![Platinum Traffic Engineering logo]

TECHNICAL MEMORANDUM

TO:	Robert Palmer, PE, Strategic Land Solutions
FROM:	Alexander E. Larson, PE
DATE:	July 13, 2024
SUBJECT:	**Traffic Memorandum - McDonald's Restaurant at Eagle Ridge 21360 E. 6th Ave Aurora, CO**
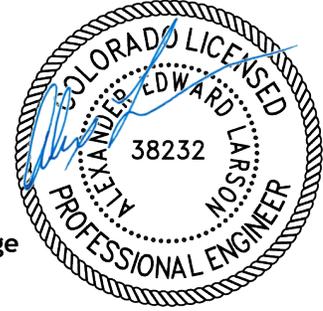
Introduction

McDonald's Corporation is planning to develop Lot 2 of Eagle Ridge Filing No.1 within the Eagle Ridge Master Planned Development with a new McDonald's Drive Thru Restaurant, parking, landscaping, drive aisles, and utility improvements (Project).

The purpose of this traffic memo is to confirm that the Project's traffic characteristics are in conformance with those base conditions in the original approved master traffic impact study, and address comments by Aurora staff during a previous review cycle.

Figure 1 Project Vicinity Map

Planned Development

The Eagle Ridge Master Planned Development (PD) is located southwest of the Stephen B Hogan Pkwy and Piccadilly Rd intersection in Aurora, CO. The proposed site is illustrated in ***Attached Figure A***. The PD's approved master traffic impact analysis (TIA), *Eagle Ridge Master TIA* [1] (Master TIA) included trip generation estimates for two phases across five Planning Areas (PA) within the PD.

Proposed Project

The Project is located at *21360 E. 6th Avenue, Aurora, CO* as shown in the Vicinity Map in ***Figure 1*** and illustrated within Lot 2 of the master site plan in ***Attached Figure B***.

Land Uses

The Project is located within PA#1, as defined in the Master TIA. Two land use scenarios within PA#1 are evaluated in this memo, with and without the land uses introduced by the Project. The two scenarios are described in more detail below.

The outcome of this section is an identification of total gross floor areas of each land use type for each land use scenario. The total GFA are subsequently used as the basis for the Trip Generation comparisons.

- **Master TIA Land Use Scenario.** The *Master TIA* land use scenario refers to the proposed land uses within PA#1 that were originally analyzed in the Master TIA. PA#1 and the individual parcels with specific assumed land uses are illustrated in ***Attached Figure A***.
- **Project Land Use Scenario.** The *Project* land use scenario includes the Project, in place of two zones in the Master TIA. ***Attached Figure B*** indicates the Project location on the PD's master site plan.

For comparison purposes, the PA#1 land uses and gross floor areas (GFA) under each scenario are summarized in ***Attached Table A***.

The main difference between the two land use scenarios is that the Project occupies both Zone 4 and Zone 5. This change results in the removal of land uses assumed as Bank and Drive-Thru for Zones 4 and 5 in the Project land use scenario.

As a final note regarding land uses, the Project is the first proposed development within the PD, and information regarding other specific developments is not available at the time this traffic memo was prepared. As such, PA#2 through PA#5 are assumed to have ***no net changes to land uses***, which naturally results in no changes to trips generated or traffic impacts. Therefore PA#2 through PA#5 are not evaluated in this memo, and the focus is placed on the differences within PA#1.

Trip Generation

The trip generation for both land use scenarios was estimated using the ITE Trip Generation [2] rates, as summarized in ***Attached Table B*** and ***Attached Table C***. ***Table 1*** is a comparison of each land use scenario's estimated trip generation totals.

Table 1 PA#1 Comparison of Trip Generation Totals – Master TIA vs. Project Land Use Scenarios

Land Use Scenario	Avg Weekday Traffic	Morning Peak Hour (PM) (trips/h)		Afternoon Peak Hour (PM) (trips/h)	
		In (AM)	Out (AM)	In (PM)	Out (PM)
Master TIA	7,670	335	316	320	303
Project	7,830	340	326	302	284
Incremental Project Trips (Trip Assignments)	**160 | 2%**	**5 | 1%**	**10 | 3%**	**(18 | 5%)**	**(19 | 6%)**

Notes:
1. Refer to Trip Generation details for each land use scenario, in ***Attached Table B*** and ***Attached Table C***.
2. Project Trips do not include trip reductions for internal trip capture or pass-by trips.

Trip Assignments

The total incremental Project trips (those site-generated trips increased or reduced by the Project), were assigned to the seven nearby external intersections evaluated in the Master TIA and one internal intersection, as summarized in ***Figure 2***, which also shows the trip distributions used to develop the

assignments. Like land uses, the trip distributions used for this memo align with those used in the Master TIA.

Figure 2: Assignment of Incremental Project Trips
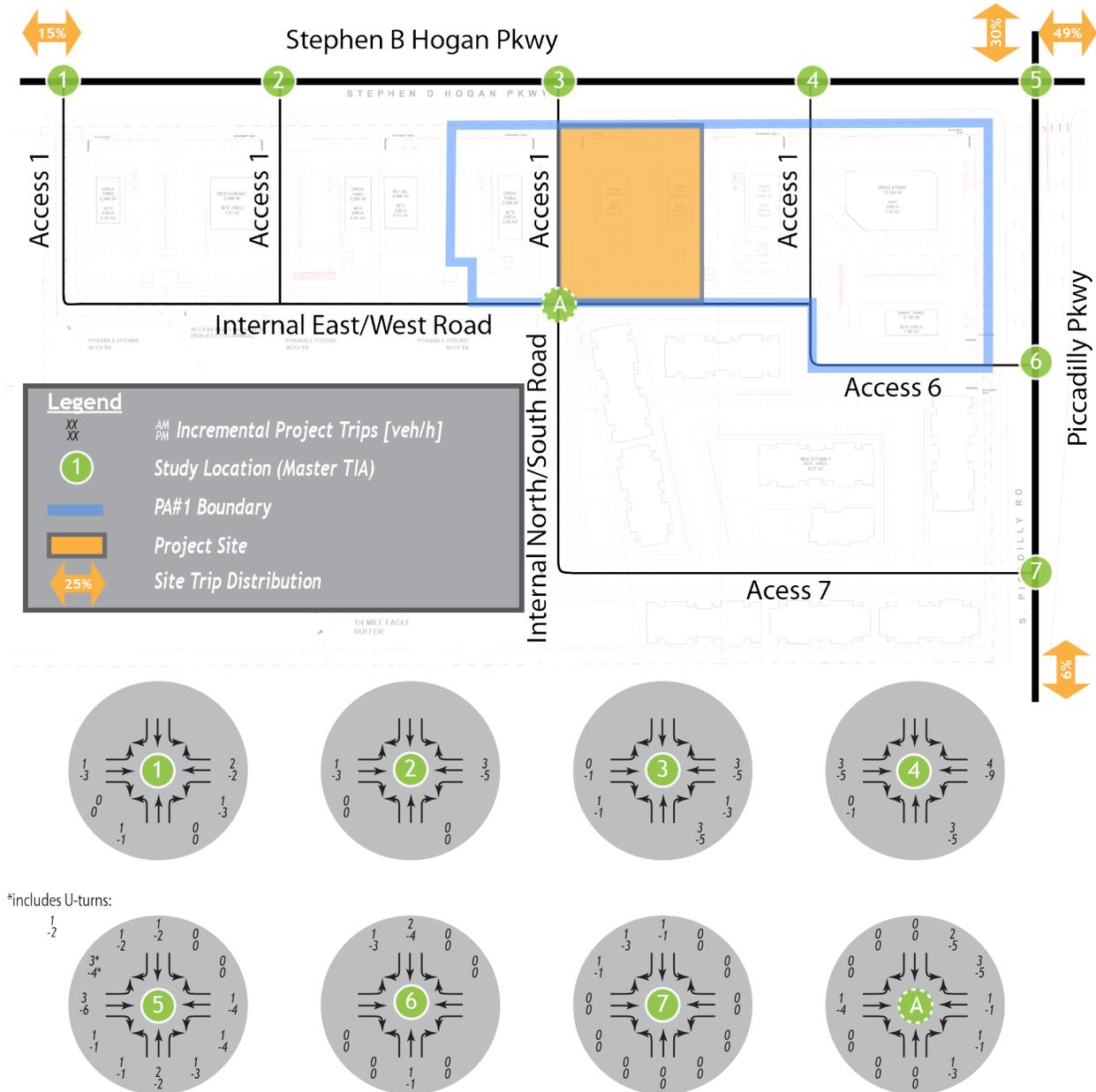
Capacity Evaluation

The incremental Project trips shown in *Figure 2* highlight that very few trips are assigned to any individual turning movement. For instance, in the morning (AM) peak period, the number of trips for any turning movement ranges from one (1) to four (4) vehicles per hour, and in the afternoon (PM) peak

period, trips are reduced. Since these are hourly trips, this means that a single trip would be added to a turning movement as infrequently as every 60 minutes and as frequently as every 15 minutes. These are very low hourly volumes that will have no appreciable impact on traffic delay compared to the analysis in the Master TIA. Additionally, during the afternoon peak period, the decrease in trip generation and negative trips assigned in Figure 2 suggest that fewer trips are expected due to the Project than originally assumed in the TIS. Because of these reasons, no new capacity analysis has been conducted as part of this traffic memo. To review the proposed capacity analysis, please refer to the Master TIA [1].

Queueing Analysis

The Project proposes on-site queue storage capacity as follows. Refer also to the Project site plan excerpt in *Attached Figure B*.

1. 68 feet from 3rd window to payment window
2. 88 feet from payment window to merge point
3. 208 feet (total length of 2 lanes) from merge point to site property line
    364 feet total storage capacity, or 18 vehicles

Two studies of drive-thru queue lengths, including one conducted in 2012 [3] and an updated report in 2019 [4] measured and identified key measures about fast food drive-thru restaurant queue behaviors. The findings of each study are summarized in *Table 1*. The report from the 2012 study specifically stated that McDonald's restaurants were included in its sample, but the 2019 findings did not name specific restaurants included in its sample.

Table 2 Fast-Food Restaurant Drive-Thru Queue Generation Data

Measure	2012 Study [3]	2019 Study [4]
Number of Data Points	14	6
Average Maximum Queue (Vehicles)	8.50	8.00
Standard Deviation (Vehicles)	2.68	3.41
Coefficient of Variation	32%	43%
Range (Vehicles)	5 to 13	5 to 14
85th Percentile (Vehicles)	12.00	13.80
33rd Percentile (Vehicles)	7.90	6.00
85th Percentile Queue Length (Feet)	240	260

The Project's proposed drive-thru provides queue storage of 364 feet or 18 vehicles, which is longer than the 85th percentile queues from either study (12.00 and 13.80 vehicles) and exceeds the highest maximum queue length (13 and 14 vehicles) observed in either study.

Conclusion

This memo demonstrated that a proposed new McDonald's Drive Thru Restaurant, parking, landscaping, drive aisles, and utility improvements at Lot 2 of Eagle Ridge Filing No.1 within the Eagle Ridge Master Planned Development is in conformance with the Eagle Ridge Master Planned Development's Master Traffic Impact Analysis and according to the cited data source, the drive-thru provides a queue storage capacity that will maintain queues within its property lines.

References

[1] LSC Transportation Consultants, "Eagle Ridge Traffic Impact Analysis (Master)," 31 March 2023.

[2] Institute of Transportation Engineers, "ITE Trip Generation Manual, 11th Edition," Transoft Solutions, Inc., 2021. [Online]. Available: https://itetripgen.org/.

[3] M. Spack, M. Moreland, L. de Leeuw and N. Hood, "Drive-Through Queue Generation," 2012.

[4] "Drive-Thru Queue Generation," Spack Solutions, 2019.

Attachments

Attached Figure A Master TIA Land Use Assumptions

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Attached Figure B Project Land Use Assumptions
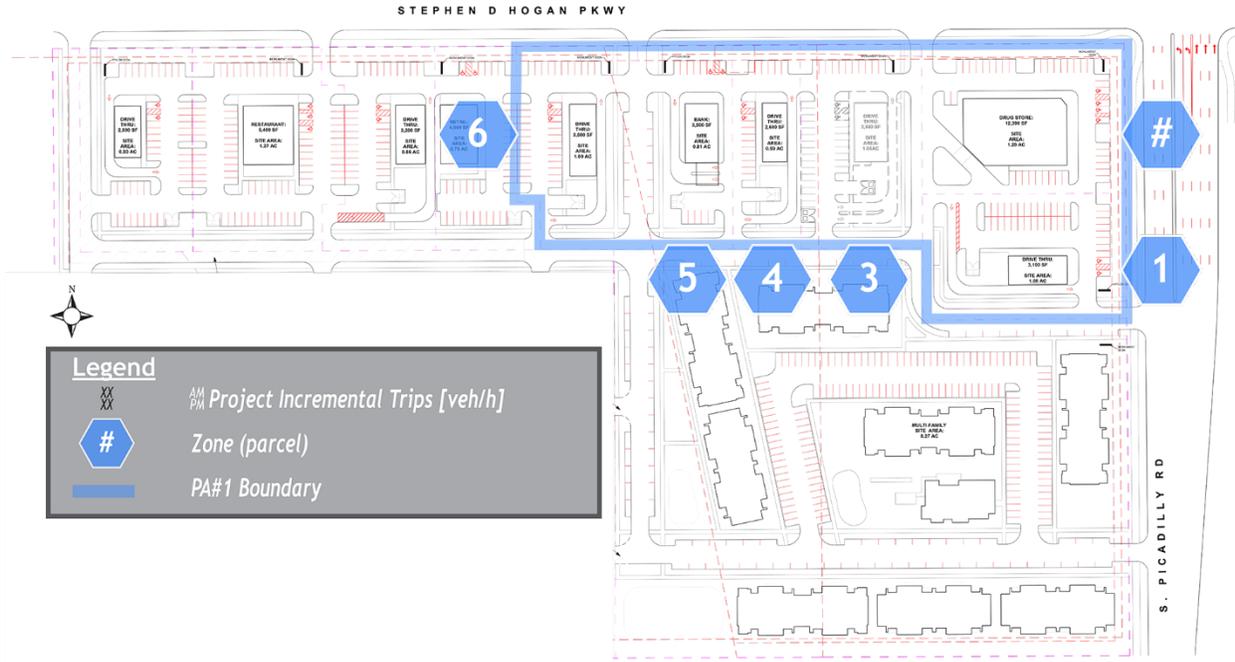
Attached Figure B Project Land Use Assumptions
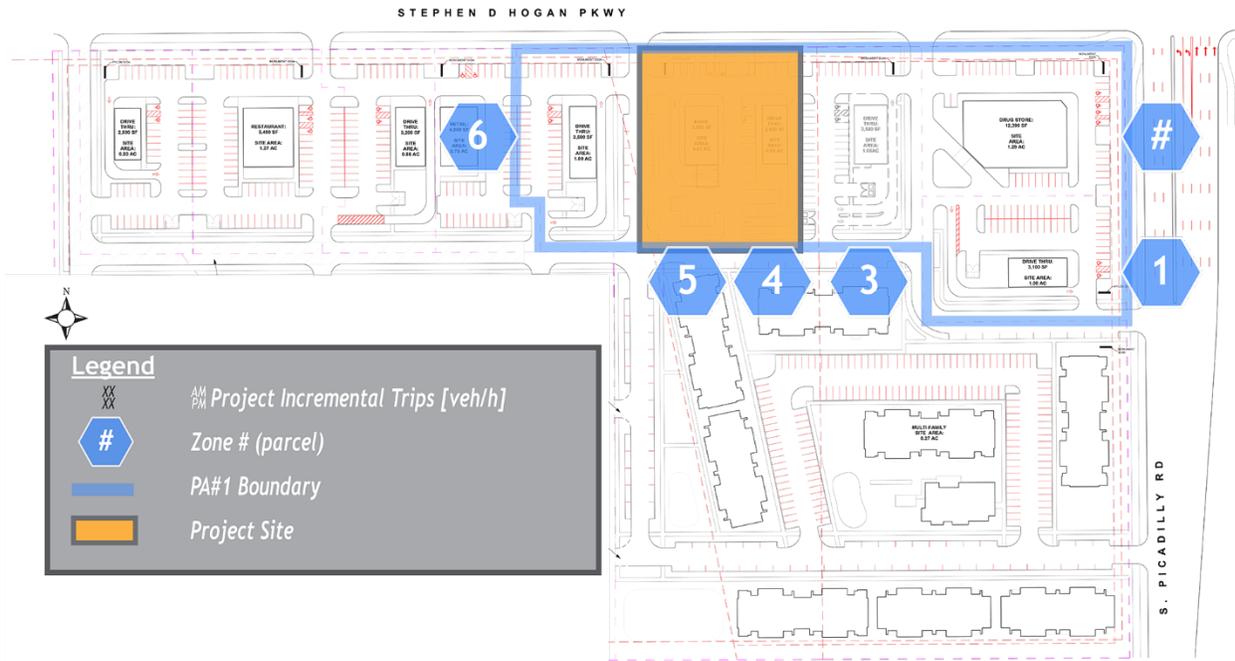
Attached Table A: PA#1 Gross Floor Areas (GFA) by Zone #s and Land Use Scenario

Development Scenario	Zone # (refer to Attached Figure A & Attached Figure B)	Bank	Drug Store	Drive-Thru (TBD)	Drive-Thru (Project)
Master TIA	1			3.10	
	2		12.39		
	3			3.50	
	4			2.60	
	5	3.50			
	6			3.58	
	Totals:	3.50	12.39	12.78	0.00
Project	1			3.10	
	2		12.39		
	3			3.50	
	4 & 5				3.69
	6			3.58	
	Totals:	0.00	12.39	10.18	3.69

Attached Table B: Summary of Eagle Ridge PA#1 Trip Generation Scenario - Master TIA

ITE Land Use	Trip Gen Qty	Trip Gen Units	Avg Weekday Traffic (Rate) (trips/unit)	In (AM Rate) (trips/unit)	Out (AM Rate) (trips/unit)	In (PM Rate) (trips/unit)	Out (PM Rate) (trips/unit)	Avg Weekday Traffic (trips/d)	In (AM) (trips/h)	Out (AM) (trips/h)	In (PM) (trips/h)	Out (PM) (trips/h)
934 Fast-Food Restaurant with Drive-Through Window	12.78	KSF	467.480	22.751	21.859	17.176	15.854	5,974	291	279	220	203
912 Drive-in Bank	3.5	KSF	100.350	5.771	4.179	10.505	10.505	351	20	15	37	37
881 Pharmacy/Drugstore with Drive-Through Window	12.4	KSF	108.400	1.945	1.795	5.125	5.125	1,344.16	24	22	64	64
								7,670	**335**	**316**	**320**	**303**

Attached Table C: Summary of Eagle Ridge PA#1 Trip Generation Scenario - Project

Land Use Description	Trip Gen Qty	Trip Gen Units	Avg Weekday Traffic (Rate) (trips/unit)	In (AM Rate) (trips/unit)	Out (AM Rate) (trips/unit)	In (PM Rate) (trips/unit)	Out (PM Rate) (trips/unit)	Avg Weekday Traffic (trips/d)	In (AM) (trips/h)	Out (AM) (trips/h)	In (PM) (trips/h)	Out (PM) (trips/h)
934 Fast-Food Restaurant with Drive-Through Window (McDonald's)	3.694	KSF	467.480	22.751	21.859	17.176	15.854	1,727	84	81	63	59
934 Fast-Food Restaurant with Drive-Through Window (Other)	10.18	KSF	467.480	22.751	21.859	17.176	15.854	4,759	232	223	175	161
912 Drive-in Bank	0	KSF	100.350	5.771	4.179	10.505	10.505	-	-	-	-	-
881 Pharmacy/Drugstore with Drive-Through Window	12.4	KSF	108.400	1.945	1.795	5.125	5.125	1,344	24	22	64	64
								7,830	**340**	**326**	**302**	**284**