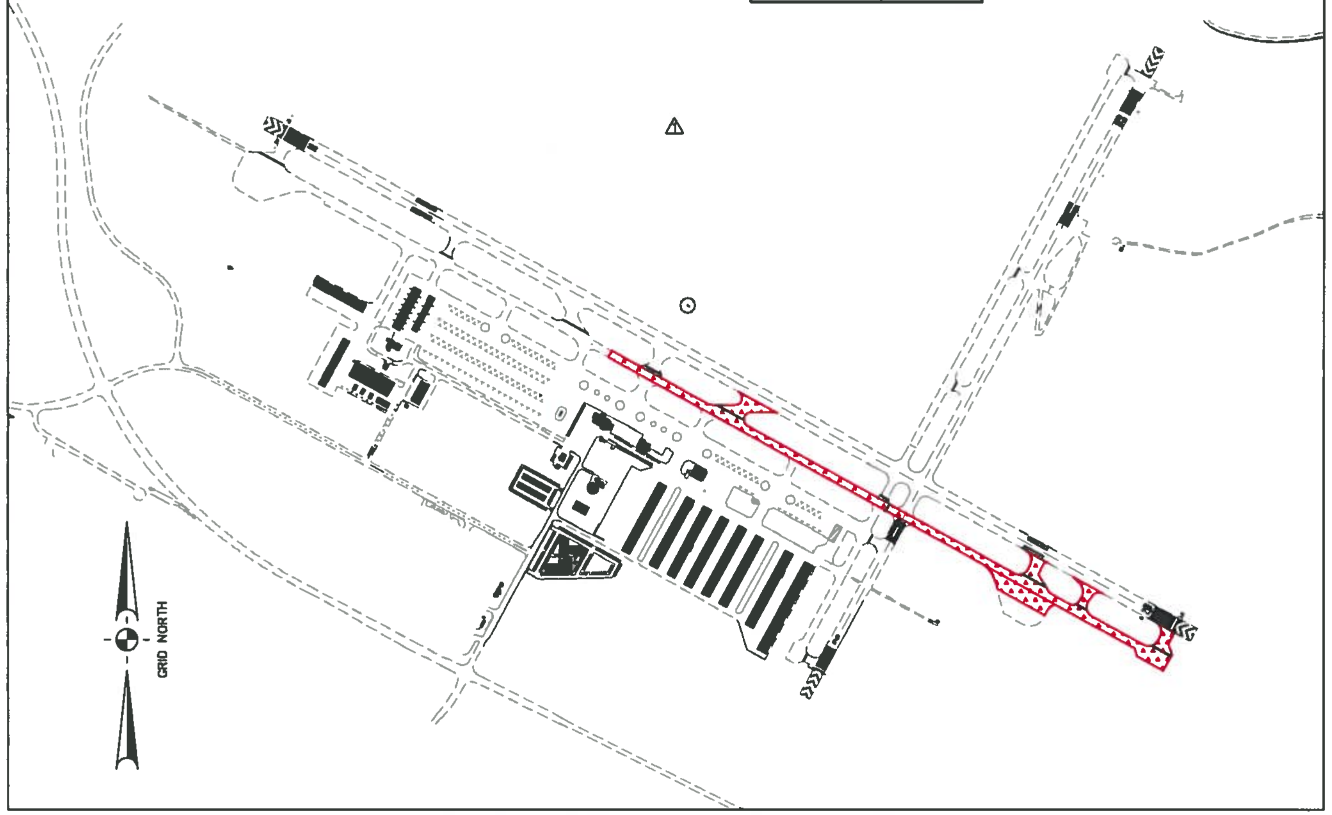
TRUCKEE TAHOE AIRPORT
TRUCKEE, CALIFORNIA

PAVEMENT EVALUATION
REHABILITATION SCHEDULE 2012-2015

DESIGN BY: RWB
DRAWN BY: DMB
CHK'D BY: RWB
DATE: SEPT. 7, 2011
CONTRACT No. -
PROJECT NO: 40
DWG FILE: MAINTENANCE SCHEDULE
DRAWING SCALE 1"=600'

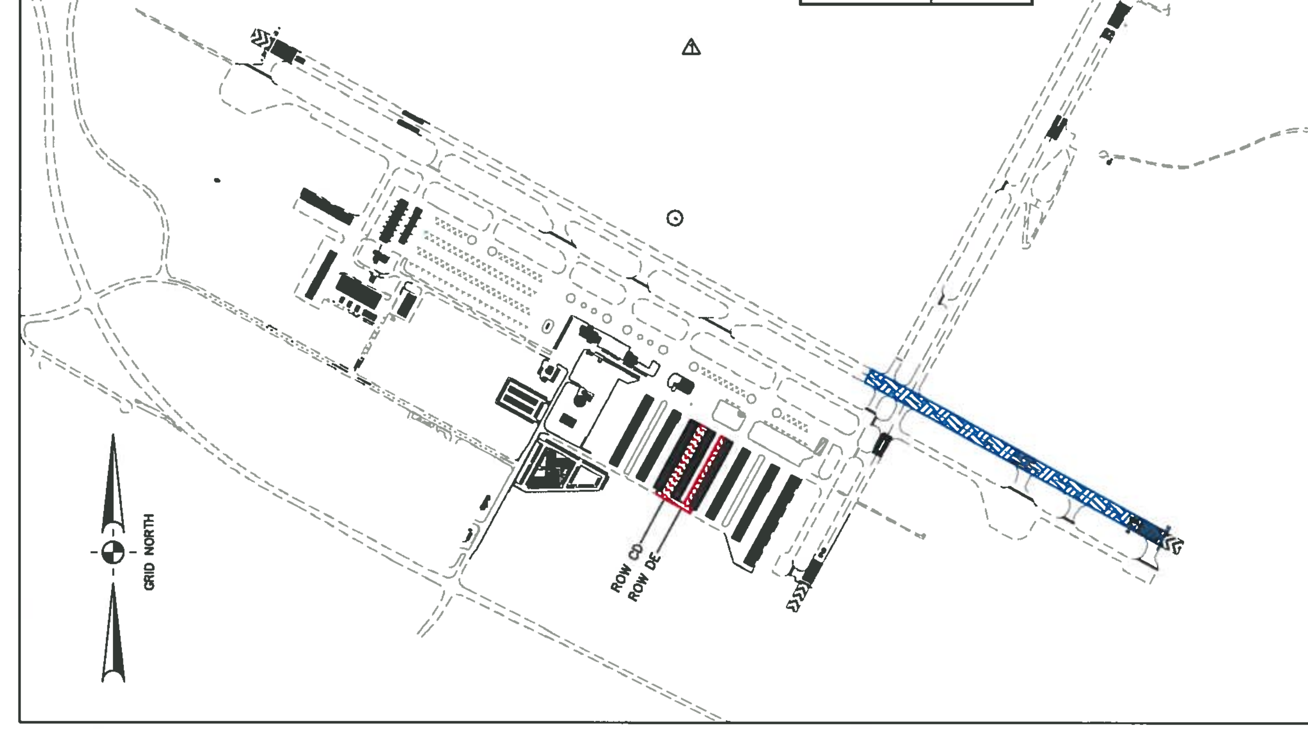
SHEET NUMBER
PLATE NO. 4-1

HATCH	AREA	PROJECT	COST
	T/Ws A (STA. 28+00 TO 72+00), F, H, U & J	REHABILITATE – RECONSTRUCT	$2,000,000
		TOTAL PROJECTS	$2,000,000



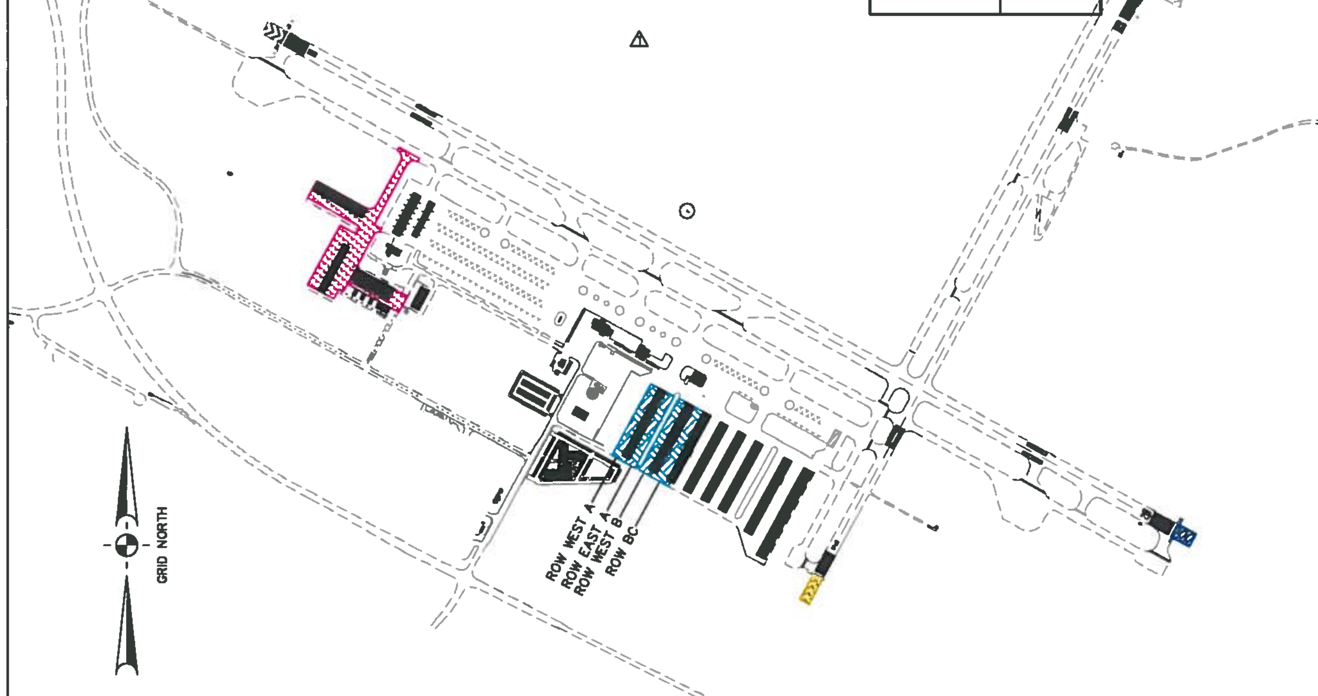
2016 MAINTENANCE AND REHABILITATION SCHEDULE

HATCH	AREA	PROJECT	COST
	RUNWAY 11–29 (STA. 47+00 TO 70+00)	SAW & SEAL NEW JOINTS – SUPPLEMENTAL	$155,000
	HANGARS A–H [ROWS CD & DE(EAST)]	REMOVE AC AND RECONSTRUCT	$390,000
	ALL AIRFIELD PAVEMENTS	REMARK AIRFIELD PAVEMENTS AS NEEDED	$250,000
		TOTAL PROJECTS	$795,000



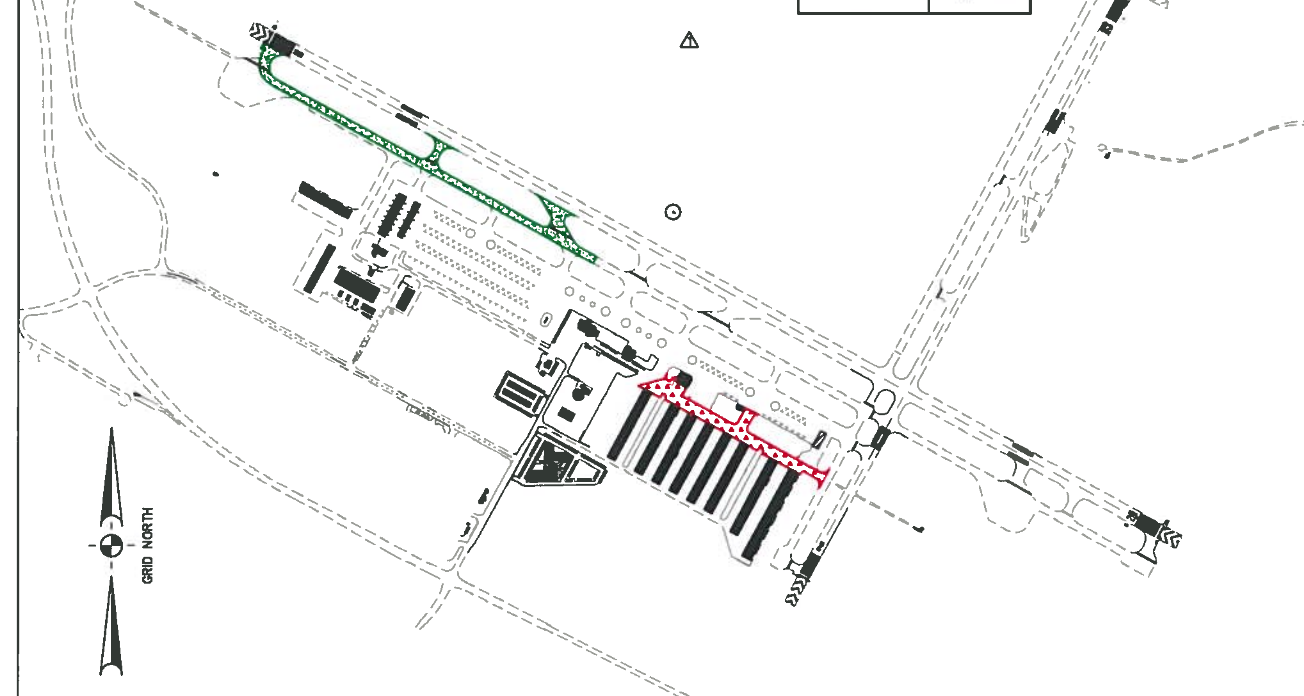
2017 MAINTENANCE AND REHABILITATION SCHEDULE

HATCH	AREA	PROJECT	COST
	RUNWAY 2–20 BLAST PADS	REMOVE AC AND RECONSTRUCT	$142,000
	RUNWAY 11–29 EAST BLAST PAD	REMOVE AC AND RECONSTRUCT	$82,000
	HANGARS A–H [ROWS WEST A, EAST A, WEST B, BC]	CRACK REPAIR, SEAL CRACKS & JOINTS	$75,000
	HANGARS L–M & WAREHOUSE AREA	CRACK REPAIR, SEAL CRACKS & JOINTS	$116,000
		TOTAL PROJECTS	$415,000



2018 MAINTENANCE AND REHABILITATION SCHEDULE

HATCH	AREA	PROJECT	COST
	HANGARS A–H – TAXILANE R	RECONSTRUCT	$760,000
	T/Ws A (0+00 TO 28+00), B, C & D	CRACK REPAIR, SEAL CRACKS	$48,000
	ALL AIRFIELD PAVEMENTS	REMARK AIRFIELD PAVEMENTS AS NEEDED	$340,000
		TOTAL PROJECTS	$1,148,000



2019 MAINTENANCE AND REHABILITATION SCHEDULE

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TRUCKEE TAHOE AIRPORT
TRUCKEE, CALIFORNIA

PAVEMENT EVALUATION

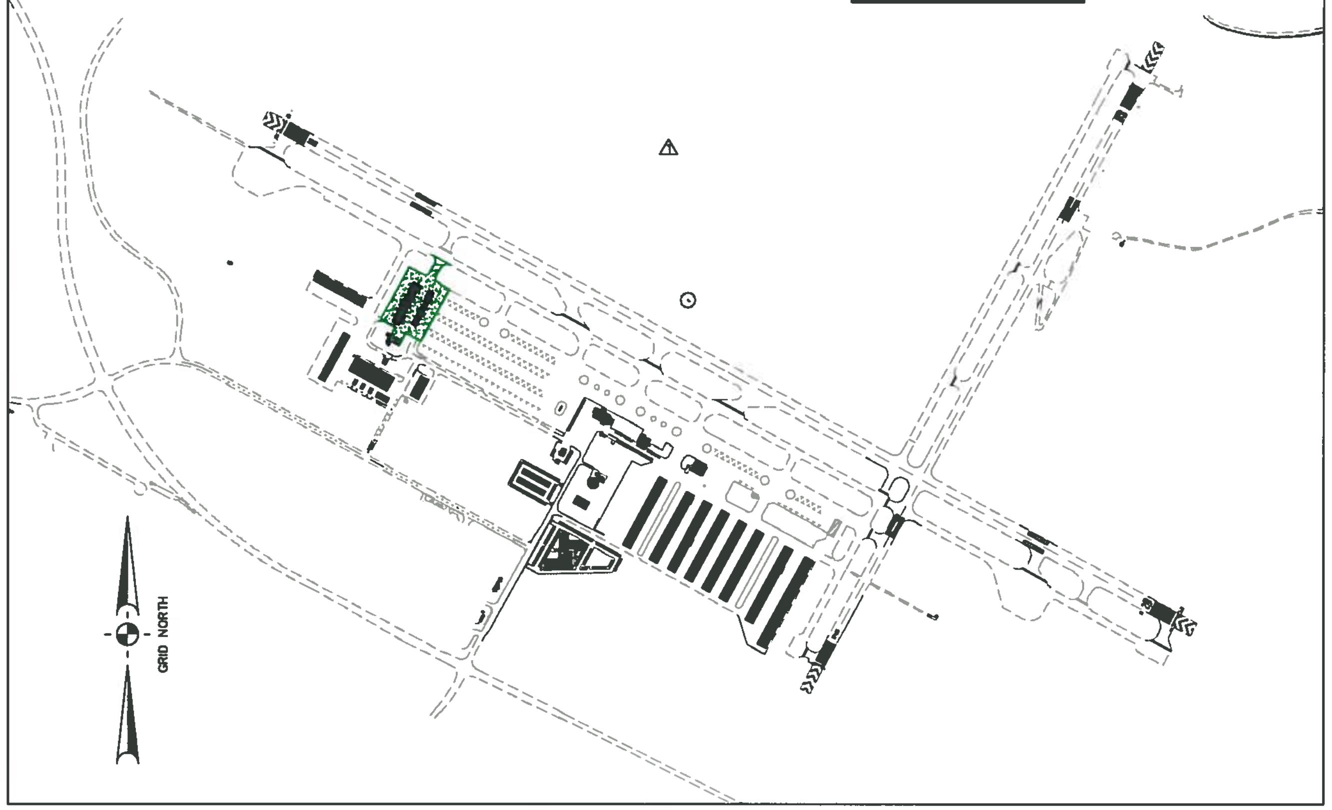
REHABILITATION SCHEDULE 2016-2019

DESIGN BY: RWB
DRAWN BY: DMB
CHK'D BY: RWB
DATE: SEPT. 7, 2011
CONTRACT No. -
PROJECT NO: 40.
DWG FILE: MAINTENANCE SCHEDULE
DRAWING SCALE: 1"=600'

SHEET NUMBER
PLATE NO. 4–2

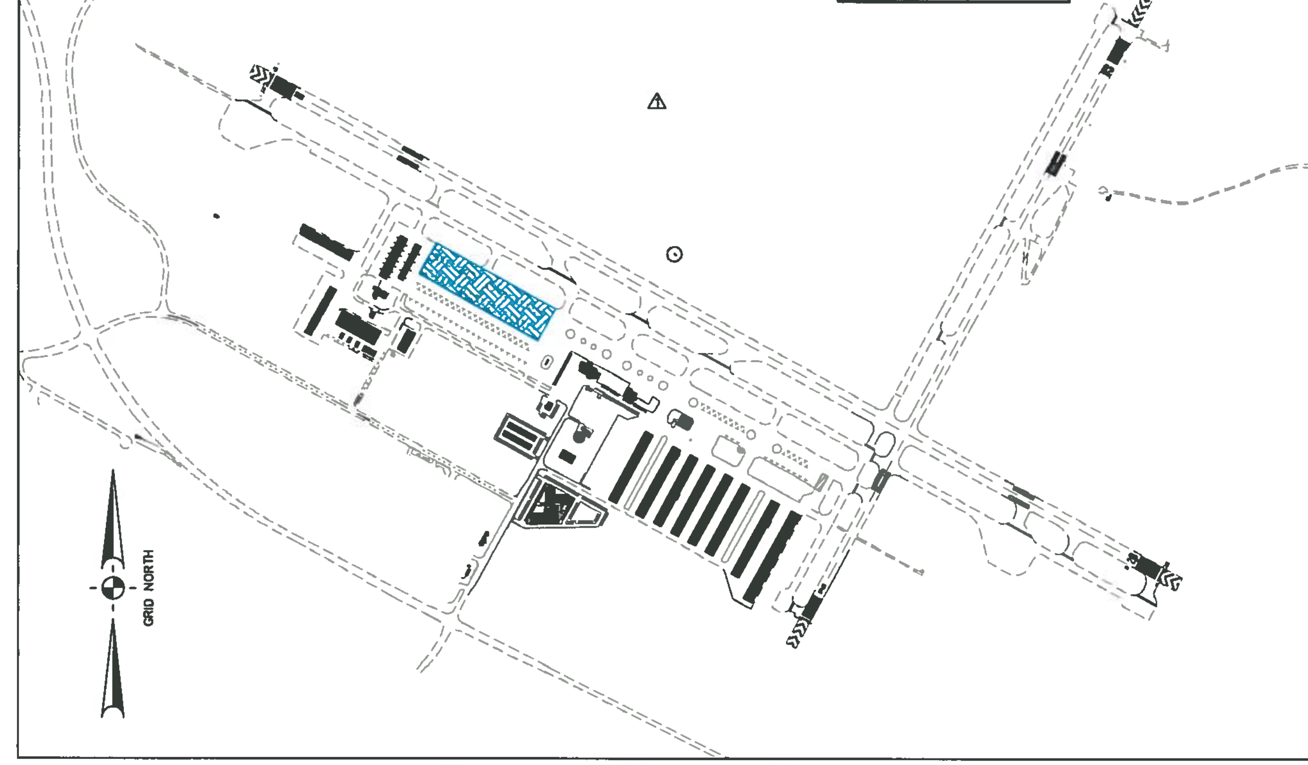
VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING
0 ▬▬▬ 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

HATCH	AREA	PROJECT	COST
(green hatch)	HANGARS J-K	SAW AND SEAL NEW JOINTS – SUPPLEMENTAL	$60,000
		TOTAL PROJECTS	$60,000



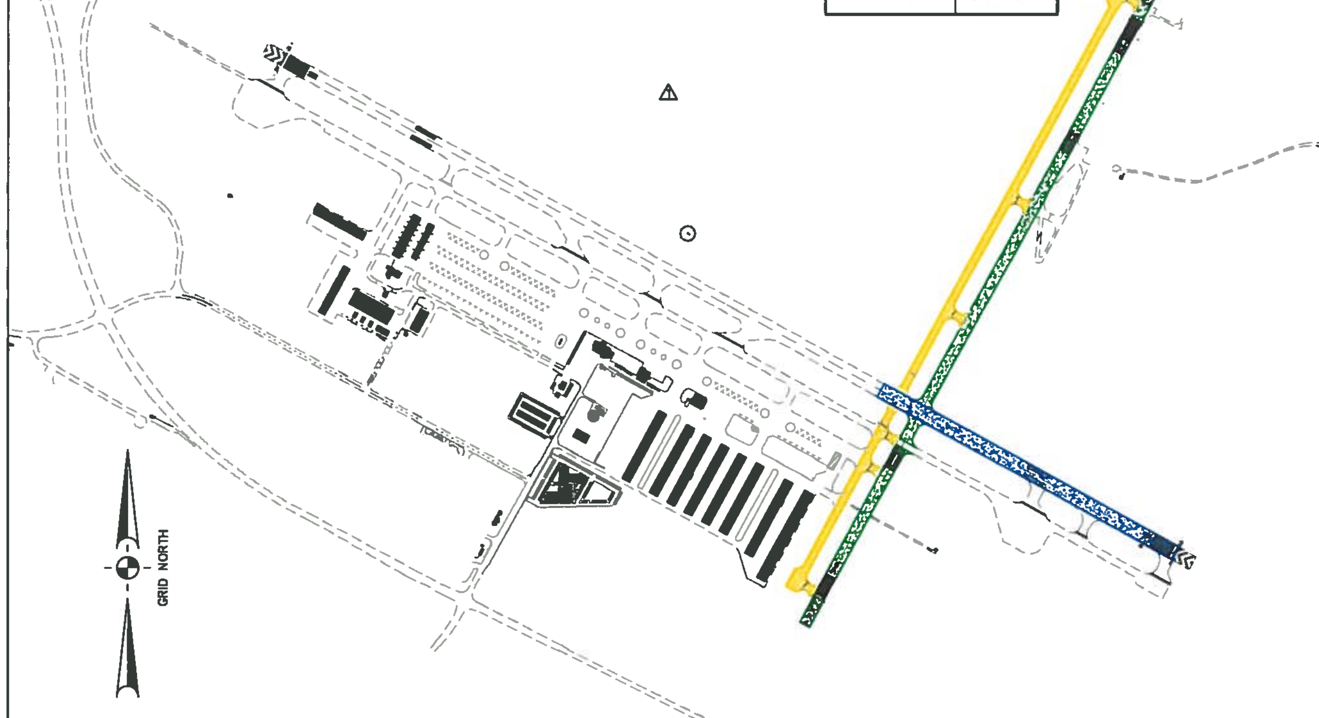
2020 MAINTENANCE AND REHABILITATION SCHEDULE

HATCH	AREA	PROJECT	COST
(blue hatch)	APRON A3	REMOVE AC AND RECONSTRUCT	$1,207,000
	ALL AIRFIELD PAVEMENTS	REMARK AIRFIELD PAVEMENTS AS NEEDED	$380,000
		TOTAL PROJECTS	$1,587,000



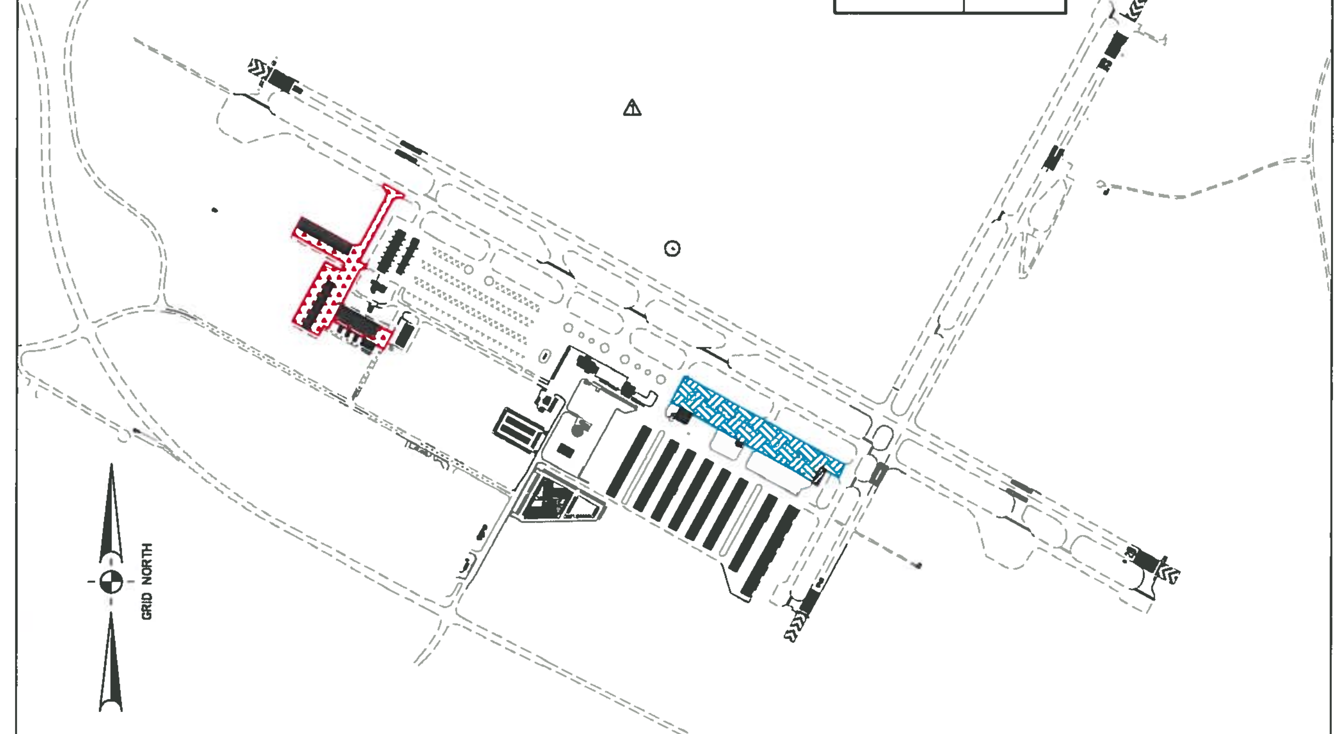
2021 MAINTENANCE AND REHABILITATION SCHEDULE

HATCH	AREA	PROJECT	COST
(green hatch)	RUNWAY 2-20	ADD ROCK, PULVERIZE, RECOMPACT + 3" AC	$1,970,000
(yellow)	T/Ws G, V, P & Q	ADD ROCK, PULVERIZE, RECOMPACT + 3" AC	$1,480,000
(dark blue hatch)	RUNWAY 11-29 (STA. 47+00 TO 70+00)	CRACK REPAIR, SEAL CRACKS & JOINTS	$156,000
		TOTAL PROJECTS	$3,606,000



2022 MAINTENANCE AND REHABILITATION SCHEDULE

HATCH	AREA	PROJECT	COST
(blue hatch)	APRON A1	REMOVE AND RECONSTRUCT	$1,590,000
(red hatch)	HANGARS L-M & WAREHOUSE AREA	CRACK REPAIR, SEAL CRACKS & JOINTS	$94,000
	ALL AIRFIELD PAVEMENTS	REMARK AIRFIELD PAVEMENTS AS NEEDED	$150,000
		TOTAL PROJECTS	$1,834,000



2023 MAINTENANCE AND REHABILITATION SCHEDULE

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ENGINEER OF RECORD

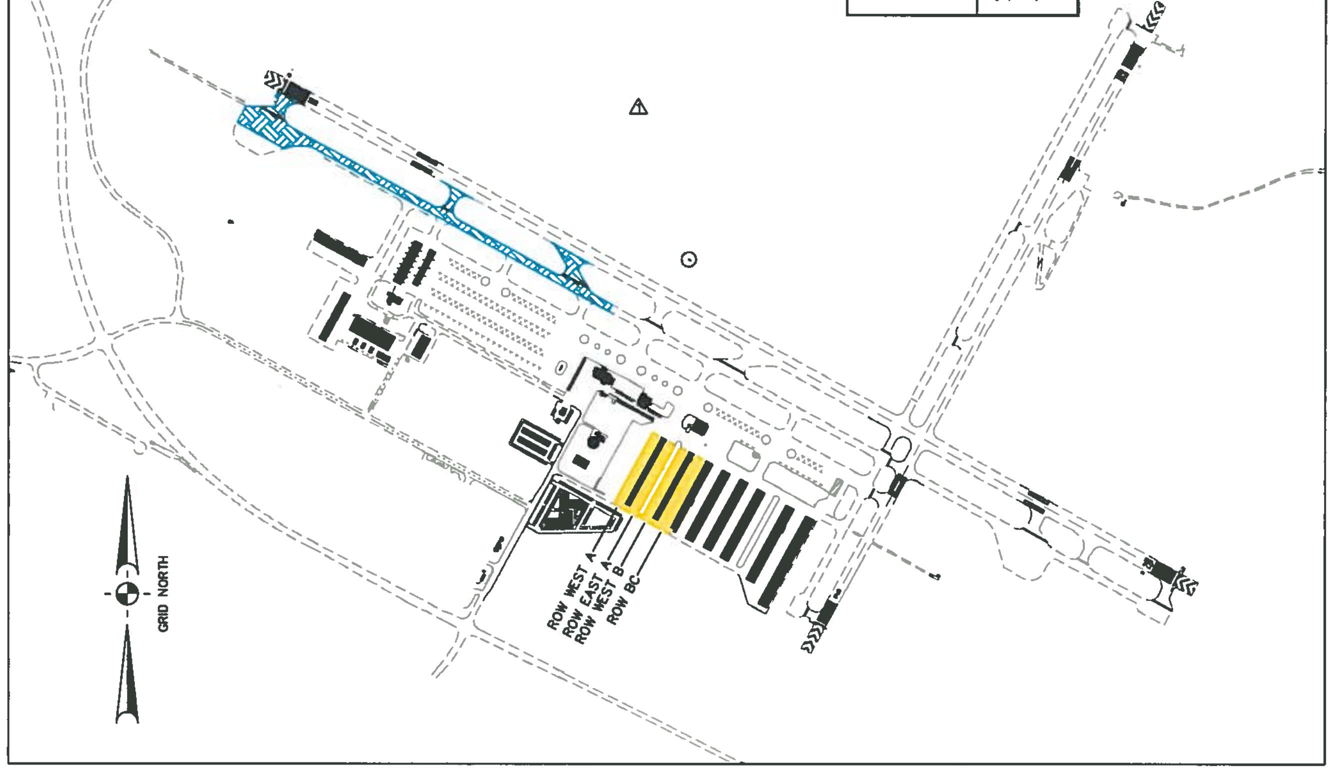
NO.	REVISIONS	BY	APR	DATE
⚠	2013 PMMP UPDATE	DB	RWB	10/14

TRUCKEE, CALIFORNIA
TRUCKEE TAHOE AIRPORT
PAVEMENT EVALUATION
REHABILITATION SCHEDULE 2020-2023

DESIGN BY: RWB
DRAWN BY: DMB
CHK'D BY: RWB
DATE: SEPT. 7, 2011
CONTRACT No. -
PROJECT NO: 40
DWG FILE: MAINTENANCE SCHEDULE
DRAWING SCALE: 1"=600'

SHEET NUMBER
PLATE NO. 4-3

HATCH	AREA	PROJECT	COST
	T/Ws A (0+00 TO 28+00), B, C, & D	REHABILITATE – RECONSTRUCT	$1,256,000
	HANGARS A–H [ROWS WEST A, EAST A, WEST B, BC]	CRACK REPAIR, SEAL CRACKS & JOINTS, FOG SEAL	$95,000
		TOTAL PROJECTS	$1,351,000



2024 MAINTENANCE AND REHABILITATION SCHEDULE

VERIFY SCALES
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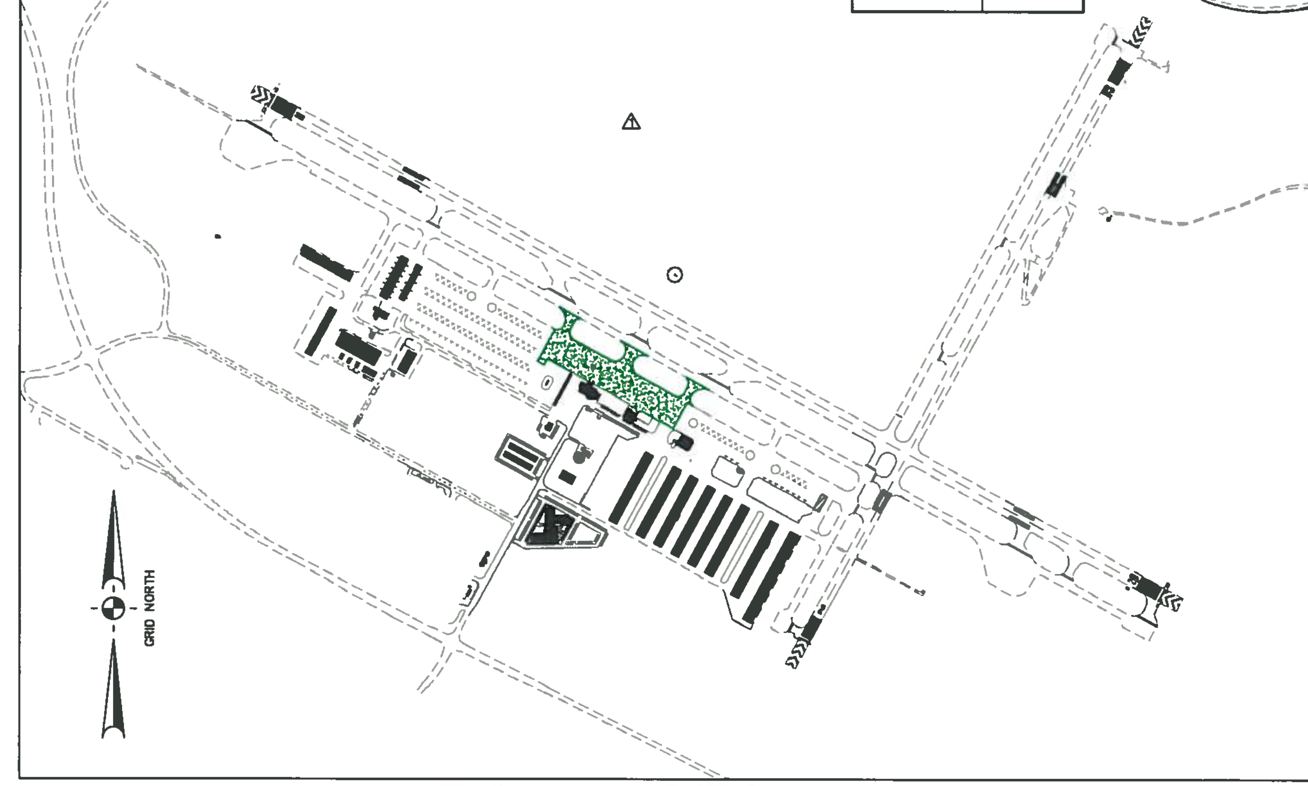
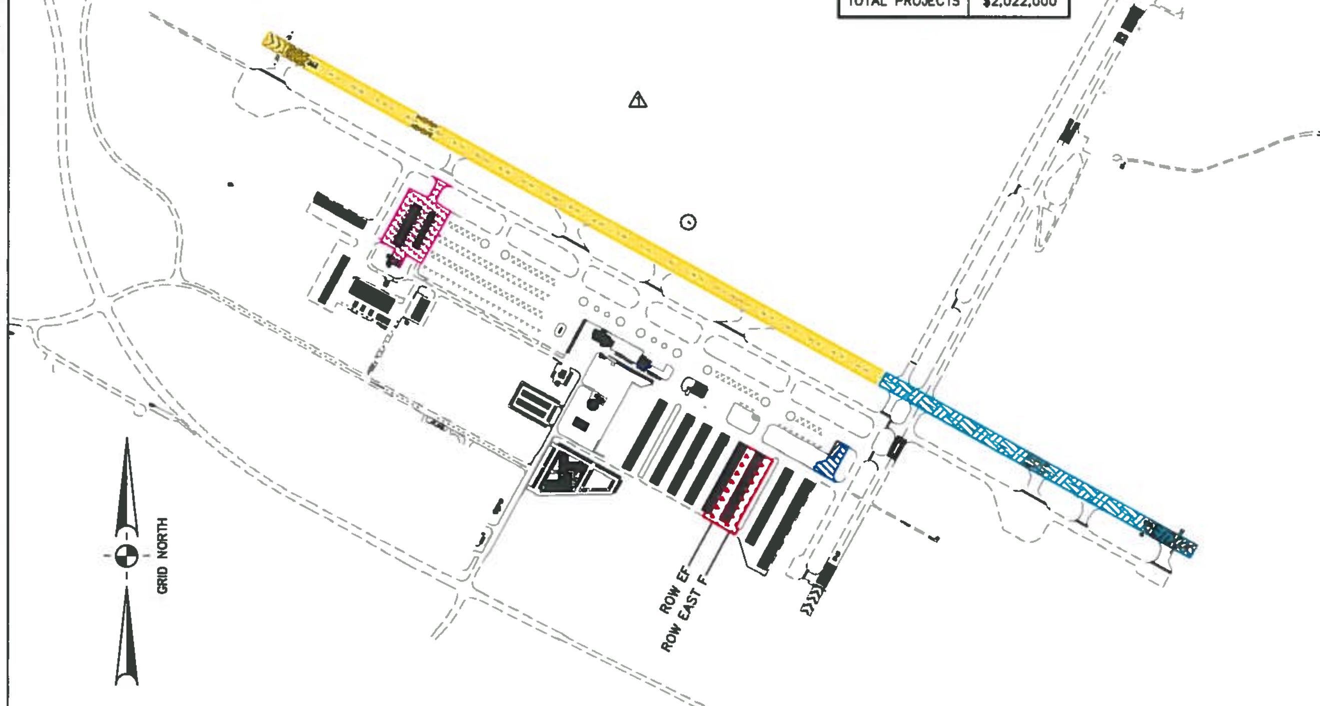
HATCH	AREA	PROJECT	COST
	APRON A2	REMOVE AND RECONSTRUCT	$1,465,000
	ALL AIRFIELD PAVEMENTS	REMARK AIRFIELD PAVEMENTS AS NEEDED	$340,000
		TOTAL PROJECTS	$1,805,000



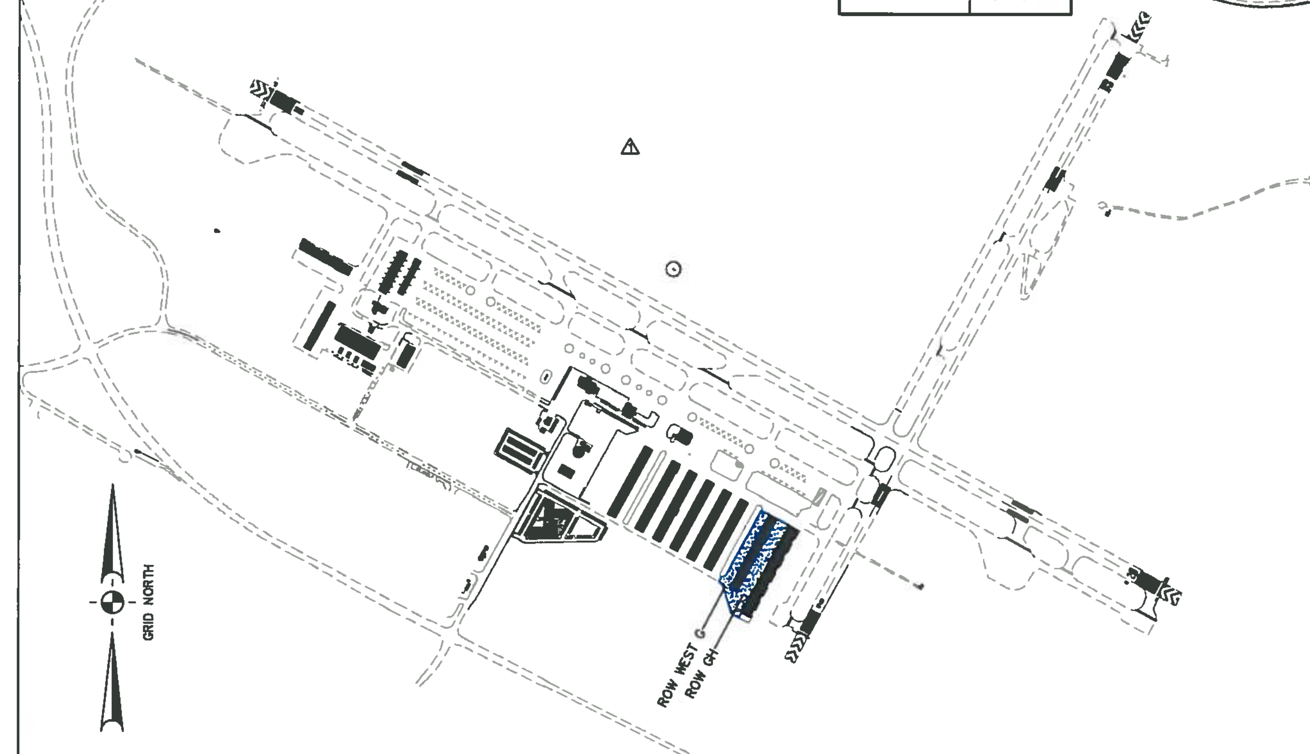
2025 MAINTENANCE AND REHABILITATION SCHEDULE

HATCH	AREA	PROJECT	COST
	RUNWAY 11–29 (0+00 TO 47+00)	SAW AND SEAL NEW JOINTS, FOG SEAL	$595,000
	RUNWAY 11–29 (47+00 TO 70+00)	RECONSTRUCT	$1,275,000
	APRON A1 (EAA PORTION)	SAW AND SEAL NEW JOINTS, FOG SEAL	$24,000
	HANGARS A–H [ROWS EF AND EAST F]	SAW AND SEAL NEW JOINTS, FOG SEAL	$50,000
	HANGARS J–K	CRACK REPAIR, SEAL CRACKS & JOINTS, FOG SEAL	$78,000
		TOTAL PROJECTS	$2,022,000



2026 MAINTENANCE AND REHABILITATION SCHEDULE

HATCH	AREA	PROJECT	COST
	HANGARS A–H [ROWS WEST G & GH]	SAW & SEAL NEW JOINTS	$60,000
	ALL AIRFIELD PAVEMENTS	REMARK AIRFIELD PAVEMENTS AS NEEDED	$120,000
		TOTAL PROJECTS	$180,000



2027 MAINTENANCE AND REHABILITATION SCHEDULE

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ENGINEER OF RECORD

NO.	REVISIONS	BY	APR	DATE
1	2013 PMMP UPDATE	DB	RWB	10/14

TRUCKEE TAHOE AIRPORT
TRUCKEE, CALIFORNIA

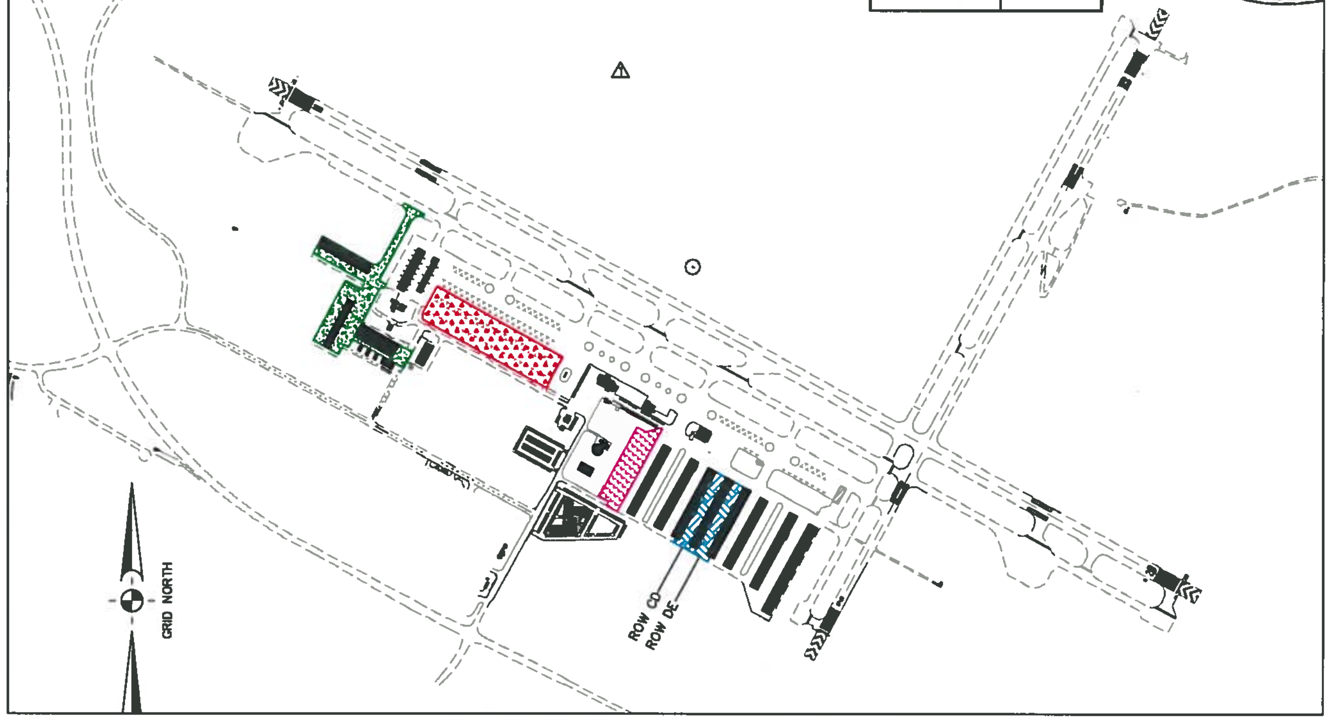
PAVEMENT EVALUATION

REHABILITATION SCHEDULE 2024-2027

DESIGN BY: RWB
DRAWN BY: DMB
CHK'D BY: RWB
DATE: SEPT. 7, 2011
CONTRACT No.: -
PROJECT NO: 40
DWG FILE: MAINTENANCE SCHEDULE
DRAWING SCALE: 1"=600'

SHEET NUMBER
PLATE NO. 4-4

HATCH	AREA	PROJECT	COST
	SOUTH JET APRON	SAW AND SEAL NEW JOINTS, FOG SEAL	$86,000
	APRON A4	SAW AND SEAL NEW JOINTS, FOG SEAL	$180,000
	HANGARS A-H [ROWS CD & DE]	SAW AND SEAL NEW JOINTS	$60,000
	HANGARS L-M & WAREHOUSE AREA	CRACK REPAIR, SEAL CRACKS & JOINTS, FOG SEAL	$145,000
		TOTAL PROJECTS	$471,000



2028 MAINTENANCE AND REHABILITATION SCHEDULE

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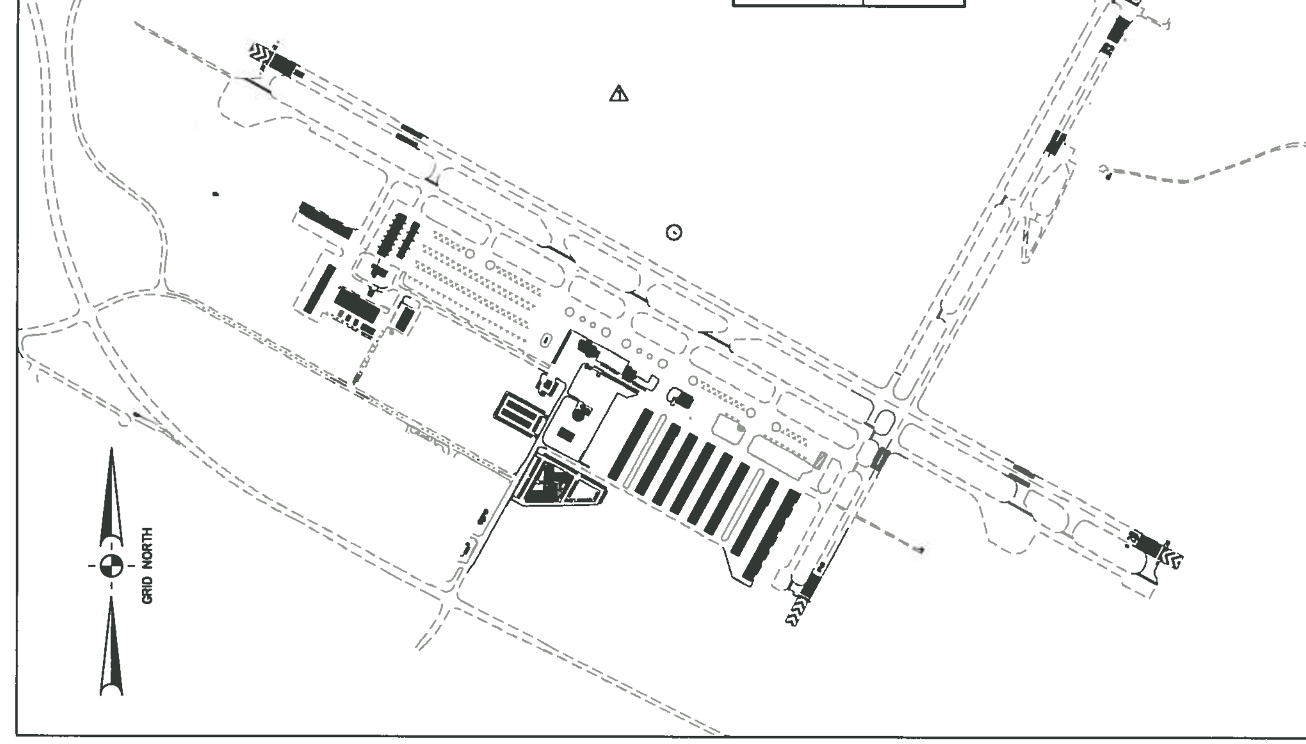
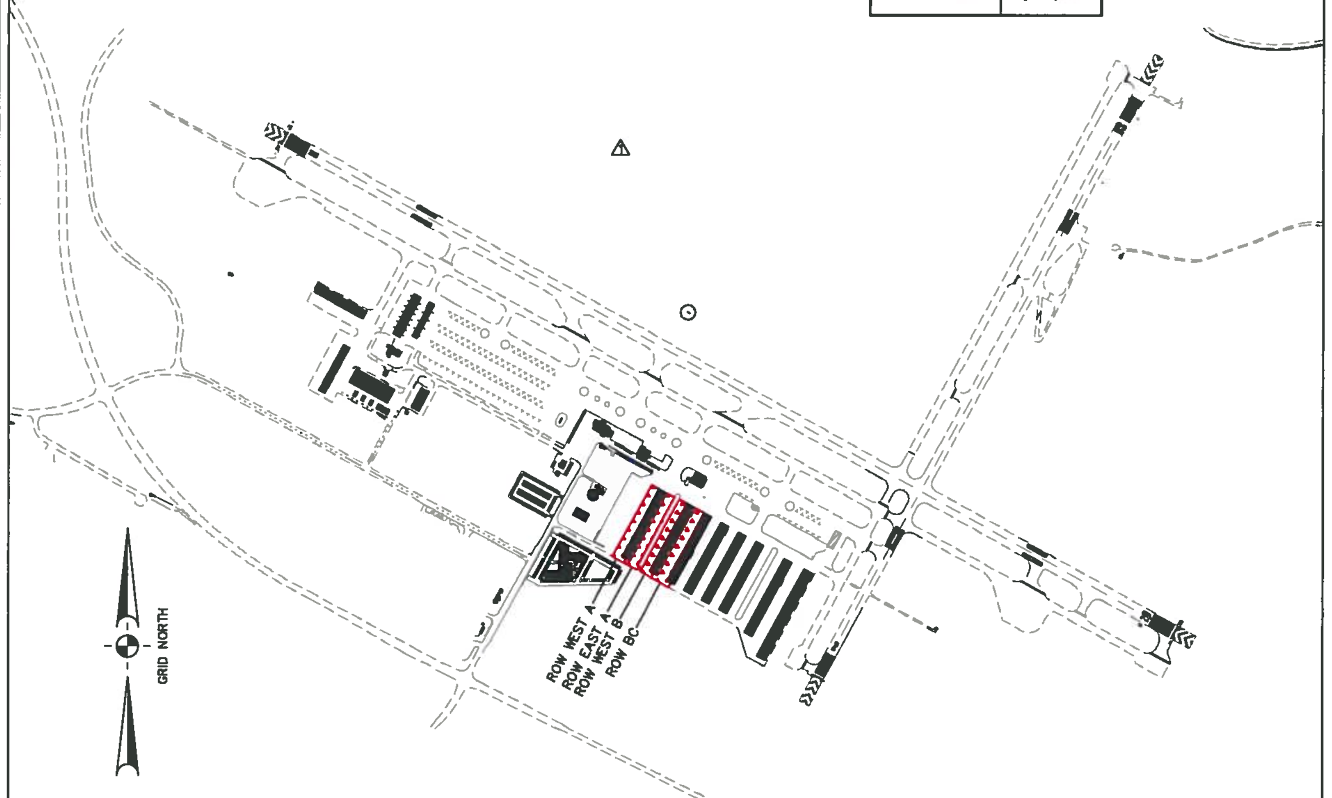
AREA	PROJECT	COST
ALL AIRFIELD PAVEMENTS	REMARK AIRFIELD PAVEMENTS AS NEEDED	$360,000
	TOTAL PROJECTS	$360,000



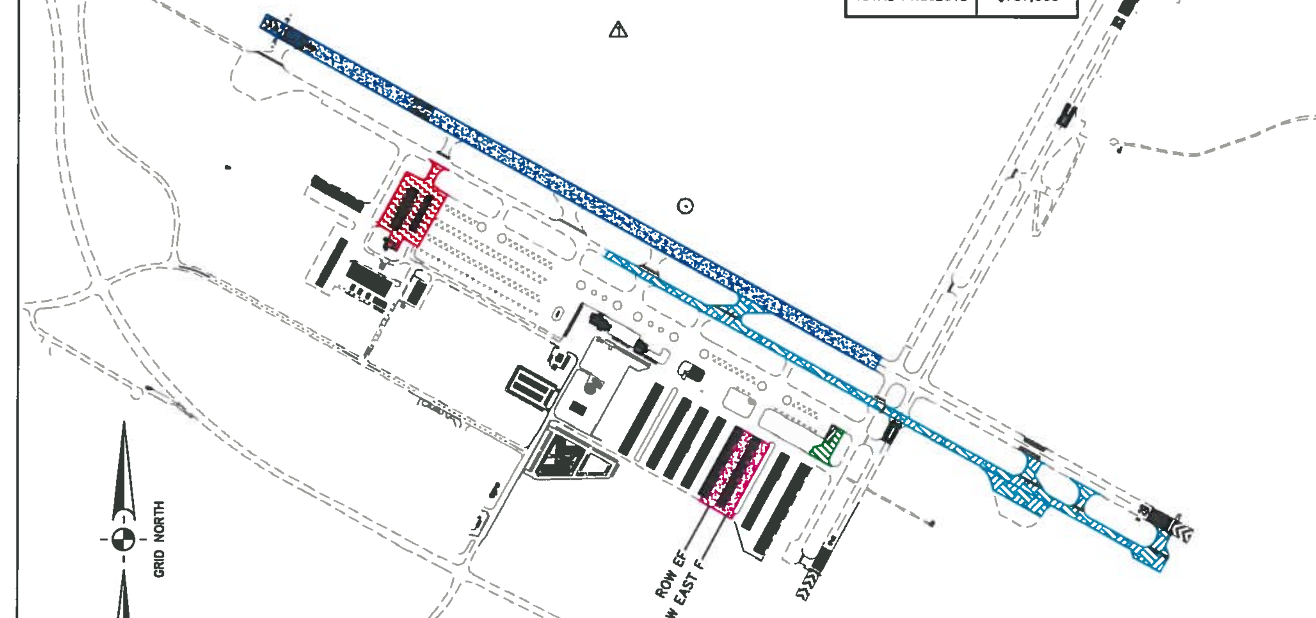
2029 MAINTENANCE AND REHABILITATION SCHEDULE

HATCH	AREA	PROJECT	COST
	HANGARS A-H [ROWS WEST A, EAST A, WEST B, & BC]	REMOVE AC AND RECONSTRUCT	$740,000
		TOTAL PROJECTS	$740,000



2030 MAINTENANCE AND REHABILITATION SCHEDULE

HATCH	AREA	PROJECT	COST
	RUNWAY 11-29 (STA. 0+00 TO 47+00)	CRACK REPAIR, SEAL CRACKS & JOINTS	$275,000
	T/Ws A (STA. 28+00 TO 72+00), F, H, U . J	SAW AND SEAL NEW JOINTS, FOG SEAL	$145,000
	APRON A1 (EAA PORTION)	CRACK REPAIR, SEAL CRACKS & JOINTS	$20,000
	HANGARS A-H [ROWS EF & EAST F]	CRACK REPAIR, SEAL CRACKS & JOINTS	$42,000
	HANGARS J-K	CRACK REPAIR, SEAL CRACKS & JOINTS	$75,000
	ALL AIRFIELD PAVEMENTS	REMARK AIRFIELD PAVEMENTS AS NEEDED	$240,000
		TOTAL PROJECTS	$797,000



2031 MAINTENANCE AND REHABILITATION SCHEDULE

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CONSULTING AIRPORT ENGINEER
6125 King Road, Suite 201 • Loomis, California 95650-8004 • (916) 652-4725

ENGINEER OF RECORD

NO.	REVISIONS	BY	APR	DATE
1	2013 PMMP UPDATE	DB	RWB	10/14

TRUCKEE TAHOE AIRPORT

TRUCKEE, CALIFORNIA

PAVEMENT EVALUATION

REHABILITATION SCHEDULE 2028-2031

DESIGN BY: RWB
DRAWN BY: DMB
CHK'D BY: RWB
DATE: SEPT. 7, 2011
CONTRACT No. -
PROJECT NO: 40.
DWG FILE: MAINTENANCE SCHEDULE
DRAWING SCALE: 1"=600'

SHEET NUMBER
PLATE NO. 4-5

EXHIBIT 4-1

TRUCKEE TAHOE AIRPORT
PAVEMENT MAINTENANCE/MANAGEMENT PLAN

NEW CONSTRUCTION/REHABILITATION WORK
ENHANCED SPECIFICATION REQUIREMENTS

For any new construction or rehabilitation work performed at the airport it is important that the contractor be required to provide quality materials placed in a professional manner. As a guide for specifications for this type of work, the requirements set forth below should be added to the F.A.A. standard specifications.

A. *Pulverize Existing Asphaltic Concrete (AC) and Aggregate Base (AB) and Reuse as Aggregate Subbase*

Pulverize all materials a maximum size of 1½ inch. Gradation requirements for the pulverized material shall be as follows:

Sieve Designation (Square Openings)	Percent by Weight Passing Sieve
1½ inch	100
¾-inch	80 – 100
No. 4	20 – 60
No. 50	10 – 40
No. 200	0 – 8

Compact pulverized AC and AB to a maximum dry density of 95 percent based on ASTM D 1557.

B. *Pulverize AC and AB and Crushed Rock Additive for use as Aggregate Base Course.*

Prior to pulverizing, the specified quantity of crushed rock ranging in size from 1 inch to No. 8 shall be uniformly placed on top of the existing AC. The existing rock, AC, and AB materials shall be pulverized and thoroughly mixed to a maximum size of 1½ inch. The gradation of the pulverized material shall be as shown in the following table:

Sieve Designation (Square Openings)	Percent by Weight Passing Sieve
1½ inch	100
1 inch	60-100
½ inch	40-80
No. 4	30-55
No. 16	15-35
No. 50	5-20
No. 200	2-8

Pulverized material shall be compacted to at least 100 percent of maximum dry density as determined by ASTM D 1557. The California Bearing Ratio (CBR) of the pulverized material, when compacted to 100% relative compaction and soaked, shall be no less than 70.

C. *New Aggregate Base Course*

Aggregate base course shall consist of crushed rock or crushed gravel and shall have at least 90 percent by weight of particles with at least 2 fractured faces and 97 percent by weight with at least one fractured face. If additional fines are required, they shall consist of material produced in the crushing operation. Crushed aggregate shall have a percent wear of not more than 45 at 500 revolutions as determined by ASTM C 131. Crushed aggregate, when compacted to a relative compaction of 100 percent of maximum dry density as determined by ASTM D 1557 Method D, shall have a California Bearing Ratio as determined by ASTM D 1883, compacted and soaked, of not less than 100 at 0.1 to 0.5 penetration inclusive. The gradation for crushed aggregate base shall be as follows

Sieve Designation (Square Openings)	Percent by Weight Passing Sieve
1½ inch	100
1 inch	70-95
1/2 inch	40-65
No. 4	23-43
No. 8	15-32
No. 30	9-20
No. 200	2-4

The portion of base course aggregate, including any blended material, passing the No. 4 sieve shall have a liquid limit of not more than 25 and a plasticity index of not more than 4 when tested in accordance with ASTM D 4318.

D. *Plant Mix Bituminous Pavements*

Bituminous material shall be polymer-modified PG64-28 PM conforming to the requirements of State of California Department of Transportation specifications, ASTM D 6373, and AASHTO M 320.

Coarse Aggregate. Coarse aggregate shall consist of sound, tough, durable particles, free from adherent films of matter that would prevent thorough coating and bonding with the bituminous material and be free from organic matter and other deleterious substances. The percentage of wear shall not be greater than 40 percent when tested in accordance with ASTM C 131. Sodium sulfate soundness loss shall not exceed 10 percent, or the magnesium sulfate soundness loss shall not exceed 13 percent, after five cycles, when tested in accordance with ASTM C 88.

Aggregate shall contain at least 70 percent by weight of individual pieces having two or more fractured faces and 95 percent having at least one fractured face. The area of each face shall be equal to at least 75 percent of the smallest mid-sectional area of the piece. When two fractured faces are contiguous, the angle between planes of fractures shall be at least 30 degrees to count as two fractured faces. Fractured faces shall be obtained by crushing.

Aggregate shall not contain more than 8 percent, by weight, of flat or elongated pieces, when tested in accordance with ASTM D 4791.

Fine Aggregate. Fine aggregate shall consist of clean, sound, durable, angular shaped particles produced by crushing stone or gravel that meets requirements for wear and soundness specified for coarse aggregate. The aggregate particles shall be free from coatings of clay, silt, or other objectionable matter and shall contain no clay balls. Fine aggregate, including any blended material for the fine aggregate, shall have a plasticity index of not more than 6 and a liquid limit of not more than 25 when tested in accordance with ASTM D 4318.

Natural (non-manufactured) sand may be used to obtain gradation of aggregate blend or to improve the workability of the mix. The amount of sand to be added will be adjusted to produce mixtures conforming to requirements of this specification. The fine aggregate shall not contain more than 10 percent natural sand by weight of total aggregates.

The aggregate shall have sand equivalent values of 35 or greater when tested in accordance with ASTM D 2419.

Composition of the mixture. The bituminous plant mix shall be composed of a mixture of at least three well-graded aggregates, filler if required, and bituminous material. The several aggregate fractions shall be sized, handled in separate size groups, and combined in such proportions that the resulting mixture meets grading requirements. The combined gradation of the aggregates shall be as shown in the following table:

Size	Percentage by Weight Passing Sieves
1-1/4 inch	---
1 inch	100
3/4 inch	90-100
1/2 inch	74-86
3/8 inch	63-75
No. 4	41-55
No. 8	30-38
No. 16	18-30
No. 30	12-18
No. 50	8-14
No. 100	6-11
No. 200	3-6
Bitumen percent: Airfield Pavements	4.5-7.0

The combined gradation when plotted on the 0.45 power plot shown in Figure 1 shall fall to the right (coarser than) of the curve shown in Figure 1 for the 1 or ¾-inch maximum size aggregate mix.

Deviations from final approved mix design for bitumen content and gradation of aggregate shall be within the limits specified below:

Sieve Size	Job Mix Formula
1 inch	0
3/4 inch	±6%
1/2 inch	±6%
3/8 inch	±6%
No. 4	±6%
No. 16	±5%
No. 50	±3%
No. 200	±2%
Asphalt Content	±0.45%

The bituminous mixture shall be designed using procedures contained in Chapter 5, Marshall Method of Mix Design of the Asphalt Institute Manual

Series No. 2 (MS-2), current edition, and shall meet the requirements of the table shown below.

MARSHALL DESIGN CRITERIA	
Test Property	Design Criteria
Number of Blows	75
Stability, Minimum Pounds	2,150
Flow, 0.01 in.	8-16
Percent Air Voids Surface	2-5
Voids, Filled with Bitumen, Percent	70-80
Percent Voids in Mineral Aggregate, Minimum	14
Stability/Flow Ratio – Minimum	200

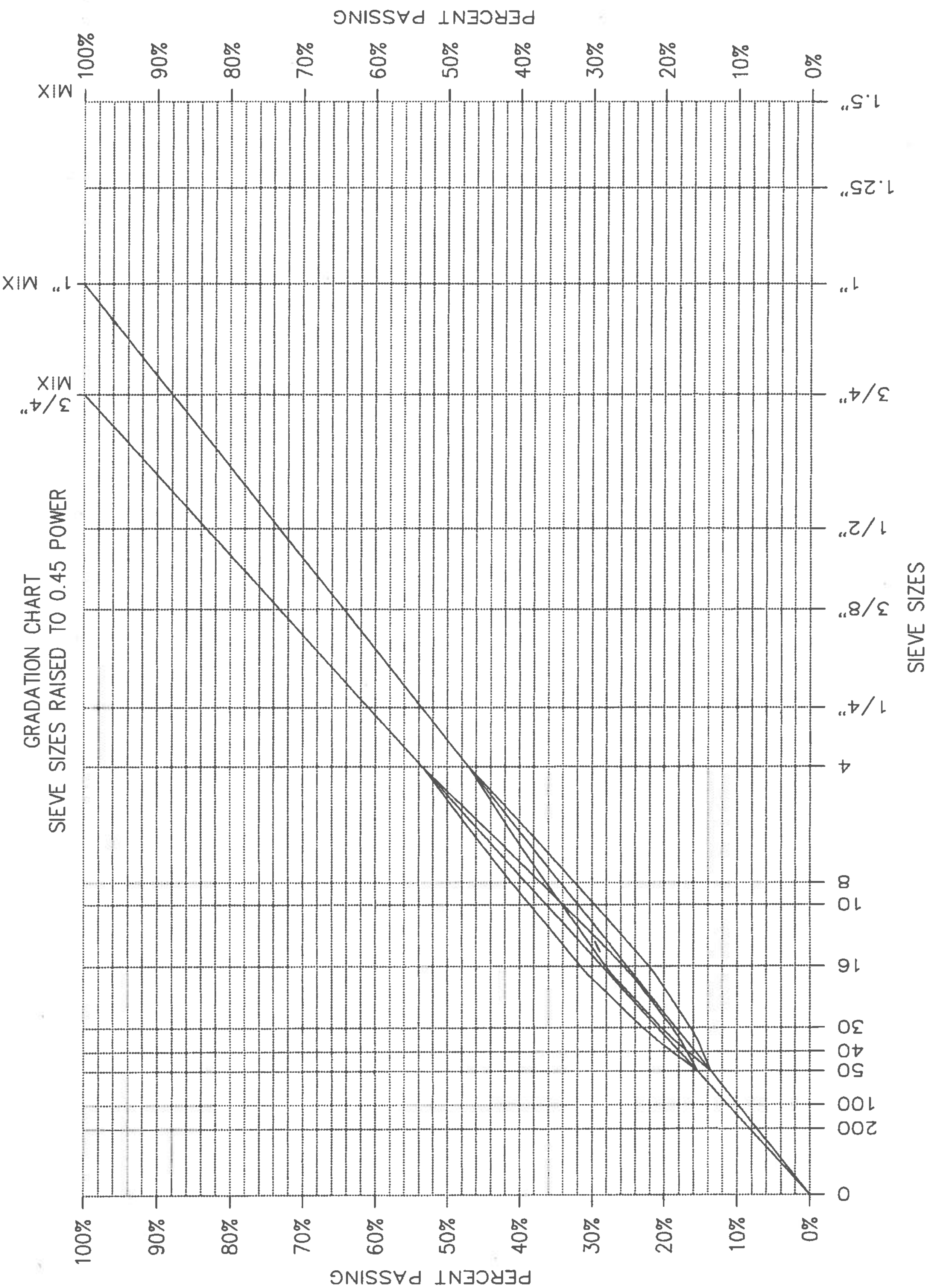

Exhibit 4-1 - Figure 1