

October 21, 2024

Mr. Chris Fellows
Windler Public Improvement Authority
9155 E. Nicholls Ave, Suite 360
Greenwood Village, CO 80112

**RE: Windler – Master Plan Amendment
FHU Project No. 12259-01**

Dear Mr. Fellows:

Felsburg Holt & Ullevig (FHU) prepared a traffic impact study for the Windler Homestead development in July 2023. The initial master plan has been adjusted to represent current aspirations for the development. These adjustments to the initial master plan include refinements to the residential unit counts and provide refinements to commercial development summarized below:

- PA-1:
 - One 125 room hotel
 - One 16 pump gas station and convenience store
- PA-14:
 - 130,000 sf of commercial which will include a Supermarket anchor
- PA-16:
 - Three 125 room hotels
 - One 16 pump gas station and convenience store

These uses have been analyzed under the assumption that the hotels would occupy 3-acre sites, and the gas stations would occupy 2-acre sites with the balance of developable acreage analyzed using the standard commercial land uses identified in the Institute of Transportation Engineers' (ITE) publication Trip Generation Manual, 11th Edition, 2021.

It should also be noted that the single-family housing was split into 60% single-family attached housing and 40% single-family detached housing across the entire development which is consistent with prior Windler site plan submittals. NCHRP Report 684 for internal capture trips and pass-by trips were also updated. The updated land use plan is depicted in **Figure 1**.

LEGEND

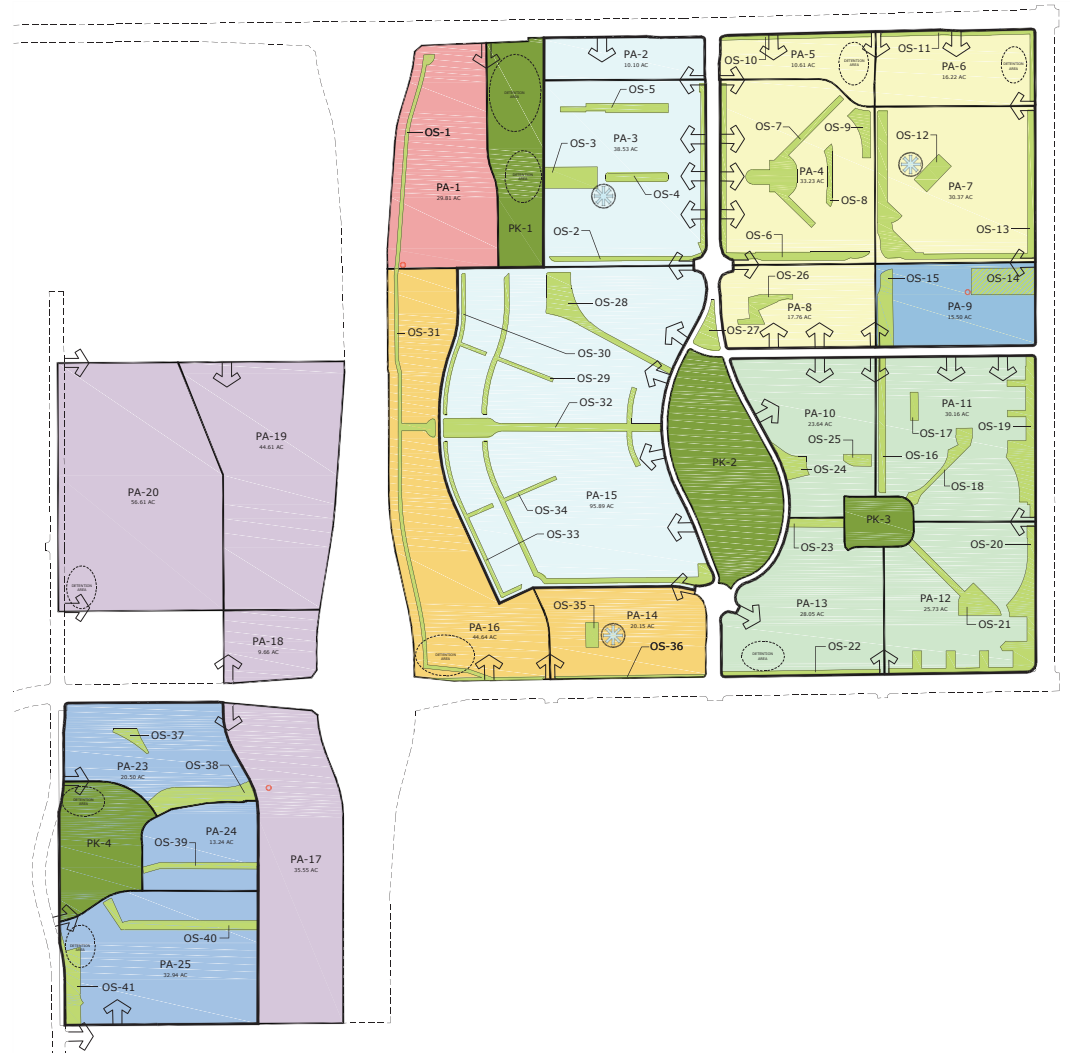
- OPEN SPACE
- NEIGHBORHOOD PARK
- FLEX RES - 1
(145.6 Acres Gross)
- FLEX RES - 2
(130.4 Acres Gross)
- FLEX RES - 3
(153.4 Acres Gross)
- FLEX RES - 4
(89.7 Acres Gross)
- MIXED USE
- COMMERCIAL
- INDUSTRIAL
- SCHOOL
- SHARED USE OPEN SPACE
- A

 ADMINISTRATIVE ACTIVITY CENTER
- W

 WHELEN WARNING SYSTEM LOCATION
- R

 RECREATION CENTER
- S

 LOCAL STREET CONNECTION



Traffic Volume Analysis

2040 average daily traffic (ADT) volumes and peak hour volumes are illustrated in **Figure 1**. These volumes are a product of the 2040 background volumes from the Master TIS (MTIS) and the updated external and internal site-generated traffic volumes. A comparison of 2040 volumes along Denali Boulevard, Biloxi Street, 48th Avenue, and 56th Avenue can be found in **Table 1**.

Table 1. 2040 ADT Comparison

Location	MTIS 2040 ADT	Master Plan Amendment 2040 ADT
Denali Boulevard	14,100 - 15,700	14,300 - 17,400
Biloxi Street	2,600 - 3,100	2,800 - 3,800
48 th Avenue	34,500 - 55,400	34,500 - 56,800
56 th Avenue	20,000 - 34,200	20,200 - 35,000

Trip Generation Analysis

The MTIS used the *Institute of Transportation Engineers' (ITE) publication Trip Generation Manual, 11th Edition, 2021* to forecast vehicle-trips based on the land use types and sizes. Land use types and sizes were modified based on the amendment to the master site plan. **Table 2** displays the comparison of total external site generated trips for the MTIS and the updated trip generation. A more detailed table of the site generated trips can be found in the **Appendix**.

Table 2. ITE Trip Generation Comparison

	Daily	AM Peak Hour		PM Peak Hour			
	Total	In	Out	Total	In	Out	Total
MTIS Site Trips	88,699	2,346	2,755	5,101	3,580	3,236	6,816
Updated Site Trips	95,213	2,734	3,057	5,821	3,508	3,107	6,614

Master Plan Amendment Impact

A minor adjustment to the internal roadway network involves the removal of 54th Place between Buchanan Street and Biloxi Street. This change is not anticipated to have a significant impact on travel patterns. It should be noted that internal site intersections were not evaluated due to the limited details available for the internal site network, and because these intersections are considered less critical.

Detailed Intersection Analysis

As part of the amendment analysis, the following intersections were further analyzed:

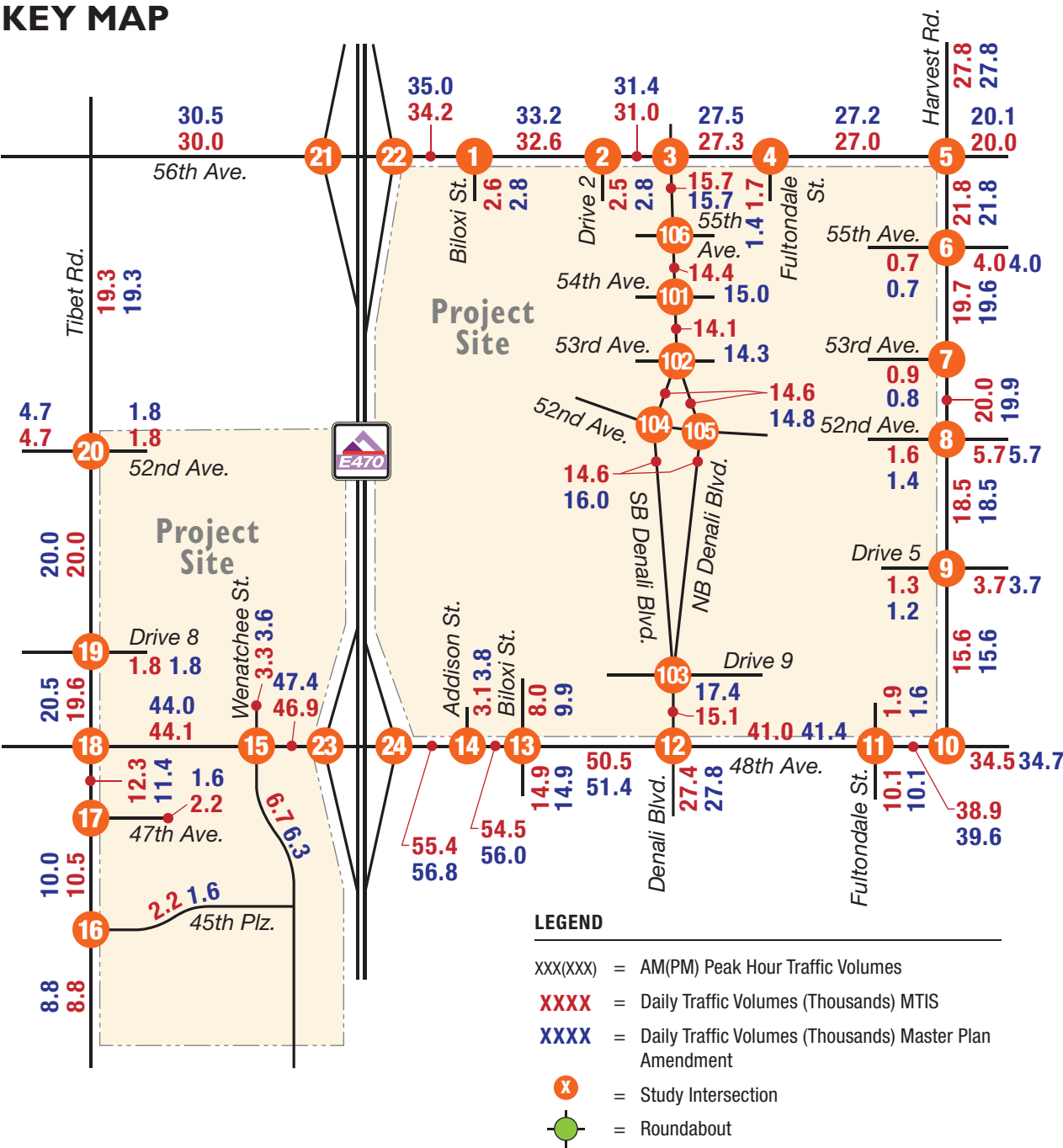
- 56th Avenue & Biloxi Street
- 56th Avenue & Denali Boulevard
- 48th Avenue & Denali Boulevard
- 48th Avenue & Addison Street
- 48th Avenue & Biloxi Street
- Northern and Southern roundabouts along Denali Boulevard

The evaluation of these intersections included Level of Service (LOS), delay, and queueing. **Figure 2** illustrates the comparison of the LOS at the analyzed intersections under MTIS conditions and the updated conditions. As illustrated, updated traffic conditions do not have a significant impact on the LOS at the intersections analyzed at the City of Aurora staff request. All intersections operate at LOS D or better with the exception of the signalized intersection of 48th Avenue with Denali Boulevard which is projected to operate at LOS E during the AM peak hour which is consistent with the findings of the MTIS.

In general, the changes in anticipated land use proposed in this master plan amendment do not adversely impact traffic operations when compared to the previous MTIS. However, given the variability in traffic generation for commercial uses it would be recommended to further evaluate as site plans are developed, in particular for intersections along 56th and 48th Avenues between E-470 and Denali Boulevard. The movements that result in a different LOS from the MTIS are as follows:

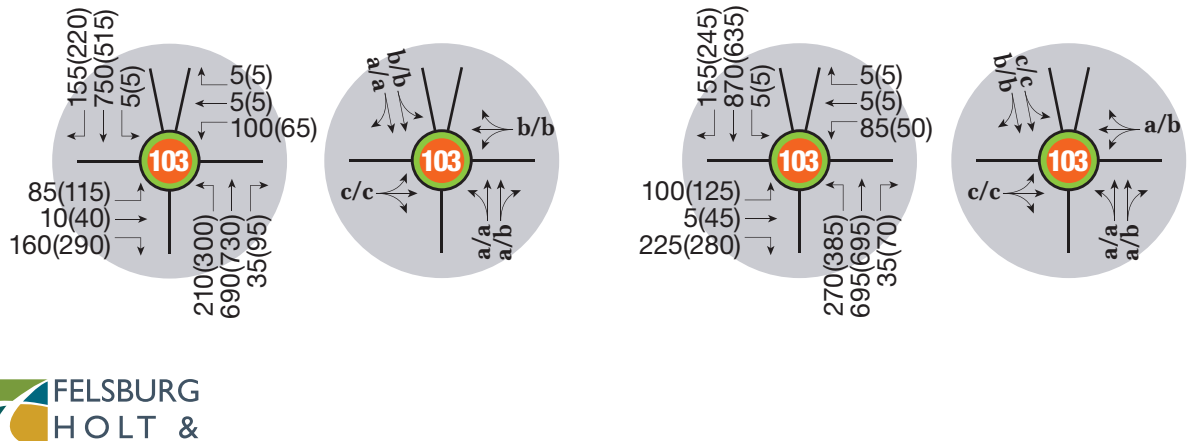
- 48th Avenue & Addison Street
 - Southbound right-turn movement changed from LOS C to LOS D in the AM peak hour and LOS F to LOS E in the PM peak hour.
- Northern roundabout along Denali Boulevard
 - Northbound movements changed from LOS B to LOS C in the AM peak hour and LOS A to LOS B in the PM peak hour.
 - Eastbound movement changed from LOS A in the AM and PM peak hours to LOS B.
 - Southbound through/left-turn movement changed from LOS A in the AM peak hour to LOS B.
- Southern roundabout along Denali Boulevard
 - Southbound through/right-turn movement changed from LOS A in the AM and PM peak hours to LOS B.
 - Southbound through/left-turn movement changed from LOS B in the AM and PM peak hours to LOS C.
 - Westbound movements changed from LOS B in the AM peak hour to LOS A.

KEY MAP



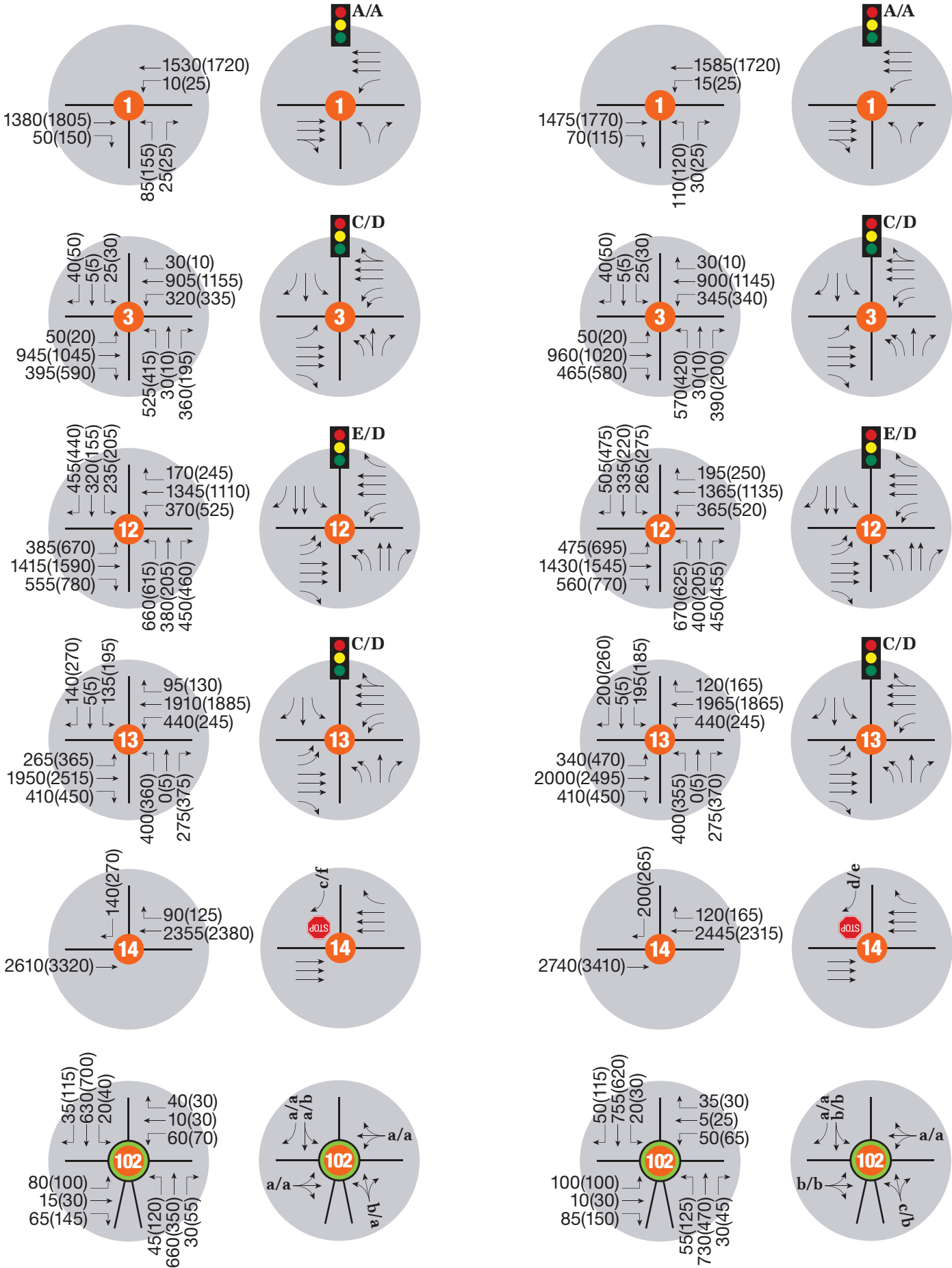
Windler MTIS

Master Plan Amendment



Windler MTIS

Master Plan Amendment



Pedestrian Connectivity Analysis

The development should provide adequate sidewalk connectivity throughout the site. Midblock crossing should be considered along Denali Boulevard to enhance pedestrian access to Discovery Park. In addition to the access to Discovery Park, the sidewalk should provide connectivity to the regional trail network including the trail west of E-470.

The removal of 54th Place discussed in master plan amendment impact section will have negligible impacts on pedestrian connectivity.

Traffic Calming Measures

The development should be designed to adhere to the City of Aroura traffic calming guidelines. The guidelines include using design tools such as automated speed radar signs, curb extensions/neckdowns, speed cushions, and mini roundabouts. In addition to the City of Aroura guidance, on-street parking, narrowing of roadways and intersection bump-outs should be incorporated into the roadway network design in accordance with the FHWA traffic calming toolkit.

Conclusions

The study resulted in the following conclusions:

- The newly proposed master plan generates more traffic as compared to the values analyzed in the master TIS. These increases are approximately 6,514 daily trips and 720 in the AM peak hours. During the PM peak hour, trips decreased by 202 trips. This equates to a roughly 6 percent increase in daily traffic, a 14 percent increase in the AM peak hour and a 3 percent decrease during the PM peak hour, with PM peak hour generating the most traffic of the two peak hours.
- The analyzed intersections are anticipated to continue to operate acceptably with the recommendations provided in the Windler Master TIS.
- The following is a list of changes to auxiliary lane requirements:
 - Recommended northbound left-turn storage length at 56th Avenue & Denali Boulevard changes from 325 feet to 300 feet.
 - Recommended northbound left-turn storage length at 48th Avenue & Denali Boulevard changes from 400 feet to 450 feet.
 - Recommended eastbound left-turn storage length at 48th Avenue & Denali Boulevard changes from 300 feet to 400 feet.
 - Recommended eastbound left-turn storage length at 48th Avenue & Biloxi Street changes from 175 feet to 200 feet.

Please let me know if you have any questions about this letter or need any additional information.



Philip Dunham, PE, PTOE
Transportation Engineer

APPENDIX A. TRIP GENERATION MATERIALS

Site Trip Generation

Map Code	ITE Code	Land Use Description	Size	Unit	Daily	AM Peak Hour			Internal Capture			AM Peak Hour			AM Pass-By %	AM Pass-By Trips	PM Peak Hour			Internal Capture			PM Peak Hour			PM Pass-By %	PM Pass-By Trips
					Total	Total Trip Generation			Trips			External Trips					Total Trip Generation			Trips			External Trips				
						In	Out	Total	In	Out	Total	In	Out	Total			In	Out	Total	In	Out	Total	In	Out	Total		
PA-1.1	820	Shopping Center	270.0	KSF	12,913	182	111	293	7	2	9	175	109	284	-	-	554	600	1,154	64	166	230	490	434	924	29%	142
PA-1.2	310	Hotel	125	Rooms	931	31	24	55	0	3	3	31	21	52	-	-	33	32	65	9	5	14	24	27	51	-	-
PA-1.3	945	Gas Station	16	Pumps	3,383	128	129	257	0	0	0	128	129	257	63%	81	147	148	295	0	0	0	147	148	295	57%	84
PA-2	220	Multifamily Housing (Low-Rise)	303	DU	2,018	28	89	117	1	2	3	27	87	114	-	-	95	56	151	20	8	28	75	48	123	-	-
PA-3.1	210	Single Family Detached Housing	160	DU	1,555	28	86	114	1	2	3	27	84	111	-	-	98	57	155	21	8	29	77	49	126	-	-
PA-3.2	215	Single Family Attached Housing	240	DU	1,778	30	89	119	1	2	3	29	87	116	-	-	79	55	134	17	8	25	62	47	109	-	-
PA-3.3	822	Strip Retail Plaza	25.0	KSF	1,285	35	24	59	1	1	2	34	23	57	-	-	75	75	149	9	21	30	66	54	119	40%	26
PA-4.1	210	Single Family Detached Housing	126	DU	1,248	23	69	92	0	1	1	23	68	91	-	-	77	46	123	17	6	23	60	40	100	-	-
PA-4.2	215	Single Family Attached Housing	190	DU	1,397	23	70	93	0	1	1	23	69	92	-	-	61	43	104	13	6	19	48	37	85	-	-
PA-5	220	Multifamily Housing (Low-Rise)	228	DU	1,537	23	71	94	0	1	1	23	70	93	-	-	75	44	119	16	6	22	59	38	97	-	-
PA-6	220	Multifamily Housing (Low-Rise)	322	DU	2,139	30	93	123	1	1	2	29	92	121	-	-	100	59	159	22	8	30	78	51	129	-	-
PA-7.1	210	Single Family Detached Housing	108	DU	1,083	20	60	80	1	1	2	19	59	78	-	-	67	40	107	14	6	20	53	34	87	-	-
PA-7.2	215	Single Family Attached Housing	161	DU	1,176	20	58	78	1	1	2	19	57	76	-	-	51	36	87	11	5	16	40	31	71	-	-
PA-7.3	822	Strip Retail Plaza	5.0	KSF	441	7	5	12	0	0	0	7	5	12	-	-	24	24	48	3	7	10	21	17	38	40%	8
PA-8.1	210	Single Family Detached Housing	64	DU	669	13	37	50	0	0	0	13	37	50	-	-	41	24	65	9	3	12	32	21	53	-	-
PA-8.2	215	Single Family Attached Housing	96	DU	681	11	33	44	0	0	0	11	33	44	-	-	28	20	48	2	1	3	26	19	45	-	-
PA-9	520	Elementary School	300	Students	681	120	102	222	0	0	0	120	102	222	-	-	22	26	48	0	0	0	22	26	48	-	-
PA-10.1	210	Single Family Detached Housing	74	DU	765	14	43	57	0	0	0	14	43	57	-	-	47	28	75	10	4	14	37	24	61	-	-
PA-10.2	215	Single Family Attached Housing	111	DU	795	13	39	52	0	0	0	13	39	52	-	-	34	23	57	7	3	10	27	20	47	-	-
PA-11.1	210	Single Family Detached Housing	82	DU	841	16	46	62	0	0	0	16	46	62	-	-	52	30	82	11	4	15	41	26	67	-	-
PA-11.2	215	Single Family Attached Housing	124	DU	894	15	44	59	0	0	0	15	44	59	-	-	38	26	64	8	4	12	30	22	52	-	-
PA-12.1	210	Single Family Detached Housing	82	DU	841	16	46	62	0	0	0	16	46	62	-	-	52	30	82	11	4	15	41	26	67	-	-
PA-12.2	215	Single Family Attached Housing	123	DU	887	15	43	58	0	0	0	15	43	58	-	-	38	26	64	8	4	12	30	22	52	-	-
PA-13.1	210	Single Family Detached Housing	64	DU	669	13	37	50	0	0	0	13	37	50	-	-	41	24	65	9	3	12	32	21	53	-	-
PA-13.2	215	Single Family Attached Housing	96	DU	681	11	33	44	0	0	0	11	33	44	-	-	28	20	48	6	3	9	22	17	39	-	-
PA-13.3	220	Multifamily Housing (Low-Rise)	338	DU	2,242	31	97	128	1	1	2	30	96	126	-	-	105	61	166	23	9	32	82	52	134	-	-
PA-14.1	210	Single Family Detached Housing	34	DU	374	7	21	28	0	0	0	7	21	28	-	-	23	13	36	5	2	7	18	11	29	-	-
PA-14.2	215	Single Family Attached Housing	52	DU	346	5	16	21	0	0	0	5	16	21	-	-	12	9	21	3	1	4	9	8	17	-	-
PA-14.3	220	Multifamily Housing (Low-Rise)	320	DU	2,127	29	93	122	1	1	2	28	92	120	-	-	100	58	158	22	8	30	78	50	128	-	-
PA-14.4	821	Shopping Plaza with Supermarket	130	KSF	11,418	285	174	459	11	4	15	274	170	444	-	-	536	580	1,116	62	160	222	474	420	894	-	-
PA-15.1	210	Single Family Detached Housing	279	DU	2,593	48	142	190	1	1	2	47	141	188	-	-	164	97	261	35	14	49	129	83	212	-	-
PA-15.2	215	Single Family Attached Housing	418	DU	3,135	53	159	212	1	2	3	52	157	209	-	-	142	99	241	30	15	45	112	84	196	-	-
PA-15.3	220	Multifamily Housing (Low-Rise)	90	DU	652	12	39	51	0	0	0	12	39	51	-	-	37	22	59	8	3	11	29	19	48	-	-
PA-16.1	220	Multifamily Housing (Low-Rise)	345	DU	2,287	31	99	130	1	1	2	30	98	128	-	-	106	63	169	23	9	32	83	54	137	-	-
PA-16.2	822	Strip Retail Plaza	257	KSF	11,075	364	243	607	15	6	21	349	237	586	-	-	390	390	780	45	107	152	345	283	628	40%	138
PA-16.3	310	Hotel	375	Rooms	3,641	101	79	180	0	11	11	101	68	169	-	-	127	123	250	37	20	57	90	103	193	-	-
PA-16.4	945	Gas Station	16	Pumps	3,383	128	129	257	0	0	0	128	129	257	63%	81	147	148	295	0	0	0	147	148	295	57%	84
PA-17.1	210	Single Family Detached Housing	84	DU	860	16	48	64	0	0	0	16	48	64	-	-	53	31	84	11	4	15	42	27	69	-	-
PA-17.2	215	Single Family Attached Housing	125	DU	902	15	44	59	0	0	0	15	44	59	-	-	38	27	65	8	4	12	30	23	53	-	-
PA-18.1	210	Single Family Detached Housing	47	DU	504	9	28	37	0	0	0	9	28	37	-	-	31	18	49	7	3	10	24	15	39	-	-
PA-18.2	215	Single Family Attached Housing	71	DU	491	8	23	31	0	0	0	8	23	31	-	-	19	14	33	4	2	6	15	12	27	-	-
PA-19.1	210	Single Family Detached Housing	96	DU	972	18	54	72	1	1	2	17	53	70	-	-	60	36	96	13	5	18	47	31	78	-	-
PA-19.2	215	Single Family Attached Housing	144	DU	1,047	17	52	69	1	1	2	16	51	67	-	-	45	31	76	10	4	14	35	27	62	-	-
PA-20.1	154	High-Cube Transload and Short-Term Storage Warehouse	250	KSF	350	15	5	20	0	0	0	15	5	20	-	-	7	18	25	0	0	0	7	18	25	-	-
PA-20.2	110	General Light Industrial	250	KSF	990	153	21	174	0	0	0	153	21	174	-	-	11	67	78	0	0	0					

ITE Trip Generation Rates and Equations

Land Use	ITE Code	Unit	Daily	Peak	Equations & Rates	Distributions	
						In	Out
General Light Industrial	110	KSF	$T=3.76 \times X+50.47$	AM	$T=0.68 \times X+3.81$	88%	12%
				PM	$\ln(T)=0.72 \times \ln(X)+0.38$	14%	86%
High-Cube Transload & Short-Term Storage Warehouse	154	KSF	$T=6.41 \times X+75.31$	AM	$T=0.31 \times X+22.85$	24%	76%
				PM	$T=0.43 \times X+20.55$	63%	37%
Single-family Detached	210	DU	$\ln(T)=0.92 \times \ln(X)+2.68$	AM	$\ln(T)=0.91 \times \ln(T)+0.12$	26%	74%
				PM	$\ln(T)=0.94 \times \ln(X)+0.27$	63%	37%
Single-family Attached	215	DU	$T=7.62 \times X-50.48$	AM	$T=0.52 \times X-5.70$	25%	75%
				PM	$T=0.60 \times X-3.93$	59%	41%
Multifamily (Low-Rise)	220	DU	$T=6.41 \times X+75.31$	AM	$T=0.31 \times X+22.85$	24%	76%
				PM	$T=0.43 \times X+20.55$	63%	37%
Elementary School	520	Students	$T=2.27 \times X$	AM	$T=0.74 \times X$	54%	46%
				PM	$T=0.16 \times X$	46%	54%
General Office	710	KSF	$T=10.84 \times X$	AM	$T=1.52 \times X$	88%	12%
				PM	$T=1.44 \times X$	17%	83%
Shopping Center (>150 KSF)	820	KSF	$T=10.84 \times X$	AM	$T=1.52 \times X$	88%	12%
				PM	$T=1.44 \times X$	17%	83%
Shopping Plaza (40-150 KSF) with Supermarket anchor	821	KSF	$T=67.52 \times X$	AM	$T=1.73 \times X$	62%	38%
				PM	$T=5.19 \times X$	49%	51%
Strip Retail Plaza (<40KSF)	822	KSF	$T=42.2 \times X+229.68$	AM	$T=2.36 \times X$	60%	40%
				PM	$T=6.59 \times X$	50%	50%
Hotel	310	Rooms	$T=10384 \times X-423.51$	AM	$T=0.50 \times X-7.45$	56%	44%
				PM	$T=0.74 \times X-27.89$	51%	49%
Gas Station	945	Pumps	$T=158.28 \times X+850.23$	AM	$T=16.06 \times X$	50%	50%
				PM	$T=18.42 \times X$	50%	50%

DU = Dwelling Units KSF = 1,000 SF

NCHRP 684 Internal Trip Capture Estimation Tool					
Project Name:	Windler TIA			Organization:	Felsburg Holt & Ullevig
Project Location:	Aurora, CO			Performed By:	TL
Scenario Description:	Full Buildout			Date:	10/21/2024
Analysis Year:	2040			Checked By:	
Analysis Period:	AM Street Peak Hour			Date:	

Table 1-A: Base Vehicle-Trip Generation Estimates (Single-Use Site Estimate)						
Land Use	Development Data (For Information Only)			Estimated Vehicle-Trips ³		
	ITE LUCs ¹	Quantity	Units	Total	Entering	Exiting
Office				0		
Retail	820,821,822	974	KSF	1,430	873	557
Restaurant	-	-	-	0	0	0
Cinema/Entertainment	-	-	-	0	0	0
Residential	210, 215, 220	5,782	DU	2,662	661	2,001
Hotel	310	500	Rooms	235	132	103
All Other Land Uses ²	0, 154, 520, 9	2,200	KSF	1,588	1,115	473
				5,915	2,781	3,134

Table 2-A: Mode Split and Vehicle Occupancy Estimates						
Land Use	Entering Trips			Exiting Trips		
	Veh. Occ. ⁴	% Transit	% Non-Motorized	Veh. Occ. ⁴	% Transit	% Non-Motorized
Office	1.00	0%	0%	1.00	0%	0%
Retail	1.00	0%	0%	1.00	0%	0%
Restaurant	1.00	0%	0%	1.00	0%	0%
Cinema/Entertainment	1.00	0%	0%	1.00	0%	0%
Residential	1.00	0%	0%	1.00	0%	0%
Hotel	1.00	0%	0%	1.00	0%	0%
All Other Land Uses ²	1.00	0%	0%	1.00	0%	0%

Table 3-A: Average Land Use Interchange Distances (Feet Walking Distance)						
Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office						
Retail						
Restaurant						
Cinema/Entertainment						
Residential						
Hotel						

Table 4-A: Internal Person-Trip Origin-Destination Matrix*						
Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office		0	0	0	0	0
Retail	0		0	0	13	0
Restaurant	0	0		0	0	0
Cinema/Entertainment	0	0	0		0	0
Residential	0	20	0	0		0
Hotel	0	14	0	0	0	

Table 5-A: Computations Summary			
	Total	Entering	Exiting
All Person-Trips	5,915	2,781	3,134
Internal Capture Percentage	2%	2%	1%
External Vehicle-Trips ⁵	5,821	2,734	3,087
External Transit-Trips ⁶	0	0	0
External Non-Motorized Trips ⁶	0	0	0

Table 6-A: Internal Trip Capture Percentages by Land Use		
Land Use	Entering Trips	Exiting Trips
Office	N/A	N/A
Retail	4%	2%
Restaurant	N/A	N/A
Cinema/Entertainment	N/A	N/A
Residential	2%	1%
Hotel	0%	14%

¹ Land Use Codes (LUCs) from <i>Trip Generation Manual</i> , published by the Institute of Transportation Engineers.
² Total estimate for all other land uses at mixed-use development site is not subject to internal trip capture computations in this estimator.
³ Enter trips assuming no transit or non-motorized trips (as assumed in ITE <i>Trip Generation Manual</i>).
⁴ Enter vehicle occupancy assumed in Table 1-A vehicle trips. If vehicle occupancy changes for proposed mixed-use project, manual adjustments must be made to Tables 5-A, 9-A (O and D). Enter transit, non-motorized percentages that will result with proposed mixed-use project complete.
⁵ Vehicle-trips computed using the mode split and vehicle occupancy values provided in Table 2-A.
⁶ Person-Trips
*Indicates computation that has been rounded to the nearest whole number.
Estimation Tool Developed by the Texas A&M Transportation Institute - Version 2013.1

Project Name:	Windler TIA
Analysis Period:	AM Street Peak Hour

Table 7-A: Conversion of Vehicle-Trip Ends to Person-Trip Ends						
Land Use	Table 7-A (D): Entering Trips			Table 7-A (O): Exiting Trips		
	Veh. Occ.	Vehicle-Trips	Person-Trips*	Veh. Occ.	Vehicle-Trips	Person-Trips*
Office	1.00	0	0	1.00	0	0
Retail	1.00	873	873	1.00	557	557
Restaurant	1.00	0	0	1.00	0	0
Cinema/Entertainment	1.00	0	0	1.00	0	0
Residential	1.00	661	661	1.00	2001	2001
Hotel	1.00	132	132	1.00	103	103

Table 8-A (O): Internal Person-Trip Origin-Destination Matrix (Computed at Origin)						
Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office		0	0	0	0	0
Retail	162		72	0	78	0
Restaurant	0	0		0	0	0
Cinema/Entertainment	0	0	0		0	0
Residential	40	20	400	0		0
Hotel	77	14	9	0	0	

Table 8-A (D): Internal Person-Trip Origin-Destination Matrix (Computed at Destination)						
Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office		279	0	0	0	0
Retail	0		0	0	13	0
Restaurant	0	70		0	33	5
Cinema/Entertainment	0	0	0		0	0
Residential	0	148	0	0		0
Hotel	0	35	0	0	0	

Table 9-A (D): Internal and External Trips Summary (Entering Trips)						
Destination Land Use	Person-Trip Estimates			External Trips by Mode*		
	Internal	External	Total	Vehicles ¹	Transit ²	Non-Motorized ²
Office	0	0	0	0	0	0
Retail	34	839	873	839	0	0
Restaurant	0	0	0	0	0	0
Cinema/Entertainment	0	0	0	0	0	0
Residential	13	648	661	648	0	0
Hotel	0	132	132	132	0	0
All Other Land Uses ³	0	1115	1115	1115	0	0

Table 9-A (O): Internal and External Trips Summary (Exiting Trips)						
Origin Land Use	Person-Trip Estimates			External Trips by Mode*		
	Internal	External	Total	Vehicles ¹	Transit ²	Non-Motorized ²
Office	0	0	0	0	0	0
Retail	13	544	557	544	0	0
Restaurant	0	0	0	0	0	0
Cinema/Entertainment	0	0	0	0	0	0
Residential	20	1981	2001	1981	0	0
Hotel	14	89	103	89	0	0
All Other Land Uses ³	0	473	473	473	0	0

¹Vehicle-trips computed using the mode split and vehicle occupancy values provided in Table 2-A

²Person-Trips

³Total estimate for all other land uses at mixed-use development site is not subject to internal trip capture computations in this estimator

*Indicates computation that has been rounded to the nearest whole number.

NCHRP 684 Internal Trip Capture Estimation Tool					
Project Name:	Windler TIA			Organization:	Felsburg Holt & Ullevig
Project Location:	Aurora, CO			Performed By:	TL
Scenario Description:	Full Buildout			Date:	10/21/2024
Analysis Year:	2040			Checked By:	
Analysis Period:	PM Street Peak Hour			Date:	

Table 1-P: Base Vehicle-Trip Generation Estimates (Single-Use Site Estimate)						
Land Use	Development Data (For Information Only)			Estimated Vehicle-Trips ³		
	ITE LUCs ¹	Quantity	Units	Total	Entering	Exiting
Office				0		
Retail	820,821,822	974	KSF	3,248	1,579	1,669
Restaurant	-	-	-	0	0	0
Cinema/Entertainment	-	-	-	0	0	0
Residential	210, 215, 220	5,782	DU	3,303	2,037	1,266
Hotel	310	500	Rooms	315	160	155
All Other Land Uses ²	0, 154, 520, 9	2,200	KSF	1,075	395	680
				7,941	4,171	3,770

Table 2-P: Mode Split and Vehicle Occupancy Estimates						
Land Use	Entering Trips			Exiting Trips		
	Veh. Occ. ⁴	% Transit	% Non-Motorized	Veh. Occ. ⁴	% Transit	% Non-Motorized
Office	1.00	0%	0%	1.00	0%	0%
Retail	1.00	0%	0%	1.00	0%	0%
Restaurant	1.00	0%	0%	1.00	0%	0%
Cinema/Entertainment	1.00	0%	0%	1.00	0%	0%
Residential	1.00	0%	0%	1.00	0%	0%
Hotel	1.00	0%	0%	1.00	0%	0%
All Other Land Uses ²	1.00	0%	0%	1.00	0%	0%

Table 3-P: Average Land Use Interchange Distances (Feet Walking Distance)						
Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office		0	0		0	
Retail					0	
Restaurant					0	
Cinema/Entertainment					0	
Residential		0	0			
Hotel					0	

Table 4-P: Internal Person-Trip Origin-Destination Matrix*						
Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office		0	0	0	0	0
Retail	0		0	0	434	27
Restaurant	0	0		0	0	0
Cinema/Entertainment	0	0	0		0	0
Residential	0	158	0	0		19
Hotel	0	25	0	0	0	

Table 5-P: Computations Summary			
	Total	Entering	Exiting
All Person-Trips	7,941	4,171	3,770
Internal Capture Percentage	17%	16%	18%
External Vehicle-Trips ⁵	6,615	3,508	3,107
External Transit-Trips ⁶	0	0	0
External Non-Motorized Trips ⁶	0	0	0

Table 6-P: Internal Trip Capture Percentages by Land Use		
Land Use	Entering Trips	Exiting Trips
Office	N/A	N/A
Retail	12%	28%
Restaurant	N/A	N/A
Cinema/Entertainment	N/A	N/A
Residential	21%	14%
Hotel	29%	16%

¹ Land Use Codes (LUCs) from <i>Trip Generation Manual</i> , published by the Institute of Transportation Engineers.
² Total estimate for all other land uses at mixed-use development site is not subject to internal trip capture computations in this estimator.
³ Enter trips assuming no transit or non-motorized trips (as assumed in ITE <i>Trip Generation Manual</i>).
⁴ Enter vehicle occupancy assumed in Table 1-P vehicle trips. If vehicle occupancy changes for proposed mixed-use project, manual adjustments must be made.
⁵ Vehicle-trips computed using the mode split and vehicle occupancy values provided in Table 2-P.
⁶ Person-Trips
*Indicates computation that has been rounded to the nearest whole number.
Estimation Tool Developed by the Texas A&M Transportation Institute - Version 2013.1

Project Name:	Windler TIA
Analysis Period:	PM Street Peak Hour

Table 7-P: Conversion of Vehicle-Trip Ends to Person-Trip Ends						
Land Use	Table 7-P (D): Entering Trips			Table 7-P (O): Exiting Trips		
	Veh. Occ.	Vehicle-Trips	Person-Trips*	Veh. Occ.	Vehicle-Trips	Person-Trips*
Office	1.00	0	0	1.00	0	0
Retail	1.00	1579	1579	1.00	1669	1669
Restaurant	1.00	0	0	1.00	0	0
Cinema/Entertainment	1.00	0	0	1.00	0	0
Residential	1.00	2037	2037	1.00	1266	1266
Hotel	1.00	160	160	1.00	155	155

Table 8-P (O): Internal Person-Trip Origin-Destination Matrix (Computed at Origin)						
Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office		0	0	0	0	0
Retail	33		484	67	434	83
Restaurant	0	0		0	0	0
Cinema/Entertainment	0	0	0		0	0
Residential	51	532	266	0		38
Hotel	0	25	105	0	3	

Table 8-P (D): Internal Person-Trip Origin-Destination Matrix (Computed at Destination)						
Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office		126	0	0	81	0
Retail	0		0	0	937	27
Restaurant	0	790		0	326	114
Cinema/Entertainment	0	63	0		81	2
Residential	0	158	0	0		19
Hotel	0	32	0	0	0	

Table 9-P (D): Internal and External Trips Summary (Entering Trips)						
Destination Land Use	Person-Trip Estimates			External Trips by Mode*		
	Internal	External	Total	Vehicles ¹	Transit ²	Non-Motorized ²
Office	0	0	0	0	0	0
Retail	183	1396	1579	1396	0	0
Restaurant	0	0	0	0	0	0
Cinema/Entertainment	0	0	0	0	0	0
Residential	434	1603	2037	1603	0	0
Hotel	46	114	160	114	0	0
All Other Land Uses ³	0	395	395	395	0	0

Table 9-P (O): Internal and External Trips Summary (Exiting Trips)						
Origin Land Use	Person-Trip Estimates			External Trips by Mode*		
	Internal	External	Total	Vehicles ¹	Transit ²	Non-Motorized ²
Office	0	0	0	0	0	0
Retail	461	1208	1669	1208	0	0
Restaurant	0	0	0	0	0	0
Cinema/Entertainment	0	0	0	0	0	0
Residential	177	1089	1266	1089	0	0
Hotel	25	130	155	130	0	0
All Other Land Uses ³	0	680	680	680	0	0

¹Vehicle-trips computed using the mode split and vehicle occupancy values provided in Table 2-P

²Person-Trips

³Total estimate for all other land uses at mixed-use development site is not subject to internal trip capture computations in this estimator

*Indicates computation that has been rounded to the nearest whole number.

APPENDIX B. QUEUE LENGTH COMPARISON

Location	Movement	95% Queue Length (ft)		Recommended Storage Length (ft) MTIS/Update	SHAC Recommendation (ft)
		Future (2040) MTIS (AM Peak/PM Peak)	Future (2040) Update (AM Peak/PM Peak)		
1. 56th Avenue & Biloxi Street	NB Left-turn	120 / 151	147 / 157	175	175
	NB Right-turn	28 / 27	30 / 27	Continuous	Continuous
	EB Through*	83 / 598	100 / 591	Continuous	Continuous
	WB Through	138 / 189	164 / 193	Continuous	Continuous
	WB Left-turn	5 / 11	7 / 11	50	50
3. 56th Avenue & Denali Boulevard	NB Left-turn**	331 / 255	273 / 215	325 / 300	750
	NB Through	327 / 256	35 / 18	Continuous	Continuous
	NB Right-turn	89 / 44	196 / 99	Continuous	Continuous
	EB Left-turn	64 / 29	63 / 30	75	75
	EB Through	314 / 312	316 / 308	Continuous	Continuous
	EB Right-turn	20 / 46	43 / 45	150	775
	SB Left-turn	46 / 58	51 / 58	50	50
	SB Through	16 / 17	17 / 17	Continuous	Continuous
	SB Right-turn	0 / 8	0 / 8	50	75
	WB Left-turn**	m151 / m193	m153 / m196	225	450
12. 48th Avenue & Denali Boulevard	WB Through*	168 / 317	156 / 333	Continuous	Continuous
	NB Left-turn**	#401 / #389	#411 / #392	400 / 425	875
	NB Through	206 / 126	218 / 126	Continuous	Continuous
	NB Right-turn	410 / #387	410 / #375	425	600
	EB Left-turn**	m150 / m#357	m174 / m#387	300 / 400	925
	EB Through	m449 / m#542	m420 / m#486	Continuous	Continuous
	EB Right-turn	m32 / m93	m49 / m106	675	1025
	SB Left-turn	204 / 242	#262 / #357	375	375
	SB Through	187 / 97	195 / 133	Continuous	Continuous
	SB Right-turn	#296 / 206	#332 / #273	350	675
13. 48th Avenue & Biloxi Street	WB Left-turn**	m#243 / #346	m#239 / #341	350	700
	WB Through	428 / 331	#531 / 343	Continuous	Continuous
	WB Right-turn	m38 / 16	m51 / 16	50	350
	NB Left-turn**	#270 / #253	#270 / #237	275	875
	NB Through	0 / 17	0 / 17	Continuous	Continuous
	NB Right-turn	151 / #520	151 / #416	Continuous	Continuous
	EB Left-turn**	152 / #520	m#190 / m194	175 / 200	925
	EB Through	m#694 / m163	m#714 / m307	Continuous	Continuous
	EB Right-turn	m45 / m0	m33 / m0	50	1025
	SB Left-turn	138 / #277	195 / 213	300	375
14. 48th Avenue & Addison Street	SB Through	16 / 17	16 / 17	Continuous	Continuous
	SB Right-turn	60 / #267	113 / #213	Continuous	Continuous
	WB Left-turn**	m#234 / m#161	m#198 / m#144	250	700
	WB Through	m699 / m442	m680 / m420	Continuous	Continuous
	SB Right-turn	20 / 68	20 / 68	Continuous	Continuous
	NB Through*	98 / 340	98 / 340	Continuous	Continuous
	EB Through*	18 / 75	18 / 75	Continuous	Continuous
	SB Through*	90 / 215	90 / 215	Continuous	Continuous
	SB Right-turn*	3 / 13	3 / 13	Continuous	Continuous
	WB Through*	8 / 23	8 / 23	Continuous	Continuous
103. Denali Boulevard & Drive 9	NB Through*	120 / 565	120 / 565	Continuous	Continuous
	NB Right-turn*	25 / 10	25 / 10	Continuous	Continuous
	EB Through*	33 / 205	33 / 205	Continuous	Continuous
	SB Through*	353 / 1433	353 / 1433	Continuous	Continuous
	WB Through*	10 / 18	10 / 18	Continuous	Continuous
*shared lane **dual turn lane SHAC values based on a HV% of ten percent. # - 95 th percentile volume exceeds capacity, queues may be longer m - volume for 95 th percentile queue is metered by upstream signal					

APPENDIX C. LOS/DELAY TABLE

Future (2040) LOS/Delay Summary Table

Location	Approach	Movement	Future (2040) MTIS				Future (2040) Update			
			Level of Service (AM / PM)		Delay (s) (AM / PM)		Level of Service (AM / PM)		Delay (s) (AM / PM)	
#1 - 56th Avenue & Biloxi Street	Eastbound	Signalized	A	B	2.1	12.9	A	A	2.9	13
	Westbound		A	A	3.1	4.1	A	A	3.8	4.2
	Northbound		D	D	52.6	54.9	D	E	53	55.2
	Total		A	A	4.4	10.4	A	A	5.5	10.6
#3 - 56th Avenue & Denali Boulevard	Eastbound	Signalized	C	B	20.8	17.6	C	B	21.1	17
	Westbound		C	C	22.9	23.8	C	C	21.7	23.3
	Northbound		C	D	32.2	37.7	D	D	35.2	38.9
	Southbound		C	C	25.3	26.0	C	C	26.1	26.7
	Total		C	D	24.5	23.4	C	D	25.1	23.3
#12 - 48th Avenue & Denali Boulevard	Eastbound	Signalized	D	C	19.7	41.7	B	D	19.5	42.3
	Westbound		D	E	32.5	24.6	D	C	39.7	30
	Northbound		E	E	52.8	60.8	E	E	55.8	62.8
	Southbound		E	C	43.8	40.7	D	D	48.1	43.8
	Total		E	D	34.2	40.5	E	D	37.4	42.9
#13 - 48th Avenue & Biloxi Street	Eastbound	Signalized	D	D	41.6	9.3	D	B	45	11.9
	Westbound		B	E	36.2	17.2	D	B	35.3	19.5
	Northbound		E	F	51.9	211.7	D	F	51.9	211.9
	Southbound		D	E	23	111.9	C	E	30.3	71.3
	Total		C	D	39.7	41.1	C	D	40.9	39.6
#14 - 48th Avenue & Addison Street	Southbound	Right	c	f	12.3	12.9	d	e	4.2	6.9
#102 - Denali Boulevard & 53rd Avenue	Eastbound	Left/thru/right	a	c	9.7	17.3	b	b	13.2	14.4
	Westbound	Left/thru/right	a	a	9.3	7.3	a	a	10	8.5
	Northbound	Left/thru/right	b	a	12.4	9.1	c	b	16.5	11.2
	Southbound	Thru/left	a	b	9.5	14.7	b	b	12.1	11.7
		Right	a	a	3.1	4.2	a	a	3.2	4.3
#103 - Denali Boulevard & Drive 9	Eastbound	Left/thru/right	b	c	14.1	15.3	c	c	21.4	19.1
	Westbound	Left/thru/right	a	b	9.4	10.1	a	b	9.9	10.2
	Northbound	Left/thru	a	a	5.4	6.5	a	a	5.7	6.8
		Thru/Right	a	b	8.8	12.5	a	b	9.6	13.4
		Thru/left	b	b	13.7	13.2	c	c	15.9	15.5
	Southbound	Thru/Right	a	a	9.3	8.6	b	b	11.6	11.3

APPENDIX D. CAPACITY ANALYSIS WORKSHEETS

Timings
1: Biloxi Street & 56th Avenue

Future Total (2040)
AM Peak Hour

	→	↖	←	↗	↘
Lane Group	EBT	WBL	WBT	NBL	NBR
Lane Configurations	↑↑↑	↖	↑↑↑	↖	↖
Traffic Volume (vph)	1475	15	1585	110	30
Future Volume (vph)	1475	15	1585	110	30
Turn Type	NA	pm+pt	NA	Prot	Perm
Protected Phases	4	3	8	2	
Permitted Phases		8			2
Detector Phase	4	3	8	2	2
Switch Phase					
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	9.5	22.5	22.5	22.5
Total Split (s)	78.0	13.0	91.0	29.0	29.0
Total Split (%)	65.0%	10.8%	75.8%	24.2%	24.2%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lag	Lead			
Lead-Lag Optimize?	Yes	Yes			
Recall Mode	C-Max	None	C-Max	None	None
Act Effect Green (s)	93.4	97.6	97.6	13.4	13.4
Actuated g/C Ratio	0.78	0.81	0.81	0.11	0.11
v/c Ratio	0.43	0.07	0.42	0.61	0.16
Control Delay	2.9	3.3	3.8	63.0	16.4
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	2.9	3.3	3.8	63.0	16.4
LOS	A	A	A	E	B
Approach Delay	2.9		3.8	53.0	
Approach LOS	A		A	D	

Intersection Summary

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 0 (0%), Referenced to phase 4:EBT and 8:WBTL, Start of Yellow

Natural Cycle: 60

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.61

Intersection Signal Delay: 5.5

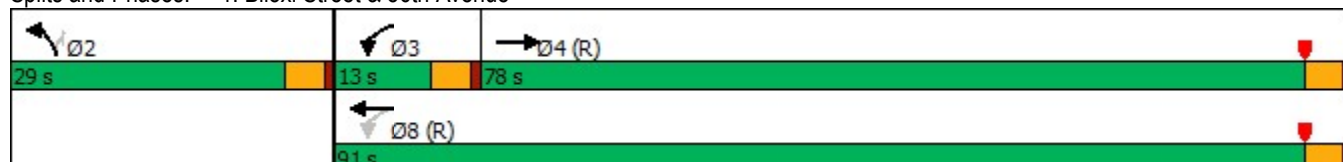
Intersection LOS: A

Intersection Capacity Utilization 44.2%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 1: Biloxi Street & 56th Avenue



Queues

1: Biloxi Street & 56th Avenue

Future Total (2040)

AM Peak Hour

	→	↙	←	↖	↗
Lane Group	EBT	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	1679	16	1723	120	33
v/c Ratio	0.43	0.07	0.42	0.61	0.16
Control Delay	2.9	3.3	3.8	63.0	16.4
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	2.9	3.3	3.8	63.0	16.4
Queue Length 50th (ft)	63	2	108	90	0
Queue Length 95th (ft)	100	7	164	147	30
Internal Link Dist (ft)	670		1090	351	
Turn Bay Length (ft)		250		275	150
Base Capacity (vph)	3931	281	4133	361	349
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.43	0.06	0.42	0.33	0.09
Intersection Summary					

HCM 6th Signalized Intersection Summary





























1: Biloxi Street & 56th Avenue

Future Total (2040)
AM Peak Hour

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑↑↱		↙	↑↑↑	↙	↗
Traffic Volume (veh/h)	1475	70	15	1585	110	30
Future Volume (veh/h)	1475	70	15	1585	110	30
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)		1.00	1.00		1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	1603	76	16	1723	120	33
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	3922	186	322	4289	151	135
Arrive On Green	1.00	1.00	0.02	0.84	0.09	0.09
Sat Flow, veh/h	5163	237	1781	5274	1781	1585
Grp Volume(v), veh/h	1092	587	16	1723	120	33
Grp Sat Flow(s),veh/h/ln	1702	1828	1781	1702	1781	1585
Q Serve(g_s), s	0.0	0.0	0.2	9.8	7.9	2.3
Cycle Q Clear(g_c), s	0.0	0.0	0.2	9.8	7.9	2.3
Prop In Lane		0.13	1.00		1.00	1.00
Lane Grp Cap(c), veh/h	2673	1435	322	4289	151	135
V/C Ratio(X)	0.41	0.41	0.05	0.40	0.79	0.24
Avail Cap(c_a), veh/h	2673	1435	417	4289	364	324
HCM Platoon Ratio	2.00	2.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.89	0.89	0.92	0.92	1.00	1.00
Uniform Delay (d), s/veh	0.0	0.0	2.0	2.3	53.9	51.3
Incr Delay (d2), s/veh	0.4	0.8	0.1	0.3	8.9	0.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	0.3	0.0	1.7	3.9	0.9
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	0.4	0.8	2.1	2.6	62.8	52.2
LnGrp LOS	A	A	A	A	E	D
Approach Vol, veh/h	1679			1739	153	
Approach Delay, s/veh	0.5			2.6	60.5	
Approach LOS	A			A	E	
Timer - Assigned Phs	2		3	4	8	
Phs Duration (G+Y+Rc), s	14.7		6.6	98.7	105.3	
Change Period (Y+Rc), s	4.5		4.5	4.5	4.5	
Max Green Setting (Gmax), s	24.5		8.5	73.5	86.5	
Max Q Clear Time (g_c+I1), s	9.9		2.2	2.0	11.8	
Green Ext Time (p_c), s	0.3		0.0	17.3	20.0	
Intersection Summary						
HCM 6th Ctrl Delay			4.1			
HCM 6th LOS			A			

Timings 3: Denali Boulevard & 56th Avenue

Future Total (2040)
AM Peak Hour

											
Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		  		 	  	 					
Traffic Volume (vph)	50	960	465	345	900	570	30	390	25	5	40
Future Volume (vph)	50	960	465	345	900	570	30	390	25	5	40
Turn Type	pm+pt	NA	pm+ov	Prot	NA	Prot	NA	pm+ov	Perm	NA	pm+ov
Protected Phases	7	4	5	3	8	5	2	3		6	7
Permitted Phases	4		4					2	6		6
Detector Phase	7	4	5	3	8	5	2	3	6	6	7
Switch Phase											
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.5	22.5	22.5	9.5	22.5	22.5	22.5	9.5	22.5	22.5	9.5
Total Split (s)	10.8	37.7	41.0	25.0	51.9	41.0	57.3	25.0	16.3	16.3	10.8
Total Split (%)	9.0%	31.4%	34.2%	20.8%	43.3%	34.2%	47.8%	20.8%	13.6%	13.6%	9.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lead	Lead	Lead	Lag	Lag	Lead		Lag	Lag	Lag	Lead
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes
Recall Mode	None	C-Max	None	None	C-Max	None	None	None	None	None	None
Act Effect Green (s)	49.0	49.0	79.6	20.5	64.1	28.8	37.0	62.0	7.9	7.9	15.6
Actuated g/C Ratio	0.41	0.41	0.66	0.17	0.53	0.24	0.31	0.52	0.07	0.07	0.13
v/c Ratio	0.25	0.50	0.43	0.64	0.37	0.75	0.06	0.50	0.30	0.04	0.15
Control Delay	29.7	29.7	2.4	39.9	15.0	48.1	24.4	17.1	61.1	51.6	1.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	29.7	29.7	2.4	39.9	15.0	48.1	24.4	17.1	61.1	51.6	1.1
LOS	C	C	A	D	B	D	C	B	E	D	A
Approach Delay		21.1			21.7		35.2			26.1	
Approach LOS		C			C		D			C	

Intersection Summary

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 0 (0%), Referenced to phase 4:EBTL and 8:WBT, Start of Yellow

Natural Cycle: 90

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.75

Intersection Signal Delay: 25.1

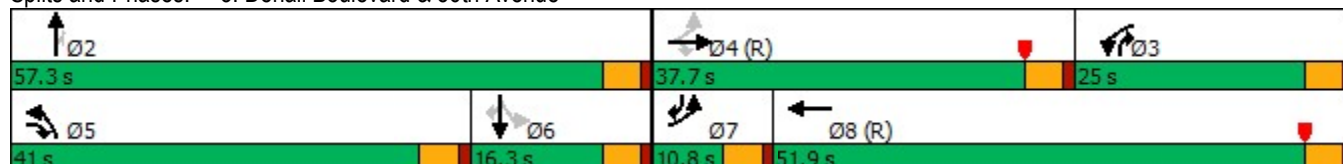
Intersection LOS: C

Intersection Capacity Utilization 62.6%

ICU Level of Service B












Analysis Period (min) 15

Splits and Phases: 3: Denali Boulevard & 56th Avenue



Queues
3: Denali Boulevard & 56th Avenue

Future Total (2040)
AM Peak Hour

											
Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	54	1043	505	375	1011	620	33	424	27	5	43
v/c Ratio	0.25	0.50	0.43	0.64	0.37	0.75	0.06	0.50	0.30	0.04	0.15
Control Delay	29.7	29.7	2.4	39.9	15.0	48.1	24.4	17.1	61.1	51.6	1.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	29.7	29.7	2.4	39.9	15.0	48.1	24.4	17.1	61.1	51.6	1.1
Queue Length 50th (ft)	27	230	17	120	123	231	17	165	20	4	0
Queue Length 95th (ft)	63	316	43	m153	156	273	35	196	51	17	0
Internal Link Dist (ft)		546			823		622			214	
Turn Bay Length (ft)	150		350	275		275			100		100
Base Capacity (vph)	219	2074	1213	586	2703	1044	819	844	134	183	290
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.25	0.50	0.42	0.64	0.37	0.59	0.04	0.50	0.20	0.03	0.15































Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

HCM 6th Signalized Intersection Summary

























3: Denali Boulevard & 56th Avenue

Future Total (2040)
AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		  		 	  		 				 	
Traffic Volume (veh/h)	50	960	465	345	900	30	570	30	390	25	5	40
Future Volume (veh/h)	50	960	465	345	900	30	570	30	390	25	5	40
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	54	1043	505	375	978	33	620	33	424	27	5	43
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	236	1413	767	1107	2853	96	716	543	968	103	86	128
Arrive On Green	0.03	0.28	0.28	0.64	1.00	1.00	0.21	0.29	0.29	0.05	0.05	0.05
Sat Flow, veh/h	1781	5106	1585	3456	5073	171	3456	1870	1585	934	1870	1585
Grp Volume(v), veh/h	54	1043	505	375	656	355	620	33	424	27	5	43
Grp Sat Flow(s),veh/h/ln	1781	1702	1585	1728	1702	1840	1728	1870	1585	934	1870	1585
Q Serve(g_s), s	2.8	22.3	4.7	6.0	0.0	0.0	20.8	1.5	0.0	3.4	0.3	3.1
Cycle Q Clear(g_c), s	2.8	22.3	4.7	6.0	0.0	0.0	20.8	1.5	0.0	3.4	0.3	3.1
Prop In Lane	1.00		1.00	1.00		0.09	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	236	1413	767	1107	1914	1034	716	543	968	103	86	128
V/C Ratio(X)	0.23	0.74	0.66	0.34	0.34	0.34	0.87	0.06	0.44	0.26	0.06	0.34
Avail Cap(c_a), veh/h	267	1413	767	1107	1914	1034	1051	823	1205	152	184	211
HCM Platoon Ratio	1.00	1.00	1.00	2.00	2.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.92	0.92	0.92	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	34.3	39.5	11.9	15.7	0.0	0.0	46.0	30.8	12.4	56.3	54.8	52.1
Incr Delay (d2), s/veh	0.4	3.2	4.1	0.2	0.5	0.9	5.4	0.0	0.3	1.3	0.3	1.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.2	9.7	7.6	2.1	0.1	0.3	9.4	0.7	5.9	0.8	0.2	1.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	34.7	42.7	16.0	15.9	0.5	0.9	51.3	30.8	12.7	57.6	55.1	53.7
LnGrp LOS	C	D	B	B	A	A	D	C	B	E	E	D
Approach Vol, veh/h		1602			1386			1077			75	
Approach Delay, s/veh		34.0			4.8			35.5			55.2	
Approach LOS		C			A			D			E	
Timer - Assigned Phs		2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s		39.3	43.0	37.7	29.3	10.0	8.7	72.0				
Change Period (Y+Rc), s		4.5	4.5	4.5	4.5	4.5	4.5	4.5				
Max Green Setting (Gmax), s		52.8	20.5	33.2	36.5	11.8	6.3	47.4				
Max Q Clear Time (g_c+I1), s		3.5	8.0	24.3	22.8	5.4	4.8	2.0				
Green Ext Time (p_c), s		1.8	1.1	5.7	2.0	0.1	0.0	8.5				
Intersection Summary												
HCM 6th Ctrl Delay			25.0									
HCM 6th LOS			C									
Notes												
User approved pedestrian interval to be less than phase max green.												

Timings
12: Denali Boulevard & 48th Avenue

Future Total (2040)
AM Peak Hour

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	475	1430	560	365	1365	195	670	400	450	265	335	505
Future Volume (vph)	475	1430	560	365	1365	195	670	400	450	265	335	505
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov	pm+pt	NA	pm+ov
Protected Phases	7	4	5	3	8	1	5	2	3	1	6	7
Permitted Phases			4			8			2	6		6
Detector Phase	7	4	5	3	8	1	5	2	3	1	6	7
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.5	22.5	9.5	9.5	22.5	9.5	9.5	22.5	9.5	9.5	22.5	9.5
Total Split (s)	27.0	46.5	31.0	20.0	39.5	24.7	31.0	28.8	20.0	24.7	22.5	27.0
Total Split (%)	22.5%	38.8%	25.8%	16.7%	32.9%	20.6%	25.8%	24.0%	16.7%	20.6%	18.8%	22.5%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lead	Lead	Lag	Lag	Lag	Lag	Lag	Lead	Lag	Lag	Lead	Lead
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	C-Max	None	None	C-Max	None	None	None	None	None	None	None
Act Effect Green (s)	21.7	42.7	74.5	15.5	36.6	60.4	27.3	20.0	40.0	40.2	16.5	38.1
Actuated g/C Ratio	0.18	0.36	0.62	0.13	0.30	0.50	0.23	0.17	0.33	0.34	0.14	0.32
v/c Ratio	0.83	0.86	0.61	0.90	0.96	0.25	0.93	0.74	0.83	0.70	0.75	0.92
Control Delay	38.3	20.3	3.4	57.4	40.2	3.1	65.3	55.2	42.1	49.8	60.0	39.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	38.3	20.3	3.4	57.4	40.2	3.1	65.3	55.2	42.1	49.8	60.0	39.3
LOS	D	C	A	E	D	A	E	E	D	D	E	D
Approach Delay		19.9			39.7			55.8			48.1	
Approach LOS		B			D			E			D	

Intersection Summary

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 49 (41%), Referenced to phase 4:EBT and 8:WBT, Start of Yellow

Natural Cycle: 110

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.96

Intersection Signal Delay: 37.6

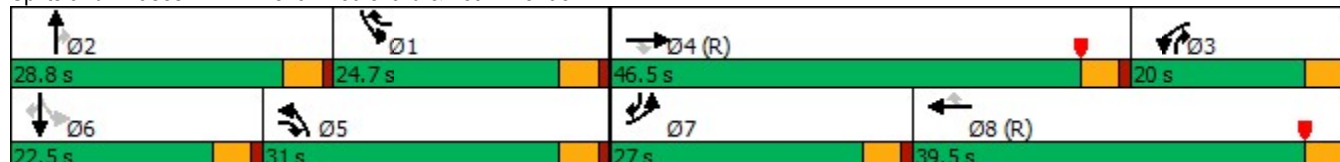
Intersection LOS: D

Intersection Capacity Utilization 88.0%

ICU Level of Service E













Analysis Period (min) 15

Splits and Phases: 12: Denali Boulevard & 48th Avenue



Queues
12: Denali Boulevard & 48th Avenue

Future Total (2040)
AM Peak Hour

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	516	1554	609	397	1484	212	728	435	489	288	364	549
v/c Ratio	0.83	0.86	0.61	0.90	0.96	0.25	0.93	0.74	0.83	0.70	0.75	0.92
Control Delay	38.3	20.3	3.4	57.4	40.2	3.1	65.3	55.2	42.1	49.8	60.0	39.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	38.3	20.3	3.4	57.4	40.2	3.1	65.3	55.2	42.1	49.8	60.0	39.3
Queue Length 50th (ft)	167	396	35	154	~405	10	287	170	288	155	143	158
Queue Length 95th (ft)	m174	m420	m49	m#239	#531	m51	#411	218	410	#262	195	#332
Internal Link Dist (ft)		1300			1760			542			586	
Turn Bay Length (ft)	250		275	300		150	400		250	300		225
Base Capacity (vph)	643	1810	1003	443	1550	843	781	716	590	412	530	605
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.80	0.86	0.61	0.90	0.96	0.25	0.93	0.61	0.83	0.70	0.69	0.91

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

























Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

HCM 6th Signalized Intersection Summary

12: Denali Boulevard & 48th Avenue

Future Total (2040)
AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	475	1430	560	365	1365	195	670	400	450	265	335	505
Future Volume (veh/h)	475	1430	560	365	1365	195	670	400	450	265	335	505
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	516	1554	0	397	1484	212	728	435	0	288	364	549
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	587	1787		446	1580	841	763	532		483	533	507
Arrive On Green	0.06	0.12	0.00	0.04	0.10	0.10	0.22	0.15	0.00	0.22	0.15	0.15
Sat Flow, veh/h	3456	5106	1585	3456	5106	1585	3456	3554	1585	1781	3554	1585
Grp Volume(v), veh/h	516	1554	0	397	1484	212	728	435	0	288	364	549
Grp Sat Flow(s),veh/h/ln	1728	1702	1585	1728	1702	1585	1728	1777	1585	1781	1777	1585
Q Serve(g_s), s	17.8	35.9	0.0	13.7	34.6	4.5	25.0	14.2	0.0	10.8	11.6	18.0
Cycle Q Clear(g_c), s	17.8	35.9	0.0	13.7	34.6	4.5	25.0	14.2	0.0	10.8	11.6	18.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	587	1787		446	1580	841	763	532		483	533	507
V/C Ratio(X)	0.88	0.87		0.89	0.94	0.25	0.95	0.82		0.60	0.68	1.08
Avail Cap(c_a), veh/h	648	1787		446	1580	841	763	720		483	533	507
HCM Platoon Ratio	0.33	0.33	0.33	0.33	0.33	0.33	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.24	0.24	0.00	0.72	0.72	0.72	1.00	1.00	0.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	55.4	50.4	0.0	56.6	52.8	7.3	46.1	49.4	0.0	38.7	48.3	17.8
Incr Delay (d2), s/veh	3.4	1.6	0.0	14.9	9.4	0.5	22.0	5.4	0.0	2.0	3.6	64.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	8.6	16.7	0.0	7.3	17.2	2.1	13.0	6.7	0.0	7.6	5.4	15.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	58.9	51.9	0.0	71.5	62.2	7.8	68.1	54.8	0.0	40.7	51.9	82.1
LnGrp LOS	E	D		E	E	A	E	D		D	D	F
Approach Vol, veh/h	2070			2093			1163			1201		
Approach Delay, s/veh	53.7			58.4			63.2			63.0		
Approach LOS	D			E			E			E		
Timer - Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	31.0	22.5	20.0	46.5	31.0	22.5	24.9	41.6				
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5				
Max Green Setting (Gmax), s	20.2	24.3	15.5	42.0	26.5	18.0	22.5	35.0				
Max Q Clear Time (g_c+I1), s	12.8	16.2	15.7	37.9	27.0	20.0	19.8	36.6				
Green Ext Time (p_c), s	0.5	1.7	0.0	3.2	0.0	0.0	0.6	0.0				

Intersection Summary























HCM 6th Ctrl Delay	58.6
HCM 6th LOS	E

Notes

Unsignalized Delay for [NBR, EBR] is excluded from calculations of the approach delay and intersection delay.

Timings
13: Biloxi Street & 48th Avenue

Future Total (2040)
AM Peak Hour

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBR	SBL	SBT	SBR	Ø2
Lane Configurations												
Traffic Volume (vph)	340	2000	410	440	1965	120	400	275	195	5	200	
Future Volume (vph)	340	2000	410	440	1965	120	400	275	195	5	200	
Turn Type	Prot	NA	pm+ov	Prot	NA	Perm	Prot	pm+ov	pm+pt	NA	pm+ov	
Protected Phases	7	4	5	3	8		5	3	1	6	7	2
Permitted Phases			4			8		2	6		6	
Detector Phase	7	4	5	3	8	8	5	3	1	6	7	
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.5	22.5	9.5	9.5	22.5	22.5	9.5	9.5	9.5	22.5	9.5	22.5
Total Split (s)	18.5	54.5	21.0	22.0	58.0	58.0	21.0	22.0	11.2	22.5	18.5	32.3
Total Split (%)	15.4%	45.4%	17.5%	18.3%	48.3%	48.3%	17.5%	18.3%	9.3%	18.8%	15.4%	27%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Lead/Lag	Lag	Lag	Lag	Lead	Lead	Lead	Lag	Lead	Lag	Lead	Lag	Lead
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	C-Max	None	None	C-Max	C-Max	None	None	None	Max	None	Max
Act Effect Green (s)	14.0	50.0	66.5	17.5	53.5	53.5	16.5	45.3	24.7	18.0	36.5	
Actuated g/C Ratio	0.12	0.42	0.55	0.15	0.45	0.45	0.14	0.38	0.21	0.15	0.30	
v/c Ratio	0.93	1.03	0.41	0.96	0.94	0.17	0.92	0.46	0.68	0.02	0.38	
Control Delay	64.9	50.6	1.5	74.6	28.5	2.1	77.3	14.9	46.2	43.8	14.5	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay	64.9	50.6	1.5	74.6	28.5	2.1	77.3	14.9	46.2	43.8	14.5	
LOS	E	D	A	E	C	A	E	B	D	D	B	
Approach Delay		45.0			35.3					30.3		
Approach LOS		D			D					C		

Intersection Summary

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 108 (90%), Referenced to phase 4:EBT and 8:WBT, Start of Yellow

Natural Cycle: 120

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 1.03

Intersection Signal Delay: 40.9

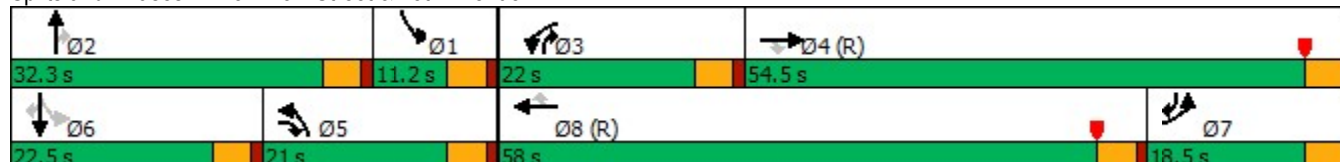
Intersection LOS: D

Intersection Capacity Utilization 80.5%

ICU Level of Service D












Analysis Period (min) 15

Splits and Phases: 13: Biloxi Street & 48th Avenue



Queues
13: Biloxi Street & 48th Avenue

Future Total (2040)
AM Peak Hour

											
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	370	2174	446	478	2136	130	435	299	212	5	217
v/c Ratio	0.93	1.03	0.41	0.96	0.94	0.17	0.92	0.46	0.68	0.02	0.38
Control Delay	64.9	50.6	1.5	74.6	28.5	2.1	77.3	14.9	46.2	43.8	14.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	64.9	50.6	1.5	74.6	28.5	2.1	77.3	14.9	46.2	43.8	14.5
Queue Length 50th (ft)	145	~654	12	184	525	4	173	88	126	3	46
Queue Length 95th (ft)	m#190	m#714	m33	m#198	m680	m5	#270	151	195	16	113
Internal Link Dist (ft)	420		1300				543				
Turn Bay Length (ft)	275		400	275		150	250	300	275		
Base Capacity (vph)	400	2118	1076	500	2267	781	472	656	310	279	576
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.93	1.03	0.41	0.96	0.94	0.17	0.92	0.46	0.68	0.02	0.38

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.
























95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

HCM 6th Signalized Intersection Summary 13: Biloxi Street & 48th Avenue

Future Total (2040)
AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	340	2000	410	440	1965	120	400	0	275	195	5	200
Future Volume (veh/h)	340	2000	410	440	1965	120	400	0	275	195	5	200
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	370	2174	0	478	2136	130	435	0	0	212	5	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	403	2128		504	2276	707	475	433		372	281	
Arrive On Green	0.23	0.83	0.00	0.29	0.89	0.89	0.14	0.00	0.00	0.06	0.15	0.00
Sat Flow, veh/h	3456	5106	1585	3456	5106	1585	3456	1870	1585	1781	1870	1585
Grp Volume(v), veh/h	370	2174	0	478	2136	130	435	0	0	212	5	0
Grp Sat Flow(s),veh/h/ln	1728	1702	1585	1728	1702	1585	1728	1870	1585	1781	1870	1585
Q Serve(g_s), s	12.5	50.0	0.0	16.3	33.3	1.3	14.9	0.0	0.0	0.0	0.3	0.0
Cycle Q Clear(g_c), s	12.5	50.0	0.0	16.3	33.3	1.3	14.9	0.0	0.0	0.0	0.3	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	403	2128		504	2276	707	475	433		372	281	
V/C Ratio(X)	0.92	1.02		0.95	0.94	0.18	0.92	0.00		0.57	0.02	
Avail Cap(c_a), veh/h	403	2128		504	2276	707	475	433		372	281	
HCM Platoon Ratio	2.00	2.00	2.00	2.00	2.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	0.22	0.22	0.22	1.00	0.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	45.4	10.0	0.0	42.1	5.4	3.7	51.1	0.0	0.0	44.5	43.5	0.0
Incr Delay (d2), s/veh	25.6	25.2	0.0	9.4	2.4	0.1	22.4	0.0	0.0	2.1	0.1	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.1	8.8	0.0	6.5	2.9	0.4	7.9	0.0	0.0	6.1	0.1	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	71.1	35.2	0.0	51.5	7.8	3.8	73.5	0.0	0.0	46.6	43.6	0.0
LnGrp LOS	E	F		D	A	A	E	A		D	D	
Approach Vol, veh/h	2544		2744			435			217			
Approach Delay, s/veh	40.5		15.3			73.5			46.5			
Approach LOS	D		B			E			D			
Timer - Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	11.2	32.3	22.0	54.5	21.0	22.5	18.5	58.0				
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5				
Max Green Setting (Gmax), s	6.7	27.8	17.5	50.0	16.5	18.0	14.0	53.5				
Max Q Clear Time (g_c+I1), s	2.0	0.0	18.3	52.0	16.9	2.3	14.5	35.3				
Green Ext Time (p_c), s	0.2	0.0	0.0	0.0	0.0	0.0	0.0	14.7				
Intersection Summary												
HCM 6th Ctrl Delay	31.4											
HCM 6th LOS	C											

HCM 6th TWSC
14: 48th Avenue & Addison Street

Future Total (2040)
AM Peak Hour

Intersection						
Int Delay, s/veh	1.2					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑↑↑	↑↑↑↑	↗		↗
Traffic Vol, veh/h	0	2740	2445	120	0	200
Future Vol, veh/h	0	2740	2445	120	0	200
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	300	-	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	2978	2658	130	0	217
Major/Minor	Major1	Major2		Minor2		
Conflicting Flow All	-	0	-	0	-	1329
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	-	-	-	7.14
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	-	-	-	3.92
Pot Cap-1 Maneuver	0	-	-	-	0	*337
Stage 1	0	-	-	-	0	-
Stage 2	0	-	-	-	0	-
Platoon blocked, %		-	-	-		1
Mov Cap-1 Maneuver	-	-	-	-	-	*337
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Approach	EB	WB		SB		
HCM Control Delay, s	0	0		33.2		
HCM LOS	D					
Minor Lane/Major Mvmt	EBT	WBT	WBR	SBLn1		
Capacity (veh/h)	-	-	-	337		
HCM Lane V/C Ratio	-	-	-	0.645		
HCM Control Delay (s)	-	-	-	33.2		
HCM Lane LOS	-	-	-	D		
HCM 95th %tile Q(veh)	-	-	-	4.2		
Notes						
~: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon						

Timings
1: Biloxi Street & 56th Avenue

Future Total (2040)
PM Peak Hour

	→	↖	←	↙	↗
Lane Group	EBT	WBL	WBT	NBL	NBR
Lane Configurations	↑↑↑	↖	↑↑↑	↖	↗
Traffic Volume (vph)	1770	25	1720	120	25
Future Volume (vph)	1770	25	1720	120	25
Turn Type	NA	pm+pt	NA	Prot	Perm
Protected Phases	4	3	8	2	
Permitted Phases		8			2
Detector Phase	4	3	8	2	2
Switch Phase					
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	9.5	22.5	22.5	22.5
Total Split (s)	81.0	12.0	93.0	27.0	27.0
Total Split (%)	67.5%	10.0%	77.5%	22.5%	22.5%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lag	Lead			
Lead-Lag Optimize?	Yes	Yes			
Recall Mode	C-Max	None	C-Max	None	None
Act Effect Green (s)	90.5	96.9	96.9	14.1	14.1
Actuated g/C Ratio	0.75	0.81	0.81	0.12	0.12
v/c Ratio	0.55	0.15	0.46	0.63	0.13
Control Delay	12.7	4.7	4.2	63.2	16.8
Queue Delay	0.3	0.0	0.0	0.0	0.0
Total Delay	13.0	4.7	4.2	63.2	16.8
LOS	B	A	A	E	B
Approach Delay	13.0		4.2	55.2	
Approach LOS	B		A	E	

Intersection Summary

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 0 (0%), Referenced to phase 4:EBT and 8:WBTL, Start of Yellow

Natural Cycle: 65

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.63

Intersection Signal Delay: 10.6

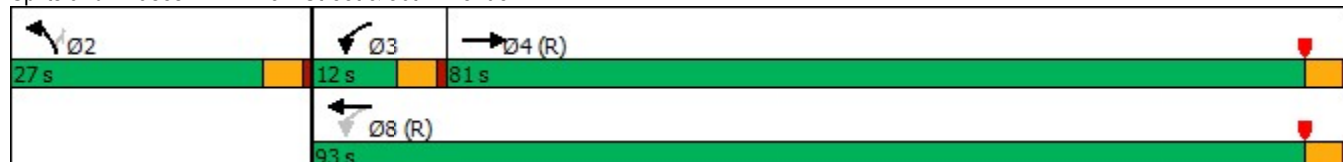
Intersection LOS: B

Intersection Capacity Utilization 51.8%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 1: Biloxi Street & 56th Avenue








Queues

1: Biloxi Street & 56th Avenue

Future Total (2040)

PM Peak Hour

					
Lane Group	EBT	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	2092	27	1870	130	27
v/c Ratio	0.55	0.15	0.46	0.63	0.13
Control Delay	12.7	4.7	4.2	63.2	16.8
Queue Delay	0.3	0.0	0.0	0.0	0.0
Total Delay	13.0	4.7	4.2	63.2	16.8
Queue Length 50th (ft)	529	3	128	97	0
Queue Length 95th (ft)	591	11	193	157	27
Internal Link Dist (ft)	670		1090	351	
Turn Bay Length (ft)		250		275	150
Base Capacity (vph)	3795	199	4106	331	318
Starvation Cap Reductn	883	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.72	0.14	0.46	0.39	0.08
Intersection Summary					

HCM 6th Signalized Intersection Summary

1: Biloxi Street & 56th Avenue





























Future Total (2040)
PM Peak Hour

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑↑↱		↙	↑↑↑	↙	↗
Traffic Volume (veh/h)	1770	155	25	1720	120	25
Future Volume (veh/h)	1770	155	25	1720	120	25
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)		1.00	1.00		1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	1924	168	27	1870	130	27
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	3695	321	256	4262	161	143
Arrive On Green	1.00	1.00	0.02	0.83	0.09	0.09
Sat Flow, veh/h	4952	416	1781	5274	1781	1585
Grp Volume(v), veh/h	1366	726	27	1870	130	27
Grp Sat Flow(s),veh/h/ln	1702	1796	1781	1702	1781	1585
Q Serve(g_s), s	0.0	0.0	0.3	11.5	8.6	1.9
Cycle Q Clear(g_c), s	0.0	0.0	0.3	11.5	8.6	1.9
Prop In Lane		0.23	1.00		1.00	1.00
Lane Grp Cap(c), veh/h	2629	1387	256	4262	161	143
V/C Ratio(X)	0.52	0.52	0.11	0.44	0.81	0.19
Avail Cap(c_a), veh/h	2629	1387	323	4262	334	297
HCM Platoon Ratio	1.33	1.33	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.79	0.79	0.90	0.90	1.00	1.00
Uniform Delay (d), s/veh	0.0	0.0	2.1	2.6	53.6	50.5
Incr Delay (d2), s/veh	0.6	1.1	0.2	0.3	9.2	0.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	0.4	0.1	2.1	4.3	0.8
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	0.6	1.1	2.3	2.9	62.7	51.1
LnGrp LOS	A	A	A	A	E	D
Approach Vol, veh/h	2092			1897	157	
Approach Delay, s/veh	0.8			2.9	60.7	
Approach LOS	A			A	E	
Timer - Assigned Phs	2		3	4	8	
Phs Duration (G+Y+Rc), s	15.3		7.5	97.2	104.7	
Change Period (Y+Rc), s	4.5		4.5	4.5	4.5	
Max Green Setting (Gmax), s	22.5		7.5	76.5	88.5	
Max Q Clear Time (g_c+l1), s	10.6		2.3	2.0	13.5	
Green Ext Time (p_c), s	0.3		0.0	27.6	23.7	
Intersection Summary						
HCM 6th Ctrl Delay			4.0			
HCM 6th LOS			A			

Timings 3: Denali Boulevard & 56th Avenue

Future Total (2040)

PM Peak Hour

											
Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		  		 	  	 					
Traffic Volume (vph)	20	1020	580	340	1145	420	10	200	30	5	50
Future Volume (vph)	20	1020	580	340	1145	420	10	200	30	5	50
Turn Type	pm+pt	NA	pm+ov	Prot	NA	Prot	NA	pm+ov	Perm	NA	pm+ov
Protected Phases	7	4	5	3	8	5	2	3		6	7
Permitted Phases	4		4					2	6		6
Detector Phase	7	4	5	3	8	5	2	3	6	6	7
Switch Phase											
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.5	22.5	22.5	9.5	22.5	22.5	22.5	9.5	22.5	22.5	9.5
Total Split (s)	9.6	40.3	33.0	24.2	54.9	33.0	55.5	24.2	22.5	22.5	9.6
Total Split (%)	8.0%	33.6%	27.5%	20.2%	45.8%	27.5%	46.3%	20.2%	18.8%	18.8%	8.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lead	Lead	Lead	Lag	Lag	Lead		Lag	Lag	Lag	Lead
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes
Recall Mode	None	C-Max	None	None	C-Max	None	None	None	None	None	None
Act Effect Green (s)	55.4	55.4	80.0	19.7	70.6	22.8	31.4	55.6	8.4	8.4	15.1
Actuated g/C Ratio	0.46	0.46	0.67	0.16	0.59	0.19	0.26	0.46	0.07	0.07	0.13
v/c Ratio	0.11	0.47	0.51	0.66	0.42	0.70	0.02	0.28	0.34	0.04	0.19
Control Delay	24.1	25.0	2.7	51.5	15.1	51.1	26.3	13.8	61.7	50.8	3.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	24.1	25.0	2.7	51.5	15.1	51.1	26.3	13.8	61.7	50.8	3.1
LOS	C	C	A	D	B	D	C	B	E	D	A
Approach Delay		17.0			23.3		38.9			26.7	
Approach LOS		B			C		D			C	

Intersection Summary

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 0 (0%), Referenced to phase 4:EBTL and 8:WBT, Start of Yellow

Natural Cycle: 80

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.70

Intersection Signal Delay: 23.3

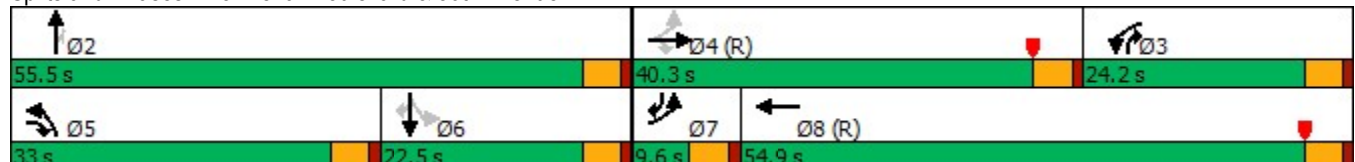
Intersection LOS: C

Intersection Capacity Utilization 61.0%

ICU Level of Service B












Analysis Period (min) 15

Splits and Phases: 3: Denali Boulevard & 56th Avenue



Queues
3: Denali Boulevard & 56th Avenue

Future Total (2040)
PM Peak Hour

											
Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	22	1109	630	370	1256	457	11	217	33	5	54
v/c Ratio	0.11	0.47	0.51	0.66	0.42	0.70	0.02	0.28	0.34	0.04	0.19
Control Delay	24.1	25.0	2.7	51.5	15.1	51.1	26.3	13.8	61.7	50.8	3.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	24.1	25.0	2.7	51.5	15.1	51.1	26.3	13.8	61.7	50.8	3.1
Queue Length 50th (ft)	10	226	17	149	152	172	6	68	25	4	0
Queue Length 95th (ft)	30	308	45	m196	333	215	18	99	58	17	8
Internal Link Dist (ft)		546			823		622			214	
Turn Bay Length (ft)	150		350	275		275			100		100
Base Capacity (vph)	195	2347	1245	563	2990	815	791	763	209	279	281
Starvation Cap Reductn	0	0	18	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.11	0.47	0.51	0.66	0.42	0.56	0.01	0.28	0.16	0.02	0.19






























Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

HCM 6th Signalized Intersection Summary


































3: Denali Boulevard & 56th Avenue

Future Total (2040)
PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		  		 	  		 					
Traffic Volume (veh/h)	20	1020	580	340	1145	10	420	10	200	30	5	50
Future Volume (veh/h)	20	1020	580	340	1145	10	420	10	200	30	5	50
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	22	1109	630	370	1245	11	457	11	217	33	5	54
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	113	1523	720	1191	3243	29	540	457	934	119	95	115
Arrive On Green	0.02	0.30	0.30	0.11	0.21	0.21	0.16	0.24	0.24	0.05	0.05	0.05
Sat Flow, veh/h	1781	5106	1585	3456	5220	46	3456	1870	1585	1153	1870	1585
Grp Volume(v), veh/h	22	1109	630	370	812	444	457	11	217	33	5	54
Grp Sat Flow(s),veh/h/ln	1781	1702	1585	1728	1702	1862	1728	1870	1585	1153	1870	1585
Q Serve(g_s), s	1.1	23.4	18.5	11.8	24.7	24.7	15.4	0.5	0.0	3.4	0.3	3.9
Cycle Q Clear(g_c), s	1.1	23.4	18.5	11.8	24.7	24.7	15.4	0.5	0.0	3.4	0.3	3.9
Prop In Lane	1.00		1.00	1.00		0.02	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	113	1523	720	1191	2115	1157	540	457	934	119	95	115
V/C Ratio(X)	0.19	0.73	0.87	0.31	0.38	0.38	0.85	0.02	0.23	0.28	0.05	0.47
Avail Cap(c_a), veh/h	150	1523	720	1191	2115	1157	821	795	1220	233	281	272
HCM Platoon Ratio	1.00	1.00	1.00	0.33	0.33	0.33	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.86	0.86	0.86	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	34.8	37.7	17.9	40.1	27.9	27.9	49.2	34.4	11.7	55.6	54.2	53.4
Incr Delay (d2), s/veh	0.7	2.7	12.3	0.1	0.5	1.0	5.2	0.0	0.1	1.3	0.2	3.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.5	10.0	7.6	5.5	11.4	12.6	7.0	0.2	2.7	1.0	0.2	1.7
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	35.5	40.4	30.2	40.2	28.4	28.8	54.5	34.5	11.9	56.9	54.4	56.4
LnGrp LOS	D	D	C	D	C	C	D	C	B	E	D	E
Approach Vol, veh/h	1761			1626			685			92		
Approach Delay, s/veh	36.7			31.2			40.6			56.5		
Approach LOS	D			C			D			E		
Timer - Assigned Phs	2		3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	33.8		45.9	40.3	23.2	10.6	7.1	79.1				
Change Period (Y+Rc), s	4.5		4.5	4.5	4.5	4.5	4.5	4.5				
Max Green Setting (Gmax), s	51.0		19.7	35.8	28.5	18.0	5.1	50.4				
Max Q Clear Time (g_c+I1), s	2.5		13.8	25.4	17.4	5.9	3.1	26.7				
Green Ext Time (p_c), s	0.8		0.7	7.0	1.3	0.2	0.0	9.5				
Intersection Summary												
HCM 6th Ctrl Delay	35.6											
HCM 6th LOS	D											
Notes												

Timings
12: Denali Boulevard & 48th Avenue

Future Total (2040)
PM Peak Hour

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	  		 	  		 	 		 	 	
Traffic Volume (vph)	695	1545	770	520	1135	250	625	205	455	275	220	475
Future Volume (vph)	695	1545	770	520	1135	250	625	205	455	275	220	475
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov	pm+pt	NA	pm+ov
Protected Phases	7	4	5	3	8	1	5	2	3	1	6	7
Permitted Phases			4			8			2	6		6
Detector Phase	7	4	5	3	8	1	5	2	3	1	6	7
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.5	22.5	9.5	9.5	22.5	9.5	9.5	22.5	9.5	9.5	22.5	9.5
Total Split (s)	31.0	44.9	29.0	24.2	38.1	26.4	29.0	24.5	24.2	26.4	21.9	31.0
Total Split (%)	25.8%	37.4%	24.2%	20.2%	31.8%	22.0%	24.2%	20.4%	20.2%	22.0%	18.3%	25.8%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lag	Lag	Lead	Lead	Lead	Lag	Lead	Lead	Lead	Lag	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	C-Max	None	None	C-Max	None	None	None	None	None	None	None
Act Effect Green (s)	26.5	40.7	69.7	22.2	36.4	67.1	24.5	12.9	35.1	26.2	14.6	41.1
Actuated g/C Ratio	0.22	0.34	0.58	0.18	0.30	0.56	0.20	0.11	0.29	0.22	0.12	0.34
v/c Ratio	1.00	0.97	0.89	0.89	0.80	0.29	0.97	0.59	0.93	0.77	0.56	0.85
Control Delay	62.1	43.8	17.7	49.0	27.4	2.4	75.1	57.2	48.5	58.7	54.3	30.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	62.1	43.8	17.7	49.0	27.4	2.4	75.1	57.2	48.5	58.7	54.3	30.4
LOS	E	D	B	D	C	A	E	E	D	E	D	C
Approach Delay		41.3			30.0			62.8			43.8	
Approach LOS		D			C			E			D	

Intersection Summary

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 16 (13%), Referenced to phase 4:EBT and 8:WBT, Start of Yellow

Natural Cycle: 120

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 1.00

Intersection Signal Delay: 42.5

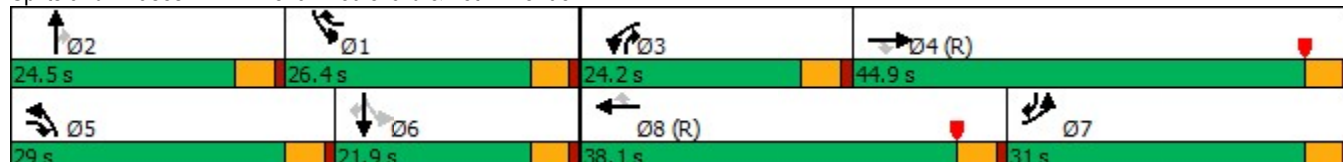
Intersection LOS: D

Intersection Capacity Utilization 84.5%

ICU Level of Service E













Analysis Period (min) 15

Splits and Phases: 12: Denali Boulevard & 48th Avenue



Queues
12: Denali Boulevard & 48th Avenue

Future Total (2040)
PM Peak Hour

														
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR		
Lane Group Flow (vph)	755	1679	837	565	1234	272	679	223	495	299	239	516		
v/c Ratio	1.00	0.97	0.89	0.89	0.80	0.29	0.97	0.59	0.93	0.77	0.56	0.85		
Control Delay	62.1	43.8	17.7	49.0	27.4	2.4	75.1	57.2	48.5	58.7	54.3	30.4		
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
Total Delay	62.1	43.8	17.7	49.0	27.4	2.4	75.1	57.2	48.5	58.7	54.3	30.4		
Queue Length 50th (ft)	295	449	87	228	337	6	271	87	177	215	91	158		
Queue Length 95th (ft)	m#387	m#486	m106	#341	343	16	#392	126	#375	#357	133	#273		
Internal Link Dist (ft)	1300				1760				542		586			
Turn Bay Length (ft)	250			275	300			150	400			250	300	225
Base Capacity (vph)	758	1723	945	636	1543	924	700	589	530	386	513	604		
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0		
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0		
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0		
Reduced v/c Ratio	1.00	0.97	0.89	0.89	0.80	0.29	0.97	0.38	0.93	0.77	0.47	0.85		

Intersection Summary

























95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

HCM 6th Signalized Intersection Summary 12: Denali Boulevard & 48th Avenue

Future Total (2040)
PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	695	1545	770	520	1135	250	625	205	455	275	220	475
Future Volume (veh/h)	695	1545	770	520	1135	250	625	205	455	275	220	475
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	755	1679	0	565	1234	272	679	223	0	299	239	516
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	787	1754		567	1430	851	706	304		517	491	580
Arrive On Green	0.46	0.69	0.00	0.05	0.09	0.09	0.20	0.09	0.00	0.26	0.14	0.14
Sat Flow, veh/h	3456	5106	1585	3456	5106	1585	3456	3554	1585	1781	3554	1585
Grp Volume(v), veh/h	755	1679	0	565	1234	272	679	223	0	299	239	516
Grp Sat Flow(s),veh/h/ln	1728	1702	1585	1728	1702	1585	1728	1777	1585	1781	1777	1585
Q Serve(g_s), s	25.4	36.1	0.0	19.6	28.6	0.0	23.4	7.3	0.0	13.1	7.5	14.0
Cycle Q Clear(g_c), s	25.4	36.1	0.0	19.6	28.6	0.0	23.4	7.3	0.0	13.1	7.5	14.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	787	1754		567	1430	851	706	304		517	491	580
V/C Ratio(X)	0.96	0.96		1.00	0.86	0.32	0.96	0.73		0.58	0.49	0.89
Avail Cap(c_a), veh/h	787	1754		567	1430	851	706	592		517	515	591
HCM Platoon Ratio	2.00	2.00	2.00	0.33	0.33	0.33	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.28	0.28	0.00	0.78	0.78	0.78	1.00	1.00	0.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	32.1	18.0	0.0	56.7	52.2	20.7	47.3	53.5	0.0	36.7	47.8	14.2
Incr Delay (d2), s/veh	9.3	5.1	0.0	32.3	5.7	0.8	24.9	3.4	0.0	1.6	0.8	15.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	9.3	8.4	0.0	11.7	13.8	5.7	12.4	3.4	0.0	7.7	3.4	8.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	41.5	23.0	0.0	89.0	57.9	21.5	72.2	56.9	0.0	38.3	48.5	29.5
LnGrp LOS	D	C		F	E	C	E	E		D	D	C
Approach Vol, veh/h	2434			2071			902			1054		
Approach Delay, s/veh	28.7			61.6			68.4			36.3		
Approach LOS	C			E			E			D		
Timer - Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	35.3	14.8	24.2	45.7	29.0	21.1	31.8	38.1				
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5				
Max Green Setting (Gmax), s	21.9	20.0	19.7	40.4	24.5	17.4	26.5	33.6				
Max Q Clear Time (g_c+I1), s	15.1	9.3	21.6	38.1	25.4	16.0	27.4	30.6				
Green Ext Time (p_c), s	0.5	0.9	0.0	2.0	0.0	0.6	0.0	2.3				

Intersection Summary

HCM 6th Ctrl Delay	46.0
HCM 6th LOS	D

























Notes

User approved pedestrian interval to be less than phase max green.

Unsignalized Delay for [NBR, EBR] is excluded from calculations of the approach delay and intersection delay.

Timings
13: Biloxi Street & 48th Avenue

Future Total (2040)
PM Peak Hour

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	470	2495	450	245	1865	165	355	5	370	185	5	260
Future Volume (vph)	470	2495	450	245	1865	165	355	5	370	185	5	260
Turn Type	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	pm+ov	pm+pt	NA	pm+ov
Protected Phases	7	4	5	3	8		5	2	3	1	6	7
Permitted Phases			4			8			2	6		6
Detector Phase	7	4	5	3	8	8	5	2	3	1	6	7
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.5	22.5	9.5	9.5	22.5	22.5	9.5	22.5	9.5	9.5	22.5	9.5
Total Split (s)	23.4	65.1	20.0	14.4	56.1	56.1	20.0	22.9	14.4	17.6	20.5	23.4
Total Split (%)	19.5%	54.3%	16.7%	12.0%	46.8%	46.8%	16.7%	19.1%	12.0%	14.7%	17.1%	19.5%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lag	Lead	Lead	Lag	Lead	Lead	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	C-Max	None	None	C-Max	C-Max	None	None	None	None	None	None
Act Effect Green (s)	18.9	79.0	97.9	9.9	70.0	70.0	15.4	6.4	11.7	16.2	5.9	20.3
Actuated g/C Ratio	0.16	0.66	0.82	0.08	0.58	0.58	0.13	0.05	0.10	0.14	0.05	0.17
v/c Ratio	0.95	0.81	0.35	0.94	0.68	0.18	0.88	0.05	1.68	0.84	0.05	0.91
Control Delay	50.7	6.7	0.1	75.7	13.6	3.4	73.1	53.8	347.1	77.5	55.2	67.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	50.7	6.7	0.1	75.7	13.6	3.4	73.1	53.8	347.1	77.5	55.2	67.1
LOS	D	A	A	E	B	A	E	D	F	E	E	E
Approach Delay		11.9			19.5			211.9			71.3	
Approach LOS		B			B			F			E	

Intersection Summary

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 35 (29%), Referenced to phase 4:EBT and 8:WBT, Start of Yellow

Natural Cycle: 150

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 1.68

Intersection Signal Delay: 39.6





Intersection LOS: D

Intersection Capacity Utilization 92.6%

ICU Level of Service F

Analysis Period (min) 15

Splits and Phases: 13: Biloxi Street & 48th Avenue













			
Ø1	Ø2	Ø4 (R)	Ø3
17.6 s	22.9 s	65.1 s	14.4 s
			
Ø5	Ø6	Ø8 (R)	Ø7
20 s	20.5 s	56.1 s	23.4 s

Queues

13: Biloxi Street & 48th Avenue

Future Total (2040)

PM Peak Hour

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	511	2712	489	266	2027	179	386	5	402	201	5	283
v/c Ratio	0.95	0.81	0.35	0.94	0.68	0.18	0.88	0.05	1.68	0.84	0.05	0.91
Control Delay	50.7	6.7	0.1	75.7	13.6	3.4	73.1	53.8	347.1	77.5	55.2	67.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	50.7	6.7	0.1	75.7	13.6	3.4	73.1	53.8	347.1	77.5	55.2	67.1
Queue Length 50th (ft)	212	148	0	110	241	0	153	4	~405	155	4	181
Queue Length 95th (ft)	m194	m307	m0	m#144	m420	m13	#237	17	#416	213	17	#213
Internal Link Dist (ft)		420			1300			548			543	
Turn Bay Length (ft)	275		400	275		150	250		300	275		
Base Capacity (vph)	540	3346	1374	283	2965	981	443	285	240	240	248	312
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.95	0.81	0.36	0.94	0.68	0.18	0.87	0.02	1.68	0.84	0.02	0.91

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

























95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

HCM 6th Signalized Intersection Summary 13: Biloxi Street & 48th Avenue

Future Total (2040)
PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	470	2495	450	245	1865	165	355	5	370	185	5	260
Future Volume (veh/h)	470	2495	450	245	1865	165	355	5	370	185	5	260
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	511	2712	0	266	2027	179	386	5	0	201	5	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	869	2579		610	2196	682	439	111		313	78	
Arrive On Green	0.50	1.00	0.00	0.06	0.14	0.14	0.13	0.06	0.00	0.11	0.04	0.00
Sat Flow, veh/h	3456	5106	1585	3456	5106	1585	3456	1870	1585	1781	1870	1585
Grp Volume(v), veh/h	511	2712	0	266	2027	179	386	5	0	201	5	0
Grp Sat Flow(s),veh/h/ln	1728	1702	1585	1728	1702	1585	1728	1870	1585	1781	1870	1585
Q Serve(g_s), s	12.5	60.6	0.0	8.9	47.0	8.2	13.2	0.3	0.0	13.0	0.3	0.0
Cycle Q Clear(g_c), s	12.5	60.6	0.0	8.9	47.0	8.2	13.2	0.3	0.0	13.0	0.3	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	869	2579		610	2196	682	439	111		313	78	
V/C Ratio(X)	0.59	1.05		0.44	0.92	0.26	0.88	0.05		0.64	0.06	
Avail Cap(c_a), veh/h	869	2579		610	2196	682	446	287		313	249	
HCM Platoon Ratio	2.00	2.00	2.00	0.33	0.33	0.33	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	0.39	0.39	0.39	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	25.4	0.0	0.0	50.7	49.5	15.8	51.5	53.2	0.0	48.8	55.3	0.0
Incr Delay (d2), s/veh	1.0	33.2	0.0	0.2	3.5	0.4	17.8	0.2	0.0	4.4	0.3	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.3	7.9	0.0	4.1	22.2	3.3	6.8	0.1	0.0	6.1	0.2	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	26.5	33.2	0.0	50.9	53.0	16.2	69.3	53.4	0.0	53.2	55.6	0.0
LnGrp LOS	C	F		D	D	B	E	D		D	E	
Approach Vol, veh/h	3223			2472			391			206		
Approach Delay, s/veh	32.2			50.1			69.1			53.2		
Approach LOS	C			D			E			D		
Timer - Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	17.6	11.6	25.7	65.1	19.7	9.5	34.7	56.1				
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5				
Max Green Setting (Gmax), s	13.1	18.4	9.9	60.6	15.5	16.0	18.9	51.6				
Max Q Clear Time (g_c+l1), s	15.0	2.3	10.9	62.6	15.2	2.3	14.5	49.0				
Green Ext Time (p_c), s	0.0	0.0	0.0	0.0	0.1	0.0	0.8	2.4				

Intersection Summary

HCM 6th Ctrl Delay 42.2
HCM 6th LOS D

Notes

User approved pedestrian interval to be less than phase max green.

Unsignalized Delay for [NBR, EBR, SBR] is excluded from calculations of the approach delay and intersection delay.

HCM 6th TWSC
14: 48th Avenue & Addison Street

Future Total (2040)
PM Peak Hour

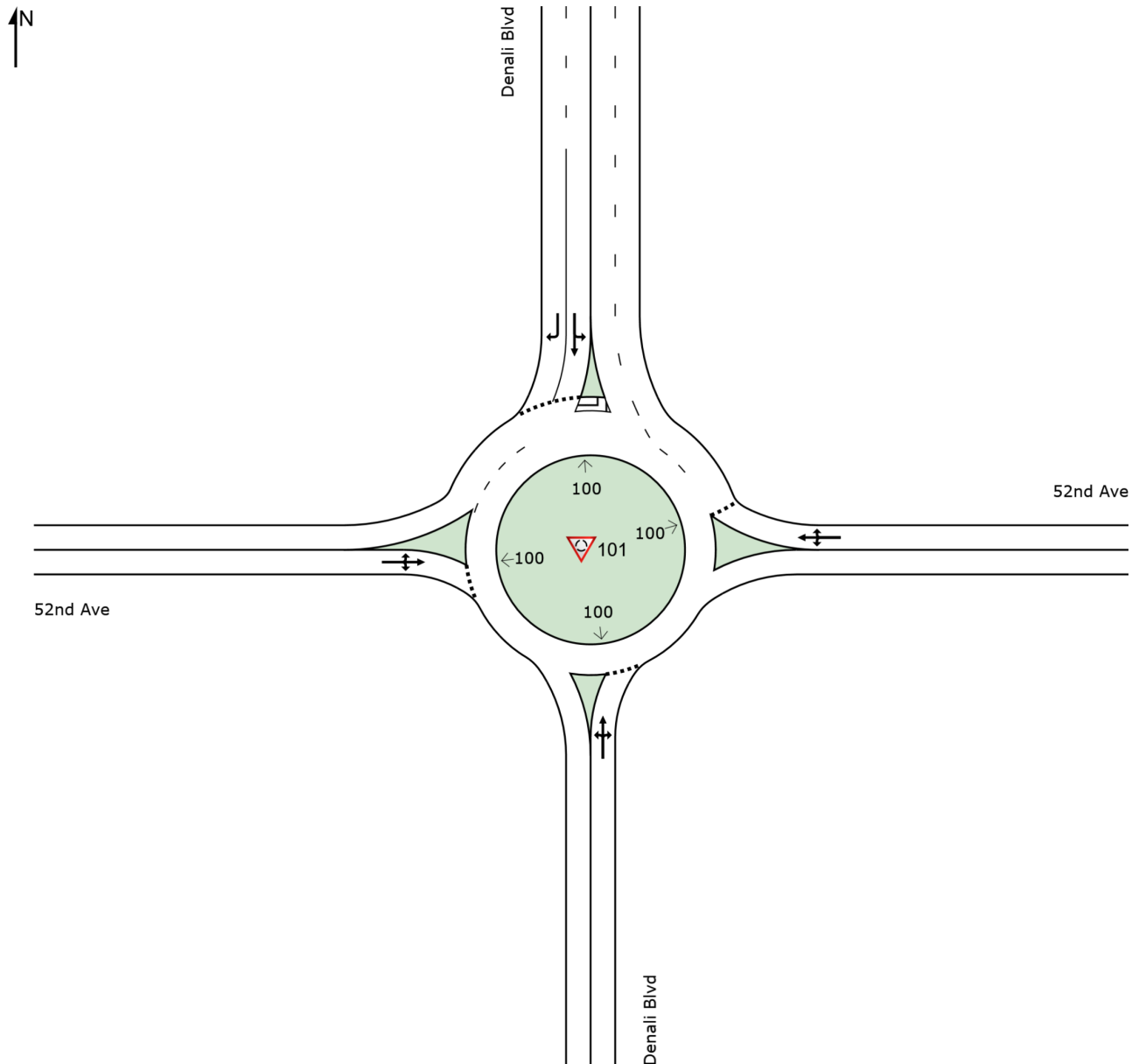
Intersection						
Int Delay, s/veh	2					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑↑↑	↑↑↑↑	↗		↗
Traffic Vol, veh/h	0	3410	2315	165	0	265
Future Vol, veh/h	0	3410	2315	165	0	265
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	300	-	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	3707	2516	179	0	288
Major/Minor	Major1	Major2		Minor2		
Conflicting Flow All	-	0	-	0	-	1258
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	-	-	-	7.14
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	-	-	-	3.92
Pot Cap-1 Maneuver	0	-	-	-	0	*359
Stage 1	0	-	-	-	0	-
Stage 2	0	-	-	-	0	-
Platoon blocked, %		-	-	-		1
Mov Cap-1 Maneuver	-	-	-	-	-	*359
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Approach	EB	WB		SB		
HCM Control Delay, s	0	0		45.4		
HCM LOS	E					
Minor Lane/Major Mvmt	EBT	WBT	WBR	SBLn1		
Capacity (veh/h)	-	-	-	359		
HCM Lane V/C Ratio	-	-	-	0.802		
HCM Control Delay (s)	-	-	-	45.4		
HCM Lane LOS	-	-	-	E		
HCM 95th %tile Q(veh)	-	-	-	6.9		
Notes						
~: Volume exceeds capacity		\$: Delay exceeds 300s		+: Computation Not Defined		*: All major volume in platoon

SITE LAYOUT

 Site: 101 [AM_2040_Future Total (Site Folder: INT # 102 - 52nd Ave & Denali Blvd)]

Intersection #102
AM Peak Hour
Site Category: (None)
Roundabout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



MOVEMENT SUMMARY

 **Site: 101 [AM_2040_Future Total (Site Folder: INT # 102 - 52nd Ave & Denali Blvd)]**

Intersection #102
AM Peak Hour
Site Category: (None)
Roundabout

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[Total veh/h	HV] %	[Total veh/h	HV] %				[Veh. veh	Dist] ft				
South: Denali Blvd														
3	L2	55	2.0	60	2.0	0.772	16.5	LOS C	13.6	346.6	0.78	0.62	0.94	29.9
8	T1	730	2.0	793	2.0	0.772	16.5	LOS C	13.6	346.6	0.78	0.62	0.94	29.9
18	R2	45	2.0	49	2.0	0.772	16.5	LOS C	13.6	346.6	0.78	0.62	0.94	29.1
Approach		830	2.0	902	2.0	0.772	16.5	LOS C	13.6	346.6	0.78	0.62	0.94	29.8
East: 52nd Ave														
1	L2	50	2.0	54	2.0	0.197	10.0	LOS A	0.7	19.0	0.69	0.69	0.69	31.3
6	T1	5	2.0	5	2.0	0.197	10.0	LOS A	0.7	19.0	0.69	0.69	0.69	31.3
16	R2	35	2.0	38	2.0	0.197	10.0	LOS A	0.7	19.0	0.69	0.69	0.69	30.5
Approach		90	2.0	98	2.0	0.197	10.0	LOS A	0.7	19.0	0.69	0.69	0.69	31.0
North: Denali Blvd														
7	L2	20	2.0	22	2.0	0.676	12.1	LOS B	6.2	157.5	0.55	0.33	0.55	31.7
4	T1	755	2.0	821	2.0	0.676	12.1	LOS B	6.2	157.5	0.55	0.33	0.55	31.6
14	R2	50	2.0	54	2.0	0.044	3.2	LOS A	0.2	4.3	0.23	0.11	0.23	34.8
Approach		825	2.0	897	2.0	0.676	11.5	LOS B	6.2	157.5	0.53	0.32	0.53	31.8
West: 52nd Ave														
5	L2	100	2.0	109	2.0	0.398	13.2	LOS B	1.9	49.1	0.74	0.81	0.97	30.2
2	T1	10	2.0	11	2.0	0.398	13.2	LOS B	1.9	49.1	0.74	0.81	0.97	30.1
12	R2	85	2.0	92	2.0	0.398	13.2	LOS B	1.9	49.1	0.74	0.81	0.97	29.3
Approach		195	2.0	212	2.0	0.398	13.2	LOS B	1.9	49.1	0.74	0.81	0.97	29.8
All Vehicles		1940	2.0	2109	2.0	0.772	13.8	LOS B	13.6	346.6	0.66	0.51	0.76	30.7

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

 **Site: 101 [PM_2040_Future Total (Site Folder: INT # 102 - 52nd Ave & Denali Blvd)]**

Intersection #102
PM Peak Hour
Site Category: (None)
Roundabout

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[Total veh/h	HV] %	[Total veh/h	HV] %				[Veh. veh	Dist] ft				
South: Denali Blvd														
3	L2	125	2.0	136	2.0	0.616	11.2	LOS B	5.0	126.5	0.61	0.43	0.61	31.8
8	T1	470	2.0	511	2.0	0.616	11.2	LOS B	5.0	126.5	0.61	0.43	0.61	31.8
18	R2	45	2.0	49	2.0	0.616	11.2	LOS B	5.0	126.5	0.61	0.43	0.61	30.9
Approach		640	2.0	696	2.0	0.616	11.2	LOS B	5.0	126.5	0.61	0.43	0.61	31.7
East: 52nd Ave														
1	L2	65	2.0	71	2.0	0.212	8.5	LOS A	0.9	21.6	0.65	0.65	0.65	32.1
6	T1	25	2.0	27	2.0	0.212	8.5	LOS A	0.9	21.6	0.65	0.65	0.65	32.0
16	R2	30	2.0	33	2.0	0.212	8.5	LOS A	0.9	21.6	0.65	0.65	0.65	31.1
Approach		120	2.0	130	2.0	0.212	8.5	LOS A	0.9	21.6	0.65	0.65	0.65	31.8
North: Denali Blvd														
7	L2	30	2.0	33	2.0	0.630	11.7	LOS B	6.8	172.2	0.64	0.59	0.82	31.9
4	T1	620	2.0	674	2.0	0.630	11.7	LOS B	6.8	172.2	0.64	0.59	0.82	31.7
14	R2	125	2.0	136	2.0	0.121	4.3	LOS A	0.5	12.5	0.35	0.23	0.35	34.2
Approach		775	2.0	842	2.0	0.630	10.5	LOS B	6.8	172.2	0.59	0.53	0.74	32.1
West: 52nd Ave														
5	L2	100	2.0	109	2.0	0.505	14.4	LOS B	3.1	78.0	0.77	0.89	1.15	30.0
2	T1	30	2.0	33	2.0	0.505	14.4	LOS B	3.1	78.0	0.77	0.89	1.15	29.9
12	R2	150	2.0	163	2.0	0.505	14.4	LOS B	3.1	78.0	0.77	0.89	1.15	29.1
Approach		280	2.0	304	2.0	0.505	14.4	LOS B	3.1	78.0	0.77	0.89	1.15	29.5
All Vehicles		1815	2.0	1973	2.0	0.630	11.2	LOS B	6.8	172.2	0.63	0.56	0.75	31.5

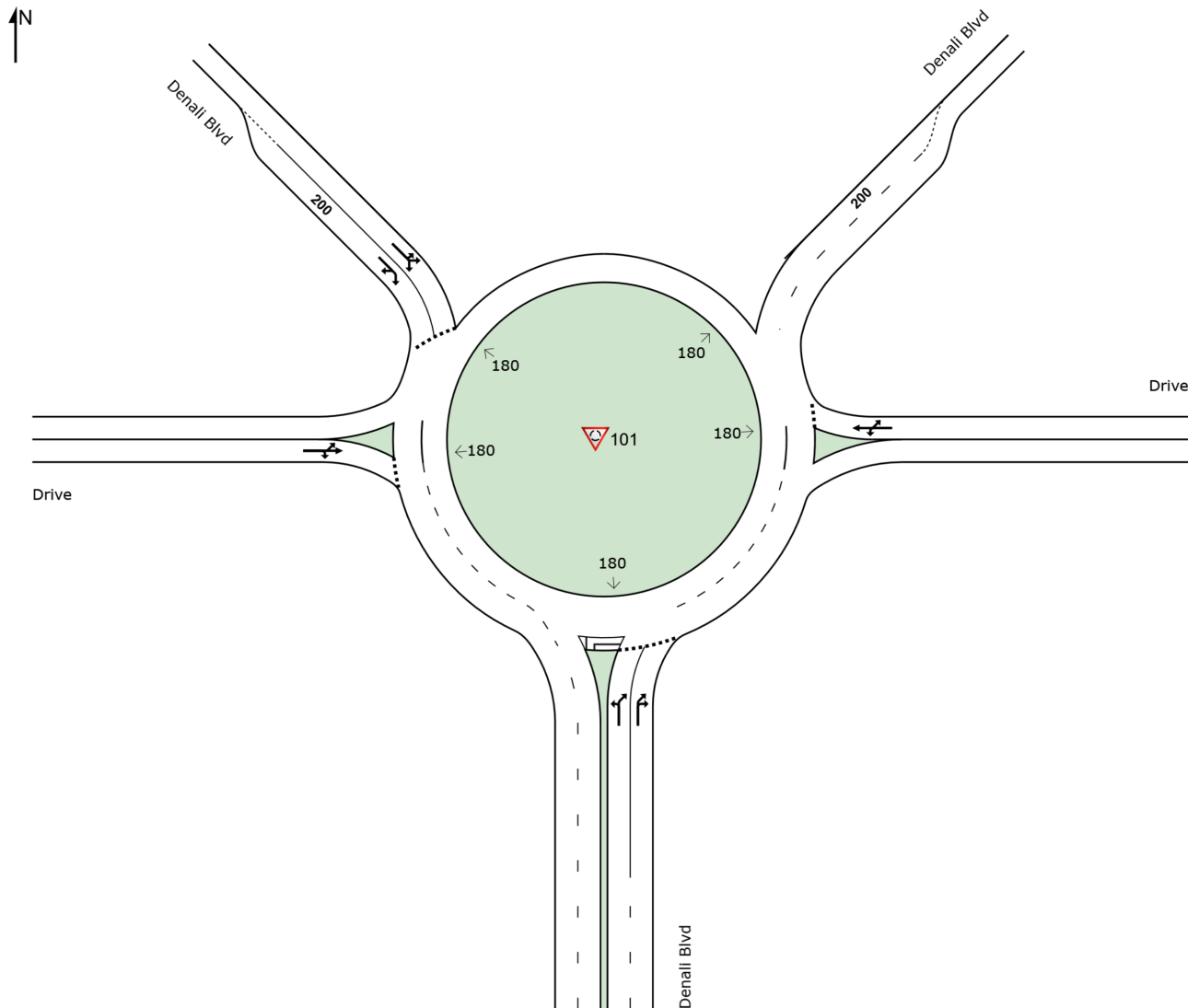
Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SITE LAYOUT

Site: 101 [AM_2040_Future Total_2-lane (Site Folder: INT # 103 - Denali Blvd)]

Intersection #103
AM Peak Hour
Site Category: (None)
Roundabout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



MOVEMENT SUMMARY


 **Site: 101 [AM_2040_Future Total_2-lane (Site Folder: INT # 103 - Denali Blvd)]**

Intersection #103
AM Peak Hour
Site Category: (None)
Roundabout

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[Total veh/h	HV %	[Total veh/h	HV %				[Veh. veh	Dist] ft				
South: Denali Blvd														
3	L2	270	2.0	293	2.0	0.302	5.7	LOS A	1.5	39.0	0.30	0.17	0.30	34.5
18a	R1	695	2.0	755	2.0	0.571	9.6	LOS A	4.3	108.3	0.43	0.26	0.43	34.1
18	R2	35	2.0	38	2.0	0.571	9.5	LOS A	4.3	108.3	0.45	0.27	0.45	33.2
Approach		1000	2.0	1087	2.0	0.571	8.5	LOS A	4.3	108.3	0.40	0.24	0.40	34.2
East: Drive														
1	L2	85	2.0	92	2.0	0.203	9.9	LOS A	0.7	17.5	0.68	0.68	0.68	32.2
6	T1	5	2.0	5	2.0	0.203	9.9	LOS A	0.7	17.5	0.68	0.68	0.68	31.6
16b	R3	5	2.0	5	2.0	0.203	9.9	LOS A	0.7	17.5	0.68	0.68	0.68	30.0
Approach		95	2.0	103	2.0	0.203	9.9	LOS A	0.7	17.5	0.68	0.68	0.68	32.0
NorthWest: Denali Blvd														
7x	L2	1	1.9	1	1.9	0.579	15.9	LOS C	5.3	134.5	0.69	0.77	1.02	34.3
7ax	L1	5	2.0	5	2.0	0.579	11.6	LOS B	5.3	134.5	0.69	0.77	1.02	33.7
14ax	R1	870	2.0	946	2.0	0.579	11.6	LOS B	5.3	134.5	0.69	0.77	1.02	33.2
14bx	R3	155	2.0	168	2.0	0.579	11.6	LOS B	5.3	134.5	0.69	0.77	1.02	31.7
Approach		1031	2.0	1121	2.0	0.579	11.6	LOS B	5.3	134.5	0.69	0.77	1.02	32.9
West: Drive														
5a	L1	100	2.0	109	2.0	0.637	24.4	LOS C	4.1	103.9	0.80	1.00	1.51	29.0
2	T1	5	2.0	5	2.0	0.637	20.1	LOS C	4.1	103.9	0.80	1.00	1.51	29.0
12	R2	225	2.0	245	2.0	0.637	20.1	LOS C	4.1	103.9	0.80	1.00	1.51	28.0
Approach		330	2.0	359	2.0	0.637	21.4	LOS C	4.1	103.9	0.80	1.00	1.51	28.3
All Vehicles		2456	2.0	2670	2.0	0.637	11.6	LOS B	5.3	134.5	0.58	0.58	0.82	32.7

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

 **Site: 101 [PM_2040_Future Total_2-lane (Site Folder: INT # 103 - Denali Blvd)]**

Intersection #103
PM Peak Hour
Site Category: (None)
Roundabout

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[Total veh/h	HV %	[Total veh/h	HV %				[Veh. veh	Dist] ft				
South: Denali Blvd														
3	L2	385	2.0	418	2.0	0.371	6.8	LOS A	2.0	50.2	0.41	0.28	0.41	33.3
18a	R1	695	2.0	755	2.0	0.701	13.4	LOS B	10.0	253.2	0.67	0.61	0.89	32.3
18	R2	70	2.0	76	2.0	0.701	13.5	LOS B	10.0	253.2	0.68	0.61	0.90	31.4
Approach		1150	2.0	1250	2.0	0.701	11.2	LOS B	10.0	253.2	0.59	0.50	0.73	32.6
East: Drive														
1	L2	50	2.0	54	2.0	0.146	10.2	LOS B	0.5	12.1	0.71	0.71	0.71	32.3
6	T1	5	2.0	5	2.0	0.146	10.2	LOS B	0.5	12.1	0.71	0.71	0.71	31.7
16b	R3	5	2.0	5	2.0	0.146	10.2	LOS B	0.5	12.1	0.71	0.71	0.71	30.0
Approach		60	2.0	65	2.0	0.146	10.2	LOS B	0.5	12.1	0.71	0.71	0.71	32.0
NorthWest: Denali Blvd														
7x	L2	1	1.9	1	1.9	0.539	15.5	LOS C	4.2	106.1	0.69	0.81	1.01	34.5
7ax	L1	5	2.0	5	2.0	0.539	11.3	LOS B	4.2	106.1	0.69	0.81	1.01	33.8
14ax	R1	635	2.0	690	2.0	0.539	11.3	LOS B	4.2	106.1	0.69	0.81	1.01	33.3
14bx	R3	245	2.0	266	2.0	0.539	11.3	LOS B	4.2	106.1	0.69	0.81	1.01	31.6
Approach		886	2.0	963	2.0	0.539	11.3	LOS B	4.2	106.1	0.69	0.81	1.01	32.8
West: Drive														
5a	L1	125	2.0	136	2.0	0.674	22.1	LOS C	5.8	146.5	0.80	1.05	1.56	30.0
2	T1	45	2.0	49	2.0	0.674	17.9	LOS C	5.8	146.5	0.80	1.05	1.56	30.0
12	R2	280	2.0	304	2.0	0.674	17.9	LOS C	5.8	146.5	0.80	1.05	1.56	28.9
Approach		450	2.0	489	2.0	0.674	19.1	LOS C	5.8	146.5	0.80	1.05	1.56	29.3
All Vehicles		2546	2.0	2767	2.0	0.701	12.6	LOS B	10.0	253.2	0.66	0.71	0.97	32.0

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
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HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.



September 5, 2024

Mr. Chris Fellows
Windler Public Improvement Authority
9155 E. Nicholls Ave, Suite 360
Greenwood Village, CO 80112

**RE: Windler – Trident Data Center Traffic Conformance
FHU Project No. 12259-01**

Dear Mr. Fellows:

Felsburg Holt & Ullevig (FHU) prepared a traffic impact study for the Windler Homestead development in July 2023 further analysis based on a Master Plan amendment was submitted in August 2024. That report used the Institute of Transportation Engineers' (ITE) publication *Trip Generation Manual, 11th Edition* (2021) to forecast vehicle-trips based on the land use types and sizes. Within that report approximately 145 acres was analyzed as an industrial park including planning areas (PAs) 26, 27, 28, and 29. PA 26 is approximately 35 acres south of 48th Avenue between Wenatchee Street and E-470 and PAs 27, 28, and 29 are approximately 110 acres north of 48th Avenue and south of 52nd Avenue between Tibet Road and E-470 less the Brandenburg Parcel, which is a part of the neighboring 310 West development. These PAs contemplated a combined 2.2 million square feet of retail that was anticipated to be split 50/50 between General Light Industrial and High-Cube Transload & Short-Term Storage Warehouse. These parcels are now being contemplated by a Data Center user who is contemplating a total of 3.3 million square feet.

The currently proposed site has also been analyzed using the ITE *Trip Generation Manual, 11th Edition* (2021) as it remains the most current publication. **Table 1** shows the equation and rates utilized in this analysis. **Table 2** shows the estimated trip generation for the current proposed site and a comparison to what was projected in the Windler Homestead Master TIS from July 2023.

Table 1. ITE Trip Generation Rates and Equations

Land Use	ITE Code	Unit	Daily	Peak	Equations & Rates	Distributions	
						In	Out
General Light Industrial	110	KSF	T=3.76*X+50.47	AM	T=0.68*X+3.81	88%	12%
				PM	Ln(T)=0.72*Ln(X)+0.38	14%	86%
High-Cube Transload & Short-Term Storage Warehouse	154	KSF	T=6.41*X+75.31	AM	T=0.31*X+22.85	24%	76%
				PM	T=0.43*X+20.55	63%	37%
Data Center	160	KSF	T=0.99*X	AM	T=0.13*X-5.63	55%	45%
				PM	T=0.11*X-5.65	30%	70%
KSF = 1,000 SF							

Table 2. Windler Industrial/Trident Trip Generation

Land Use (Trip Generation Category)	Quantity	Daily Vehicle Trips	AM Peak Hour Trips			PM Peak Hour Trips		
			In	Out	Total	In	Out	Total
Current Trident Proposal								
Data Center (#160)	3,300 KSF	3,267	233	190	423	107	250	357
Subtotal		3,267	233	190	423	107	250	357
2023 Windler Master TIS								
PA-26 High-Cube Transload & Short- Term Storage Warehouse (#154)	250 KSF	350	15	5	20	7	18	25
PA-26 Light Industrial (#110)	250 KSF	990	153	21	174	11	67	78
PA-27 High-Cube Transload & Short- Term Storage Warehouse (#154)	100 KSF	140	6	2	8	3	7	10
PA-27 Light Industrial (#110)	100 KSF	426	63	9	72	6	34	40
PA-28 High-Cube Transload & Short- Term Storage Warehouse (#154)	375 KSF	525	23	7	30	11	27	38
PA-28 Light Industrial (#110)	375 KSF	1,460	228	31	259	15	89	104
PA-29 High-Cube Transload & Short- Term Storage Warehouse (#154)	375 KSF	525	23	7	30	11	27	38
PA-29 Light Industrial (#110)	375 KSF	1,460	228	31	259	15	89	104
Subtotal		5,876	739	113	852	79	358	437
Change from Previous Plan		-2,609	-506	+77	-429	+28	-108	-80
Percent Change		-44.4%	--	--	-50.4%	--	--	-18.3%

The comparison of trip generation indicates a decrease of 429 and 80 trips during the AM and PM peak hour respectively. These correspond to percentage decreases of 50 and 18 in those peak hours.

Conclusions

The study resulted in the following conclusions:

- The newly proposed Trident Data Center within Windler Homestead generates less traffic as compared to the values analyzed in the master TIS. These decreases are approximately 2,609 daily trips and 430 and 80 trips in the AM and PM peak hours respectively. This equates to a roughly 44 percent decrease in daily traffic and 50 to 18 percent during the AM and PM peak hours respectively.

September 5, 2024

Mr. Chris Fellows

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- It is not anticipated that any additional off-site roadway improvements will be needed and that the Trident Data Center plan is in conformance with the previously assessed land use plan from the July 2023 Master TIS.

Please let me know if you have any questions about this letter or need any additional information.



Philip Dunham, PE, PTOE
Transportation Engineer