Runway Feasibility Study: Runway Utilization Estimate Paper

This Runway Utilization Estimate Paper is intended to summarize the process by which operations are estimated on the different alternative runway scenarios for the Master Plan's Runway Feasibility Study. This Paper is organized into the following sections: project introduction, runway alternatives overview, pilot and operator interview summary, and runway use estimates with methodologies. The intent of this Paper is to receive feedback and concurrence on the runway use estimates, which will be used as input for noise and overflight analysis. This Paper will eventually be merged into the full Runway Feasibility Study. Appendices and Sections highlighted will be added later.

Introduction

The Truckee Tahoe Airport District (TTAD), sponsor of the Truckee Tahoe Airport, are updating the Airport Master Plan (AMP). The last AMP was completed between 2013 and 2015 with TTAD Board acceptance in 2015. The primary goal of this AMP Update is to evaluate the future disposition of the TRK airfield. This process will involve analysis of several runway development options and alternatives to assess and quantify the potential benefits to the community surrounding TRK in terms of reduced noise and annoyance and reduced aircraft overflight in areas of residential development. Ancillary benefit analysis may include the reduction of greenhouse gas emissions and enhanced safety. The preferred alternative from this analysis will likely be carried forward into an environmental project, and this AMP Update will be structured to facilitate the transition from planning to environmental analysis.

Before taking any action related to a third runway or alternative airfield configuration, TTAD must first update the adopted TRK Airport Layout Plan (ALP). Building justification for the airfield improvements requires an AMP Update with a Feasibility Study that shows the planning that supports the change, including how impacts to existing facilities that are Federal Aviation Administration (FAA) eligible will be met and how FAA airfield geometry standards will be followed. The AMP process will provide TTAD an opportunity to further evaluate the purpose for the third runway, perform public outreach, refine the layout of the conceptual runway and parallel taxiway, and determine how the runway will be integrated with the existing airfield and airport operations.

The AMP Update will also provide a means for TTAD to officially engage with the FAA. The FAA will not begin the federal environmental review process until the AMP Update is completed, and the agency has formally approved/signed the associated ALP. The FAA will also lead the environmental review for a federally sponsored project.

The AMP Update will be prepared following FAA standards and guidance so that the ensuing capital program is positioned for FAA funding eligibility, and so that TTAD continues to meet FAA Grant Assurances that they have previously accepted. Key FAA guidance includes:

- FAA *Advisory Circular (AC) 150/5300-138, Airport Design* (AC-13B)
- FAA *AC 150/5070-6B, Change 2, Airport Master Plans* (AC-6B)
- FAA *AC 150/5000-17, Critical Aircraft and Regular Use Determination*
- Federal Regulation Title 14 Part 77, "Objects Affecting Navigable Airspace, Section 25, Civil Airport Imaginary Surfaces" (Part 77)
- "Standard Operating Procedure for FAA Review and Approval of Airport Layout Plans" (SOP No. 2.00)
- "Standard Operating Procedure for FAA Review of Exhibit 'A' Airport Property Inventory Maps" (SOP No. 3.00)

RUNWAY FEASIBILITY STUDY AND PHASE 1

The AMP will be separated into two phases. Phase 1 will focus on the third runway with this Runway Feasibility Study. Phase 1 of the AMP Update also includes Airside Facility Requirements. Phase 2 will integrate the Phase 1 findings and further evaluate impacts based on the Preferred Runway Alternative and geometry on the airfield and existing facilities. Phase 2 of the AMP may also evaluate other airside facilities, landside facilities, land use, airport sustainability, and property interest considerations.

Runway Alternative Analysis

The Study established four alternatives that alter the runways and airfield composition and compared them to a no build scenario. These runway alternatives configurations will be evaluated on the scoring and criteria established to meet TTAD established goals.

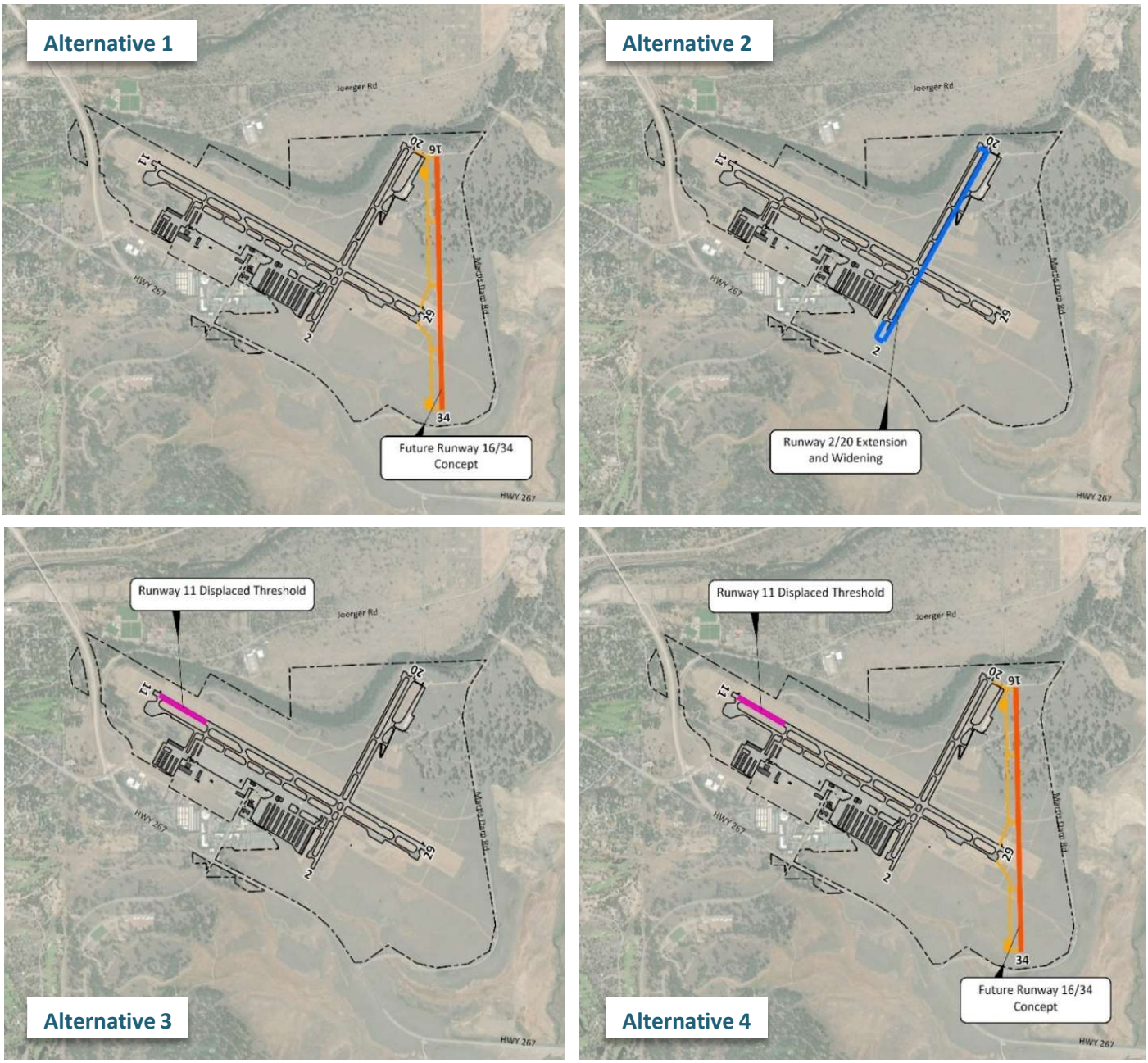
- Alternative 1 – Third Runway (Runway 16/34)
- Alternative 2 – Runway 02/20 Extension and Widening (2015 AMP preferred)
- Alternative 3 – Runway 11 Displaced Threshold
- Alternative 4 – Third Runway and Runway 11 Displaced Threshold
- Alternative 5 – No Build

The intended purpose of the Runway Feasibility Study is to identify the runway configuration that will result in the least noise and overflight impacts to the TRK community and residences. In addition, the alternatives will be compared for how each effects the greater TRK community.

RUNWAY ALTERNATIVES SYNOPSIS

This section describes the five runway alternatives analyzed in this Feasibility Study, including the No-Build scenario. Sketches for the four build alternatives are shown on **Figure 4-1**.

Figure 4-1: Runway Alternative Diagrams



Source: Mead & Hunt, Inc.

Alternative 1 – Third Runway (Runway 16/34)

Alternative 1 is the conceptual third runway. Runway 16/34 is 5,900 feet long and located on existing TRK property. To maintain standard runway safety areas, the threshold for Runway 29 shifts 485 feet to the west and declared distances are proposed on Runway 11/29 to maximize operational length.

Access to the approach end of Runway 34 is from Taxiway A and extending this beyond the arrival end of Runway 29 to a taxiway parallel to Runway 16/34. The approach end of Runway 16 may be accessed by crossing the approach end of Runway 20 from Taxiway G and extending the connector taxiway to a taxiway parallel to Runway 16/34.

Runway 16 would be equipped with a Lateral Precision with Vertical Guidance (LPV) approach with 1-mile visibility minimums and 355 feet above airport elevation decision altitude. This means an appropriately equipped aircraft may approach the runway when restrictions such as clouds and fog or precipitation limit reported visibility to not less than 1 mile. The decision altitude is the vertical height above the ground at which the aircraft may descend under those restricted visibility conditions before a decision to go around and utilize the missed approach procedures becomes required.

This design features a departure procedure for Runway 34 with a lower climb gradient than what is offered on Runway 02 today. This means the aircraft will need to climb vertically up 344 feet for each nautical mile over the ground it travels. More information on the proposed instrument procedures is provided in **SECTION**.

The Preliminary Siting Study for Runway 16/34 finalized the location of the third runway for this evaluation. The study analyzed Runway 16/34 to be located on existing TRK property, maintain standard runway safety areas and other critical design areas and surfaces, minimize impacts on the existing airfield geometry, and provide an optimal approach to Runway 16 and departure path off Runway 34. The study established the Runway 16/34 end points, length, and alignment used in the alternative analysis. Analysis results confirmed the geometry of Runway 16/34 is feasible without affecting Runway 02/20 geometry. The Preliminary Siting Study is included in **APPENDIX**.

A goal of constructing Alternative 1 is to shift traffic from the existing runways to Runway 16/34. By constructing this runway, air traffic will arrive and depart in airspace directly north of TRK and over fewer residences and lower terrain. Evaluation of this alternative will determine if this results in less noise and overflight impacts to residences.

Alternative 2 – Runway 02/20 Extension and Widening (2015 AMP preferred)

Extending and widening Runway 02/20 is the preferred alternative from the 2015 AMP. Alternative 2 proposes to lengthen Runway 02/20 from 4,650 feet to 5,055 feet and widen it from 75 to 100 feet. This alternative is included on the TTAD and FAA approved 2015 ALP.

The goal for construction of Alternative 2 is to entice more operations on this runway, especially by turboprops, and small- and medium-sized business jets. Extending beyond 5,000 feet opens this runway up for a larger class of aircraft that are currently operating on Runway 11/29, for example those with higher approach speeds or heavier aircraft. These aircraft are already operating at TRK and lengthening/widening Runway 02/20 would not open up TRK to larger aircraft since Runway 11/29 would still be the longest runway.

Extending beyond 5,000 feet also enables existing turboprop and turbine airport users to evaluate this surface while conducting planning activities such as runway use calculations. Currently, runways of less than 5,000 feet are seldom considered in the arrival planning process, which drive utilization of 02/20 downward. Aircraft able to use Alternative 2 will vary based on operating manuals, company standard operating procedures, and weather conditions at time of operation.

Alternative 3 – Runway 11 Displaced Threshold

Alternative 3 shortens the landing threshold on Runway 11 by 1,000 feet. No other changes to Runway 29 or Runway 02/20 are proposed with this alternative. With declared distances, the length for arrivals and departures on Runway 29 does not change, nor does the departure length on Runway 11.

Implementing Alternate 3 serves two purposes: keeping aircraft landing on Runway 11 higher over residences west of TRK, and with the shorter available landing length, enticing aircraft to circle to land on Runway 29 when this operation is safe to perform.

Alternative 4 – Third Runway and Runway 11 Displaced Threshold

Alternative 4 combines Alternative 1 and Alternative 3.

Alternative 5 – No Build

Alternative 5 maintains the existing runway configuration at TRK. This alternative is included for analysis as a control scenario to compare with the four build alternatives.

ALTERNATIVE RUNWAY UTILIZATION ESTIMATES

This section details runway utilization estimates for operations on the alternative runway scenarios. Estimating runway use on the runway alternatives is important to help evaluate the different alternatives. The use estimates will be used for input into models that will produce analysis of noise and overflight impacts.

Implementation of changes to runway lengths or widths will likely change operating patterns. For instance, if Runway 16/34 is constructed, some operations will likely shift to this third runway from the existing runways to utilize the direction and instrument approaches. Likewise, if Runway 2/20 is lengthened and widened, operations will likely move to this runway to take advantage of the longer/wider runway.

The runway utilization estimates were developed through interviews with TRK operators and pilots who use the airfield and supplemented with analysis of weather data. Interviews had the specific goal of understanding how many operations may be shifted from the existing runways to Runway 16/34 or an extended Runway 02/20 in the various Alternative scenarios. This will help quantify the estimated number of operations on the conceptual runway alternatives. These operations will be used for input into models that will produce analysis of noise and overflight impacts.

This section is not intended to present a goal of operations moving to any of the alternative runway configurations. Rather this section describes the process to estimate operations on the alternative runways that will be used for noise and overflight impacts and analysis later in the Study. The full process is described below, with a wind data summary, pilot interview summary, air traffic control (ATC) observations, and the technical steps taken to calculate the utilization estimates.

Prevailing Wind Data Summary

A Wind Analysis Study was completed for TRK in 2021 that details historical wind coverage by month (2001 – 2020) and daytime wind data by month showing wind direction over 3-hour intervals throughout the day. The complete Wind Analysis Study is included in **APPENDIX**. The following observations and trends in wind patterns at TRK were found.

Wind Data by Month

- With the exception of the late spring and summer months, prevailing winds are out of the southwest, ranging from 190- to 220-degrees true north.
- From May through August, winds are more variable shift and shift to the west-southwest, 170- to 270-degrees true north.
- Daytime calm wind conditions are more common in the winter months, with 69 percent of daytime observations indicating calm winds in January. The month with the least amount of calm wind daytime observations is June with 38 percent of observations.
- Calm wind (0 to 3 knots) conditions are more common during nighttime hours (11 p.m. – 6 a.m.) than daytime hours.
- Throughout March and April, winds are most common in the 2:00 p.m. – 5:00 p.m. interval, when winds are out of the southwest.
- Between May and September, winds are most prevalent in the 5:00 p.m. – 8:00 p.m. interval, when winds are out of the west. Winds also shift from the south-southwest to the west from the late morning to the evening during these warm months.

Note on Wind Data and Headings:
Wind data is recorded and presented in this Study in true north headings. Runway end designations are based on the magnetic heading at the airport.

The magnetic declination at Truckee is 13° 7' East ± 0° 22' changing by 0° 5' West per year. (NOAA Magnetic Declination calculator)

Wind data source: The ASOS Network (https://mesonet.agron.iastate.edu/ASOS/). Wind direction data in degrees from true north.

Pilot and Operator Interviews

- **Part 91**: An operator only permitted to provide flights for non-commercial purposes, as defined and regulated by the FAA. Under Part 91, the pilot-in-command is the final authority. Part 91 can be owner flown or operated or by a professional pilot or aviation operator.
- **Part 91K:** Fractional ownership of an aircraft or aircraft fleet operated as not-for-hire services under Part 91 rules.
- **Part 135:** An operator who provides commuter and on-demand operations. This may include commercial, scheduled, and non-scheduled aircraft operations such as private air charter and air taxi flights. Part 135 operations have a much more detailed and stricter operational and legal framework than a Part 91 operator. The FAA requires a Part 135 operator to have a full team of management personnel to oversee all aspects of organization.

The pilot and operator group survey covered operations on the proposed alternative scenarios. Pilots were asked about operations on existing runways, on conceptual Runway 16/34, on an extended Runway 02/20, and with a displaced threshold on Runway 11. The pilots and operators account for just under 5,200 annual operations, or about 15 percent of annual operations. This information was used to estimate operations under these scenarios. The information that follows summarizes the pilot interviews and highlights recurring themes and patterns.

Operators each offered thorough and detailed answers. Local pilots based at TRK, transient pilots, and Part 91 and Part 135 (charter or air taxi) operators were interviewed and represented those who base at TRK, conduct itinerant operations, and operate various aircraft types (piston to larger corporate jets).

Table 4-1 profiles each interviewee. Some operators requested they remain anonymous; therefore, operator identities are not included.

Table 4-1: Airplane Design Group

Operator ID[1]	Est. Annual Operations (2021)	Aircraft Model(s)	Based at TRK?	Type of Operation
1	2,200	PC-12	No	Part 135
2	30	Phenom 300	Yes	Part 91
3	300	Turboprops and jets – varies	Yes	Part 91
4	300	PC-12	No	Part 135
5	775	Challenger 300, King Air 350, PC-12, FD 328, Lear 75	No	Part 135
6	320	King Air 350, Citation Excel, Citation X, Hawker 400, CJ3, Citation Sovereign, Gulfstreams, Challenger 300	No	Part 91K
7	100	PC-12, Occasional jets	No	Part 91
8	1,030	Globals, Phenom 300, Citations (Xs, Svg, Lat, Long), Challenger (350, 650), G450	No	Part 91K
9	140		No	Part 91

1 – Operator ID correlates with the number in the full Operator Survey APPENDIX
Source: Mead & Hunt

Operations on Existing Runways

All operators interviewed gave the similar perspective on operating at TRK on the existing runway. Landing and taking off at TRK is complicated process and runways, and the approach and departure routes flown depend on many factors. These include wind, cloud cover, runway length, terrain, runway conditions (contaminated runways – wet or icy), temperature, and takeoff weight, among others. Other factors include air route traffic control demands and a diverse fleet mix of gliders, skydivers, and small slow moving light aircraft.

At TRK, operations are further complicated by high density altitudes during summer months. Density altitude basically means the air is thinner because of heat, altitude, and humidity. Higher density altitude means an aircraft will need longer runways and/or taking on less weight when departing, usually balancing fuel or payload. During high density altitude conditions an aircraft will:

- Accelerate slower on takeoff from reduced power production.
- Require a longer takeoff roll to achieve the indicated airspeed required to develop lift on the wing.
- Climb slower as a result of reduced power production and degraded lift performance.

With these factors in mind, interviewed pilots all stated they will select the runway that provides the safest option to land or depart. Operators offer the following on existing runways at TRK.

Existing Operations

- Operator consensus indicated the preferred runway for arrivals and departures is Runway 29. The primary reason was this runway offers the longest length and aligns with winds during summer months during the day. Runway 11 was next choice, and Runway 20 for arrivals (when possible or winds dictate) and Runway 02 for departures under calm winds.
- During calm wind conditions (0-3 knots), operators overwhelming indicated that Runway 29 is the preferred runway for arrivals and departures. One operator did indicate that Runway 11 is also preferred for arrivals due to the direct Instrument Approach Procedure (IAP) and avoiding the need to circle to land on Runway 29.
- Jets and some turboprops utilize the Runway 20 IAP to access TRK, and then circle to land on Runway 29 if Runway 02/20 is too short for the specific aircraft operating specifications.
- The operators indicated they will land on Runway 20 when winds favor this runway and their aircraft is able to use the shorter runway. By favorable, they mean winds that are stronger and more aligned directly with the runway true north heading of 210 degrees, thus reducing the ground speed of the aircraft and the resultant ground roll-out upon landing.
- Multiple pilots stated they try to be good community members and use Runway 02/20 today to try and distribute impacts.
- The maximum tailwind used for landings varies from zero knots (never land with a tailwind) up to 10 knots. This answer was dependent on aircraft performance, pilot comfort, wind variability, and numerous other factors.

Other Findings

Other responses as summarized below cover procedures, engagement with ATC, and preference for when to use what runways.

- Pilots and operators indicated they are familiar with and follow noise abatement procedures.
- Pilots and operators revealed they will listen to ATC direction for runway use when this is suggested during calm wind conditions and will use the suggested runway if the pilot finds it to be safe.
- Some operators also have detailed preferences on which runways to operate on at TRK. For instance, some pilots will choose, under calm and clear conditions, to operate from the runway end closest to their hangar. The airport has intentionally congregated frequent users (power users) at the east end of the airfield in Hangar N & P rows, which by default drives some traffic to Runway 11.
- Multiple operators reiterated that origin or destination can dictate runway of use, especially during calm winds and clear days. For origins and destinations to the west and south, using Runway 11/29 is preferred.
- When visibility is low (1 mile or below), most operators stated this equates to a snowstorm in the area, and operating at TRK would not be allowed under company policy.
- Chemical deicing operations would significantly increase operations by charter operators.

Runway 16/34

The operators offered a range of viewpoints on when and how Runway 16/34 may be used without consensus on operational patterns, should Runway 16/34 be constructed. Each operator viewed this runway objectively, and each stressed that selecting a runway to land or depart on at TRK depends on many factors. Each operator indicated that aircraft performance, weight, wind, temperature, and origin or destination will also factor into which runway to use at TRK. Operators offer the following on operations on the conceptual Runway 16/34.

General Operations on Runway 16/34

- About half the operators stated a continuing preference for using Runway 11/29 for operations, due to length, lack of access (taxiing time from the terminal area), and lack of facilities near Runway 16/34.
- Over half of the operators indicated the IAP LPV and Departure Procedures (DP) are not enough to entice operations on Runway 16/34. Operators indicated that a longer runway length supersedes these procedures for the preferred runway at TRK.
- Conversely, two major Part 135 operators did express that Runway 16/34 would be the preferred runway at TRK, due to the improved IAP LPV and DP procedures.

Arrivals on Runway 16

- Most operators did indicate the preference to use Runway 16 for arrivals when winds are directly out of the south and during times of low visibility.
- Two operators indicated a preference for using the proposed Runway 16 IAP direct and landing on Runway 16 instead of using the Runway 20 LP Approach and circling to land on Runways 11 or 29. The Runway 16 IAP takes away the need to circle to land, assuming 5,900 feet is suitable for landings.

Departures on Runway 34

- Multiple operators indicated the DP on Runway 34 allow aircraft to take on more weight, but the tradeoff might not be worth departing on 34 over 29.
- Multiple operators indicated the DP on Runway 34 allow for more operations on days with higher temperatures and density altitudes.

Operations During Calm Winds

- Pilots and operators revealed they will listen to ATC direction for runway use when this is suggested during calm wind conditions and will use suggested runway if this is found to be safe by the pilot.
- A few operators indicated that incentives or policies offered by the District may help entice operations on Runway 16/34 during calm winds. Some ideas suggested were offering a fuel discount or reduced transient fees, a rent discount for based aircraft (similar to the voluntary "Fly Quiet" policy) when using this runway, or encouraging use by only plowing this runway in winter months. These are ideas are from the operators, and this Study does not endorse or suggest these policies for TTAD.

Other Findings

The pilot group also offered opinions regarding impacts to operations in terms of continuity and demand on Runway 16/34 and the facilities at TRK. They added further suggestions to incentivize use of Runway 16/34.

- Operators were split on whether constructing Runway 16/34 would increase operations. However, most charter operators indicated its construction would result in TRK being open more often.
- Charter operators stated the demand to operate to and from TRK is constant, but sometimes weather conditions push operations to Reno, limiting the demand. An LPV approach and a new runway would likely keep the Airport open more often and reduce the need to divert to RNO.
- One charter operator suggested they have demand to operate a 30-passenger regional jet during peak season and believes if facilities are built to accommodate this, then these operations would likely happen.

- Operators indicated if more facilities are built near Runway 16/34 (fuel, fixed base operators, hangars), this may also entice operations on this runway.
- One charter operator estimated that constructing Runway 16/34 with the LPV approach could increase their activity by about 20-30 percent.
- Multiple operators reiterated that the origin or destination may dictate runway of use, especially during calm winds and clear days. Using Runway 16/34 benefits operations with origins or destinations to the north or east. However, for origins and destinations to the west and south, the preference is to use Runway 11/29.

Runway 02/20 Extension and Widening

Operators also asked how extending and widening Runway 02/20 would affect operating patterns at TRK. Similar to Runway 16/34, opinions varied. Each operator stressed again that aircraft performance, weight, wind, temperature, and origin or destination will factor into which runway to use at TRK. Operators offer the following on operations on the conceptual Runway 02/20.

General Operations on Lengthened/Widened Runway 02/20

- The majority of operators indicated lengthening Runway 02/20 beyond 5,000 feet opens this runway up to larger cabin classes that currently only use Runway 29 for arrivals and departures. Repeatedly, comments indicated this improvement will make Runway 02/20 more available for turbine operations and will increase turboprops operations on this runway.
- Two operators opined that lengthening and widening Runway 02/20 makes more sense than constructing Runway 16/34, based on cost and practicality.
- One operator stated their preference continues to be using the longer Runway 11/29 with a crosswind of 10 knots over a lengthened Runway 02/20.
- Operators suggested that increasing length on Runway 02/20 in 500-foot increments, up to 6,000 feet, may offer more benefits and entice more use. Multiple operators suggested prioritizing the study of the ultimate buildout and total length for Runway 02/20 over Runway 16/34.
- One operator indicated that taxiing is an issue for utilizing Runway 02/20 but does support widening and lengthening Runway 02/20 over Runway 16/34 and believes this will increase safety.
- One charter operator indicated they prefer Runway 16/34 over lengthening and widening Runway 02/20.

Runway 11 Displaced Threshold

Operators were questioned on the effects of displacing the Runway 11 threshold 1,000 feet to the east and shortening the landing distance available on Runway 11 to 6,000 feet. The intention of this is to keep aircraft landing on Runway 11 higher over residences west of TRK and persuade aircraft to circle to land on Runway 29 when this operation is safe to perform.

- No operator was in favor of this, as they stated this proposal reduces landing length and decreases safety margin. Multiple operators indicated that shortening the landing distance on Runway 11 just for noise is a bad idea.
- This action reduces the ability to land with a tail wind on Runway 11.
- This is unlikely to significantly affect operations, except by larger jet aircraft using the Runway 11 IAP and circling to land on Runway 29 during safe conditions.

Air Traffic Controller Observations

TRK on-site ATC staff also provided input on how a conceptual Runway 16/34 and extended/widened Runway 02/20 may be used.

Existing Conditions

- ATC sets up flow patterns early in the day, based on weather, ceiling, and wind forecasts as well as actual winds aloft data over the Sierra ridge crests. Sierra winds may be different than what is on the ground at TRK and may dictate operating patterns.
- Seventy-five percent of operations are to and from the west, and therefore request or utilize Runway 11/29 and Runway 29 for departures during calm winds.
- From ATCT perspective, ultimately the pilots determine which runways to land and takeoff from.

Operations on Runway 16/34

- ATC staff iterated that using Runway 16/34 may not be efficient, especially during peak operation times as demand and the resultant flow of traffic will be coming from the west and south and have a vector of travel that will benefit from using Runway 11 or 29.
- ATC staff stated that they could be trained to use and direct operations on Runway 16/34 if needed.
- Operators using the proposed IAP to Runway 16 to access TRK from the west may choose not to fly the entire approach. Rather, once the Airport is in view, the operator may choose to break off the IAP and fly visually using landmarks near the I-80 scales then turn to join a right base to land on Runway 16. Operators approaching from the south will need to overfly the area and execute a 180-degree procedure turn to gain a heading to line up for a Runway 16 landing. This procedure is considered a circle to land maneuver. Various methods including use of the IAP may accomplish this directional change.

TRK ATC staff indicated two possible calm wind operation flows:

- Arrivals on Runway 16 and departures on Runway 29
- Arrivals on Runway 29 and departures on Runway 34

TRK ATC staff listed pros and cons regarding the timing and manner of use of Runway 16/34, including a concern on contra flow operations during IFR conditions. This includes potential for opposite direction operations with arrivals on Runway 16 and departures on Runway 29. The instrument procedures may conflict north of the airport and would require IFR separation when this flow is in use. More coordination with Oakland Center would be needed to help with this flow.

Instrument Flight Rules

ATC indicated that IFR operation days at TRK are actually rare and reiterated pilot observations that if visibility is at 1 mile or less, TRK is closed usually due to a snowstorm. IFR/VFR operation days are as follows (from ATC):

- VFR operations: 300 days per year
- IFR Operations: 20 days per year for all aircraft
- Marginal IFR: 40 days per year for all aircraft
- IFR operations separation: every day with itinerant operations

The numbers above represent operations on days that IFR procedures are completed to landing. On VFR days, Part 91, Part 135, and most itinerant operators to TRK will fly IFR for access to TRK airspace using IFR procedures with a flight plan. Once the Airport is in sight, the operator may cancel the IFR flight plan and land straight-in or circle to land on another runway when conditions warrant this.

Alternative Runway Utilization Calculations

The runway analysis as part of this Feasibility Study is meant to produce objective data and results for the alternative scenarios for the TTAD Board to evaluate. The utilization calculations in this section quantify the expected number of operations for each alternative. These operations will be used for input into models that will produce analysis of noise and overflight impacts.

The development of the runway utilization estimates uses information provided by pilots and ATC and supplemented with analysis of weather data. The numbers represent the maximum-use scenario and were vetted with TRK and ATC staff. Assumptions on how each alternative runway will be used are provided for each scenario.

Operations Data Background

The Vector operations data set from June 1, 2020, to May 31, 2021, was agreed to be used for base year operations in the Feasibility Study during scoping meetings. This data contains a full year of operations with time, runway, and aircraft type. The data represents typical flow on the existing runways: there was no runway construction, no major fires or smoke impacts, and operations had recovered to pre-2020 Covid shutdown numbers.

TTAD classifies jet categories based on published maximum takeoff weights, as follows:

- Jet 2: <12,500 lbs.
- Jet 3: 12,500 – 20,000 lbs.
- Jet 4: 20,000 – 50,000 lbs.
- Jet 5: > 50,000 lbs.

These operations are summarized in **Table 4-2** below and will be used as part of Alternative 5, the No Build scenario. These operations do not include helicopter, glider, or touch-and-go operations.

Table 4-2: Existing Operations Summary

Aircraft Type	Runway				Total
	11	29	02	20	
Arrivals					
Piston	498	5,100	872	2,661	9,131
Turboprop	246	2,177	158	704	3,285
Jet 2-3	171	1,123	12	218	1,524
Jet 4-5	243	887	10	99	1,239
Total	1,158	9,287	1,052	3,682	15,179
Departures					
Piston	585	4,277	2,806	2,087	9,755
Turboprop	278	2,392	310	323	3,303
Jet 2-3	121	1,373	29	50	1,573
Jet 4-5	14	1,220	18	22	1,274
Total	998	9,262	3,163	2,482	15,905
Grand Total	**2,156**	**18,549**	**4,215**	**6,164**	**31,084**

Source: TRK Vector operations data (June 1, 2020, to May 31, 2021)
Note: Operations do not include helicopter, glider, or touch-and-go operations

The Vector operations data was then matched with weather data over the same time period. This data was matched to show how many operations occur during various wind and weather conditions, and when these conditions would favor operations on Runway 16/34 or the extended/widened Runway 02/20.

Runway 16/34 Estimates

The following describes the process to estimate operations on Runway 16/34. A summary of estimate utilization and assumptions for these totals are included at the end of this section.

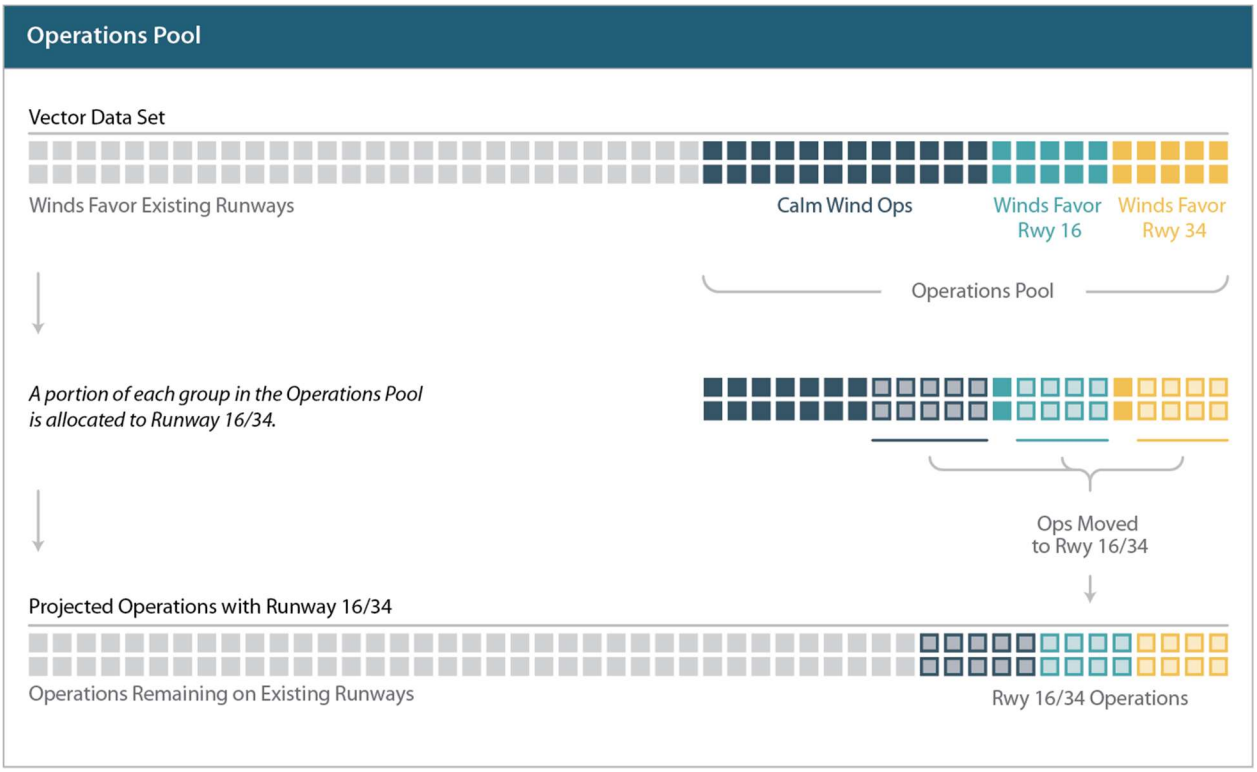
Operations Pool

An operations pool was created from the 2020-2021 Vector data set to help quantify the number of operations that may be moved to Runway 16/34 for alternative analysis. The operations pool represented scenarios when weather conditions favor Runway 16/34 operations:

- Calm winds
- Winds out of south (Arrivals on 16)
- Wind out of north (Departures on 34)
- Low visibility

These scenarios enable a total of 15,537 operations (7,205 arrivals and 8,132 departures) in the operations pool to be considered for Runway 16/34. The Runway 16/34 operations pool did not include operations when winds favor the existing runway alignments. A graphical representation of moving operations from the operations pool to Runway 16/34 is shown in **Figure 4-2**.

Figure 4-2: Operations Pool Scenario



Source: Mead & Hunt, Inc.

Calm Winds (0 to 3 knots)

The calm wind operations pool includes all operations at TRK from the 2020-2021 Vector data set when winds are 3 knots or below. The data det shows 6,534 total arrivals and 7,532 total departures during calm winds. From this information and feedback from operators and ATC staff, the following calm wind use percentages were applied to the calm wind operations pool:

- During calm wind conditions, 30 percent of piston arrivals move to Runway 16, and 30 percent of piston departures, to Runway 34.
- During calm wind conditions, 40 percent of turboprop and jet (all classes) arrivals move to Runway 16, and 40 percent of turboprop and jet (all classes) departures move to Runway 34.

Winds Out of South (Arrivals on 16)

The operations pool for arrivals on Runway 16 include arrivals when the winds are out of the south, at true north headings of 160-190 degrees. This provides a 30-degree window where winds favor arrivals on Runway 16. Operations from the following scenarios in the Vector data set, which occurred on existing runways, were moved to Runway 16 for this analysis.

- During conditions when winds are out of the south, 160-190 true heading, and over 5 knots, 80 percent of arrivals by piston and turboprop move to Runway 16.
- During conditions when winds are out of the south, 160-190 true heading, and over 10 knots, 85 percent of arrivals by jets (all classes) move to Runway 16.

Wind Out of North (Departures on 34)

The operations pool for departures on Runway 34 include departures when the winds are out of the north, at true north headings of 340-010 degrees. This provides a 30-degree window where winds favor departures on Runway 34. Operations from the following scenarios in the Vector data set, which occurred on existing runways, were moved to Runway 34 for this analysis.

- During conditions when winds are out of the north, 340-010 true heading, and over 5 knots, 80 percent of departures by piston and turboprops move to Runway 34.
- During conditions when winds are out of the north, 340-010 true heading, and over 10 knots, 85 percent of departures by jets (all classes) move to Runway 34.

Low Visibility

Operations during low visibility conditions are rare at TRK. Operators indicated that when visibility minimums are at 1.5 miles or less, this usually equates to a storm in the TRK area, and the airport is likely closed. During these conditions, itinerant operators will either not operate at TRK, or choose to land at RNO. Because these conditions are rare (less than 80 operations found in the operation data set), a separate low visibility operations pool was not evaluated. However, while these operations are rare, these may increase slightly with implementation of an LPV approach. Also, during low ceiling conditions, winds are typically calm, and these operations may be captured in the calm wind operations pool.

Estimated Runway 16/34 (Alternative 1) Operation Summary

The numbers presented above summarize which operations from the Vector data set were moved from the Operations Pool to Runway 16/34, summarized in the **Table 4-3**.

Table 4-3: Runway 16/34 Use Estimate Matrix

Scenario	Operation	Aircraft	Wind Speed (knots)	Wind Direction	Total Ops	Variables		Change In Operations					
						+16 use %	+34 use %	11	29	02	20	16	34
Calm Wind	Arrivals	Piston	0-3	N/A	3,957	30%	0%	-61	-801	-96	-228	1,187	0
		TP			1,370	40%	0%	-51	-400	-27	-70	548	0
		Jet 2-3			678	40%	0%	-30	-214	-1	-27	271	0
		Jet 4-5			529	40%	0%	-49	-153	-1	-9	212	0
	Departures	Piston			5,042	0%	30%	-106	-638	-616	-153	0	1,513
		TP			1,376	0%	40%	-64	-386	-85	-15	0	550
		Jet 2-3			620	0%	40%	-26	-212	-8	-2	0	248
		Jet 4-5			494	0%	40%	0	-193	-3	-2	0	198
Winds Out of South 160-190 (ops on 16)	Arrivals	Piston	>5	160-190 True north	426	80%	0%	-58	-55	-16	-212	341	0
		TP	>5		173	80%	0%	-27	-47	-1	-63	138	0
		Jet 2-3	>10		38	85%	0%	-9	-8	0	-15	32	0
		Jet 4-5	>10		34	85%	0%	-11	-12	0	-6	29	0
Winds Out of North 340-010 (ops on 34)	Departures	Piston	>5	340-010 True north	428	0%	80%	-6	-152	-156	-29	0	342
		TP	>5		149	0%	80%	-7	-96	-16	0	0	119
		Jet 2-3	>10		10	0%	85%	0	-9	0	0	0	9
		Jet 4-5	>10		13	0%	85%	0	-9	-2	0	0	11
Totals:					**15,337**			**-504**	**-3,386**	**-1,028**	**-831**	**2,758**	**2,990**

Source: TRK Vector operations data (June 1, 2020, to May 31, 2021) and Mead & Hunt
Note: Operations do not include helicopter, glider, or touch-and-go operations
Totals may not add due to rounding

The justification for these operations moving from the existing runways to Runway 16/34 assumes the following:

- Aircraft operators will utilize Runway 16/34 for arrivals and departures when winds favor this runway.
- Operators utilizing the Runway 16 IAP will land on this runway instead of circling to land on Runway 11/29.
- Operators will use the Runway 34 DP when needed for taking on more weight for longer range or departing during low visibly conditions.
- Operators may prefer to use Runway 16/34 under visual conditions when arriving from the east or north of TRK and departing to a destination to the east or north of TRK.
- A public information campaign or incentives from TTAD policies to use Runway 16/34 will be implemented. This Study is not suggesting these items as policy.
- Direction from ATC will help move aircraft to Runway 16/34 during calm wind conditions. It is assumed that to be used during calm winds, ATC staff will need to provide direction, and the operator will need to accept that direction.
- Not all operators would depart from 34 due to taxiing distance. This is reflected in the assumed use percentages.

TRK ATC staff listed pros and cons for the use of Runway 16/34, including a concern on contra flow operations during IFR conditions. However, the proposed shift of operations from existing runways to Runway 16/34 during calm winds was found to be acceptable by TRK ATC staff. ATC stated these may be maximum-use operations numbers, but with direction from ATC and non-conflicting IFR flow, this may be achieved. TRK ATC staff indicated two possible calm wind operation flows:

- Arrivals on Runway 16 and departures on Runway 29
- Arrivals on Runway 29 and departures on Runway 34

Table 4-4 summarizes the total operations for noise and overflight analysis for Alternative 1.

Table 4-4: Alternative 1 Operations Summary

Aircraft Type	Runway						Total
	11	29	02	20	16	34	
Arrivals							
Piston	379	4,244	760	2,221	1,528	0	9,131
Turboprop	168	1,729	130	571	686	0	3,285
Jet 2-3	132	901	11	176	304	0	1,524
Jet 4-5	183	722	9	84	241	0	1,239
Total	862	7,597	910	3,052	2,758	0	15,179
Departures							
Piston	474	3,487	2,034	1,905	0	1,855	9,755
Turboprop	207	1,910	209	308	0	670	3,303
Jet 2-3	95	1,152	21	48	0	257	1,573
Jet 4-5	14	1,018	14	20	0	209	1,274
Total	790	7,567	2,277	2,281	0	2,990	15,905
Grand Total	**1,652**	**15,163**	**3,188**	**5,333**	**2,758**	**2,990**	**31,084**

Source: TRK Vector operations data (June 1, 2020, to May 31, 2021) and Mead & Hunt
Note: Operations do not include helicopter, glider, or touch-and-go operations
Totals may not add due to rounding

Extended Runway 02/20 Estimates

The following describes the process to estimate operations on Runway 02/20 if lengthened to 5,055 feet and widened to 100 feet. A summary of estimate utilization and assumptions for these totals are included at the end of this section.

Operations Pool

The operations pool was created from the 2020-2021 Vector data set to help quantify the number of operations that may be moved from Runway 11/29 to an extended Runway 02/20 for alternative analysis. The operations pool represents scenarios when weather conditions favor more operations on an extended Runway 02/20:

- Calm winds
- Winds out of southwest
- Wind out of northeast

These scenarios enable a total of 19,018 operations (9,046 arrivals and 9,972 departures) in the operations pool to be considered for an extended Runway 02/20. The Runway 02/20 operations pool did not include operations when winds favor Runway 11/29. This process is similar to the graphical representation of moving operations from the operations pool as shown in **Figure 4-2** above.

Calm Winds (0 to 3 knots)

The calm wind operations pool includes all operations at TRK from the 2020-2021 Vector data set when winds are 3 knots or below. The operations data det shows 6,534 total arrivals and 7,532 total departures at TRK during calm winds for all current runway surfaces. Operations from the following calm wind operations in the Vector data set that occurred on Runway 11/29 were moved to Runway 02/20 for this analysis.

- During calm wind conditions, 20 percent of arrivals by piston, 15 percent of arrivals by turboprop, and 5 percent of arrivals by jets (classes 2 and 3) move to Runway 02.
- During calm wind conditions, 30 percent of arrivals by piston, turboprop, and jets (classes 2 and 3) and 5 percent of arrivals by jets (classes 4 and 5) move to Runway 20.
- During calm wind conditions, 30 percent of departures by piston, turboprop, and jets (classes 2 and 3) and 5 percent of departures by jets (classes 4 and 5) move to Runway 02.
- During calm wind conditions, 20 percent of departures by piston, 15 percent of departures by turboprop, and 5 percent of departures by jets (classes 2 and 3) move to Runway 20.

Winds Out of Southwest (Operations on 20)

The pool for operations on Runway 20 includes arrivals and departures when the winds are out of the southwest at true north headings of 190-230 degrees. This provides a 40-degree window where winds favor operations on Runway 20. Operations from the following scenarios in the Vector data set, which occurred on Runway 11/29, were moved to Runway 02/20 for this analysis.

- During conditions when winds are out of the southwest, 190-230 true heading, and over 5 knots, 85 percent of arrivals and departures by piston and turboprop move to Runway 20
- During conditions when winds are out southwest, 190-230 true heading, and over 10 knots, 70 percent arrivals and departures by jets (classes 2-3), and 25 percent arrivals and departures by jets (classes 4-5) move to Runway 20.

The 40-degree window for Runway 02/20 analysis is larger than the 30-degree window included for Runway 16/34. This is due to less runway options (four) under the Runway 02/20 analysis, compared to six runway options for the Runway 16/34 analysis. With more runway options, operators may be more discriminate in choosing a runway based on winds.

Winds Out of Northeast (Operations on 02)

The pool for operations on Runway 02 includes arrivals and departures when the winds are out of the northeast, at true north headings of 010-050 degrees. This provides a 40-degree window where winds favor operations on Runway 02. Operations from the following scenarios in the Vector data set, which occurred on Runway 11/29, were moved to Runway 02/20 for this analysis.

- During conditions when winds are out of the northeast, 010-050 true heading, and over 5 knots, 85 percent of arrivals and departures by piston and turboprop move to Runway 02.
- During conditions when winds are out of the northeast, 010-050 true heading, and over 10 knots, 70 percent of arrivals and departures by jets (classes 2-3), and 25 percent of arrivals and departures by jets (classes 4-5) move to Runway 02.

Estimated Runway 02/20 Extension/Widening (Alternative 2) Operation Summary

The scenarios presented above describe which operations were moved from the Operations Pool to an extended Runway 02/20, summarized in **Table 4-5**.

Table 4-5: Extended Runway 02/20 Use Estimate Matrix

Scenario	Operation	Aircraft	Wind Speed (knots)	Wind Direction	Total Ops	Variables		Change In Operations			
						+02 use %	+20 use %	11	29	02	20
Calm Wind	Arrivals	Piston	0-3	N/A	3,957	20%	30%	-102	-1336	575	863
		TP			1,370	15%	30%	-57	-450	169	338
		Jet 2-3			678	5%	30%	-26	-187	30	183
		Jet 4-5			529	0%	5%	-6	-19	0	25
	Departures	Piston			5,042	30%	20%	-177	-1063	744	496
		TP			1,376	30%	15%	-72	-435	338	169
		Jet 2-3			620	30%	5%	-23	-186	179	30
		Jet 4-5			494	5%	0%	0	-24	24	0
Winds Out of SW 190-230 (ops on 20)	Arrivals	Piston	>5	190-230 True north	959	0%	85%	-14	-158	0	173
		TP	>5		367	0%	85%	-15	-107	0	122
		Jet 2-3	>10		114	0%	70%	-12	-28	0	40
		Jet 4-5	>10		93	0%	25%	-5	-11	0	16
	Departures	Piston	>5		864	0%	85%	-15	-177	0	192
		TP	>5		377	0%	85%	-11	-197	0	208
		Jet 2-3	>10		105	0%	70%	-4	-57	0	62
		Jet 4-5	>10		106	0%	25%	0	-25	0	25
Winds Out of NE 010 - 050 (ops on 02)	Arrivals	Piston	>5	010-050 True north	688	85%	0%	-14	-300	315	0
		TP	>5		249	85%	0%	-8	-155	162	0
		Jet 2-3	>10		21	70%	0%	0	-12	12	0
		Jet 4-5	>10		21	25%	0%	0	-4	4	0
	Departures	Piston	>5		693	85%	0%	-12	-214	226	0
		TP	>5		244	85%	0%	-11	-145	156	0
		Jet 2-3	>10		26	70%	0%	0	-18	18	0
		Jet 4-5	>10		25	25%	0%	0	-4	4	0
Totals:					**19,018**			**-584**	**-5,312**	**2,955**	**2,940**

Source: TRK Vector operations data (June 1, 2020, to May 31, 2021) and Mead & Hunt
Note: Operations do not include helicopter, glider, or touch-and-go operations. Totals may not add due to rounding

The justification for these operations moving from Runway 11/29 to an extended/widened Runway 02/20 assumes the following:

- By lengthening and widening Runway 02/20, it is assumed this will drive operations from Runway 11/29 to this runway.
- Extending Runway 02/20 to over 5,000 feet and widening by 100 feet will open this runway up to larger aircraft classes (business jets and turboprops) that currently only use Runway 29 for arrivals and departures.
- Operators using the Runway 20 LP IAP with aircraft in these larger classes will land on Runway 20 instead of circling to land on Runway 11/29.
- Direction from ATC will help move aircraft to Runway 02/20 during calm wind conditions.
- Under calm winds, more arrival operations are moved onto Runway 20 with the existing LP approach, contrasted with fewer arrivals on Runway 02 with a visual approach.
- Arrival operations on Runway 20 are expected from aircraft arriving from the south or southwest under VFR conditions and landing directly on this runway.
- Under calm winds, more departures operations are moved onto Runway 02, which is supported with an existing DP, contrasted with fewer departures on Runway 20 due to terrain limitations.

Table 4-6 summarizes total operations for noise and overflight analysis for Alternative 2.

Table 4-6: Alternative 2 Operations Summary

Aircraft Type	Runway				Total
	11	29	02	20	
Arrivals					
Piston	382	3,493	1,386	3,870	9,131
Turboprop	168	1,469	405	1,243	3,285
Jet 2-3	129	866	55	474	1,524
Jet 4-5	232	853	14	140	1,239
Total	912	6,681	1,860	5,727	15,179
Departures					
Piston	412	2,967	3940	2437	9,755
Turboprop	188	1,603	888	624	3,303
Jet 2-3	91	1,080	256	146	1,573
Jet 4-5	14	1,167	46	47	1,274
Total	705	6,816	5,130	3,254	15,905
Grand Total	**1,616**	**13,497**	**6,990**	**8,981**	**31,084**

Source: TRK Vector operations data (June 1, 2020, to May 31, 2021) and Mead & Hunt
Note: Operations do not include helicopter, glider, or touch-and-go operations
Totals may not add due to rounding

Runway 11 Displaced Threshold Estimates

The following describes the process to estimate what operations will shift if Runway 11 is displaced 1,000 feet, reducing landing distance on this runway. With declared distances, the length for arrivals and departures on Runway 29 does not change, nor does the departure length on Runway 11. The displacement will likely only affect arrival operations, primarily by turbine aircraft, on Runway 11. A summary of estimate utilization and assumptions for these totals are included at the end of this section.

Operations Pool

The operations pool was created from the 2020-2021 Vector data set to help quantify the number of operations that may be moved from Runway 11. The operations pool represents scenarios when weather conditions warrant fewer operations on Runway 11 for arrivals:

- Calm winds
- Winds out of the west, 280-320 true heading, with tailwinds that would affect landing distance on Runway 11

These scenarios enable a total of 6,750 arrival operations in the pool for consideration of moving off Runway 11 with a displaced threshold. Arrival operations when winds favor Runway 11, operations on Runway 02/20, and operations on Runway 29 were not included in this pool. Under this scenario the length of Runway 02/20 will not change, so turbine arrivals are assumed to shift to Runway 29 rather than this runway.

Calm Winds (0 to 3 knots)

The calm wind operations pool includes all operations at TRK from the 2020-2021 Vector data set when winds are 3 knots or below. Based on information and feedback from operators and ATC staff, the following use percentages were applied to the calm wind operations pool:

- During calm wind conditions, 25 percent of arrivals by jets (classes 2 and 3) move from Runway 11 to Runway 29.
- During calm wind conditions, 50 percent of arrivals by jets (classes 4 and 5) move from Runway 11 to Runway 29.

Winds Out of West-Northwest (True Heading 280-320)

This pool of operations includes turbine aircraft using Runway 11 with a tailwind, and shortening the landing distance will require these aircraft to circle to land on Runway 29. Runway 02/20 is not considered for these operations since this is a shorter runway.

- During conditions when winds are out of the west-northwest, 280-320 true heading, and over 5 knots, 90 percent of arrivals by jets (classes 2 and 3) move from Runway 11 to Runway 29.
- During conditions when winds are out of the west-northwest, 280-320 true heading, and over 10 knots, 90 percent of arrivals by jets (classes 4 and 5) move from Runway 11 to Runway 29.

Analyzing the operations pool for arrival operations on Runway 11 with tailwinds show no operations by all jet classes in the Vector data set. This indicates that turbine aircraft do not land on Runway 11 with a tailwind. Therefore, no operations were moved to Runway 29 under this scenario.

Estimated Runway 11 Displaced Threshold (Alternative 3) Operation Summary

The scenarios presented above describe which operations were moved from the Operations Pool to Runway 29 with a displaced threshold on Runway 11, as summarized in **Table 4-7**.

Table 4-7: Runway 11 Displaced Threshold Use Estimate Matrix

Scenario	Operation	Aircraft	Wind Speed (knots)	Wind Direction	Total Ops	Variables	Change In Operations			
						+02 use %	11	29	02	20
Calm Wind	Arrivals	Jet 2-3	0-3	N/A	3,957	25%	-19	19	0	0
		Jet 4-5			1,370	50%	-61	61	0	0
Totals:					**19,018**		**-80**	**80**	**0**	**0**

Source: TRK Vector operations data (June 1, 2020, to May 31, 2021) and Mead & Hunt
Note: Operations do not include helicopter, glider, or touch-and-go operations
Totals may not add due to rounding

The justification for these operations moving from Runway 11 with a displaced threshold to Runway 29 assumes the following:

- By shortening the landing distance available on Runway 11, turbine aircraft that require landing distances over of 6,000 feet or more during calm wind conditions would circle to land on Runway 29.
- No operations by piston or turboprops are expected to move from Runway 11 since these aircraft classes can generally land on a 6,000-foot runway under calm conditions.
- Arrival operations by turbine aircraft on Runway 11 with a tailwind are rare at TRK, and no operations were moved to Runway 29 under these conditions (winds out of 280-320 and greater than 10 knots).

Table 4-8 summarizes the total operations for noise and overflight analysis for Alternative 2.

Table 4-8: Alternative 3 Operations Summary

Aircraft Type	Runway				Total
	11	29	02	20	
Arrivals					
Piston	382	3,493	1,386	3,870	9,131
Turboprop	168	1,469	405	1,243	3,285
Jet 2-3	129	866	55	474	1,524
Jet 4-5	232	853	14	140	1,239
Total	912	6,681	1,860	5,727	15,179
Departures					
Piston	412	2,967	3940	2437	9,755
Turboprop	188	1,603	888	624	3,303
Jet 2-3	91	1,080	256	146	1,573
Jet 4-5	14	1,167	46	47	1,274
Total	705	6,816	5,130	3,254	15,905
Grand Total	**1,616**	**13,497**	**6,990**	**8,981**	**31,084**

Source: TRK Vector operations data (June 1, 2020, to May 31, 2021) and Mead & Hunt
Note: Operations do not include helicopter, glider, or touch-and-go operations
Totals may not add due to rounding

Alternative 4 would combine the use percentages of Alternative 1 (**Table 4-4**) and Alternative 3 (**Table 4-8)**.

NEXT STEPS

The next step is to receive TTAD feedback or concurrence of the operations totals in **Tables 4-4, 4-6, and 4-8**. The estimated operations totals will be used for input into the noise model. This will result in quantifying noise and overflight impacts that will be used for the runway alternative analysis. This Paper will eventually be merged into the full Runway Feasibility Study. Appendices and Sections highlighted will be added later.