Roundabout Versus Traffic Controlled Intersections Combined with Smart Traffic Control

The purpose of this discussion is to outline the pros and cons associated with traffic controlled intersections versus a Modern Roundabout as applied to the intersections in Tylerville.

Before looking at alternatives, it is important to examine what we currently have.

The northern intersection is what the DOT calls a “Simple T” intersection currently controlled by a fixed timed traffic light that becomes a blinking caution light in late hours when traffic is extremely light. This intersection functions reasonably well in light to moderate traffic. It has one major flaw which was created by the DOT''s design of the traffic light currently in use and the intersection's physical size. There are two problems. First, southbound traffic has a protected green arrow allowing southbound traffic to turn left for about 5 seconds while the northbound traffic still has a Red Light. However, the northbound leg has a breakdown lane wide enough for drivers to easily pass drivers stopped in the travel lane and pass them on the right. While this is illegal, it happens constantly. Southbound drivers turning left under the protected Green Arrow onto Bridge Rd. are forced to stop in the intersection to allow drivers to make this illegal right turn onto Bridge Rd. There are no warning signs to northbound traffic of the protected left turn arrow. With this one exception, under low to moderate traffic conditions the intersection still functions reasonably well.

The southern intersection between the Route 82 Connector and Route 154 is also a “Simple T” intersection currently controlled by a flashing Red Light for the Connector leg and a Flashing Yellow Caution Light in the Route 154 “T” top leg. This intersection performs well under light to moderate traffic conditions. The problems in this intersection are related to speed and visibility. Drivers who are unfamiliar with this intersection (Tourists) approaching on the 82 Connector leg need to be warned that this intersection exists and to slow down. This intersection also becomes problematic when bumper to bumper traffic backs up from the northern “T” intersection when the Swing Bridge is open.

The biggest problem with both of these intersections is not their design. The problem is traffic backup from the Swing Bridge and from compressed arrivals and departures from the various seasonal venues that operate in this area.

Modern Roundabout

All drivers are familiar with conventional traffic control signals and the many different permutations possible using this technology. However, many drivers are not familiar with the “Modern Roundabout” and how it is supposed to work and the advantages and disadvantages associated with it. This type of intersection has several advantages when it comes to smoothing traffic flow in intersections with low to moderate balanced traffic flows because in these cases traffic does not have to stop and then go as it does at more traditional signal controlled intersections. However, roundabouts have a number of distinct disadvantages in some situations.

The Modern Single Lane Roundabouts proposed for the intersections in Tylerville are smaller in diameter than the traditional multi-lane rotaries most people think of when they picture an intersection like this. In fact, because these Modern Roundabouts are so small in diameter, and have only a single travel lane, a standard tractor-trailer truck has problems negotiating a turn through this type of intersection. To permit these over-sized vehicles to move through these roundabouts, specially designed “Truck Curbs” are built into the center and outsides of the roundabout. These are raised over-sized concrete curbs designed for these large vehicles to drive up on as they pass through the roundabout. As the truck enters the roundabout the driver must steer his vehicle's front left tires up onto the inside curb while the right rear trailer tires glide up on the outside curb as he moves crabwise through the turn. As the truck exits the roundabout, the driver steers his vehicle off the center curb back into the normal travel lane and, gradually, the rear tires of the trailer glide back down into the the travel lane as well. To accomplish this the driver must reduce his speed to that of a walk to safely execute this complex maneuver. When this happens, all other traffic in the roundabout will have to match the speed of this truck.

There are some other important characteristics unique to the single lane roundabout. Because they are only a single lane, all traffic in the roundabout must move at the same speed and the speed of vehicles entering the roundabout must match that speed as they enter it. As with all rotaries or roundabouts, the vehicles already in the circular portion have the right-of-way and vehicles entering must wait for a gap in traffic large enough to allow them to safely enter the roundabout. These roundabouts are physically small and, therefore, the number of vehicles that can fit in them is low and under high traffic conditions the spaces between vehicles are small as well. For this reason they can experience severe congestion under certain conditions. For this reason single lane roundabouts are not recommended for intersections with high traffic volumes, especially if the traffic volumes from the various roads entering the roundabout have significantly different volumes. This is because the traffic on the high volume legs will dominate the flow into the roundabout and create traffic backups in the lower volume legs. Experience has shown that when peak traffic flows approach 1,800 vehicles per hour an/or flow imbalances approach 2 to 1, significant problems can develop. The DOT data on traffic volume taken for these intersections in late March and early April of 2021 during the pandemic at a time when bridge openings were essentially zero and all the seasonal venues were closed shows peak traffic volumes approaching 1,200 cars per hour. Additionally, the ratio of traffic entering the various legs of these intersections was measured to be 2 to 1 or higher. During tourist season when the bridge is in use and all the venues are in full operation, these volumes will increase dramatically. In fact, bumper to bumper traffic is often seen backed up from the bridge through both intersections. Because of the existing traffic controls at the northern intersection, the backups eventually dissipate. If a roundabout is installed all traffic in the high volume legs will “hog” the roundabout and traffic in the other lags will remain stopped until the high volume leg returns to normal. Then the problem will resume as the backups in the others lanes start to hog the roundabout. During peak tourist seasons it is obvious the roundabout may well exacerbate traffic problems rather than reduce them. An Addendum included with this dialog contains detailed data related to actual traffic flows in these intersections and outlines design limitations related to Modern Roundabouts.

The next aspect of this proposed intersection modification that needs to be considered is pedestrian and bicycle traffic. First, Route 154 is designated a “Scenic Highway”. As such, it attracts a higher than normal number of cyclists who will have to safely navigate these roundabouts. Additionally, two separately funded projects are in the works. One involves the installation of sidewalks in both intersections along with additional parking for people who wish to walk to view the scenery and visit the local establishments. The second proposal involves the construction of a pedestrian walkway across the Swing Bridge with a connecting walkway to Tylerville where these intersections are located. When completed, these projects will increase both pedestrian as well as bicycle traffic in this area. As part of the proposed roundabouts, six unprotected pedestrian crosswalks are proposed. Roundabouts are designed to allow unimpeded traffic flow.(Traffic does not stop). However, by State Law vehicles entering and exiting the roundabout will be expected to stop when they observe pedestrians or cyclists in the crosswalks. When pedestrians or cyclists do cross especially during periods of high traffic, all vehicles in the roundabout will have to stop. How this will impact traffic flow through the roundabout needs to be considered. What kind of increased risk will this pose to pedestrians and cyclists is also important. Also, this proposed intersection modification is in close proximity to The Saybrook (An assisted living facility) and the recently approved 56 unit apartment complex adjacent to The Saybrook are both located within easy walking distance of the northern proposed roundabout and need to be considered and factored into any proposed modifications to this intersection.

Finally, there is the issue of maintenance and snow removal. Maintenance can be scheduled for periods of low traffic and should not present a serious problem. Snow removal is a different issue because it cannot always be scheduled for period of low traffic. In the roundabout it is not a simple matter of plowing the main travel lane. The “Truck Curbs” and adjacent sidewalks must be cleared as well. How will this be done? Will special equipment like payloaders be needed to clear the “Truck Curbs”? Will it be necessary to close the intersection to traffic while this is being done? Where will the snow be put? Who will clear the sidewalks? These concerns need to be addressed before the roundabout is built.

Alternatives to the Modern Roundabout

One obvious alternative to the Modern Single Lane Roundabout is a traditional multi-lane rotary. Use of this type of rotary is declining for several reasons. First, they consume more space and cost more to build. Second, accidents increase because of the problem with vehicle lane crossing in the rotary and drivers' lack of understanding of how it is supposed to work. The DOT has rejected this for these reasons.

There are also some simple modifications to both of these intersection that could help reduce the high volume traffic problems, but the DOT has rejected these as well. The reasons these simpler, lower cost alternative have been rejected is unclear.

One of these possible solutions would be to modify the northern intersection with what the DOT calls a “Flared” intersection. This type of intersection is similar to a “Simple” intersection except that the width of the intersection is expanded to add turning lanes to expedite traffic flow and reduce the possibility of serious accidents. Intersections like this consume less land and lend themselves more readily to snow removal. Finally, because they rely on traffic signals, the traffic flow through them can be adjusted to meet varying traffic conditions and other requirements like pedestrian and bicycle traffic. There are an infinite number of combinations of signals that could be used and, as signal control technology advances, these more standard style intersections can be readily modified or upgraded to accommodate future development in the area serviced by them.

The major advantage of a more conventional signal controlled Flared intersection over a Modern Roundabout is the ability to add important features like protected pedestrian crosswalks and reduction of backups created when the high volume roads that dominate traffic in a roundabout create backups in the lower volume legs. Finally, recent advances in traffic control signal technology could be applied which would address any potential shortcomings of conventional signal control technology.

Traffic Controlled Intersections Combined with Smart Traffic Control

The advent of "Smart Traffic Control Technology" has added a new dimension to signal controlled intersections. Unlike fixed program systems that are set when they are first installed based on previously collected data, this new technology provides for real-time adjustments based on continuous monitoring of traffic flow data together with monitoring of various things that can impact traffic flow. Based on this data, signal timing and functional adjustments to things like directional arrows, red and green light lengths, and so forth are constantly adjusted to maximized traffic flow through the intersection. This is extremely important in the case of these intersections because of the huge variations in traffic that occur here depending on the time of year and time of day.

To better understand how this might work, lets look at a real example related to these intersections involving the Swing Bridge. Sensing units could be installed near the Bridge to determine if any boats are waiting for or approaching it. These sensors could measure both the speed and height of these vessels to determine if the Bridge will need to open and for how long. Based on this, it would adjust the green light times to allow as much traffic as possible to flow across the Bridge prior to opening to minimize the size of the backup that will result from the actual opening. It may even send a signal to the Bridge operator to delay the opening for a short period to minimize these backups. In preparation for the Bridge opening, using these same signals the system will stop traffic at strategic locations to insure the intersection and business entrances located along the Bridge route are not blocked by backed up traffic when the Bridge finally does open. Once Bridge traffic is stopped lights will be appropriately reset to permit traffic not going over the Bridge to proceed uninhibited insuring there no needless backups created by the Bridge opening itself. Once the Bridge starts to close the system will sense the size of the backups at the affected intersections and readjust light settings to maximize uninhibited flow of traffic over the Bridge until the traffic load returns to normal. This is just one example of how a Smart Traffic System could be used to maximize traffic flow through these intersections. Existing programmable message signs on Route 9 could also display temporary messages warning travelers of potential delays and suggesting alternate routes.

Sensors can also be used to anticipate Railroad Crossing closures on Bridge Rd. and adjust traffic signals to maximize traffic flow for these situations. Finally, sensors can be installed at the entrances/exits from the various high traffic venues like the Opera House and as with the Bridge example, adjust signal timings to maximize flow through these intersections during these situations.

Finally, because Smart Traffic Systems employ Artificial Intelligence, the longer they operate, the smarter and the more efficient they get.

Because a Modern Roundabout has no signal controls, when the Bridge opens and traffic backs up, as it does now, the Roundabouts will become clogged with traffic and all traffic will stop. It is also likely aggressive and frustrated drivers will attempt to use the "Truck Curbs" in an attempt to get through these intersections. This will be unsafe. Furthermore, a roundabout is a “Dumb Intersection”. Once built, it is what it is and the problems it creates will remain as long as it exists. It can only be adapted to change through physical modifications.

Addendum

Based on the most recent DOT traffic count data available for the northern Tylerville intersection which was collected in late March of 2021 during the pandemic, peak traffic flows occurred between 4:00PM and 5:00PM and were about 1,200 cars per hour (See Figure 1). Unfortunately this data is not a realistic representation of peak traffic flow through this intersection for two reasons. First, because of the pandemic and second because it was collected during a period of the year when traffic through this intersection is at a minimum because all of the tourist venues were not operating. It's also important to note that during this period the Swing Bridge openings were essentially zero. However, even during this slow period, peak traffic flows were measured to be relatively high. During tourist seasons when additional traffic related to the Opera House, Cruise Boats, Steam Train, and Event Center are all high, it is not uncommon to experience traffic flows significantly higher than the ones reported here. This situation is further complicated by the periodic opening and closing of the Swing Bridge from late Spring to into the Fall which by the very nature of its operation generates significant traffic backups. The DOT's own manuals used to design roads and intersections recommends against the use of single lane roundabouts when hourly traffic volumes exceed 1800 cars per hour[3] . During the tourist season it is likely traffic volumes will exceed the 1800 car per hour limit for single lane roundabouts when all the previously mentioned venues are operating. The following statement appears on page 1.4-23 of reference[3]. “At roundabouts, motor vehicle capacity is governed by the ability of entering traffic to enter the stream of motor vehicles in the circulating roadway. This capacity is neared as the vehicular volume in the circulating roadway (single lane) approaches 1,800 motor vehicles hourly. At this point, entering the stream of circulating motor vehicles within the roundabout becomes difficult or impossible. At this threshold, additional lanes on one or more approaches and a second circulating lane should be considered.“ The US Department of Transportation guidelines also cite this figure as a limit. Finally, DOT traffic count data also revealed that even during these periods of relatively low traffic, 2,000 vehicles use Camp Bethel Rd. each day to avoid this intersection because of backups (See Figure 2). Camp Bethel Rd. is a narrow local town road with steep hills and a 300^0 hairpin turn,. This road has only about 3 dozen year- round homes, so this high traffic volume is not from the residents who live on this road. This road is routinely used as a shortcut to avoid the northern intersection currently being considered for a roundabout. When the proposed Roundabouts become gridlocked, as the guidelines suggest it will, the traffic on Camp Bethel Rd. will increase dramatically.

Figure 1 shows the traffic data cited above. Figure 2 is a DOT map showing the traffic data pictorially. Another important fact shown here is the imbalance in traffic flows between the various legs of both intersections. This data shows an imbalance of more that 2 to 1, another condition that makes the use of a Modern Single Lane Roundabout potentially problematic. It also shows the shortcut traffic flow through Camp Bethel Rd. Finally, Photos 1 & 2 were taken seconds apart at about 4:30 on May 21, 2021 showing these backups. Note the small gaps between the vehicles. Finally, the references are links to the web pages where the information was obtained or the titles of manuals cited above.

Status: OK | West | Combined | East | Class | Speed

eHAD-085 - Combined - e/w Route 82 - 3.8 mi | At the Haddam Town Line

Collected during COVID-19 epoch

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Town............................East Haddam
Station.................................85
Location.............. 41.451685,-72.46447
Posted Speed Limit..................25 MPH
2015-Minor Arterial  4..........2015-Rural
Start Report...........29-Mar-2021 02:00PM
End Report.............01-Apr-2021 01:00PM
Annualized ADT.......................11800
24-Hour Count...10770 * G2(1.08) = 11631.6
Day 1..........+11399 * G2(1.08) = 23942.5
Day 2..........+10482 * G2(1.08) = 35263.1
UnRounded AADT.......35263.1 / 3 = 11754.4
OK  2021 Mon 29-Mar -this report-...11800
OK  2019 Wed 23-Oct ................11100
OK  2018 Wed 09-May ................11600
OK  2015 Wed 10-Jun ................11600
OK  2009 Tue 12-May .................9800
OK  2006 Mon 27-Mar ................10000
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	29-Mar Mon	30-Mar Tue	31-Mar Wed	01-Apr Thu
12:00am		48	43	44
01:00am		13	13	4
02:00am		14	9	6
03:00am		20	7	13
04:00am		62	67	49
05:00am		301	274	235
06:00am		613	607	571
07:00am		838	805	751
08:00am		748	671	744
09:00am		293	574	636
10:00am		549	575	627
11:00am		648	563	637
12:00pm		643	687	724
01:00pm	x	684	603	x
02:00pm	888	871	868	
03:00pm	967	1102	881	
04:00pm	1137	1273	1126	
05:00pm	893	907	881	
06:00pm	559	706	476	
07:00pm	350	424	263	
08:00pm	215	283	205	
09:00pm	144	176	139	
10:00pm	72	93	89	
11:00pm	71	90	56	
Totals	5296	11399	10482	5041

Figure 1

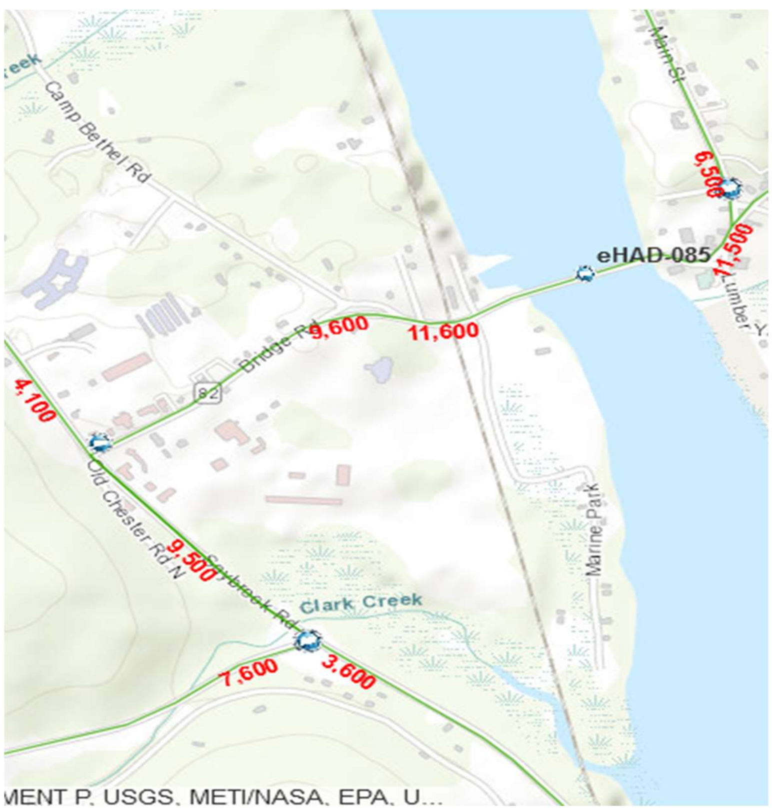

Figure 2

Photo 1

Photo 2

Ref. 1 https://tminfo-dot.ct.gov/TMINFO/top?year=latest,town=40,station=85,dataset=0

Ref. 2 https://tminfo-dot.ct.gov/TMINFO/reparse?wgid=reposerv10349,f=CLASS

Ref. 3 NorwalkTMP Chapter 1.Section 4 Intersection Design PDF page 1.4-23