TRAFFIC FEASIBILITY STUDY

Route 28 (South Orleans Road)/Route 39 (Harwich Road)/Quanset Road Intersection

Orleans, Massachusetts

Prepared for:

Town of Orleans

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1.0 INTRODUCTION

Fay, Spofford & Thorndike (FST) is assisting the Town of Orleans with the preliminary planning for improvements to the Route 28 (South Orleans Road)/Route 39 (Harwich Road)/Quanset Road intersection. The study area intersection is shown in Figure 1 below.

Figure 1 –Study Area Intersection

This 4-way unsignalized intersection serves as one of the primary access points from the south on Route 28 to Orleans Center. Land use at the intersection consists of town property (former old school house site) in the northeast quadrant, American Heritage Reality headquarters on the northwest side, residential property on the southeast and west quadrants and Ridgewood Motel and cottages on Quanset Road to the east.

The intent of this preliminary traffic assessment is to provide some background traffic information on the intersection as well as provide intersection conceptual improvement plans to supplement the Project Need Form (PNF). The PNF will be submitted to MassDOT District 5 and the Cape Cod Commission (CCC). In 2010, the CCC conducted peak period traffic counts and developed some preliminary conceptual plans for the intersection. In 2013 the count program was supplemented. In summer 2014 and 2015 additional field work was conducted in both the peak and off-peak periods. This information will be built upon in this transportation assessment.

2.0 EXISTING CONDITIONS

2.1 Intersection

Route 28 (South Orleans Road), is intersected from the southwest by Route 39 (Harwich Road) and Quanset Road from the east to form a skew-angle unsignalized intersection in South Orleans. Route 28 runs north/south,[1] is owned and maintained by MassDOT and is functionally classified as a principal arterial. Route 39 (Harwich Road) is a Town-owned roadway and is classified as a rural minor arterial while Quanset Road is also owned by the Town and is classified as a local road. The minor approaches are offset from each other creating awkward turning movements to/from the side streets approaches. This intersection is under MassDOT jurisdiction.

Northbound on Route 28 there is a single through/left/right turn lane, while southbound on Route 28 there is an exclusive right turn lane to Route 39 that separates from Route 28 at a highway-type ramp configuration that is free-flowing. There is also a shared left/through lane on Route 28 (South Orleans Road).

Quanset Road, intersecting from the east technically has a single lane approach, but widens at the intersection with Route 28 to form a two-lane approach that is approximately 45 feet wide. This leg of the intersection is separated by an 8 foot-long, 4 foot-wide raised median island. On the Route 39 (Harwich Road) side there are two (2) raised islands, one a triangular-shaped raised delta island that separates right turns from Route 28 (South Orleans Road) southbound with northbound left turning traffic and westbound traffic entering from Quanset Road. In addition, there is a 70 foot-long, variable-width raised median island on the Route 39 approach that separates entering and exiting traffic. There are worn pavement markings, including solid white edge lines, demarking limited shoulder widths on both sides of Route 28.

One-half mile north and south of the intersection, the posted speed limit of Route 28 is 40 mph in both directions. The speed limit on Route 39 west of the intersection is 40 mph. There

[1] Route 28 is technically designed and signed for north and south but is reversed from the actual compass directions

are no sidewalks, pedestrian or bicycle accommodations at the intersection. Both Route 39 (Harwich Road) and Quanset Road operate under Stop sign control, with two (2) Stop signs on the Quanset Road approach and an obscure Stop sign on the Route 39 (Harwich Road) approach. The right of way for Route 28 is 40-60 feet, 50 feet for Quanset Road and 65 feet for Route39.

2.2 Traffic Volumes

- *Summer Seasonal Traffic Counts*

The Cape Cod Commission (CCC) maintains a traffic count data base for each town on the Cape. A historical summary and the most recent 24-hour average daily traffic data for the intersection is shown in Table 1.

Table 1 – Estimated Average Daily Traffic Volume Summary

Location	Summer Average Daily Traffic (vpd)	Year	Peak Hour Volume
Route 28 at north of Route 39 ((#20623)	14,675	2013	1226
Route 28 at south of Route 39 (#20624)	7,550	2013	700
Quanset Road, east of Route 28 (#20618)	2,100	2010	178
Route 39, south of Route 28 (#20625)	6,420	2013	513
*two-way volumes; vpd=vehicles per day (two-way); vph=vehicles per hour			

From the above table it can be seen that north of the intersection, Route 28 carries the higher traffic volume with over 14,000 vehicles per day during an August summer period.

2.3 Accident Summary

Accident data was secured for the subject intersection from the most recent files of MassDOT for the years 2009-2013. The most common accident recorded from the MassDOT data was the rear-end collision and the angle-type intersection. The accident summary can be seen in Table 2.

Although the number of accidents alone is important, the actual exposure or potential for an individual driver being involved in an accident is reflected in the crash rate. The crash rate is defined as the number of accidents per million entering vehicles (MEV) at an intersection. Using MassDOT's Crash Rate Worksheet, it can be seen that the study area intersection is below the statewide accident rate of 0.60 MEV and the MassDOT District 5 crash rate of 0.58 for unsignalized intersections.

Table 2 5-Year Intersection Crash Summary	
	Rte 28(Orleans-Chatham Rd)/Rte 39(Harwich Rd)/Quanset Rd
Year	
2009	6
2010	1
2011	3
2012	4
2013	2
Total	16
Average per year	3.2
Severity	
Non-fatal injury	5
Not Reported	1
Property damage only	10
Total	16
Type of Accident	
Angle	4
Rear-end	3
Sideswipe, opposite direction	1
Single vehicle crash	8
Total	16
Weather Conditions	
Clear	9
Cloudy	3
Rain	1
Sleet, hail	1
Snow	2
Grand Total	16

2.4 Traffic Operations

Level of Service (LOS) is an expression of the quality of flow of traffic. LOS is a commonly used and accepted measure of the effectiveness of peak hour traffic operating conditions. It takes into account automobile and truck volumes, roadway width, speed, grade, parking restrictions, pedestrian activity, and traffic control devices.

LOS is designated in a range from Level "A", which is the best operating condition, to Level "F" which indicates excessive delays. Levels "A" through "D" is typically associated with acceptable levels of peak hour traffic operations.

A capacity analysis for the intersection was performed in accordance with the methodologies set forth in the *2010 Highway Capacity Manual*[2]. Table 3 identifies the Level of Service criteria.

Table 3 – Unsignalized Intersection Level of Service Criteria

Level of Service	Delay (seconds per vehicle)
A	<10
B	>10 to 15
C	>15 to 25
D	>25 to 35
E	>35 to 50
F	>50

Source: Highway Capacity Manual 2010

The base 2010 peak period traffic volumes collected by the Cape Cod Commission, were increased to the 2015 conditions using a growth factor of ½ of 1%. Analysis was then conducted using the procedures described above. Table 4 presents a summary of the existing summertime traffic operating conditions for the subject intersection and results indicate traffic operations are overall generally acceptable at this location except during the PM period for the Route 39 approach which operates at LOS F, an unacceptable condition. It should be noted that during field observations during both the AM (7-9) and PM (3-6) weekday periods there are long delays for the Route 39 approach to the intersection and during the PM period, vehicle queues on Route 39 ranged 3 to 10 vehicles. Delays on Quanset Road were minimal and vehicle queues were observed to be 1-3 vehicles.

[2] *Highway Capacity Manual*; Transportation Research Board; 2010

Table 4 – 2015 Existing Level of Service Summary – Unsignalized										
Route 28 (NB/SB)	AM Peak					PM Peak				
	Delay[1]	LOS	v/c[2]	Queue[3]		Delay[1]	LOS	v/c[2]	Queue[3]	
				50%	95%				50%	95%
Route 39 EB Lt/Th/Rt	33.7	D	0.70	-	129	182.3	F	1.23	-	345
Quanset Rd WB Lt/Th/Rt	11.3	B	0.15	-	13	16.5	C	0.25	-	24
Route 28 NB Lt/Th/Rt	0.2	A	0.0	-	0	0.1	A	0.0	-	0
Route 28 SB Lt/Th	1.5	A	0.03	-	2	1.8	A	0.06	-	4
Route 28 SB Rt	0.0	A	0.11	-	0	0.0	A	0.22	-	0
OVERALL	**10.6**					**34.6**				

1. Control Delay in seconds per vehicle
2. Volume-to-capacity ratio
3. Queue in feet per lane, 50th percentile and 95th percentile (25 feet per vehicle)

2.5 Intersection Deficiencies

Based on observing traffic operations at the intersection, general site observations and review of studies completed in the area, the following intersection deficiencies are noted:

- Traffic travels on Route 28 southbound to Route 39 via a free right-turn movement at high speeds;
- There are no sidewalks on any of the approaches at the intersection even though pedestrian were observed walking in the area;
- There are no pedestrian or bicycle accommodations at the intersection;
- The awkward geometry and multiple raised islands lead to wrong-way directional turning movements and confusing activity at the intersection;
- Trucks have difficulty maneuvering at the intersection;
- Unclear access and egress points;
- Vegetation on the island on the Route 39 westbound approach limits visibility, to the north;
- The wide driveway at Ocean View Realty to the north is a safety concern at the intersection contributing conflicts;
- The westbound left out of Quanset Road and the eastbound left out of Route 39 are conflicting;
- Limited visibility of the intersection is evident approaching from the east and west directions;
- Poor advance signing of 'intersection ahead' from the east and west;
- Very long vehicle queues on the Route 39 approach to the intersection; and
- There is a lack of shoulders on all approaches to the intersection.

2.6 Environmental Screening

A preliminary environmental screening was conducted of the intersection and the following key points are noted:

- The project area is outside the zone of the priority habitats (PH) of rare species;
- The project area is outside the zone of the estimated habitats (EH) of rare wildlife;
- The project area is within an approved DEP wellhead protection zone IIs; and
- In the northeast quadrant of the intersection, there is a designated historic marked by the Orleans Historical Society and listed with the Massachusetts Historic Commission. A granite boulder with bronze plaque designates the site as the location at the site of the South Orleans District School from 1856-1893.

3.0 IMPROVEMENT ALTERNATIVES

3.1 Roundabout – Alternative 1

One alternative for improvement at the intersection is to construct a round-about to control turns and improve operations. A roundabout has recently been constructed in the Town at the Route 28/6A intersection in a more densely-populated and constrained area, so installing one on the south end of Town would provide another gateway to the Town. Advantages at this location would include, reduce speeds in the area, a better mechanism for controlling turns at two designated State routes, minimal or no land takings and minimal roadway maintenance to maintain this traffic control device. A street view picture of the intersection as it exists today is shown in Figure 1 (before condition); while a photo simulation of the intersection with the roundabout in place (after condition) is shown in Figure 2.

3.2 Signalized Intersection - Alternative 2

Another alternative for intersection improvement would be to install a traffic signal and re-design the geometry. A signal would provide a controlled mechanism for all traffic movements and reduce vehicle delays that presently exist on the side street approaches. New sidewalks would be added, and bicycle accommodation provided. Exclusive turn lanes could be provided for this improvement alternative. Preliminary review of traffic signal warrants in the *Manual on Uniform Traffic Control Devices*[3], indicate that the intersection meets peak hour warrants. Capacity analysis was conducted of the signalized alternative and for a multi-phase signal the intersection would operate at level of service A (LOS A) for both peak periods. A photo simulation of this intersection upgrade is shown in Figure 3.

3.3 Unsignalized Intersection - Alternative 3

A third improvement alternative would have the intersection remain unsignalized, but rework the geometry, tighten-up the intersection corners, reduce curve radii, narrow roadway widths to better accommodate pedestrian crossings and adding sidewalks. Traffic operations would remain unchanged, that is long vehicle delays would still remain on side street approaches.

[3] *Manual on Uniform Traffic Control Devices*; FHWA; 2009

4.0 RECOMMENDED ALTERNATIVE

Based on the review of expected traffic operations, minimal right-of-way impacts and limited long-term maintenance, the roundabout alternative is recommended to be pursued. With an existing roundabout at Route 28/Route 28 in north Orleans that serves as a gateway from the north in the busiest location in-Town, this South Orleans location will serve as the southern gateway to Town. As currently proposed, this roundabout will have single lane approaches on Route 28, Route 39 and Quanset Road and provide for both pedestrians and bicycles.

5.0 CONCLUSIONS

While the Route 39/Route 28/Quanset Road intersection is not above the state-wide crash rate, there exist significant geometric and operational deficiencies at the intersection. The intersection does not meet MassDOT's "Complete Streets" policy and with the upgrade will provide accommodations for pedestrian and bicycle as well as slow traffic down at through the intersection while addressing some of the expansive curb cuts in the area.

Since Route 28 is a State-owned highway, the project will be required to enter the Transportation Improvement Program (TIP) process, through the Cape Cod Commission (CCC) or be identified as a maintenance project under MassDOT's traffic maintenance program. However, based on the extent of improvements needed, it is unlikely the intersection would be a maintenance project. Preliminary construction estimates to construct a single lane roundabout would be $350,000 - $450,000.

Figure 2 – Alternative 1 - Roundabout

Figure 3 – Alternative 2 – Signalized