APPENDIX B
Noise Modeling Technical Report

Appendix B describes the noise modeling input parameters of the No-Action Alternative as well as the Proposed Action Alternative. **Section B.1** reviews the methodology used to conduct the noise analysis, **Section B.2** describes the development of input data and the sources for the No-Action Alternative, and **Section B.3** describes input data development for the Proposed Action Alternative. **Section B.4** describes the sensitivity analysis that was performed to determine if additional operations being added to the RNAV (GPS) RWY 4L Instrument Approach Procedure (IAP) could cause a significant impact at Boston Logan International Airport (the Airport).

All departure and approach procedures at the Airport as they were flown during the baseline timeframe (November 1, 2018 – October 31, 2019) of the Environmental Assessment (EA) were retained in the No Action Alternative. Under the No Action Alternative, input track data from the baseline timeframe was analyzed to create 275 backbones representing each individual traffic flow (including helicopters) to and from all runways at the Airport.

The Proposed Action Alternative model reflects Airport operations during the baseline timeframe inclusive of the implementation of the RNAV (GPS) RWY 4L Instrument Approach Procedure (IAP). Implementation of the IAP has airport efficiency benefits in certain weather conditions, the effects of which are included in the noise model and the details of which are included in **Section B.3**. With the exception of traffic that is moved to the proposed RNAV (GPS) RWY 4L IAP and offsetting departure traffic, the Proposed Action Alternative maintains the same runway usage as the No Action Alternative. This method provides a means to evaluate the Proposed Alternative as the sole cause of any modeled impacts.

B.1 Methodology

The methodology used in the noise analysis of the proposed RNAV (GPS) RWY 4L IAP for the Airport follows established Federal Aviation Administration (FAA) guidelines in both the construction of a representative data model and the evaluation of noise impacts. Model construction and execution relied heavily on guidance provided in the FAA document titled "*Guidance on Using the Aviation Environmental Design Tool (AEDT) to Conduct*

Environmental Modeling for FAA Actions Subject to NEPA" updated 10/27/2017.[1] AEDT is the FAA's approved model for assessing noise and emissions at civilian airports. AEDT has been used for environmental review of aviation noise and emissions impacts since 2012 and is used for 14 CFR Part 150 studies, National Environmental Policy Act (NEPA) EAs and Environmental Impact Statements (EISs). For this EA, AEDT was used as an integrated model to estimate the total noise impact of all modeled aircraft flights.

AEDT model settings such as weather, terrain, and atmospheric absorption were chosen based on the guidance provided in this document. In particular, the average annual weather at the Airport during the baseline timeframe was used, as was National Elevation Dataset (NED) GridFloat terrain, and the SAE-ARP-5534 setting for atmospheric absorption.

As per the guidance, model input data suitable for AEDT modeling was collected and aggregated into an operationally representative form known as an Annual Average Day (AAD) indicating the expected mix of aircraft operations over the course of a representative "average" day. The model inputs, which consist of flight tracks and specific aircraft operations utilizing these tracks, were imported into the AEDT model and evaluated for noise exposure by using AEDT settings required by FAA guidance as described above. Key attributes of an aircraft operation relevant to noise modeling are the aircraft type, the operation type (arrival or departure), the runway used, the ground track used, the time of day (day or night), and the stage length. Stage length is an indication of aircraft weight and is typically inferred by knowing the aircraft type and the trip distance. For the purposes of noise modeling, multiple aircraft operations possessing identical values for these key attributes were aggregated.

In the noise analysis AEDT version 3b was used to calculate No Action and Proposed Action noise exposure levels at population centroids within the General Study Area (GSA). In addition, noise exposure under both alternatives was calculated at the Section 4(f) and Historic locations identified within the GSA.

B.2 No Action Alternative Noise Model Input

The No Action Alternative represents the annualized traffic flown at the Airport during the baseline timeframe. It is treated as the baseline against which noise exposure changes associated with the Proposed Action Alternative are measured. The baseline timeframe was chosen as it is representative of a typical recent year at the Airport, free of major traffic disruptions and is reflective of the brisk traffic growth that the Airport has experienced since 2009. This section details the noise model design for the No Action Alternative.

[1] https://aedt.faa.gov/Documents/guidance_aedt_nepa.pdf

B.2.1 No Action Alternative Aircraft Operations and Runway Use

Performance Data Analysis and Reporting System (PDARS) radar data for the baseline timeframe was obtained to develop operations data for noise modeling. The FAA OpsNet database identifies a count of 432,328 Instrument Flight Rules (IFR) itinerant (non-local) operations during the baseline timeframe, 413,174 of which are identified as tracks in the PDARS radar data. Each of the operations on the radar tracks were placed onto representative backbones that were built based on individual traffic flows to and from each runway. The number of operations on each backbone was scaled appropriately (by runway) to bring the total number of operations to the OpsNet count of 432,328. Helicopter operations are not identified in the OpsNet count, but 339 operations that were identified as helicopters in the PDARS data were included in the model, bringing the total number of modeled fixed wing and helicopter operations to 432,667. The total number of annual operations at the Airport was divided by the number of days in the year to determine the AAD, which was then used as input to AEDT. Operations without both an origin and destination airport (such as VFR, circuit, and local operations) were not included.

The Airport operates in several unique configurations primarily based on prevailing surface wind direction. When wind is from the north and east, traffic at the Airport primarily uses the Northeast configuration, where aircraft usually depart Runway 9 and arrive Runway 4R. When in the Northeast configuration, the Airport uses Runway 4L as the secondary runway for arrivals, while both Runway 4L and Runway 4R can be used for additional departures in the event of high departure demand. While in the Northeast configuration operations in Visual Meteorological Conditions (VMC), Runway 4L is usually only used for arrivals when the queue for Runway 4R exceeds 10 nautical miles (NM), corresponding to an arrival line of approximately 3-4 aircraft). Currently, Runway 4L arrivals are limited by both the proximity of Runway 4L to Runway 4R, (which limits the utility of parallel arrival operations to both runways) as well as the lack of an IAP of any kind. There is a preferred runway use program between midnight and 6:00 AM where aircraft usually arrive Runway 33L and depart Runway 15R if operationally feasible. Generally, Runway 4L is not currently used for night arrivals when the Airport is in the Northeast configuration, regardless of meteorological conditions.

Table B.1 shows the weighting used in AEDT to model the number of OpsNet arrivals by runway. **Table B.2** shows the same data for departures.

Runway	PDARS	OpsNet	Percentage	AEDT Weighting
4L	11,520	13,906	6.4%	1.207
4R	62,612	63,831	29.5%	1.019
9	106	341	0.2%	3.217

Runway	PDARS	OpsNet	Percentage	AEDT Weighting
14	-	-	-	-
15L	10	20	<0.1%	2.000
15R	662	985	0.5%	1.488
22L	58,338	60,575	28.0%	1.038
22R	637	853	0.4%	1.339
27	38,928	39,883	18.4%	1.025
32	5,603	6,580	3.0%	1.174
33L	26,325	27,442	12.7%	1.042
33R	894	1,557	0.7%	1.742
Helicopters (all routes)	202	202	0.1%	1.000
Totals	**205,837**	**216,175**	**100.0%**	**1.050**
Source: RoVolus 2020				

TABLE B.2
IFR ITINERANT DEPARTURE OPERATIONS WEIGHTING BY RUNWAY

Runway	PDARS	OpsNet	Percentage	AEDT Weighting
4L	5,502	5,685	2.6%	1.033
4R	6,856	8,239	3.8%	1.202
9	54,965	62,125	28.7%	1.130
14	250	75	<0.1%	0.300
15L	120	103	<0.1%	0.858
15R	9,810	8,506	3.9%	0.867
22L	3,919	3,447	1.6%	0.880
22R	75,568	62,684	29.0%	0.830
27	11,498	23,899	11.0%	2.079
32	-	-	-	-
33L	38,648	41,202	19.0%	1.066
33R	64	390	0.2%	6.094
Helicopters (all routes)	137	137	0.1%	1.000
Totals	**207,337**	**216,492**	**100.0%**	**1.044**
Source: RoVolus 2020				

B.2.2 No Action Alternative Flight Tracks, Profiles, and Flight Track Use

For the purposes of noise modeling, representative flight tracks were modeled as backbone tracks with expanded sub-tracks accounting for the dispersion of operations across a corridor. These backbones and sub-tracks were developed by isolating distinct flows by runway and operation type (arrivals or departures). Some flows were further isolated by day operations and night operations where the determination of day and night operations conforms to the FAA's Day-Night Average Sound Level (DNL) time periods. All the flight operations from each flow were distributed onto the representative backbone and its sub-tracks by using the default AEDT binomial weight distribution scheme.

AEDT includes a series of "standard" arrival and departure profiles with variability in the altitude over the initial portion of departure trajectories determined by trip length or stage length. Depending on the aircraft type, AEDT's "standard" departure profiles are provided for different stage lengths ranging from one to nine – with higher numbers indicating heavier takeoff weights. The chosen "standard" profile effectively serves as a surrogate for aircraft weight and models heavier aircraft of a given aircraft type at a lower altitude on departures. As mentioned in Section B.1 the stage length can be determined by the trip distance. For both the No Action and Proposed Action scenarios the stage length for each modeled operation was determined by computing the trip distance between the origin and destination airports and translating the trip distance into a stage length and choosing the appropriate standard profile for that stage length. In addition, flights were modeled as day and night operations as per the distribution shown below in **Table B.4** below.

TABLE B.4
AVERAGE ANNUAL DAY OPERATIONS MODELED IN AEDT

Aircraft Type	Category	Day (7:00:00 AM – 9:59:59 PM)		Night (10:00:00 PM – 6:59:59 AM)	
		Arrivals	Departures	Arrivals	Departures
7478	JET	0.579	0.555	0.000	0.003
717200	JET	4.356	3.674	1.070	1.686
737700	JET	51.017	53.894	16.689	11.033
737800	JET	13.283	15.550	6.487	3.229
747400	JET	0.643	0.620	0.003	0.013
757300	JET	0.535	0.514	0.017	0.015
767300	JET	7.087	6.461	2.393	3.058
777200	JET	3.107	3.022	0.843	0.924
1900D	TURBOPROP	0.009	0.009	0.000	0.000
737MAX8	JET	0.968	1.010	0.718	0.577

Aircraft Type	Category	Day (7:00:00 AM – 9:59:59 PM)		Night (10:00:00 PM – 6:59:59 AM)	
		Arrivals	Departures	Arrivals	Departures
757RR	JET	12.884	13.859	4.491	2.780
767CF6	JET	0.567	0.034	0.172	0.650
7773ER	JET	2.398	0.108	0.366	2.410
7878R	JET	5.279	3.619	0.068	1.421
A109	HELICOPTER	0.003	0.008	0.000	0.000
A300-622R	JET	1.152	1.949	1.803	1.221
A319-131	JET	19.157	18.778	3.352	3.226
A320-232	JET	63.618	69.911	22.024	12.845
A321-232	JET	48.052	51.426	16.449	10.682
A330-301	JET	2.515	1.976	0.524	0.906
A330-343	JET	7.303	5.435	0.552	2.051
A340-211	JET	1.034	0.353	0.011	0.615
A340-642	JET	0.893	0.797	0.006	0.043
A350-941	JET	0.905	0.756	0.006	0.102
A380-841	JET	0.909	0.473	0.003	0.299
B407	HELICOPTER	0.003	0.000	0.000	0.005
BD-700-1A11	JET	1.501	1.316	0.154	0.135
BEC58P	PISTON	38.787	60.156	0.250	0.310
CIT3	JET	0.078	0.061	0.003	0.000
CL600	JET	8.002	6.460	0.574	0.509
CNA172	PISTON	0.144	0.097	0.003	0.000
CNA182	PISTON	0.232	0.258	0.000	0.000
CNA206	PISTON	0.013	0.032	0.000	0.000
CNA208	PISTON	7.231	8.581	0.318	0.370
CNA441	TURBOPROP	0.060	0.113	0.009	0.016
CNA500	JET	0.023	0.025	0.003	0.002
CNA510	JET	0.592	0.547	0.026	0.034
CNA55B	JET	2.675	2.023	0.206	0.149
CNA560U	JET	3.253	2.789	0.207	0.161
CNA680	JET	1.192	0.929	0.071	0.057
CNA750	JET	3.086	2.687	0.229	0.127

Aircraft Type	Category	Day (7:00:00 AM – 9:59:59 PM)		Night (10:00:00 PM – 6:59:59 AM)	
		Arrivals	Departures	Arrivals	Departures
COMJET	JET	0.621	0.552	0.031	0.040
COMSEP	PISTON	0.857	1.357	0.042	0.082
CRJ9-ER	JET	18.368	16.993	1.740	2.369
DHC6	TURBOPROP	2.814	2.892	0.254	0.427
DHC830	TURBOPROP	11.534	12.450	0.451	0.598
EC130	HELICOPTER	0.000	0.030	0.000	0.000
ECLIPSE500	JET	0.023	0.027	0.003	0.000
EMB120	TURBOPROP	0.000	0.000	0.003	0.006
EMB145	JET	1.529	1.410	0.125	0.126
EMB14L	JET	4.084	4.194	0.278	0.030
EMB170	JET	13.183	12.330	0.751	0.982
EMB175	JET	23.165	22.758	2.892	2.305
EMB190	JET	85.847	82.640	17.275	16.198
FAL20	JET	0.027	0.032	0.011	0.008
FAL900EX	JET	0.321	0.255	0.028	0.023
G650ER	JET	0.609	0.557	0.091	0.022
GASEPF	PISTON	0.088	0.137	0.000	0.000
GASEPV	PISTON	0.706	0.851	0.039	0.028
GIV	JET	1.858	1.539	0.245	0.190
GV	JET	1.380	1.143	0.129	0.110
HS748A	JET	0.006	0.003	0.000	0.000
IA1125	JET	0.605	0.535	0.070	0.050
LEAR25	JET	0.005	0.000	0.000	0.000
LEAR35	JET	2.714	2.308	0.425	0.282
MD11PW	JET	0.243	0.236	0.029	0.057
MU3001	JET	0.124	0.111	0.011	0.012
PA28	PISTON	0.090	0.140	0.003	0.000
PA42	TURBOPROP	0.036	0.039	0.000	0.011
R44	HELICOPTER	0.003	0.000	0.000	0.000
S70	HELICOPTER	0.011	0.003	0.000	0.000
S76	HELICOPTER	0.238	0.156	0.033	0.033

Aircraft Type	Category	Day (7:00:00 AM – 9:59:59 PM)		Night (10:00:00 PM – 6:59:59 AM)	
		Arrivals	Departures	Arrivals	Departures
SA330J	HELICOPTER	0.244	0.123	0.019	0.016
SF340	TURBOPROP	0.636	0.758	0.000	0.000
		487.098	**507.421**	**105.081**	**85.669**
Source: Prepared by RoVolus, 2020					

B.3 FAA Proposed Action Noise Model Input

The input to AEDT represents estimated operations after the implementation of the RNAV (GPS) RWY 4L IAP. When compared with the No Action Alternative, the Proposed Action Alternative incorporates two major changes. First, a net total of 255 annual operations will be added to traffic at the Airport to represent additional operations that would currently be canceled under the No Action Alternative. This will occur because the additional gain in efficiency attributable to the Proposed Action increases the Airport's hourly Average Arrival Rate (AAR) and allows additional arrival operations. These operations comprise:

- An additional 359 annual arrivals to Runway 4L, representing flights that are no longer canceled or delayed due to additional runway throughput available with the RNAV (GPS) RWY 4L IAP.
- A reduction of 104 annual arrivals to Runway 4R, representing flights that can now use Runway 4L earlier in the day due to increased throughput and no longer need to wait to use Runway 4R.

Note that the net increase of 255 annual departures is assigned to use Runway 9, as this is the primary departure runway when the Airport is in the Northeast configuration. The detailed methodology on the determination of the number of annual flights and associated runway usage in the Proposed Action Alternative is described in **Section B.3.1**.

The second major change is associated with aircraft that are currently flying the ILS 15R approach in marginal VFR conditions, and then transitioning to a visual landing on Runway 4L once the aircraft has visual contact with the runway. Due to operational restrictions associated with flying this procedure, these aircraft are always small, maneuverable aircraft. In the Proposed Action Alternative, the ILS RWY 15R visual transition to Runway 4L approach will still be available, but based on consultation with Boston Consolidated TRACON (A90) personnel, it is not expected that it will continue to be used. Instead, Air Traffic Control (ATC) plans to assign the aircraft previously flying the ILS RWY 15R visual transition to Runway 4L approach to fly the RNAV (GPS) RWY 4L in the Proposed Action Alternative. This action will not result in any change in the number of operations to any runway but is implemented in the AEDT noise model as four new backbones representing unique transitions to Runway 4L used by only those small, maneuverable aircraft that previously flew the ILS RWY 15R visual transition to Runway 4L approach. A total of 594 operations have been modeled to fly these new backbones in the Proposed Action Alternative.

B.3.1 Proposed Action Alternative Aircraft Operations and Runway Use

The Proposed Action represents an additional IAP to the Airport that ATC plans to use when the Airport is in the Northeast configuration during periods of Instrument Meteorological Conditions (IMC). As this has clear implications to the current operations at the Airport, it was critical to identify what those implications were and how they could affect runway use at the Airport under the Proposed Action. Additionally, a model had to be developed that could accurately represent the number of arrivals at the Airport under the Proposed Action as well as the distribution of those arrivals by runway. The approach that was chosen to develop this model is detailed in **Section B.3.1.1** and **Section B.3.1.4** that follow.

B.3.1.1 Arrival Capacity Balancing Model Background

Early in the EA process, FAA identified an efficiency gain that would be associated with the implementation of the RNAV (GPS) RWY 4L approach at the Airport. When in the Northeast configuration during IMC, the AAR is 32 in the No Action Alternative. FAA estimated that with the new IAP available, the AAR under these conditions would increase by four operations per hour for a new AAR of 36.

Currently, brief periods of IMC over the course of any day generally do not cause major impacts because the Airport is well below capacity during periods of VMC. Unless a day has significant continuous periods of IMC during times of high arrival demand, flights are not usually canceled at the Airport. However, long periods of IMC at the Airport cause delays and cascading cancellations in any configuration, with the magnitude of those flight impacts directly tied to the length of time when the Airport is in IMC. In order to determine the number of flight cancellations that would be eliminated under the Proposed Action, it was necessary to estimate the amount of time that the Airport was both in IMC and in the Northeast configuration over the course of a year, as well as the number of cancellations and delays attributable to an acute lack of capacity during those times.

C.3.1.2 Determination of Bad-weather Days and Control Days

The first step in determining the amount of time during the baseline timeframe where significant weather-related cancellations have taken place was to retrieve operational data
for the Airport from the FAA's Operations and Performance Data system. Once the operational data were retrieved, the days of the year containing cancellations due to weather or air traffic congestion were isolated. The runway use for these days was analyzed to determine when the Airport was in the Northeast configuration. Any dates

where the Airport was shown to be in another configuration during the times where cancellations took place were discarded at this stage.

Weather Underground data for the remaining dates was analyzed to determine significant periods of IMC, which, for the purposes of this analysis, were identified as hourly time blocks where the visibility is less than or equal to five miles. For the purposes of this EA, any hourly time block where visibility is lower than five miles was considered IMC in terms of airport capacity because Runway 4L arrival operations currently require at least five miles of visibility for both the standard visual approach as well as the ILS RWY 15R visual transition to Runway 4L approach. Below five miles of visibility, only Runway 4R can be used for arrivals when the Airport is in the Northeast configuration.

A day was considered a bad weather day (and hence eligible for inclusion in the analysis) if it met both of the following criteria:

1. The Airport was in IMC for either six consecutive daytime hours, or eight of any ten daytime hours, and
2. The Airport was in the Northeast configuration for at least 80% of the hours when it was in IMC.

Over the baseline timeframe, seven days were identified that met the above criteria. These days are listed below:

- January 5, 2019
- January 20, 2019
- February 18, 2019
- March 2, 2019
- April 22, 2019
- June 1, 2019
- October 11, 2019

Next, seven additional dates were selected to represent days that were scheduled similarly to the above bad weather dates, but had good weather and minimal cancellations. These days were treated as control days and were selected to provide a delta between operations on a good weather/VMC day and operations on a day with cancellations and delays due to weather. Control days were selected on the same day of the week during the same season as their corresponding bad weather days in order to minimize the effect of seasonality and day of the week on the number and makeup of the flight schedule. The selected control days are listed below:

- December 8, 2018
- January 13, 2019
- February 11, 2019
- March 9, 2019
- April 8, 2019
- May 18, 2019
- October 4, 2019

B.3.1.3 Calculation of Additional Throughput Attributable to Proposed Action

Arrivals were categorized by day operations and night operations for the runway from the schedule data for the bad weather days. Average arrival throughput was then calculated for both day (07:00:00 AM to 9:59:59 PM) and night (10:00:00 PM to 6:59:59 AM) hours, and four arrivals per hour were added to represent the additional throughput available under the Proposed Action Alternative. As a simplifying assumption, new maximum daily throughput available due to implementing the new IAP was assumed to be 96 arrivals (60 day/36 night) representing the additional four operations over the 24-hour period for all of the bad weather days. The additional throughput was applied hourly over the course of the bad weather day to obtain an estimated maximum Airport capacity value for the bad weather day under the Proposed Action Alternative. This was the upper bound of additional flights that could potentially be added for each of the seven identified bad weather days.

B.3.1.4 Determination of Arrival Runway Usage in the Proposed Action

The next step was a determination of how flights could be shifted between runways due to the presence of additional arrival throughput at the Airport under IMC in the Northeast configuration. An estimate of scheduled arrival demand (for both day and night operations) on the bad weather days was determined by adding the number of arrival cancellations to the number of observed arrivals on those dates. That value was compared with the calculated maximum runway capacity value for each bad weather day under the Proposed Action Alternative. If either day or night demand exceeded the calculated day or night maximum runway capacity then the number of flights were limited to that maximum runway capacity and further flights were considered to be canceled.

Additional schedule data was evaluated to determine the average split of day and night traffic during normal operations for each bad weather day. This was done by analyzing the arrival operations from additional dates on the same day of the week and from the same season as the seven bad weather days to determine the day/night split over time. This split was very consistent over the analyzed dates, with approximately 18% of traffic at the Airport landing during night hours.

Then, flights were reallocated to Runway 4R and Runway 4L based on the estimated split of day and night flights and the new runway capacity value in the Proposed Action Alternative. All flights utilizing the additional new capacity available were assigned to Runway 4L. Runway 4R was assumed to serve the existing flights as in the No Action Alternative. For some days, this resulted in a reduction in the number of night flights on Runway 4R as those flights were shifted forward into the day to take advantage of newly available capacity on Runway 4L. For other days with more cancellations, the number of night flights increased as flights that were previously canceled took advantage of additional night capacity on Runway 4L. It should be noted that after midnight local time, Runway 33L is the preferred arrival runway for noise abatement and would be used unless there are significant operational constraints, such as incompatible wind conditions, requiring the Northeast configuration to be used at that time. In practice, Runway 4L will only be used for a very limited number of annualized night operations under the Proposed Action Alternative.

Through this process, the estimated arrival runway use by day and night operations was deduced for each bad weather day. This updated number of arrival operations by runway was compared to the number of arrival operations by runway present in the No Action Alternative. The difference between the two values represents the number of additional or reduced operations associated with that runway. These values were averaged across the seven bad weather days to yield a single value representing the mean increase, or reduction, in arrivals to each runway. This value was multiplied by the number of days, giving an estimate of the difference in annualized arrivals per runway.

The analysis showed that Runway 4L arrivals, during both day and night, increase due to the availability of the new IAP, while Runway 4R arrivals at night decrease due to those operations (some of which are delays from earlier in the day) now being able to use Runway 4L during the day. The number of daytime operations to Runway 4R are not expected to change because this runway is already operating under maximum capacity conditions during the bad weather days, so the operations associated with that runway are identical between both scenarios.

B.3.2 Proposed Action Flight Tracks, Profiles, and Use

The model for the Proposed Action utilizes the same methodology as the No Action Alternative for constructing representative backbones, sub-tracks, and operation loading. With the exception of operations that have changed due to the presence of the RNAV (GPS) RWY 4L IAP arrival operations, the Proposed Action Alternative reuses the model data that was built to model the No Action Alternative. As described earlier, in the Proposed Action Alternative, eight new backbones were developed to model the changes associated with implementing the RNAV (GPS) RWY 4L IAP. Four of these backbones model traffic flying the new IAP via four different transitions, as follows and as summarized in **Table B.5**:

- NUNZO transition – flights begin the new IAP via the NUNZO fix to the southwest of the Airport and proceed along the charted procedure to Runway 4L. Operations on this backbone comprise 50% of all new arrivals to Runway 4L in the Proposed Action (179 annualized operations) and consist of jets only.
- Left downwind transition – flights begin the new IAP flying a left downwind approach from north of the Airport, similar to operations today, before transitioning into the final leg of the procedure between LVRON and MTAPN. This backbone contains 108 operations, evenly divided between jets and pistons/turboprops.
- Cape-area transition – flights begin the new IAP over the Plymouth area southeast of the Airport, and transition into the final leg of the procedure over LVRON. This backbone contains 54 piston and turboprop operations.

- WOONS transition – flights begin the new IAP via the WOONS fix located southwest of the Airport and proceed along the charted procedure to Runway 4L. This backbone contains 18 piston and turboprop operations.

TABLE B.5
OPERATIONS BY TRANSITION IN PROPOSED ACTION SCENARIO

Transition	Jet Arrivals	Turboprop/Piston Arrivals	Totals
NUNZO	179	0	179
Left downwind	54	54	108
Cape-area	0	54	54
WOONS	0	18	18
Totals	**233**	**126**	**359**
Source: Prepared by RoVolus, 2020.			

The other four backbones model the paths of the 594 flights that previously flew the ILS RWY15R visual transition to Runway 4L approach and will now fly the RNAV (GPS) RWY 4L IAP. These flights enter the GSA in an identical fashion as today, but diverge before beginning the ILS 15R leg and transition into the RNAV (GPS) RWY 4L IAP. As these aircraft would generally be getting vectored to the new procedure, the arrival backbones were designed in consultation with A90 personnel to ensure that the design is reasonable relative to operational expectations.

With two specific differences, all other backbones (including those associated with helicopters) from the No Action Alternative otherwise retain the same number of operations and the time of day of those operations in the Proposed Action Alternative. The differences include the previously specified reduction of 104 Runway 4R arrivals and the increase of 255 Runway 9 departures as required to offset additional arrivals in this configuration.

The RNAV (GPS) RWY 4L IAP specifies minimum altitude restrictions at coded waypoints. These altitude restrictions were implemented on the representative backbones as AEDT "at-or-above" control codes which instruct AEDT to model standard profile arrivals as long as the control code restrictions are met. All other backbones in the Proposed Action Alternative were modeled using standard profiles.

B.4 Sensitivity Analysis

While the estimate of the number of operations that will use the RNAV (GPS) RWY 4L IAP is based on actual weather conditions observed during the baseline timeframe, it is recognized that the number of hours where the Airport experiences IMC while in the Northeast configuration could exceed the estimate, primarily due to the variability of winter weather in the Boston area. Therefore, the FAA chose to carry out a sensitivity analysis to determine if a reasonable number of additional operations using the RNAV (GPS) RWY 4L IAP could potentially result in significant impacts.

This analysis was carried out by adding arrival operations to Runway 4L to the representative backbones for the RNAV (GPS) RWY 4L IAP. Each transition was weighted proportionally to its weighting in the Proposed Action, with the only change being the number of operations placed on each backbone. All other flights operate as they do in the Proposed Action. **Table B.6** shows the number of operations modeled for each representative backbone comprising the RNAV (GPS) RWY 4L IAP in the Proposed Action and the Sensitivity Analysis.

TABLE B.6

NUMBER OF MODELED OPERATIONS FOR EACH TRANSITION ON RNAV (GPS) RWY 4L IAP

Transition	Proposed Alternative	Sensitivity Analysis
NUNZO	179	7,132
Left downwind	108	4,280
Cape-area	54	2,140
WOONS	18	713
Total Runway 4L arrivals	**14,265**	**14,265**
Source: Prepared by RoVolus, 2020.		

The results of the Sensitivity Analysis showed that shifting traffic that currently flies visual approaches to Runway 4L to the RNAV (GPS) RWY 4L IAP does not result in significant impacts when compared to the No Action Alternative. Note that the scenario used in the Sensitivity Analysis reflects a very high usage of the RNAV (GPS) RWY 4L IAP that is not anticipated to be reached in actual operations, even in the case of high advisory usage by flight crews flying visual approaches.

Table B.7 shows the maximum noise exposure change at any population centroid in the GSA associated with the Proposed Action and the Sensitivity Analysis. As shown in the table, the additional concentration of flight tracks onto the RNAV (GPS) RWY 4L IAP results in both larger DNL increases and decreases within the GSA. However, even with a very large allocation of flights using the RNAV (GPS) RWY 4L IAP, the maximum DNL increase seen at any population centroid is still less than the 3 dB increase required (at or above DNL 65 dB) to indicate a significant noise impact.

TABLE B.7
NUMBER OF MODELED OPERATIONS FOR EACH TRANSITION ON RNAV (GPS) RWY 4L IAP

Scenario	Maximum DNL Increase (dB)	Maximum DNL Decrease (dB)
Proposed Action	+0.2	-0.1
Sensitivity Analysis	+2.2	-2.8
Source: Prepared by RoVolus, 2020.		

The results of this Sensitivity Analysis confirm that implementation of the RNAV (GPS) RWY 4L IAP is unlikely to result in any significant impacts without regards to the number of days the Airport is both in IMC and using the Northeast configuration.