Appendix G

Airfield Capacity Analysis

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APPENDIX G: Airfield Capacity Analysis

This appendix summarizes the assumptions and methodologies used to develop the airfield capacity and runway length analyses for the Environmental Assessment (EA) for the Dallas Love Field Airport Runway 13R-31L Reconstruction and Associated Improvements. An airfield and runway analysis was required to determine whether DAL could accommodate the No Action Alternative fleet mix during the time that Runway 13R-31L is anticipated to be closed for reconstruction. During the reconstruction time, the Airport would be operating with a single air carrier runway (Runway 13L-31R) that is shorter than Runway 13R-31L.

G.1 Background

Alternatives that would maintain Runway 13R-31L open at shorter operational lengths for phased construction were initially considered. However, discussions with the City, the airlines, and other key stakeholders determined that closing the runway completely for a shorter overall construction period would be optimal from both a construction and airport operations standpoint. It is estimated that Runway 13R-31L would remain closed for nine months, from approximately mid-February 2021 to mid-November 2021.

The Runway 13R-31L closure would restrict aircraft operations to the east runway – Runway 13L-31R. In addition, Runway 13L-31R (7,752 feet long) is approximately 1000 feet shorter than Runway 13R-31L (8,800 feet long). Therefore, analysis of the Proposed Action Alternative requires an assessment of the ability of Runway 13L-31R to accommodate all of DAL's forecast aircraft operations and to accommodate the landing and takeoff distance requirements of the larger aircraft in the No Action fleet mix.

G.2 Airfield Capacity Analysis

The spreadsheet model developed for Airport Cooperative Research Program (ACRP) Report 79 – *Evaluating Airfield Capacity*, was used to estimate the hourly capacity of a single-runway system at DAL. The model was developed as part of an ACRP project to calculate capacities and annual service volumes for non-complex situations. It considers key factors such as aircraft separation, aircraft fleet mix by weight, and aircraft approach speeds. It then estimates hourly aircraft throughput capacities assuming an arrivals-only operation, a departures-only operation, and a mixed arrivals and departures operation. The model calculates these capacities for both visual meteorological conditions (VMC) and instrument meteorological conditions (IMC). **Table 1** summarizes the hourly capacities at DAL with a single runway under alternative operational configurations and weather conditions.

Table 1
Hourly Capacity Summary with Single Runway at DAL

	2015 Master Plan		EA Forecast Update	
	VMC	**IMC**	**VMC**	**IMC**
Arrivals Only Capacity	39	29	38	28
Departures Only Capacity	62	56	62	56
Total Mixed Operations Capacity	58	58	57	57

Source: ACRP Report 79 and HNTB analysis.

Table 1 shows the forecast hourly capacity prepared for the EA (see *Appendix E, Forecast Fleet Mix*) and the 2015 Master Plan hourly capacity for comparison. Although the two forecasts are similar in many respects, the 2015 Master Plan projected a significantly larger percentage of small aircraft. Despite the differences in fleet mix, the hourly capacity estimates in Table 1 are very similar.

The throughput capacity of a single runway system depends on whether the Airport is accepting aircraft arrivals only, aircraft departures only, or both aircraft arrivals and departures. The hourly capacity is reduced when the Airport is operating in arrivals only mode because of the increased aircraft separation requirements. In addition, the increased visibility in VMC conditions permits reduced aircraft separation and greater hourly arrivals capacity compared to IMC conditions. In a departures only mode, the hourly capacity is also slightly greater under VMC conditions than under IMC conditions. The VMC advantage essentially disappears in a mixed operations mode.

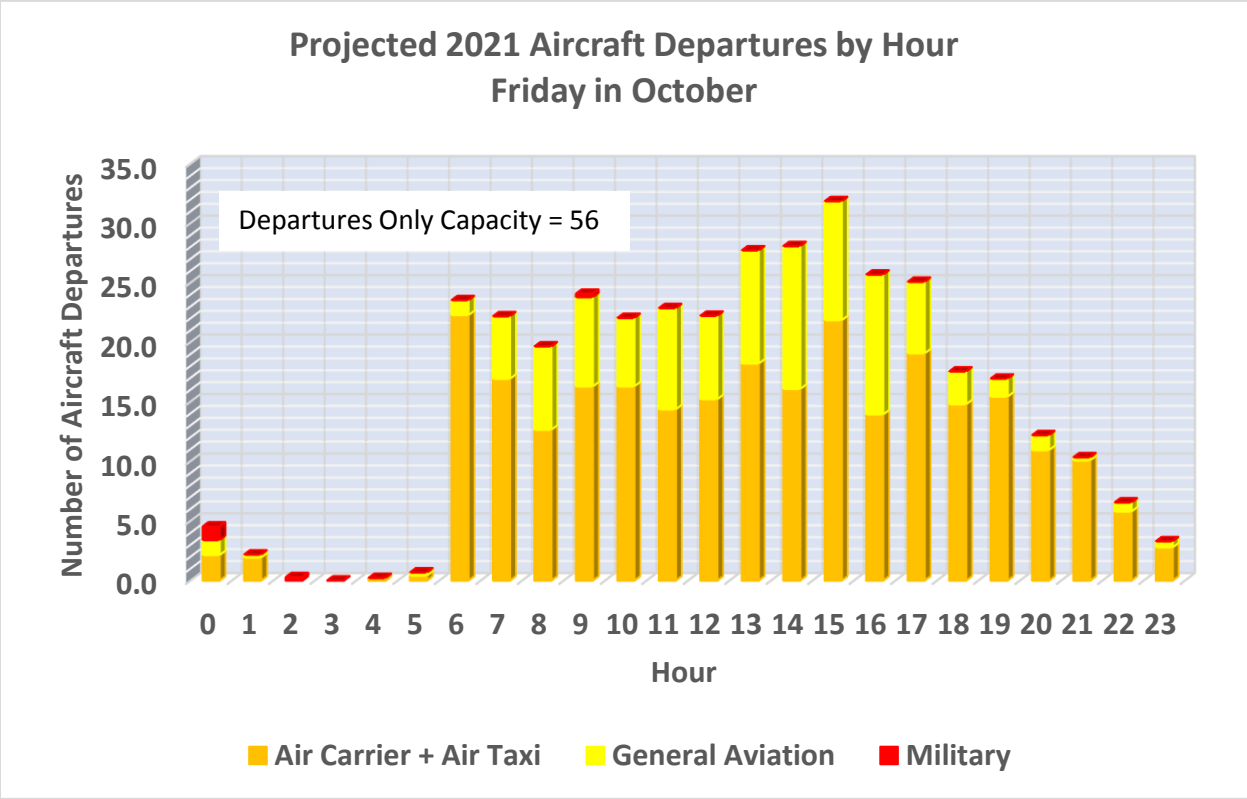
An hourly operations forecast was derived from the annual forecast in *Appendix E, Forecast Fleet Mix*, to determine the ability of a single runway at DAL to accommodate peak demand. The hourly distributions were calculated using the following approach:

1. Historical DAL seasonal factors from the FAA OPSNET database were applied to the 2021 operations forecast to calculate 2021 operations by month.
2. The estimated 2021 monthly operations were distributed by day of the week based on DAL daily distributions in the FAA OPSNET data.
3. The day of week data estimates were further distributed by individual hour using FAA Distributed OPSNET data for DAL for each day of the week.

The hourly operations forecasts were organized by aircraft category, including commercial (air carrier plus air taxi), general aviation and military. October is the busiest month at DAL, and Thursday is typically the busiest day of the week in terms of total daily aircraft operations. Friday is slightly less busy than Thursday in terms of total daily operations but has the greatest hourly peaks. Therefore, an average Friday in October was selected for the analysis.

Figure 1 shows projected aircraft departures for an average Friday in October 2021. Departures are projected to peak at 32 between 3:00 and 4:00 pm, well below the departures only capacity of 56 hourly operations.

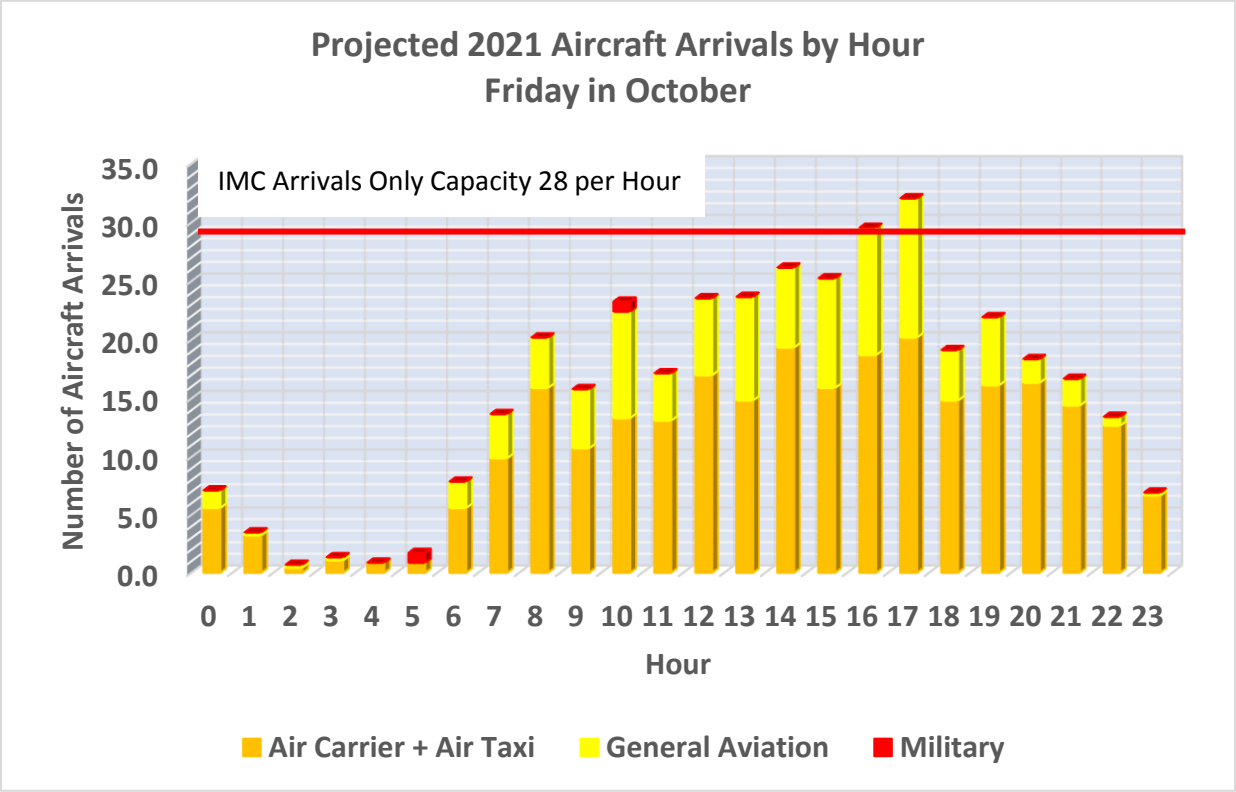
Figure 1



Source: FAA Distributed OPSNET and HNTB analysis.

Figure 2 shows projected hourly aircraft arrivals for a Friday in October 2021. The hourly peak is 32 aircraft arrivals, like the departures peak, but between 5:00 and 6:00 pm. However, the arrivals only capacity is much less than the departures only capacity. Arrivals only IMC capacity (28 operations per hour) is exceeded between 4:00 and 5:00 pm (29 arrivals) and again between 5:00 and 6:00 pm. Note that IMC capacity is exceeded in only two hours of the busiest day in the busiest month, and that under VMC conditions which are much more common, there is still ample capacity (38 operations per hour).

Figure 2

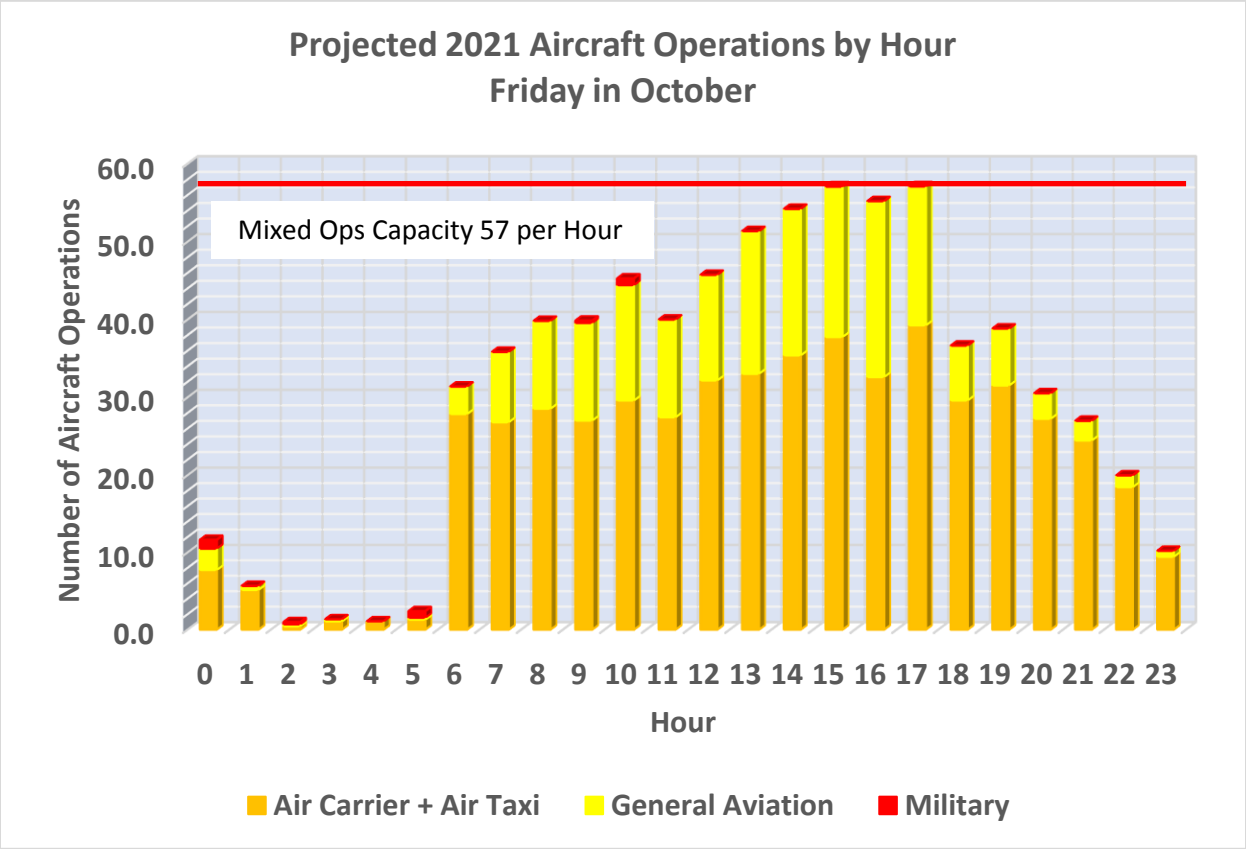


Source: FAA Distributed OPSNET and HNTB analysis.

Figure 3 shows projected total aircraft operations (arrivals plus departures) for a Friday in October 2021. The total hourly peak is 57 operations between 3:00 and 4:00 pm and again between 5:00 and 6:00 pm. This matches both the IMC and VMC hourly capacity for mixed operations. The mixed operation mode is the most common at DAL.

Based on the above analysis, DAL will be able to accommodate projected demand with a single runway even during peak periods. Therefore, it is considered unlikely that air carriers or other operators at the Airport would reduce operations or change schedules as a result of the temporary runway shutdown.

Figure 3



Source: FAA Distributed OPSNET and HNTB analysis.

G.3 Runway Length Analysis

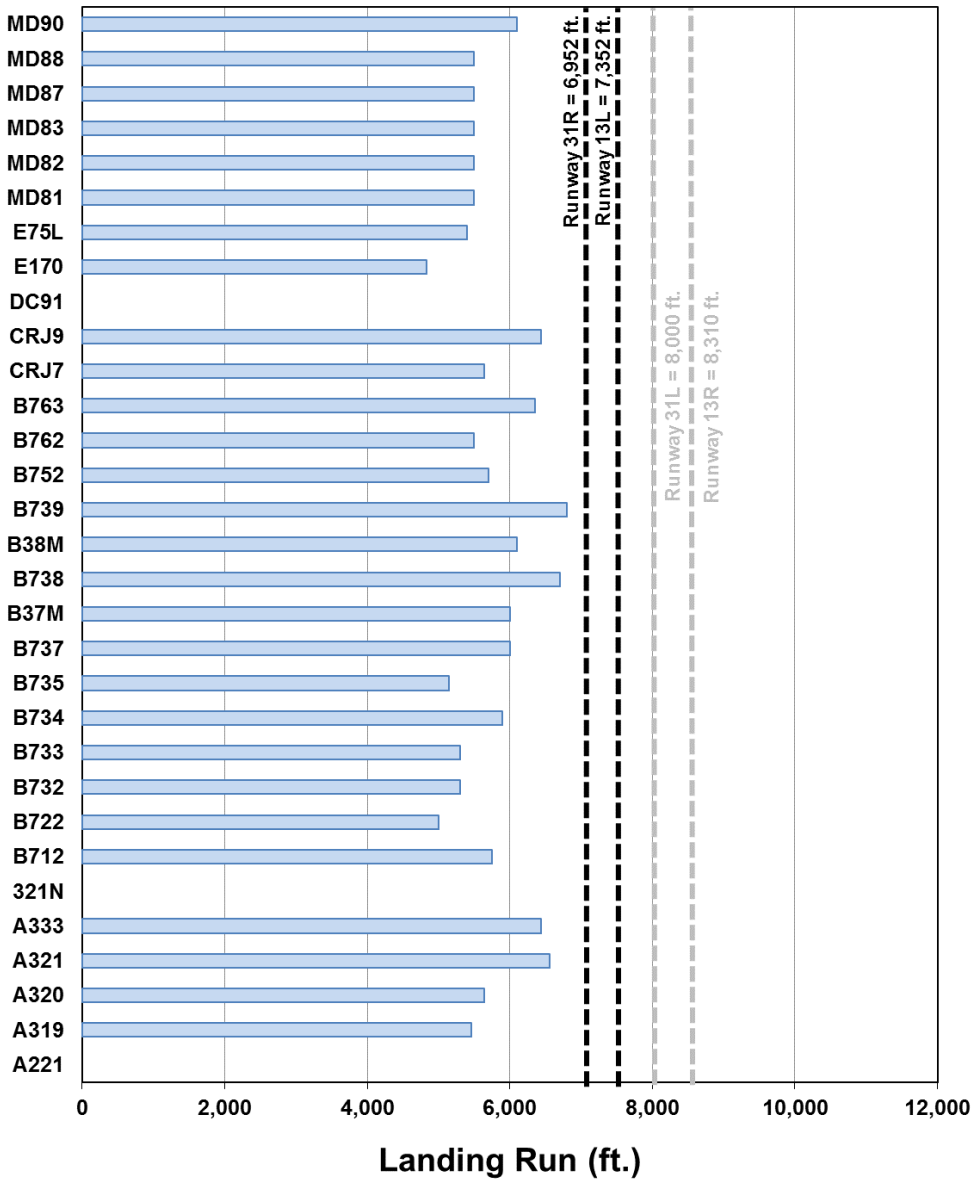
As noted in Section G.1, Runway 13L-31R is approximately 1,000 feet shorter than Runway 13R-31L. Therefore, the ability of the shorter runway to accommodate the No Action Alternative fleet mix needs to be evaluated.

The runway requirements of the commercial aircraft in the 2021 No Action Alternative fleet mix were calculated using factors from aircraft manufacturer planning manuals. These factors take average summer high temperature, airport altitude, and runway slope into account to generate landing and take-off requirements at various aircraft payloads.

Figure 4 shows the landing requirements for the projected 2021 DAL fleet mix. These calculations are for a wet runway with good braking characteristics, which requires a greater landing length than needed under dry conditions. The Boeing 737-800 (B738)_and the Boeing 737-900 (B739) have the greatest runway landing length requirements. The analysis indicates that Runway 13L-31R has adequate landing length to accommodate these aircraft.

Figure 4

DAL Arrival Runway Length Analysis
Maximum Landing Weight - LDA

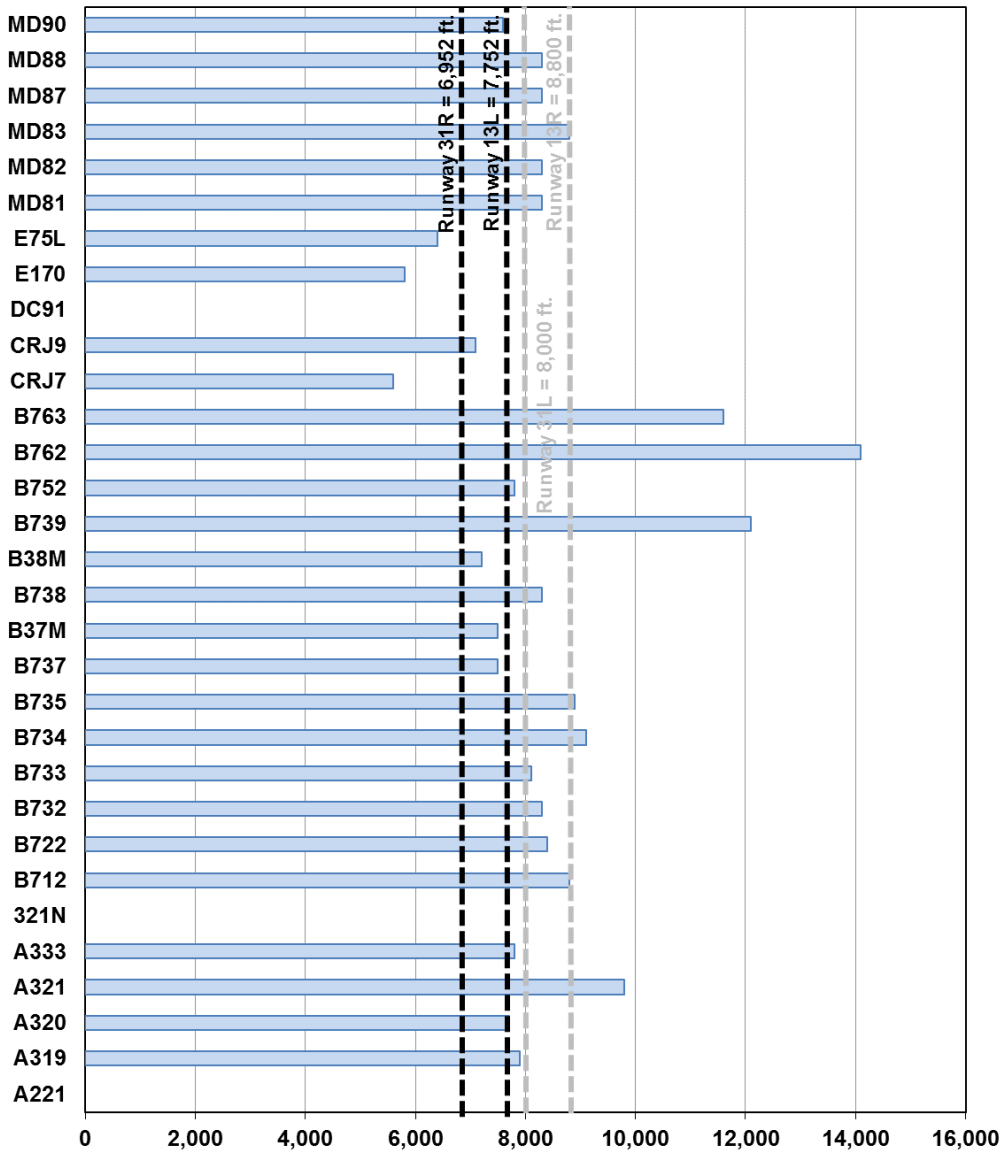


Source: HNTB analysis.

Figure 5 shows the aircraft departure requirements assuming a maximum take-off weight (MTOW). Aircraft with full passenger, cargo, and fuel payloads are heavier and therefore require a greater takeoff distance than aircraft that are not fully loaded. As shown, several commercial aircraft that operate at DAL have a takeoff length requirement at maximum payload that exceed the length of Runway 13L-31R. The aircraft types with the greatest runway takeoff length requirements, specifically the Boeing 767-200, 767-300, 737-900, and Airbus A321 currently average less than one operation per day at DAL and are projected to average less than one operation per day in 2021 under the No Action Alternative. In addition, almost all aircraft at DAL fly to destinations less than 1,500 nautical miles distant, and therefore do not require full fuel loads.

Figure 5

DAL Departure Runway Length Analysis
Maximum Takeoff Weight (MTOW) - Future ASDA [100% MTOW]

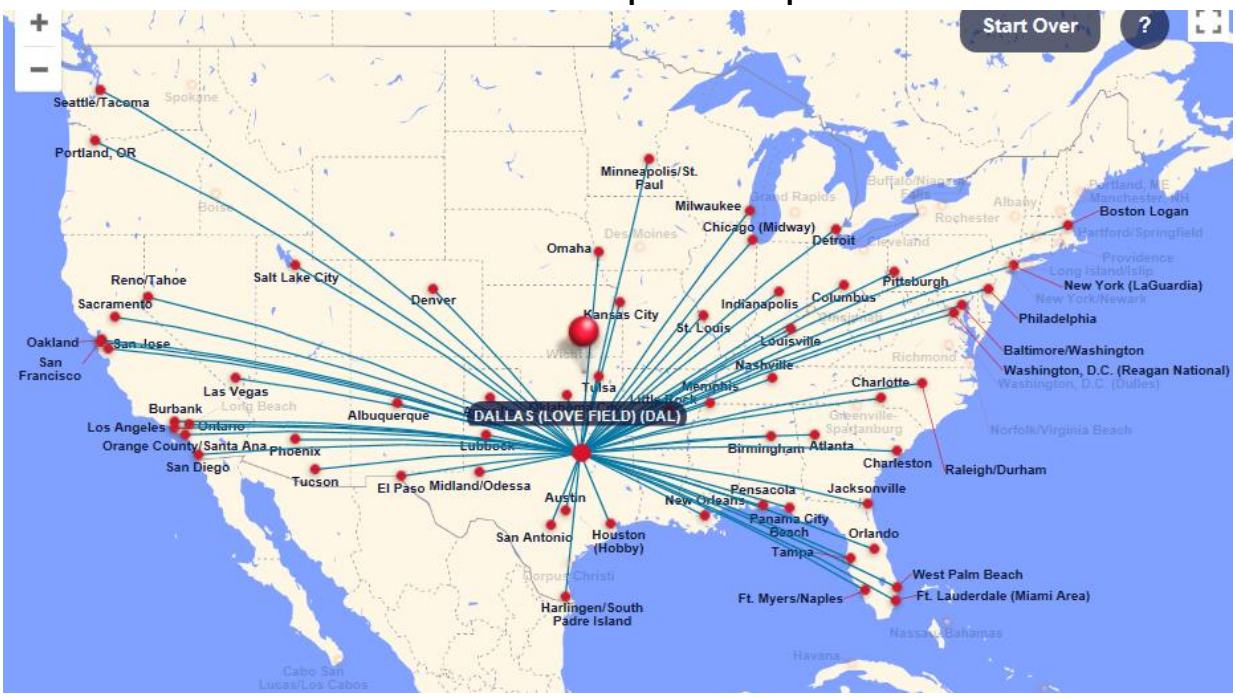


Source: HNTB analysis.

Among the aircraft in regular use at DAL (more than one operation per day), the Boeing 737-800 has the greatest runway takeoff length requirement. Southwest Airlines is the primary operator of this aircraft and **Figure 6** shows their nonstop flights from DAL. Seattle-Tacoma (SEA) is the most distant nonstop market at 1,451 nautical miles. An additional analysis of the Boeing 737-800 runway takeoff requirements using the fuel load required to access the continental United States from DAL (1,600 nautical miles) was undertaken. With a full passenger and baggage load (100 percent), and sufficient fuel and reserves to fly 1,600 nautical miles, it was determined that a Boeing 737-800 would require 6,400 feet for takeoff. This is substantially less than the effective available takeoff distance for Runway 31R (6,952 feet) or Runway 13L (7,752 feet). Consequently, the forecast 2021 Proposed Action Alternative fleet mix is not expected to be affected if Runway 13L-31R is the only available runway. Note that these calculations assume the average high temperature during the summer months at DAL. At other times, such as morning, evening, spring, or fall, temperatures would be cooler and runway length requirements would be reduced. Occasionally temperatures could be higher, in which case the airlines could limit passenger loads on those days as opposed to changing their schedule during the construction period.

Figure 6

SWA Nonstop Route Map



DAL – SEA	**1451 NM**
DAL – PDX	**1413 NM**
DAL – BOS	**1351 NM**
DAL – OAK	**1276 NM**
DAL – LGA	**947 NM**

G.4 Conclusion

As noted in Sections G.2 and G.2, restriction of operations to a single runway - Runway 13L-31R is not expected to restrict the number of aircraft operations or the fleet mix at DAL. The results of these analysis were presented before key stakeholders, including the City and the major airlines at DAL on November 6, 2018, and received concurrence. Therefore, it was determined that the 2021 Proposed Action Alternative operation levels and fleet mix would be the same as the 2021 No Action Alternative operation levels and fleet mix.