November 28, 2023

Ms. Kathleen Bradley-Colwell Planning Division Director
City of Methuen
41 Pleasant Street
Methuen, MA 01844

RE: Proposed Aroma Joe's
79 Haverhill Street, Methuen, MA
Peer Review Responses

Dear Ms. Colwell and Members of the Community Development Board:

Bayside Engineering is in receipt of the TEC, Inc. (TEC) October 5, 2023 review of the Traffic Impact and Access Study (TIAS) prepared for the proposed Aroma Joe's at 79 Haverhill Street in Methuen, MA. The purpose of this letter is to respond to the traffic comments raised on the Bayside TIAS (dated August 1, 2023). Bayside has prepared the responses below. Only those comments requiring a response have been included.

Site Circulation, Access and Egress

Comment No. 4: **TEC noted that intersection of Elm Street / Haverhill Street, located within 500 feet from the proposed east site driveway, is a high-volume intersection and experienced a higher crash trend within the past three years. Although it is not expected to have any specific capacity- related impacts issue, the Applicant should provide crash statistics and address any safety deficiencies that may be associated with the site driveway intersections along Haverhill Street.**

Response: *Bayside has added the intersection of Elm Street and Haverhill Street to the crash summary. The results are summarized in Table 1. Of the sixteen (16) crashes, one (1) was reported at the intersection of Haverhill Street, Strathmore Road, and the driveway to 79 Haverhill Street, three (3) crashes were reported at the intersection of Haverhill Street, Madison Street, and the driveway to 39 Haverhill Street, and twelve (12) were reported at the intersection of Elm Street and Haverhill Street. No fatalities were reported. The additional crash data is included in the Appendix.*

TABLE 1
MOTOR VEHICLE CRASH DATA SUMMARY[a]

Scenario	*Haverhill Street, Strathmore Road, and 79 Haverhill Street Driveway*	*Haverhill Street, Madison Street, and 39 Haverhill Street Driveway*	*Haverhill Street and Elm Street*
Year:			
2017	*0*	*1*	1
2018	*0*	*0*	2
2019	*0*	*0*	3
2020	*0*	*1*	1
2021	*0*	*0*	2
2022	*1*	*1*	3
Total	*1*	*3*	12
Average:	*0.17*	*0.50*	2.00
Crash Rate:	*0.03*	*0.09*	*NA*
Significance:	*No*	*No*	*NA*
Type:			
Angle	*0*	*2*	*3*
Rear-End	*0*	*1*	*4*
Front to Rear	*0*	*0*	*3*
Sideswipe	*0*	*0*	*2*
Single Vehicle Crash	*1*	*0*	*2*
Total	*1*	*3*	*12*
Time of Day:			
Weekday (7:00 to 9:00 AM)	*0*	*1*	*2*
Weekday (4:00 to 6:00 PM)	*0*	*2*	*5*
Remainder of Day	*1*	*0*	*5*
Total	*1*	*3*	*12*
Pavement Conditions:			
Dry	*0*	*3*	*7*
Wet	*1*	*0*	*5*
Snow/Ice	*0*	*0*	*0*
Other	*0*	*0*	*0*
Unknown	*0*	*0*	*0*
Total	*1*	*3*	*12*
Severity:			
Property Damage Only	*1*	*2*	*9*
Personal Injury	*0*	*1*	*3*
Fatal Accident	*0*	*0*	*0*
Unknown	*0*	*0*	*0*
Total	*1*	*3*	*12*

[a]*Source: MassDOT Crash Portal, 2017 to 2022.*
[b]*Average crashes over analysis period.*
[c]*Crash rate per million entering vehicles (mev).*
[d]*Signalized intersections are significant if rate >0.75 crashes per million vehicles, and unsignalized intersections re significant if rate >0.57 crashes per million vehicles.*
NA = Not Available.

Comment No. 6: **Site trip generation calculations for the proposed Project were generated based on the Institute of Transportation Engineers (ITE) *Trip Generation Manual, 11th Edition,* Land Use Code (LUC) 937 – Coffee/Donut Shop with Drive-Through Window, and empirical data obtained by CES, Inc. as part of a study conducted by others. In order to provide conservative trip generation estimate, the Applicant utilized the weekday morning peak hour trip generation data from the study by Eaton Traffic Engineering. The daily and weekday evening peak hour trips were determined based on a proportional relationship to the average trip rates found in LUC 937 for the related time periods. On page 18 of the TIAS, it is mentioned that ITE 8th Edition was reviewed. The Applicant should clarify how the use of ITE 8th Edition contributed to obtaining trip generation data. TEC generally concurs with the use of empirical data for a similar Aroma Joe's coffee shop. However, it is noted that no supporting documentation has been provided to validate the data collection process, including details regarding the facility's size, data collection timing, volume on the adjacent street, and service rates, all of which are integral to the TIAS.**

The TIAS accounts for pass by trips consisting of vehicles passing by the site on their way to another destination. A pass by trip rate of 70 percent was applied to trip generation numbers. TEC understands that the pass by trip rate was utilized based on information provided as part of a study that was done for similar Aroma Joe's coffee shop in Augusta, Maine. However, the information was not supplied in the appendix. The Applicant should provide additional backup on how this rate was estimated and provide a narrative regarding the characteristics of Bangor Street, adjacent to the Aroma Joe's in Augusta, Maine, and Haverhill Street in Methuen in terms of daily volumes and trip numbers.

Response: *The reference to the 8th Edition of the ITE Trip Generation manual is a typographical error. The reference should be the 11th Edition. The various sources used to anticipate the projected traffic generation are included in the Appendix.*

The traffic assessment prepared for the Bangor Street Aroma Joe's is included in the Appendix. The assessment provided no characteristics for Bangor Street. However, a review of the studies that were found for other Aroma Joe's facilities indicated that the trip generation was generally consistent at 130 weekday morning peak hour trips, regardless of the size of the Aroma Joes.

Comment No. 10: **The intersection sight lines were partially obstructed at both driveway**

intersections with Haverhill Street due to roadway's horizontal curvature. The Applicant should maintain any proposed plantings low to the ground (no more than 2.0 feet above street level) within the sight line triangles along the site frontage. The sight lines should be depicted on the site plan based on AASHTO criteria. In addition, the Applicant should confirm that occupancy of the parking lot for the abutting building located (east of the Project along Haverhill Street) will not impede the sight lines.

In addition to the site driveways, TEC recommends that the Applicant review the sight line characteristics for the Madison Street approach to Haverhill Street. This is particularly important as the existing retaining wall and on-street parking along Haverhill Street appear to limit visibility when looking west. This restriction in sight lines could potentially pose challenges at the intersection of Haverhill Street / Madison Street because the proposed easterly site driveway will provide additional vehicle conflicts within the intersection.

Response: *Sight lines have been added to the Site Plans. The Applicant will maintain any proposed plantings low to the ground (no more than 2.0 feet above street level) within the sight line triangles along the site frontage.*

Sight lines for the Madison Street approach to Haverhill Street were measured in the field. The resulting measurements are summarized in Table 2.

TABLE 2
MADISON STREET AT HAVERHILL STREET
INTERASECTION SIGHT DISTANCE SUMMARY

	Required Minimum (Feet)[a]	*Measured (Feet)*
Intersection Sight Distance:		
Madison Street looking to the east	*325[b]/375[c]*	*500*
Madison Street looking to the west	*325[b]/375[c]*	*500*

[a]Recommended minimum values obtained from A Policy on Geometric Design of Highways and Streets; American Association of State Highway and Transportation Officials (AASHTO); 2018 and based on 85th percentile speed.
[b]Recommended minimum value for vehicles turning right exiting a roadway under STOP-sign control.
[c]Recommended minimum value for vehicles turning left exiting a roadway under STOP-sign control.

The intersection sight distances are not impeded by the existing retaining

wall located in the southwestern quadrant of the intersection as can be seen in the following photographs.

Photo No. 1
Madison Street looking to the West

Comment No. 11: **The Applicant should provide parking demand observations from a similar Aroma Joe's Facility in order to demonstrate that the limited employee/patron parking supply will be sufficient to accommodate the parking demands of the Project.**

Response: *The Applicant reached out to Aroma Joe's to determine if there was any available data to support the number of parking spaces provided for the*

project. Aroma Joe's indicated that there is no parking demand data available. Aroma Joe's indicates that their locations usually employ three (3) persons maximum on a shift.

Photo No. 2
Madison Street looking to the East

Please do not hesitate to contact me if you have any questions or require additional information.

Sincerely,

BAYSIDE ENGINEERING, INC.

Kenneth P. Cram, P.E.
Director, Traffic Engineering

APPENDIX

Crash Data
Trip Generation Back-up

Crash Data

Crash Number	Crash Date	Crash Severity	Crash Time	Max Injury Severity Reported	Number of Vehicles	Driver Contributing Circumstances (All Drivers)	Driver Distracted By (All Vehicles)	First Harmful Event	Is Geocoded	Light Conditions	Manner of Collision	Road Surface Condition	Roadway Junction Type	Total Fatalities	Total Non-Fatal Injuries	Traffic Control Device Type	Trafficway Description	Vehicle Actions Prior to Crash (All Vehicles)	Vehicle Configuration (All Vehicles)	Vehicle Emergency Use (All Vehicles)	Vehicle Towed From Scene (All Vehicles)	Vehicle Travel Directions (All Vehicles)	Weather Conditions	Hit and Run	Most Harmful Event (All Vehicles)	Road Contributing Circumstance	School Bus Related	Speed Limit	Traffic Control Device Function	Vehicle Sequence of Events (All Vehicles)	Latitude	Longitude	Street Number	Roadway
4329365	02/10/2017	Non-fatal injury	6:31 PM	Non-fatal injury - Possible	2	D1: (No improper driving) / D2: (Followed too closely)	D1: Not Distracted / D2: Not Distracted	Collision with motor vehicle in traffic	Yes	Dark - lighted roadway	Rear-end	Wet	Not at junction	0	1	No controls	Two-way, divided, unprotected median	V1: Travelling straight ahead / V2: Travelling straight ahead	V1:(Passenger car) / V2:(Passenger car)	V1:(No) / V2:(No)	V1:(No) / V2:(No)	V1: W / V2: W	Clear/Clear	No hit and run	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	None	No, school bus not involved	35	Not reported	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	42.70418	-71.19192	27	HAVERHILL ST
4513123	03/07/2018	Property damage only (none injured)	2:10 PM	No injury	2	D1: (No improper driving) / D2: (Failed to yield right of way)	D1: Not Distracted / D2: Not Distracted	Collision with motor vehicle in traffic	Yes	Daylight	Angle	Wet	T-intersection	0	0	Stop signs	Two-way, not divided	V1: Travelling straight ahead / V2: Slowing or stopped in traffic	V1:(Light truck(van, mini-van, pickup, sport utility)) / V2:(Light truck(van, mini-van, pickup, sport utility))	V1:(No) / V2:(No)	V1:(No) / V2:(No)	V1: W / V2: S	Snow/Snow	No hit and run	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	Traffic congestion related	No, school bus not involved	30	Yes, device functioning	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	42.70423	-71.19169		HAVERHILL ST / ELM ST
4577123	06/01/2018	Property damage only (none injured)	5:36 PM	No injury	2	D1: (No improper driving) / D2: (Followed too closely),(Inattention)	D1: Not Distracted / D2: Not Distracted	Collision with motor vehicle in traffic	Yes	Daylight	Rear-end	Dry	T-intersection	0	0	Stop signs	Two-way, not divided	V1: Slowing or stopped in traffic / V2: Not reported	V1:(Light truck(van, mini-van, pickup, sport utility)) / V2:(Passenger car)	V1:(No) / V2:(No)	V1:(No) / V2:(No)	V1: S / V2: S	Cloudy/Cloudy	No hit and run	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	None	No, school bus not involved	5	Yes, device functioning	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	42.70423	-71.19169		HAVERHILL ST Rte 110 E / ELM ST / CYPRESS ST
4686296	04/06/2019	Property damage only (none injured)	11:06 PM	No injury	2	D1: (Failed to yield right of way) / D2: (No improper driving)	D1: Manually operating an electronic device / D2: Manually operating an electronic device	Collision with motor vehicle in traffic	Yes	Dark - lighted roadway	Sideswipe, same direction	Dry	Not at junction	0	0	No controls	Two-way, divided, unprotected median	V1: Travelling straight ahead / V2: Travelling straight ahead	V1:(Passenger car) / V2:(Passenger car)	V1:(No) / V2:(No)	V1:(No) / V2:(No)	V1: E / V2: E	Clear/Clear	No hit and run	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)		No, school bus not involved		Not reported	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	42.70423	-71.19169		HAVERHILL STREET Rte SR110 W / ELM STREET
4772792	10/23/2019	Property damage only (none injured)	8:59 AM	No Apparent Injury (O)	2	D1: (No improper driving) / D2: (Followed too closely)	D1: Not Distracted / D2: Not Distracted	Collision with motor vehicle in traffic	Yes	Daylight	Rear-end	Wet	T-intersection	0	0	Stop signs	Two-way, not divided	V1: Slowing or stopped in traffic / V2: Travelling straight ahead	V1:(Light truck(van, mini-van, pickup, sport utility)) / V2:(Passenger car)	V1:(No) / V2:(No)	V1:(No) / V2:(No)	V1: S / V2: S	Clear	No hit and run	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	None	No, school bus not involved	30	Yes, device functioning	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	42.70423	-71.19169		ELM ST / HAVERHILL ST Rte 110 E
4776496	11/17/2019	Property damage only (none injured)	4:15 PM	No Apparent Injury (O)	2	D1: (Failure to keep in proper lane or running off road) / D2: (No improper driving)		Collision with motor vehicle in traffic	Yes	Dusk	Sideswipe, same direction	Dry	T-intersection	0	0	No controls	Two-way, not divided	V1: Overtaking/passing / V2: Turning left	V1:(Passenger car) / V2:(Passenger car)	V1:(No) / V2:(No)	V1:(No) / V2:(No)	V1: E / V2: E	Clear	No hit and run	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	None	No, school bus not involved	30	Not reported	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	42.70423	-71.19169		HAVERHILL Rte 110 E / ELM Rte 110 E /
4815358	02/07/2020	Property damage only (none injured)	4:01 PM	No Apparent Injury (O)	2	D1: (No improper driving) / D2: (Inattention)	D1: Not Distracted	Collision with motor vehicle in traffic	Yes	Daylight	Rear-end	Wet	Not at junction	0	0	No controls	Two-way, not divided	V1: Travelling straight ahead / V2: Travelling straight ahead	V1:(Light truck(van, mini-van, pickup, sport utility)) / V2:(Light truck(van, mini-van, pickup, sport utility))	V1:(No) / V2:(No)	V1:(No) / V2:(No)	V1: W / V2: W	Cloudy/Cloudy	No hit and run	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	None	No, school bus not involved	35	Yes, device functioning	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	42.70423	-71.19169		HAVERHILL STREET / ELM STREET
5005967	09/08/2021	Non-fatal injury	11:46 AM	Suspected Minor Injury (B)	1	D1: (Distracted),(Driving too fast for conditions)	D1: Other activity, electronic device	Collision with unknown fixed object	Yes	Daylight	Angle	Dry	Four-way intersection	0	1	No controls	Two-way, not divided	V1: Leaving traffic lane	V1:(Light truck(van, mini-van, pickup, sport utility))	V1:(No)	V1:(Yes, vehicle or trailer disabled)	V1: E	Clear/Clear	No hit and run	V1:(Collision with light pole or other post/support)	None	No, school bus not involved	30	No, device not functioning	V1:(Collision with other fixed object(wall, building, tunnel, etc.)),(Collision with light pole or other post/support)	42.70423	-71.19169		32 HAVERHILL ST Rte 110 E / ELM STREET / WELLINGTON STREET
5016748	10/05/2021	Property damage only (none injured)	7:47 AM	No Apparent Injury (O)	1	D1: (Driving too fast for conditions),(Operating vehicle in erratic, reckless, careless, negligent or aggressive manner)		Collision with unknown fixed object	Yes	Daylight	Angle	Wet	T-intersection	0	0	No controls	Two-way, not divided	V1: Overtaking/passing	V1:(Light truck(van, mini-van, pickup, sport utility))	V1:(No)	V1:(Yes, other reason not disabled)	V1: W	Clear/Clear	No hit and run	V1:(Collision with other fixed object (wall, building, tunnel, etc.))	Road surface condition (wet, icy, snow, slush, etc.)	No, school bus not involved	35	Not reported	V1:(Collision with curb),(Collision with other fixed object(wall, building, tunnel, etc.))	42.70423	-71.19169		25 HAVERHILL ST / HAVERHILL ST / ELM ST
5094623	04/20/2022	Property damage only (none injured)	5:28 PM	No Apparent Injury (O)	2	D1: (No improper driving) / D2: (Inattention)	D1: Not Distracted / D2: Other activity, electronic device	Collision with motor vehicle in traffic	Yes	Daylight	Front to Rear	Dry	Not at junction	0	0	No controls	Two-way, divided, unprotected median	V1: Travelling straight ahead / V2: Travelling straight ahead	V1:(Passenger car) / V2:(Passenger car)	V1:(No) / V2:(No)	V1:(No) / V2:(Yes, vehicle or trailer disabled)	V1: W / V2: W	Clear	No hit and run	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	None	No, school bus not involved		Not reported	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	42.70417	-71.19195	27	HAVERHILL ST
5138611	08/12/2022	Property damage only (none injured)	3:17 PM	No Apparent Injury (O)	2	D1: (No improper driving) / D2: (No improper driving)	D1: Not Distracted / D2: Not Distracted	Collision with motor vehicle in traffic	Yes	Daylight	Front to Rear	Dry	Not at junction	0	0	No controls	Two-way, not divided	V1: Slowing or stopped in traffic / V2: Travelling straight ahead	V1:(Light truck(van, mini-van, pickup, sport utility)) / V2:(Passenger car)	V1:(No) / V2:(No)	V1:(No) / V2:(No)	V1: W / V2: W	Clear/Clear	No hit and run	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	None	No, school bus not involved	30	Not reported	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	42.70419	-71.19188	26	HAVERHILL ST
5150742	09/15/2022	Non-fatal injury	5:19 PM	Possible Injury (C)	2	D1: (Inattention),(Inattention) D2: (No improper driving)	D1: Not Distracted / D2: Not Distracted	Collision with motor vehicle in traffic	Yes	Daylight	Front to Rear	Dry	Not at junction	0	1	No controls	Two-way, not divided	V1: Travelling straight ahead / V2: Slowing or stopped in traffic	V1:(Passenger car) / V2:(Passenger car)	V1:(No) / V2:(No)	V1:(No) / V2:(No)	V1: E / V2: E	Clear/Clear	No hit and run	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	None	No, school bus not involved	30	No, device not functioning	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	42.70421	-71.19179	25	HAVERHILL ST

Trip Generation Back-up

SECTION 1
SITE AND TRAFFIC INFORMATION

A. SITE DESCRIPTION WITH EXISTING AND PROPOSED SITE USES

The proposed site is located at 1 Bridges Drive, which is the southeast quadrant of the intersection of Bridges Drive and Payne Road in Scarborough, Maine on a vacant 2.00+/- acre lot. The intersection of Bridges Drive and Payne Road is a non-signalized intersection that is STOP controlled on Bridges Drive and sees heavy traffic movement on northbound Payne Road in the AM peak hour. Bridges Drive is an unposted road with a statutory speed limit of 45 MPH. Payne Road in the vicinity of Bridges Drive has a posted speed limit of 45 MPH.

Access to the site will be via one full-movement entrance onto Bridges Drive located approximately 227 feet westerly of the intersection which is as far west as the property boundary will allow. Sight distance at this location is 227 feet to the east (which is all the way to the intersection of Payne Road) and 1,000+ feet to the west on Bridges Drive. The site is approximately 1.32+/- acres in area and is identified on Scarborough Tax Map R039, Lot 024. The site survey and site plan are included in **Attachment 1A**.

The Applicant proposes to construct a 1,010 square-foot Aroma Joe's coffee drive-through as shown on the enclosed Site Plan. The proposed coffee shop will utilize two drive-through windows; one for payment and one for filling coffee orders. There will be no indoor seating at this site.

B. SITE AND VICINITY BOUNDARIES

A site location map showing the development area is included on the Site Plan in **Attachment 1A**. The site is bounded to the east by Payne Road and to the south by Bridges Drive. Payne Road and Bridges Drive in this area is a mixture of residential homes and small retail buildings in the immediate area surrounding the proposed site. Much of the immediate surrounding area, including the project site, is undeveloped.

C. PROPOSED USES IN THE VICINITY OF THE PROPOSED DEVELOPMENT

CES, Inc. contacted the Town of Scarborough concerning proposed developments around the proposed Aroma Joe's coffee drive-through. According to the Assistant Town Planner Jamel Torres and the Town's Traffic Engineer Bill Bray, there are 10 proposed developments in the Town of Scarborough that may impact the proposed Aroma Joe's site. We have reviewed these developments and included a diagram (TR105) that lists the proposed or permitted developments and shows the increased traffic associated with these developments that impacts our study area. This diagram and supporting documentation is provided in **Attachment 1D.**

D. TRIP GENERATION

Aroma Joe's is a relatively new coffee franchise to Maine. Typically, they are small (less than 1,000 SF) drive-through coffee shops without any seating catering to commuters or the food offerings of a Dunkin Donuts or Tim Horton's. Coffee shop traffic is greatest during the (Monday – Friday) AM commute.

CES, Inc. utilized the following sources to determine the potential trip generation of the site.

Historical Aroma Joe's Sales and Traffic Data – We analyzed order data from an existing Aroma Joe's franchise on Route 1 in Saco for a three-week period. Based on order data from this site we expect the AM peak hour traffic generation to be 110 trips in the AM peak hour. The AADT at the Saco location is 21,480 which is the sum of Stations 01616 and 01606 at the time the order information was generated. From this we can determine that the traffic generation based on AADT will be 5.12 trips/1,000 AADT.

Eaton Traffic Engineering Queue Study for Aroma Joe's – A queue study was performed by Eaton Traffic Engineering in August of 2014 to determine queue lengths for three different Aroma Joe's franchises in Maine. Based on the included study we find that an AM peak hour traffic generation of 130 trips in the peak hour has been an accepted traffic generation for a drive-through Aroma Joe's with no seating.

ITE Trip Generation Manual, 8th Edition (LUC 937 – Coffee Donut Shop w/Drive Through Window) – LUC 937 gives an AM peak traffic generation rate of 112.32 trips/1,000 SF of gross floor area. This would equate to an AM peak generation rate for this site of 112 trips in the AM peak hour.

AADT Data for the Proposed Site – Based on data collected from the MaineDOT Public Map Viewer we have determined that the AADT (factored to 2018) at the site location on Bridges Drive and Payne Road will be 2,990 vehicles/day on Bridges Drive and 13,606 vehicles/day on Payne Road at this location. For the purposes of this application we have summed the two values for a total AADT for this site of 16,596 vehicles/day which almost matches the factored AADT of 16,642 vehicles/day for Payne Road north of the intersection. This AADT is lower than the AADT at the Saco site and the Sanford site referenced in the Eaton Traffic Engineering Queue Report. Using the previously determined trip generation based on AADT and the combined AADT's of Bridges Drive and Payne Road we get a trip generation of 85 trips in the AM peak hour.

Based upon the above information we have determined that the appropriate AM peak trip generation for this site.

AM Peak Hour-Generator 130 trips

The PM peak traffic volumes for coffee shops (even Dunkin Donuts and Tim Horton's) typically run less than 100 trips in the peak hour. Saturday peaks are generally less than the weekday AM peak and are typically coupled with far less commuter traffic.

The trip generation summary above shows that the proposed Aroma Joe's will require a MaineDOT 100-200 PCE Traffic Movement Permit Application based on the AM peak hour trip generation of 130 trip ends.

The trip generation documentation is included in **Attachment 1B**.

E. TRIP DISTRIBUTION, COMPOSITION, and ASSIGNMENT

CES, Inc. has based the ratio of entering and exiting traffic on a review of the Institute of Transportation Engineers publication *Trip Generation, 8th Edition.* The distribution for Land Use Code 937, Coffee-Donut Shop with Drive-Thru Window is given below:

AM Peak Hour	**51% enter, 49% exit**

There is little data to determine the trip composition for an Aroma Joe's coffee drive-through, so we have modeled it according to the Dunkin Donuts trip generation study which concluded that traffic to a typical Dunkin Donuts is composed of primary, diverted link, and pass-by trips in the following percentages:

Primary Trips	**15%**
Diverted Link trips	**15%**
Pass-by Trips	**70%**

For the purposes of this application we have combined the pass-by and diverted link trips since we believe that the proposed development will pull traffic from Payne Road which technically will be diverted link trips due to the new turn movement at the intersection. The breakdown of trips is given below:

Primary Trips	**19 trips**	**10 enter, 9 exit**
Pass-by and Diverted Link Trips	**111 trips**	**56 enter, 55 exit**
Totals	**130 trips**	**66 enter, 64 exit**

Trip assignment is based on AM peak directional data collected by Gorrill-Palmer on June 26, 2019 and August 13, 2019 at the intersection of Payne Road/Bridges Drive and Payne Road/Holmes Road as part of a study for the proposed Scarborough Downs Redevelopment. Primary trips are based on the directional traffic distribution of the existing traffic.

Our analysis of the proposed traffic determines that the study area for the proposed development is from the intersection of Holmes Road and Bridges Drive to the intersection of

Payne Road and Bridges Drive based on the 85% pass-by and diverted link traffic generated by the proposed development.

Trip assignment diagrams and traffic counts are included in **Attachment 1C**.

Section 1

Site and Traffic Information

Section I
Site and Traffic Information

I.A. Site Description and Site Plan

This application is for the proposed development of an Aroma Joes coffee shop located at 3 Bangor Street in Augusta, Maine. The site is bounded by Bangor Street to the west and Morse Street to the east, with a restaurant to the north and a gun shop to the south. The overall site is shown on Augusta's Tax Map 38 as Lot 73. The proposed preliminary site plans are included in Attachment 1A.

I.B. Existing and Proposed Site Uses

The existing 0.37 acre site is currently undeveloped. A car wash had existed on the site previously but has since been razed. The site is anticipated to be accessed by a right turn in only and a right turn out only from Bangor Street. The ingress is to be located approximately 240 feet north of the existing roundabout where Bangor Street, Cony Street, and Stone Street intersect. The right turn out only egress will be located to the south of the ingress. In addition to the Bangor Street accesses, an egress only will be provided to Morse Street.

The applicant is proposing to construct a new 897 SF Aroma Joes coffee shop complete with a drive thru and parking area (no indoor seating). The internal circulation has been designed to accommodate approximately 14 vehicles from the pick-up window to reduce the potential for vehicles to back onto Bangor Street. The proposed preliminary site plan is provided in Attachment 1A.

I.C. Site and Vicinity Boundaries

The site is bounded by Bangor Street to the west and Morse Street to the east, with a restaurant to the north and a gun shop to the south. The overall site is shown on Augusta's Tax Map 38 as Lot 73. The preliminary site plans are included in Attachment 1A.

I.D. Proposed Uses in Vicinity of Proposed Development

Based on discussions with City staff and the MaineDOT, there are no other developments that need to be included in future analysis.

I.E Trip Generation

The trip generation for the potential Aroma Joes is based on the study by Haley Ward that was previously completed for the Scarborough, Maine Aroma Joe's location (stamped & signed 12/9/19). Since Aroma Joe's highest trip generation is the AM peak hour, that is the time period that was used for this evaluation. Based on that information, the following trip generation was used.

Table 1 – Trip Generation

	AM Trip Generation (Trip Ends)		
	Enter	Exit	Total
Primary + Diverted (30%)	20	19	39
Pass-By (70%)	46	45	91
Total	66	64	130

Shown in the table above are the trip ends anticipated for the proposed use, where a trip end is a trip into or out of the site, thus a round trip is equal to two trip ends. The proposed site is forecast to generate 130 trip ends during the AM peak hour of adjacent street traffic – the busiest time of day for Aroma Joes.

As seen in Table 1, the proposed development is forecast to generate a peak of 130 trip ends during the AM peak hour of the generator. Therefore a 100-200 level MaineDOT Traffic Movement Permit is required.

I.F. Trip Distribution

Based on the study previously completed by Haley Ward (stamped and signed 12/9/19), the highest trip generation for Aroma Joe's is in the AM peak hour, and the following distribution is appropriate:

- AM Peak Hour Adjacent Street: 51% enter / 49% exit

I.G. Trip Composition and Assignment

Given the proposed uses, the trip composition for this project has been categorized as follows:

- 30% Primary and Diverted
- 70% Pass By

Primary trips are made for the sole purpose of going to or from the site. These primary drivers go back in the direction where they came from when exiting the site. Diverted trips are made a short distance out of the way while on route to somewhere else. Pass-By trips are made by people who would otherwise already be driving past the site location and elect to stop – someone commuting on Bangor Street stopping on their way to work for coffee, for example. For this project, the primary and diverted trips have all been assumed as primary.

To establish existing traffic volumes and patterns, turning movement counts were collected at the intersections of Noyes Street / Bangor Street and Cony Street / Morse Street on Wednesday August 24, 2021. The turning movement counts were completed from 6:30 – 8:30 AM and again from 3:30 – 6:00 PM. The turning movement Raw Data is shown on the attached Figure 2 in Attachment 1B. The trip assignment for this project has been based on a combination of existing traffic patterns, proposed driveway location and restrictions as well as AADTs of the surrounding roadway network. See Figures 3-5 in Attachment 1B.

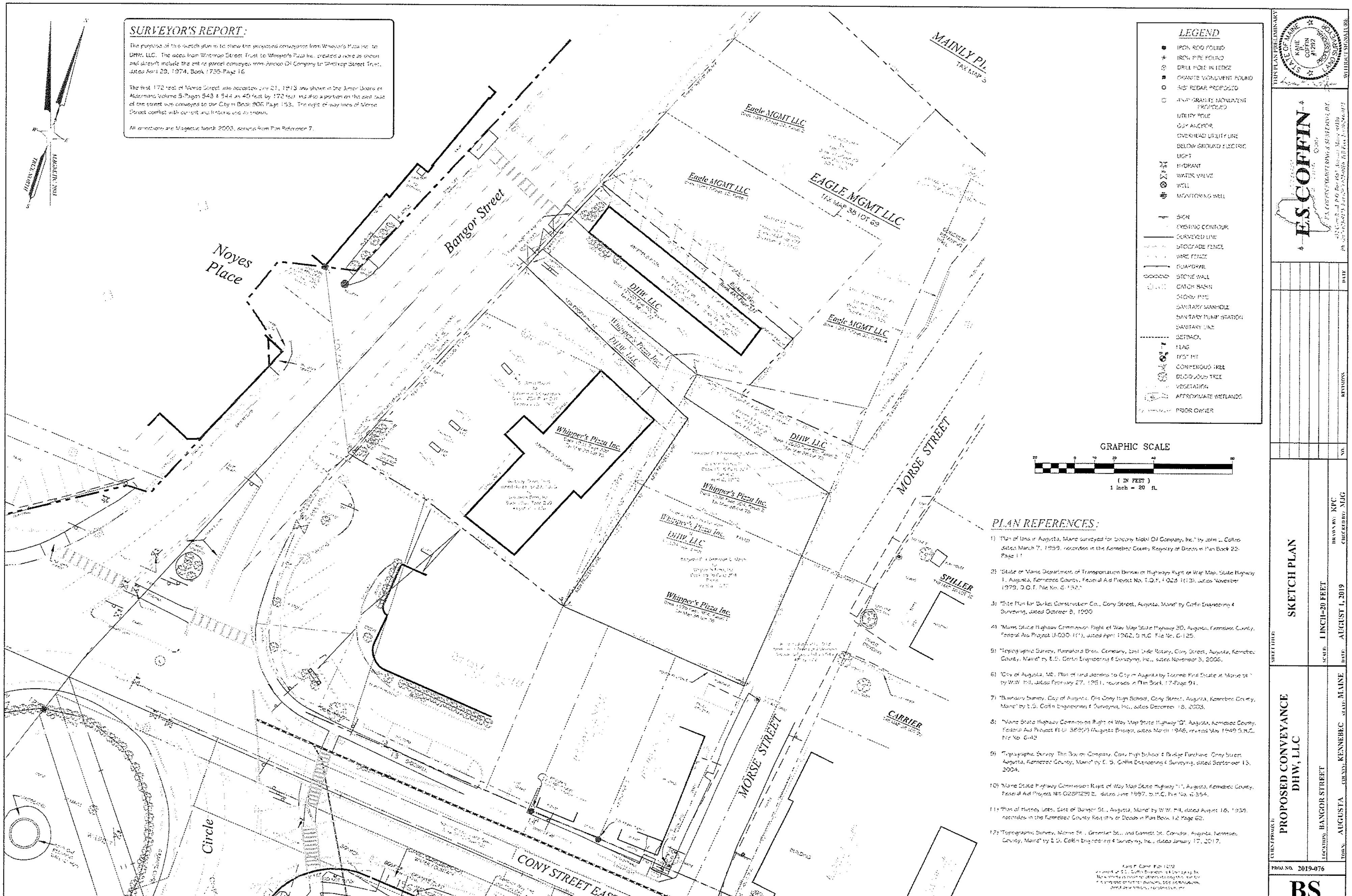
1.H. Attachments

Attachment 1A – Site Survey, Proposed Site Plan
Attachment 1B – Site Location Map, Trip Assignment Diagrams
Attachment 1C – Trip Generation Calculations

Attachment 1A

Site Survey

Proposed Site Plan


SURVEYOR'S REPORT:
The purpose of this sketch plan is to show the proposed conveyance from Whipper's Pizza Inc. to DHW, LLC. The deed from Winthrop Street Trust to Whipper's Pizza Inc. created a gore as shown and doesn't include the entire parcel conveyed from Amoco Oil Company to Winthrop Street Trust, dated April 29, 1974, Book 1735-Page 16
The first 172 feet of Morse Street was accepted July 21, 1913 and shown in the Junior Board of Aldermans Volume 5-Pages 543 & 544 as 40 feet by 172 feet and also a portion on the east side of the street was conveyed to the City in Book 806 Page 153. The right-of-way lines of Morse Street conflict with current and historic use as shown.
All directions are Magnetic North 2003, derived from Plan Reference 7.
MAGNETIC 2003
TRUE NORTH
Noyes Place
Bangor Street
MAINLY PL
TAX MAP 3
Eagle MGMT LLC
Eagle MGMT LLC
EAGLE MGMT LLC
TAX MAP 38 LOT 69
Eagle MGMT LLC
DHW LLC
Whipper's Pizza Inc.
DHW LLC
Whipper's Pizza Inc.
DHW LLC
Whipper's Pizza Inc.
Whipper's Pizza Inc.
DHW LLC
Whipper's Pizza Inc.
MORSE STREET
MORSE STREET
SPILLER
CARRIER
CONY STREET EAST
Circle
LEGEND
IRON ROD FOUND
IRON PIPE FOUND
DRILL HOLE IN LEDGE
GRANITE MONUMENT FOUND
5/8" REBAR PROPOSED
4"x4" GRANITE MONUMENT PROPOSED
UTILITY POLE
GUY ANCHOR
OVERHEAD UTILITY LINE
BELOW GROUND ELECTRIC
LIGHT
HYDRANT
WATER VALVE
WELL
MONITORING WELL
SIGN
EXISTING CONTOUR
SURVEYED LINE
STOCKADE FENCE
WIRE FENCE
GUARDRAIL
STONE WALL
CATCH BASIN
STORM PIPE
SANITARY MANHOLE
SANITARY PUMP STATION
SANITARY LINE
SETBACK
FLAG
TEST PIT
CONIFEROUS TREE
DECIDUOUS TREE
VEGETATION
APPROXIMATE WETLANDS
PRIOR OWNER
GRAPHIC SCALE
20
0
10
20
40
80
(IN FEET)
1 inch = 20 ft.
PLAN REFERENCES:
1) "Plan of land in Augusta, Maine surveyed for Socony Mobil Oil Company, Inc." by John L. Collins dated March 7, 1959, recorded in the Kennebec County Registry of Deeds in Plan Book 22-Page 11
2) "State of Maine Department of Transportation Bureau of Highways Right of Way Map, State Highway 11, Augusta, Kennebec County, Federal Aid Project No. T.Q.F. F028 1(13), dated November 1979, D.O.T. File No. 6-192"
3) "Site Plan for Burke Construction Co., Cony Street, Augusta, Maine" by Coffin Engineering & Surveying, dated October 8, 1990
4) "Maine State Highway Commission Right of Way Map State Highway 30, Augusta, Kennebec County, Federal Aid Project U-030-1(1), dated April 1962, S.H.C. File No. 6-125.
5) "Topographic Survey, Hannaford Bros. Company, East Side Rotary, Cony Street, Augusta, Kennebec County, Maine" by E.S. Coffin Engineering & Surveying, Inc., dated November 3, 2006.
6) "City of Augusta, ME. Plan of land deeded to City of Augusta by Titcomb Real Estate at Morse St." by W.W. Hill, dated February 27, 1951, recorded in Plan Book 17-Page 91.
7) "Boundary Survey, City of Augusta, Old Cony High School, Cony Street, Augusta, Kennebec County, Maine" by E.S. Coffin Engineering & Surveying, Inc., dated December 18, 2003.
8) "Maine State Highway Commission Right of Way Map State Highway "Q", Augusta, Kennebec County, Federal Aid Project FI-U 365(2) (Augusta Bridge), dated March 1948, revised May 1949 S.H.C. File No. 6-42
9) "Topographic Survey, The Bouchard Company, Cony High School & Bridge Purchase, Cony Street, Augusta, Kennebec County, Maine" by E. S. Coffin Engineering & Surveying, dated September 13, 2004.
10) "Maine State Highway Commission Right of Way Map State Highway "1", Augusta, Kennebec County, Federal Aid Project NH-028(128)E, dated June 1997, S.H.C. File No. 6-354.
11) "Plan of Hussey Lots, East of Bangor St., Augusta, Maine" by W.W. Hill, dated August 16, 1938, recorded in the Kennebec County Registry of Deeds in Plan Book 12 Page 62.
12) "Topographic Survey, Morse St., Greenleaf St., and Gannett St. Corridor, Augusta, Kennebec County, Maine" by E.S. Coffin Engineering & Surveying, Inc., dated January 17, 2017.
THIS PLAN PRELIMINARY WITHOUT SIGNATURE
STATE OF MAINE
KARE P. COFFIN
#1292
PROFESSIONAL LAND SURVEYOR
E.S. COFFIN
E.S. COFFIN ENGINEERING & SURVEYING, INC.
NO.
REVISIONS
DATE
SHEET TITLE:
SKETCH PLAN
SCALE: 1 INCH=20 FEET
DRAWN BY: KPC
DATE: AUGUST 1, 2019
CHECKED BY: MJG
CLIENT/PROJECT:
PROPOSED CONVEYANCE
DHW, LLC
LOCATION: BANGOR STREET
TOWN: AUGUSTA
COUNTY: KENNEBEC
STATE: MAINE
PROJ. NO. 2019-076
BS

SURVEYOR'S REPORT:

The purpose of this sketch plan is to show the proposed conveyance from Whipper's Pizza Inc. to DHW, LLC. The deed from Winthrop Street Trust to Whipper's Pizza Inc. created a gore as shown and doesn't include the entire parcel conveyed from Amoco Oil Company to Winthrop Street Trust, dated April 29, 1974, Book 1735-Page 16.

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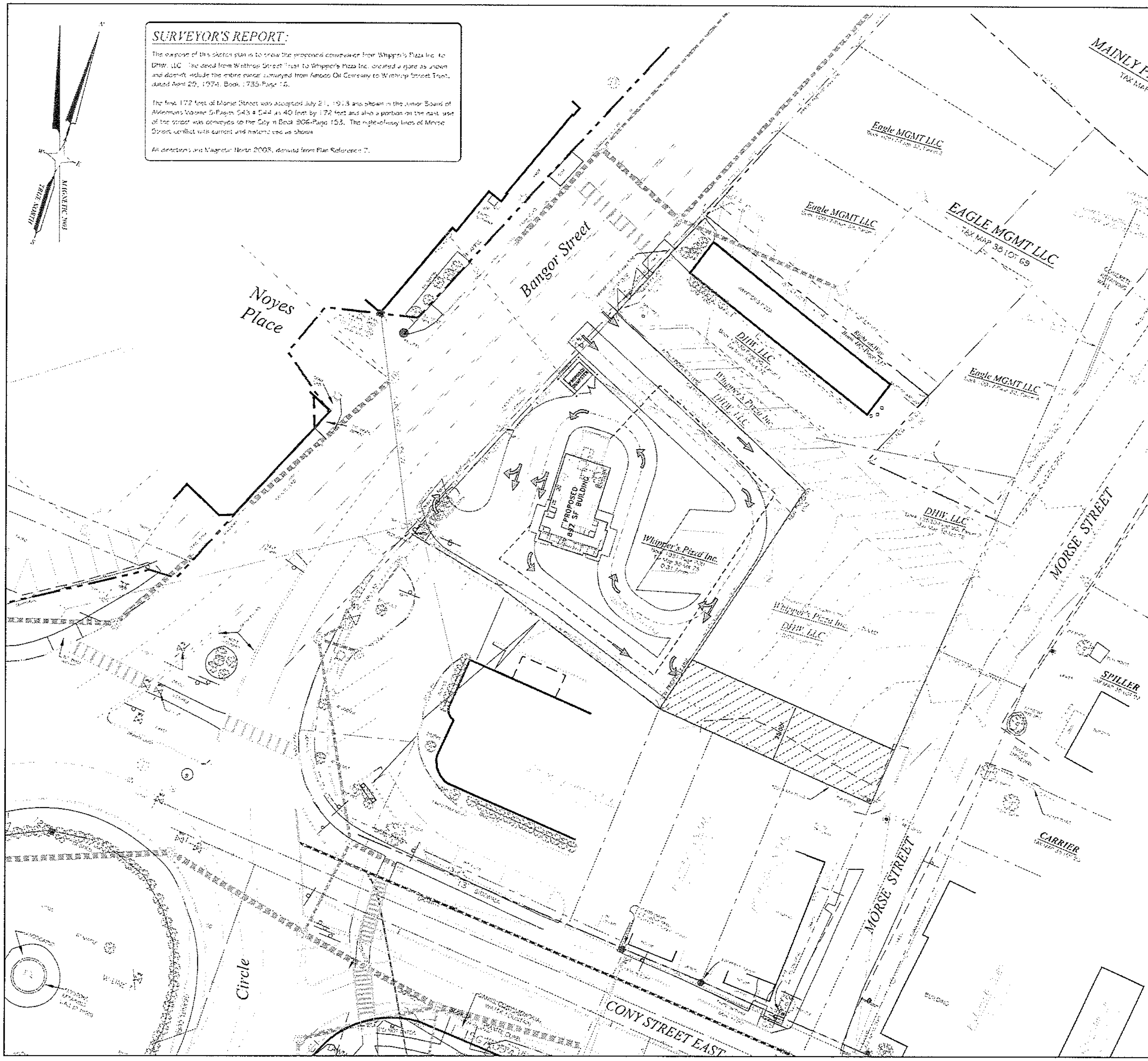
All directions are Magnetic North 2003, derived from Plan Reference 7.



LEGEND

- IRON ROD FOUND
- IRON PIPE FOUND
- DRILL HOLE IN LEDGE
- GRANITE MONUMENT FOUND
- 5/8" REBAR PROPOSED
- 4"x4" GRANITE MONUMENT PROPOSED
- UTILITY POLE
- GUY ANCHOR
- OVERHEAD UTILITY LINE
- BELOW GROUND ELECTRIC
- LIGHT
- HYDRANT
- WATER VALVE
- WELL
- MONITORING WELL
- UNDERGROUND WATER LINE
- SIGN
- EXISTING CONTOUR
- SURVEYED LINE
- STOCKADE FENCE
- WIRE FENCE
- GUARDRAIL
- STONE WALL
- CATCH BASIN
- STORM PIPE
- SANITARY MANHOLE
- SANITARY PUMP STATION
- SANITARY LINE
- SETBACK
- FLAG
- TEST PIT
- CONIFEROUS TREE
- DECIDUOUS TREE
- VEGETATION
- APPROXIMATE WETLANDS
- PRIOR OWNER

GRAPHIC SCALE

20 0 10 20 40 80

(IN FEET)
1 inch = 20 ft.

PLAN REFERENCES:

1) "Plan of land in Augusta, Maine surveyed for Socony Mobil Oil Company, Inc." by John L. Collins dated March 7, 1959, recorded in the Kennebec County Registry of Deeds in Plan Book 22-Page 11.

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4) "Maine State Highway Commission Right of Way Map State Highway 30, Augusta, Kennebec County, Federal Aid Project U-030-1(1), dated April 1962, S.H.C. File No. 6-125.

5) "Topographic Survey, Hannaford Bros. Company, East Side Rotary, Cony Street, Augusta, Kennebec County, Maine" by E.S. Coffin Engineering & Surveying, Inc., dated November 3, 2006.

6) "City of Augusta, ME. Plan of land deeded to City of Augusta by Fitzmore Real Estate at Morse St." by W.W. Hill, dated February 27, 1951, recorded in Plan Book 17-Page 91.

7) "Boundary Survey, City of Augusta, Old Cony High School, Cony Street, Augusta, Kennebec County, Maine" by E.S. Coffin Engineering & Surveying, Inc., dated December 18, 2003.

8) "Maine State Highway Commission Right of Way Map State Highway "O", Augusta, Kennebec County, Federal Aid Project FI-U-360(2) (Augusta Bridge), dated March 1946, revised May 1949 S.H.C. File No. 6-43.

9) "Topographic Survey, The Bouse Company, Cony High School & Bridge Purchase, Cony Street, Augusta, Kennebec County, Maine" by E.S. Coffin Engineering & Surveying, dated September 13, 2004.

10) "Maine State Highway Commission Right of Way Map State Highway "1", Augusta, Kennebec County, Federal Aid Project NH-028P(29) 2, dated June 1997, S.H.C. File No. 6-354.

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STATE OF MAINE
JAMES ... COFFIN
6509
PROFESSIONAL ENGINEER

E.S. COFFIN

E.S. COFFIN ENGINEERING & SURVEYING, INC.

NO.	REVISIONS	DATE

SHEET TITLE: SITE PLAN

SCALE: 1 INCH=20 FEET

DATE: SEPTEMBER 15, 2021

DRAWN BY: TGH

CHECKED BY: JEC

CLIENT/PROJECT: SITE PLAN DHW, LLC

LOCATION: BANGOR STREET

TOWN: AUGUSTA COUNTY: KENNEBEC STATE: MAINE

PROJ. NO. 2019-074

C-1

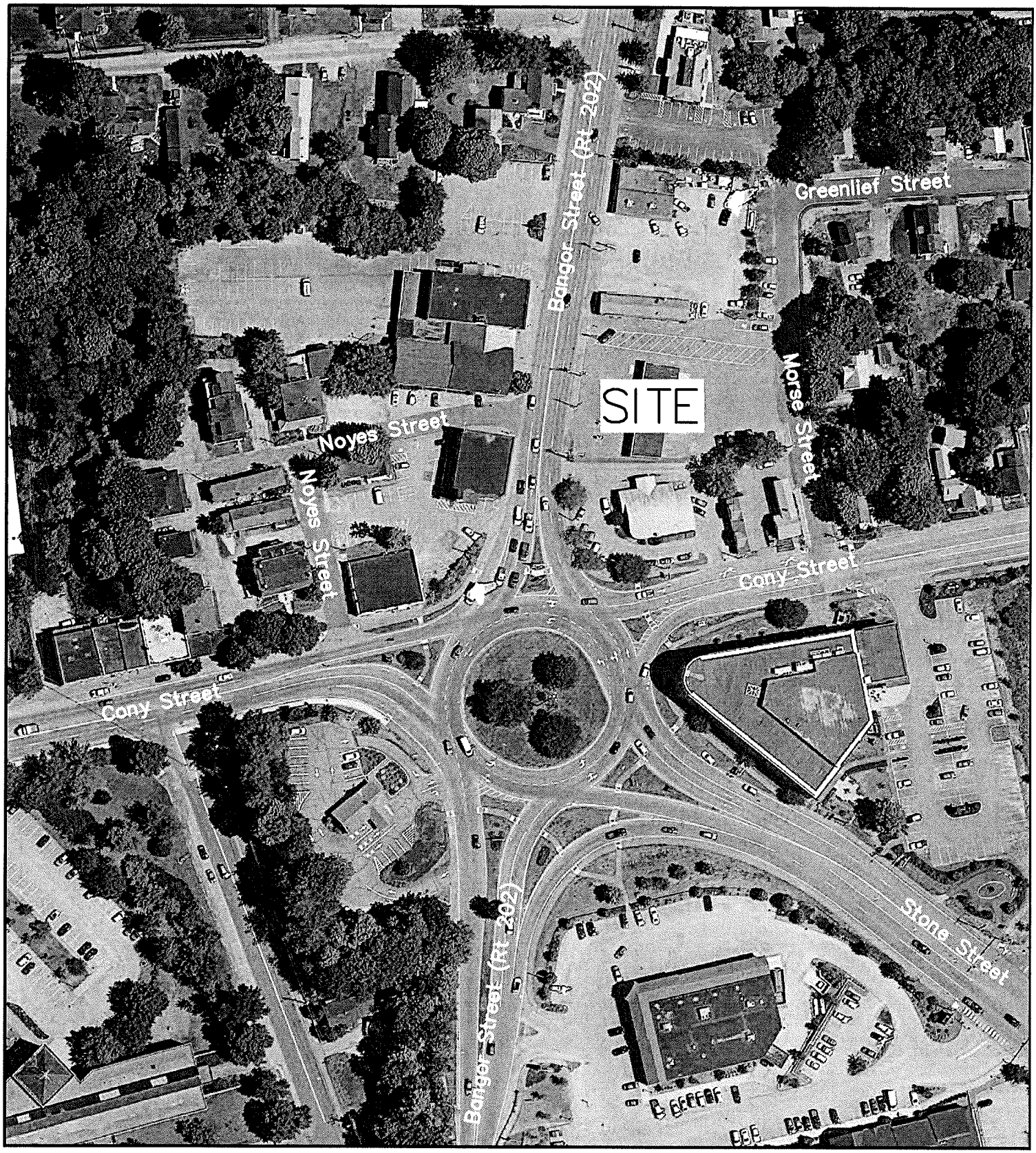
Attachment 1B

Site Location Map

Trip Assignment Diagrams

Site Location

Figure No. 1



AROMA JOE'S
AUGUSTA, MAINE

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Draft: BP
Checked: RED
Scale: NONE
Date: 8/31/2021
File Name: Figure Set.dwg

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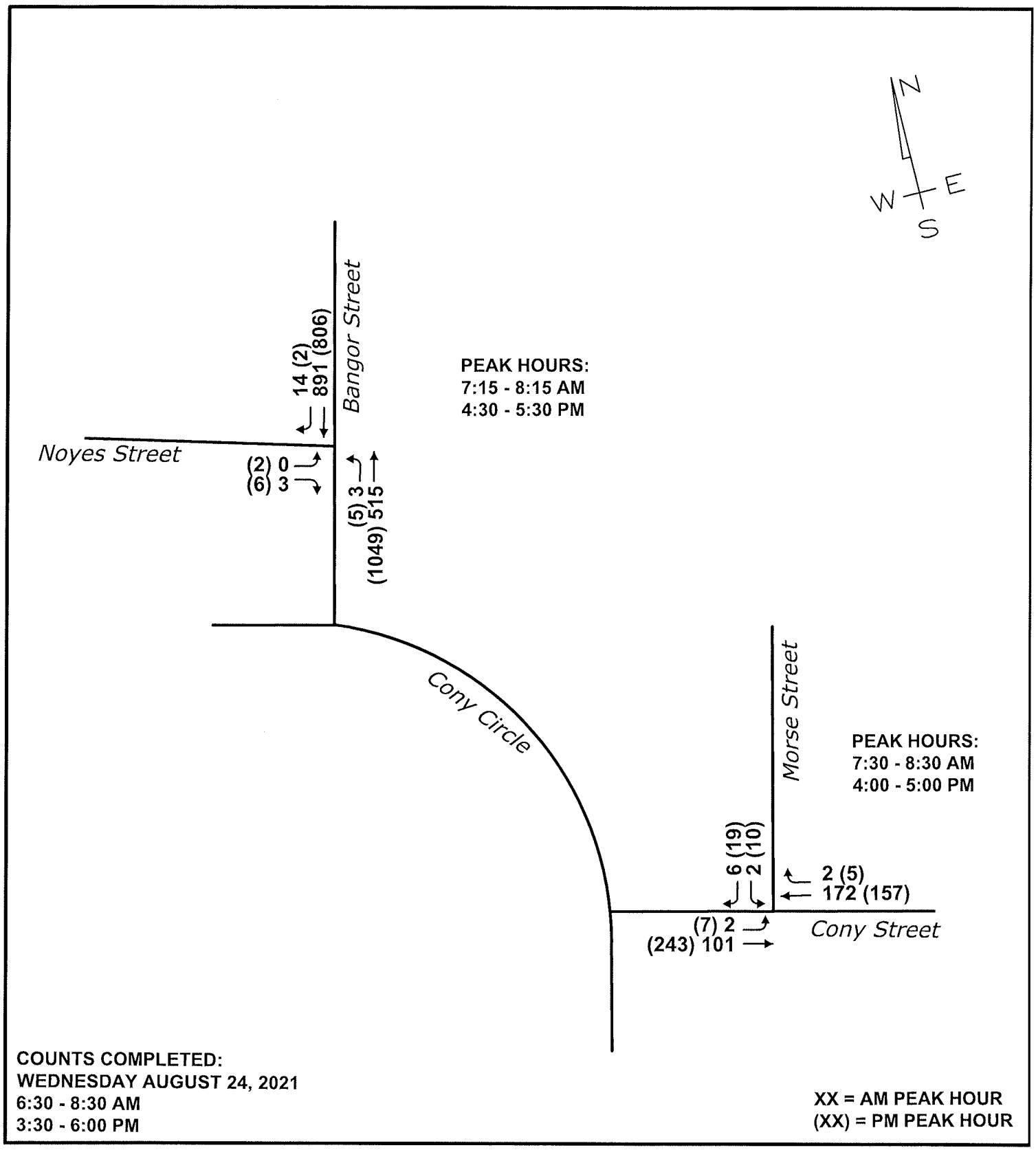
207.772.2515

Raw Volumes

Figure No. 2



AROMA JOE'S
AUGUSTA, MAINE

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Draft: BP Date: 8/31/2021
Checked: RED File Name: Figure Set.dwg

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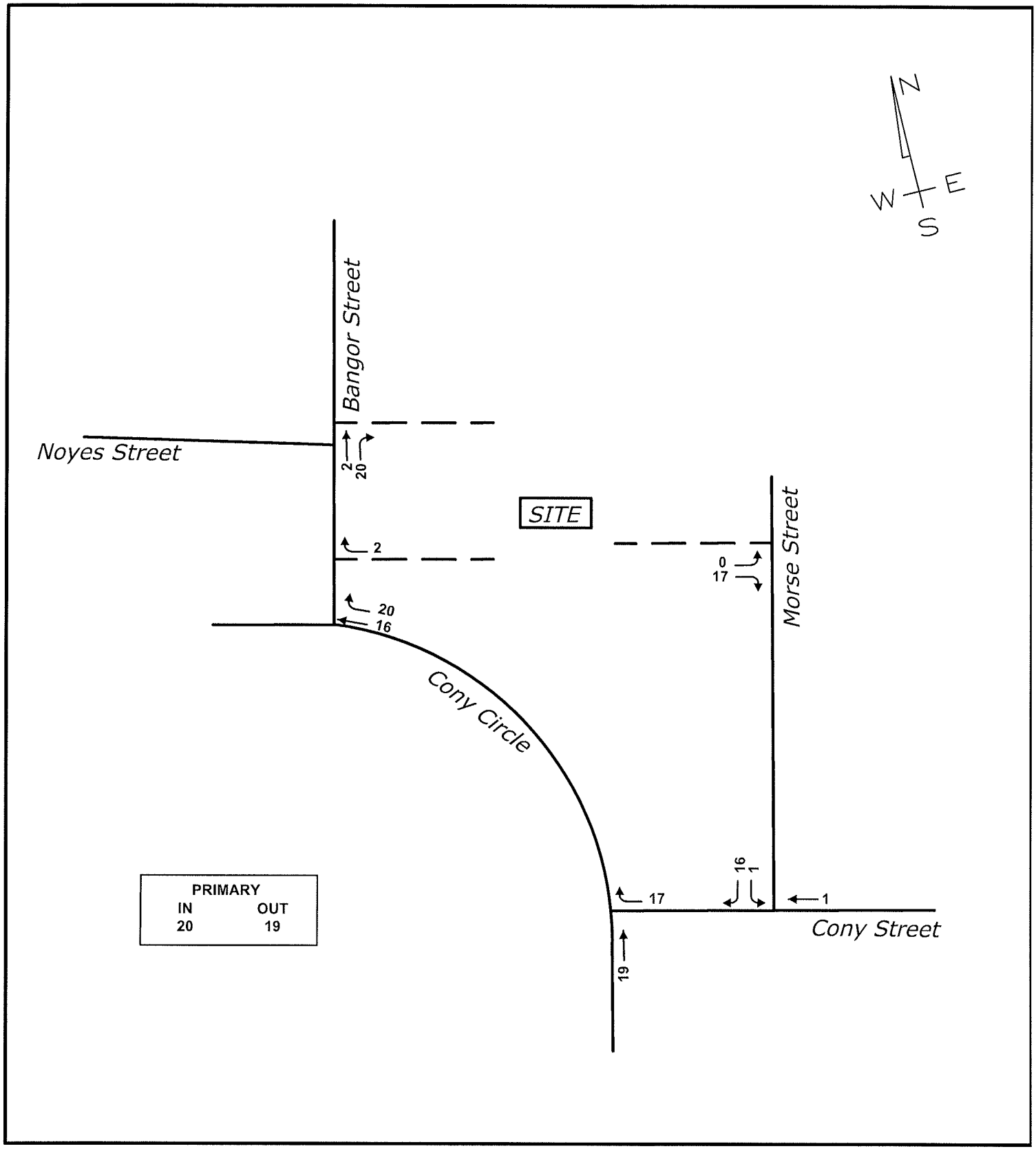
AM Primary & Diverted Trips

Figure No. 3



AROMA JOE'S
AUGUSTA, MAINE

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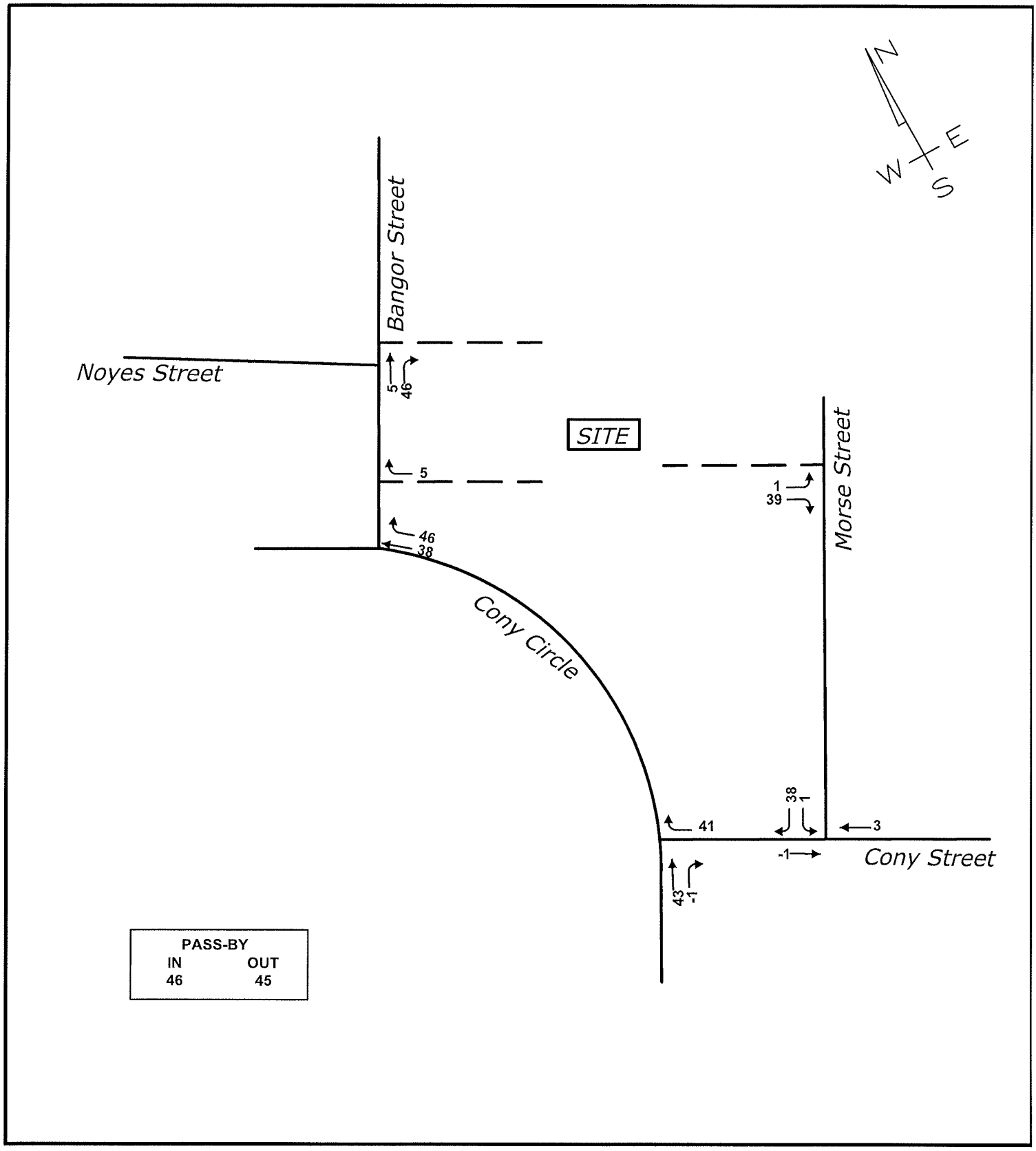
Draft: BP
Checked: RED
Scale: NONE
Date: 9/27/2021
File Name: Figure Set.dwg

AM Pass By Trips

Figure No. 4



AROMA JOE'S
AUGUSTA, MAINE

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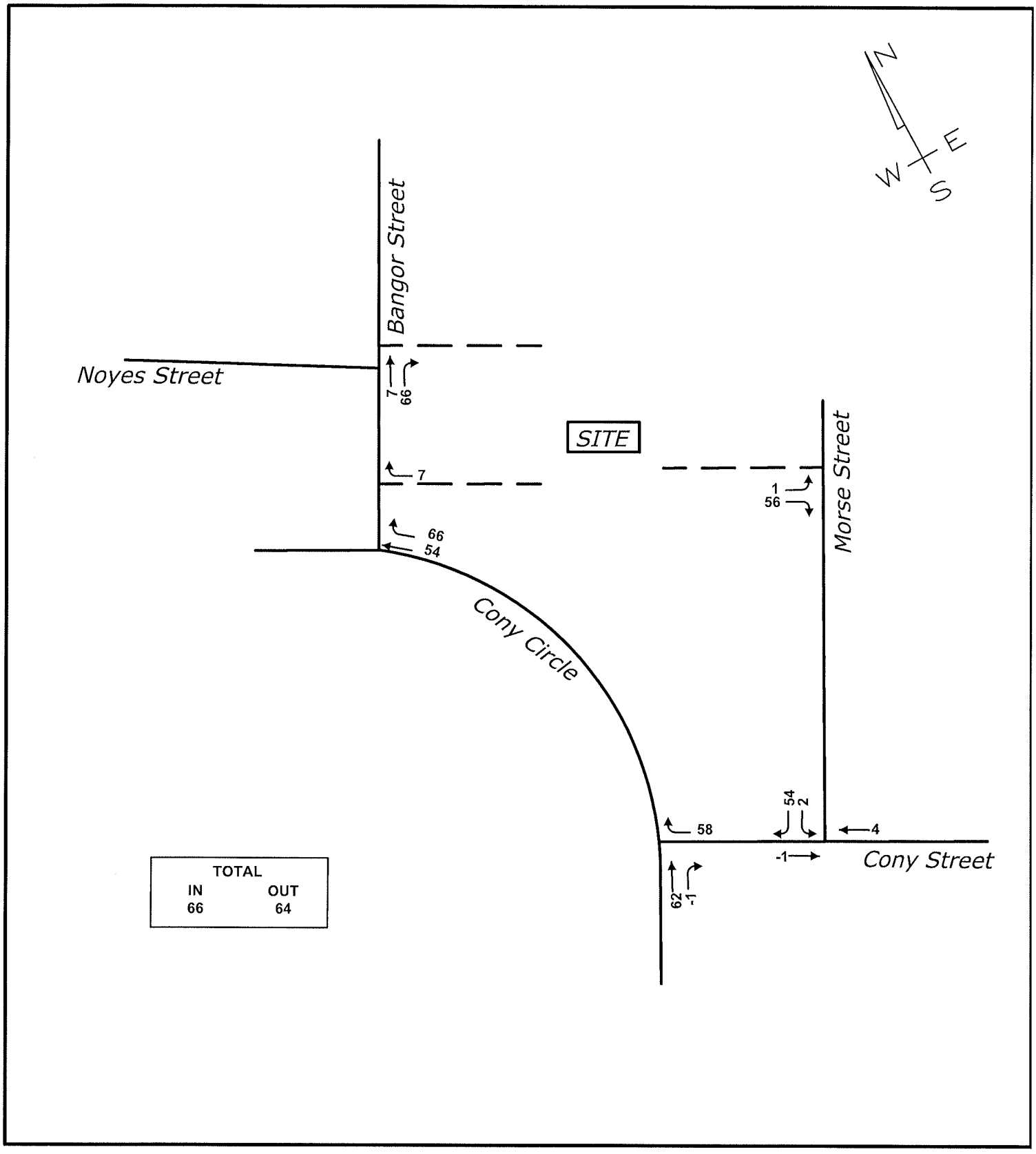
Checked: RED File Name: Figure Set.dwg

AM Total Trips

Figure No. 5



AROMA JOE'S
AUGUSTA, MAINE

Design: BP Scale: NONE
Draft: BP Date: 9/27/2021
Checked: RED File Name: Figure Set.dwg

Attachment 1C

Trip Generation Calculations

CES INC Engineers • Environmental Scientists • Surveyors

LETTER OF TRANSMITTAL

Date: December 11, 2019 **JN:** 12725.001

To: Randy Illian, RTE
MaineDOT, Region 1
51 Pleasant Hill Road
Scarborough, ME 04074

Re: Proposed Aroma Joe's
Scarborough, Maine

WE ARE SENDING YOU

☒ ATTACHED ☐ BY EMAIL ☐ UNDER SEPARATE COVER _____

COPIES	DATE	DESCRIPTION
3	December 2019	Traffic Movement Permit Application (23 M.R.S.A. § 704-A)
1	11/2019	TMP Application Fee (Ck# 258 - $500.00)

THESE ARE TRANSMITTED AS CHECKED BELOW:

☒ For Approval
☐ For Your Use
☐ As Requested
☐ For Review and Comment
☐ Other

☐ Approved as Submitted
☐ Approved as Noted
☐ Returned for Corrections
☐ For Bids Due_____20____

☐ Resubmit___Copies for Approval
☐ Submit___Copies for Distribution
☐ Return___Corrected Prints
☐ Prints Returned After Loan to CES

Remarks: Any questions or correspondence concerning this Application should be directed to Victor Smith at vsmith@cesincusa.com.

Copy To: Town of Scarborough
Annechild Enterprises, LLC

Signed: Victor J. Smith, PE (gdr)

[illegible]

TRAFFIC IMPACT AND ACCESS STUDY

56 DERRY ROAD
Hudson, New Hampshire

July 1, 2021

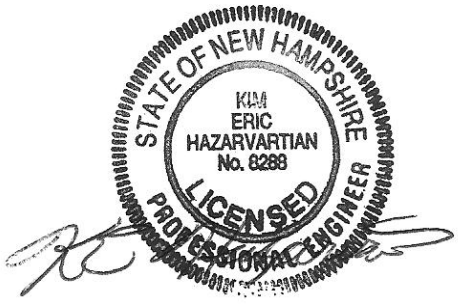
Prepared for Keach-Nordstrom Associates, Inc.

TEPP LLC TRANSPORTATION ENGINEERING, PLANNING AND POLICY

TRAFFIC-IMPACT AND ACCESS STUDY

56 DERRY ROAD
Hudson, New Hampshire

July 1, 2021



Prepared for Keach-Nordstrom Associates, Inc.

TEPP LLC **TRANSPORTATION ENGINEERING, PLANNING AND POLICY**

93 Stiles Road, Suite 201, Salem, New Hampshire 03079 USA
800 Turnpike Street, Suite 300, North Andover, Massachusetts 01845 USA
Phone (603) 212-9133 and Fax (603) 226-4108
Email tepp@teppllc.com and Web www.teppllc.com

CONTENTS

TABLES

FIGURES

SUMMARY

PROJECT DESCRIPTION

Keach-Nordstrom Associates, Inc. (KNA) has retained TEPP LLC to prepare this traffic impact and access study (TIAS) for a proposed commercial redevelopment in the Town of Hudson, New Hampshire.

The proposed redevelopment will:

- be at 56 Derry Road
- provide one drive-through coffee shop
- have one driveway to the west side of Derry Road, with a one-lane entrance and a two-lane exit

STUDY SCOPE

The TIAS study area includes the following unsignalized intersections:

- Derry Road/Ledge Road
- Derry Road/driveway

This TIAS analyzes the following conditions as applicable:

- 2021 existing
- 2022 and 2032 no-build, with background-traffic growth
- 2022 and 2032 build, with background-traffic growth and the proposed redevelopment

This TIAS analyzes traffic operations for the following hours as applicable:

- weekday AM street-peak hour
- weekday PM street-peak hour

TRIP GENERATION

Total trips appear on the site driveway but not all are added to Derry Road near the site. 2022 total vehicle-trips are:

- weekday daily, 629 (total of in and out)
- weekday AM-street-peak hour, 106 (53 in and 53 out)
- weekday PM-street-peak hour, 40 (20 in and 20 out)

2032 total vehicle-trips are:

- weekday daily, 694 (total of in and out)
- weekday AM-street-peak hour, 117 (58 in and 539 out)
- weekday PM-street-peak hour, 44 (22 in and 22 out)

Primary trips are added to Derry Road near the site. 2022 primary vehicle-trips are:

- weekday daily, 69 (total of in and out)
- weekday AM-street-peak hour, 12 (6 in and 6 out)
- weekday PM-street-peak hour, 4 (2 in and 2 out)

2032 primary vehicle-trips are:

- weekday daily, 78 (total of in and out)
- weekday AM-street-peak hour, 13 (6 in and 7 out)
- weekday PM-street-peak hour, 6 (3 in and 3 out)

CAPACITY ANALYSIS

Capacity analysis shows, for the Derry Road/Ledge Road intersection

- low delays for left turns from Derry Road
- moderate delays or delayed operations for movements from Ledge Road
- insignificant project impacts

Capacity analysis shows, for the Derry Road/driveway intersection:

- low delays for left turns from Derry Road
- moderate delays or delayed operations for movements from the driveway

Delayed operations on minor-street approaches to high-volume arterials are typical and acceptable.

TRAFFIC IMPACTS

Analysis indicates no significant area impact due to the proposed redevelopment.

INTRODUCTION

PROJECT DESCRIPTION

KNA has retained TEPP LLC to prepare this TIAS for a proposed commercial redevelopment in the Town of Hudson, New Hampshire.

The proposed redevelopment will:

- be at 56 Derry Road
- provide one drive-through coffee shop
- have one driveway to the west side of Derry Road, with a one-lane entrance and a two-lane exit

Figure 1 shows site location. The project plan is in Appendix A.

STUDY APPROACH

This TIAS assesses traffic impacts and access for the proposed redevelopment.

The TIAS study area includes the following unsignalized intersections:

- Derry Road/Ledge Road
- Derry Road/driveway

This TIAS analyzes the following conditions as applicable:

- 2021 existing
- 2022 and 2032 no-build, with background-traffic growth
- 2022 and 2032 build, with background-traffic growth and the proposed redevelopment

This TIAS analyzes traffic operations for the following hours as applicable:

- weekday AM street-peak hour
- weekday PM street-peak hour

Differences in traffic operations between the no-build and build conditions approximate traffic impacts of the proposed redevelopment.

Figure 1. Site location.

EXISTING CONDITIONS

INTRODUCTION

Existing conditions include:

- physical conditions of the transportation network, roads, and intersections
- traffic volumes
- other relevant information

PHYSICAL CONDITIONS

INTRODUCTION

Figure 1 shows the transportation network.

The TIAS study area includes the following existing unsignalized intersection: Derry Road/Ledge Road.

Description of the TIAS study area follows.

DERRY ROAD

Derry Road:

- is oriented approximately north-south
- functions as an arterial street
- is also known as New Hampshire Routes (NH) 3A and 102
- to the south, connects with the Town Center and New Hampshire Route 111 (NH 111), an arterial highway that leads to the City of Nashua and Towns of Windham and Salem
- to the north, connects with NH 102, an arterial highway that leads to the Towns of Londonderry and Derry, and NH 3A, an arterial highway that leads to the Town of Litchfield and the City of Manchester
- has a horizontal alignment includes minor to moderate horizontal curvature, but is essentially tangent at the proposed driveway location
- has a near-level vertical alignment

- has a three-lane cross-section with one travel lane per direction, a center-two-way-left-turn lane (TWLTL), and paved shoulders
- has asphaltic-cement concrete (ACC) pavement in overall good condition
- has curb and sidewalk along both sides
- includes utility poles along the west side, some with luminaires
- has a posted speed limit of 30 miles per hour (mph)
- has nearby commercial and residential development
- is under the jurisdiction of the Town

DERRY ROAD/LEDGE ROAD INTERSECTION

The intersection:

- is three legged
- has Derry Road as the major north-south street
- has Ledge Road as the minor east leg
- on Derry Road, has one travel lane per direction and one center TWLTL
- on the Ledge Road approach, has one lane
- has a STOP sign on the Ledge Road approach
- is illuminated
- has commercial and residential development nearby

TRAFFIC VOLUMES

TRAFFIC COUNTS

TEPP LLC obtained an automatic traffic counter (ATR) count:

- on Derry Road along the site frontage
- from Wednesday, June 2, to Thursday, June 3, 2021

The ATR data are in Appendix B.

ADJUSTMENTS

The June 2021 traffic counts were adjusted to reflect peak-month and non-pandemic conditions.

The increase to peak month was 2.0 percent, based on based on NHDOT 2019 monthly volumes for Group 4 (Urban Highways) averages in Appendix C,

The increase to pre-pandemic was 5.6 percent. NHDOT continuous count station 82229031, on Daniel Webster Highway north of Hilton Drive, in the Town of Merrimack showed May 2021 two-way average-daily traffic (ADT) of 15,404 vehicles. The station showed May 2019 pre-pandemic two-way ADT of 16,260 vehicles, which is 5.6 percent greater.

The combined increase was 7.7 percent.

RESULTS

Table 1 and Figure 2 show 2021 existing traffic volumes.

Table 1. 2021 existing traffic volumes.

Location and Time Period	Vehicles[a]	K-factor[b]	Percent Direction
Derry Road near Site Frontage			
Weekday Daily	28,667	---	---
Weekday AM-Street-Peak Hour	2,157	7.5	58 Southbound
Weekday PM-Street-Peak Hour	2,290	8.0	54 Northbound

[a] Two-way-total volumes.
[b] K = hour volume as a percent of daily volume.

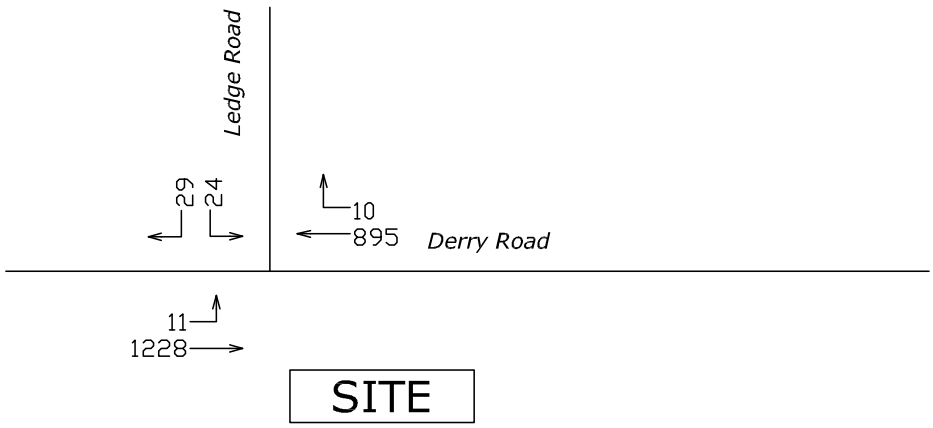
Derry Road near the site frontage showed about:

- 28,667 weekday-daily vehicles
- 2,157 vehicles during the weekday AM street-peak hour, predominantly southbound
- 2,290 vehicles during the weekday PM street-peak hour, predominantly northbound

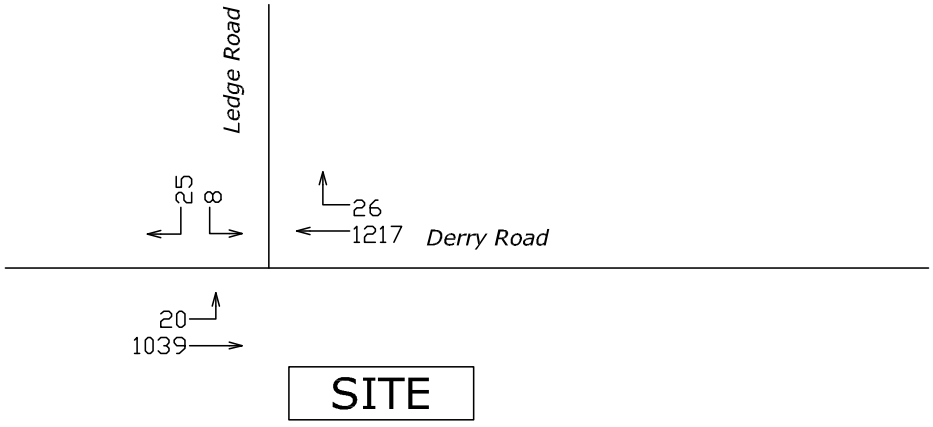
VEHICLE SPEEDS

The ATR collected vehicle speeds:

- on Derry Road along the site frontage
- from Wednesday, June 2, to Thursday, June 3, 2021



Weekday AM-Street-Peak Hour



N

Not to Scale

Weekday PM-Street-Peak Hour

Figure 2. 2021 existing traffic volumes.

The data are in Appendix D and are summarized in Table 2.

Table 2 indicates that on Derry Road:

Table 2. Vehicle speeds.

	Speeds (mph)		
Location and Direction	Speed Limit	Mean[a]	85th Percentile[a]
Derry Road along Site Frontage			
Northbound	30	35.3	39.0
Southbound	30	33.6	37.2

[a] From ATR conducted from Wednesday, June 2, to Thursday, June 3, 2021.

- the posted speed limit was 30 mph
- the northbound the mean speed was 35.3 mph and the 85th percentile speed was 39.0 mph
- for southbound the mean speed was 33.6 mph and the 85th percentile speed was 37.2 mph

SIGHT DISTANCES

The American Association of State Highway and Transportation Officials (AASHTO) has established authoritative policy for sight distances at unsignalized intersections[1] in terms of:

- stopping sight distance (SSD)
- optional intersection sight distance (ISD)

SSD: [2]

- provides for safety
- enables a driver, on the major road, to perceive and react accordingly to a vehicle entering the major road from a minor road
- is conservative because it encompasses a wide range of brake-reaction times and deceleration rates

[1] AASHTO, *A Policy on Geometric Design of Highways and Streets*, 6th Edition (Washington, DC, 2011), pages 9-28 to 9-29.

[2] AASHTO, pages 3-2 to 3-6.

Optional ISD:[3]

- is ordinarily greater than SSD and may enhance traffic operations
- is not required for safety

Table 3 shows relevant available sight distances that are at least 400 ft, per NHDOT practice, and are adequate.

Table 3. Sight distances.

Intersection, Movements, and View	Available Sight Distance (ft)[a]	Speeds (miles per hour)		
		Limit	SSD Provides For	ISD Provides For
Portland Street/Proposed Road for Proposed Road Movements				
Portland Street to/from South	400	30	45+	36+
Portland Street to/from North	400	30	45+	36+

[a] With appropriate roadside and vegetation maintenance.

[3] AASHTO, pages 9-22 to 9-55.

FUTURE CONDITIONS

INTRODUCTION

Future conditions include:

- planned road improvements independent of the proposed redevelopment
- future no-build traffic volumes, with background-traffic growth and without the proposed redevelopment
- future build traffic volumes, with background-traffic growth and with the proposed redevelopment

PLANNED ROAD IMPROVEMENTS

TEPP LLC identified no significant planned road improvement in the study area independent of the project.

BACKGROUND-TRAFFIC GROWTH

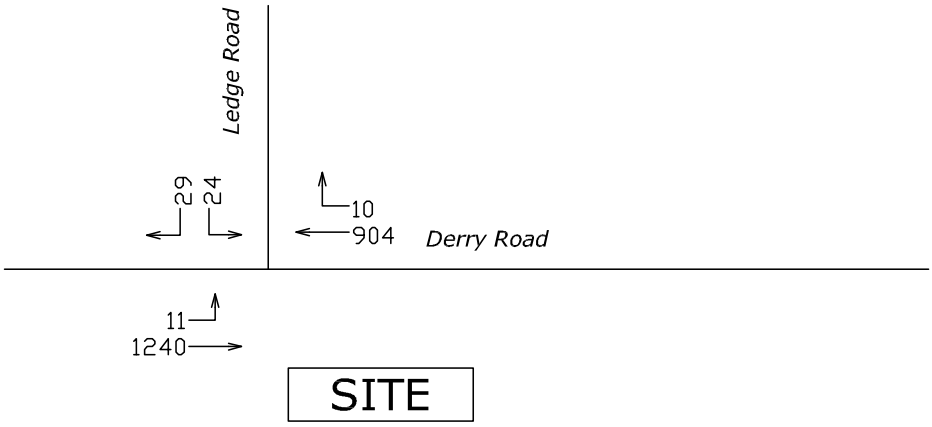
Background-traffic growth:

- is independent of the proposed redevelopment
- is related to land development in the immediate area, population and economic development in the region, and changes in travel patterns in the region
- typically considers two factors: a general traffic-growth rate and specific planned land developments in the immediate area

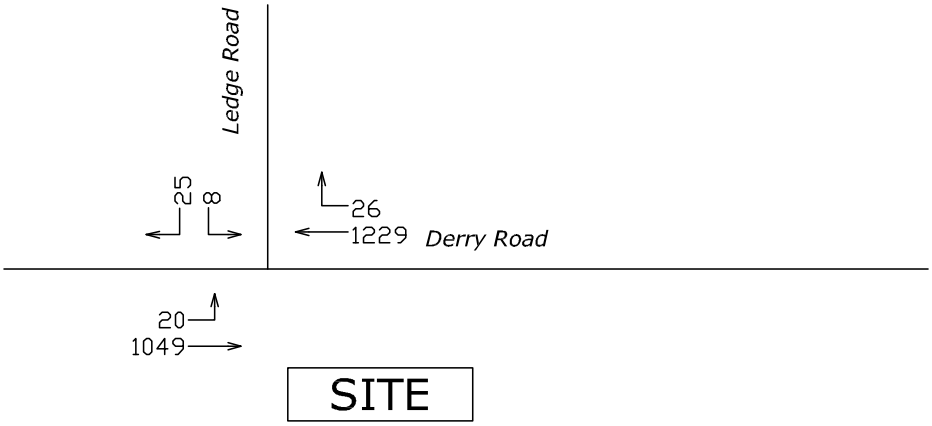
This TIAS uses a 1.0-percent annual growth rate. This yields about 11.6-percent growth between 2021 and 2032.

NO-BUILD TRAFFIC VOLUMES

The background-traffic growth described above was applied to 2021 existing traffic volumes. Figures 3 and 4 show 2022 and 2032 no-build traffic volumes.



Weekday AM-Street-Peak Hour

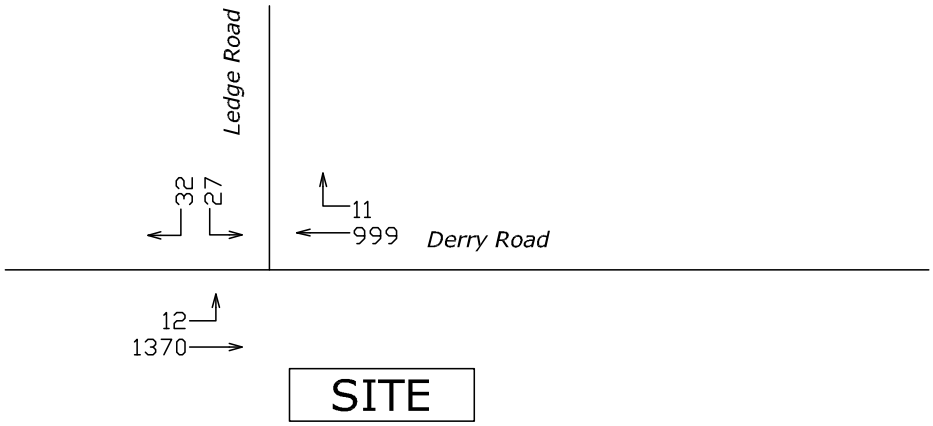


N

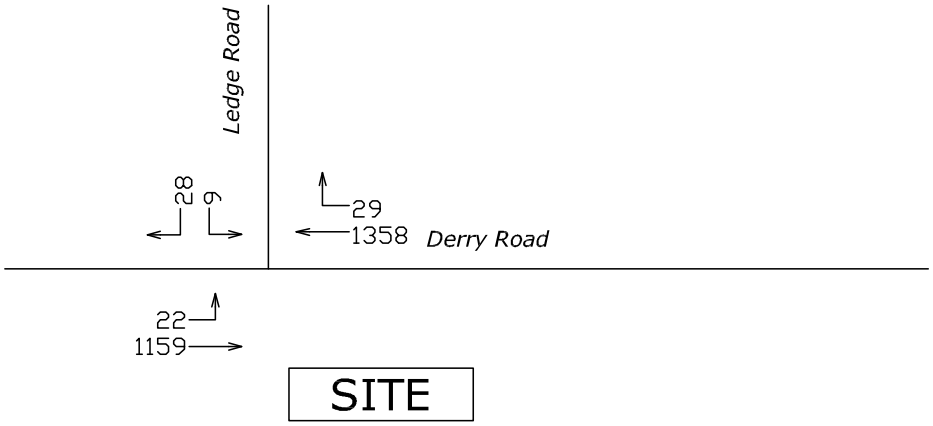
Not to Scale

Weekday PM-Street-Peak Hour

Figure 3. 2022 no-build traffic volumes.



Weekday AM-Street-Peak Hour



N

Not to Scale

Weekday PM-Street-Peak Hour

Figure 4. 2032 no-build traffic volumes.

TRIP GENERATION

BASIC TRIP GENERATION

The Institute of Transportation Engineers (ITE) compiles and publishes trip-generation information for a variety of land uses in *Trip Generation Manual*.[4] This guide for estimating site traffic includes coffee/donut shop with drive-through window and no indoor seating, land use 938, based on floor area.[5] However, this information is based on sites with floor areas of 90 square feet (sf) and is not applicable to the proposed land use, with a floor area of about 900 sf.

Stephen G. Pernaw & Company, Inc. has published appropriate and applicable trip-generation information specific to this land use, which estimates trip generation based on traffic volumes passing the site.[6] Basic trip generation is based on this information.

TRIP TYPES

Total trips appear on site driveways but not all are added to roads near the site. Accordingly, ITE compiles information on three trip types, based on empirical data for many land uses, in the authoritative Hooper, *Trip Generation Handbook*.[7] These three trip types are:

- primary trips that are added to the area and are primarily for visiting the site
- diverted trips that not added to the general area; these trips are from existing traffic on roads near the site
- pass-by trips that are not added to the general area; these trips are from existing traffic passing the site[8]

RESULTS

Table 4 shows calculated weekday vehicle-trip generation for the site.

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[4] ITE, *Trip Generation Manual,* 10th edition (Washington DC, September 2017).

[5] ITE, *Trip Generation Manual,* V Volume 2, Data, Services (Land Uses 900-999), pages 250 and 251, pages 249 to 254.

[6] Stephen G. Pernaw & Company, Inc., *Traffic Impact Assessment, Proposed Drive-Thru Coffee Shop, Northwood, New Hampshire* (Concord, New Hampshire, October 2019), page 10 and Appendix E.

[7] Kevin G. Hooper, P.E., Principal Editor, *Trip Generation Handbook,* 3rd edition (Washington DC: Institute of Transportation Engineers, September 2017).

[8] Definitions of primary trips, diverted trips, and pass-by trips are in Hooper, page 93. Relevant data on primary trips, diverted trips and pass-by trips are in Hooper, 3rd edition, page 216.

Table 4. Calculated weekday vehicle-trip generation

		AM-Street-Peak Hour			PM-Street-Peak Hour		
	Daily[a]	Total[b]	In	Out	Total[c]	In	Out
2022 Vehicle-Trips							
Primary	69	12	6	6	4	2	2
Pass-By[d]	560	94	47	47	36	18	18
Total	629	106	53	53	40	20	20
2032 Vehicle-Trips							
Primary	78	13	6	7	6	3	3
Pass-By[d]	616	104	52	52	38	19	19
Total	694	117	58	59	44	22	22

[a] Estimated total weekday daily trips are 5.93 times weekday AM-street-peak hour trips, based on ITE, *Trip Generation Manual*, Volume 2, Data, Services (Land Uses 900-999), pages 250 and 251.

[b] Total weekday AM-street-peak hour trips are 0.0488 times 2021 no-build weekday AM-street-peak hour volume on Derry Road along the site frontage. Stephen G. Pernaw & Company, Inc., Appendix E.

[c] Total weekday PM-street-peak hour trips are 0.0172 times 2021 no-build weekday PM-street-peak hour volume on Derry Road along the site frontage. Stephen G. Pernaw & Company, Inc., Appendix E.

[d] Pass-by trip percentage is 89. Based on Hooper, *Trip Generation Handbook*, 3rd edition, page 216, coffee/donut shop with drive-through window and no indoor seating, land use 938.

Total trips appear on the site driveway but not all are added to Derry Road near the site. 2022 total vehicle-trips are:

- weekday daily, 629 (total of in and out)
- weekday AM-street-peak hour, 106 (53 in and 53 out)
- weekday PM-street-peak hour, 40 (20 in and 20 out)

2032 total vehicle-trips are:

- weekday daily, 694 (total of in and out)
- weekday AM-street-peak hour, 117 (58 in and 539 out)
- weekday PM-street-peak hour, 44 (22 in and 22 out)

Primary trips are added to Derry Road near the site. 2022 primary vehicle-trips are:

- weekday daily, 69 (total of in and out)
- weekday AM-street-peak hour, 12 (6 in and 6 out)

- weekday PM-street-peak hour, 4 (2 in and 2 out)

2032 primary vehicle-trips are:

- weekday daily, 78 (total of in and out)
- weekday AM-street-peak hour, 13 (6 in and 7 out)
- weekday PM-street-peak hour, 6 (3 in and 3 out)

TRIP DISTRIBUTION AND NETWORK ASSIGNMENT

Trip distribution and network assignment of vehicle-trips to and from the site may consider such factors as existing site distribution, travel patterns, population, regional land development, and site access. Trip distribution and network assignment for this TIAS considered the 2021 existing volumes.

Table 5 shows trip distribution and network assignment for primary trips. Pass-by trips were assigned reflecting peak-hour directional distributions on Derry Road: 58-percent southbound for the weekday AM-street-peak hour and 54-percent northbound for the weekday PM-street-peak hour. Figures 5 and 6 show site traffic volumes.

Table 5. Trip distribution and network assignment.

Road and Direction (To/From)	Approximate Percent
Derry Road to/from South	45
Derry Road to/from South	55
Total	100

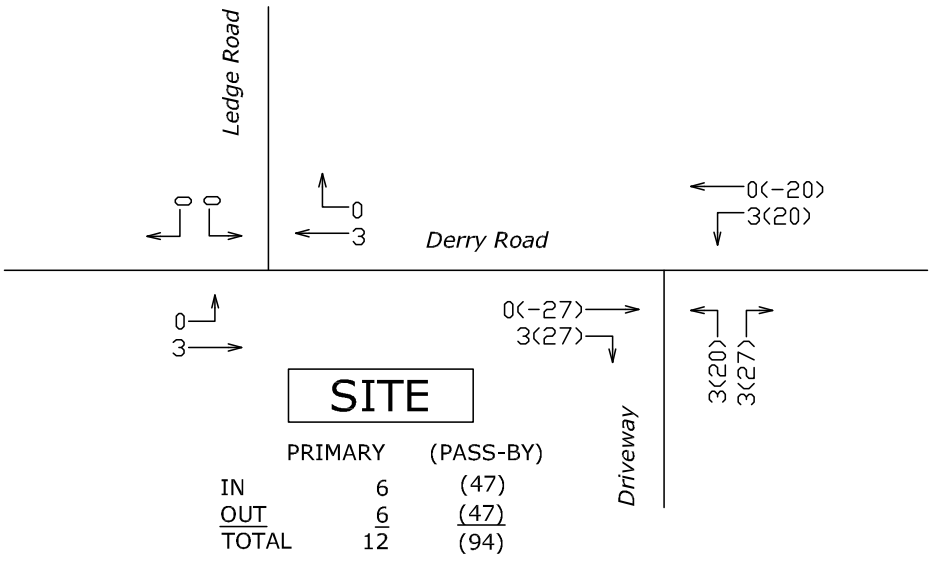
BUILD TRAFFIC VOLUMES

Site traffic volumes were superimposed on the no-build traffic volumes to estimate build traffic volumes. Figures 7 and 8 show the resulting 2022 and 2032 build traffic volumes.

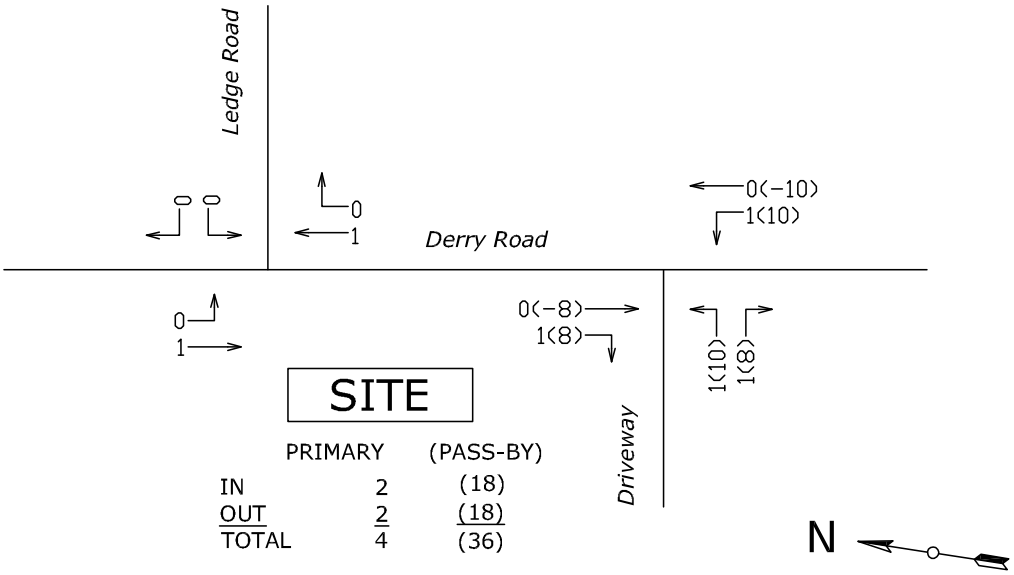
TRAFFIC-VOLUME CHANGES

Table 6 presents calculated traffic-volume changes due to the proposed redevelopment for the:

- weekday AM-street-peak hour
- weekday PM-street-peak hour



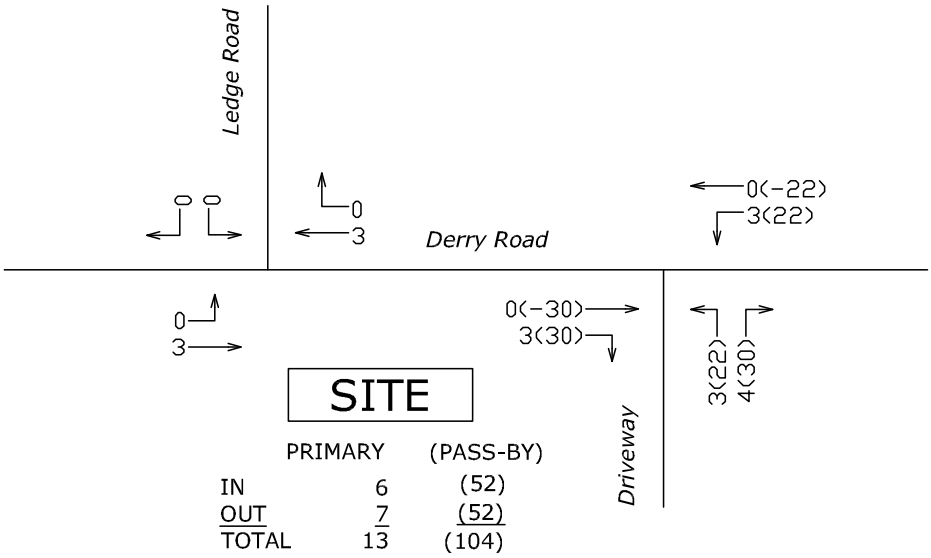
Weekday AM-Street-Peak Hour



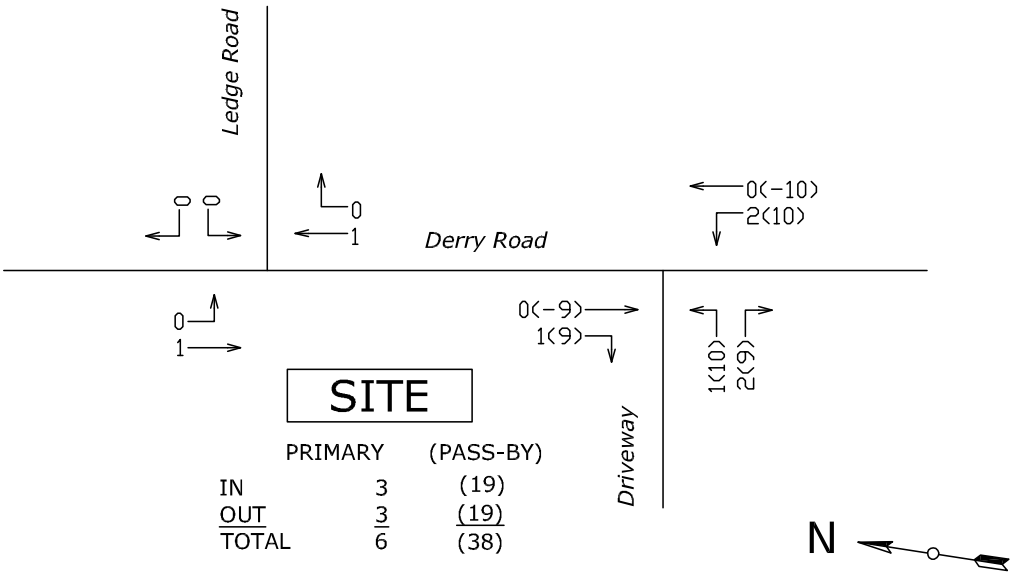
Not to Scale

Weekday PM-Street-Peak Hour

Figure 5. 2022 site traffic volumes.



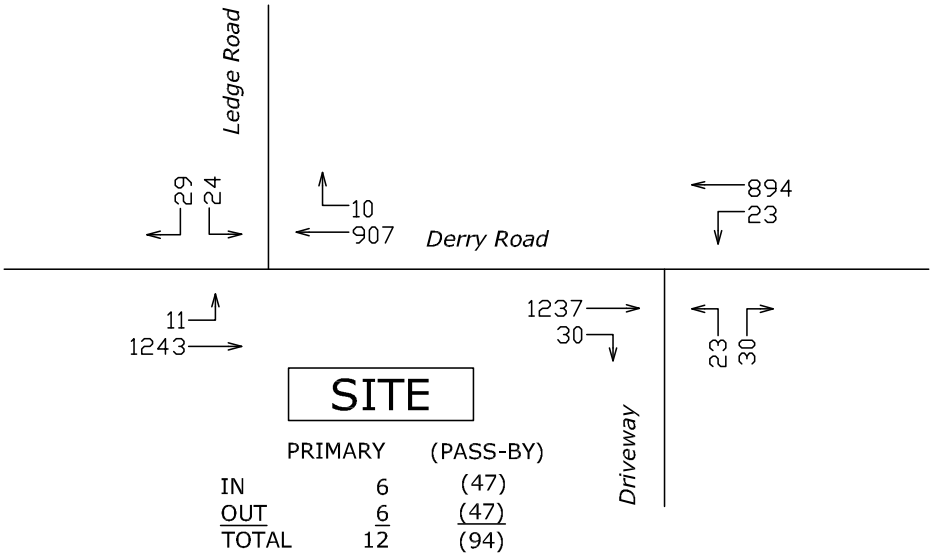
Weekday AM-Street-Peak Hour



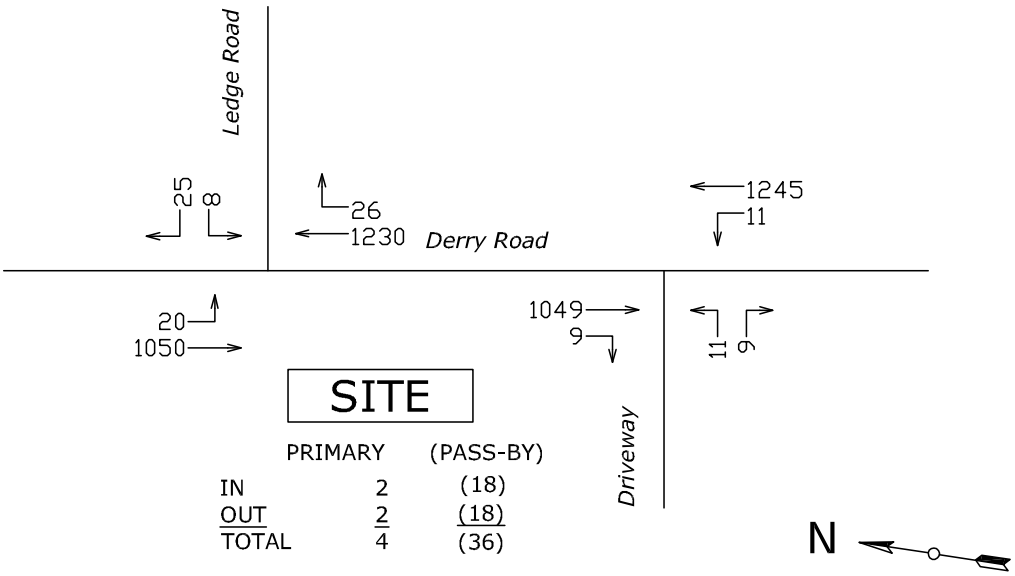
Not to Scale

Weekday PM-Street-Peak Hour

Figure 6. 2032 site traffic volumes.

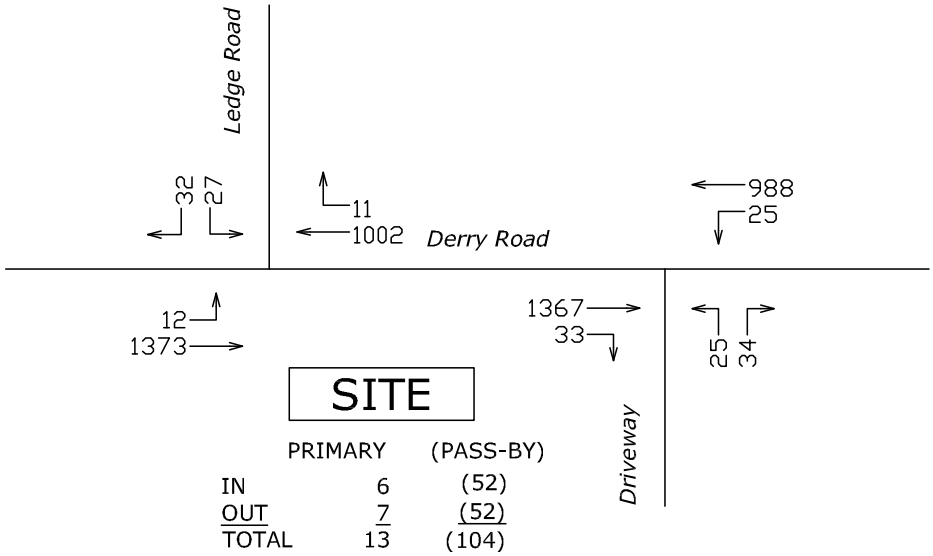


Weekday AM-Street-Peak Hour

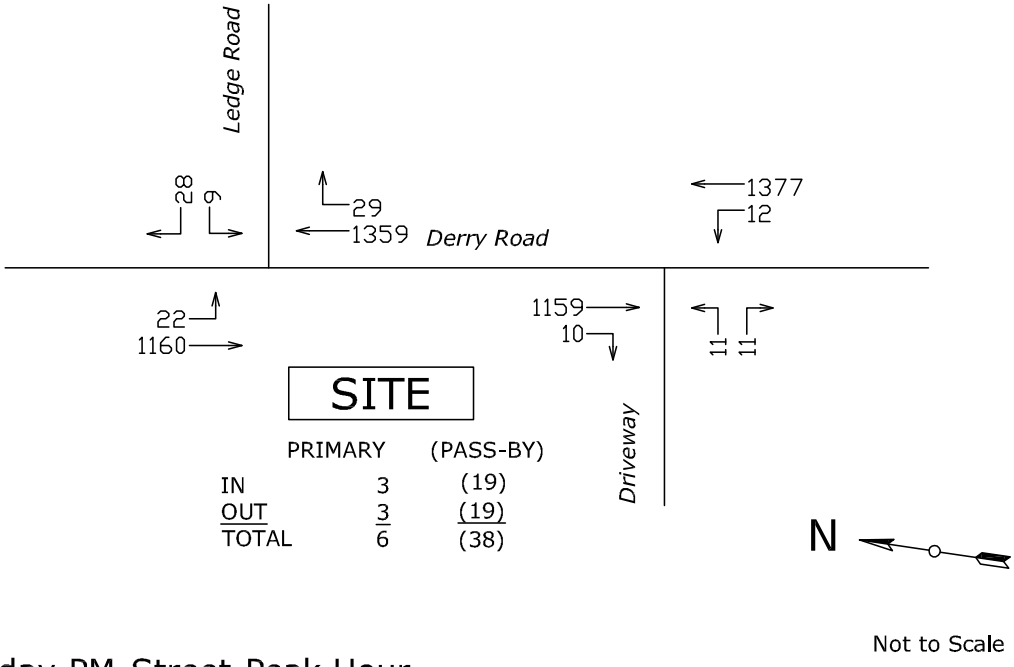


Weekday PM-Street-Peak Hour

Figure 7. 2022 build traffic volumes.



Weekday AM-Street-Peak Hour



Weekday PM-Street-Peak Hour

Figure 8. 2032 build traffic volumes.

Table 6. Traffic-volume changes.

Location and Time Period	2022 Traffic Volumes (vph)[a]			2032 Traffic Volumes (vph)		
	No-Build	Build	Change	No-Build	Build	Change
Derry Road North of Driveway						
Weekday AM-Street-Peak Hour	2,178	2,184	6	2,407	2.413	6
Weekday PM-Street-Peak Hour	2,312	2,314	2	2,555	2,557	2
Derry Road South of Driveway						
Weekday AM-Street-Peak Hour	2,178	2,184	6	2,407	2,414	7
Weekday PM-Street-Peak Hour	2,312	2,314	2	2,555	2,559	4

[a] Two-way total volumes.

Table 6 shows peak-hour-traffic-volume increases:

- of 2 to 7 vehicle-trips
- constituting averages about one vehicle-trip per 8 to 30 minutes
- that are further split by northbound and southbound direction on Derry Road

CAPACITY ANALYSIS

INTRODUCTION

This TIAS has quantified existing, future-no-build and future-build traffic volumes. Capacity analysis models the quality of traffic operations. Comparing build conditions to the no-build conditions indicates impacts of the proposed redevelopment on quality of traffic operations.

METHODS

Capacity analysis calculates LOS for transportation facilities. LOS indicates the quality of traffic operations based on delay and other measures. The six LOS are designated A to F. LOS A represents the best or highest operating conditions. LOS F is the lowest, but does not necessarily connote failure.

LOS is a function of traffic volumes and traffic control. Because these volumes can vary, LOS of a transportation facility can differ by time of day, day of the week, or month. For example, a transportation facility with a low LOS during peak hours may have a high LOS during other hours. The operational analysis methods of the Transportation Research Board (TRB)[9] models LOS for intersections based on calculated delay per vehicle, as shown in Table 7. Synchro analysis software was used.

Method inputs include:

- intersection geometry
- traffic control, such as YIELD sign, two-way STOP sign, all-way STOP sign, roundabout, or signal (including phasing, timing, and progression)
- traffic volumes
- vehicle composition, such as passenger cars and trucks

The methods are all approximate. In particular, the method for two-way STOP-sign control can be conservative, with observed delays and queuing shorter than those modeled.

[9] TRB, *Highway Capacity Manual 2000* (Washington DC 2000) and *Highway Capacity Manual 2010* (Washington DC, 2010).

Table 7. Level-of-service criteria for intersections.

	Control Delay (seconds/vehicle)	
Level of Service	Unsignalized Intersections[a]	Signalized Intersections
A	≤10.0	≤10.0
B	>10.0 and ≤15.0	>10.0 and ≤20.0
C	>15.0 and ≤25.0	>20.0 and ≤35.0
D	>25.0 and ≤35.0	>35.0 and ≤55.0
E	>35.0 and ≤50.0	>55.0 and ≤80.0
F	>50	>80

From Transportation Research Board, *Highway Capacity Manual 2010* (Washington D.C., 2010).

[a] For YIELD sign, two-way STOP sign or all-way STOP sign, control delay defines LOS. For roundabout approaches and overall intersection, control delay defines LOS. For roundabout lanes with volume/capacity ratio ≤1.0, control delay defines LOS. For roundabout lanes with volume/capacity ratio > 1.0, LOS is F regardless of control delay.

RESULTS

Table 8 shows computed LOS, delays, and queues at study-area intersections for the:

- weekday AM-street-peak hour
- weekday PM-street-peak hour

The analysis is under the following conditions, as applicable:

- 2021 existing
- 2022 and 2032 no build
- 2022 and 2032 build

Capacity-analysis worksheets that give detail and explanation are in Appendix E.

Table 8 shows, for the Derry Road/Ledge Road intersection

- low delays for left turns from Derry Road
- moderate delays or delayed operations for movements from Ledge Road
- insignificant project impacts

Table 8 shows, for the Derry Road/driveway intersection:

- low delays for left turns from Derry Road
- moderate delays or delayed operations for movements from the driveway

Delayed operations on minor-street approaches to high-volume arterials are typical and acceptable.

Table 8. Capacity-analysis summary.

Intersection, Control, Hour and Movement	2021 Existing				2022 No Build				2032 No Build				2022 Build				2032 No Build			
	LOS[a]	Delay[b]	V/C[c]	Queue[d]	LOS	Delay	V/C	Queue	LOS	Delay	V/C	Queue	LOS	Delay	V/C	Queue	LOS	Delay	V/C	Queue
Derry Road/Ledge Road Intersection, Unsignalized, Weekday AM-Street-Peak Hour																				
Derry Road SB L	B	10.7	0.019	0.1	B	10.9	0.020	0.1	B	11.6	0.024	0.1	B	11.0	0.020	0.1	B	11.6	0.024	0.1
Ledge Road WB LR	D	33.3	0.370	1.6	D	31.8	0.307	1.2	E	41.2	0.402	1.8	E	35.2	0.333	1.4	E	41.6	0.405	1.8
Derry Road/Ledge Road Intersection, Unsignalized, Weekday PM-Street-Peak Hour																				
Derry Road SB L	B	11.7	0.037	0.1	B	12.6	0.045	0.1	B	13.7	0.056	0.2	B	12.6	0.045	0.1	B	13.7	0.056	0.2
Ledge Road WB LR	D	29.6	0.250	1.0	D	33.4	0.225	0.8	E	42.9	0.305	1.2	D	33.6	0.226	0.8	E	43.3	0.307	1.2
Derry Road/Driveway Intersection, Unsignalized, Weekday AM-Street-Peak Hour																				
Derry Road NB L	---	---	---	---	---	---	---	---	---	---	---	---	B	12.9	0.053	0.2	B	14.1	0.2	0.066
Driveway EB L	---	---	---	---	---	---	---	---	---	---	---	---	E	37.5	0.188	0.7	E	46.9	0.246	0.9
Driveway EB R	---	---	---	---	---	---	---	---	---	---	---	---	D	30.5	0.192	0.7	E	39.3	0.266	1.0
Derry Road/Driveway Intersection, Unsignalized, Weekday PM-Street-Peak Hour																				
Derry Road NB L	---	---	---	---	---	---	---	---	---	---	---	---	B	11.2	0.021	0.1	B	11.9	0.025	0.1
Driveway EB L	---	---	---	---	---	---	---	---	---	---	---	---	E	36.1	0.095	0.3	E	42.5	0.113	0.4
Driveway EB R	---	---	---	---	---	---	---	---	---	---	---	---	C	21.0	0.043	0.1	C	24.3	0.061	0.2

[a] LOS = level of service.

[b] Delay = average delay in seconds per vehicle.

[c] V/C = volume/capacity ratio.

[d] 95th percentile queue in vehicles.

EB = eastbound, WB = westbound, SB = southbound, NB = northbound, L = left, T = through, R = right.

CONCLUSION

PROJECT DESCRIPTION

The proposed redevelopment will:

- be at 56 Derry Road
- provide one drive-through coffee shop
- have one driveway to the west side of Derry Road, with a one-lane entrance and a two-lane exit

TRIP GENERATION

Total trips appear on the site driveway but not all are added to Derry Road near the site. 2022 total vehicle-trips are:

- weekday daily, 629 (total of in and out)
- weekday AM-street-peak hour, 106 (53 in and 53 out)
- weekday PM-street-peak hour, 40 (20 in and 20 out)

2032 total vehicle-trips are:

- weekday daily, 694 (total of in and out)
- weekday AM-street-peak hour, 117 (58 in and 539 out)
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Primary trips are added to Derry Road near the site. 2022 primary vehicle-trips are:

- weekday daily, 69 (total of in and out)
- weekday AM-street-peak hour, 12 (6 in and 6 out)
- weekday PM-street-peak hour, 4 (2 in and 2 out)

2032 primary vehicle-trips are:

- weekday daily, 78 (total of in and out)
- weekday AM-street-peak hour, 13 (6 in and 7 out)

- weekday PM-street-peak hour, 6 (3 in and 3 out)

CAPACITY ANALYSIS

Capacity analysis shows, for the Derry Road/Ledge Road intersection

- low delays for left turns from Derry Road
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- insignificant project impacts

Capacity analysis shows, for the Derry Road/driveway intersection:

- low delays for left turns from Derry Road
- moderate delays or delayed operations for movements from the driveway

Delayed operations on minor-street approaches to high-volume arterials are typical and acceptable.

TRAFFIC IMPACTS

Analysis indicates no significant area impact due to the proposed redevelopment.