Appendix J includes the following:

- Appendix J1: International Parkway Modernization Traffic Impact Analysis (TIA) and
- Appendix J2: CTA Traffic Memorandum

Appendix J1 – International Parkway Modernization Traffic Impact Analysis (TIA)

International Parkway Modernization Program

Traffic Impact Analysis (TIA)

DFW

Prepared For:

Dallas / Fort Worth International Airport

August 2020

GARVER

GarverUSA.com

International Parkway Modernization Program

Traffic Impact Analysis (TIA)

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August 26, 2020

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1.0 Introduction

At the request of Dallas Fort Worth International Airport (DFW), Garver conducted a Traffic Impact Analysis (TIA) to determine the impact of proposed modifications to the South Airfield Drive interchange, International Parkway between South Airfield Drive and North Airfield Drive, and the North Airfield Drive interchange. Schematic design is currently underway to add capacity to International Parkway and to convert all left turns in and out of each terminal to right turns only. This project is an effort to simplify surface traffic operations and enhance user safety throughout the DFW terminal areas.

This report documents the traffic operation within the study area and is included as an Appendix in the National Environmental Policy Act (NEPA) documentation. This report shows traffic operations within the study area for:

- South Airfield Drive interchange and North Airfield Drive interchange, where the following scenarios are analyzed
    - 2019 Existing
    - 2043 No Build
    - 2043 Build
- Central Terminal Area (CTA) along International Parkway between South Airfield Drive and North Airfield Drive - where the following scenarios are analyzed:
    - 72 Million Annual Passengers (MAP) Baseline
    - 90 MAP No Build
    - 90 MAP Build

The study includes, but is not limited to the following items:

- Review of available traffic data for 2019 Existing conditions for North Airfield Drive and South Airfield Drive
- Review of available traffic data for 72 MAP Baseline and 90 MAP No Build and 90 MAP Build conditions along International Parkway and on terminal ramps (i.e., CTA area)
- Analysis of 2019 Existing, 2043 No Build, and 2043 Build traffic operations at the South Airfield Drive interchange, and at the North Airfield Drive interchange
- Analysis of 72 MAP Baseline, 90 MAP No Build and 90 MAP Build traffic operations along International Parkway, (i.e., CTA area)
- Vehicle speed and travel time evaluation throughout the terminal areas for CTA
- Comparison of system wide vehicle delay, vehicle miles traveled (VMT), and vehicle hours traveled (VHT) for all scenarios for CTA
- Based on analysis of 90 MAP Build condition for CTA, and 2043 Build condition for South Airfield Drive interchange and North Airfield Drive interchange, note any necessary improvements to ensure acceptable traffic operations

The traffic analysis techniques used in this study are those most commonly used in the traffic engineering profession. These techniques include distribution of traffic, capacity analysis, and level of service analysis.

2.0 Study Area Roadway Network

The study area stretches nearly 4.5-miles along International Parkway from South Airfield Drive to North Airfield Drive. For the purpose of this study, the analysis was divided into three sub-areas – 1) South Airfield Drive Interchange, 2) CTA, and 3) North Airfield Drive Interchange.

2.1 South Airfield Drive Interchange

The interchange at South Airfield Drive is located approximately 1,400 feet south of the DFW south entry toll plaza. The interchange is a modified folded diamond, providing access to/from northbound and southbound service roads at stop-controlled intersections on South Airfield Drive. Access to/from International Parkway is also provided within the influence area of the interchange. At this location, South Airfield Drive is four-lane divided Regional Arterial and has a posted speed limit of 45 miles per hour (mph). DFW Remote South Parking is located east of the South Airfield Drive interchange. The limits of the South Airfield Drive study are shown in **Figure 1.**

Figure 1: South Airfield Drive Study Limits

2.2 Central Terminal Area

For the CTA, the study limits stretch from Terminal E and South Express Parking at the south to north of Terminal A and Terminal B. Specifically, the southern study limits extend to the service road Crossunder #5, between the Skylink tram overpass at International Parkway and Taxiway Bravo. The northern limits of the CTA study area terminate at the service road Crossunder #1, slightly north of Taxiway Yankee. **Figure 2** on the following page shows the CTA study limits. Note that an area between North Airfield Drive and

CTA, and an area between South Airfield Drive and CTA, where the toll plazas are located, are not analyzed in this study.

Within the CTA, International Parkway is a six-lane divided toll road with a posted speed limit of 55 mph. This segment of International Parkway provides access to DFW Terminals A, B, C, D, and E and to North and South Express parking lots.

Northbound and southbound one-way service roads run parallel to International Parkway. The service roads are two-lane facilities with a posted speed limited of 35 mph. These roadways provide access to parking lots, administrative buildings, and commercial properties and are mostly used by service and emergency vehicles. The service roads do not provide passenger access to the terminals.

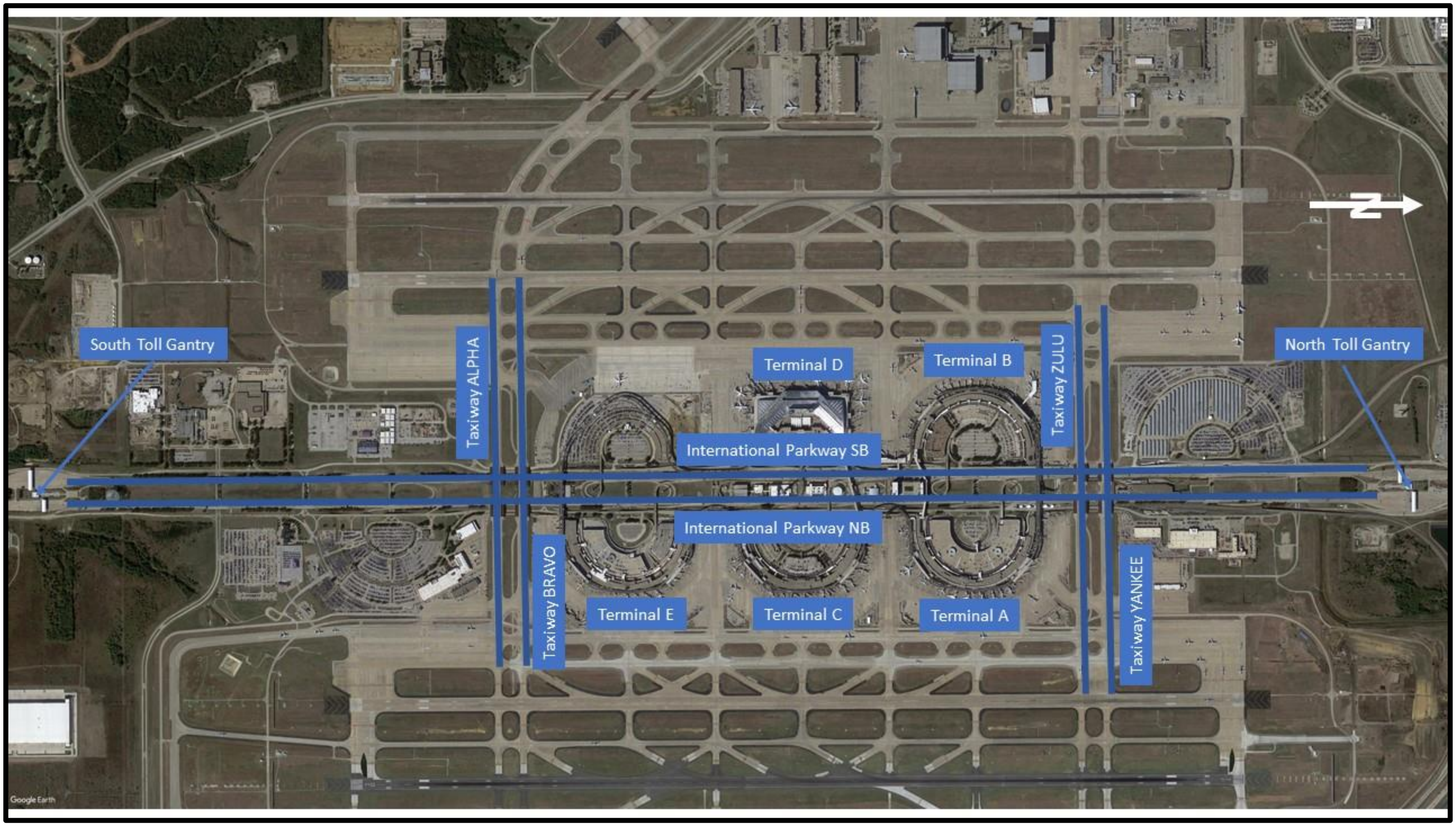


Figure 2: Central Terminal Area Study Limits

2.3 North Airfield Drive Interchange

Located approximately 1,400 feet north of the DFW north entry toll plaza, the North Airfield Drive interchange provides access to/from northbound and southbound DFW service roads. The northbound exit ramps are yield-controlled. Within the influence area of the interchange, access is provided to/from International Parkway via slip ramps. North Airfield Drive is a four-lane divided Regional Arterial and has a posted speed limit of 45 mph. Access to DFW Remote North Parking is provided along North Airfield Drive west of the interchange. The North Airfield Drive study limits are depicted in **Figure 3.**

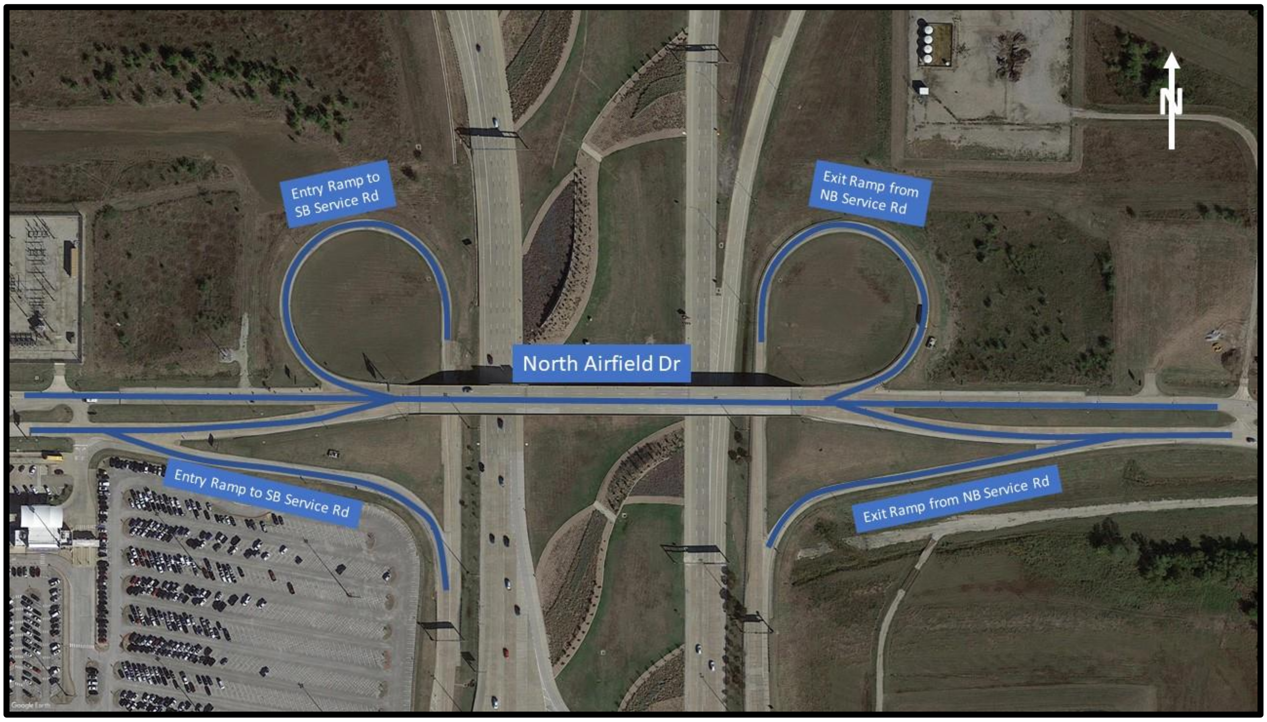


Figure 3: North Airfield Drive Study Limits

3.0 Volumes Development

3.1 Existing Daily Traffic Volumes

Along International Parkway, Average Annual Daily Traffic (AADT) volumes were obtained from the Texas Department of Transportation's (TxDOT) *Statewide Traffic Analysis and Reporting System (STARS II)*. This database contains detailed traffic data, including traffic counts, travel times, traffic signal information, and traffic crash reports.

On International Parkway, *STARS II* shows the AADT at the south entrance, just south of South Airfield Drive, was 45,385 vehicles per day (vpd) in 2019. The northbound AADT was 22,316 vpd and the southbound AADT was 22,069 vpd, which is approximately a 50/50 directional traffic split. At the same location, the northbound service road carried 20,504 vpd and southbound service road recorded 19,345 vpd.

At the north entrance to the DFW Airport, on International Parkway, the 2019 AADT just south of North Airfield Drive was 63,061 vpd, with 32,278 vpd in the northbound direction and 30,783 vehicles in southbound direction. At the same location, northbound and southbound service roads did not have 2019 data available. Available data for year 2014 indicated AADT on the northbound service road to be 20,860 vpd, and 22,916 vpd for southbound service road.

3.2 Development of Existing Peak Hour Volumes

Peak hour traffic volumes within the study sub-areas were compiled from a variety of sources, including typical traffic counts, 72 MAP Baseline VISSIM models, and design hourly volumes based on daily traffic volumes. North Airfield Drive and South Airfield Drive have AM and PM peak hours defined. CTA has one peak hour defined, called overall peak hour period.

3.2.1 South Airfield Drive Interchange

On January 30, 2018, 24-hour turning movement counts and 24-hour tubes counts were collected near the South Airfield Drive interchange. Using the yearly growth rate of 2.5% provided by DFW, the AM and PM peak hour counts were projected to reflect 2019 traffic volumes as shown in **Figure 4**. The AM peak hour is from 7:15 AM to 8:15 AM, and the PM peak hour is from 5:00 PM to 6:00 PM.

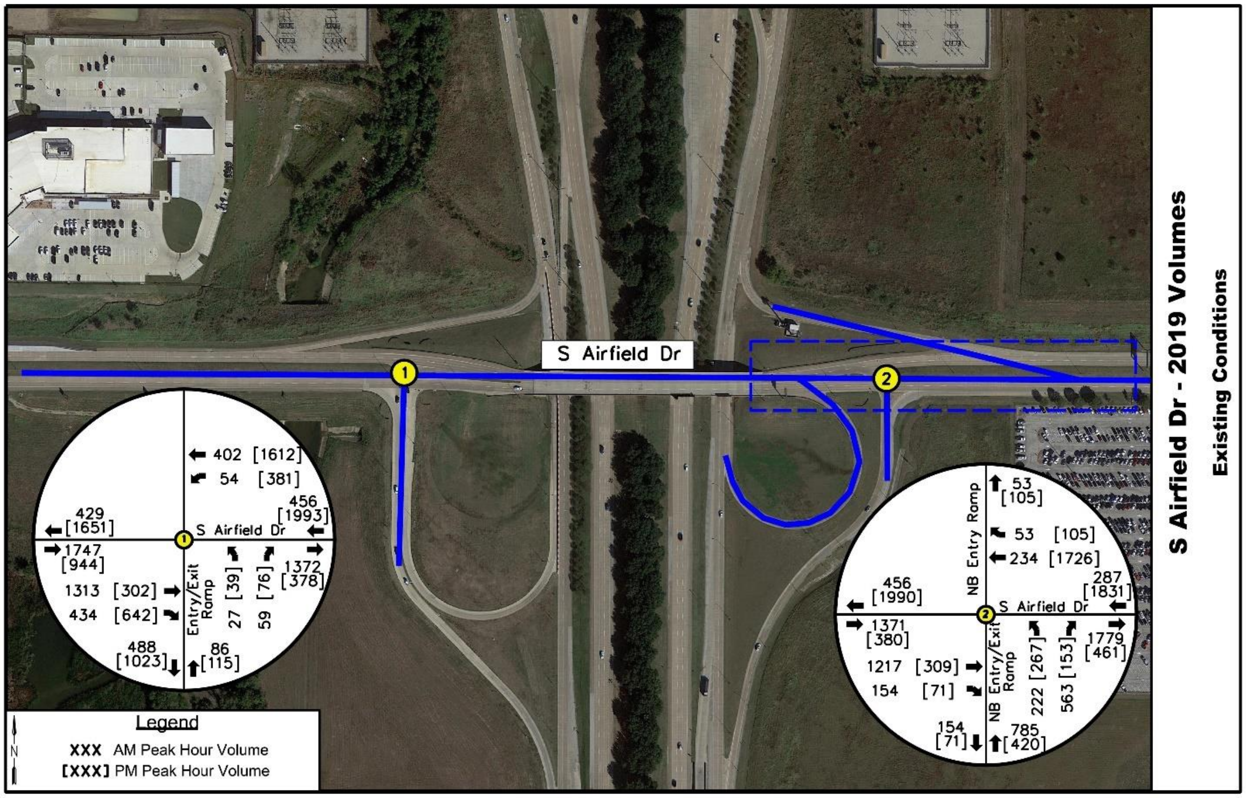


Figure 4: 2019 South Airfield Drive Peak Hour Volumes

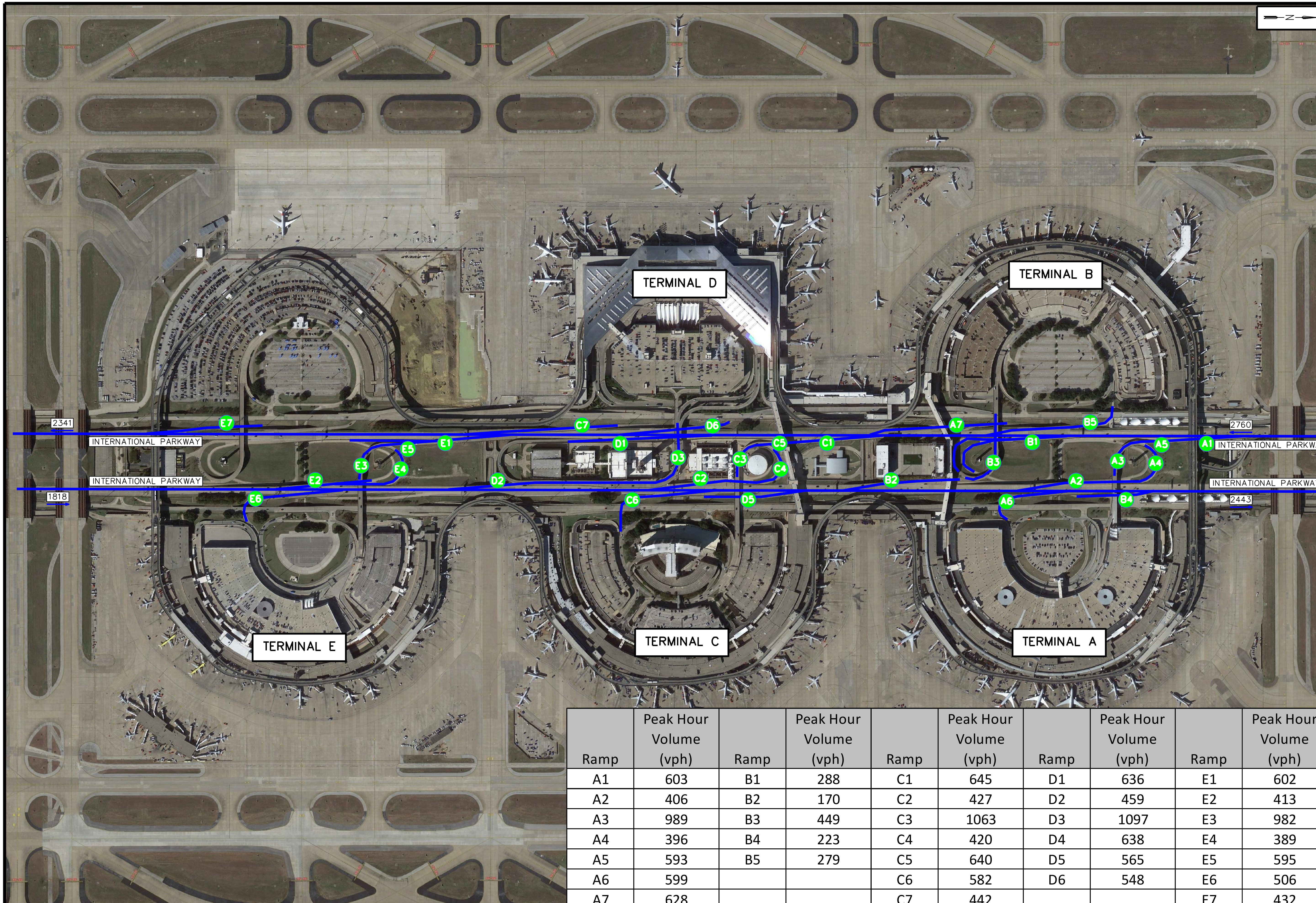
3.2.2 Central Terminal Area

A complex VISSIM model of the CTA developed and maintained by DFW Planning Division and their Planning consultants, Landrum & Brown and Shenoy Analytics, was provided for review. This model includes expected traffic volumes associated with the departure peak hours, the arrival peak hours and overall peak hours for Terminal A through Terminal E as well as the overall airport peak hour.

For the purposes of this study, volumes from the 72 MAP Baseline model, occurring during the overall airport peak hour (10:00 AM to 11:00 AM), were used as the baseline for existing analysis. The 72 MAP Baseline peak hour traffic volumes were provided as VISSIM outputs in Excel spreadsheets, PDF files, and Google Earth KMZ files and are displayed on **Figure 5**. The VISSIM models do not include service roads in any of the scenarios.

Figure 5: Central Terminal Area Volumes

Existing Conditions (72 MAP)



Ramp	Peak Hour Volume (vph)	Ramp	Peak Hour Volume (vph)	Ramp	Peak Hour Volume (vph)	Ramp	Peak Hour Volume (vph)	Ramp	Peak Hour Volume (vph)
A1	603	B1	288	C1	645	D1	636	E1	602
A2	406	B2	170	C2	427	D2	459	E2	413
A3	989	B3	449	C3	1063	D3	1097	E3	982
A4	396	B4	223	C4	420	D4	638	E4	389
A5	593	B5	279	C5	640	D5	565	E5	595
A6	599			C6	582	D6	548	E6	506
A7	628			C7	442			E7	432

3.2.3 North Airfield Drive Interchange

North Airfield Drive Interchange volumes were developed using available information from two data sources:

- North Central Texas Council of Governments (NCTCOG)
- TxDOT's *STARS II*

NCTCOG's data is available in an online mapping tool supported by Carto Vista software. The ramp traffic counts from NCTCOG website are from year 2015, while the *STARS II* Design Hourly Volumes (DHV) on North Airfield Drive are from 2019. A yearly growth factor of 2.5% was used to project 2015 data to Existing 2019 volumes. **Figure 6** shows peak hour volumes for the North Airfield Drive interchange. The AM peak hour is from 7:15 AM to 8:15 AM, and the PM peak hour is from 5:00 PM to 6:00 PM.

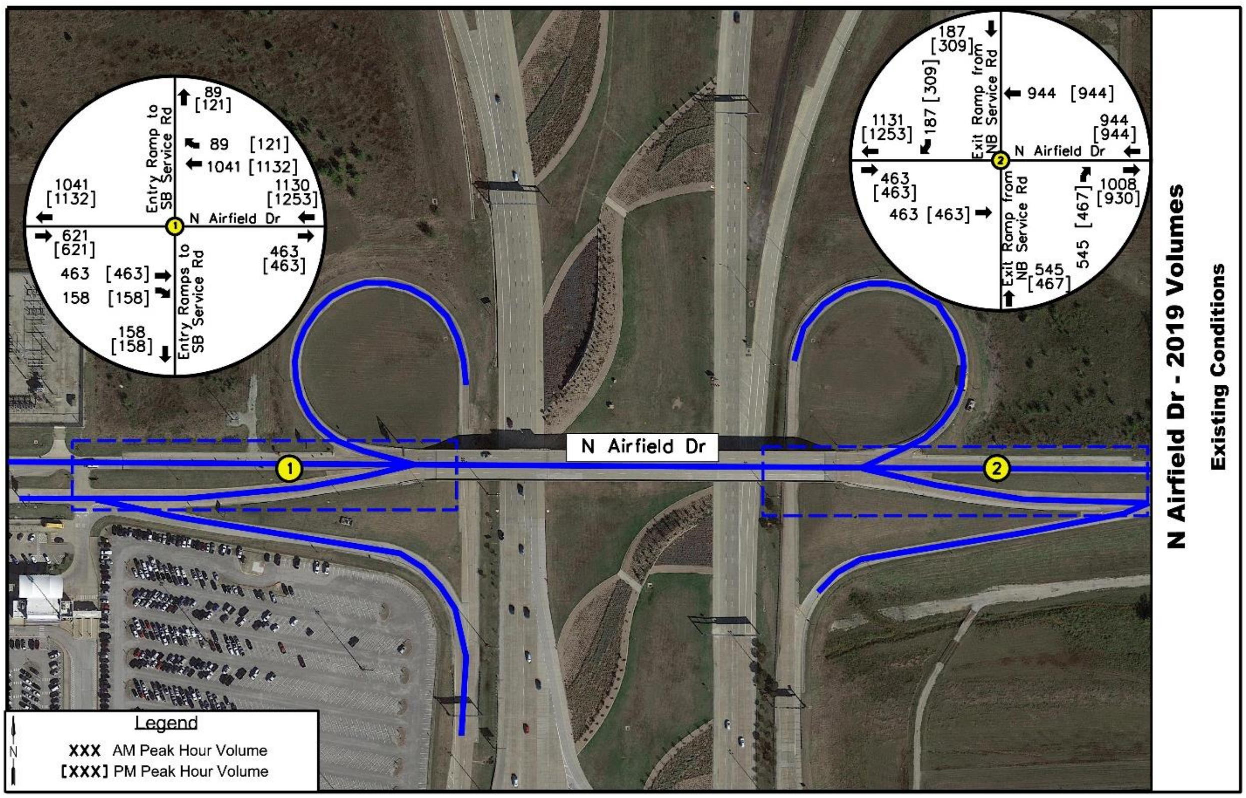


Figure 6: 2019 North Airfield Drive Peak Hour Volumes

3.3 Development of Future No Build Traffic Volumes

Similar to existing peak hour volumes, future volumes were developed using a variety of methods, including projecting traffic counts based on a growth rate of 2.5% per year and using 90 MAP VISSIM models provided by DFW Planning Division.

3.3.1 South Airfield Drive Interchange

Existing 2019 turning movement volumes were projected to 2043 volumes using a growth rate of 2.5% per year as provided by DFW. Expected future volumes are shown in **Figure 7.**

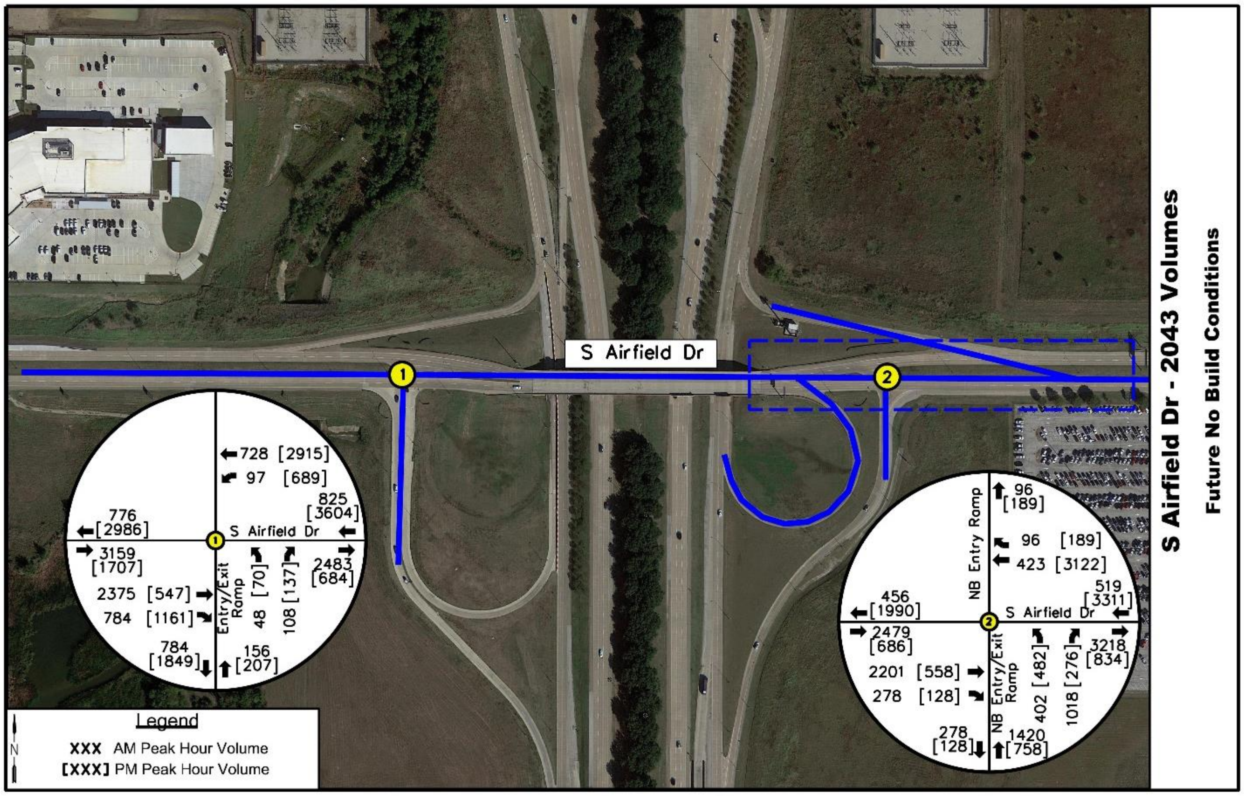
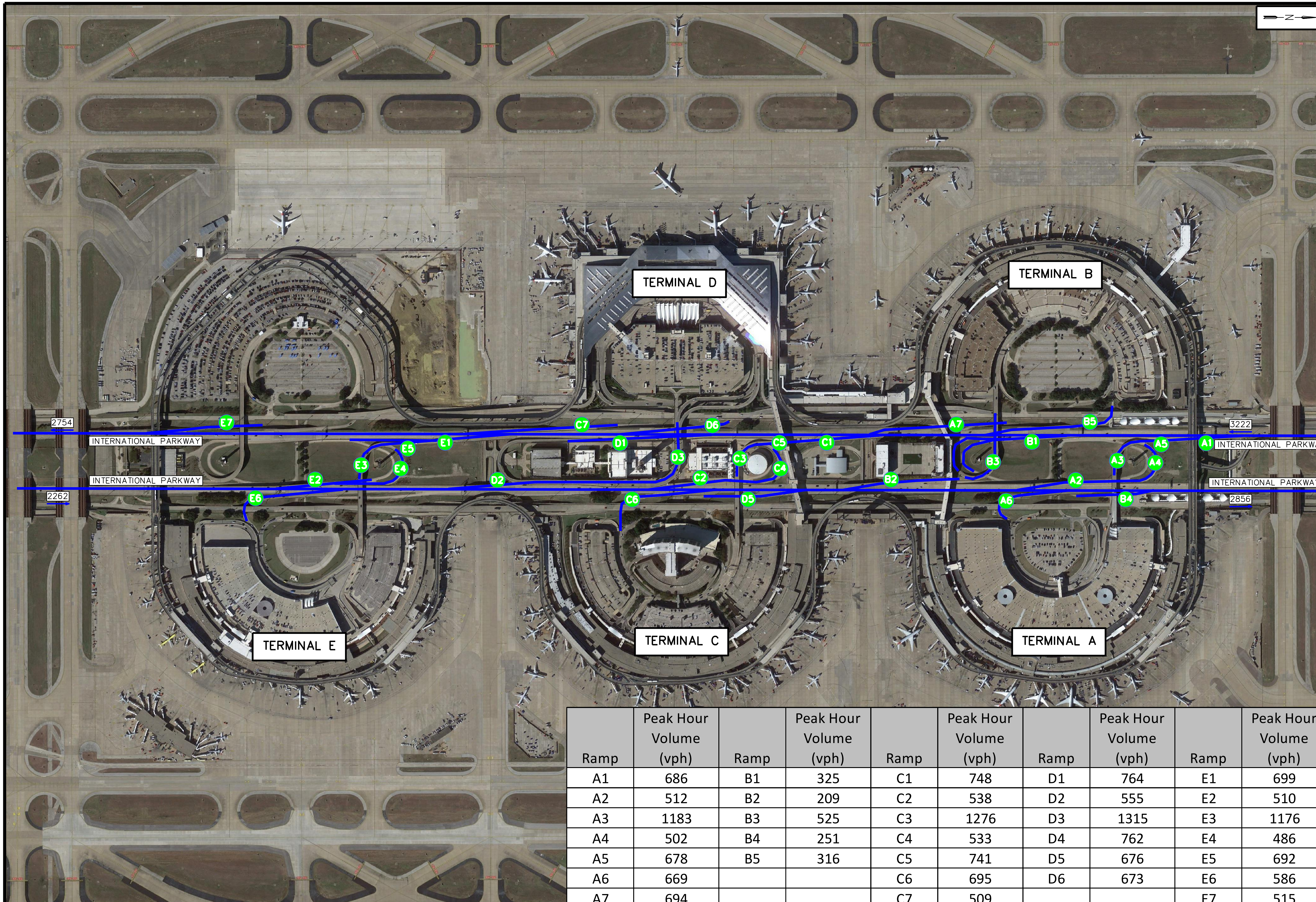


Figure 7: 2043 South Airfield Drive Peak Hour Volumes

3.3.2 Central Terminal Area

As in the 72 MAP Baseline scenario, 90 MAP No Build peak hour volumes were provided as output from DFW's VISSIM model in Excel spreadsheets, PDF files, and Google Earth KMZ files. The 90 MAP No Build volumes are displayed in **Figure 8.**



Ramp	Peak Hour Volume (vph)	Ramp	Peak Hour Volume (vph)	Ramp	Peak Hour Volume (vph)	Ramp	Peak Hour Volume (vph)	Ramp	Peak Hour Volume (vph)
A1	686	B1	325	C1	748	D1	764	E1	699
A2	512	B2	209	C2	538	D2	555	E2	510
A3	1183	B3	525	C3	1276	D3	1315	E3	1176
A4	502	B4	251	C4	533	D4	762	E4	486
A5	678	B5	316	C5	741	D5	676	E5	692
A6	669			C6	695	D6	673	E6	586
A7	694			C7	509			E7	515

Figure 8: Central Terminal Area Volumes

Future No Build Conditions (90 MAP)

3.3.3 North Airfield Drive Interchange

As shown in **Figure 9,** Existing 2019 volumes were project to year 2043 using 2.5% yearly traffic growth.

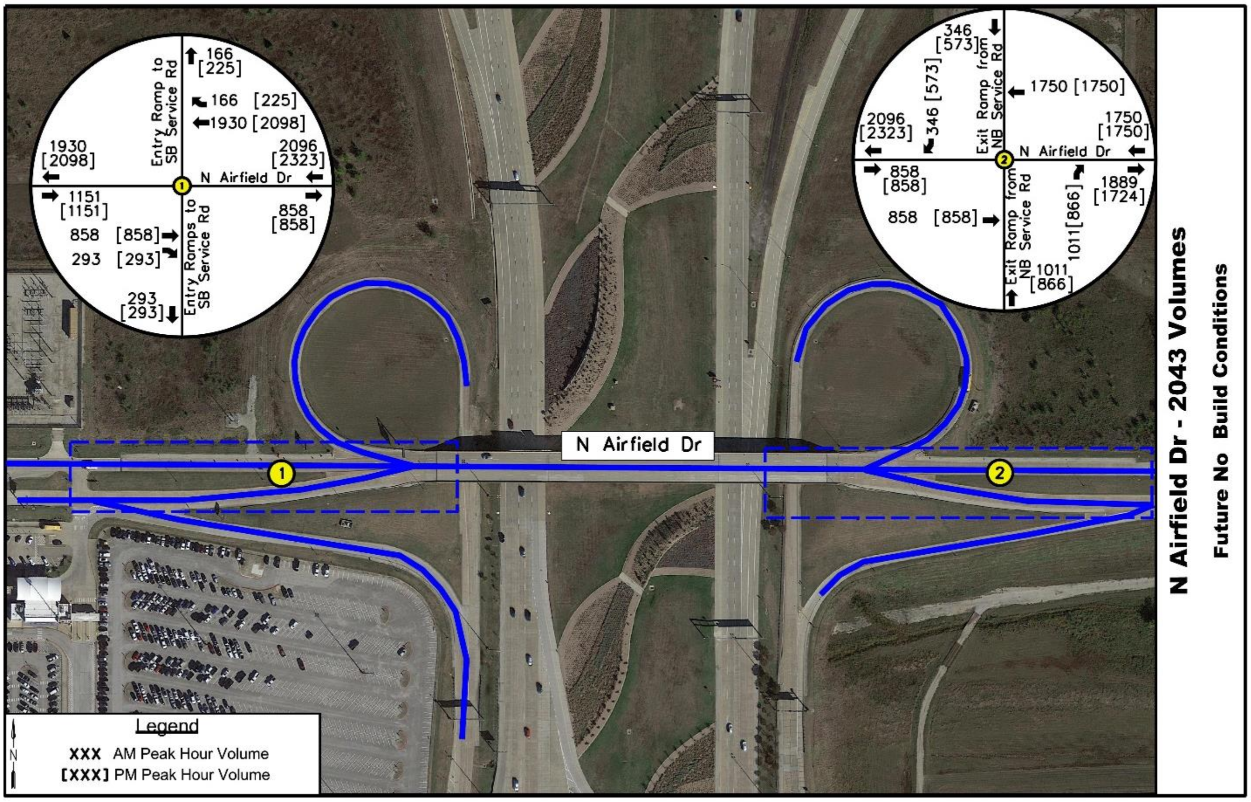


Figure 9: 2043 North Airfield Drive Peak Hour Volumes

4.0 Operational Analysis

The South Airfield Drive and North Airfield Drive study areas were evaluated under 2019 Existing and 2043 Future No Build conditions to establish a baseline for comparison for the Build alternatives. Similarly, for a baseline comparison, CTA was evaluated under 72 MAP and 90 MAP No Build conditions. Level of Service (LOS) was the key performance measure used for the analysis.

LOS is a qualitative measure used to depict operational conditions within a traffic stream or at an intersection. LOS is typically designated into six categories. These range from LOS A indicating free-flow, low density, or nearly negligible delay conditions to LOS F where demand exceeds capacity and large queues are experienced. A graphical representation of LOS is presented in **Figure 10**.

For the South Airfield Drive Interchange study area and the North Airfield Drive Interchange study area, operational analyses were conducted using *Synchro 10* and *SimTraffic* software according to the *Highway Capacity Manual 6th Edition (HCM)* methodology and *SimTraffic* methodology.

For unsignalized and signalized intersections, the *HCM* uses control delay for the basis of determining LOS. Control delay at an intersection is the average stopped time per vehicle traveling through the intersection plus the movements at slower speeds due to the vehicles moving up in the queue or slowing down upstream of the approach. **Table 1** show the Levels of Service as stated in the *HCM*.

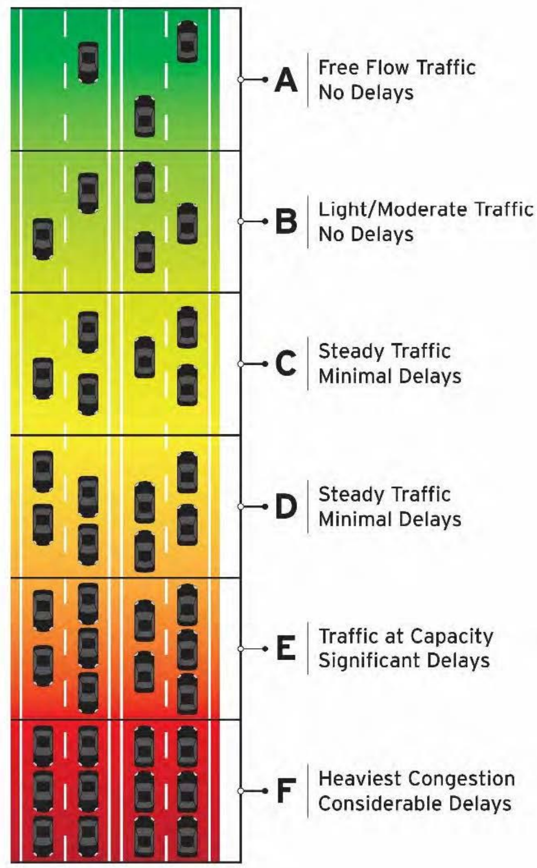


Figure 10: Level of Service (LOS) Categories

Table 1: LOS Thresholds for Intersections (Control Delay)

Level of Service	Description	Signal Controlled Intersection Delay (sec/veh)	Stop Controlled Intersection Delay (sec/veh)
A	Most vehicles do not stop	0 to 10	0 to 10
B	Some vehicles stop	>10 to 20	>10 to 15
C	Signficant number of stops	>20 to 35	>15 to 25
D	Many stops, individual cycle failure	>35 to 55	>25 to 35
E	Frequent individual cycle failure, at capacity	>55 to 80	>35 to 50
F	Arrival rate exceeds capacity	>80 or v/c > 1	>50 or v/c > 1

Roadway segment analysis was conducted within the CTA using data provided from 72 MAP Baseline and 90 MAP No Build VISSIM models. Per the *HCM* for basic freeways and multilane highways, a segment can be characterized by three performance measures: density in passenger cars per mile per lane (pcpmpl), space mean speed in miles per hour, and the ratio of demand flow rate to capacity (v/c ratio). Each of these measures is an indication of how well traffic is being accommodated by the basic freeway segment or multilane highway. Because speed is constant through a broad range of traffic flows and the v/c ratio cannot be directly perceived by road users, density is the service measure for basic freeway and multilane highway segments. **Table 2** shows LOS thresholds for basic freeways and multilane highways.

Table 2: LOS Thresholds for Roadway Segments (Density)

Level of Service	Density (pc/mi/ln)
A	≤11
B	>11-18
C	>18-26
D	>26-35
E	>35-45
F	Demand exceeds capacity OR density > 45

The results from the operational analyses of Existing conditions and Future No Build conditions for the study areas are discussed in the following subsections.

4.1 Operational Analysis – Existing Conditions

4.1.1 South Airfield Drive Interchange

Currently, the South Airfield Drive interchange is not controlled by traffic signals. The traffic is controlled by stop signs at minor approaches (i.e., ramps). *HCM* analysis presented in **Table 3** shows overall intersection LOS A at the southbound service road intersection for both AM and PM peak hours. The overall intersection level of services for the northbound service road is LOS D during the AM peak hour and LOS B in the PM peak hour. A closer look at the study intersections shows LOS F for the northbound left turn movement from the southbound service road ramp during the PM peak hour, and LOS F for both AM and PM peak hours at the northbound service road ramp. It is common for a stop controlled minor approach to operate at low level of service with an acceptable overall intersection level of service.

SimTraffic analysis shown in **Table 4** supports these *HCM* results and shows few other issues for left and right turn movements. The drivers cannot find acceptable gaps to execute a turn in a timely manner because there are no signals to give the right of way or create gaps in traffic. Thus, some movements experience LOS F. As traffic continues to increase, the traffic operations will decrease.

Table 3: 2019 Existing South Airfield Drive – *HCM* Results

Intersection	Time Period	Control	MOE	EB Movement			WB Movement			NB Movement			SB Movement			Overall
				Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
S Airfield Dr @ SB Service Rd Ramps	AM	Stop Controlled	LOS		n/a²	n/a²	B	n/a²		D		C				A
			Delay				13.4			28.8		16.3				1.3
	PM		LOS		n/a²	n/a²	A	n/a²		F		A				A
			Delay				9.5			88.6		9.7				3.2
S Airfield Dr @ NB Service Rd Ramps	AM	Stop Controlled	LOS		n/a²	n/a²		n/a²		F		n/a²				D
			Delay							193.8						25.7
	PM		LOS		n/a²	n/a²		n/a²		F		n/a²				B
			Delay							86.6						10.1

n/a² - This is a free movement

Table 4: 2019 Existing South Airfield Drive – *SimTraffic* Results

Intersection	Time Period	Control	MOE	EB Movement			WB Movement			NB Movement			SB Movement			Overall
				Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
S Airfield Dr @ SB Service Rd Ramps	AM	Stop Controlled	LOS		A	A	F	A		A		A				A
			Delay		4.5	5.1	56.7	0.1		2.4		0.4				5.7
	PM		LOS		A	F	A	A		F		A				C
			Delay		8.5	87.3	4.4	0.5		59.1		3.1				18.7
S Airfield Dr @ NB Service Rd Ramps	AM	Stop Controlled	LOS		A	A		A		F		F				F
			Delay		0.6	1.2		0.7		356.7		97.4				53.6
	PM		LOS		A	A		A		F		F				F
			Delay		0.0	0.0		1.4		865.6		561.4				67.2

4.1.2 Central Terminal Area

The primary area of interest for the CTA study area is International Parkway. This analysis focused on the International Parkway roadway, flyover ramps, and entry/exit ramps only. Northbound and southbound service roads through the CTA were not included in the operational analysis.

4.1.2.1 Roadway Segment Analysis

For the roadway analysis through the CTA, International Parkway was divided into segments. Due to the length of the project area, the exact location of the International Parkway segments can be found in **Appendix A – International Parkway Segments**. The segmentation of the road was developed based on the entry and exit ramp location along International Parkway. Each road segment is part of the highway between two consecutive ramps.

For the operational analysis of the CTA study area, output was again provided from the 72 MAP Baseline VISSIM model, including number of lanes, traffic volume, average vehicle speed, and density. **Table 5** displays the VISSIM outputs for each segment and the segment level of service based on density. It should be noted that the VISSIM models are based on the 10% completed schematic design.

Table 5: 72 MAP Baseline Scenario - LOS Results

International Parkway Segments	Number of Lanes	Volume (veh/hr)	Speed (mph)	Density (veh/mi/ln)	Level of Service
Segment 1	3	2,443	55.9	16.2	B
Segment 2	3	2,224	51.4	18.0	C
Segment 3	4	2,212	52.8	11.3	B
Segment 4	3	1,647	49.4	14.6	B
Segment 5	4	1,956	57.9	8.7	A
Segment 6	3	1,904	51.2	16.1	B
Segment 7	3	2,760	58.6	16.4	B
Segment 8	3	2,135	57.7	13.1	B
Segment 9	3	2,757	50.8	22.1	C
Segment 10	3	2,017	53.9	14.5	B
Segment 11	3	1,860	56.1	19.3	C
Segment 12	3	1,909	59.4	10.8	A
Segment 13	3	2,341	56.0	15.1	B
Segment 14	4	2,450	58.1	10.8	A
Segment 15	4	2,692	48.9	15.2	B
Segment 16	4	1,818	59.4	7.7	A
Segment 17	4	2,337	58.7	10.1	B

For 72 MAP Baseline conditions, the lowest level of service within the study area is LOS C on International Parkway Segment 2 near Terminal A in the northbound direction, on International Parkway Segment 9 between Terminals B and D in the southbound direction, and on International Parkway Segment 11 in the southbound direction near South Express Parking facility. The table also shows that the speed on all segments throughout the CTA is nearly 50 mph or higher. The posted speed limit along International Parkway is 55 mph.

Based on information provided in the *Airport Cooperative Research Program (ACRP) Report 40: Airport Curbside and Terminal Area Roadway Operations*, LOS D is considered acceptable for regional freeways and arterials and densely developed urban areas. On airport roadways where only a single path is available (and the cost of delay to the traveler is great), LOS C is typically considered to be the minimum acceptable level of service. Following *ACRP Report 40* guidance, all segments of International Parkway operate at acceptable level of service under 72 MAP Baseline conditions.

4.1.2.2 Ramp Analysis

VISSIM output data was provided for each ramp throughout the CTA, including number of lanes, traffic volumes, and averages speed. The output data is summarized for every terminal below and the locations of each ramp and flyover are presented in **Appendix A – International Parkway Segments.** It should be noted that *HCM* methodology cannot be used to calculate LOS for ramps and flyover ramps.

Table 6 shows volumes and average speeds for entry ramps, exit ramps, and flyover ramps within Terminal A. The posted speed limit on International Parkway is 55 mph. Ramp A1 and A2 function as left turn exit ramps with average speeds over 45 mph. Due to geometric constraints, loop ramps A3, A4, and A5 have posted advisory speeds of 20 mph and average modeled speeds of less than 17 mph.

Table 6: Terminal A - Ramp Data

Terminal A Ramps	Number of Lanes	Volume (veh/hr)	Speed (mph)
A1	1	603	47.4
A2	1	406	54.9
A3	2	989	16.7
A4	1	396	16.8
A5	1	593	16.9
A6	1	599	25.2
A7	1	628	23.7

Terminal B volumes and average speeds for entry ramps, exit ramps, and flyover ramps from the 72 MAP Baseline VISSIM models are summarized in **Table 7**. Ramps B1 and B2 are ramps entering the terminal from International Parkway in the southbound and northbound direction, respectively. Ramp B3 is a flyover ramp, and ramps B4 and B5 are exit ramps from Terminal B to International Parkway in southbound and northbound directions.

Table 7: Terminal B - Ramp Data

Terminal B Ramps	Number of Lanes	Volume (veh/hr)	Speed (mph)
B1	1	288	54.2
B2	1	170	57.0
B3	2	449	19.4
B4	1	223	22.0
B5	1	279	25.4

VISSIM output, including volumes and average speeds for entry ramps, exit ramps, and flyover ramps for Terminal C are shown in **Table 8**. Ramps C1 and C2 are exit ramps from International Parkway with higher speeds because drivers are exiting a 55 mph speed facility. Ramps C3, C4, and C5 are loops ramps/flyover ramps where the speed is lower due to the geometrical constraints. All ramp volumes within Terminal C are below capacity.

Table 8: Terminal C - Ramp Data

Terminal C Ramps	Number of Lanes	Volume (veh/hr)	Speed (mph)
C1	1	645	49.9
C2	1	427	52.8
C3	2	1,063	17.0
C4	1	420	17.2
C5	1	640	16.8
C6	1	582	24.7
C7	1	442	39.9

Terminal D volumes and average speeds for entry ramps, exit ramps, and flyover ramps are shown in **Table 9**. Ramps D1 and D2 exit International Parkway in the southbound and northbound direction, respectively. Ramp D3 is a flyover ramp, and ramps D5 and D6 are entering International Parkway from low speed terminal roads in the northbound and southbound direction with speeds near 20 mph.

Table 9: Terminal D - Ramp Data

Terminal D Ramps	Number of Lanes	Volume (veh/hr)	Speed (mph)
D1	1	636	57.1
D2	1	459	57.5
D3	3	1,097	21.1
D4	1	638	30.5
D5	1	565	21.6
D6	1	548	21.9

Table 10 summarizes VISSIM model volumes and speeds for entry ramps, exit ramps, and flyover ramps for Terminal E. Ramps E3, E4, and E5 are loop ramps within in Terminal E with accordingly lower speeds.

Table 10: Terminal E - Ramp Data

Terminal E Ramps	Number of Lanes	Volume (veh/hr)	Speed (mph)
E1	1	602	50.0
E2	1	413	53.8
E3	2	982	19.6
E4	1	389	16.6
E5	1	595	17.8
E6	1	506	25.5
E7	1	432	21.7

Overall statistics within the CTA for 72 MAP Baseline scenario are shown in **Table 11**. Average travel time is the time in minutes it takes a vehicle to get from a toll control plaza(s) to the specific terminal and back to exit the airport via toll control plaza. For example, for Terminal A, it takes on average 14.61 minutes for a vehicle to enter the airport premises via control plaza, arrive at Terminal A, and then exit the airport premises via control plaza. The highest average travel time is observed for Terminal A, where, on average, it takes about 14.61 minutes per vehicle to enter the airport, travel to Terminal A, and exit the airport.

Table 11: 72 MAP Baseline Scenario - Overall Statistics for All Terminals

Terminal	Total Travel Time (Total Hrs)	Average Speed (mph)	Distance (Total Miles)	Vehicles (Total)*	Average Travel Time (Min)
Terminal A	1,585,342	15.4	6,000.24	1,596	14.61
Terminal B	555,358	18.5	2,229.28	654	11.06
Terminal C	1,296,792	16.2	5,243.86	1,415	13.72
Terminal D	973,760	17.6	4,314.17	1,012	14.55
Terminal E	1,199,232	17.9	4,964.98	1,279	13.04

*Total of active and vehicles that reached destinations and exited the model.

4.1.3 North Airfield Drive Interchange

Since North Airfield Drive does not have signals or stop signs at the interchange, *HCM* results are not reported. *HCM* methodology does not report delays for free or yield movements. **Table 12** shows results from *SimTraffic* microsimulation software. There are no operational issues at the interchange, as all approaches and movements operate at LOS A.

Table 12: 2019 Existing North Airfield Drive – *SimTraffic* Results

Intersection	Time Period	Control	MOE	EB Movement			WB Movement			NB Movement			SB Movement			Overall
				Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
N Airfield Dr @ WBR Loop and EBR Ramp	AM	Free	LOS		A	A		A	A							A
			Delay		0.4	0.3		1.2	1.2							0.9
	PM		LOS		A	A		A	A							A
			Delay		0.4	0.3		1.4	1.5							1.2
N Airfield Dr @ SBR Loop and NBR Ramp	AM	Yield	LOS		A			A				A			A	A
			Delay		0.4			0.6				7.2			5.0	1.3
	PM		LOS		A			A				A			A	A
			Delay		0.4			0.7				3.7			8.9	2.1

4.2 Operational Analysis – 2043 Future No Build Conditions

4.2.1 South Airfield Drive Interchange

Both intersections at South Airfield Drive interchange are stop controlled. As traffic continues to increase, stop controlled intersections will reach capacity which will adversely affect all left turn and right turn movements. Eastbound and westbound through movements are expected to operate with minimal delays in both AM and PM peak periods as those are major free movements. All other minor movements will experience LOS F, except the westbound left turn and the northbound left turn in the PM peak hour at the southbound service road intersection. The results are shown in **Table 13** and **Table 14**.

Table 13: 2043 South Airfield Drive – *HCM* Results

Intersection	Time Period	Control	MOE	EB Movement			WB Movement			NB Movement			SB Movement			Overall
				Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
S Airfield Dr @ SB Service Rd Ramps	AM	Stop Controlled	LOS		n/a[2]	n/a[2]	F	n/a[2]		F		F				A
			Delay				51.5			361.2		69.4				8.9
	PM		LOS		n/a[2]	n/a[2]	C	n/a[2]		F		B				F
			Delay				20.0			7817.9		11.2				129.1
S Airfield Dr @ NB Service Rd Ramps	AM	Stop Controlled	LOS		n/a[2]	n/a[2]		n/a[2]		F		n/a[2]				F
			Delay							3766.3						1006.3
	PM		LOS		n/a[2]	n/a[2]		n/a[2]		F		n/a[2]				F
			Delay							1702.3						197.1

n/a[2] - This is a free movement

Table 14: 2043 South Airfield Drive – *SimTraffic* Results

Intersection	Time Period	Control	MOE	EB Movement			WB Movement			NB Movement			SB Movement			Overall
				Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
S Airfield Dr @ SB Service Rd Ramps	AM	Stop Controlled	LOS		C	C	F	B		F		F				F
			Delay		20.0	20.0	1301.0	10.5		3178.8		2072.4				66.7
	PM		LOS		C	F	A	A		F		F				E
			Delay		19.3	197.7	4.0	1.4		1698.9		984.7				47.5
S Airfield Dr @ NB Service Rd Ramps	AM	Stop Controlled	LOS		A	A		C		F		F				F
			Delay		4.3	0.5		21.5		1844.2		978.6				73.9
	PM		LOS		A	A		A		F		F				F
			Delay		0.0	0.2		6.2		3275.9		2776.4				54.1

4.2.2 Central Terminal Area

Table 15 shows the International Parkway segments and related data and measures of effectiveness. Like in 72 MAP Baseline scenario, the segmentation of the road was done based on the entry and exit ramps. For MAP 90 No Build conditions, the model shows the worst LOS F on Segment 14 where the speed drops to about 34 mph and the density is over 99 vehicles per mile per lane (veh/mi/ln). This segment is located before the exiting north toll plaza. Since the drivers have to make a stop to pay the toll and exit the airport, queues are forming causing the average speed to drop and density to increase.

Table 15: 90 MAP No Build Scenario - LOS Results

International Parkway Segments	Number of Lanes	Volume (veh/hr)	Speed (mph)	Density (veh/mi/ln)	Level of Service
Segment 1	3	2,856	55.6	19.4	C
Segment 2	3	2,609	50.9	22.3	C
Segment 3	4	2,664	52.6	13.7	B
Segment 4	3	1,988	48.6	18.4	C
Segment 5	4	2,392	56.8	11.4	B
Segment 6	3	2,336	50.7	21.0	C
Segment 7	3	3,222	58.4	23.1	C
Segment 8	3	2,510	57.3	14.7	B
Segment 9	3	3,203	47.2	33.2	D
Segment 10	3	2,359	52.8	18.4	B
Segment 11	3	2,174	54.5	25.2	C
Segment 12	3	2,241	59.0	12.7	B
Segment 13	3	2,754	55.5	18.1	C
Segment 14	4	2,561	33.8	99.6	F
Segment 15	4	3,156	48.2	17.9	B
Segment 16	4	2,262	59.1	9.6	A
Segment 17	4	2,752	58.3	12.1	B

Terminal A volumes and average speeds from the VISSIM model for entry ramps, exit ramps, and flyover ramps are shown in **Table 16**. When compared to the 72 MAP Baseline scenario, the ramp speeds are slightly lower. Similar to the 72 MAP Baseline scenario, loop ramps A3, A4, and A5 have an average speed of less than 17 mph because of the geometric constraints.

Table 16: Terminal A - Ramp Data

Terminal A Ramps	Number of Lanes	Volume (veh/hr)	Speed (mph)
A1	1	686	42.4
A2	1	512	53.6
A3	2	1,183	16.5
A4	1	502	16.7
A5	1	678	16.7
A6	1	669	25.2
A7	1	694	23.3

Table 17 shows volumes and average speeds for entry ramps, exit ramps, and flyover ramps provided by VISSIM model output for Terminal B. As would be expected with higher traffic volumes, the ramps operate at lower average speeds when compared to 72 MAP Baseline VISSIM model output. At ramp B3, speeds are lower because the drivers have to slow down at the entry flyover ramp.

Table 17: Terminal B - Ramp Data

Terminal B Ramps	Number of Lanes	Volume (veh/hr)	Speed (mph)
B1	1	325	53.4
B2	1	209	56.3
B3	2	525	18.9
B4	1	251	21.8
B5	1	316	25.4

VISSIM model outputs, as summarized in **Table 18,** show volumes and average speeds for entry ramps, exit ramps, and flyover ramps for Terminal C. With 90 MAP No Build traffic volumes, Terminal C ramps operate with slightly lower average speeds. Ramps C3, and C5 are exiting terminal roads and entering International Parkway, while C4 is a flyover ramp. Due to the geometry constraints and short merging distances, the speeds are expectedly lower.

Table 18: Terminal C - Ramp Data

Terminal C Ramps	Number of Lanes	Volume (veh/hr)	Speed (mph)
C1	1	748	47.0
C2	1	538	52.1
C3	2	1,276	16.9
C4	1	533	16.9
C5	1	741	16.5
C6	1	695	24.7
C7	1	509	39.6

VISSIM model volumes and average speeds for entry ramps, exit ramps, and flyover ramps within Terminal D are reported in **Table 19.** Ramp D3 is a flyover, and ramps D5 and D6 exit Terminal D and merge with International Parkway in the northbound and southbound directions with speeds near 20 mph.

Table 19: Terminal D - Ramp Data

Terminal D Ramps	Number of Lanes	Volume (veh/hr)	Speed (mph)
D1	1	764	56.2
D2	1	555	55.5
D3	3	1315	21.0
D4	1	762	30.2
D5	1	676	21.6
D6	1	673	21.8

As reported in **Table 20,** Terminal E loop ramps E3, E4, and E5 have an expected average speed below 20 mph.

Table 20: Terminal E - Ramp Data

Terminal E Ramps	Number of Lanes	Volume (veh/hr)	Speed (mph)
E1	1	699	47.5
E2	1	510	53.0
E3	2	1,176	19.4
E4	1	486	16.5
E5	1	692	17.4
E6	1	586	25.4
E7	1	515	21.7

The overall statistics for the 90 MAP No Build condition are shown in **Table 21**. The average travel time for Terminal A increased by nearly five minutes, from 14.61 minutes to 19.47 minutes. This is the highest average travel time observed for all terminals in MAP 90 No Build scenario.

Table 21: 90 MAP No Build Scenario - Overall Statistics for All Terminals

Terminal	Total Travel Time (Total Hrs)	Average Speed (mph)	Distance (Total Miles)	Vehicles (Total)*	Average Travel Time (Min)
Terminal A	2,851,839	9.9	6,803.09	2,114	19.47
Terminal B	963,195	12.9	2,577.54	886	13.58
Terminal C	2,256,856	10.9	6,203.8	1,888	18.15
Terminal D	1,699,992	11.9	5,064.86	1,335	19.05
Terminal E	2,037,561	12.9	5,860.01	1,702	16.00

*Total of active and vehicles that reached destinations and exited the model.

4.2.3 North Airfield Drive Interchange

Similar to the 2019 Existing scenario, the *HCM* results are not reported for the North Airfield Drive 2043 No Build scenario. **Table 22** shows the results from *SimTraffic* microsimulation. Eastbound and westbound major through movements will not experience level of service deterioration. However, northbound right turn and southbound right turn movements at the intersection east of the International Parkway will fail in both AM and PM peak periods.

Table 22: 2043 North Airfield Drive – *SimTraffic* Results

Intersection	Time Period	Control	MOE	EB Movement			WB Movement			NB Movement			SB Movement			Overall
				Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
N Airfield Dr @ WBR Loop and EBR Ramp	AM	Free	LOS		A	A		A	A							A
			Delay		0.8	0.7		3.6	3.5							0.9
	PM		LOS		A	A		A	A							A
			Delay		0.8	0.7		3.9	3.7							3.0
N Airfield Dr @ SBR Loop and NBR Ramp	AM	Yield	LOS		A			A				F			F	C
			Delay		0.7			1.8				59.6			148.6	19.5
	PM		LOS		A			A				E			F	C
			Delay		0.7			1.8				46.3			196.7	24.8

4.3 Operational Analysis – Future Build Conditions

4.3.1 South Airfield Drive Interchange

The proposed future signalized interchange design of South Airfield Drive at International Parkway is shown in **Figure 11**. Proposed improvements on South Airfield Drive include three through lanes in each direction. The intersection of South Airfield Drive and the southbound service road has an eastbound 300 foot channelized right turn pocket and a westbound 200 foot dual left turn bay. Southbound and northbound approaches have one left and one right turn lane.

South Airfield Drive at the northbound service road intersection has a 200 foot left turn bay in the eastbound direction and a dedicated westbound 250 foot right lane. At this intersection, the northbound approach improvements include two left turning lanes, a through lane, and dual right turn lanes. The intersection and approach layout are subject to change as noted on page 2 in the document *"Project Narrative – South Airfield Drive Interchange improvements"*. The modeled geometry was developed based on the available traffic counts and traffic projections using 2.5% yearly growth.

Figure 11: South Airfield Drive - Future Build

Table 23 and **Table 24** show results from *Synchro* and *SimTraffic* simulation models. *HCM* Analysis presented in Table 23 shows that both intersections should operate with overall LOS D or better in AM and PM peak hours. The eastbound left and northbound left movements at the northbound service road intersection may experience LOS E in the PM peak. That is due to the heavy traffic on South Airfield Drive. In the eastbound direction, projected through volume exceeds 3,000 vehicles per hour resulting in less green time being given to the left turn movements.

SimTraffic microsimulation results show that both intersections will operate at LOS C or better. Like *HCM* methodology, *SimTraffic* shows northbound left turn movement at the northbound service road intersection may experience LOS E due to high volume of projected traffic at South Airfield Drive mainlines.

Table 23: 2043 Build South Airfield Drive – *HCM* Results

Intersection	Time Period	Control	MOE	EB Movement			WB Movement			NB Movement			SB Movement			Overall
				Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
S Airfield Dr @ SB Service Rd	AM	Signal	LOS		B	n/a[2]	B	A		C		n/a[2]	n/a[3]		n/a[3]	B
			Delay		18.3		19.2	5.3		29.2						15.6
	PM		LOS		A	n/a[2]	A	B		C		n/a[2]	n/a[3]		n/a[3]	B
			Delay		9.1		8.2	10.7		30.6						10.4
S Airfield Dr @ NB Service Rd	AM	Signal	LOS	B	C		C	n/a[2]		B		B				C
			Delay	16.0	24.0		24.3			18.4		18.3				22.3
	PM		LOS	E	A		D	n/a[2]		E		D				D
			Delay	67.8	4.7		54.5			58.0		42.5				48.6

n/a[1] - *HCM* methodology does not calculate delay for yield-controlled channelized right at signalized intersections
n/a[2] - This is a free movement
n/a[3] – No volumes for specific movement. Expected to operate similar as NB approach in terms of LOS

Table 24: 2043 Build South Airfield Drive – *SimTraffic* Results

Intersection	Time Period	Control	MOE	EB Movement			WB Movement			NB Movement			SB Movement			Overall
				Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
S Airfield Dr @ SB Service Rd	AM	Signal	LOS		B	A	C	A		D		B	n/a[3]		n/a[3]	B
			Delay		11.9	3.3	31.7	7.6		44.5		16.5				10.5
	PM		LOS		B	D	C	C		D		A	n/a[3]		n/a[3]	C
			Delay		15.6	36.9	26.9	22.7		54.8		6.5				25.3
S Airfield Dr @ NB Service Rd	AM	Signal	LOS	C	C		C	A		B		C				C
			Delay	30.6	23.9		22.1	0.8		19.0		28.7				24.4
	PM		LOS	D	A		C	A		E		A				C
			Delay	53.2	6.5		23.5	7.9		60.6		8.1				24.9

n/a[3] – No volumes for specific movement. Expected to operate similar as NB approach in terms of LOS

4.3.2 Central Terminal Area

The build scenario assumes replacing left exit flyover ramps from International Parkway with right exit ramps to all five terminals. The proposed improvements would result in more intuitive driver decision making and improved efficiency in travel times and VMT.

Table 25 shows International Parkway segments with related data and measures of effectiveness for 90 MAP Build scenario. The segmentation of the road was developed based on the entry and exit ramp locations. Each road segment is part of the highway between the two consecutive ramps. Level of Service is calculated using *HCM 6th Edition* multilane highway segments methodology. For 90 MAP Build conditions, the model shows the LOS C on northbound International Parkway Segment 2 north of Terminal A and on southbound International Parkway Segment 11 between North Express Parking and Terminal B.

The speed limit at International Parkway for the Future Build is increased to 65 mph. Due to the length of the project area, the exact location of International Parkway segments presented in **Table 25** are shown in the **Appendix A - International Parkway Segments**.

Table 25: 90 MAP Build Scenario - LOS Results

International Parkway Segments	Number of Lanes	Volume (veh/hr)	Speed (mph)	Density (veh/mi/ln)	Level of Service
Segment 1	4	3,056	63.2	11.9	B
Segment 2	3	3,724	58.5	21.2	C
Segment 3	4	2,842	62.4	11.5	B
Segment 4	4	3,199	59.3	13.6	B
Segment 5	4	3,040	60.2	12.5	B
Segment 6	3	2,289	59.4	12.9	B
Segment 7	3	2,285	64.3	12.0	B
Segment 8	4	3,042	63.5	11.9	B
Segment 9	4	3,331	52.9	16.7	B
Segment 10	4	3,184	62.3	12.8	B
Segment 11	3	4,040	62.0	21.9	C
Segment 12	4	3,331	62.2	13.3	B

Table 26 shows volumes and speeds for entry ramps, exit ramps, and flyover ramps for Terminal A. Ramp A5 is proposed to exit Terminal A and merge with northbound International Parkway. Due to the curvature and high volume in the peak hour, the average speed drops down to about 15 mph.

Table 26: Terminal A - Ramp Data

Terminal A Ramps	Number of Lanes	Volume (veh/hr)	Speed (mph)
A1	1	726	41.0
A2	1	726	40.6
A3	1	576	43.5
A4	3	1,301	41.5
A5	1	1,222	15.1

Volumes and speeds for Terminal B entry ramps, exit ramps, and flyover ramps for are shown in **Table 27**. The data was obtained from the 90 MAP Build VISSIM model. Ramp B2 is an exit ramp from Terminal B. Due to the proposed curvature, the speed is expected to be lower on ramp B2.

Table 27: Terminal B - Ramp data

Terminal B Ramps	Number of Lanes	Volume (veh/hr)	Speed (mph)
B1	2	591	36.1
B2	2	716	20.2
B3	1	472	32.7
B4	1	244	30.9

Terminals A and B volumes and speeds for entry ramps, exit ramps, and flyover ramps are shown in **Table 28**. Ramp A2 & B2 carries traffic exiting Terminal A and Terminal B. The average speeds are expectedly lower due merging traffic maneuvers.

Table 28: Terminals A and B (Combined Traffic) - Ramp Data

Terminal A & B Ramps	Number of Lanes	Volume (veh/hr)	Speed (mph)
A1 & B1	2	1,318	43.2
A2 & B2	2	1,466	14.2
A3 & B3	1	1,467	25.2

Table 29 shows volumes and speeds for entry ramps, exit ramps, and flyover ramps for Terminal C. The average speed on Ramp C1 is lower due to curvature and geometric constraints.

Table 29: Terminal C - Ramp and Flyover Data

Terminal C Ramps	Number of Lanes	Volume (veh/hr)	Speed (mph)
C1	2	1,364	27.1
C2	1	1,264	30.8
C3	1	769	45.8
C4	1	494	41.0
C5	1	492	41.0

Table 30 shows volumes and speeds for entry ramps, exit ramps, and flyovers for Terminal D. The data was obtained from the 09 MAP Build VISSIM model. Ramp D2 is the road that exits Terminal D, providing access to southbound International Parkway. Due to the U-turn shaped curvature and high volume, the speed is lower than 20 mph.

Table 30: Terminal D - Ramp Data

Terminal D Ramps	Number of Lanes	Volume (veh/hr)	Speed (mph)
D1	3	1,326	34.8
D2	1	1,223	18.7

Table 31 shows volumes and speeds for entry ramps, exit ramps, and flyover ramps for Terminals C and D. The data was obtained from the 90 MAP Build VISSIM model. Ramp C6 & D6 carries vehicles exiting Terminal C and Terminal D. With merging traffic at this location, the average speed is only 20 mph.

Table 31: Terminals C and D (Combined Traffic) - Ramp Data

Terminal C & D Ramps	Number of Lanes	Volume (veh/hr)	Speed (mph)
C1 & D1	1	1,569	42.6
C2 & D2	1	1,569	25.5
C3 & D3	1	1,572	40.8
C4 & D4	1	1,116	44.5
C5 & D5	3	2,687	39.8
C6 & D6	2	1,714	20.7
C7 & D7	1	1,713	28.3

Terminal E volumes and speeds for entry ramps, exit ramps, and flyover ramps are shown in **Table 32**. All projected speeds are above 35 mph and no queues or spillbacks are expected to occur.

Table 32: Terminal E - Ramp Data

Terminal E Ramps	Number of Lanes	Volume (veh/hr)	Speed (mph)
E1	1	745	41.1
E2	1	744	40.5
E3	1	515	47.1
E4	2	1,258	36.9
E5	1	684	40.7
E6	1	397	40.9
E7	1	398	41.4

Overall statistics for all modeled terminals in the 90 MAP Build scenario is shown in **Table 33**. The average speed at all terminals is higher than 30 mph during the overall airport peak hour. This means that there is no congestion expected as the posted speed limits on the terminal roadway network are between 20 mph and 40 mph. The highest average travel time is observed for Terminal D, where, on average, it takes about 10 minutes per vehicle to enter the airport, arrive at Terminal D, and exit the airport.

Table 33: 90 MAP Build Scenario - Overall Statistics for All Terminals

Terminal	Total Travel Time (Total Hrs)	Average Speed (mph)	Distance (Total Miles)	Vehicles (Total)*	Average Travel Time (Min)
Terminal A	956,461	32.8	7,475.7	1,799	7.61
Terminal B	335,599	40.6	3,264.5	778	6.20
Terminal C	829,413	33.5	7,045.2	1,647	7.67
Terminal D	1,182,546	31.1	8,577.0	1,633	10.13
Terminal E	756,532	34.9	6,635.5	1,466	7.77

4.3.3 North Airfield Drive Interchange

The proposed future interchange design of North Airfield Drive at International Parkway is shown in **Figure 12**. The figure is taken from the document "*Scenario 2 Interconnect IP-SR*" compiled by AECOM. The intersection would be reconfigured from an interchange with loop ramps to a typical Diamond Interchange, with signals at both the northbound and southbound service road intersections. The bridge is planned to have three lanes in each direction. The northbound and southbound service roads are planned as one-way three lane facilities. On the north side of each intersections, a future connection to TxDOT roadways is shown but no volumes were assigned or analyzed as part of this report.

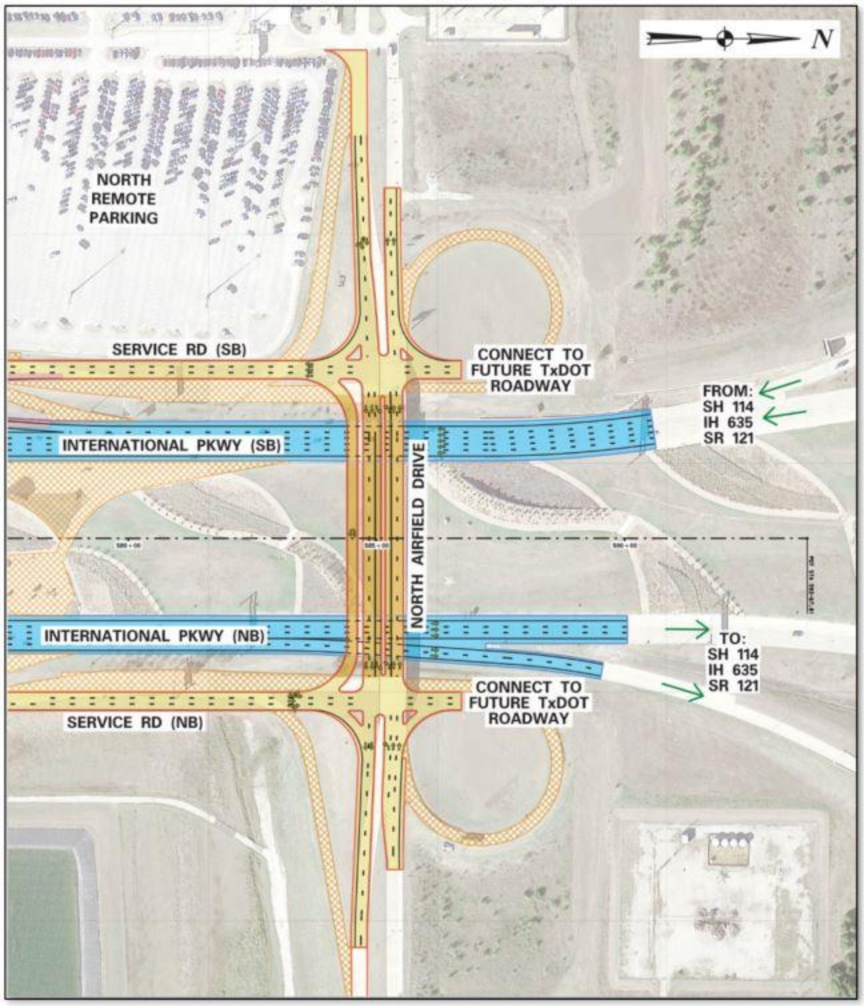


Figure 12: Proposed Schematic for North Airfield Drive

Table 34 and **Table 35** show results from *Synchro* and *SimTraffic* simulation models. *HCM* Analysis presented in **Table 34** shows that both intersections should operate with LOS C or better in AM and PM peak hours. Proposed geometric improvements will significantly improve operations at the interchange as no movements will experience LOS F, which was the case in the 2043 Future No Build scenario.

Table 34: 2043 Future Build North Airfield Drive – *HCM* Results

Control	MOE	EB Movement			WB Movement			NB Movement			SB Movement			Overall
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
Signal	LOS		B	n/a[1]	A	B					n/a[3]	n/a[3]	n/a[3]	B
	Delay		13.3		9.5	16.7								15.3
	LOS		B	n/a[1]	A	B					n/a[3]	n/a[3]	n/a[3]	B
	Delay		12.4		9.1	16.2								14.7
Signal	LOS		B			B		B		n/a[2]				B
	Delay		11.9			17.6		14.4						15.6
	LOS		B			B		C		n/a[2]				B
	Delay		12.7			18.2		27.5						18.4

n/a[1] - *HCM* methodology does not calculate delay for yield-controlled channelized right at signalized intersections
n/a[2] - This is a free movement
n/a[3] – No volumes for specific movement. Not expected to affect overall LOS significantly

Table 35: 2043 Future Build North Airfield Drive – *SimTraffic* Results

Intersection	Time Period	Control	MOE	EB Movement			WB Movement			NB Movement			SB Movement			Overall
				Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
N Airfield Dr @ SB Service Rd	AM	Signal	LOS		B	A	C	C					n/a[3]	n/a[3]	n/a[3]	C
			Delay		19.0	5.8	21.8	23.2								20.5
	PM		LOS		B	A	C	C					n/a[3]	n/a[3]	n/a[3]	B
			Delay		18.3	5.4	23.1	20.7								18.9
N Airfield Dr @ NB Service Rd	AM	Signal	LOS		B			B		B		C				B
			Delay		17.2			17.9		12.3		27.5				19.7
	PM		LOS		B			B		B		B				B
			Delay		18.3			19.1		18.4		13.0				17.5

n/a[3] – No volumes for specific movement. Not expected to affect overall LOS significantly

5.0 Scenario Comparisons

5.1.1 South Airfield Drive Interchange

Table 36 shows *SimTraffic* AM peak hour results for three scenarios analyzed in the report. The results are the average of five simulation runs to account for the stochastic nature of the simulation software. Vehicle miles traveled are the highest for 2043 Build conditions since the number of vehicles that entered the network is the highest (e.g., 5,258 vehicles versus 2,793 for the 2019 Existing scenario and 3,365 for the 2043 No Build scenario). The total delay for the network is the lowest for the 2043 Build scenario, showing that the interchange improvements are beneficial. The highest amount of denied vehicles (i.e., vehicles not being able to enter the simulation network due to congestion on links and overall network) is reported for 2043 No Build scenario. It clearly depicts potential issues at the interchange in the future if no geometric improvements are made. Note that input vehicle volume for 2043 No Build and 2043 Build conditions is the same.

Table 36: South Airfield Drive AM Peak Scenario Comparison

Scenario	VMT	VHT	Delay (hr)	Vehicles in Network		Denied Entry Vehicles
				Entered	Exited	
2019 Existing	2,405	182.2	119.9	2,793	2,759	197
2043 No Build	2,443	1,264.3	1,203	3,365	3,252	2,098
2043 Build	3,736	147.7	53.0	5,258	5,258	1

Table 37 shows *SimTraffic* PM peak hour results for the three South Airfield Drive scenarios analyzed. The table shows the lowest delay for the 2043 Build scenario and the highest number of vehicles that entered the network. There are 270 denied entries, mostly due to high projected traffic volumes for east-west movements on South Airfield Drive. Side street movements, such as northbound left turns, will experience longer wait times, and some of the vehicles have to wait to enter the network. Overall, the benefits of interchange redesign are clear as VMT and vehicles that entered the network almost double from the 2019 Existing scenario to the 2043 Build scenario, while vehicle hours travelled stay about the same and the overall delay decreases.

Table 37: South Airfield Drive PM Peak Scenario Comparison

Scenario	VMT	VHT	Delay (hr)	Vehicles in Network		Denied Entry Vehicles
				Entered	Exited	
2019 Existing	2,137	359.7	304.6	2,997	2,926	197
2043 No Build	2,908	1,655.5	1,584.1	3,741	3,724	2,098
2043 Build	4,180	357.5	250.8	5,725	5,725	270

5.1.2 Central Terminal Area

Table 38 and **Figure 13** summarize the VISSIM output for the 72 MAP Baseline, 90 MAP No Build and 90 MAP Build scenarios that were evaluated as part of this report. Despite higher VMT, total VHT for the 90 MAP Build scenario is 31% lower than for the 72 MAP Baseline scenario and 60% lower than for the 90 MAP No Build scenario. Similar observations can be made for total and average delay. The delay for 90 MAP Build is about 75% lower than for the 72 MAP Baseline scenario and about 88% lower than for the 90 MAP No Build scenario. The model parameter 'Vehicles in network' shows that VISSIM processes more vehicles in the 90 MAP Build scenario than in the other two scenarios. It should be note that there are no stops at entry and exit toll plazas in the Build scenario (i.e., automated tolling), contributing to lower vehicle hours traveled within the project area.

Table 38: Comparison for the three analyzed scenarios

Scenario	VMT	VHT	Delay (s/veh)		Vehicles in Network	
			Total	Average	Active*	Arrived**
72 MAP Baseline	26,504	6,478,454	3,463,583	389.94	1,988	6,892
90 MAP No Build	30,654	11,186,434	7,699,016	668.40	3,701	7,818
90 MAP Build	35,637	4,499,964	893,167	86.23	1,232	9,119

*Active vehicles are vehicles still in network when the simulation period was over
**Arrived vehicles are vehicles that completed their desired routes and have left the network by the time simulation was over

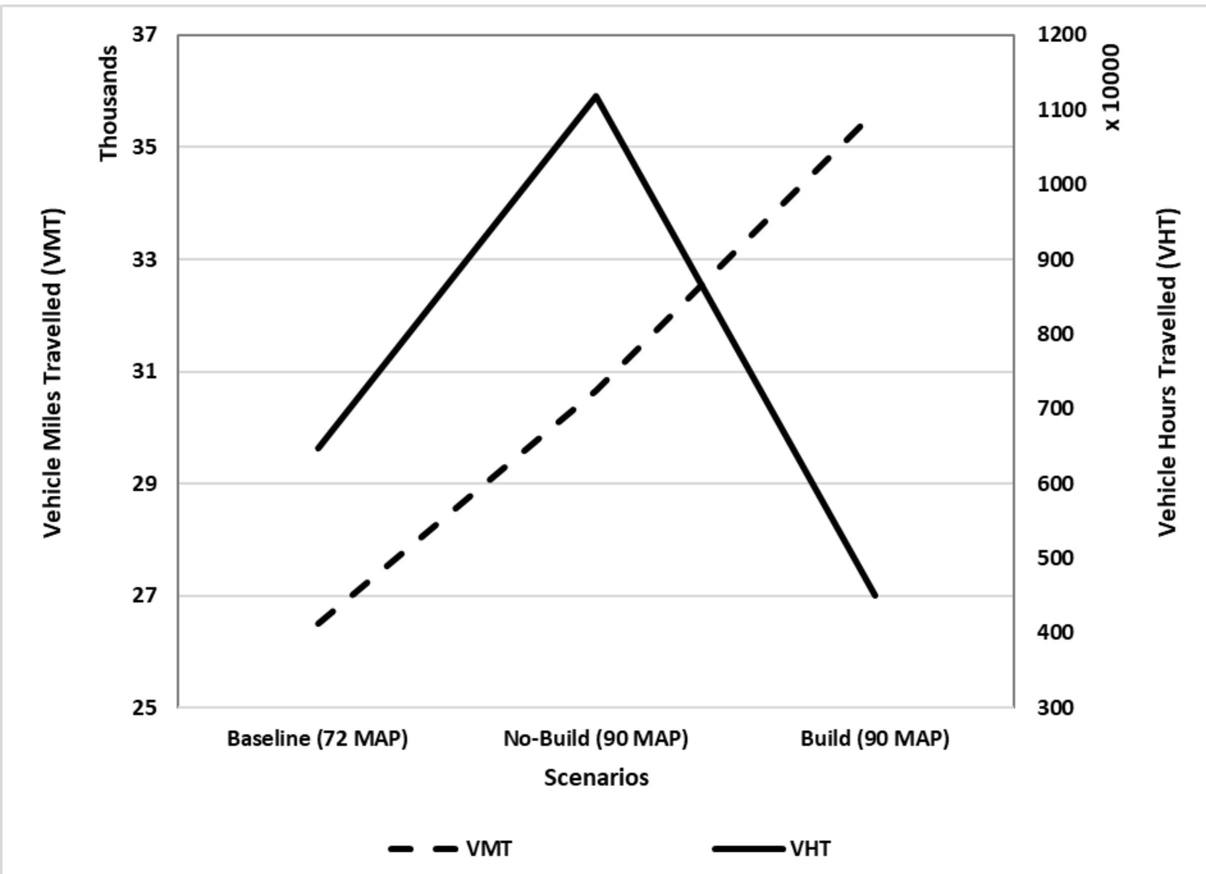


Figure 13: Vehicle Miles Travelled vs. Vehicle Hours Traveled

The travel times for all three scenarios are displayed in **Table 39**. The proposed changes included in 90 MAP Build scenario show the biggest benefits for Terminals A and C. For Terminal A, the time saving on average, when compared to 90 MAP No Build scenario, is almost 12 minutes. When compared to 72 MAP Baseline scenario, time savings are 7 minutes. For Terminal D, the savings are about 9 minutes and 4.5 minutes when compared to 90 MAP No Build and 72 MAP Baseline scenarios, respectively. Note that in the 90 MAP Build scenario, there are no stops at entry and exit toll plazas as all tolling will be made automatic and contactless.

Table 39: Travel Time Comparisons for Various Scenarios

Terminal	Travel Times (min)			Time difference between scenarios (min)	
	72 MAP Baseline	90 MAP No Build	90 MAP Build	72 MAP Baseline – 90 MAP No Build	90 MAP No Build – 90 MAP Build
Terminal A	14.61	19.47	7.61	7.00	11.86
Terminal B	11.06	13.58	6.20	4.86	7.38
Terminal C	13.72	18.15	7.67	6.06	10.48
Terminal D	14.55	19.05	10.13	4.42	8.93
Terminal E	13.04	16.00	7.77	5.26	8.22

5.1.3 North Airfield Drive Interchange

Table 40 shows *SimTraffic* AM peak hour results for the three scenarios analyzed in the report. The results presented are average of five simulation runs. The delay and VHT are the lowest for the 2019 Existing scenario because this scenario has no stop controlled or signalized approaches and many of the movements are free flow with some yield control turns. Vehicle miles traveled are the highest for 2043 Build conditions since the number of vehicles that entered the network is the highest (e.g., 4,230 vehicles versus 2,289 for 2019 Existing and 4,078 for 2043 No Build). The delay for the 2043 Build scenario is 53% lower than for the 2043 No Build scenario which shows that proposed interchange improvements are beneficial. This statement is also supported by the fact that there are no vehicles that are denied entry in the 2043 Build scenario.

Table 40: North Airfield Drive AM Peak Scenario Comparison

Scenario	VMT	VHT	Delay (hr)	Vehicles in Network		Denied Entry Vehicles
				Entered	Exited	
2019 Existing	1,269	38	3.1	2,289	2,286	0
2043 No Build	2,312	181.7	119.3	4,078	4,078	180
2043 Build	2,739	123	56.5	4,230	4,213	0

Similar findings are obtained for the PM peak hour and shown in **Table 41**. The highest number of vehicles is processed in the 2043 Build scenario, with only one vehicle being denied entry to the network. The delay is 71% lower in the 2043 Build scenario than in the 2043 No Build scenario which shows even higher benefits of geometric improvements at this interchange when compared to AM peak hour results.

Table 41: North Airfield Drive PM Peak Scenario Comparison

Scenario	VMT	VHT	Delay (hr)	Vehicles in Network		Denied Entry Vehicles
				Entered	Exited	
2019 Existing	1,306	39.2	3.3	2,314	2,309	0
2043 No Build	2,291	248.8	187	4,021	4,030	305
2043 Build	2,820	122.8	54	4,333	4,333	1

6.0 Summary and Conclusions

South Airfield Drive interchange, North Airfield Drive interchange, and the CTA section, which is located in between North and South Airfield Drive interchanges were analyzed to define the baseline traffic operations and determine the impact of the Build Alternatives. North Airfield Drive and South Airfield Drive were assessed for 2019 Existing conditions, 2043 No Build, and 2043 Build conditions. The CTA area was assessed for 72 MAP Baseline conditions, 90 MAP No Build conditions, and 90 MAP Build conditions. The interchanges were analyzed using *Synchro* and *SimTraffic* microsimulation software, while PTV VISSIM was used to simulate CTA due to complexity of the terminal road network.

The results show that if no action is taken, both interchanges will experience LOS F conditions and heavy congestion due to the projected traffic increases. This can also affect nearby roadways as spillbacks occur. By improving both interchanges and designing standard signalized diamond configurations, the delay will be reduced, and overall LOS will be an acceptable LOS C or better.

The improvements within the CTA include closing left turn ramps from/to International Parkway and realigning merge and diverge movements to right turn movements only. The intent of these configuration improvements is to enhance user experience and driver safety. From the operational standpoint, International Parkway is expected to operate at LOS C or better on all segments between South Airfield Drive and North Airfield Drive interchanges. Travel times at the terminal roads and to/from gantries are expected to decrease when left turn ramps and current tolling gantries are removed and replaced with right turn ramps and open road tolling.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Appendix J2 – DFW CTA Traffic Impact Memorandum

DFW TRAFFIC IMPACT MEMO

March 27, 2023

Subject: Potential Traffic Impacts Resulting from CTA Development

The purpose of this memorandum is to document, for purposes of NEPA evaluation, potential vehicle traffic impacts resulting from implementation of proposed improvements to the DFW Central Terminal Area (CTA). The framework for the memo is based on guidance contained within the *FAA Environmental Desk Reference for Airport Actions, October 2007 (FAA Environmental Desk Reference)*.

CTA improvements are needed to provide additional aircraft gates to meet FAA forecasted passenger growth, renovate aging facilities, and modernize CTA facilities. Therefore, traffic analysis for this effort is focused on the growth of annual passengers that could occur with the addition of additional CTA gates and associated improvements.

Table 1 summarizes forecast passenger levels forecasted within the 2021 FAA Terminal Area Forecasts (TAF). The 2021 TAF was selected as the operational level upon which the demand for additional facilities are based. It was determined that an additional 31 aircraft gates are necessary by 2038 to meet passenger demand. If the gates are not constructed (No Action Alternative) the airport will reach capacity in 2028. Please note, the FAA only provides forecasts for enplaned passengers and not deplaned passengers; therefore, to estimate total number of passengers the number of enplaned passengers can be multiplied by two.

Based on the forecast, when all new gates are operational at DFW in 2038, the number of annual passengers is estimated to be 103,677,178 (51,838,589 x 2).

Table 1 – DFW Historical and Forecast TAF Enplanements

Historic Passenger Enplanements			
TAF Year	Air Carrier	Commuter	Total Enplanements
2003	20,793,894	3,807,587	24,601,481
2004	22,748,736	4,850,042	27,598,778
2005	24,044,682	3,915,662	27,960,344
2006	24,558,015	4,069,889	28,627,904
2007	24,387,536	4,008,175	28,395,711
2008	23,637,147	4,006,389	27,643,536
2009	22,481,833	4,083,152	26,564,985
2010	22,498,994	4,251,087	26,750,081
2011	23,117,592	4,346,566	27,464,158
2012	23,438,053	4,361,864	27,799,917
2013	24,346,676	4,599,762	28,946,438
2014	25,699,892	4,651,914	30,351,806
2015	25,489,407	5,866,768	31,356,175
2016	25,016,146	6,416,414	31,432,560
2017	25,108,840	6,324,255	31,433,095
2018	26,573,503	6,191,939	32,765,442
2019	28,252,269	6,610,026	34,862,295
2020	17,623,662	4,844,444	22,468,106
2021	21,020,665	6,554,504	27,575,169
Forecast Passenger Enplanements			
TAF Year	Air Carrier	Commuter	Total Enplanements
2022	25,311,338	6,577,592	31,888,930
2023	28,827,529	7,455,216	36,282,745
2024	30,071,455	7,752,429	37,823,884
2025	30,895,270	7,962,353	38,857,623
2026	31,688,516	8,163,999	39,852,515
2027	32,515,341	8,374,772	40,890,113
2028	33,346,451	8,586,683	41,933,134
2029	34,140,582	8,788,926	42,929,508
2030	34,918,401	8,986,070	43,904,471
2031	35,693,444	9,182,082	44,875,526
2032	36,482,739	9,382,958	45,865,697
2033	37,266,982	9,582,466	46,849,448
2034	38,072,227	9,787,195	47,859,422
2035	38,883,843	9,993,921	48,877,764
2036	39,698,794	10,201,356	49,900,150
2037	40,476,592	10,399,268	50,875,860
2038	41,245,065	10,593,524	51,838,589
2039	42,019,729	10,790,039	52,809,768

Traffic Analysis Background

In August 2020 a Traffic Impact Analysis (TIA) was completed for the International Parkway Modernization Program. This program sought to replace aging infrastructure, enhance roadway safety, and increase throughput efficiency by removing several, non-standard left-hand exits and associated flyover bridges. The removed left-hand exits will be replaced by national and TxDOT standard right-hand exits.

The TIA evaluated the entire CTA road network and concluded that a level of service (LOS) C is maintained through 90 million annual passengers (MAP). Based on FAA forecasts, this passenger level is anticipated to occur between the years 2031 and 2032. Once that passenger level is reached, the road network LOS may begin to decline (refer to **Appendix A** for prior coordination regarding the 90 MAP analysis).

CTA Improvement Traffic Analysis

In accordance with the *FAA Environmental Desk Reference,* analysis is needed to provide information on the CTA development's potential to reduce the LOS of airport access roads, or of roads in the areas immediately surrounding the airport. Once analysis is complete, appropriate transportation management agencies are to then be consulted regarding potential impact and their level of significance considering the long-term development of the area.

To support necessary analysis the following was undertaken:

- Estimated the number of daily vehicular trips that would occur on primary roads serving the CTA.
- Determined the ability of the existing road network to meet estimated traffic demand and described impact on LOS of roads serving the CTA

Estimation of Daily Trips Resulting from CTA Improvements

Historical Control Plaza data was analyzed to determine an estimated number of additional vehicles that could operate on the landside roadways throughout the CTA as a result of proposed development. Control Plaza transaction data was obtained for calendar years 2016 to 2022 and adjusted to remove vehicle pass-thru or U-turn operations. Additionally, due to the impact of the COVID-19 Pandemic, data from calendar years 2020 and 2021 were removed.

The resulting analysis showed that, on average, 0.3 vehicle operations occur per passenger using DFW. This metric was applied to the increased passengers as forecasted within the TAF. For the purposes of NEPA evaluation the vehicle operations of the No Action Alternative and the Proposed Action Alternative were compared. The comparison began in 2028 when DFW operations would be constrained by gate availability.

Table 2 provides the comparison of the No Action and Proposed Action Alternatives and summarizes the additional vehicle trips that would occur with development of the proposed CTA Improvements.

Table 2 – Proposed Action vs. No-Action Vehicle Trips Comparison

Year	Proposed Action		No Action		Difference in Number of Vehicle Trips
	Total Passengers	Vehicle Trips	Total Passengers	Vehicle Trips	
2028	83,866,268	25,159,880	81,132,685	24,339,805	820,075
2029	85,859,016	25,757,705	81,772,055	24,531,617	1,226,088
2030	87,808,942	26,342,683	82,412,008	24,723,602	1,619,080
2031	89,751,052	26,925,316	83,057,922	24,917,376	2,007,939
2032	91,731,394	27,519,418	83,704,869	25,111,461	2,407,958
2033	93,698,896	28,109,669	84,348,351	25,304,505	2,805,164
2034	95,718,844	28,715,653	84,995,035	25,498,510	3,217,143
2035	97,755,528	29,326,658	85,643,399	25,693,020	3,633,639
2036	99,800,300	29,940,090	86,285,510	25,885,653	4,054,437
2037	101,751,720	30,525,516	86,917,293	26,075,188	4,450,328
2038	103,677,178	31,103,153	87,550,427	26,265,128	4,838,025

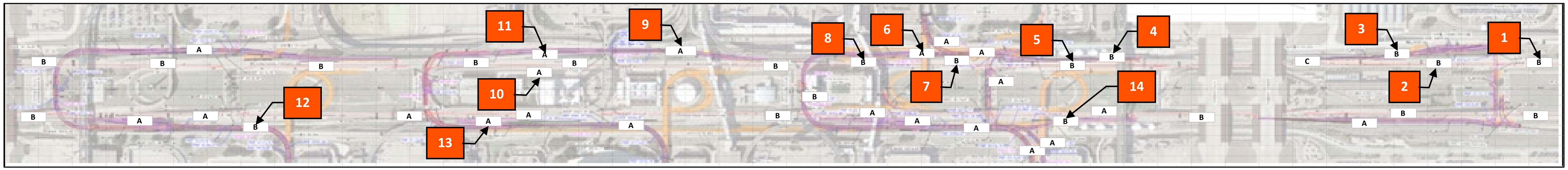
Impact of Traffic Demand on Road System

As previously described, a Traffic Impact Analysis was completed in 2020 for the International Parkway Modernization Program. This analysis, and resulting report, evaluated the entire CTA road network and concluded a LOS C is maintained through 90 MAP.

According to the 2021 TAF, passenger levels in 2038 are expected to exceed 100 MAP, reaching 103 MAP. The 2020 traffic analysis was updated to reflect 100 MAP to determine resultant LOS. Findings are shown on **Figure 1** which provides an overview of the LOS on the CTA roadway network at both 90 MAP and 100 MAP. **Table 3** summarizes those roadway segments shown in **Figure 1** which experience an LOS degradation between 90 and 100 MAP.

Figure 1 – LOS Comparison: 90 MAP Versus 100 MAP

90 MAP LOS Overview



100 MAP LOS Overview

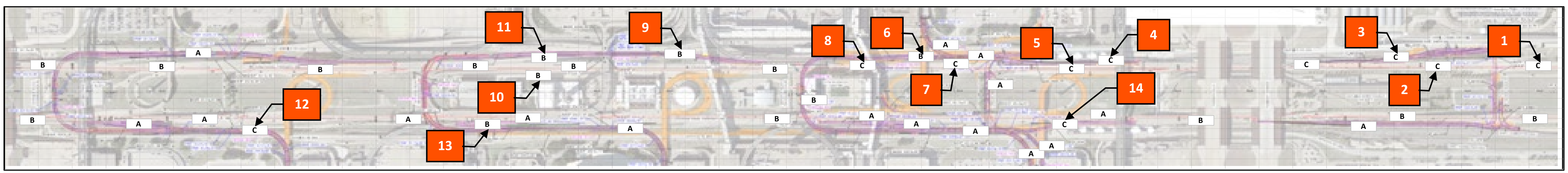


Table 3 – CTA Roadway Segment LOS Degradation Between 90 MAP and 100 MAP

Roadway Segment ID	Roadway Location	90 MAP LOS	100 MAP LOS
1	SB International Parkway before exit from Express North	B	C
2	SB International Parkway after exit from Express North	B	C
3	Ramp to SB IP from Turnaround from IP North	B	C
4	Ramp from SB IP to Terminal A/B	B	C
5	SB International Parkway after Ramp to Terminal A/B	B	C
6	Terminal A/B Ramp from SB IP after peel off to Terminal B	A	B
7	SB International Parkway after Ramp to Terminal A/B	B	C
8	SB International Parkway after Terminal B Existing Exit ramp (incase Terminal B existing exit remains)	B	C
9	Ramp from SB IP to Terminal C	A	B
10	Ramp from SB IP to Terminal D (RT Hand)	A	B
11	Exit ramp from Terminal D to SB IP	A	B
12	Ramp to Terminal E After merge of SB and NB IP traffic	B	C
13	Ramp to Terminal C from NB IP	A	B
14	Ramp from Terminal A/B to NB IP After merge of Terminal A and Terminal B Exit Traffic	B	C

CONCLUSION

Implementation of the proposed CTA improvements will result in an increase in vehicle trips; however, this increase is not considered significant from both a traffic and road level of service perspective. No changes, modifications, or additions to the CTA road network, beyond the International Parkway Right-Hand Exits project are needed to support the development of this CTA improvement project.