PRELIMINARY DESIGN REPORT - TRAFFIC

September 2013

Prepared for:

Town of Concord
Concord Public Works

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1.0 INTRODUCTION

The Town of Concord and the Louis Berger Group (LBG) Design Team are undertaking the Cambridge Turnpike Improvement Project to develop and implement a comprehensive plan to improve the many problems that affect the roadway from Lexington Road to Routes 2 and 2A (Crosby's Corner). While the primary focus of this project is to address the existing drainage conditions that result in frequent road closures, flooding of homes and businesses, we recognize the community's priority issues of Traffic, Pedestrian and Bicycle Safety and Traffic Congestion.

This Preliminary Design Report (PDR) focuses on the traffic improvements along the Cambridge Turnpike from Lexington Road to Route 2 in Concord, Massachusetts and presents preliminary design alternatives for the study area.

Improvements are being considered at the intersections of Cambridge Turnpike with Lexington Road, Hawthorne Lane, Mildred Circle and Sandy Pond Road. The existing Lexington Road intersection is a critical location due to the skewed alignment which creates difficult lines of sight and sharp turning angles. Traffic volumes are high and delays are lengthy during peak hours. Substantial improvements are being considered at this location. Crosby's Corner, at the intersection of Cambridge Turnpike and Concord Turnpike (Route 2), was recently redesigned and is currently under construction as part of a separate Massachusetts Department of Transportation (MassDOT) project. The Cambridge Turnpike Improvement Project will meet with the limit of new construction at Crosby's Corner and therefore this intersection is not considered herein.

At each of the four intersections listed above and along the entire project length from Lexington Road to Routes 2 and 2A, the LBG Design Team has:

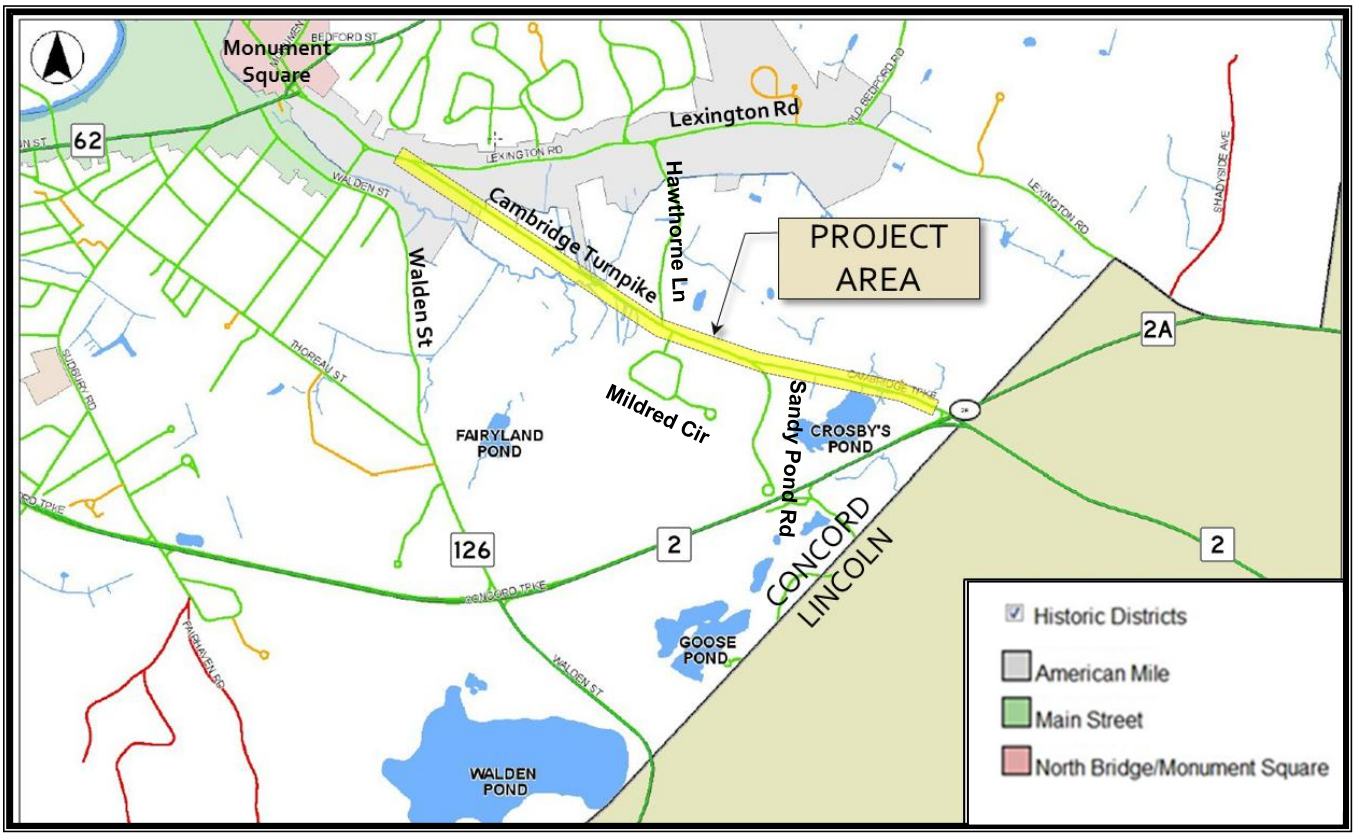
- Collected existing traffic volumes;
- Measured intersection sight distance using desktop software and verified the measurements in the field;
- Evaluated intersection turning radii to determine if improvements are justified;
- Analyzed speed and crash data to determine any changes that may improve safety;
- Defined possible design concepts for improving the operation of each intersection;
- Evaluated measures to reduce speed and facilitate pedestrian and bicycle traffic along the Cambridge Turnpike;
- Performed traffic operational analyses to compare the functionality of the proposed improvements.

1.1 The Study Area

The portion of the Cambridge Turnpike studied lies to the east of the historic Concord downtown. The Ralph Waldo Emerson House and the Concord Museum are immediately

adjacent to the intersection of Cambridge Turnpike and Lexington Road. Limited on-street parking is currently available near these two attractions and will be considered in all design options. A study area map identifying the limits of this project is provided in Figure 1.

Figure 1 – Study Area



2.0 EXISTING CONDITIONS

2.1 Survey and Base Plan Preparation

The LBG Design Team completed an existing conditions survey utilizing an aerial photogrammetry survey performed in April 2012 and supplemented by a detailed on-the-ground topographic survey. From this information, an existing conditions base map was produced for the project limits.

The survey included the collection of existing topographic features and roadway cross-sections along Cambridge Turnpike. The survey included approximately 7000 linear feet of Cambridge Turnpike, beginning at the intersection with Lexington Road and continuing southeasterly to approximately 200 feet northwesterly of the intersection with Concord Turnpike (Route 2). The survey extended laterally approximately 50 feet from the centerline of the roadway and included about 100 feet at cross streets.

2.2 Traffic Data Collection

Accurate Counts, under contract with LBG, conducted automatic traffic recorder (ATR) counts over a two-day period from Wednesday, September 26th to Thursday, September 27th 2012. Volumes were recorded for each 15 minute period and summarized for each hour. These ATR counts were taken at six locations to determine 24-hour directional traffic volumes. Four ATR counts were conducted along Cambridge Turnpike and two additional counts were taken on Lexington Road east and west of the Cambridge Turnpike intersection.

In addition, ***Accurate Counts*** conducted manual turning movement counts (TMCs) and pedestrian counts on Thursday September 27th and Tuesday October 9th 2012 at the following locations and during the time periods specified below:

- Cambridge Turnpike & Lexington Road (7:00– 9:00 AM and 4:00– 6:00 PM)
- Cambridge Turnpike, Hawthorne Lane & Mildred Circle (8:00-9:00 AM and 5:00- 6:00 PM)
- Cambridge Turnpike & Sandy Pond Road (7:00-8:00 AM and 4:00-5:00 PM).

The ***Accurate Counts*** raw data sheets from the ATR and manual TMC can be found in Appendix A.

2.3 2012 Traffic Volumes

The ***Accurate Counts*** ATR data shows the ADT (Average Daily Traffic) on Cambridge Turnpike to be between 5,493 and 6,136 vehicles per day (veh/day); depending on the location of the counter. The ADT on Lexington Road was recorded to be 9,941 veh/day east of Cambridge Turnpike and 15,664 veh/day west of Cambridge Turnpike.

A MassDOT count completed in 2007 showed the ADT on Cambridge Turnpike to be 6,994 veh/day. The 2007 MassDOT count included a full vehicle classification count which indicated that 1.5% of the vehicles were trucks and 0.5% were buses. The 2007 classification count can be found in Appendix A.

The 2012 TMC obtained by ***Accurate Counts*** were filtered to estimate 2012 weekday AM and PM peak hourly volumes. The adjustment of the traffic counts to account for seasonal factors was then considered. Upon review of the monthly adjustment factors supplied by MassDOT, LBG concluded that September counts are typically higher as compared to the average yearly daily traffic. Since the seasonal adjustment would produce lower volumes than those collected, LBG did not adjust the traffic counts and utilized the more conservative, unadjusted traffic counts for the traffic analysis. Peak hourly volumes (PHV) derived from these traffic counts were used to determine traffic operations at the three intersections located on the Cambridge Turnpike within the project area during the peak commute periods for existing and future conditions.

Existing weekday morning and evening peak hour traffic volumes have been derived from the 2012 TMCs and utilized in this PDR. Figure 2 and Figure 3 illustrate a schematic representation of AM and PM peak hour traffic flow in the study area. The variations in peak traffic between the intersections shown on Figures 2 and 3 are due to daily changes in traffic. Not all intersections within the study area were counted on the same day of the week.

The 2012 ATR counts taken by ***Accurate Counts*** were compared to the peak hour TMC data for verification purposes. It was found that the data from the two collections compares well and is within the standard deviation to be expected for traffic data collection. AM and PM peak hour ATR data is available in Appendix A.

Figure 2 – 2012 AM Peak Hour Traffic Counts

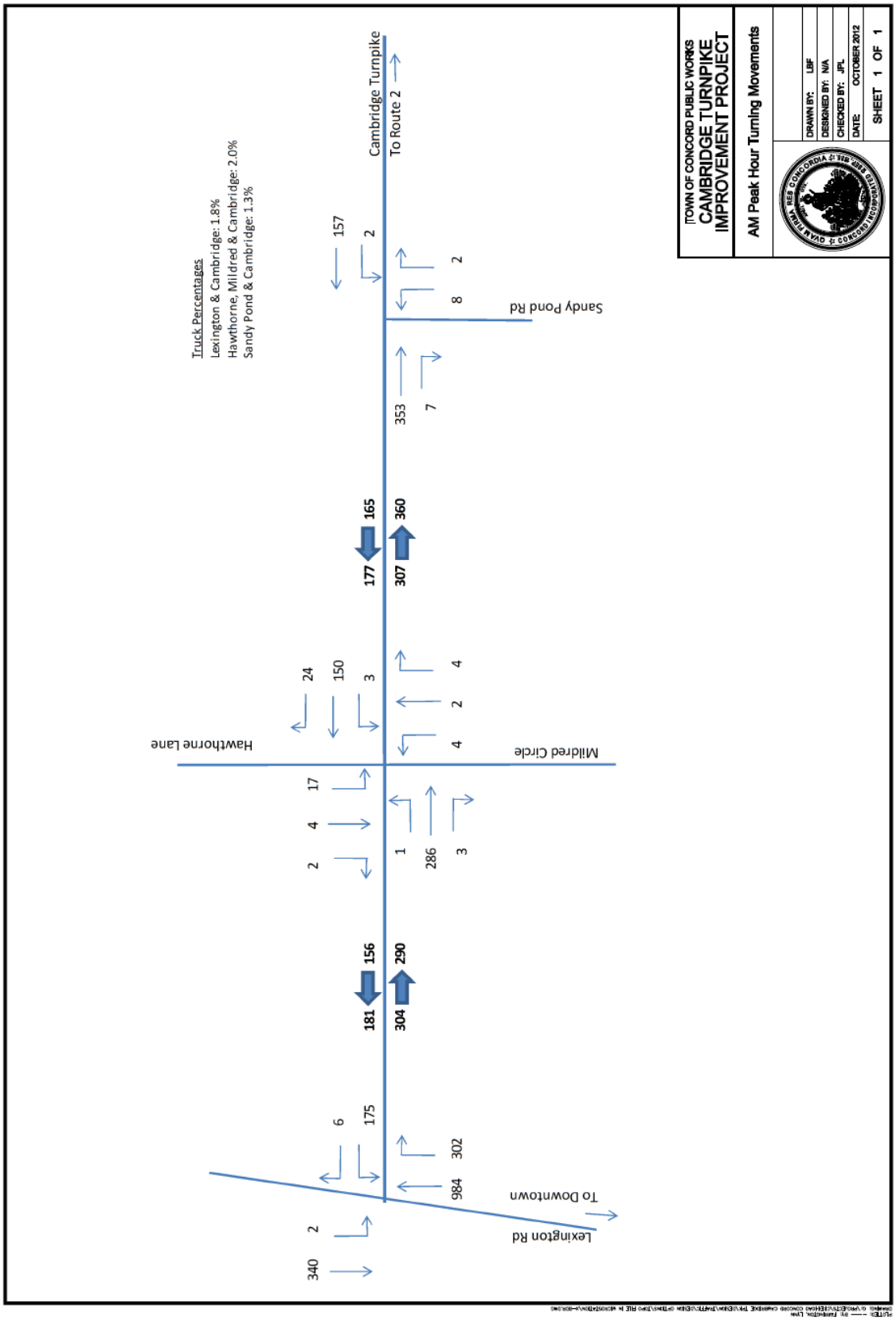
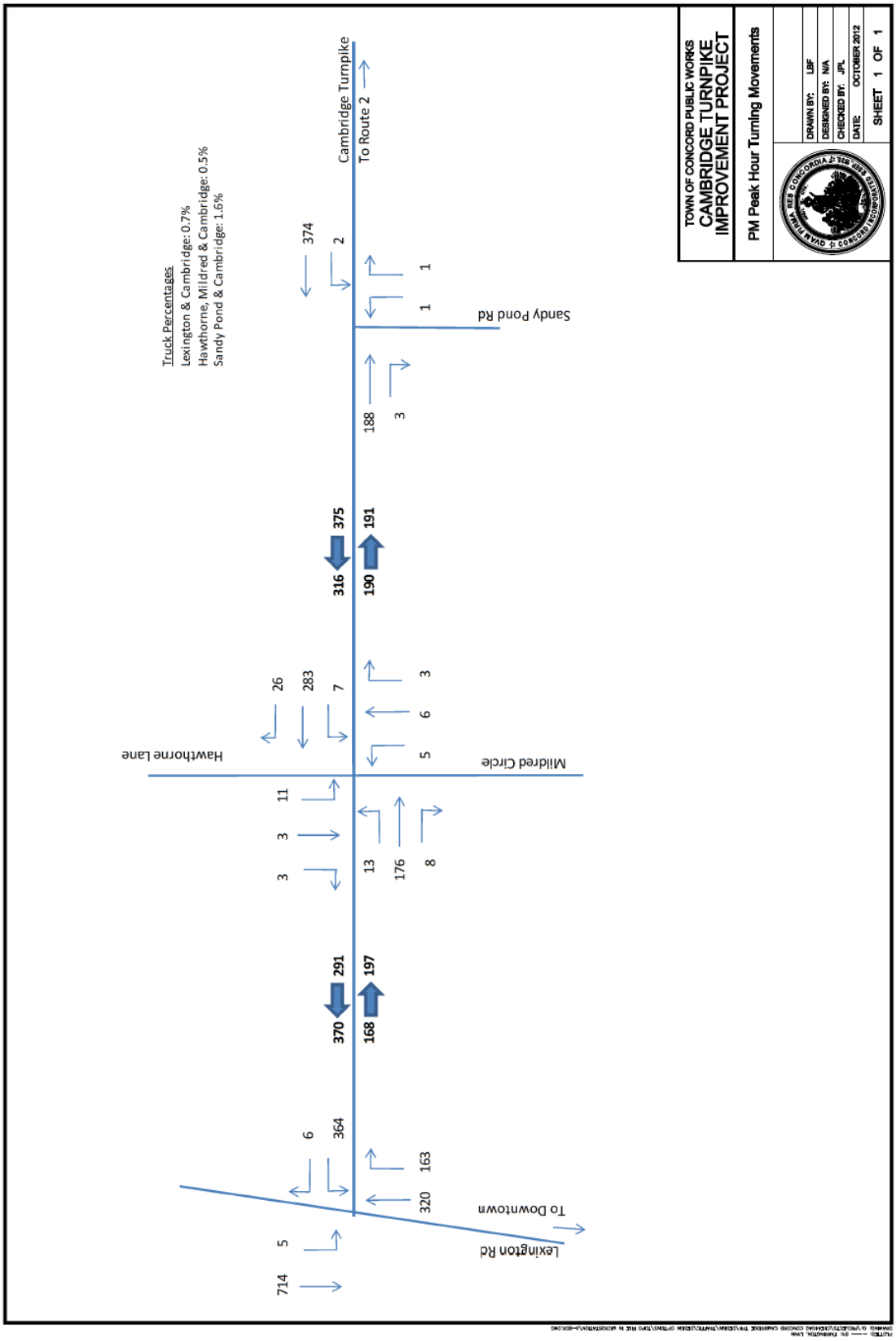


Figure 3 – 2012 PM Peak Hour Traffic Counts



2.4 Existing Conditions on Cambridge Turnpike

Geometry

The section of Cambridge Turnpike being studied is classified by MassDOT as a rural major collector. The length of the roadway from Lexington Road to Route 2 is approximately 1.3 miles. The typical width of the traveled roadway is 24-feet with a double-yellow centerline stripe. No striped shoulders are present. In addition to the traveled roadway width, an average 5-feet wide sidewalk is present on the northerly side of the road from Lexington Road to Hawthorne Lane and along the southerly side from Hawthorne Lane to Mildred Circle.

Travel Speed

Speed data was collected during the ATR counts at three locations on the Cambridge Turnpike within the study area and is included in Appendix A. Recorded speeds are reported as the average and 85th percentile speeds. 85th percentile speed is the speed at or below which 85% of all vehicles are observed to travel. The speed limit throughout the study area is posted at 35 miles per hour (mph). Figure 4 presents the average speed data collected, while Figure 5 presents the 85th percentile speed data collected. Generally, the average speed is within 5 mph of the posted speed limit and the 85th percentile speed is 7-12 mph above the posted speed.

Figure 4 – Average Speed Data on Cambridge Turnpike

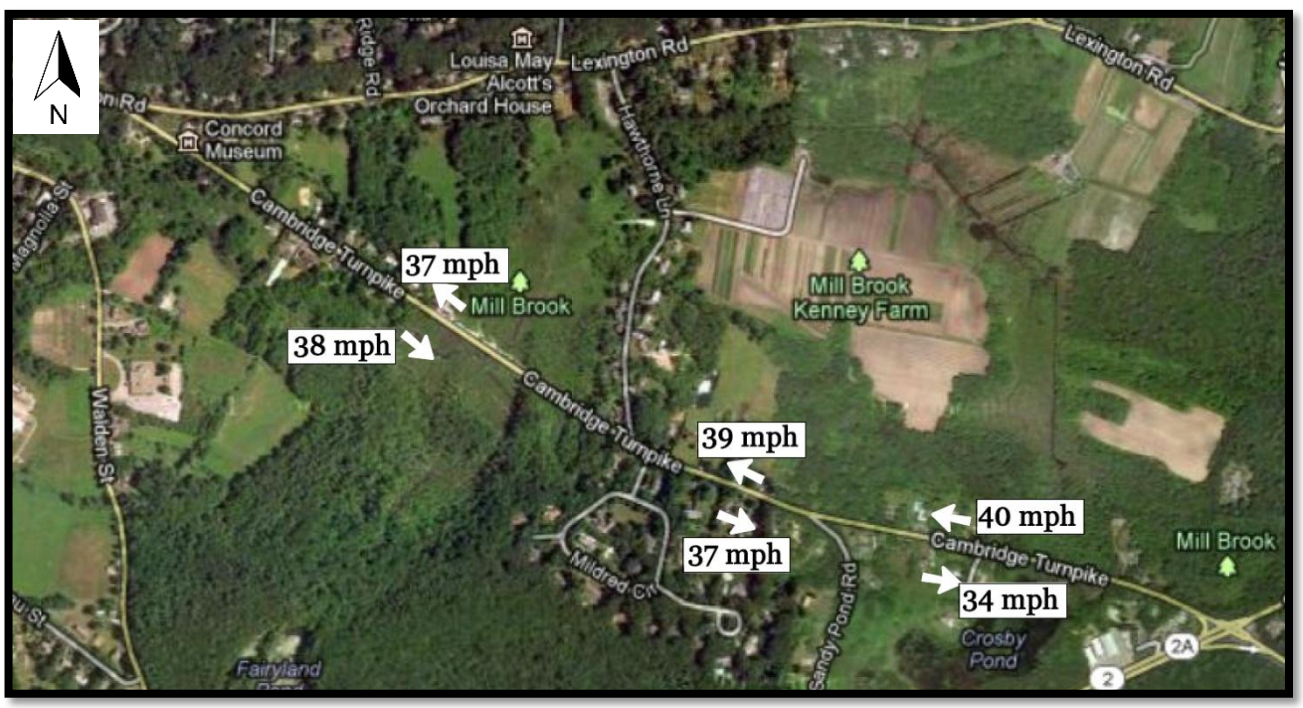


Figure 5 – 85th Percentile Speed Data on Cambridge Turnpike

Terrain

Overall, the terrain of Cambridge Turnpike is described as rolling. Existing grades vary from three-tenths of a percent to six percent. The lower lying areas near Mill Brook Farm and Crosby Pond have historically been problematic due to flooding of Mill Brook. Roadside development is mostly open with some vegetation and significant wet, low lying areas. Amongst predominantly residential land use, a roadside farm stand and two museums are also located within the limits of this study.

2.5 Existing Conditions at Lexington Road

The existing intersection of Cambridge Turnpike and Lexington Road was analyzed based on the criteria of safety, traveling speed, sight distance, traffic operations, and turning movements.

Figure 6 – Aerial: Lexington Road Intersection

Safety

Motor vehicle crash data for the Town of Concord during the most recent three-year period available (January 2008 through December 2010) was obtained from MassDOT. Data was sorted by location to determine if applicable to the study area.

From 2008 to 2010, seven reported crashes occurred at the intersection of Cambridge Turnpike and Lexington Road according to MassDOT data. The Town of Concord Safety Officer was also contacted but no additional accident data was available. The crash rate per million entering vehicles (MEV) is calculated as 0.40 which is lower than the average crash rate in the district (0.59). The detailed crash analysis and MassDOT crash rate worksheet are provided in Appendix B.

Four of the seven crashes at this intersection were classified as 'rear-end', occurring when a vehicle stopped at the intersection was struck from behind. These rear-end type crashes may be attributed to the difficult sight lines at the intersection. One explanation of circumstances could be that a driver at the WB Cambridge Turnpike stop sign begins to enter the Lexington Road traffic stream, realizes a conflicting vehicle is nearby and stops abruptly, causing the following driver to strike the rear of the first vehicle.

Appropriate signage and striping is lacking at this intersection:

- No signage encouraging drivers to use the Connector Road for right turns onto Lexington Road.
- No signage prohibiting right turns onto Lexington Road from the end of Cambridge Turnpike. This right turn is very dangerous due to the skew of the intersection and the narrow width of the two roads, and encroaches upon the opposite direction of traffic.
- No stop sign or striping on the Connector Road.

Sight Distance

The required sight distance necessary to depart from the stop condition, as described in the *2011 AASHTO Geometric Design of Highways and Streets,* was evaluated and compared to the actual sight distance observed in the field. Both stop controlled legs of the intersection meet the necessary design criteria for 35 mph, as illustrated in Table 1.

Although no stop sign is present at the Connector Road/Lexington Road, this intersection is analyzed as a stop-controlled intersection and the required sight distances listed in the table below correspond to the stop-controlled condition.

Table 1– 35 mph Sight Distance (Required vs. Existing)

		Looking Right		Looking Left	
Intersection	**Description**	**Required Sight Distance (ft)**	**Existing Sight Distance (ft)**	**Required Sight Distance (ft)**	**Existing Sight Distance (ft)**
Lexington Road & Cambridge Turnpike	**From Cambridge Turnpike**	390	545	335	705
Lexington Road & Cambridge Turnpike	**From Connector Road**	390	705	335	790

While the criteria for sight distance are met, the skew of the intersection does cause other problems including:

- The vehicle body may obstruct the line of sight of drivers with an acute-angle approach to the driver's right.
- Vehicles have a longer distance to traverse while turning onto WB Lexington Road, resulting in an increased time of exposure to the cross-street traffic.
- Elderly drivers or drivers with physical impairments may find it more difficult to turn their heads, necks, or upper bodies for an adequate line of sight.
- Through-roadway drivers making left turns across an obtuse angle may attempt to maintain a higher than normal turning speed and cut across the oncoming EB traffic on Lexington Road.

Traffic Operations

A Level-of-Service (LOS) analysis was completed for this intersection established on base year (2012) traffic volumes with existing geometry and lane configurations. Intersection capacity

analyses were performed using both HCS (Highway Capacity Software) and SYNCHRO 6.0. Both are computer software packages based on the methodology outlined in the *2000 Highway Capacity Manual* (HCM). HCS is preferred for analyzing stop controlled intersections while SYNCHRO is the preferred program for signalized intersections and roundabouts. The analyses assign a level of service (LOS) to each lane group, which is then aggregated for the approach and intersection.

LOS is a qualitative measure describing operational conditions within a traffic stream, generally in terms of factors such as speed, travel time, and freedom to maneuver. There are six LOS conditions designated by letters A to F, with LOS A representing the best operating condition and LOS F the poorest. Each level of service is a representation of a range of operating conditions and how drivers perceive them. The LOS criteria for unsignalized intersections are summarized in Table 2.

Table 2 – LOS Criteria, Unsignalized Intersections

Level of Service	Average Delay (sec/veh)
A	≤ 10
B	>10-15
C	>15-25
D	>25-35
E	>35-50
F	>50

The LOS criteria for signalized intersections are summarized in Table 3.

Table 3 – LOS Criteria, Signalized Intersections

Level of Service	Average Delay (sec/veh)
A	≤ 10
B	>10-20
C	>20-35
D	>35-55
E	>55-80
F	>80

The LOS at the stop controlled approach of the intersection (Cambridge Turnpike in the northwest bound direction) is 'F' during both the AM and PM peak hours. Average delay per vehicle was between 7 and 8 minutes during both peak times. While these values may be exaggerated in comparison to actual conditions (it has been proven that heavy congestion causes drivers at stop controlled intersections to accept shorter gap lengths to merge with traffic) this analysis still shows that there is a real operational concern at this location. The overall LOS for the intersection is also 'F', even though the Lexington Road approaches are free flowing.

There are two museums in close proximity to this intersection which generally should not impact traffic operations. The peak travel times at the Lexington intersection generally occur from 7:30 to 9:00 AM and from 5:00 to 6:00 PM, Monday through Friday. The hours for the Concord Museum do not conflict with these heavy travel times at any point during the year. As of fall 2012, the Museum's hours are listed as:

April – December
Monday – Saturday: 9:00 AM – 5:00 PM
Sunday 12:00: PM – 5:00 PM
Open Sundays in June, July and August: 9:00 AM – 5:00 PM
January – March
Monday – Saturday: 11:00 AM – 4:00 PM
Sunday: 1:00 PM – 4:00 PM

The hours of the Ralph Waldo Emerson House do not conflict with the Lexington intersection peak travel times either. As of fall 2012, the Emerson House's hours are:

April 24th – October 26th
Thursday – Saturday: 10:00 AM – 4:30 PM
Sunday and Holiday Mondays: 1:00 PM – 4:30 PM

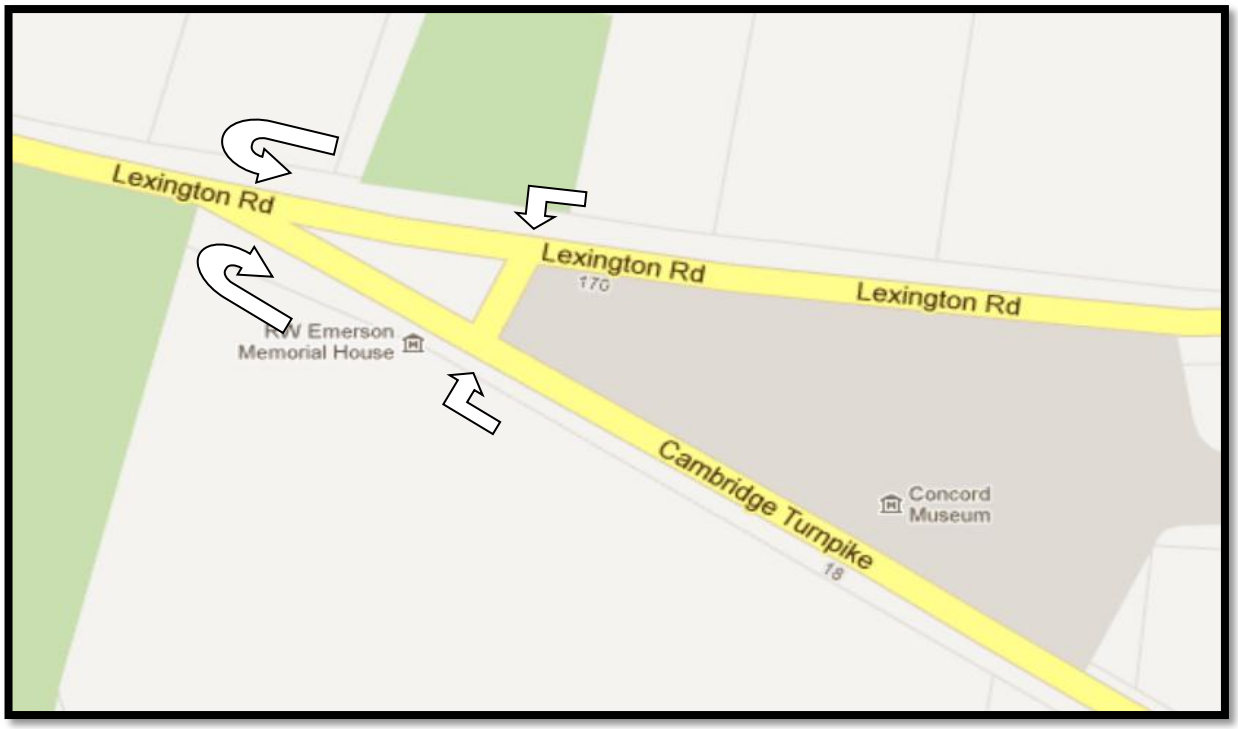
Truck and Bus Turning Movements
At the Lexington Road intersection the ATR counts indicate that 1.8% of traffic is classified as a 'truck' during the AM peak hour and 0.8% during the PM peak.

The existing roadway layout was evaluated using a semitrailer model vehicle with a 50-feet wheel base (WB-50). This is the recommended design vehicle for arterial roadways from the *2006 MassHighway Project Development and Design Guide*. The analysis shows that geometry constraints interfere with proper truck turning maneuvers and WB-50 or larger vehicles are forced to track beyond the edge of pavement to complete the turning movement. This is true for vehicles making the following movements:

- Left from Lexington Road onto the Connector Road
- Right from Cambridge Turnpike onto the Connector Road
- Left from Lexington Road onto Cambridge Turnpike
- Right from Cambridge Turnpike onto Lexington Road.

These four maneuvers are illustrated in Figure 7.

Figure 7 – Restricted Truck Turning Movements (WB-50) at Lexington Road Intersection



It is believed that truck operators familiar with the area currently avoid these movements when possible.

Bus access is also an important consideration at this intersection to ensure that large groups can continue to visit the Concord Museum and Emerson House by way of tour bus. Both facilities currently offer group tours; the museum tour is approximately one hour in length and the Emerson house, grounds and garden can be viewed in roughly 30 minutes. While buses coming from downtown Concord can easily make the right turn onto Cambridge Turnpike, buses coming from WB Lexington Road may need to find an alternative route and deviate from the most direct path in order to access the Concord Museum or Emerson House sites.

Parking

The Concord Museum currently utilizes both on and off street parking. The Emerson house utilizes on street parking only. There are approximately thirteen unstriped, paved on street parking spaces on the northerly side of the road and fifteen unstriped, gravel shoulder parking spaces on the southerly side of the road. The museum typically handles 50 to 60 visitors a day and most will spend between 1 and 2 hours. Fewer visitors can be expected at the Emerson house each day and they typically spend less than an hour on the grounds. The parking for both facilities is reportedly sufficient unless there is a special exhibit or function.

2.6 Existing Conditions at Hawthorne Lane

The existing intersection of Cambridge Turnpike and Hawthorne Lane was analyzed based on the criteria of safety, sight distances and vehicle turning movements.

Figure 8 – Aerial: Hawthorne Lane Intersection

Safety

Motor vehicle crash data for the Town of Concord during the most recent three-year period available (January 2008 through December 2010) was obtained from MassDOT. Data was sorted by location to determine if applicable to the study area.

From 2008-2010, two reported crashes occurred at the intersection of Cambridge Turnpike and Hawthorne Lane. The crash rate per MEV is calculated as 0.31 which is lower than the average crash rate in the district (0.59). The detailed crash analysis and MassDOT crash rate worksheet are provided in Appendix B.

One crash was classified as an 'angle' collision where a vehicle was struck while turning left. The other was a head on collision of two vehicles traveling straight ahead on the Cambridge Turnpike in rain conditions.

There is currently no stop sign or striping on Hawthorne Lane at the intersection with Cambridge Turnpike.

Sight Distance

The required sight distance necessary to depart from the stop condition, as described in the *2011 AASHTO Geometric Design of Highways and Streets,* was evaluated and compared to the actual sight distance observed in the field. The stop controlled leg of the intersection did not meet the necessary design criteria for 35 mph in either direction, as illustrated in Table 3.

Although no stop sign is present, this intersection is analyzed as a stop-controlled intersection and the required sight distances listed in the table below correspond to the stop-controlled condition.

Table 4 – 35 mph Sight Distance (Required vs. Existing)

		Looking Right		Looking Left	
Intersection	**Description**	**Required Sight Distance (ft)**	**Existing Sight Distance (ft)**	**Required Sight Distance (ft)**	**Existing Sight Distance (ft)**
Cambridge Turnpike & Hawthorne Lane	**From Hawthorne Lane**	390	145	335	265

Lack of appropriate sight distance at this location is due to overgrown vegetation, as shown in Figure 9.

Figure 9 – Vegetation at Hawthorne Lane Intersection (looking southeast)

Truck Turning Movements

The TMCs indicate that 10% of traffic entering and exiting Hawthorne lane during the AM peak hour is classified as a truck or bus. This is the equivalent of four larger vehicles entering Hawthorne Lane and one exiting. No trucks or buses were recorded entering or exiting Hawthorne Lane during the PM peak hour.

The existing roadway layout was evaluated using a single unit model vehicle that is 30-feet in length with a 20-feet wheel base (SU-30), commonly called a box truck. The analysis shows that the current roadway layout does not interfere with proper truck turning maneuvers at this location. There is currently no lane striping on Hawthorne at this intersection.

2.7 Existing Conditions at Mildred Circle

The existing intersection of Cambridge Turnpike and Mildred Circle was analyzed based on the criteria of safety, and sight distances.

Figure 10 – Aerial: Mildred Circle Intersection

Safety

Motor vehicle crash data for the Town of Concord during the most recent three-year period available (January 2008 through December 2010) was obtained from MassDOT. Data was sorted by location to determine if applicable to the study area.

From 2008-2010, one reported crash occurred at the intersection of Cambridge Turnpike and Mildred Circle. The crash rate per MEV is calculated as 0.16 which is lower than the average crash rate in the district (0.59). The detailed crash analysis and MassDOT crash rate worksheet are provided in Appendix B.

The crash was a single vehicle collision with a tree during snow conditions.

There is currently no stop sign or striping on Mildred Circle at the intersection with Cambridge Turnpike.

Sight Distance

The required sight distance necessary to depart from the stop condition, as described in the *2011 AASHTO Geometric Design of Highways and Streets,* was evaluated and compared to the actual sight distance observed in the field. The stop controlled leg of the intersection meets the design criteria for a driver looking to the right in one direction but does not meet the criteria for a driver looking to the left, as illustrated in Table 5.

Although no stop sign is present, this intersection is analyzed as a stop-controlled intersection and the required sight distances listed in the table below correspond to the stop-controlled condition.

Table 5 – 35 mph Sight Distance (Required vs. Existing)

		Looking Right		Looking Left	
Intersection	**Description**	**Required Sight Distance (ft)**	**Existing Sight Distance (ft)**	**Required Sight Distance (ft)**	**Existing Sight Distance (ft)**
Cambridge Turnpike & Mildred Circle	**From Mildred Circle**	390	850	335	205

Lack of appropriate sight distance at this location is due to overgrown vegetation, as shown in Figure 11.

Figure 11 – Vegetation at Mildred Circle Intersection (looking northwest)

2.8 Existing Conditions at Sandy Pond Road

The existing intersection of Cambridge Turnpike and Sandy Pond Road was analyzed based on the criteria of safety, sight distance and truck turning movements.

Figure 12 – Sandy Pond Rd Intersection

Safety

Motor vehicle crash data for the Town of Concord during the most recent three-year period available (January 2008 thru December 2010) was obtained from MassDOT. Data was sorted by location to determine if applicable to the study area.

From 2008-2010, two reported crashes occurred at the intersection of Cambridge Turnpike and Sandy Pond Road. The crash rate per MEV is calculated as 0.29 which is lower than the average crash rate in the district (0.59). The detailed crash analysis and MassDOT crash rate worksheet are provided in Appendix B.

One crash was classified as an 'angle' collision where a vehicle was struck while attempting to make a U-turn. The other was a single vehicle crash with limited details reported.

There is currently no lane striping or regulatory signage on Sandy Pond Road at this intersection.

Sight Distance

The required sight distance necessary to depart from the stop condition, as described in the *2011 AASHTO Geometric Design of Highways and Streets,* was evaluated and compared to the actual sight distance observed in the field. The stop controlled leg of the intersection does not meet the necessary design criteria in either direction, as illustrated in Table 6.

Table 6 – 35 mph Sight Distance (Required vs. Existing)

		Looking Right		Looking Left	
Intersection	**Description**	**Required Sight Distance (ft)**	**Existing Sight Distance (ft)**	**Required Sight Distance (ft)**	**Existing Sight Distance (ft)**
Cambridge Turnpike & Sandy Pond Road	**To turn Left from Sandy Pond Road**	390	530	335	260
Cambridge Turnpike & Sandy Pond Road	**To turn Right from Sandy Pond Road**	390	170	335	335

Lack of appropriate sight distance, when looking left from Sandy Pond Road, is due to the vertical curvature of the Cambridge Turnpike, as shown in Figure 13. Lack of appropriate sight distance, when looking right from Sandy Pond Road, is due to overgrown vegetation, as shown in Figure 14.

Figure 13 – Vertical Curve of Cambridge Turnpike (looking left from Sandy Pond Rd)

Figure 14 - Vegetation at Sandy Pond Rd Intersection (looking southeast)

Truck Turning Movements

The TMCs indicate that 15.8% of traffic entering and exiting Sandy Pond Road during the AM Peak Hour is classified as a 'truck' or bus. This is the equivalent of one larger vehicle entering Sandy Pond Road and two larger vehicles exiting. No trucks or buses were recorded entering or exiting Sandy Pond Road during the PM peak hour.

The existing roadway layout was evaluated using a single unit model vehicle that is 30-feet in length with a 20-feet wheel base (SU-30), commonly called a box truck. The analysis shows that the current roadway layout does not interfere with proper truck turning maneuvers at this location.

3.0 FUTURE CONDITIONS

3.1 Growth Rate

Base year traffic volumes were projected from the current year to the 2030 forecast year. LBG has been advised by the Metropolitan Area Planning Council (MAPC) of historical growth in this Traffic Analysis Zone (TAZ). Based on the historical traffic counts, area development plans and anticipated future conditions, a growth rate of 0.5% was recommended. LBG considers this average growth rate of one half percent per year to be appropriate.

3.2 Future Design Volumes

The traffic flow maps for the forecasted AM and PM peak hours of future year 2030 are presented in Figure 15 and Figure 16.

Figure 15 – 2030 AM Peak Hour Volumes

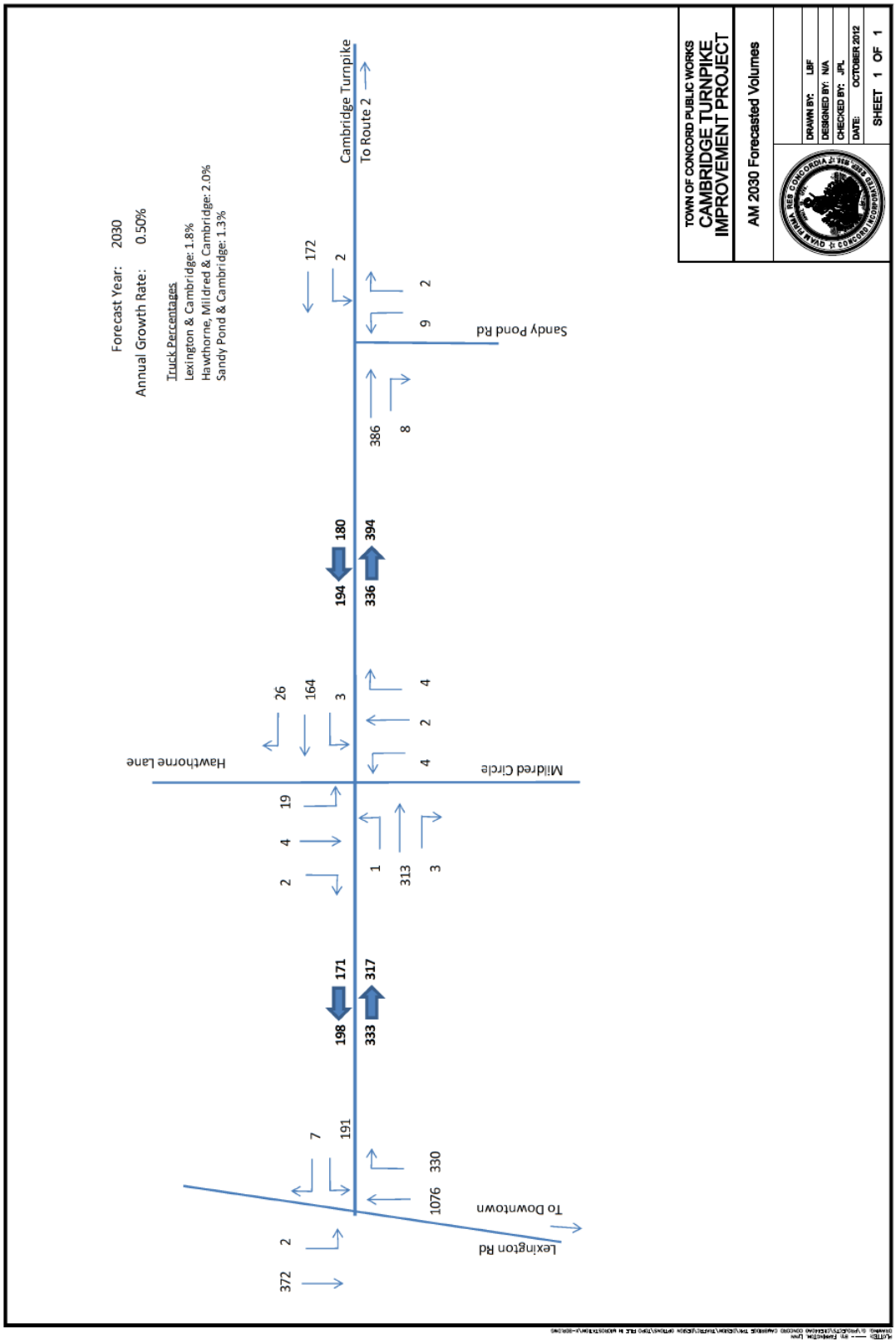
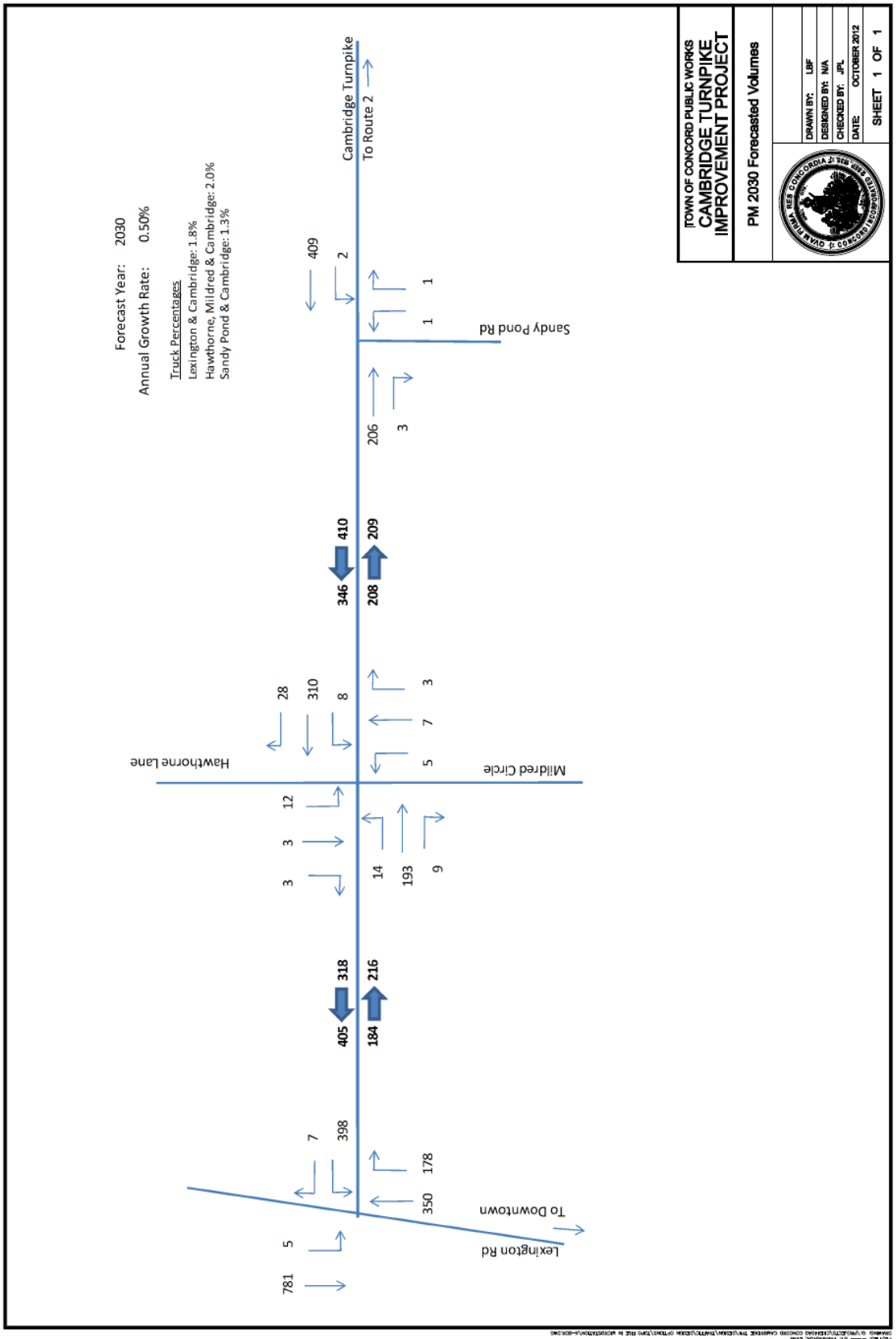


Figure 16 – 2030 PM Peak Hour Volumes



4.0 INTERSECTION ALTERNATIVES

Possible improvements and upgrades to each intersection were considered and analyzed based on the following criteria, whenever appropriate:

1. Safety
2. Sight Distance
3. Traffic Operations
4. Turning Movements
5. Cost
6. Tree Removal
7. Green Space/Impervious Area
8. Historical Impact
9. Parking
10. Land Acquisition

The Cambridge Turnpike / Lexington Road intersection is significantly more complex than the other intersections. At this location, the following 5 alternatives were analyzed and discussed:

- No-Build Alternative – Existing Conditions
- Alternative 1 – Re-route WB Cambridge Turnpike with stop control
- Alternative 2 – Signalized Intersection
- Alternative 3 – Roundabout
- Alternative 4 – Re-route EB and WB Cambridge Turnpike with stop control
- Alternative 5 – Relocate intersection east of Concord Museum

4.1 No-Build Alternative at Lexington Road – Existing Conditions

The No-Build Alternative proposes to leave the Lexington Road intersection configuration as it is today. The current layout is shown on Figure 17.

Minor grading, striping and tree trimming may be included but the capacity, operation, and safety aspects would not change significantly. As traffic volumes increase, vehicle delays for Cambridge Turnpike will also increase and safety may deteriorate.

20 0 10 20 40 80

GRAPHIC SCALE

TOWN OF CONCORD PUBLIC WORKS

CAMBRIDGE TURNPIKE IMPROVEMENT PROJECT

FIGURE 17
NO-BUILD ALTERNATIVE

DRAWN BY:	TW
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DATE:	SEPTEMBER 2013

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Safety and Sight Distance

Seven crashes occurred at this intersection during the most recent three year period available. This is not ranked as a high crash location and the calculated crash rate per MEV is lower than the district average. However, without geometric improvements to this intersection, no decrease in the crash rate would be expected.

While this intersection currently meets sight distance requirements, the skew of the intersection proves to cause difficulty for many drivers. Intersections with large skew can cause issues for drivers being able to find an adequate line of sight and aligning vehicles as they enter the intersection. This issue is not expected to improve, if the intersection geometry is not altered.

Traffic Operations

Current traffic operations for the Cambridge Turnpike approach at Lexington Road are operating at a failing 'F' LOS during the weekday AM and PM peak hours. With no improvements to capacity, the delay times and queue lengths on the Cambridge Turnpike are expected to grow as traffic increases in the future. Table 7 and Table 8 show the current and projected delays, LOS and queue lengths of the Cambridge Turnpike approach at Lexington Road, for the No-Build Alternative. More details are provided in Appendix D.

Table 7 - Delay and LOS – No-Build Alternative

	Cambridge Tpke Westbound	
	Delay (sec)	*LOS*
2012 AM	469	F
2030 AM	791	F
2012 PM	465	F
2030 PM	711	F

Table 8 – 95th Percentile Queue Length[1] (# of cars) – No-Build Alternative

	Cambridge Tpke
2012 AM	15
2030 AM	19
2012 PM	28
2030 PM	35

The delays on the Cambridge Turnpike are expected to increase to over 11 minutes by year 2030 during both peak hours. The advantage of the current layout of a single stop controlled leg is that

[1] The 95th percentile queue is the length of the queue below which 95% of the observations may be found.

the Lexington Road approaches are essentially free flowing and experience no significant delay. However, during the PM peak hour, westbound Lexington Road queues forming at Monument Square occasionally extend to the Cambridge Turnpike intersection. During these circumstances, the intersection delays would be increased for all scenarios.

Truck Movements
As mentioned previously, the existing roadway layout cannot accommodate a semitrailer for the following movements:

- Left from Lexington Road onto the Connector Road
- Right from Cambridge Turnpike onto the Connector Road
- Left from Lexington Road onto Cambridge Turnpike
- Right from Cambridge Turnpike onto Lexington Road.

This condition is not expected to change with the No-Build alternative. Significant roadway widening would be required to accommodate these movements or they could be restricted with signs advising truck drivers to seek an alternate route.

Cost
The construction costs associated with the No-Build alternative are very minimal.

Tree Removal
No trees are expected to be removed with the No-Build alternative.

Green Space/Impervious Area
No green space or impervious areas are expected to be added or removed with the No-Build alternative.

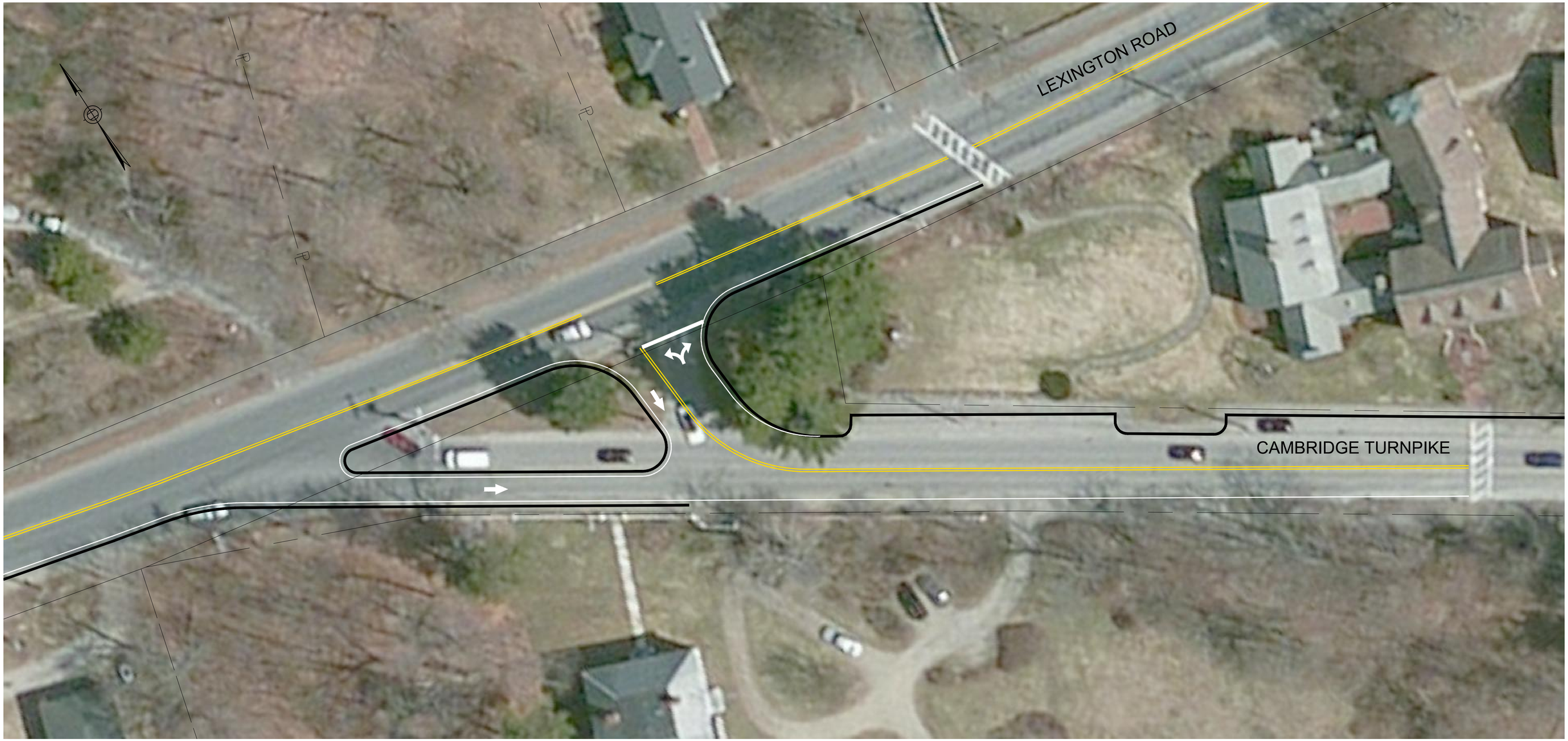
Historical Impact
There are no historical impacts associated with the No-Build alternative.

Parking
There are no anticipated parking impacts associated with the No-Build alternative.

Land Acquisition
No land acquisitions are necessary with the No-Build alternative.

4.2 Alternative 1 at Lexington Road – Re-route WB Cambridge Turnpike with stop control

Alternative 1 proposes reconstructing the connector roadway between Lexington Road and Cambridge Turnpike at its current location. The eastbound movement from Lexington Road onto Cambridge Turnpike will be reconstructed as a one-way roadway with minor curbing realigning to help with traffic calming. The EB traffic from Lexington Road onto Cambridge Turnpike will have the right-of-way over the traffic from the Connector Road. The layout is shown on Figure 18.



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GRAPHIC SCALE

TOWN OF CONCORD PUBLIC WORKS

CAMBRIDGE TURNPIKE IMPROVEMENT PROJECT

FIGURE 18
ALTERNATIVE 1

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Safety and Sight Distance

By reducing the skew of the Cambridge Turnpike turning traffic relative to Lexington Road, Alternative 1 is expected to make it easier for drivers on Cambridge Turnpike to view approaching traffic on Lexington Road. The available sight distance will continue to exceed the minimum required by *2011 AASHTO Geometric Design of Highways and Streets* and the number of motor vehicle accidents at this location is expected to decrease.

Traffic Operations

Traffic operations for Alternative 1 are similar to the existing condition: the Lexington Road approaches experience no noticeable delay and the stop controlled Cambridge Turnpike approach experiences considerable delay and LOS 'F'. The 2012 peak time delay on Cambridge Turnpike improves from 7-8 minutes in the existing condition to 5-6 minutes. This improvement is due to the right turning traffic from Lexington Road to Cambridge Turnpike exiting the traffic stream farther from the Cambridge Turnpike stop controlled decision point. This causes more frequent breaks in the EB Lexington Road traffic, allowing Cambridge Turnpike vehicles an easier merge onto Lexington Road. Table 9 and Table 10 show the current and projected delays, LOS and queue lengths at the Lexington Road intersection for Alternative 1. More details are provided in Appendix D.

Table 9- Delay and LOS - Alternative 1

	Cambridge Tpke Westbound	
	Delay (sec)	*LOS*
2012 AM	306	F
2030 AM	521	F
2012 PM	371	F
2030 PM	575	F

Table 10 - 95th Percentile Queue Length[2] (# of cars) - Alternative 1

	Cambridge Tpke Westbound
2012 AM	13
2030 AM	17
2012 PM	25
2030 PM	32

[2] The 95th percentile queue is the length of the queue below which 95% of the observations may be found.

Delays on Cambridge Turnpike for Alternative 1 are in the 5-6 minute range for 2012 and 8-9.5 minutes in 2030. While LOS remains at 'F', this alternative does offer a significant operational advantage when compared to the current condition.

The advantage of Alternative 1 which has a single stop controlled leg is that the Lexington Road approaches experience no significant delay most of the time. However, during the PM peak hour, westbound Lexington Road traffic often backs-up from Monument Square, sometimes causing lengthy queues that extend back to the Cambridge Turnpike intersection. During these circumstances, the delays caused to Cambridge Turnpike vehicles entering Lexington Road may be different that those shown in Table 9 and Table 10.

Truck Movements
The Alternative 1 roadway layout will accommodate a semitrailer vehicle with a 50-feet wheel base for all movements with minimal encroachment into the lane serving the opposite direction of traffic.

Cost
The cost of Alternative 1 is mostly associated with reconstructing pavement at the intersection and is lower than Alternatives 2 to 5.

Tree Removal
One tree is expected to be removed from the island area between the intersection and the connector road to accommodate Alternative 1.

Green Space/Impervious Area
The implementation of this alternative would result in a net gain of approximately 950 square feet of green space and a net decrease of approximately 950 square feet of impervious area in the vicinity of the intersection.

Historical Impact
This alternative will slightly alter the island and pavement layout located at the Lexington Road intersection. This impact is expected to be minimal and the general character of the small, stop controlled intersection will be maintained.

Parking
No change to parking from the existing condition is expected upon implementation of Alternative 1.

Land Acquisition
No private right-of-way will have to be acquired upon implementation of Alternative 1.

4.3 Alternative 2 at Lexington Road – Signalized Intersection

Alternative 2 proposes to keep the current geometry of the intersection and add a traffic signal system at the Lexington Road / Cambridge Turnpike intersection. The eastbound Lexington Road right turn onto the Turnpike would remain in place with a red 'stop' phase and curbing changes to help with traffic calming. The right turn movement from Cambridge Turnpike onto Lexington Road will be restricted to the Connector Road. The Connector Road would remain at its existing location but would be converted to one-way right-turn only. The draft layout is shown in Figure 19. A signal warrant analysis was completed and warrants 1-A, 2, 3 and 8 are met at this location. The full analysis can be found in Appendix C.

LEGEND:

S = TRAFFIC SIGNAL POLE

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GRAPHIC SCALE

TOWN OF CONCORD PUBLIC WORKS

CAMBRIDGE TURNPIKE IMPROVEMENT PROJECT

FIGURE 19
ALTERNATIVE 2

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CONCORD INCORPORATED 12 SEP. 1635

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DESIGNED BY:	TW/MW
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DATE:	SEPTEMBER 2013

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Safety and Sight Distance

In general, signals have been found to decrease the number of serious motor vehicle accidents at an intersection but they may increase the number of rear-end type accidents that are less likely to cause serious injury. During the 2008-2010 study period, two of the seven motor vehicle accidents occurring at this intersection were classified as 'angle' collisions.

Alternative 2 eliminates the need to improve sight distance at the location where the signal is installed. At the Connector Road / Lexington Road intersection, sight distance requirements will still be met but the skew of the approach will continue to cause difficulty for some Cambridge Turnpike vehicles to view approaching traffic on Lexington Road.

Traffic Operations

Traffic operations for Alternative 2 differ from the existing condition by distributing the delay to all approaches and eliminating the free flow condition on Lexington Road. While Lexington Road drivers will now experience some delay, the delay experienced by drivers on the Cambridge Turnpike is greatly reduced. Overall the intersection is rated as a very good 'A' or 'B' Level of Service (LOS) during all scenarios. The overall delay is significantly better than the existing condition. Table 11 and Table 12 show the current and projected delays, LOS and queue lengths at the Lexington Road intersection for Alternative 2. More details are provided in Appendix D.

Table 11- Delay and LOS - Alternative 2

	Cambridge Tpke WB		**Lexington EB**		**Lexington WB**		**Intersection Overall**	
	Delay (sec)	*LOS*	*Delay (Sec)*	*LOS*	*Delay (Sec)*	*LOS*	*Delay (Sec)*	*LOS*
2012 AM	21.8	C	21.1	C	2.1	A	17.1	B
2030 AM	27.2	C	41.3	D	2.3	A	31.8	C
2012 PM	13.4	B	8.5	A	5.2	A	8.0	A
2030 PM	15.0	B	9.1	A	5.2	A	8.5	A

Table 12 - Queue Lengths (ft) - Alternative 2

	Cambridge Tpke WB		**Lexington EB**		**Lexington WB**	
	50th	*95th*[3]	*50th*	*95th*	*50th*	*95th*
2012 AM	73	110	198	412	40	81
2030 AM	80	109	348	828	46	85
2012 PM	87	107	63	117	75	91
2030 PM	91	114	69	132	77	92

[3] The 95th percentile queue is the length of the queue below which 95% of the observations may be found.

Overall the delays and queues are acceptable for this alternative and a significant operational advantage is gained when compared to the current condition.

Truck Movements
The Alternative 2 roadway layout cannot accommodate a semitrailer vehicle with a 50-feet wheel base (WB-50) for the following movements:

- Right from Cambridge Turnpike onto the Connector Road
- Left from Lexington Road onto the Cambridge Turnpike
- Right from Cambridge Turnpike onto Lexington Road.

Cost
Alternative 2 construction cost will be mostly related to the construction of the traffic signal system at the intersection.

Tree Removal
No trees are expected to be removed to accommodate Alternative 2.

Green Space/Impervious Area
No green space will be affected due to implementation of Alternative 2 and the impervious area will not change.

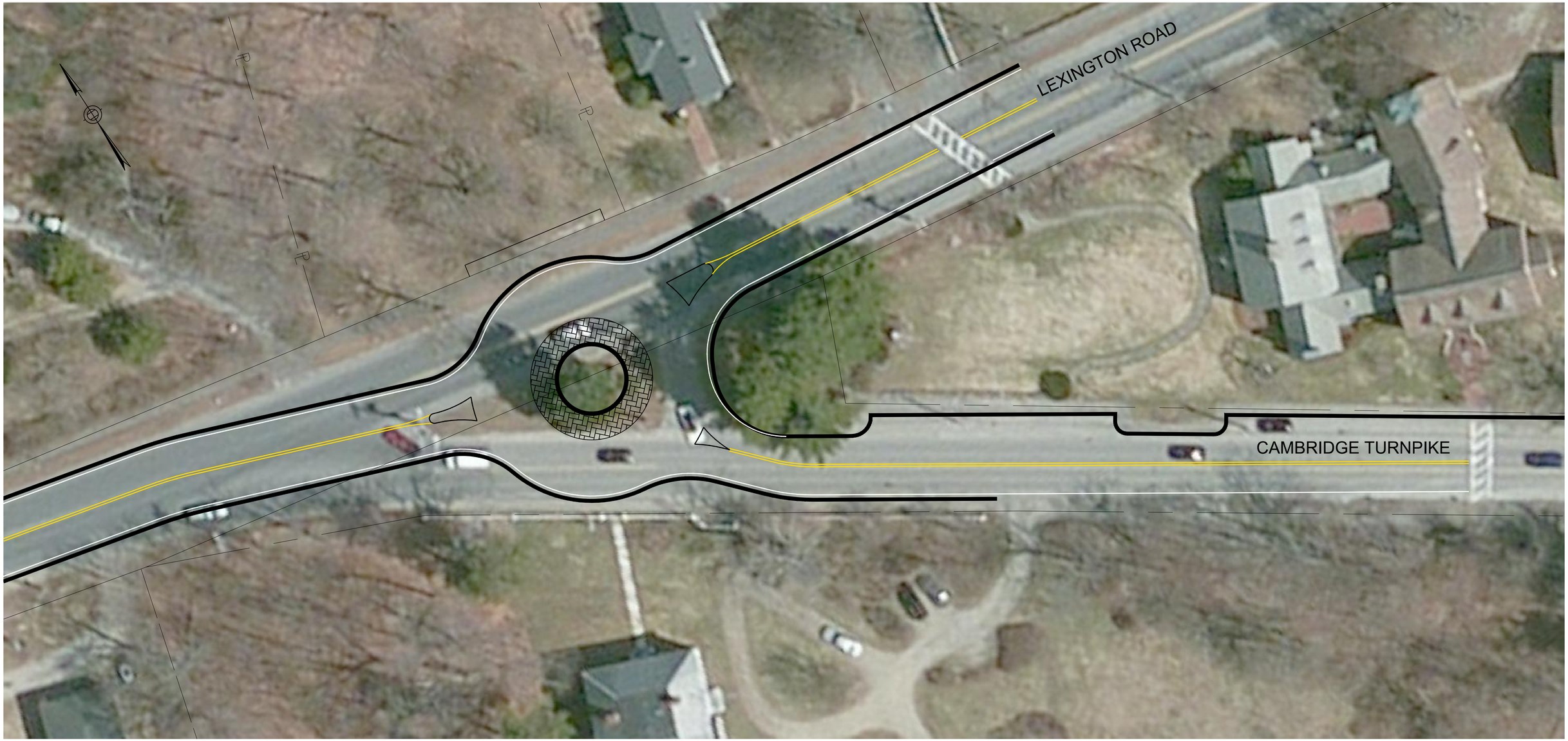
Historical Impact
While the intersection pavement layout will not change, the addition of the traffic signal system (posts, cabinets, signal heads, etc.) will have a visual impact at the intersection. To minimize this impact, it was suggested that ground mounted signal posts be used at each approach instead of mast arms. Nevertheless, merely the addition of the traffic signal equipment at this intersection may be intrusive to the historical, rural character of this site and therefore counter to the goals of this project.

Parking
The number of on-street parking spaces is not expected to change upon implementation of Alternative 2.

Land Acquisition
No land acquisition is anticipated for implementation of Alternative 2.

4.4 Alternative 3 at Lexington Road – Roundabout

Alternative 3 proposes to replace the current intersection with a roundabout. The draft layout is shown in Figure 20.



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GRAPHIC SCALE

TOWN OF CONCORD PUBLIC WORKS

CAMBRIDGE TURNPIKE IMPROVEMENT PROJECT

FIGURE 20
ALTERNATIVE 3

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A number of limitations are apparent in this design including:

- The westbound Lexington Road approach lacks deflection which may result in higher travel speeds entering the roundabout.
- The right turn from Cambridge Turnpike onto Lexington Road is quite sharp.
- The sidewalk on the north side of Lexington Road at the roundabout would likely have to be relocated outside of the existing right-of–way.
- Slope grading on the north side would take place outside of the existing right-of-way.
- Current traffic conditions in downtown Concord cause queue build-ups on Lexington Road from Monument Square back to the Cambridge Turnpike intersection. As these queues build-up to the roundabout location, its LOS is drastically reduced.

Safety and Sight Distance

In general, roundabouts have been found to decrease the number of motor vehicle accidents and it is expected that safety would improve at this location, if a roundabout was the selected alternative.

Traffic Operations

Traffic operations for Alternative 3 differ from the existing condition by distributing the delay to all approaches and eliminating the free flow condition on Lexington Road. While Lexington Road drivers will experience some delay, the delay on the Cambridge Turnpike is greatly reduced. Overall the intersection is rated as a very good 'A' or 'B' Level of Service (LOS) during all scenarios listed in Table 13 below. The overall delay is significantly better than the existing condition. Table 13 and Table 14 show the 2012 and projected 2030 delays, LOS and queue lengths at the Lexington Road intersection for Alternative 3. More details are provided in Appendix D.

Table 13- Delay (sec) and LOS - Alternative 3

	Cambridge Tpke WB		**Lexington EB**		**Lexington WB**		**Intersection Overall**	
	Delay (sec)	*LOS*	*Delay (sec)*	*LOS*	*Delay (sec)*	*LOS*	*Delay (sec)*	*LOS*
2012 AM	12.5	B	11.7	B	5.2	A	10.1	B
2030 AM	13.2	B	16.2	C	5.7	A	13.7	B
2012 PM	6.0	A	5.2	A	9.6	A	7.3	A
2030 PM	9.3	A	5.4	A	14.2	B	9.3	A

Table 14 - Queue Lengths (ft) - Alternative 3

	Cambridge Tpke		**Lexington EB**		**Lexington WB**	
	50th	*95th*[4]	*50th*	*95th*	*50th*	*95th*
2012 AM	54	90	4	32	26	55
2030 AM	60	103	5	39	29	57
2012 PM	54	100	2	18	85	176
2030 PM	74	139	2	17	118	242

[4] The 95th percentile queue is the length of the queue below which 95% of the observations may be found.

Overall the delays and queues are acceptable for this alternative and a significant operational advantage is gained when compared to the current condition.

Truck Movements
The proposed roundabout layout is designed to accommodate a semitrailer vehicle with a 50-feet wheel base (WB-50) for all turning movements.

Cost
The roundabout is subject to traffic back-ups due to the existing traffic conditions at Monument Square in downtown Concord and therefore should not be retained for further study. For this reason, no cost information has been developed for this alternative. It should be noted that the construction cost associated with this alternative will be higher than the other alternatives.

Tree Removal
Two or three trees are expected to be removed to accommodate Alternative 3.

Green Space/Impervious Area
The implementation of this alternative would result in a net gain of approximately 1,450 square feet of green space and a net decrease of approximately 1,450 square feet of impervious area in the vicinity of the intersection.

Historical Impact
The visual aspect of the intersection would change considerably, if a roundabout was installed. There will be very little similarity between the existing layout and Alternative 3.

Parking
The number of on street parking spaces in not expected to change upon implementation of Alternative 3.

Land Acquisition
It is expected that approximately 300 square feet of private land will need to be acquired on the north side of the proposed roundabout in order to implement Alternative 3.

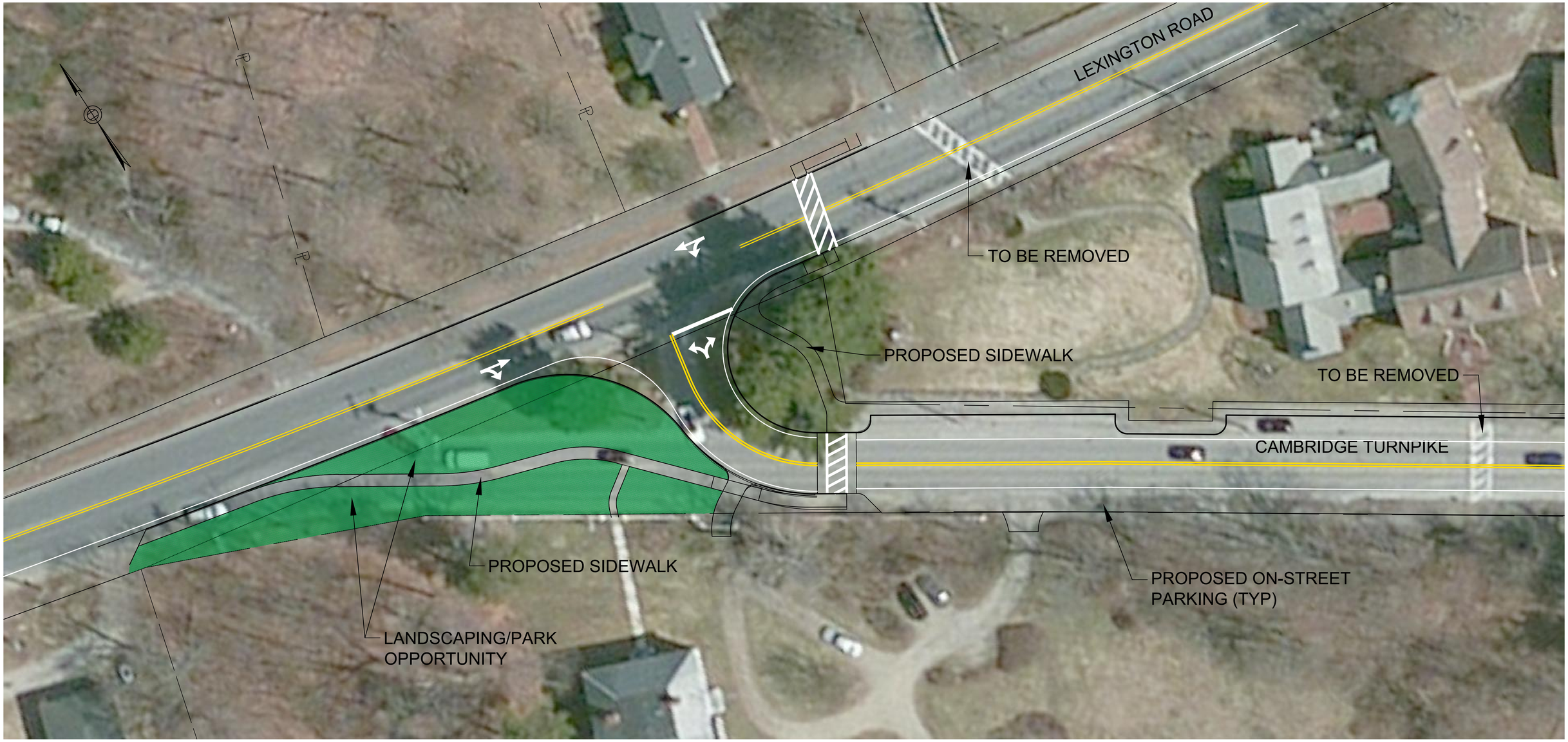
4.5 Alternative 4 at Lexington Road – Re-route EB and WB Cambridge Turnpike with stop control

Alternative 4 proposes reconstructing the entire intersection as shown on Figure 21. All turning movements will occur at the same intersection and the existing Connector Road between Lexington Road and the Cambridge Turnpike will be eliminated. Only the Cambridge Turnpike approach will be stop controlled.

Consideration was also given to placing stop signs for both the Cambridge Turnpike and the WB Lexington Road approach at this intersection, since it was thought that this may facilitate the merge of the Cambridge Turnpike traffic with WB Lexington Road, especially in the PM peak hours

when WB Lexington traffic is heaviest. However, this alternative was not retained for further study for the following reasons:

- Per *The Manual of Uniform Traffic Control Devices (MUTCD)*, multi-way intersection stop control is normally used on all approaches and when the volume of traffic of the intersecting roadways is approximately equal. This is not the case for this location, since traffic on Lexington Road is significantly higher than traffic on Cambridge Turnpike. At locations with significantly different volumes on intersecting roadways, the roadway carrying the lowest traffic volume (in this case Cambridge Turnpike) should be controlled.
- By adding an additional stop sign on the major roadway, the LOS for the associated approach will necessarily drop. Currently, the major movements are free flowing and delays for the majority of travelers are limited. An additional stop sign would cause additional, unnecessary delay while also increasing the generation of greenhouse gasses.
- Non-standard configurations, such as this, lead to general disrespect for stop signs. Traffic control is based on designing for situations drivers expect. Creating an unfamiliar condition is likely to cause confusion, particularly for drivers unfamiliar with the area.
- Placing an unexpected and unneeded stop control on WB Lexington Road is likely to increase the number of motor vehicle accidents at this intersection. The Long Plains Road (Route 22)/Portland Road intersection in Buxton Maine is a similar example of an intersection with only one leg uncontrolled. This intersection is notorious for crashes caused by confusion because drivers are unfamiliar with this type of layout. From 2010-2012, there were 11 recorded crashes at this location each with a cost of more than $1,000 damage and a crash rate factor of 2.95. To be considered a high crash location the State of Maine required 8 crashes and a crash rate factor greater than 1. This intersection is ranked 15th in the County in the high crash locations database.



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GRAPHIC SCALE

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CAMBRIDGE TURNPIKE IMPROVEMENT PROJECT

FIGURE 21
ALTERNATIVE 4

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Safety and Sight distance

By reducing the skew of the intersection, Alternative 4 is expected to make it easier for drivers on Cambridge Turnpike to view approaching traffic on Lexington Road. Available sight distance will continue to exceed the minimum required by *2011 AASHTO Geometric Design of Highways and Streets*. This alternative will also slow eastbound Lexington Road right turning traffic onto Cambridge Turnpike which will contribute to traffic calming at this location. By relocating all turning movements to the same location, the number of conflict points will be reduced as compared to the existing condition.

It is anticipated that these improvements will reduce the number of motor vehicle accidents at this location.

Traffic Operations

Traffic operations for Alternative 4 are similar to the existing condition in that the stop controlled Cambridge Turnpike approach experiences considerable delay. Overall, the intersection is rated as a failing LOS 'F' during all scenarios. Table 15 and Table 16 show the current and projected delays, LOS and queue lengths at the Lexington Road intersection for Alternative 4. More details are provided in Appendix D.

Table 15- Delay (sec) and LOS - Alternative 4

	Cambridge Tpke	
	Delay	*LOS*
2012 AM	469	F
2030 AM	791	F
2012 PM	465	F
2030 PM	710	F

Table 16 95th Percentile Queue Length[5] (# of cars) - Alternative 4

	Cambridge Tpke
2012 AM	15
2030 AM	19
2012 PM	28
2030 PM	35

Delays, LOS and queue lengths for Alternative 4 are identical to the existing condition. While the existing intersection is relocated, there are no proposed changes that significantly affect the level of service.

[5] The 95th percentile queue is the length of the queue below which 95% of the observations may be found.

Truck Movements
The Alternative 4 roadway layout will accommodate a semitrailer vehicle with a 50-feet wheel base (WB-50) for all movements with minimal amount of encroachment into the lane serving the opposite direction of traffic.

Cost
Alternative 4 has a medium construction cost, mostly associated with reconstructing the intersection pavement at its current location.

Tree Removal
One tree is expected to be removed from the island area between the intersection and the connector road to accommodate Alternative 4.

Green Space/Impervious Area
The implementation of this alternative would result in a net gain of approximately 2,400 square feet of green space and a net decrease of approximately 2,400 square feet of impervious area in the vicinity of the intersection.

Historical Impact
The site layout will significantly change upon implementation of Alternative 4 but the historic, rural character of this small, stop controlled intersection will be maintained. This alternative also provides the opportunity to landscape the area located between the new intersection and the Emerson House.

Parking
Although the gravel shoulder in front of Emerson House is currently used for parking, it is expected that upon implementation of alternative 4 the parking spaces will have better delineation and possibly paved. The total number of parking spaces available for the Emerson House and the Concord Museum will not change upon implementation of Alternative 4.

Land Acquisition
No land acquisition is anticipated for implementation of Alternative 4.

4.6 Alternative 5 at Lexington Road – Relocate intersection east of Concord Museum

Alternative 5 proposes realigning the Cambridge Turnpike approach approximately 700-feet east of the current intersection location. All turning movements will occur at the same intersection and the existing Connector Road between Lexington Road and the Cambridge Turnpike will be eliminated. The draft layout is shown in Figure 22.

40 0 20 40 80 160

GRAPHIC SCALE

TOWN OF CONCORD PUBLIC WORKS

CAMBRIDGE TURNPIKE IMPROVEMENT PROJECT

FIGURE 22
ALTERNATIVE 5 (CONCEPT 2)

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Safety and Sight distance

By reducing the skew of the intersection, Alternative 5 is expected to make it easier for drivers on Cambridge Turnpike to view approaching traffic on Lexington Road. Available sight distance will continue to exceed the minimum required by *2011 AASHTO Geometric Design of Highways and Streets*. This alternative will also slow eastbound Lexington Road right turning traffic onto Cambridge Turnpike. By relocating all turning movements to the same location, the number of conflict points will be reduced as compared to the existing condition.

It is anticipated that these improvements will reduce the number of motor vehicle accidents at this location.

Traffic Operations

Traffic operations for Alternative 5 are identical to those in Alternative 4. The stop controlled Cambridge Turnpike approach will still be expected to experience considerable delay. Overall, the intersection is rated as a failing 'F' Level of Service (LOS) during all scenarios. Table 17 and Table 18 show the current and projected delays, LOS and queue lengths at the Lexington Road intersection for Alternative 5. More details are provided in Appendix D.

Table 17- Delay and LOS - Alternative 5

	Cambridge Tpke	
	Delay (sec)	*LOS*
2012 AM	469	F
2030 AM	791	F
2012 PM	465	F
2030 PM	710	F

Table 18 95th Percentile Queue Length[6] (# of cars) - Alternative 5

	Cambridge Tpke
2012 AM	15
2030 AM	19
2012 PM	28
2030 PM	35

Delays, LOS and queue lengths for Alternative 5 are identical to Alternative 4. While the location of the intersection is moved, there are no proposed changes that significantly affect the level of service.

[6] The 95th percentile queue is the length of the queue below which 95% of the observations may be found.

Truck Movements
The Alternative 5 roadway layout will accommodate a semitrailer vehicle with a 50-feet wheel base for all movements with a reasonable amount of encroachment into the lane serving the opposite direction of traffic.

Cost
Alternative 5 has a high construction cost due to the long length of the Cambridge Turnpike that has to be relocated.

Tree Removal
Approximately ten trees are expected to be removed to accommodate Alternative 5.

Green Space/Impervious Area
The implementation of this alternative would result in a net loss of approximately 2,500 square feet of green space and a net increase of approximately 2,500 square feet of impervious area in the vicinity of the intersection.

Historical Impact
Access to both the Emerson House and the Concord Museum will be impacted by Alternative 5. By removing a section of the Cambridge Turnpike, the site layout will have to change significantly. A new drive could be constructed to re-establish the direct connection between the Emerson House and Lexington Road. The parking spaces along Cambridge Turnpike that serve both the Emerson House and the Museum will have to be relocated to a different location. New walking paths connecting the new parking lot with the Emerson House and the Concord Museum will have to be built. A potential site layout is shown on Figure 22.

Parking
It is expected that the number of existing parking spaces will be maintained or increased by constructing a new parking lot as shown on Figure 22.

Land Acquisition
When this concept was developed, it was envisioned that a mutual land swap agreement could be implemented between the Town and the property owners affected by the relocated alignment. The area at the west end of Cambridge Turnpike where the existing pavement is removed is currently owned by Town of Concord, whereas the area required to relocate the Turnpike is partially owned by the Concord Museum and partially owned by the Emerson House.

Upon a more detailed review of this alternative, the Emerson House expressed their concern related to loss of right-of-way in the southwestern corner of their property that is located at the 90 degree curve of the relocated Turnpike. Consequently, implementation of this alternative would hinge on fee acquisition of private property and therefore is unlikely to be studied further.

4.7 Comparison of Lexington Road Alternatives

To evaluate all the criteria discussed above, the following summary matrix has been developed to compare the six alternatives. In this matrix, improvements that seem to have a positive impact on the site and the community have been colored in green, improvements that seem to have a negligible (neutral) effect are yellow and changes that are considered unfavorable are colored in red. In the table below "No change" should be understood as "No change relative to the existing condition", "Improved" as "Improved from the existing condition", etc.:

Table 19 – Summary Matrix

Criteria	No-Build	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Safety	No change	Improved	Improved	Improved	Improved	Improved
Sight Distance	No change	Improved	Improved	N/A	Improved	Improved
Truck Movements	No change	Improved	Minimally Improved	Improved	Improved	Improved
Cost	Negligible	Low	Medium	High	Medium	High
Tree Removal	0	1 +/-	0	2-3 +/-	1 +/-	10 +/-
Green Space/ Impervious Area	No Change	950 sqft green space added	No Change	1,450 sqft green space added	2,400 sqft green space added	2,500 sqft green space lost
Historical Impact	No Change	Low	High	High	Low	Medium
Number of Parking Spaces	No Change	No Change	No Change	No Change	No Change	May Increase
Land Acquisition	None	None	None	300 sqft	None	Land Swap Town/Museum/Emerson

An additional criterion to be considered is traffic operation. Table 20 presents traffic operations LOS ratings for each of the time periods studied.

Table 20 – Traffic Operations Matrix

	No-Build*	Alt. 1*	Alt. 2	Alt. 3	Alt. 4*	Alt. 5*
2012 AM	F	F	B	B	F	F
2030 AM	F	F	B	B	F	F
2012 PM	F	F	A**	A**	F	F
2030 PM	F	F	A**	A**	F	F

In Table 20, the stop controlled alternatives (marked with *) illustrate LOS only for the stop controlled leg of the intersection (Cambridge Turnpike). For these alternatives, Lexington Road is free flowing.

** For alternatives 2 and 3, the LOS shown in Table 20 is the overall intersection delay. It should be noted that the traffic simulation software used to calculate the LOS, isolates the intersection of Lexington Road and Cambridge Turnpike from other adjacent intersections. In reality, the LOS for these two alternatives will also be LOS F during the PM peak hour whenever the queues from downtown Concord reach Cambridge Turnpike.

The No-Build Alternative has been considered unacceptable due to the safety issues currently experienced at this intersection. Alternatives 2 and 3 have been rejected due to unacceptable impacts to the rural and historical character of this site and because the roundabout included in Alternative 3 may be blocked by potential traffic back-ups and queue lengths from Monument Square during the PM peak hours. Alternative 5 has been rejected due to its relatively higher construction cost as well as due to the fact that it requires significant site redevelopment, including a land swap that has been deemed unacceptable by the Emerson House.

Alternatives 1 and 4 are somewhat similar with respect to maintaining the character of this site. Alternative 4 has a safety advantage because all the turning movements are at the same location, thereby reducing the number of traffic conflicts. It also offers a greater opportunity to add value to the site by providing an additional 2,400 square feet of green space for future landscaping in front of the Emerson House. Upon discussions with the Town, the Concord Museum and the Emerson House, it was tentatively agreed to select Alternative 4 for further advancement at the Lexington Road intersection. This selection will be confirmed with other abutters and stakeholders through future public outreach as the design progresses.

4.8 Hawthorne Lane

Proposed improvements at the Hawthorne Lane intersection include:

1. Striping a center line and a stop bar.
2. Adding a stop sign on Hawthorne Lane.
3. Trimming hedges and low lying foliage that currently impede sight distance.
4. Adding a two feet wide striped and textured median on Cambridge Turnpike.

The two feet wide striped median on Cambridge Turnpike will help calm traffic and reduce operating speeds at this location. This median will be developed by shifting the Cambridge Turnpike lanes by one foot to the outside in each direction. Cobbles, stamped colored pavement or other similar treatments may be used for this median in order to emphasize its presence.

A draft of these improvements is shown on Figure 23. These improvements are intended to increase safety by reducing operating speeds, informing drivers, creating a defined stop location and meeting sight distance recommendations.

No changes to the pavement are necessary at this location other than widening for the two feet wide median island since the layout currently meets design standards for truck turning. Tree removal is expected to be minimal and no permanent right-of-way impacts are anticipated.

4.9 Mildred Circle

Proposed improvements at the Mildred Circle intersection include:

1. Striping a center line and a stop bar.
2. Adding a stop sign on Mildred Circle.
3. Trimming vegetation that currently impedes sight distance
4. Adding a two feet wide striped median on Cambridge Turnpike (similar to Hawthorne Lane).

A draft of these improvements is shown on Figure 23. These improvements are intended to increase safety by reducing operating speeds, informing drivers, creating a defined stop location and meeting sight distance recommendations.

No changes to the pavement are necessary at this location other than widening for the two feet wide median island. Tree removal is expected to be minimal and no permanent right-of-way impacts are anticipated.

20 0 10 20 40 80

GRAPHIC SCALE

TOWN OF CONCORD PUBLIC WORKS

CAMBRIDGE TURNPIKE IMPROVEMENT PROJECT

FIGURE 23
HAWTHORNE LN & MILDRED CIR.

DRAWN BY:	TW
DESIGNED BY:	TW/MW
CHECKED BY:	LSF
DATE:	SEPTEMBER 2013

PLOTTED: 10/8/2013 9:25 AM BY: WATSON, TIMOTHY
DRAWING: G:\PROJECTS\CKE440A0 CONCORD CAMBRIDGE TPK\DESIGN\TRAFFIC\PDR FIGURES\FIGURES-ALTERNATIVES\PDR-PLANS_ALT 4.DWG

4.10 Sandy Pond Road

Several intersection improvement alternatives have been considered at this location with the purpose of improving sight distance and reducing operating speeds, while maintaining the character of the intersection. It is currently proposed to move all turning movements to the same location and to eliminate the existing traffic island. This will reduce the speed of the right turn traffic from Cambridge Turnpike and will provide for additional sight distance across the crest curve located on the west side of Sandy Pond Road. The total pavement area will be reduced and a larger area will be created in the southwestern corner of the intersection that could be landscaped in order to improve the aesthetic character of this intersection.

To reduce thru-traffic operating speeds, a two feet wide striped median is proposed on the Cambridge Turnpike through this intersection. This median will be developed by shifting the Cambridge Turnpike lanes by one foot to the outside in each direction. Cobbles, stamped colored pavement or other similar treatments may be used for this median in order to emphasize its presence.

The vertical crest curve located along Cambridge Turnpike on the west side of the intersection will be flattened in order to provide better sight distance. Other proposed improvements at the Sandy Pond Road intersection include striping, signing and trimming vegetation.

All improvements listed above are intended to increase safety by consolidating the intersection geometry, creating a defined stop location and improving sight distance. A draft of these improvements is shown in Figure 24.

No tree removals and no permanent right-of-way impacts are anticipated. Approximately 1,650 square feet of green space will be added at this site and approximately 1,650 square feet of impervious area will be eliminated.

20 0 10 20 40 80

GRAPHIC SCALE

TOWN OF CONCORD PUBLIC WORKS

CAMBRIDGE TURNPIKE IMPROVEMENT PROJECT

FIGURE 24
SANDY POND ROAD INTERSECTION

DRAWN BY:	TW
DESIGNED BY:	TW/MW
CHECKED BY:	LSF
DATE:	SEPTEMBER 2013

PLOTTED: 10/8/2013 9:33 AM BY: WATSON, TIMOTHY
DRAWING: G:\PROJECTS\CKE440A0 CONCORD CAMBRIDGE TPK\DESIGN\TRAFFIC\PDR FIGURES\FIGURES-ALTERNATIVES\PDR-PLANS_ALT 4.DWG

5.0 TRAFFIC MANAGEMENT PLAN

Most of Cambridge Turnpike pavement will be reconstructed by using alternating one-way traffic. However, closure of Cambridge Turnpike to thru-traffic will most likely be required to construct the proposed bridge structure. Other short-duration road closures may be required to reconstruct the proposed culverts and road sections that are significantly raised from the existing condition. The time of year and duration of these closures will be evaluated during the project design to ensure that they correspond with local business needs. Local access to homes and businesses will be maintained and appropriate traffic and business signage will be provided during these closures. Hawthorne Lane will also remain open at all times and will provide a permanent connection between Lexington Road and the Turnpike.

During the Cambridge Turnpike closures, the recommended detour route by-passing the work zone will use Lexington Road and Route 2A. This is shown on Figure 25.

Figure 25 – Proposed Detour Route

Consideration will be given to the operating capacity of Lexington Road and Route 2A along the detour route.

Traffic volume data was collected by ***Accurate Counts*** during September of 2012. The ATR data was taken for each hour over a 2 day period and TMC's were completed during the AM and PM peak hours. The count data is included in Appendix A.

Route 2A within the detour route is a two lane roadway classified as a 'Rural Minor Collector'. Although no recent traffic data is available for Route 2A, the Route 2 Environmental Impact Report provided an estimated AADT of 8,600 vehicles per day on Route 2A.

Lexington Road is also a two lane roadway classified as a Rural Major Collector. Based on the September, 2012 counts provided by ***Accurate Counts,*** LBG approximates that:

- the ADT is 9,750 vehicles/day,
- the peak hour two-way volume is 1,330 veh/hour,
- the peak directional flow is 886 veh/hour eastbound during the AM peak, and
- the peak directional flow is 595 veh/hour westbound during the PM peak.

Cambridge Turnpike within the study area and proposed construction zone is also a 2 lane roadway classified as a Rural Major Collector. Based on the September, 2012 counts provided by ***Accurate Counts,*** LBG approximates that:

- the ADT is 6,140 vehicles/day,
- the peak hour two-way volume is 533 veh/hour,
- the peak directional flow is 360 veh/hour eastbound during the AM peak,
- the peak directional flow is 375 veh/hour westbound during the PM peak.

While all detour signing will advise travelers to use Lexington Road, it is expected that a minimum of 20% of travelers will be familiar with the area and find another route that is more convenient based on their final destination. Assuming that 80% of traffic from Cambridge Turnpike is re-routed to Lexington Road the following is expected:

- the ADT during construction would be 14,662 veh/day (9,750 + 80% of 6,140),
- the expected peak hour two-way volume would be 1,756 veh/hour,
- the eastbound directional flow during the AM peak would be 1,174 veh/hour, and
- the westbound directional flow during the PM peak would be 895 veh/hour.

The *Highway Capacity Manual (HCM)* indicates that the two-way capacity of a road during the peak hour is 3,200 passenger cars per hour. The expected two-way peak hour volume is 1,756 veh/hour. While some factors may decrease this capacity (lane width, gradients, speed limit, turning vehicles) Lexington Road can handle the detoured traffic from Cambridge Turnpike with limited disruption to traffic flow.

A serious concern during the PM peak hour is the additional 300 veh/hour that are expected to turn left from Route 2A onto Lexington road since this is an unsignalized intersection. Also of concern are the additional 288 veh/hour that will turn right from Lexington Road and merge with traffic on Route 2A during the AM peak hour. The current geometry of this intersection is unlikely to be able to handle the additional traffic. Several options can be implemented at this intersection and they will likely require constructing temporary pavement and possibly relocating the existing flashing beacon. These options will be evaluated and discussed further with the Town during the progress of the design. It may also be necessary that traffic enforcement officers be present at this intersection during peak hours while the detour is in place.

For drivers re-routed along the detour, 1.2 miles will be added to their trip. The distance from the Lexington Road intersection to the Route 2A intersection using the Cambridge Turnpike is approximately 1.3 miles. The detoured route is a total of 2.5 miles.

6.0 TRAFFIC CALMING STRATEGIES

The Town of Concord has expressed concern about the current traveling speeds on the Cambridge Turnpike within the study area. In order to address this concern, LBG will recommend in final design several 'traffic calming' techniques that are meant to reduce operating speeds and promote pedestrian and bicycle traffic along the Cambridge Turnpike. These techniques include:

Sidewalk Reconstruction. The existing sidewalk from Lexington Road to Mildred Circle will be reconstructed and extended to the Route 2/2A intersection. The proposed sidewalk adjacent to Cambridge Turnpike will be constructed at the same elevation as the new roadway with the goal of eliminating its closures due to flooding conditions. Upon completion of this project, there will be a continuous sidewalk along the entire length of Cambridge Turnpike that will connect downtown Concord to Crosby's corner and to other sites located along the project area such as the existing Heywood Meadows pedestrian path and the Hapgood Wright Forest trail system.

10-feet Travel Lanes. Travel lanes have historically been designed at a 12-feet width. By striping a 2-ft shoulder and reducing the striped lane width to 10-feet, vehicles can still pass safely but drivers are slightly less comfortable traveling at higher speeds. This has become common practice and is cited by the Institute of Traffic Engineers as a successful way to reduce speeds.

Raised Pedestrian Crosswalk. Raised pedestrian crosswalks are raised humps with a 10-15 feet wide flat section in the middle and sloped ramps on the ends. They should be installed, clearly painted, and signed at all areas where pedestrian traffic is high and speeds must be reduced such as at the Emerson House and Concord Museum location. These raised crosswalks tend to be efficient in reducing motor vehicle speeds and they enhance the pedestrian environment.

Textured Pavement. Textured pavement is a change in pavement material and/or color that creates a sound and vibration when driven over. Areas of textured pavement could be used at selected location along the Turnpike such as at pedestrian crossings or to delineate the parking spaces and the Concord Museum and the Emerson House.

On-Street Parking. On-street parking is a traffic calming measure since it sends the driver a visual clue that pedestrians may be present and vehicles may be attempting to merge from the parked position. Currently there is on-street parking at Emerson House, at the Concord Museum and at Milbrook Farm. During design, care will be taken to retain and provide better delineation for these parking spaces.

Striped Medians. As mentioned in previous sections of this report, two feet wide striped medians on Cambridge Turnpike are proposed at the Hawthorne Lane, Mildred Circle and Sandy Pond Road

intersections. These medians will be developed by shifting Cambridge Turnpike traffic by one foot to the outside in each direction. Cobbles, stamped colored pavement or other similar treatments may be used in order to emphasize the presence of these medians. The traffic shift and the presence of the median islands should help reducing operating speeds on Cambridge Turnpike.

7.0 CONCLUSIONS AND RECOMMENDATIONS

Upon discussions with the Town, the Concord Museum and the Emerson House, it was tentatively agreed to select Alternative 4 for further advancement at the Lexington Road intersection. Although this alternative may not be the best from a strictly traffic operation perspective, it provides minimal historic impacts, maintains the character of the area, improves safety, and creates additional green space at the Emerson House which could be landscaped in order to further enhance the historic value of the site. The selection of this alternative will be confirmed will the other abutters and stakeholders through future public outreach as the design progresses.

Minor signing and striping improvements are suggested at the Hawthorne Avenue and Mildred Circle intersections in order to improve the overall safety.

The Sandy Pond intersection will be reconstructed and the existing island will be eliminated. The crest curve that is located west of the intersection will be improved to provide better sight distance. Minor signing and striping improvements will also be implemented in order to improve overall safety.

In order to facilitate the construction of the new Cambridge Turnpike bridge structure, it is recommended that a section of this roadway be temporarily closed to through traffic. The LBG Design Team will coordinate with the Town, Emergency Response Agencies, and other stakeholders in order to determine the most appropriate detour route. Every effort will be made to limit the closure of Cambridge Turnpike for the bridge replacement to the summer months. This will help limit impacts to the Millbrook Farm.

Several traffic calming measures will be evaluated for implementation along Cambridge Turnpike with the purpose of encouraging pedestrian and bicycle traffic and reducing motor vehicle operating speeds. Because the Turnpike is classified as an arterial, limited options may be suitable but the LBG Design Team will discuss available options with the Town and implement them to the extent that is practical.

APPENDIX A

TRAFFIC DATA COLLECTION

Accurate Counts

MassDOT

Accurate Counts

Traffic Data Collection

Accurate Counts
978-664-2565

N/S Street : Cambridge Turnpike
E/W Street: Lexington Road
City/State : Concord, MA
Weather : Cloudy

File Name : 440A0001
Site Code : 440A0001
Start Date : 9/27/2012
Page No : 1

Groups Printed- Cars - Trucks

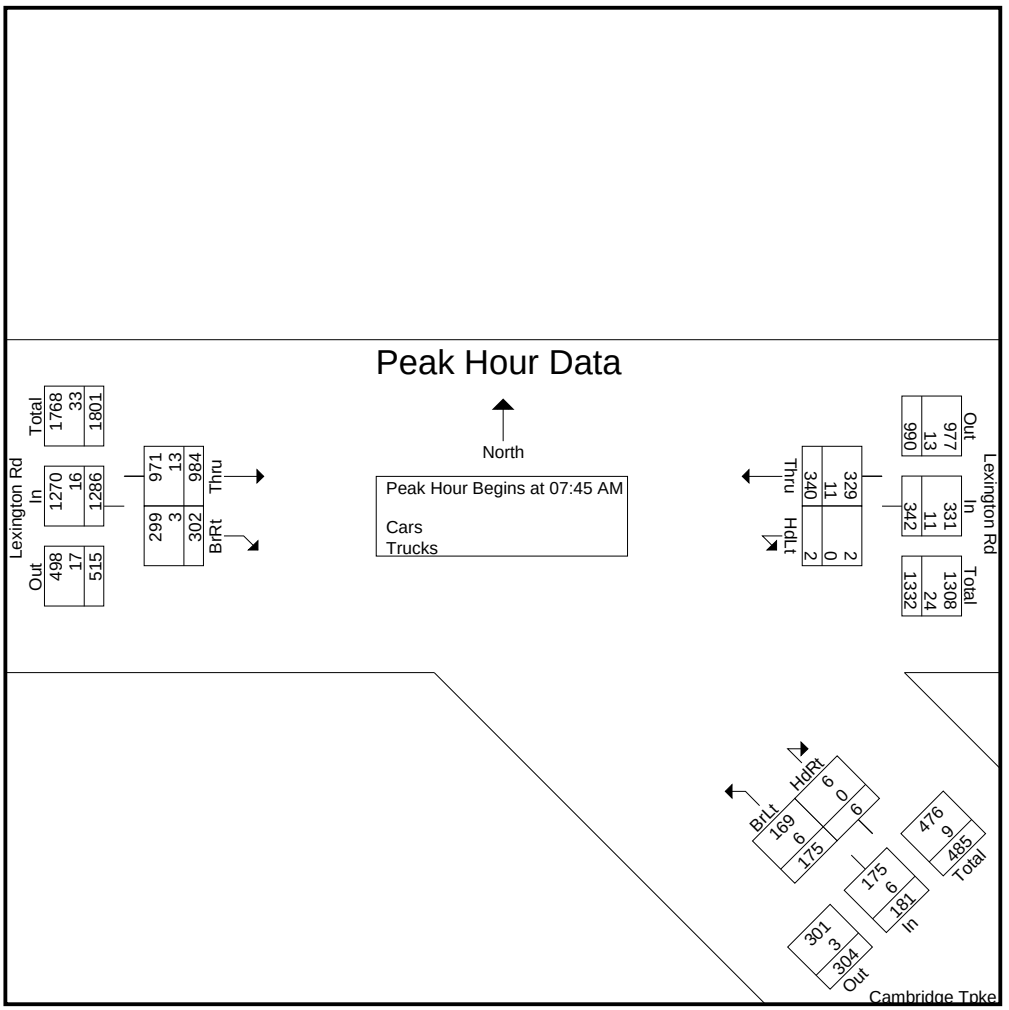
	Lexington Rd From East		Cambridge Tpke From Southeast		Lexington Rd From West		
Start Time	HdLt	Thru	BrLt	HdRt	Thru	BrRt	Int. Total
07:00 AM	2	48	28	0	185	71	334
07:15 AM	0	51	42	1	236	102	432
07:30 AM	1	64	36	0	248	112	461
07:45 AM	0	90	46	3	260	72	471
Total	3	253	152	4	929	357	1698
08:00 AM	2	76	44	1	236	76	435
08:15 AM	0	84	35	1	248	71	439
08:30 AM	0	90	50	1	240	83	464
08:45 AM	0	67	49	0	246	75	437
Total	2	317	178	3	970	305	1775
Grand Total	5	570	330	7	1899	662	3473
Apprch %	0.9	99.1	97.9	2.1	74.2	25.8	
Total %	0.1	16.4	9.5	0.2	54.7	19.1	
Cars	5	545	318	7	1874	654	3403
% Cars	100	95.6	96.4	100	98.7	98.8	98
Trucks	0	25	12	0	25	8	70
% Trucks	0	4.4	3.6	0	1.3	1.2	2

	Lexington Rd From East			Cambridge Tpke From Southeast			Lexington Rd From West			
Start Time	HdLt	Thru	App. Total	BrLt	HdRt	App. Total	Thru	BrRt	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 07:45 AM										
07:45 AM	0	**90**	**90**	46	**3**	49	**260**	72	**332**	**471**
08:00 AM	**2**	76	78	44	1	45	236	76	312	435
08:15 AM	0	84	84	35	1	36	248	71	319	439
08:30 AM	0	90	90	**50**	1	**51**	240	**83**	323	464
Total Volume	2	340	342	175	6	181	984	302	1286	1809
% App. Total	0.6	99.4		96.7	3.3		76.5	23.5		
PHF	.250	.944	.950	.875	.500	.887	.946	.910	.968	.960
Cars	2	329	331	169	6	175	971	299	1270	1776
% Cars	100	96.8	96.8	96.6	100	96.7	98.7	99.0	98.8	98.2
Trucks	0	11	11	6	0	6	13	3	16	33
% Trucks	0	3.2	3.2	3.4	0	3.3	1.3	1.0	1.2	1.8

Accurate Counts
978-664-2565

N/S Street : Cambridge Turnpike
E/W Street: Lexington Road
City/State : Concord, MA
Weather : Cloudy

File Name : 440A0001
Site Code : 440A0001
Start Date : 9/27/2012
Page No : 2



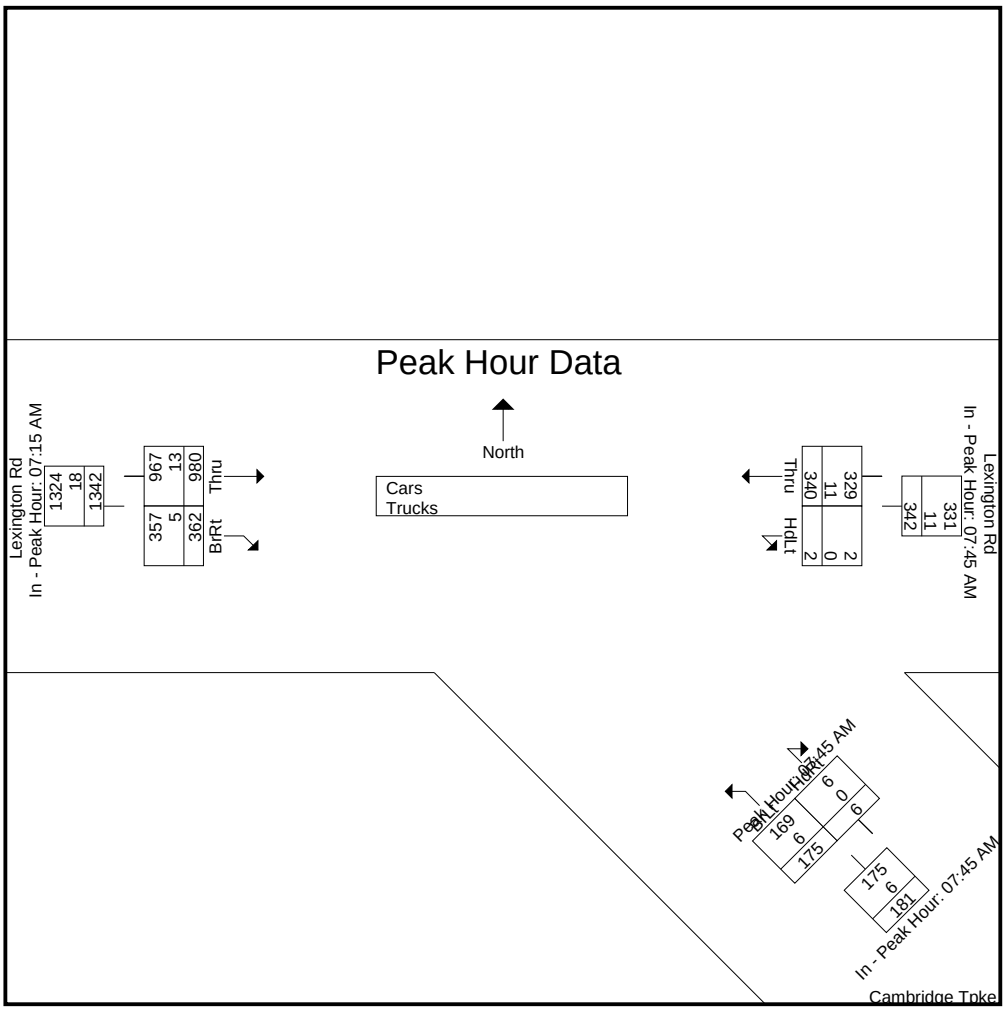
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:45 AM			07:45 AM			07:15 AM		
+0 mins.	0	**90**	**90**	46	**3**	49	236	102	338
+15 mins.	**2**	76	78	44	1	45	248	**112**	**360**
+30 mins.	0	84	84	35	1	36	**260**	72	332
+45 mins.	0	90	90	**50**	1	**51**	236	76	312
Total Volume	2	340	342	175	6	181	980	362	1342
% App. Total	0.6	99.4		96.7	3.3		73	27	
PHF	.250	.944	.950	.875	.500	.887	.942	.808	.932
Cars	2	329	331	169	6	175	967	357	1324
% Cars	100	96.8	96.8	96.6	100	96.7	98.7	98.6	98.7
Trucks	0	11	11	6	0	6	13	5	18
% Trucks	0	3.2	3.2	3.4	0	3.3	1.3	1.4	1.3

Accurate Counts
978-664-2565

N/S Street : Cambridge Turnpike
E/W Street: Lexington Road
City/State : Concord, MA
Weather : Cloudy

File Name : 440A0001
Site Code : 440A0001
Start Date : 9/27/2012
Page No : 3



Accurate Counts
978-664-2565

N/S Street : Cambridge Turnpike
E/W Street: Lexington Road
City/State : Concord, MA
Weather : Cloudy

File Name : 440A0001
Site Code : 440A0001
Start Date : 9/27/2012
Page No : 1

Groups Printed- Cars

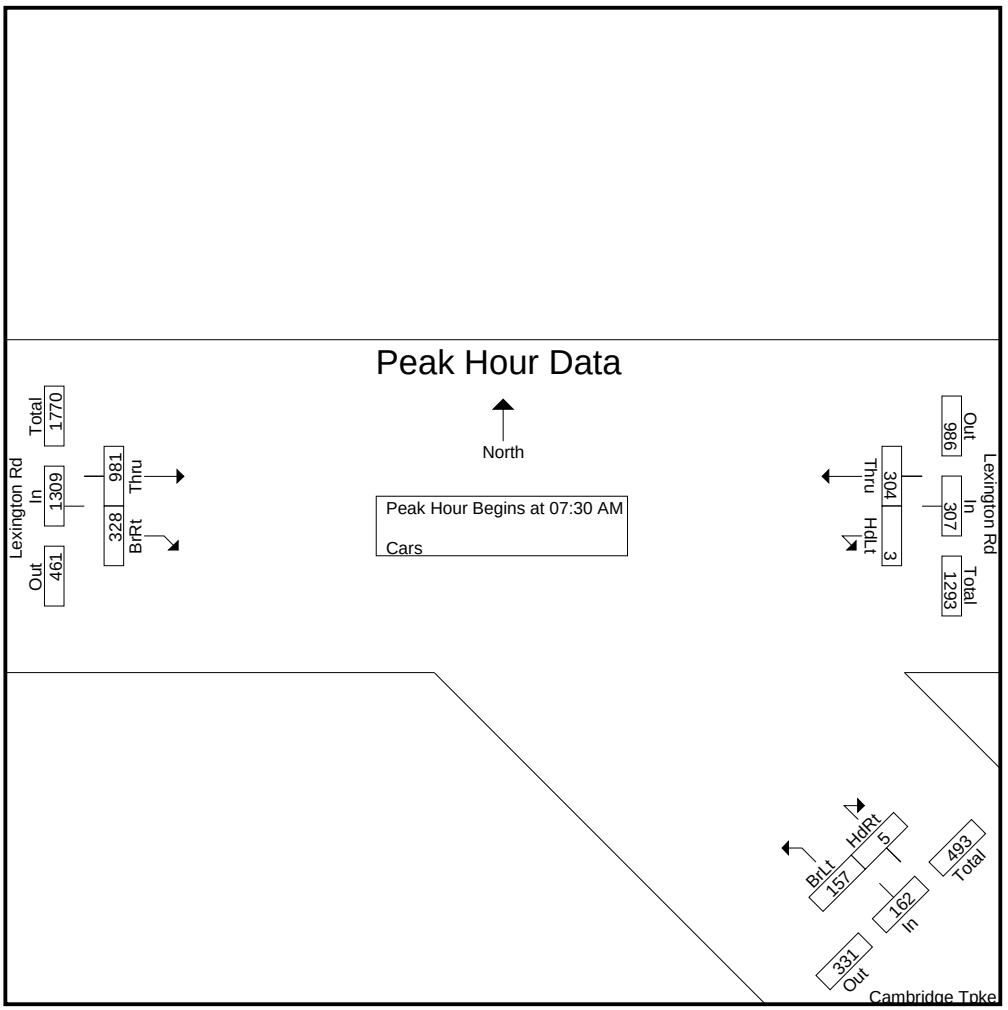
	Lexington Rd From East		**Cambridge Tpke From Southeast**		**Lexington Rd From West**		
Start Time	HdLt	Thru	BrLt	HdRt	Thru	BrRt	Int. Total
07:00 AM	2	44	26	0	182	71	325
07:15 AM	0	51	42	1	233	99	426
07:30 AM	1	60	33	0	246	112	452
07:45 AM	0	89	45	3	256	71	464
Total	3	244	146	4	917	353	1667
08:00 AM	2	74	44	1	232	75	428
08:15 AM	0	81	35	1	247	70	434
08:30 AM	0	85	45	1	236	83	450
08:45 AM	0	61	48	0	242	73	424
Total	2	301	172	3	957	301	1736
Grand Total	5	545	318	7	1874	654	3403
Apprch %	0.9	99.1	97.8	2.2	74.1	25.9	
Total %	0.1	16	9.3	0.2	55.1	19.2	

	Lexington Rd From East			**Cambridge Tpke From Southeast**			**Lexington Rd From West**			
Start Time	HdLt	Thru	App. Total	BrLt	HdRt	App. Total	Thru	BrRt	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 07:30 AM										
07:30 AM	1	60	61	33	0	33	246	**112**	**358**	452
07:45 AM	0	**89**	**89**	**45**	**3**	**48**	**256**	71	327	**464**
08:00 AM	**2**	74	76	44	1	45	232	75	307	428
08:15 AM	0	81	81	35	1	36	247	70	317	434
Total Volume	3	304	307	157	5	162	981	328	1309	1778
% App. Total	1	99		96.9	3.1		74.9	25.1		
PHF	.375	.854	.862	.872	.417	.844	.958	.732	.914	.958

Accurate Counts
978-664-2565

N/S Street : Cambridge Turnpike
E/W Street: Lexington Road
City/State : Concord, MA
Weather : Cloudy

File Name : 440A0001
Site Code : 440A0001
Start Date : 9/27/2012
Page No : 2



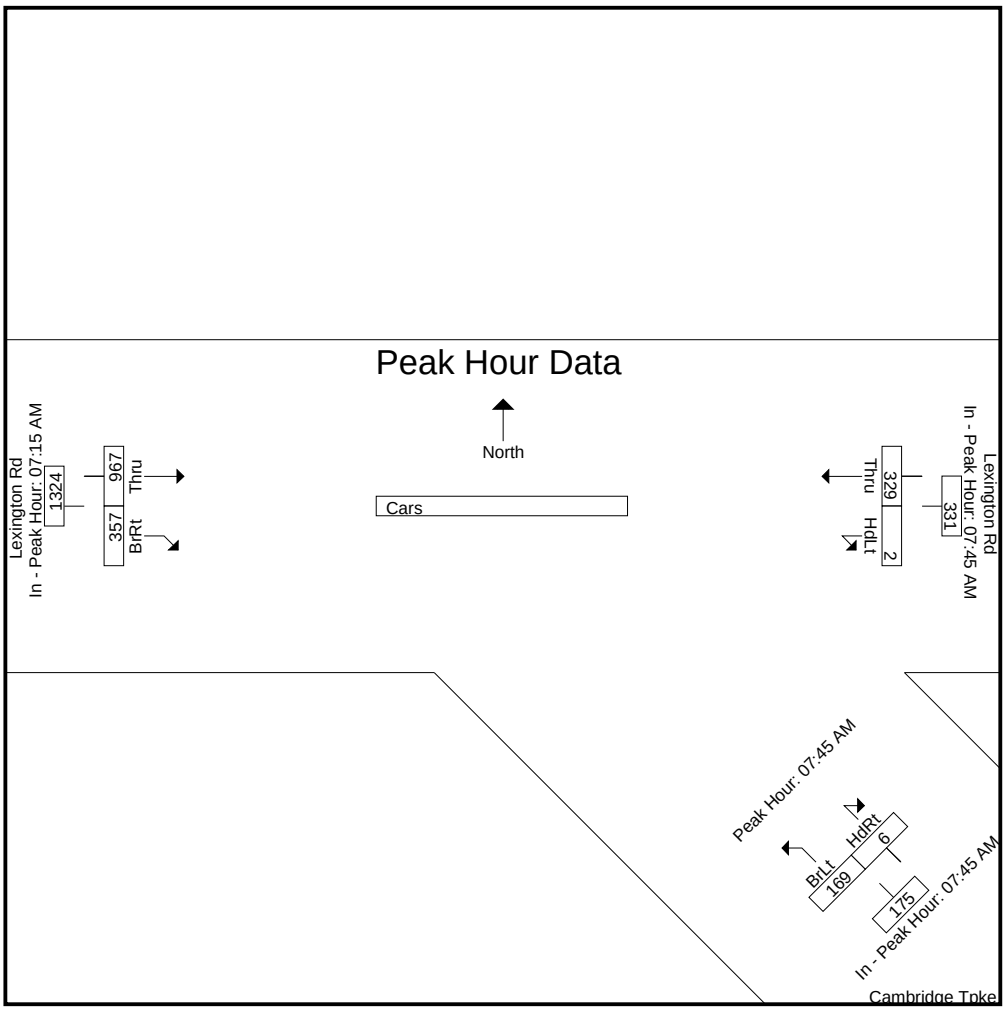
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:45 AM			07:45 AM			07:15 AM		
+0 mins.	0	**89**	**89**	**45**	**3**	**48**	233	99	332
+15 mins.	**2**	74	76	44	1	45	246	**112**	**358**
+30 mins.	0	81	81	35	1	36	**256**	71	327
+45 mins.	0	85	85	45	1	46	232	75	307
Total Volume	2	329	331	169	6	175	967	357	1324
% App. Total	0.6	99.4		96.6	3.4		73	27	
PHF	.250	.924	.930	.939	.500	.911	.944	.797	.925

Accurate Counts
978-664-2565

N/S Street : Cambridge Turnpike
E/W Street: Lexington Road
City/State : Concord, MA
Weather : Cloudy

File Name : 440A0001
Site Code : 440A0001
Start Date : 9/27/2012
Page No : 3



Accurate Counts
978-664-2565

N/S Street : Cambridge Turnpike
E/W Street: Lexington Road
City/State : Concord, MA
Weather : Cloudy

File Name : 440A0001
Site Code : 440A0001
Start Date : 9/27/2012
Page No : 1

Groups Printed- Trucks

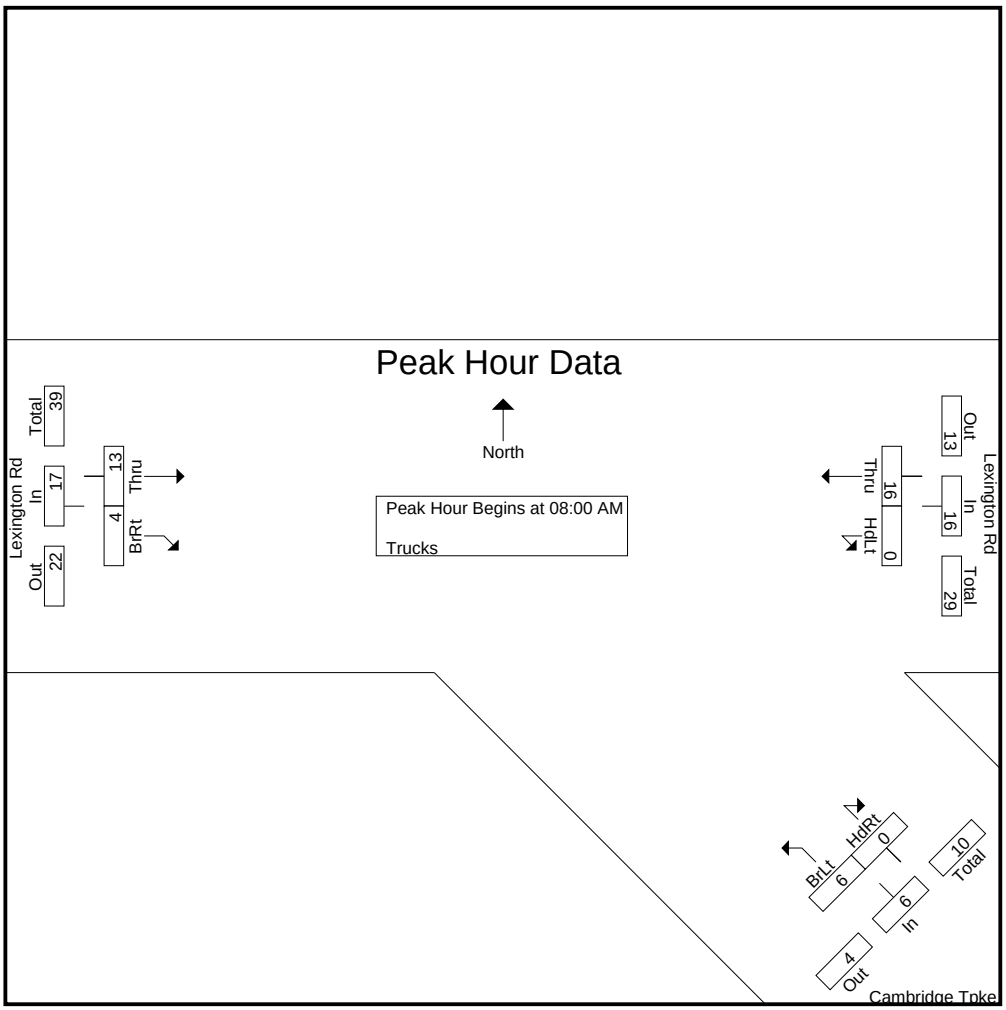
	Lexington Rd From East		Cambridge Tpke From Southeast		Lexington Rd From West		
Start Time	HdLt	Thru	BrLt	HdRt	Thru	BrRt	Int. Total
07:00 AM	0	4	2	0	3	0	9
07:15 AM	0	0	0	0	3	3	6
07:30 AM	0	4	3	0	2	0	9
07:45 AM	0	1	1	0	4	1	7
Total	0	9	6	0	12	4	31
08:00 AM	0	2	0	0	4	1	7
08:15 AM	0	3	0	0	1	1	5
08:30 AM	0	5	5	0	4	0	14
08:45 AM	0	6	1	0	4	2	13
Total	0	16	6	0	13	4	39
Grand Total	0	25	12	0	25	8	70
Apprch %	0	100	100	0	75.8	24.2	
Total %	0	35.7	17.1	0	35.7	11.4	

	Lexington Rd From East			Cambridge Tpke From Southeast			Lexington Rd From West			
Start Time	HdLt	Thru	App. Total	BrLt	HdRt	App. Total	Thru	BrRt	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 08:00 AM										
08:00 AM	0	2	2	0	0	0	**4**	1	5	7
08:15 AM	0	3	3	0	0	0	1	1	2	5
08:30 AM	0	5	5	**5**	0	**5**	4	0	4	**14**
08:45 AM	0	**6**	**6**	1	0	1	4	**2**	**6**	13
Total Volume	0	16	16	6	0	6	13	4	17	39
% App. Total	0	100		100	0		76.5	23.5		
PHF	.000	.667	.667	.300	.000	.300	.813	.500	.708	.696

Accurate Counts
978-664-2565

N/S Street : Cambridge Turnpike
E/W Street: Lexington Road
City/State : Concord, MA
Weather : Cloudy

File Name : 440A0001
Site Code : 440A0001
Start Date : 9/27/2012
Page No : 2



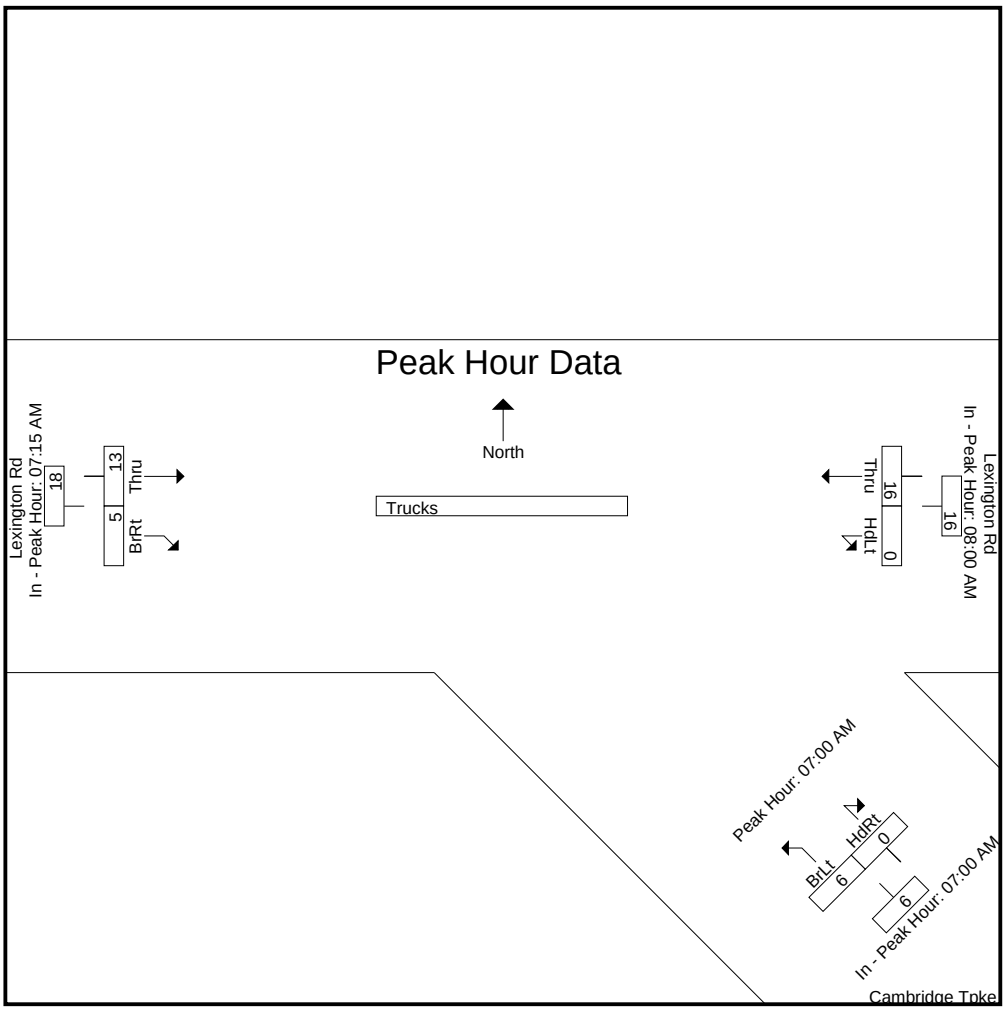
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	08:00 AM			07:00 AM			07:15 AM		
+0 mins.	0	2	2	2	0	2	3	**3**	**6**
+15 mins.	0	3	3	0	0	0	2	0	2
+30 mins.	0	5	5	**3**	0	**3**	**4**	1	5
+45 mins.	0	**6**	**6**	1	0	1	4	1	5
Total Volume	0	16	16	6	0	6	13	5	18
% App. Total	0	100		100	0		72.2	27.8	
PHF	.000	.667	.667	.500	.000	.500	.813	.417	.750

Accurate Counts
978-664-2565

N/S Street : Cambridge Turnpike
E/W Street: Lexington Road
City/State : Concord, MA
Weather : Cloudy

File Name : 440A0001
Site Code : 440A0001
Start Date : 9/27/2012
Page No : 3



Accurate Counts
978-664-2565

N/S Street : Cambridge Turnpike
E/W Street: Lexington Road
City/State : Concord, MA
Weather : Cloudy

File Name : 440A0001
Site Code : 440A0001
Start Date : 9/27/2012
Page No : 1

Groups Printed- Bikes Peds

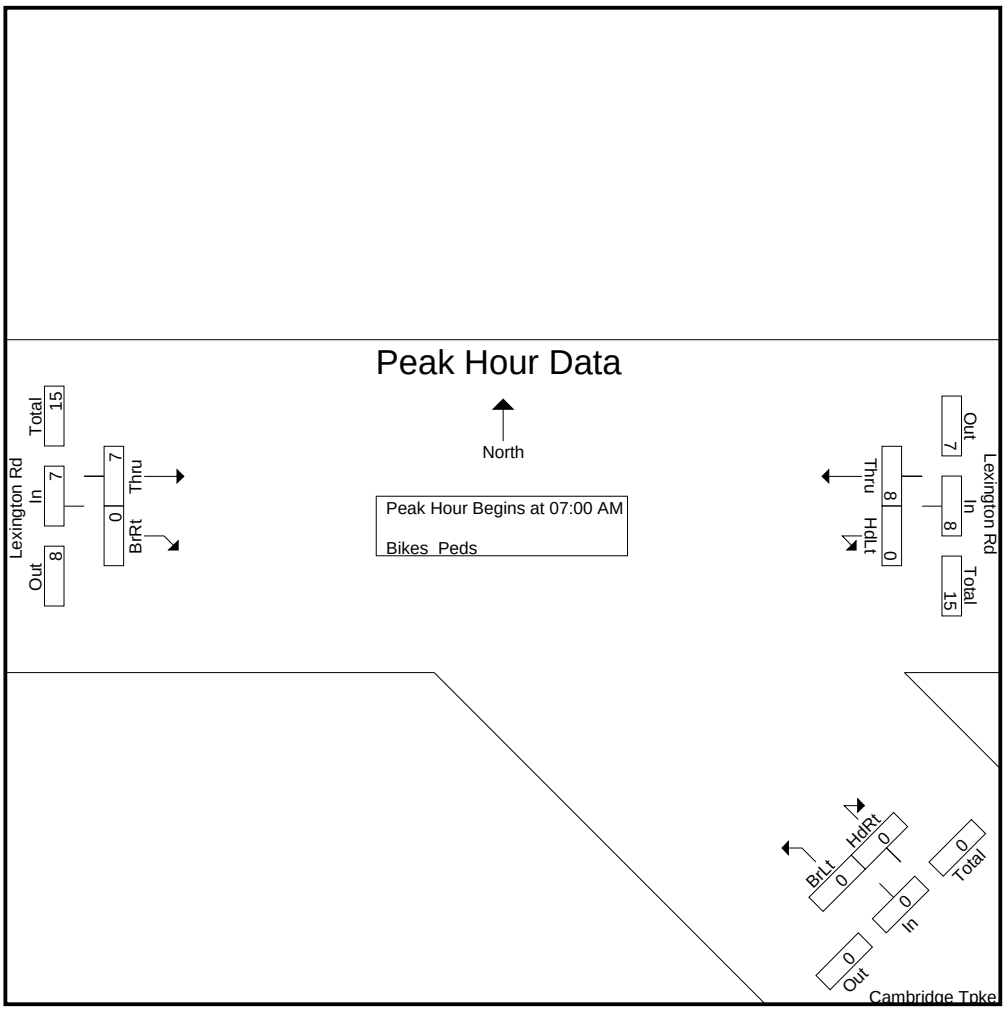
	Lexington Rd From East			Cambridge Tpke From Southeast			Lexington Rd From West					
Start Time	HdLt	Thru	Peds	BrLt	HdRt	Peds	Thru	BrRt	Peds	Exclu. Total	Inclu. Total	Int. Total
07:00 AM	0	3	0	0	0	0	2	0	0	0	5	5
07:15 AM	0	2	0	0	0	0	2	0	0	0	4	4
07:30 AM	0	2	0	0	0	0	0	0	0	0	2	2
07:45 AM	0	1	0	0	0	0	3	0	0	0	4	4
Total	0	8	0	0	0	0	7	0	0	0	15	15
08:00 AM	0	0	0	0	0	0	2	0	0	0	2	2
08:15 AM	0	1	0	1	0	0	0	1	0	0	3	3
08:30 AM	0	1	0	0	1	0	2	0	0	0	4	4
08:45 AM	0	0	0	0	0	0	1	0	0	0	1	1
Total	0	2	0	1	1	0	5	1	0	0	10	10
Grand Total	0	10	0	1	1	0	12	1	0	0	25	25
Apprch %	0	100		50	50		92.3	7.7				
Total %	0	40		4	4		48	4		0	100	

	Lexington Rd From East			Cambridge Tpke From Southeast			Lexington Rd From West			
Start Time	HdLt	Thru	App. Total	BrLt	HdRt	App. Total	Thru	BrRt	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 07:00 AM										
07:00 AM	0	**3**	**3**	0	0	0	2	0	2	**5**
07:15 AM	0	2	2	0	0	0	2	0	2	4
07:30 AM	0	2	2	0	0	0	0	0	0	2
07:45 AM	0	1	1	0	0	0	**3**	0	**3**	4
Total Volume	0	8	8	0	0	0	7	0	7	15
% App. Total	0	100		0	0		100	0		
PHF	.000	.667	.667	.000	.000	.000	.583	.000	.583	.750

Accurate Counts
978-664-2565

N/S Street : Cambridge Turnpike
E/W Street: Lexington Road
City/State : Concord, MA
Weather : Cloudy

File Name : 440A0001
Site Code : 440A0001
Start Date : 9/27/2012
Page No : 2



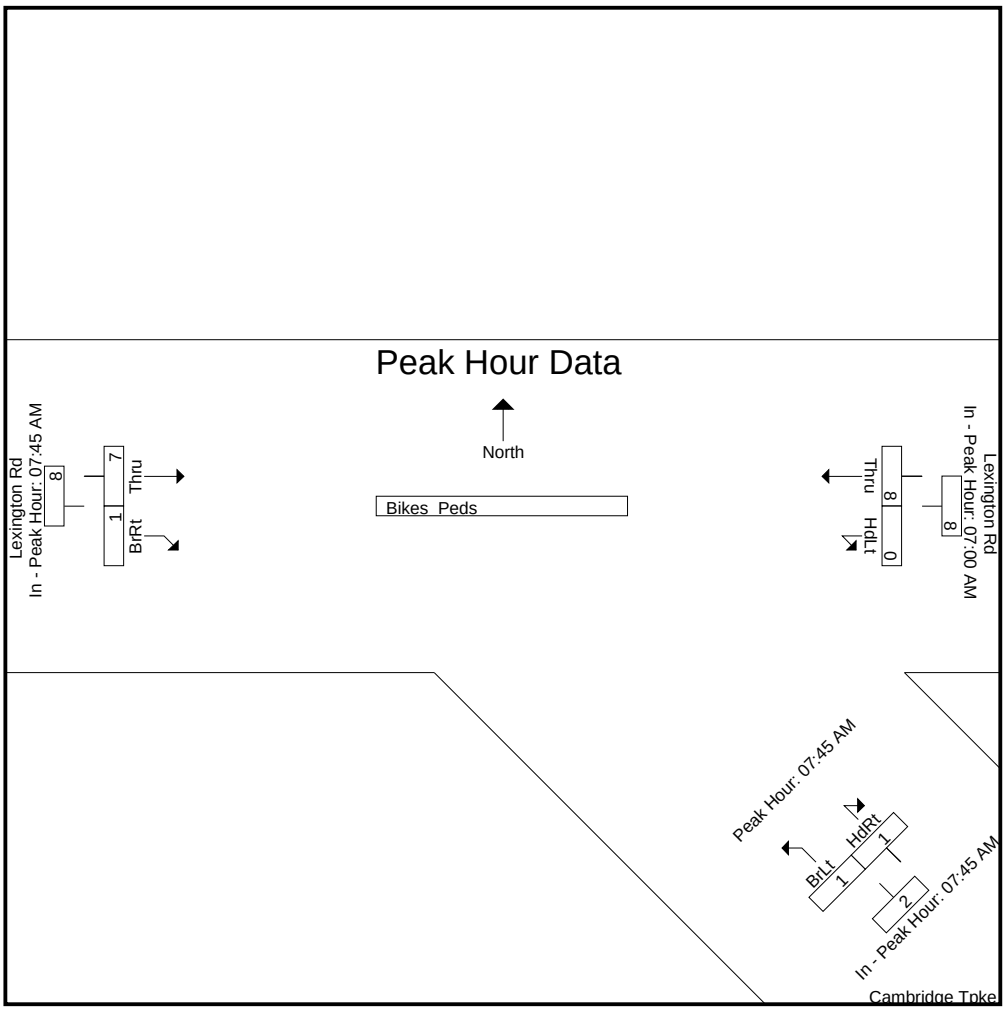
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:00 AM			07:45 AM			07:45 AM		
+0 mins.	0	**3**	**3**	0	0	0	**3**	0	**3**
+15 mins.	0	2	2	0	0	0	2	0	2
+30 mins.	0	2	2	**1**	0	**1**	0	**1**	1
+45 mins.	0	1	1	0	**1**	1	2	0	2
Total Volume	0	8	8	1	1	2	7	1	8
% App. Total	0	100		50	50		87.5	12.5	
PHF	.000	.667	.667	.250	.250	.500	.583	.250	.667

Accurate Counts
978-664-2565

N/S Street : Cambridge Turnpike
E/W Street: Lexington Road
City/State : Concord, MA
Weather : Cloudy

File Name : 440A0001
Site Code : 440A0001
Start Date : 9/27/2012
Page No : 3



Accurate Counts
978-664-2565

N/S Street : Cambridge Turnpike
E/W Street: Lexington Road
City/State : Concord, MA
Weather : Cloudy

File Name : 440A0RD1
Site Code : 440A0001
Start Date : 10/9/2012
Page No : 1

Groups Printed- Cars - Trucks

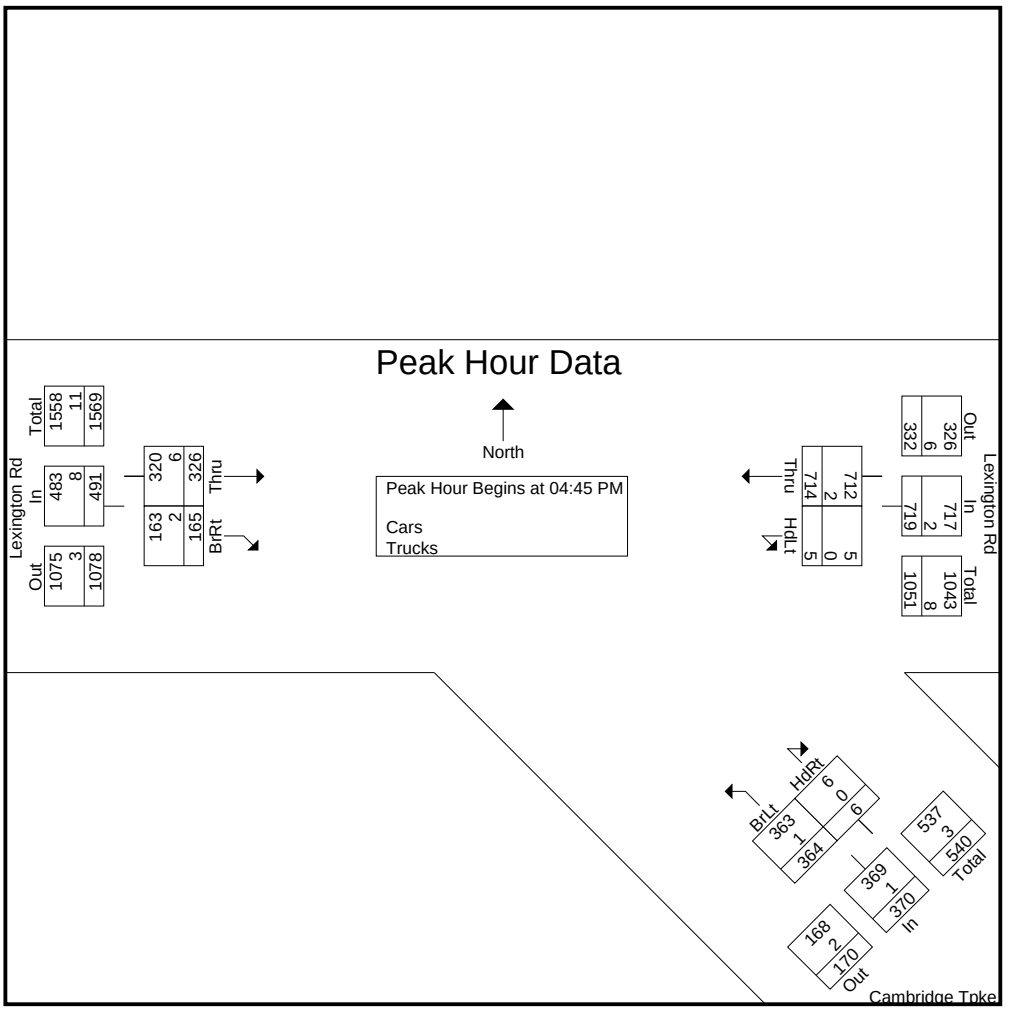
	Lexington Rd From East		Cambridge Tpke From Southeast		Lexington Rd From West		
Start Time	HdLt	Thru	BrLt	HdRt	Thru	BrRt	Int. Total
04:00 PM	1	126	101	0	72	53	353
04:15 PM	0	153	95	2	49	49	348
04:30 PM	3	181	90	2	81	39	396
04:45 PM	1	178	97	3	86	40	405
Total	5	638	383	7	288	181	1502
05:00 PM	1	164	91	2	85	41	384
05:15 PM	2	182	87	1	72	43	387
05:30 PM	1	190	89	0	83	41	404
05:45 PM	0	183	93	1	79	42	398
Total	4	719	360	4	319	167	1573
Grand Total	9	1357	743	11	607	348	3075
Apprch %	0.7	99.3	98.5	1.5	63.6	36.4	
Total %	0.3	44.1	24.2	0.4	19.7	11.3	
Cars	9	1351	741	11	599	344	3055
% Cars	100	99.6	99.7	100	98.7	98.9	99.3
Trucks	0	6	2	0	8	4	20
% Trucks	0	0.4	0.3	0	1.3	1.1	0.7

	Lexington Rd From East			Cambridge Tpke From Southeast			Lexington Rd From West			
Start Time	HdLt	Thru	App. Total	BrLt	HdRt	App. Total	Thru	BrRt	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 04:45 PM										
04:45 PM	1	178	179	**97**	**3**	**100**	**86**	40	**126**	**405**
05:00 PM	1	164	165	91	2	93	85	41	126	384
05:15 PM	**2**	182	184	87	1	88	72	**43**	115	387
05:30 PM	1	**190**	**191**	89	0	89	83	41	124	404
Total Volume	5	714	719	364	6	370	326	165	491	1580
% App. Total	0.7	99.3		98.4	1.6		66.4	33.6		
PHF	.625	.939	.941	.938	.500	.925	.948	.959	.974	.975
Cars	5	712	717	363	6	369	320	163	483	1569
% Cars	100	99.7	99.7	99.7	100	99.7	98.2	98.8	98.4	99.3
Trucks	0	2	2	1	0	1	6	2	8	11
% Trucks	0	0.3	0.3	0.3	0	0.3	1.8	1.2	1.6	0.7

Accurate Counts
978-664-2565

N/S Street : Cambridge Turnpike
E/W Street: Lexington Road
City/State : Concord, MA
Weather : Cloudy

File Name : 440A0RD1
Site Code : 440A0001
Start Date : 10/9/2012
Page No : 2



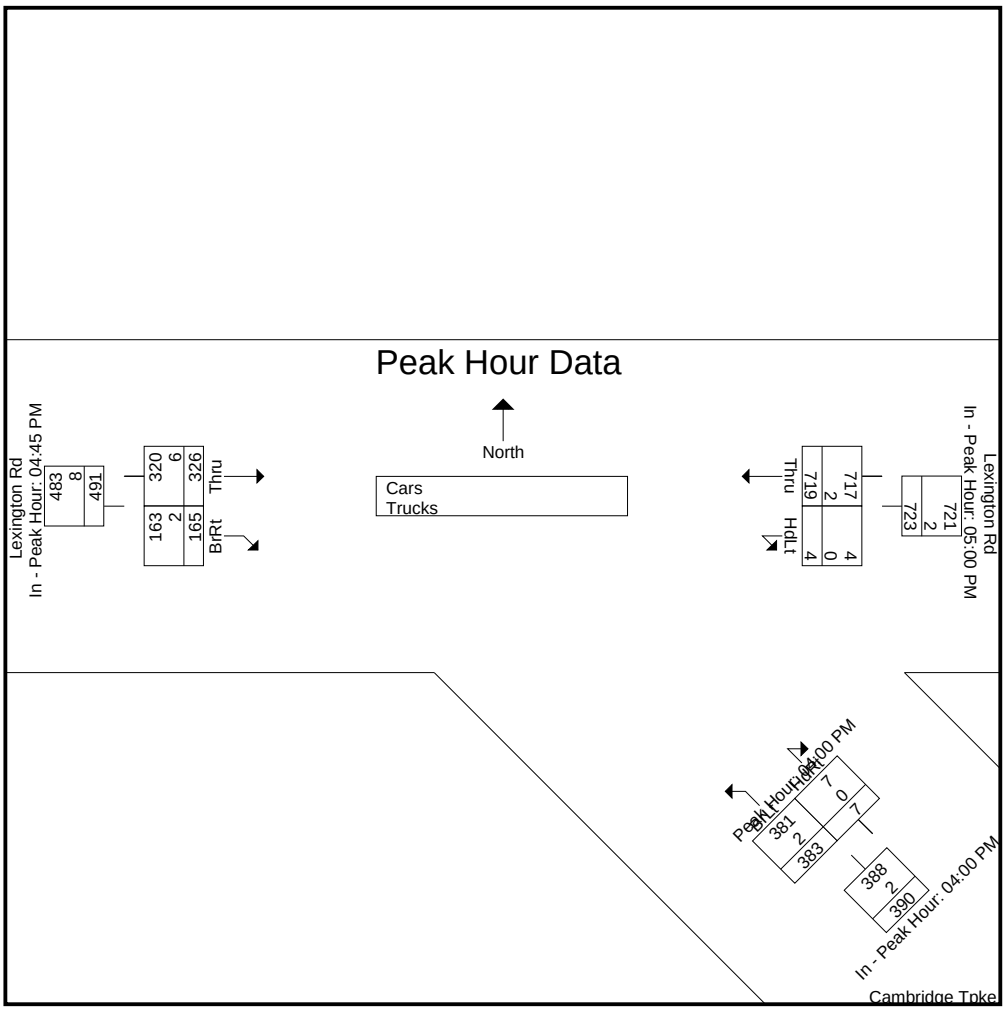
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	05:00 PM			04:00 PM			04:45 PM		
+0 mins.	1	164	165	**101**	0	**101**	**86**	40	**126**
+15 mins.	**2**	182	184	95	2	97	85	41	126
+30 mins.	1	**190**	**191**	90	2	92	72	**43**	115
+45 mins.	0	183	183	97	**3**	100	83	41	124
Total Volume	4	719	723	383	7	390	326	165	491
% App. Total	0.6	99.4		98.2	1.8		66.4	33.6	
PHF	.500	.946	.946	.948	.583	.965	.948	.959	.974
Cars	4	717	721	381	7	388	320	163	483
% Cars	100	99.7	99.7	99.5	100	99.5	98.2	98.8	98.4
Trucks	0	2	2	2	0	2	6	2	8
% Trucks	0	0.3	0.3	0.5	0	0.5	1.8	1.2	1.6

Accurate Counts
978-664-2565

N/S Street : Cambridge Turnpike
E/W Street: Lexington Road
City/State : Concord, MA
Weather : Cloudy

File Name : 440A0RD1
Site Code : 440A0001
Start Date : 10/9/2012
Page No : 3



Accurate Counts
978-664-2565

N/S Street : Cambridge Turnpike
E/W Street: Lexington Road
City/State : Concord, MA
Weather : Cloudy

File Name : 440A0RD1
Site Code : 440A0001
Start Date : 10/9/2012
Page No : 1

Groups Printed- Cars

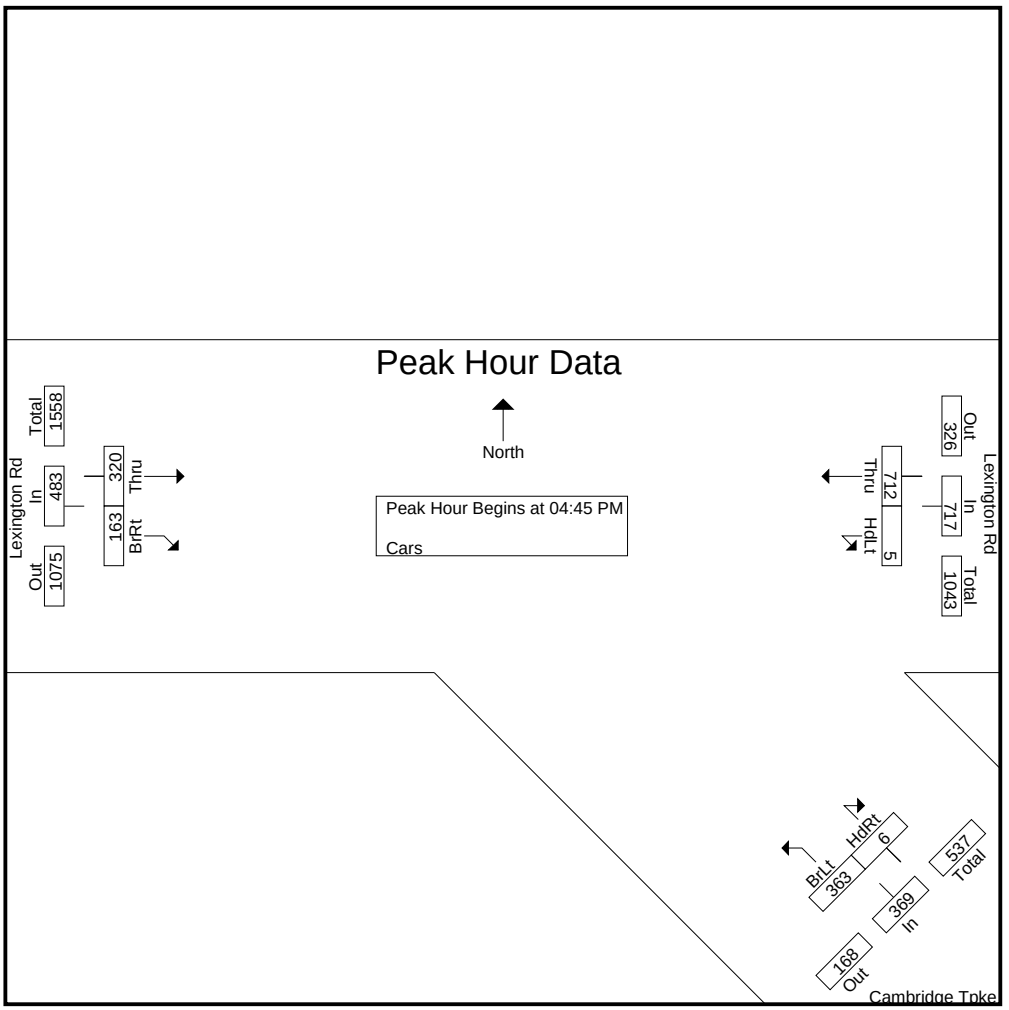
	Lexington Rd From East		Cambridge Tpke From Southeast		Lexington Rd From West		
Start Time	HdLt	Thru	BrLt	HdRt	Thru	BrRt	Int. Total
04:00 PM	1	124	101	0	72	52	350
04:15 PM	0	152	94	2	49	48	345
04:30 PM	3	180	90	2	80	39	394
04:45 PM	1	178	96	3	86	39	403
Total	5	634	381	7	287	178	1492
05:00 PM	1	163	91	2	81	41	379
05:15 PM	2	181	87	1	71	43	385
05:30 PM	1	190	89	0	82	40	402
05:45 PM	0	183	93	1	78	42	397
Total	4	717	360	4	312	166	1563
Grand Total	9	1351	741	11	599	344	3055
Apprch %	0.7	99.3	98.5	1.5	63.5	36.5	
Total %	0.3	44.2	24.3	0.4	19.6	11.3	

	Lexington Rd From East			Cambridge Tpke From Southeast			Lexington Rd From West			
Start Time	HdLt	Thru	App. Total	BrLt	HdRt	App. Total	Thru	BrRt	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 04:45 PM										
04:45 PM	1	178	179	**96**	**3**	**99**	**86**	39	**125**	**403**
05:00 PM	1	163	164	91	2	93	81	41	122	379
05:15 PM	**2**	181	183	87	1	88	71	**43**	114	385
05:30 PM	1	**190**	**191**	89	0	89	82	40	122	402
Total Volume	5	712	717	363	6	369	320	163	483	1569
% App. Total	0.7	99.3		98.4	1.6		66.3	33.7		
PHF	.625	.937	.938	.945	.500	.932	.930	.948	.966	.973

Accurate Counts
978-664-2565

N/S Street : Cambridge Turnpike
E/W Street: Lexington Road
City/State : Concord, MA
Weather : Cloudy

File Name : 440A0RD1
Site Code : 440A0001
Start Date : 10/9/2012
Page No : 2



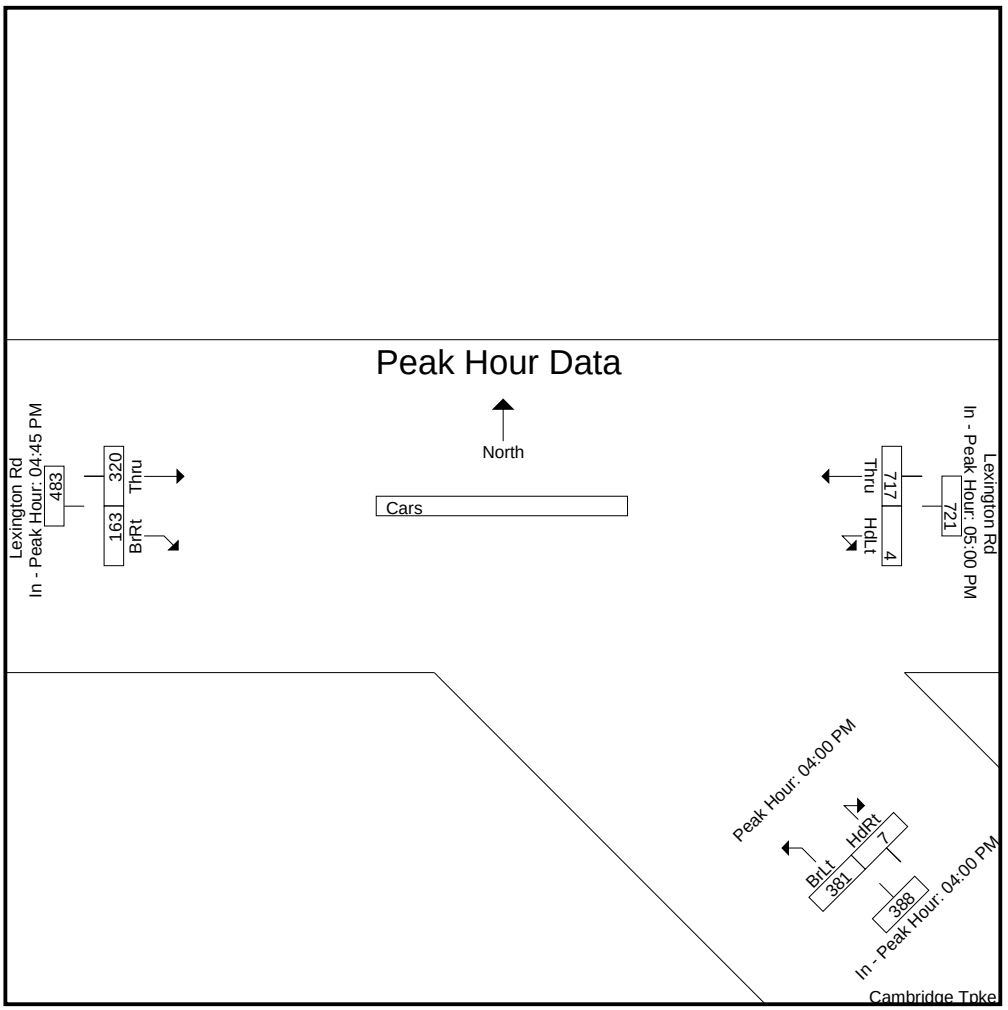
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	05:00 PM			04:00 PM			04:45 PM		
+0 mins.	1	163	164	**101**	0	**101**	**86**	39	**125**
+15 mins.	**2**	181	183	94	2	96	81	41	122
+30 mins.	1	**190**	**191**	90	2	92	71	**43**	114
+45 mins.	0	183	183	96	**3**	99	82	40	122
Total Volume	4	717	721	381	7	388	320	163	483
% App. Total	0.6	99.4		98.2	1.8		66.3	33.7	
PHF	.500	.943	.944	.943	.583	.960	.930	.948	.966

Accurate Counts
978-664-2565

N/S Street : Cambridge Turnpike
E/W Street: Lexington Road
City/State : Concord, MA
Weather : Cloudy

File Name : 440A0RD1
Site Code : 440A0001
Start Date : 10/9/2012
Page No : 3



Accurate Counts
978-664-2565

N/S Street : Cambridge Turnpike
E/W Street: Lexington Road
City/State : Concord, MA
Weather : Cloudy

File Name : 440A0RD1
Site Code : 440A0001
Start Date : 10/9/2012
Page No : 1

Groups Printed- Trucks

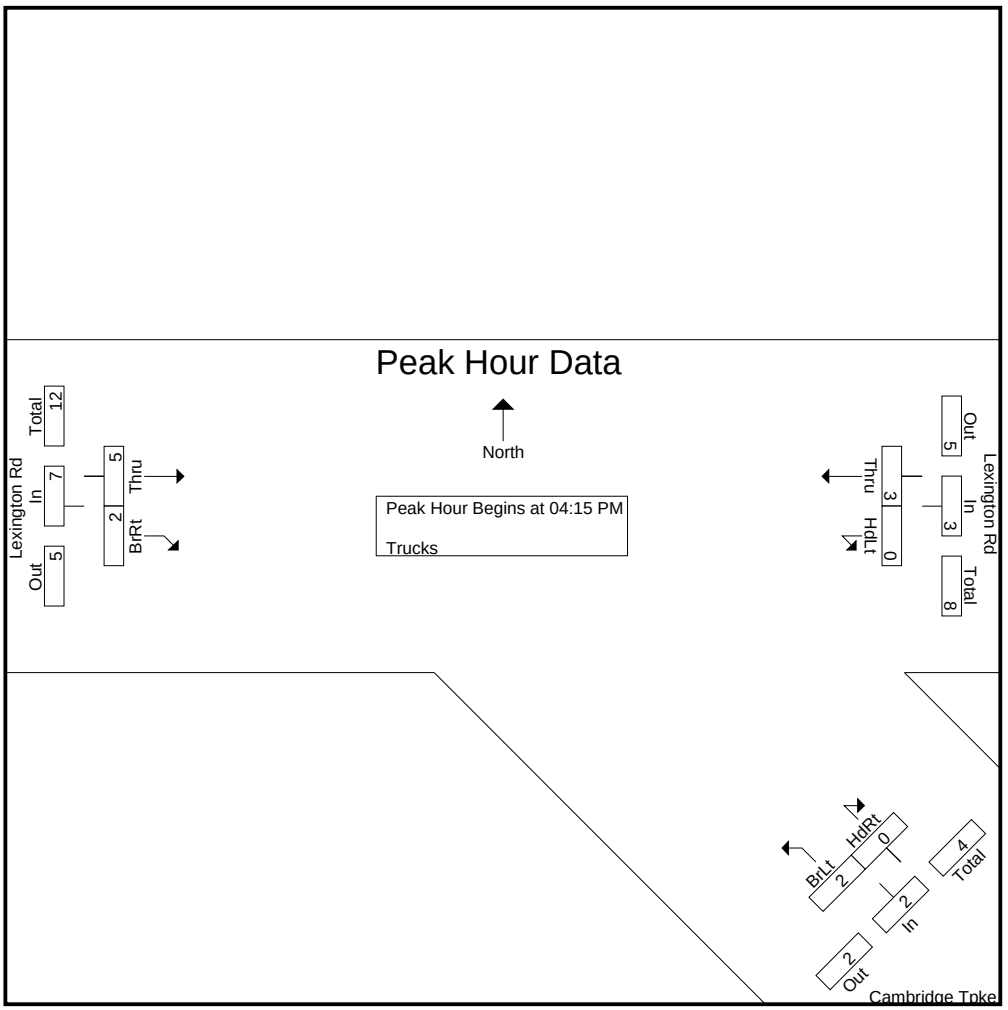
	Lexington Rd From East		Cambridge Tpke From Southeast		Lexington Rd From West		
Start Time	HdLt	Thru	BrLt	HdRt	Thru	BrRt	Int. Total
04:00 PM	0	2	0	0	0	1	3
04:15 PM	0	1	1	0	0	1	3
04:30 PM	0	1	0	0	1	0	2
04:45 PM	0	0	1	0	0	1	2
Total	0	4	2	0	1	3	10
05:00 PM	0	1	0	0	4	0	5
05:15 PM	0	1	0	0	1	0	2
05:30 PM	0	0	0	0	1	1	2
05:45 PM	0	0	0	0	1	0	1
Total	0	2	0	0	7	1	10
Grand Total	0	6	2	0	8	4	20
Apprch %	0	100	100	0	66.7	33.3	
Total %	0	30	10	0	40	20	

	Lexington Rd From East			Cambridge Tpke From Southeast			Lexington Rd From West			
Start Time	HdLt	Thru	App. Total	BrLt	HdRt	App. Total	Thru	BrRt	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 04:15 PM										
04:15 PM	0	**1**	**1**	**1**	0	**1**	0	**1**	1	3
04:30 PM	0	1	1	0	0	0	1	0	1	2
04:45 PM	0	0	0	1	0	1	0	1	1	2
05:00 PM	0	1	1	0	0	0	**4**	0	**4**	**5**
Total Volume	0	3	3	2	0	2	5	2	7	12
% App. Total	0	100		100	0		71.4	28.6		
PHF	.000	.750	.750	.500	.000	.500	.313	.500	.438	.600

Accurate Counts
978-664-2565

N/S Street : Cambridge Turnpike
E/W Street: Lexington Road
City/State : Concord, MA
Weather : Cloudy

File Name : 440A0RD1
Site Code : 440A0001
Start Date : 10/9/2012
Page No : 2



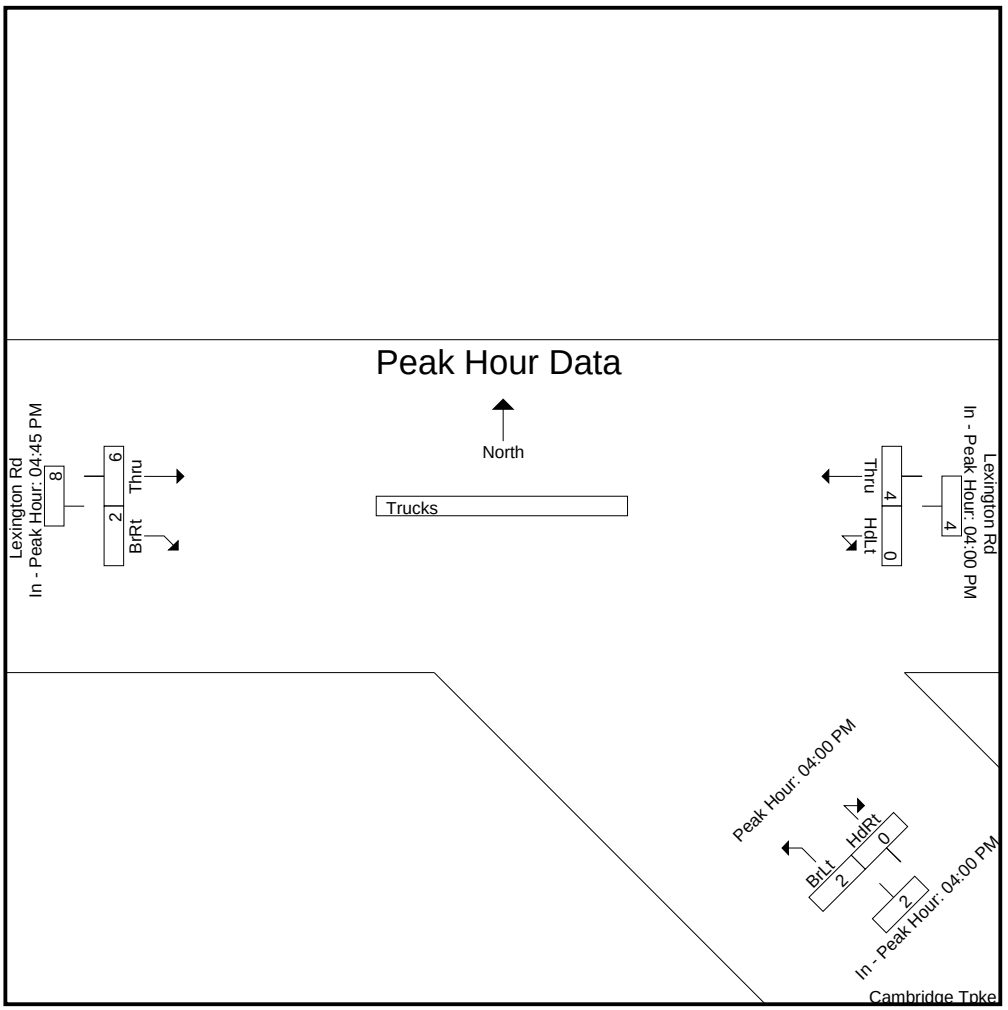
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	04:00 PM			04:00 PM			04:45 PM		
+0 mins.	0	**2**	**2**	0	0	0	0	**1**	1
+15 mins.	0	1	1	**1**	0	**1**	**4**	0	**4**
+30 mins.	0	1	1	0	0	0	1	0	1
+45 mins.	0	0	0	1	0	1	1	1	2
Total Volume	0	4	4	2	0	2	6	2	8
% App. Total	0	100		100	0		75	25	
PHF	.000	.500	.500	.500	.000	.500	.375	.500	.500

Accurate Counts
978-664-2565

N/S Street : Cambridge Turnpike
E/W Street: Lexington Road
City/State : Concord, MA
Weather : Cloudy

File Name : 440A0RD1
Site Code : 440A0001
Start Date : 10/9/2012
Page No : 3



Accurate Counts
978-664-2565

N/S Street : Cambridge Turnpike
E/W Street: Lexington Road
City/State : Concord, MA
Weather : Cloudy

File Name : 440A0RD1
Site Code : 440A0001
Start Date : 10/9/2012
Page No : 1

Groups Printed- Bikes Peds

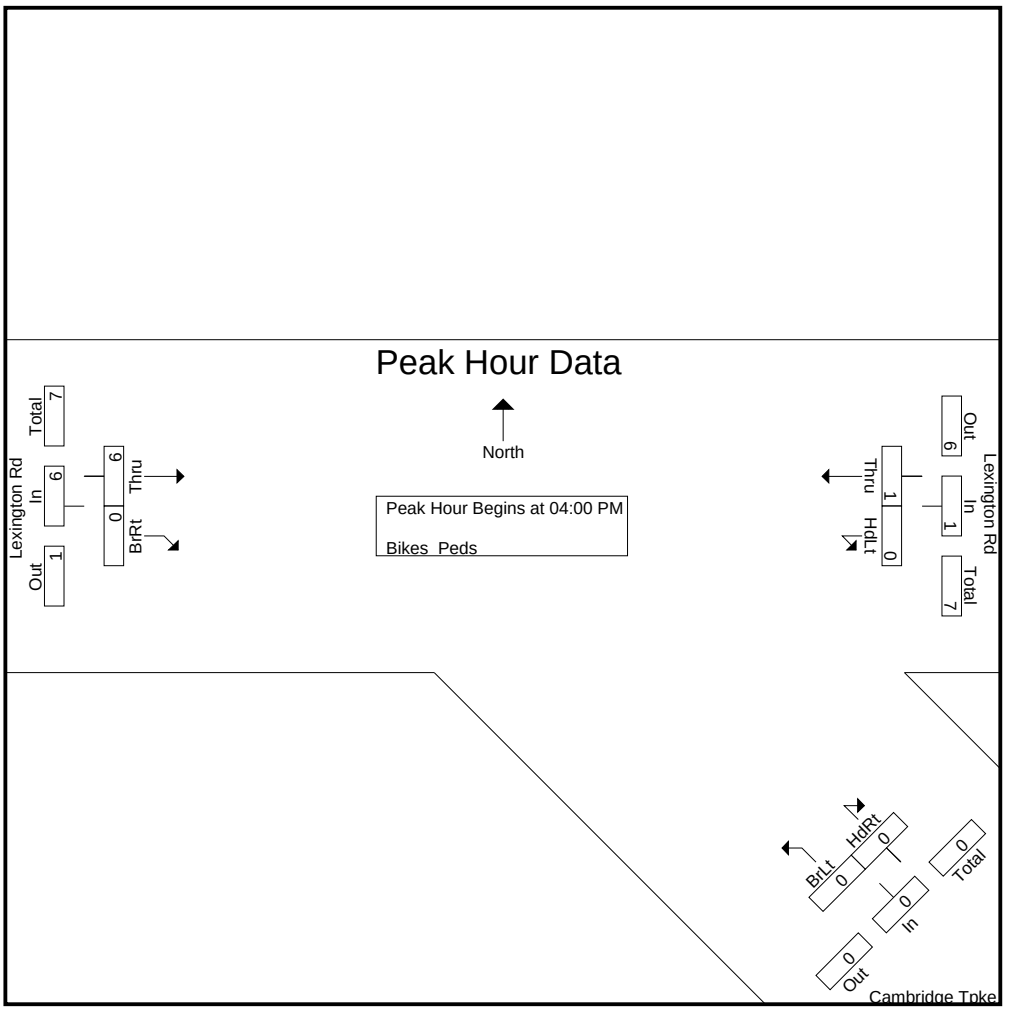
	Lexington Rd From East			Cambridge Tpke From Southeast			Lexington Rd From West					
Start Time	HdLt	Thru	Peds	BrLt	HdRt	Peds	Thru	BrRt	Peds	Exclu. Total	Inclu. Total	Int. Total
04:00 PM	0	0	0	0	0	0	0	0	0	0	0	0
04:15 PM	0	0	0	0	0	0	3	0	0	0	3	3
04:30 PM	0	1	2	0	0	0	0	0	0	2	1	3
04:45 PM	0	0	0	0	0	0	3	0	0	0	3	3
Total	0	1	2	0	0	0	6	0	0	2	7	9
05:00 PM	0	0	0	0	0	0	0	0	0	0	0	0
05:15 PM	0	1	0	0	0	0	0	0	0	0	1	1
05:30 PM	0	0	0	0	1	0	1	0	0	0	2	2
05:45 PM	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	1	0	0	1	0	1	0	0	0	3	3
Grand Total	0	2	2	0	1	0	7	0	0	2	10	12
Apprch %	0	100		0	100		100	0				
Total %	0	20		0	10		70	0		16.7	83.3	

	Lexington Rd From East			Cambridge Tpke From Southeast			Lexington Rd From West			
Start Time	HdLt	Thru	App. Total	BrLt	HdRt	App. Total	Thru	BrRt	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 04:00 PM										
04:00 PM	0	0	0	0	0	0	0	0	0	0
04:15 PM	0	0	0	0	0	0	**3**	0	**3**	**3**
04:30 PM	0	**1**	**1**	0	0	0	0	0	0	1
04:45 PM	0	0	0	0	0	0	3	0	3	3
Total Volume	0	1	1	0	0	0	6	0	6	7
% App. Total	0	100		0	0		100	0		
PHF	.000	.250	.250	.000	.000	.000	.500	.000	.500	.583

Accurate Counts
978-664-2565

N/S Street : Cambridge Turnpike
E/W Street: Lexington Road
City/State : Concord, MA
Weather : Cloudy

File Name : 440A0RD1
Site Code : 440A0001
Start Date : 10/9/2012
Page No : 2



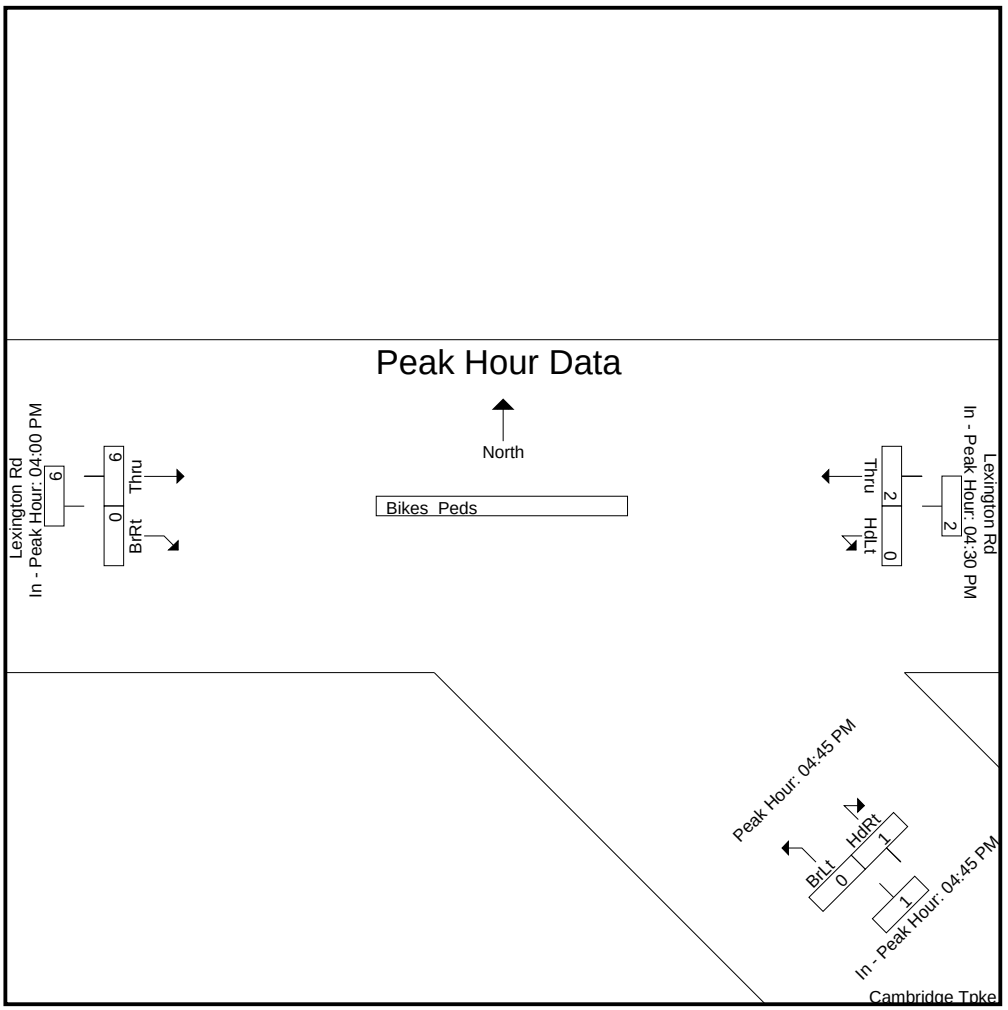
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	04:30 PM			04:45 PM			04:00 PM		
+0 mins.	0	**1**	**1**	0	0	0	0	0	0
+15 mins.	0	0	0	0	0	0	**3**	0	**3**
+30 mins.	0	0	0	0	0	0	0	0	0
+45 mins.	0	1	1	0	**1**	**1**	3	0	3
Total Volume	0	2	2	0	1	1	6	0	6
% App. Total	0	100		0	100		100	0	
PHF	.000	.500	.500	.000	.250	.250	.500	.000	.500

Accurate Counts
978-664-2565

N/S Street : Cambridge Turnpike
E/W Street: Lexington Road
City/State : Concord, MA
Weather : Cloudy

File Name : 440A0RD1
Site Code : 440A0001
Start Date : 10/9/2012
Page No : 3



Accurate Counts
978-664-2565

N/S Street : Sandy Pond Road
E/W Street : Cambridge Turnpike
City/State : Concord, MA
Weather : Cloudy

File Name : 440A0002
Site Code : 440A0002
Start Date : 9/27/2012
Page No : 1

Groups Printed- Cars - Trucks

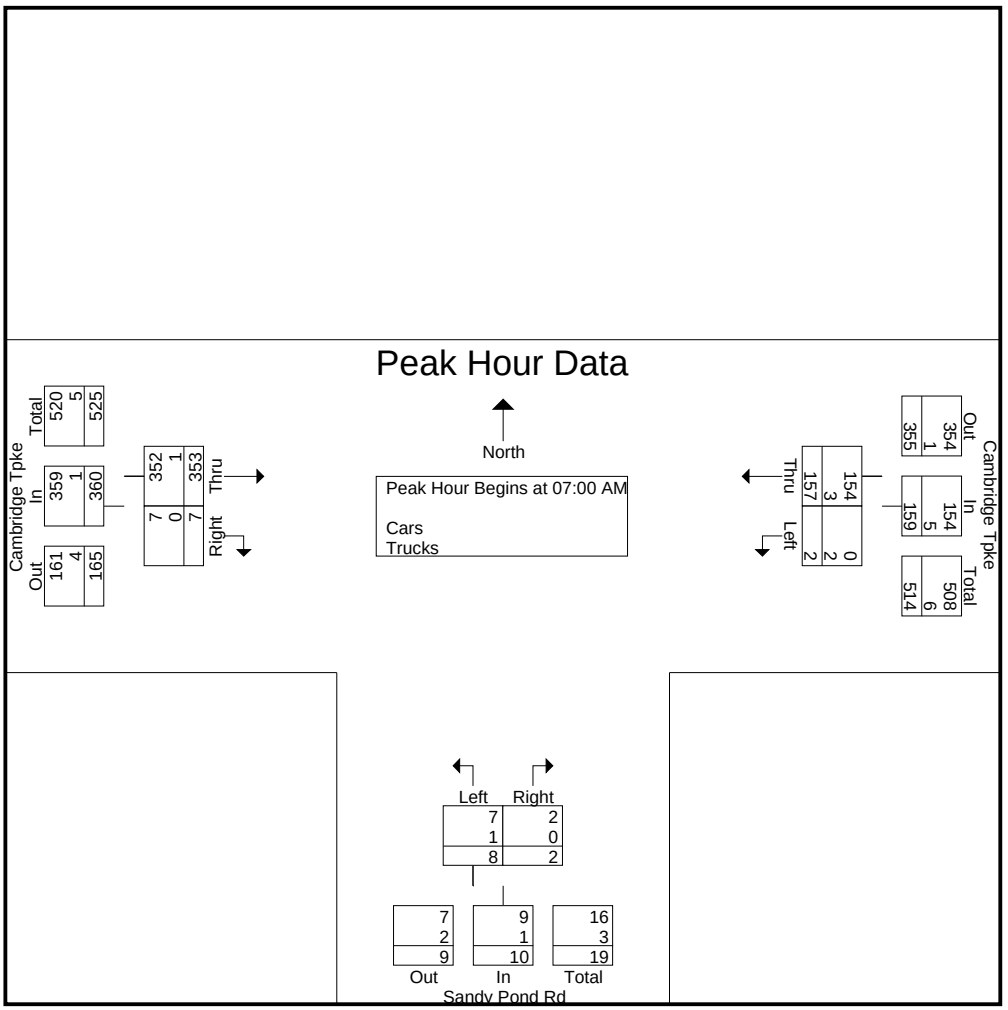
	Cambridge Tpke From East		Sandy Pond Rd From South		Cambridge Tpke From West		
Start Time	Left	Thru	Left	Right	Thru	Right	Int. Total
07:00 AM	0	31	1	0	80	1	113
07:15 AM	1	42	1	1	98	0	143
07:30 AM	1	38	3	1	106	4	153
07:45 AM	0	46	3	0	69	2	120
Total	2	157	8	2	353	7	529
Grand Total	2	157	8	2	353	7	529
Apprch %	1.3	98.7	80	20	98.1	1.9	
Total %	0.4	29.7	1.5	0.4	66.7	1.3	
Cars	0	154	7	2	352	7	522
% Cars	0	98.1	87.5	100	99.7	100	98.7
Trucks	2	3	1	0	1	0	7
% Trucks	100	1.9	12.5	0	0.3	0	1.3

	Cambridge Tpke From East			Sandy Pond Rd From South			Cambridge Tpke From West			
Start Time	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 07:45 AM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 07:00 AM										
07:00 AM	0	31	31	1	0	1	80	1	81	113
07:15 AM	**1**	42	43	1	**1**	2	98	0	98	143
07:30 AM	1	38	39	**3**	1	**4**	**106**	**4**	**110**	**153**
07:45 AM	0	**46**	**46**	3	0	3	69	2	71	120
Total Volume	2	157	159	8	2	10	353	7	360	529
% App. Total	1.3	98.7		80	20		98.1	1.9		
PHF	.500	.853	.864	.667	.500	.625	.833	.438	.818	.864
Cars	0	154	154	7	2	9	352	7	359	522
% Cars	0	98.1	96.9	87.5	100	90.0	99.7	100	99.7	98.7
Trucks	2	3	5	1	0	1	1	0	1	7
% Trucks	100	1.9	3.1	12.5	0	10.0	0.3	0	0.3	1.3

Accurate Counts
978-664-2565

N/S Street : Sandy Pond Road
E/W Street : Cambridge Turnpike
City/State : Concord, MA
Weather : Cloudy

File Name : 440A0002
Site Code : 440A0002
Start Date : 9/27/2012
Page No : 2



Peak Hour Analysis From 07:00 AM to 07:45 AM - Peak 1 of 1

Peak Hour for Each Approach Begins at:

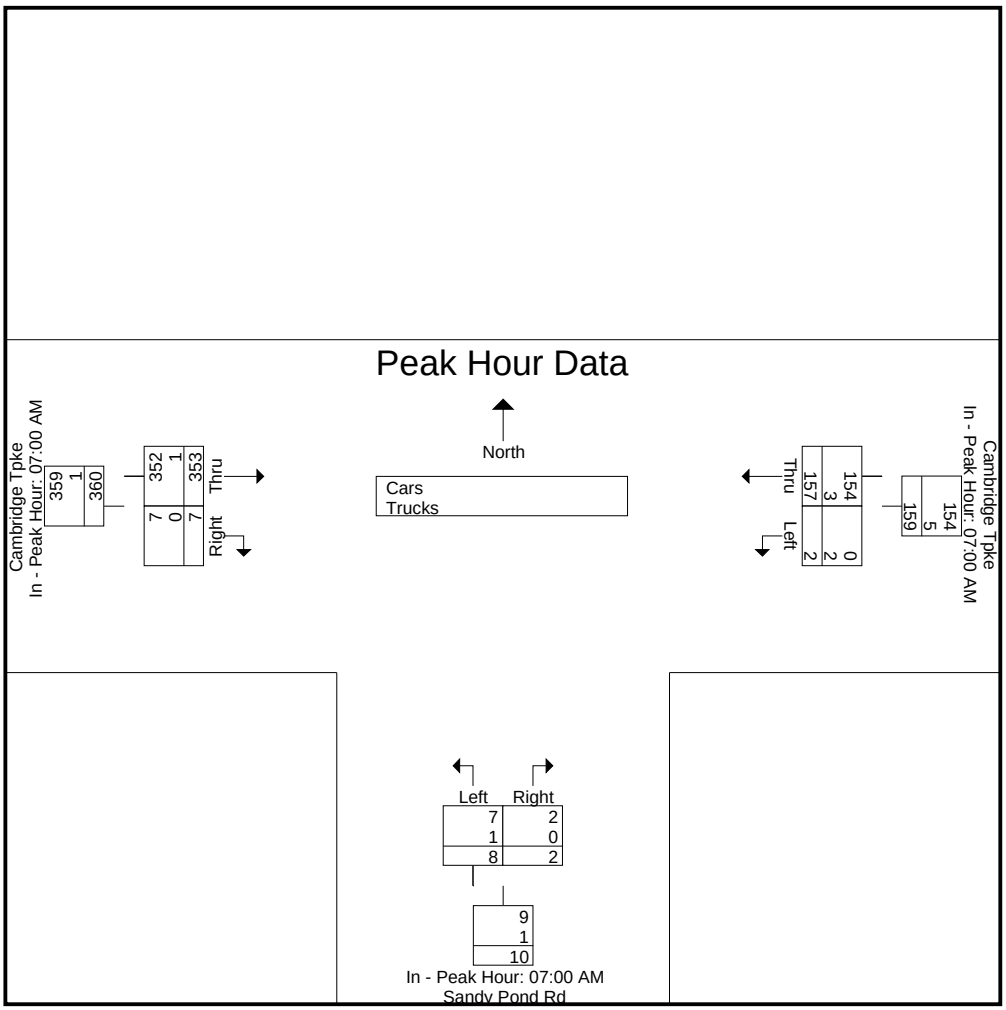
	07:00 AM			07:00 AM			07:00 AM		
+0 mins.	0	31	31	1	0	1	80	1	81
+15 mins.	**1**	42	43	1	**1**	2	98	0	98
+30 mins.	1	38	39	**3**	1	**4**	**106**	**4**	**110**
+45 mins.	0	**46**	**46**	3	0	3	69	2	71
Total Volume	2	157	159	8	2	10	353	7	360
% App. Total	1.3	98.7		80	20		98.1	1.9	
PHF	.500	.853	.864	.667	.500	.625	.833	.438	.818
Cars	0	154	154	7	2	9	352	7	359
% Cars	0	98.1	96.9	87.5	100	90	99.7	100	99.7
Trucks	2	3	5	1	0	1	1	0	1
% Trucks	100	1.9	3.1	12.5	0	10	0.3	0	0.3

Accurate Counts
978-664-2565

N/S Street : Sandy Pond Road
E/W Street : Cambridge Turnpike
City/State : Concord, MA
Weather : Cloudy

File Name : 440A0002
Site Code : 440A0002
Start Date : 9/27/2012
Page No : 3

Peak Hour Data



Accurate Counts
978-664-2565

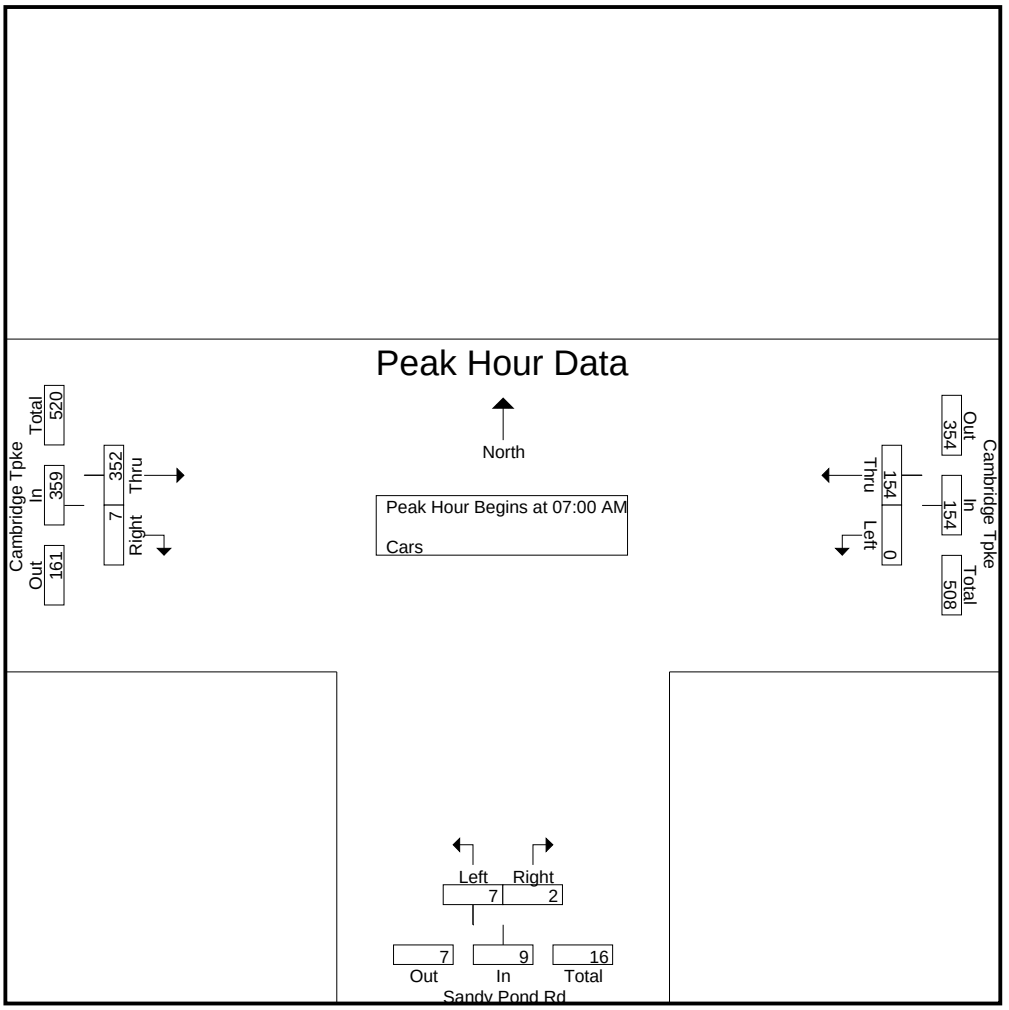
N/S Street : Sandy Pond Road
E/W Street : Cambridge Turnpike
City/State : Concord, MA
Weather : Cloudy

File Name : 440A0002
Site Code : 440A0002
Start Date : 9/27/2012
Page No : 1

Groups Printed- Cars

	Cambridge Tpke From East		Sandy Pond Rd From South		Cambridge Tpke From West		
Start Time	Left	Thru	Left	Right	Thru	Right	Int. Total
07:00 AM	0	30	1	0	80	1	112
07:15 AM	0	42	1	1	97	0	141
07:30 AM	0	36	2	1	106	4	149
07:45 AM	0	46	3	0	69	2	120
Total	0	154	7	2	352	7	522
Grand Total	0	154	7	2	352	7	522
Apprch %	0	100	77.8	22.2	98.1	1.9	
Total %	0	29.5	1.3	0.4	67.4	1.3	

	Cambridge Tpke From East			Sandy Pond Rd From South			Cambridge Tpke From West			
Start Time	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 07:45 AM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 07:00 AM										
07:00 AM	0	30	30	1	0	1	80	1	81	112
07:15 AM	0	42	42	1	**1**	2	97	0	97	141
07:30 AM	0	36	36	2	1	**3**	**106**	**4**	**110**	**149**
07:45 AM	0	**46**	**46**	**3**	0	3	69	2	71	120
Total Volume	0	154	154	7	2	9	352	7	359	522
% App. Total	0	100		77.8	22.2		98.1	1.9		
PHF	.000	.837	.837	.583	.500	.750	.830	.438	.816	.876

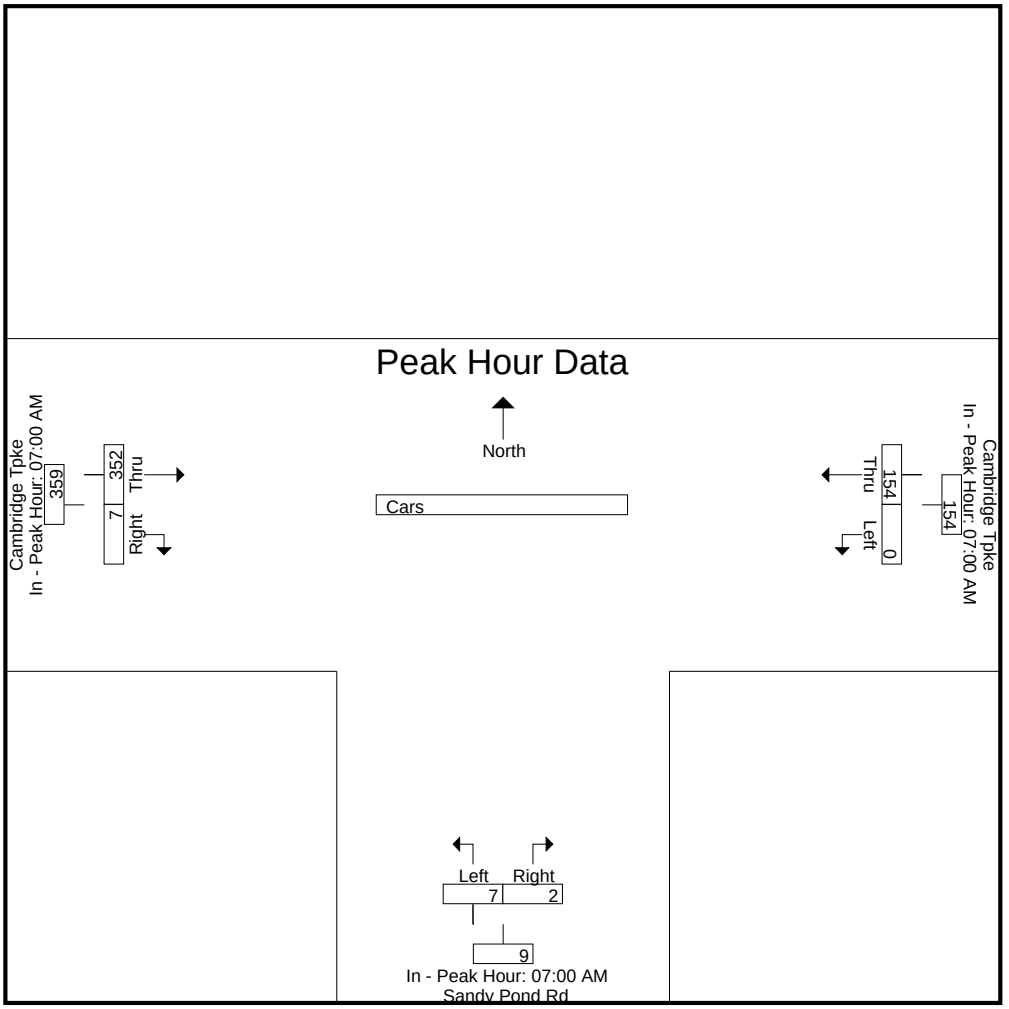


Accurate Counts
978-664-2565

N/S Street : Sandy Pond Road
E/W Street : Cambridge Turnpike
City/State : Concord, MA
Weather : Cloudy

File Name : 440A0002
Site Code : 440A0002
Start Date : 9/27/2012
Page No : 2

	Cambridge Tpke From East			Sandy Pond Rd From South			Cambridge Tpke From West			
Start Time	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 07:45 AM - Peak 1 of 1										
Peak Hour for Each Approach Begins at:										
	07:00 AM			07:00 AM			07:00 AM			
+0 mins.	0	30	30	1	0	1	80	1	81	
+15 mins.	0	42	42	1	**1**	2	97	0	97	
+30 mins.	0	36	36	2	1	**3**	**106**	**4**	**110**	
+45 mins.	0	**46**	**46**	**3**	0	3	69	2	71	
Total Volume	0	154	154	7	2	9	352	7	359	
% App. Total	0	100		77.8	22.2		98.1	1.9		
PHF	.000	.837	.837	.583	.500	.750	.830	.438	.816	



Accurate Counts
978-664-2565

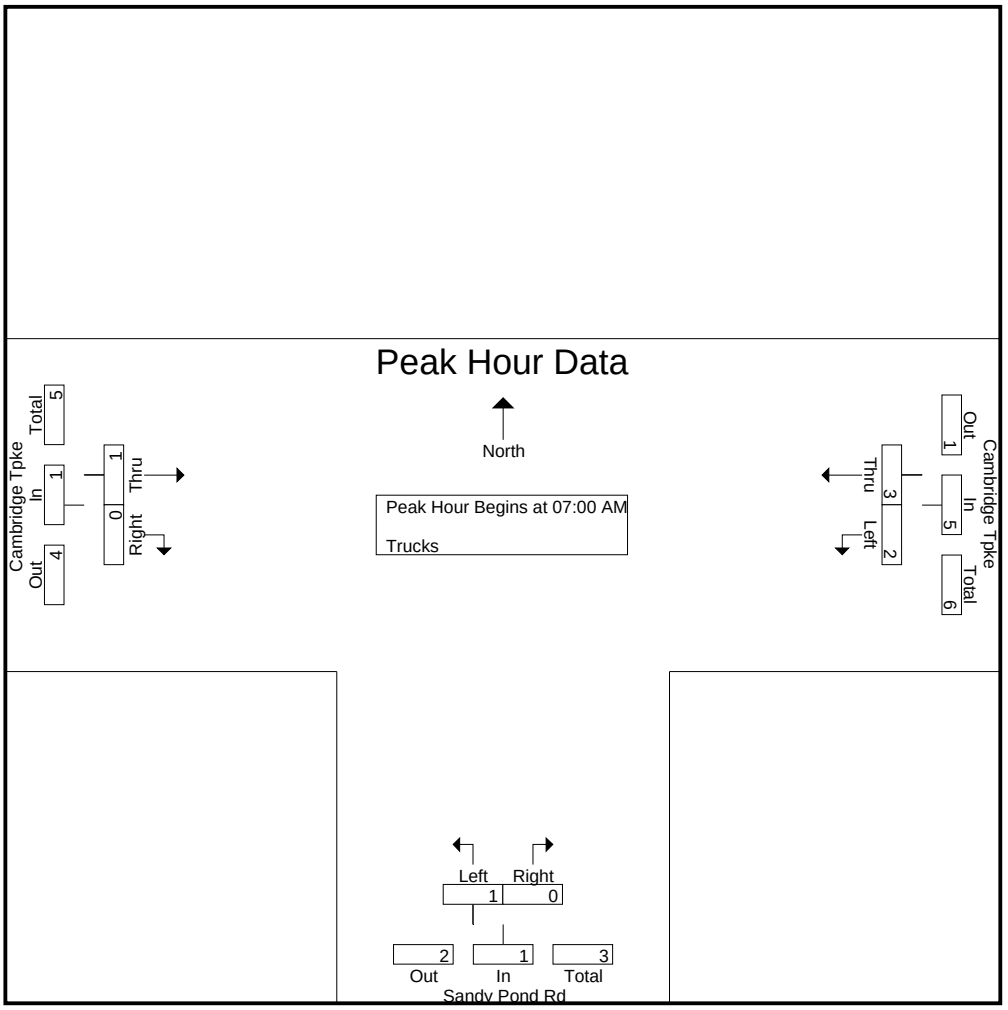
N/S Street : Sandy Pond Road
E/W Street : Cambridge Turnpike
City/State : Concord, MA
Weather : Cloudy

File Name : 440A0002
Site Code : 440A0002
Start Date : 9/27/2012
Page No : 1

Groups Printed- Trucks

	Cambridge Tpke From East		Sandy Pond Rd From South		Cambridge Tpke From West		
Start Time	Left	Thru	Left	Right	Thru	Right	Int. Total
07:00 AM	0	1	0	0	0	0	1
07:15 AM	1	0	0	0	1	0	2
07:30 AM	1	2	1	0	0	0	4
07:45 AM	0	0	0	0	0	0	0
Total	2	3	1	0	1	0	7
Grand Total	2	3	1	0	1	0	7
Apprch %	40	60	100	0	100	0	
Total %	28.6	42.9	14.3	0	14.3	0	

	Cambridge Tpke From East			Sandy Pond Rd From South			Cambridge Tpke From West			
Start Time	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 07:45 AM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 07:00 AM										
07:00 AM	0	1	1	0	0	0	0	0	0	1
07:15 AM	**1**	0	1	0	0	0	**1**	0	**1**	2
07:30 AM	1	**2**	**3**	**1**	0	**1**	0	0	0	**4**
07:45 AM	0	0	0	0	0	0	0	0	0	0
Total Volume	2	3	5	1	0	1	1	0	1	7
% App. Total	40	60		100	0		100	0		
PHF	.500	.375	.417	.250	.000	.250	.250	.000	.250	.438

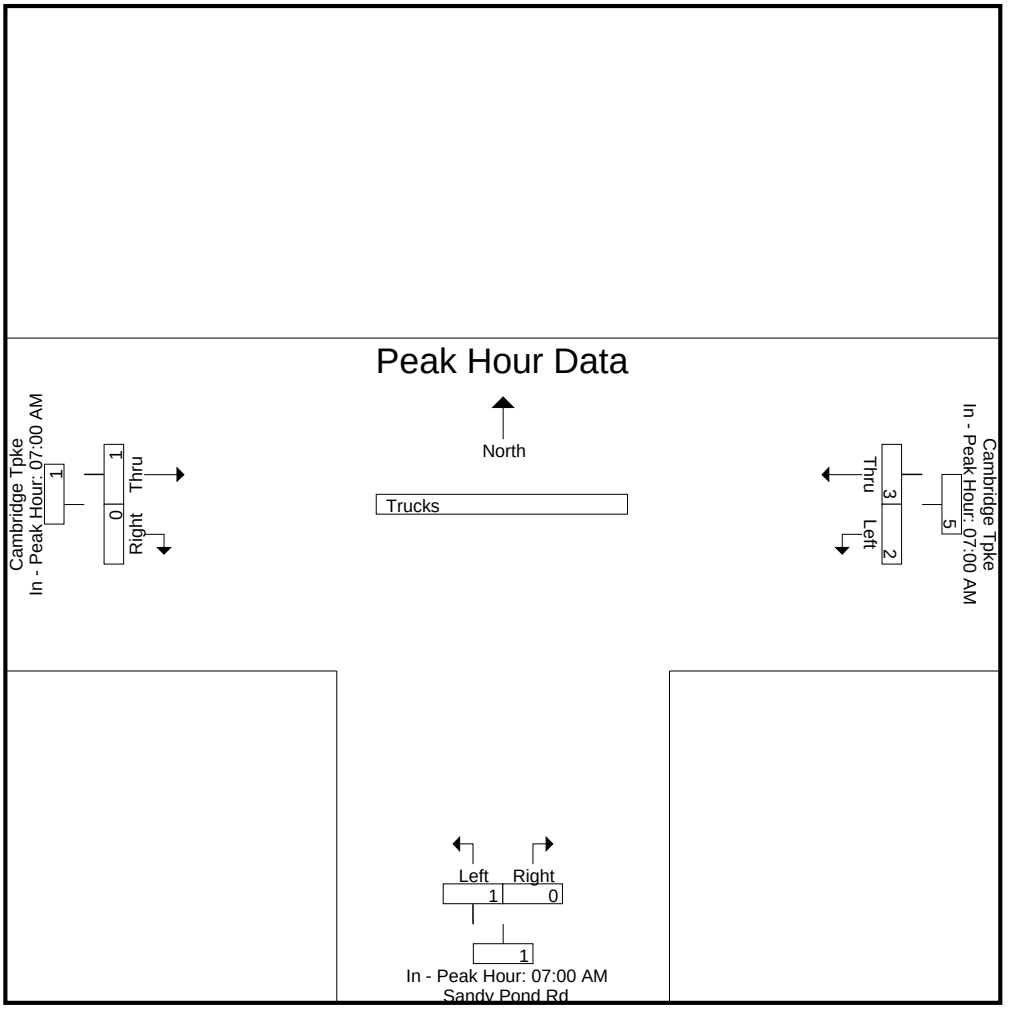


Accurate Counts
978-664-2565

N/S Street : Sandy Pond Road
E/W Street : Cambridge Turnpike
City/State : Concord, MA
Weather : Cloudy

File Name : 440A0002
Site Code : 440A0002
Start Date : 9/27/2012
Page No : 2

	Cambridge Tpke From East			Sandy Pond Rd From South			Cambridge Tpke From West			
Start Time	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 07:45 AM - Peak 1 of 1										
Peak Hour for Each Approach Begins at:										
	07:00 AM			07:00 AM			07:00 AM			
+0 mins.	0	1	1	0	0	0	0	0	0	
+15 mins.	**1**	0	1	0	0	0	**1**	0	**1**	
+30 mins.	1	**2**	**3**	**1**	0	**1**	0	0	0	
+45 mins.	0	0	0	0	0	0	0	0	0	
Total Volume	2	3	5	1	0	1	1	0	1	
% App. Total	40	60		100	0		100	0		
PHF	.500	.375	.417	.250	.000	.250	.250	.000	.250	



Accurate Counts
978-664-2565

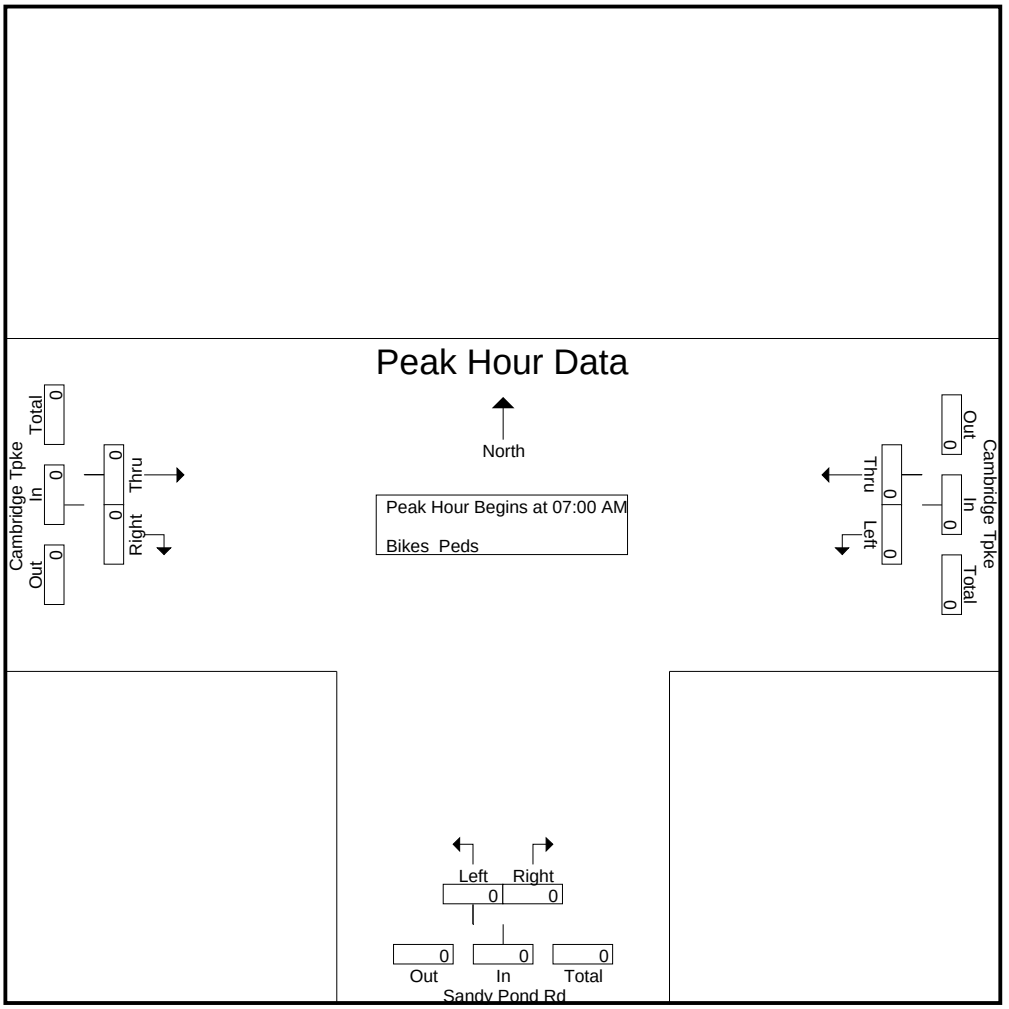
N/S Street : Sandy Pond Road
E/W Street : Cambridge Turnpike
City/State : Concord, MA
Weather : Cloudy

File Name : 440A0002
Site Code : 440A0002
Start Date : 9/27/2012
Page No : 1

Groups Printed- Bikes Peds

	Cambridge Tpke From East			Sandy Pond Rd From South			Cambridge Tpke From West					
Start Time	Left	Thru	Peds	Left	Right	Peds	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
07:00 AM	0	0	2	0	0	0	0	0	0	2	0	2
07:15 AM	0	0	0	0	0	0	0	0	0	0	0	0
07:30 AM	0	0	0	0	0	0	0	0	0	0	0	0
07:45 AM	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	2	0	0	0	0	0	0	2	0	2
Grand Total	0	0	2	0	0	0	0	0	0	2	0	2
Apprch %	0	0		0	0		0	0				
Total %										100	0	

	Cambridge Tpke From East			Sandy Pond Rd From South			Cambridge Tpke From West			
Start Time	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 07:45 AM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 07:00 AM										
07:00 AM	0	0	0	0	0	0	0	0	0	0
07:15 AM	0	0	0	0	0	0	0	0	0	0
07:30 AM	0	0	0	0	0	0	0	0	0	0
07:45 AM	0	0	0	0	0	0	0	0	0	0
Total Volume	0	0	0	0	0	0	0	0	0	0
% App. Total	0	0		0	0		0	0		
PHF	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000

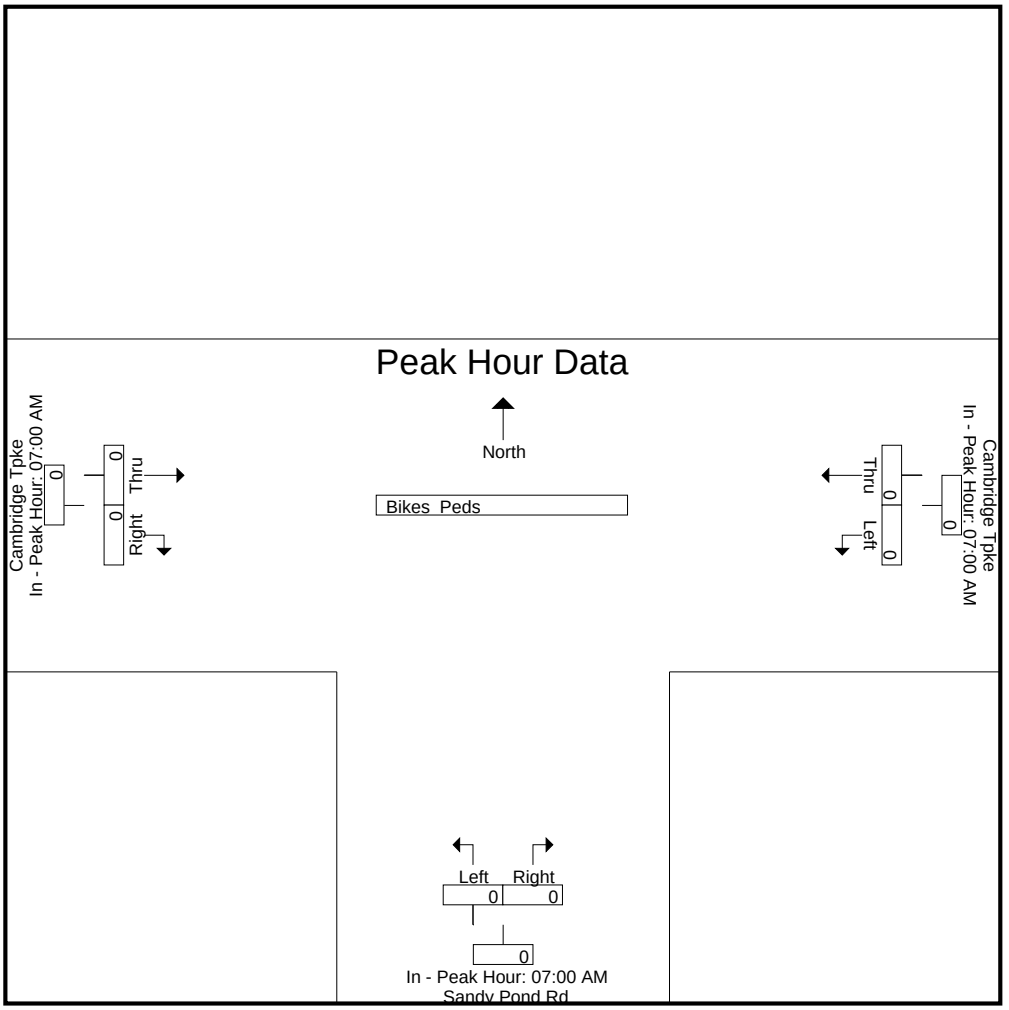


Accurate Counts
978-664-2565

N/S Street : Sandy Pond Road
E/W Street : Cambridge Turnpike
City/State : Concord, MA
Weather : Cloudy

File Name : 440A0002
Site Code : 440A0002
Start Date : 9/27/2012
Page No : 2

	Cambridge Tpke From East			Sandy Pond Rd From South			Cambridge Tpke From West			
Start Time	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 07:45 AM - Peak 1 of 1										
Peak Hour for Each Approach Begins at:										
	07:00 AM			07:00 AM			07:00 AM			
+0 mins.	0	0	0	0	0	0	0	0	0	
+15 mins.	0	0	0	0	0	0	0	0	0	
+30 mins.	0	0	0	0	0	0	0	0	0	
+45 mins.	0	0	0	0	0	0	0	0	0	
Total Volume	0	0	0	0	0	0	0	0	0	
% App. Total	0	0		0	0		0	0		
PHF	.000	.000	.000	.000	.000	.000	.000	.000	.000	



Accurate Counts
978-664-2565

N/S Street : Sandy Pond Road
E/W Street : Cambridge Turnpike
City/State : Concord, MA
Weather : Cloudy

File Name : 440A0002
Site Code : 440A0002
Start Date : 9/27/2012
Page No : 1

Groups Printed- Cars - Trucks

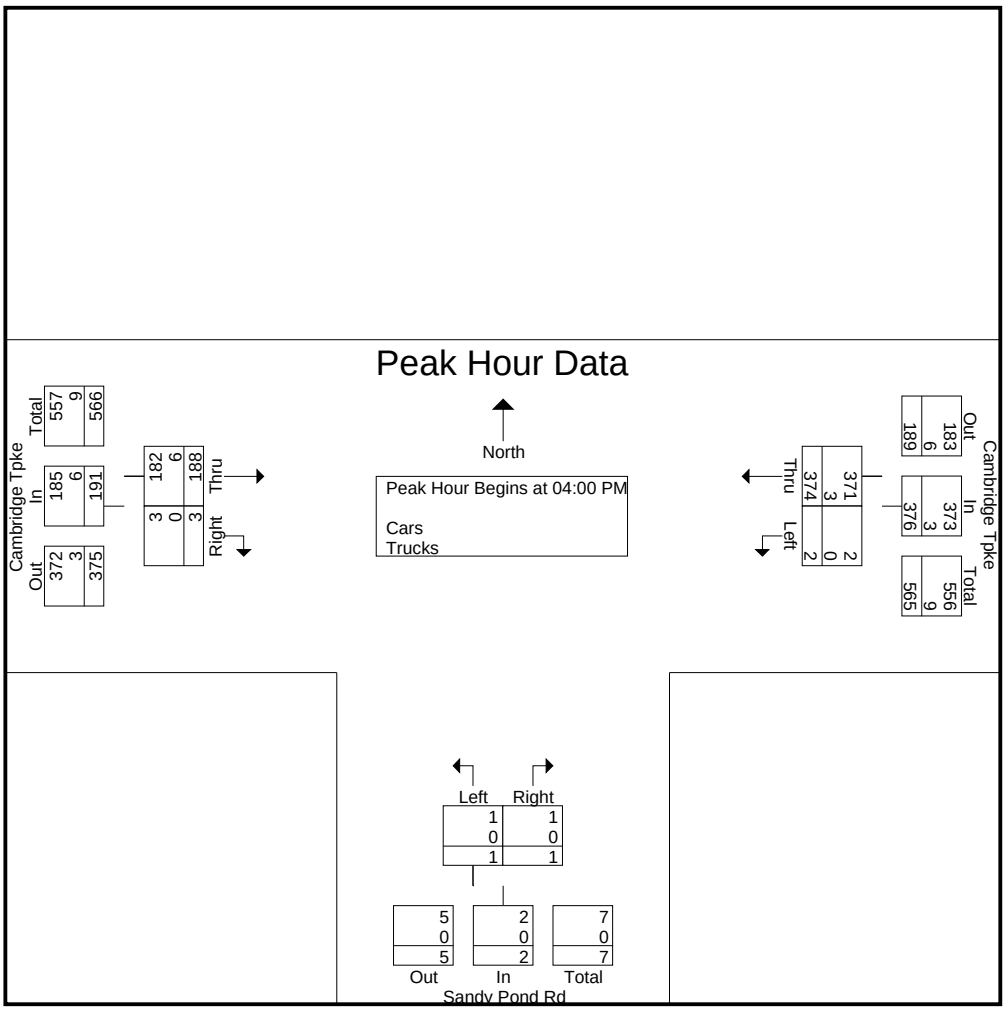
	Cambridge Tpke From East		Sandy Pond Rd From South		Cambridge Tpke From West		
Start Time	Left	Thru	Left	Right	Thru	Right	Int. Total
04:00 PM	0	87	0	0	42	1	130
04:15 PM	0	85	0	0	50	1	136
04:30 PM	0	111	1	0	54	1	167
04:45 PM	2	91	0	1	42	0	136
Total	2	374	1	1	188	3	569
Grand Total	2	374	1	1	188	3	569
Apprch %	0.5	99.5	50	50	98.4	1.6	
Total %	0.4	65.7	0.2	0.2	33	0.5	
Cars	2	371	1	1	182	3	560
% Cars	100	99.2	100	100	96.8	100	98.4
Trucks	0	3	0	0	6	0	9
% Trucks	0	0.8	0	0	3.2	0	1.6

	Cambridge Tpke From East			Sandy Pond Rd From South			Cambridge Tpke From West			
Start Time	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 04:45 PM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 04:00 PM										
04:00 PM	0	87	87	0	0	0	42	**1**	43	130
04:15 PM	0	85	85	0	0	0	50	1	51	136
04:30 PM	0	**111**	**111**	**1**	0	**1**	**54**	1	**55**	**167**
04:45 PM	**2**	91	93	0	**1**	1	42	0	42	136
Total Volume	2	374	376	1	1	2	188	3	191	569
% App. Total	0.5	99.5		50	50		98.4	1.6		
PHF	.250	.842	.847	.250	.250	.500	.870	.750	.868	.852
Cars	2	371	373	1	1	2	182	3	185	560
% Cars	100	99.2	99.2	100	100	100	96.8	100	96.9	98.4
Trucks	0	3	3	0	0	0	6	0	6	9
% Trucks	0	0.8	0.8	0	0	0	3.2	0	3.1	1.6

Accurate Counts
978-664-2565

N/S Street : Sandy Pond Road
E/W Street : Cambridge Turnpike
City/State : Concord, MA
Weather : Cloudy

File Name : 440A0002
Site Code : 440A0002
Start Date : 9/27/2012
Page No : 2



Peak Hour Analysis From 04:00 PM to 04:45 PM - Peak 1 of 1

Peak Hour for Each Approach Begins at:

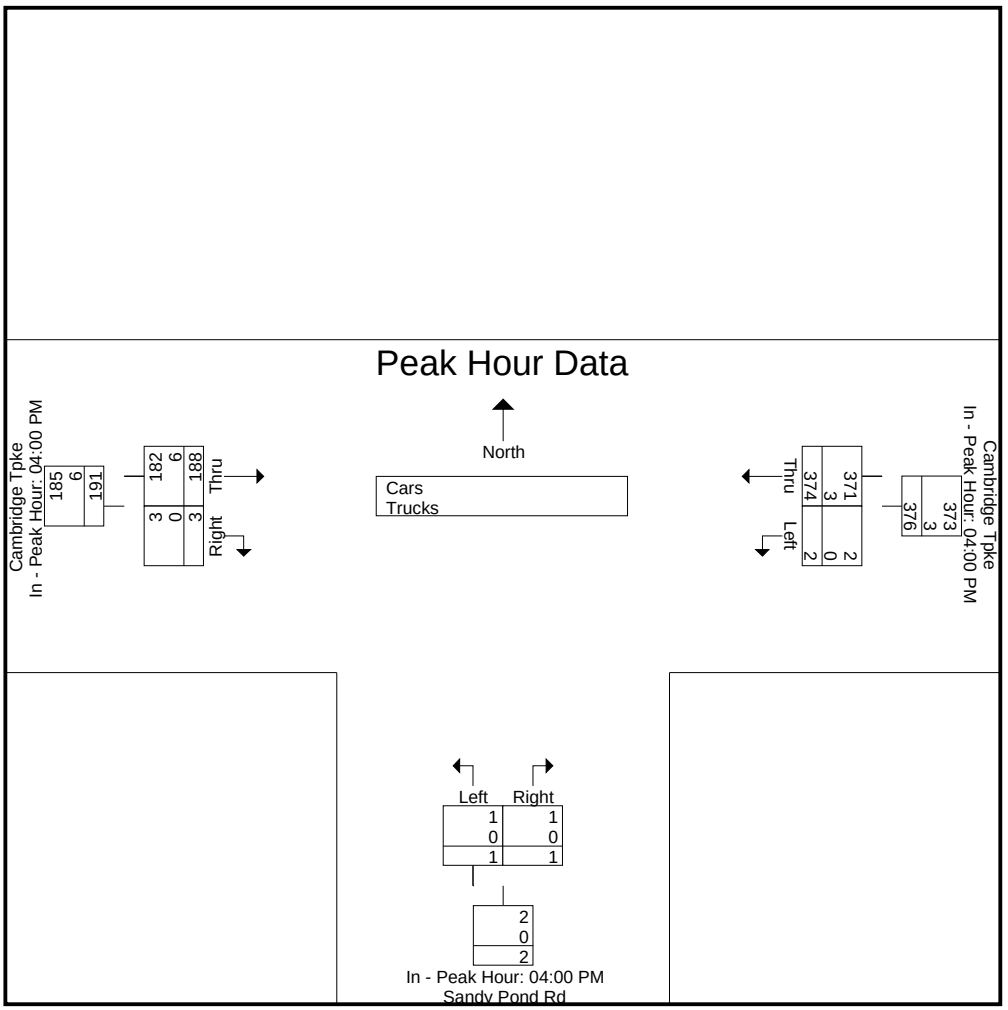
	04:00 PM			04:00 PM			04:00 PM		
+0 mins.	0	87	87	0	0	0	42	**1**	43
+15 mins.	0	85	85	0	0	0	50	1	51
+30 mins.	0	**111**	**111**	**1**	0	**1**	**54**	1	**55**
+45 mins.	**2**	91	93	0	**1**	1	42	0	42
Total Volume	2	374	376	1	1	2	188	3	191
% App. Total	0.5	99.5		50	50		98.4	1.6	
PHF	.250	.842	.847	.250	.250	.500	.870	.750	.868
Cars	2	371	373	1	1	2	182	3	185
% Cars	100	99.2	99.2	100	100	100	96.8	100	96.9
Trucks	0	3	3	0	0	0	6	0	6
% Trucks	0	0.8	0.8	0	0	0	3.2	0	3.1

Accurate Counts
978-664-2565

N/S Street : Sandy Pond Road
E/W Street : Cambridge Turnpike
City/State : Concord, MA
Weather : Cloudy

File Name : 440A0002
Site Code : 440A0002
Start Date : 9/27/2012
Page No : 3

Peak Hour Data



Accurate Counts
978-664-2565

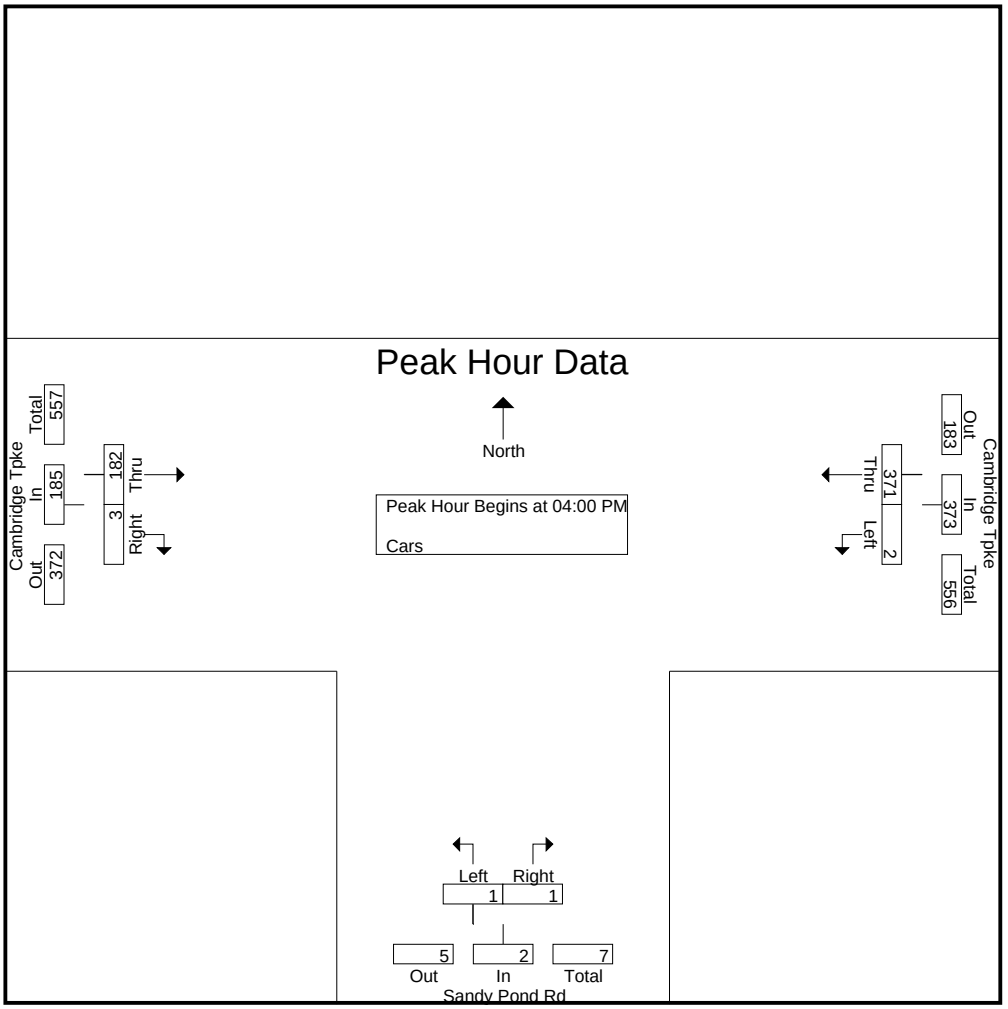
N/S Street : Sandy Pond Road
E/W Street : Cambridge Turnpike
City/State : Concord, MA
Weather : Cloudy

File Name : 440A0002
Site Code : 440A0002
Start Date : 9/27/2012
Page No : 1

Groups Printed- Cars

	Cambridge Tpke From East		Sandy Pond Rd From South		Cambridge Tpke From West		
Start Time	Left	Thru	Left	Right	Thru	Right	Int. Total
04:00 PM	0	85	0	0	42	1	128
04:15 PM	0	84	0	0	49	1	134
04:30 PM	0	111	1	0	50	1	163
04:45 PM	2	91	0	1	41	0	135
Total	2	371	1	1	182	3	560
Grand Total	2	371	1	1	182	3	560
Apprch %	0.5	99.5	50	50	98.4	1.6	
Total %	0.4	66.2	0.2	0.2	32.5	0.5	

	Cambridge Tpke From East			Sandy Pond Rd From South			Cambridge Tpke From West			
Start Time	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 04:45 PM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 04:00 PM										
04:00 PM	0	85	85	0	0	0	42	**1**	43	128
04:15 PM	0	84	84	0	0	0	49	1	50	134
04:30 PM	0	**111**	**111**	**1**	0	**1**	**50**	1	**51**	**163**
04:45 PM	**2**	91	93	0	**1**	1	41	0	41	135
Total Volume	2	371	373	1	1	2	182	3	185	560
% App. Total	0.5	99.5		50	50		98.4	1.6		
PHF	.250	.836	.840	.250	.250	.500	.910	.750	.907	.859

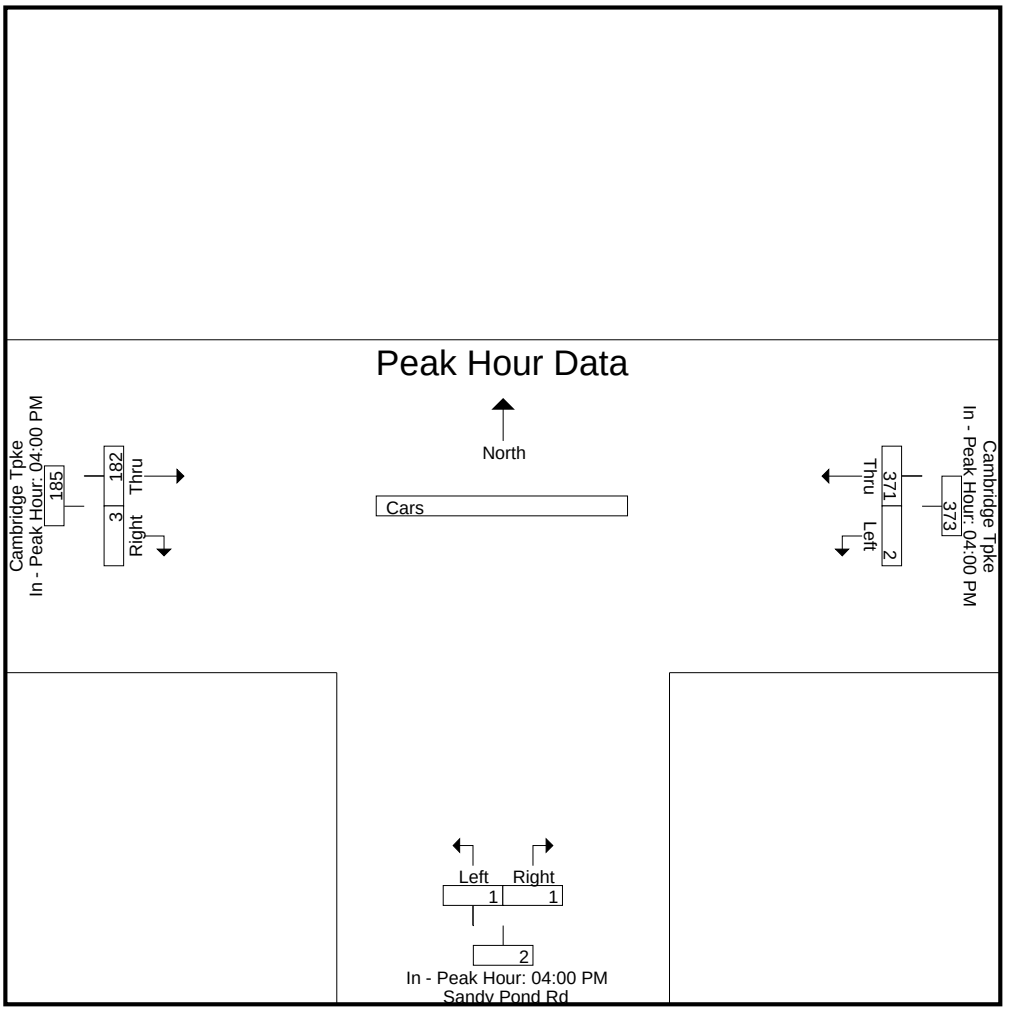


Accurate Counts
978-664-2565

N/S Street : Sandy Pond Road
E/W Street : Cambridge Turnpike
City/State : Concord, MA
Weather : Cloudy

File Name : 440A0002
Site Code : 440A0002
Start Date : 9/27/2012
Page No : 2

	Cambridge Tpke From East			Sandy Pond Rd From South			Cambridge Tpke From West			
Start Time	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 04:45 PM - Peak 1 of 1										
Peak Hour for Each Approach Begins at:										
	04:00 PM			04:00 PM			04:00 PM			
+0 mins.	0	85	85	0	0	0	42	**1**	43	
+15 mins.	0	84	84	0	0	0	49	1	50	
+30 mins.	0	**111**	**111**	**1**	0	**1**	**50**	1	**51**	
+45 mins.	**2**	91	93	0	**1**	1	41	0	41	
Total Volume	2	371	373	1	1	2	182	3	185	
% App. Total	0.5	99.5		50	50		98.4	1.6		
PHF	.250	.836	.840	.250	.250	.500	.910	.750	.907	



Accurate Counts
978-664-2565

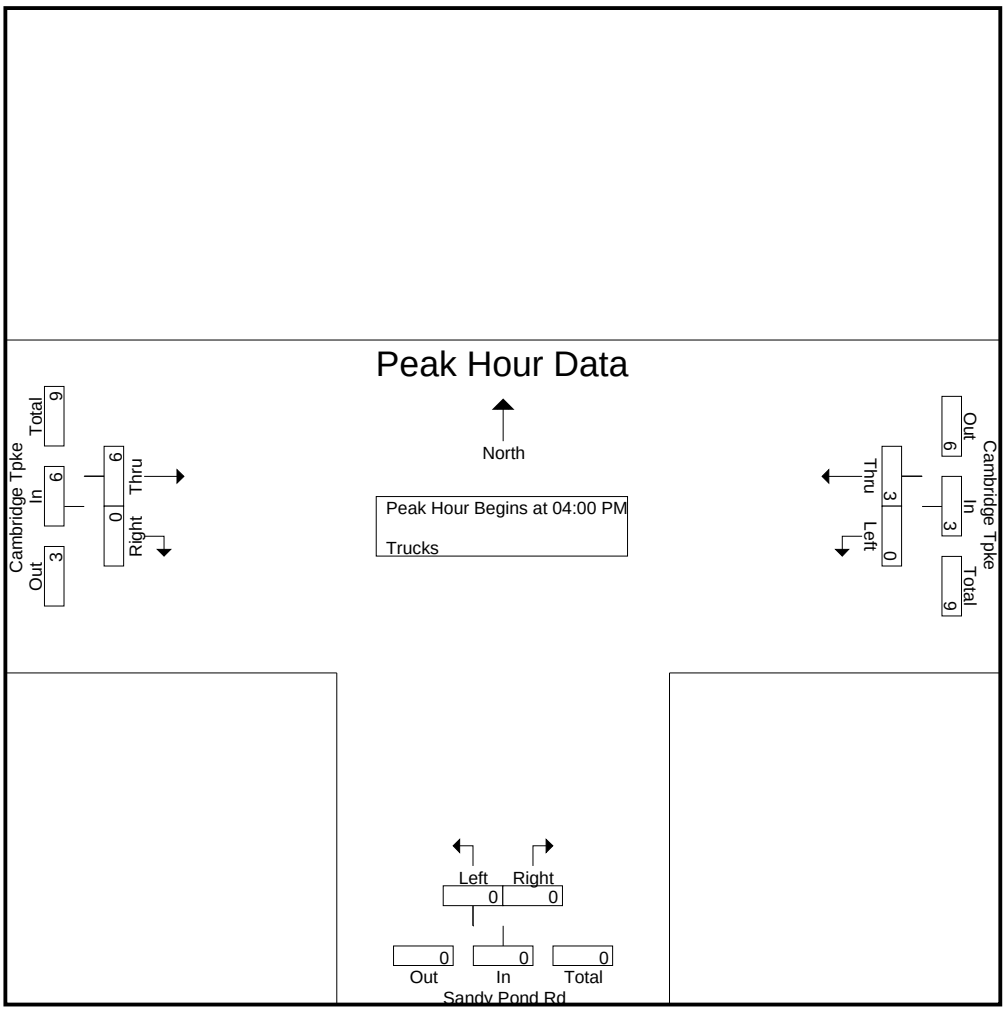
N/S Street : Sandy Pond Road
E/W Street : Cambridge Turnpike
City/State : Concord, MA
Weather : Cloudy

File Name : 440A0002
Site Code : 440A0002
Start Date : 9/27/2012
Page No : 1

Groups Printed- Trucks

	Cambridge Tpke From East		Sandy Pond Rd From South		Cambridge Tpke From West		
Start Time	Left	Thru	Left	Right	Thru	Right	Int. Total
04:00 PM	0	2	0	0	0	0	2
04:15 PM	0	1	0	0	1	0	2
04:30 PM	0	0	0	0	4	0	4
04:45 PM	0	0	0	0	1	0	1
Total	0	3	0	0	6	0	9
Grand Total	0	3	0	0	6	0	9
Apprch %	0	100	0	0	100	0	
Total %	0	33.3	0	0	66.7	0	

	Cambridge Tpke From East			Sandy Pond Rd From South			Cambridge Tpke From West			
Start Time	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 04:45 PM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 04:00 PM										
04:00 PM	0	**2**	**2**	0	0	0	0	0	0	2
04:15 PM	0	1	1	0	0	0	1	0	1	2
04:30 PM	0	0	0	0	0	0	**4**	0	**4**	**4**
04:45 PM	0	0	0	0	0	0	1	0	1	1
Total Volume	0	3	3	0	0	0	6	0	6	9
% App. Total	0	100		0	0		100	0		
PHF	.000	.375	.375	.000	.000	.000	.375	.000	.375	.563

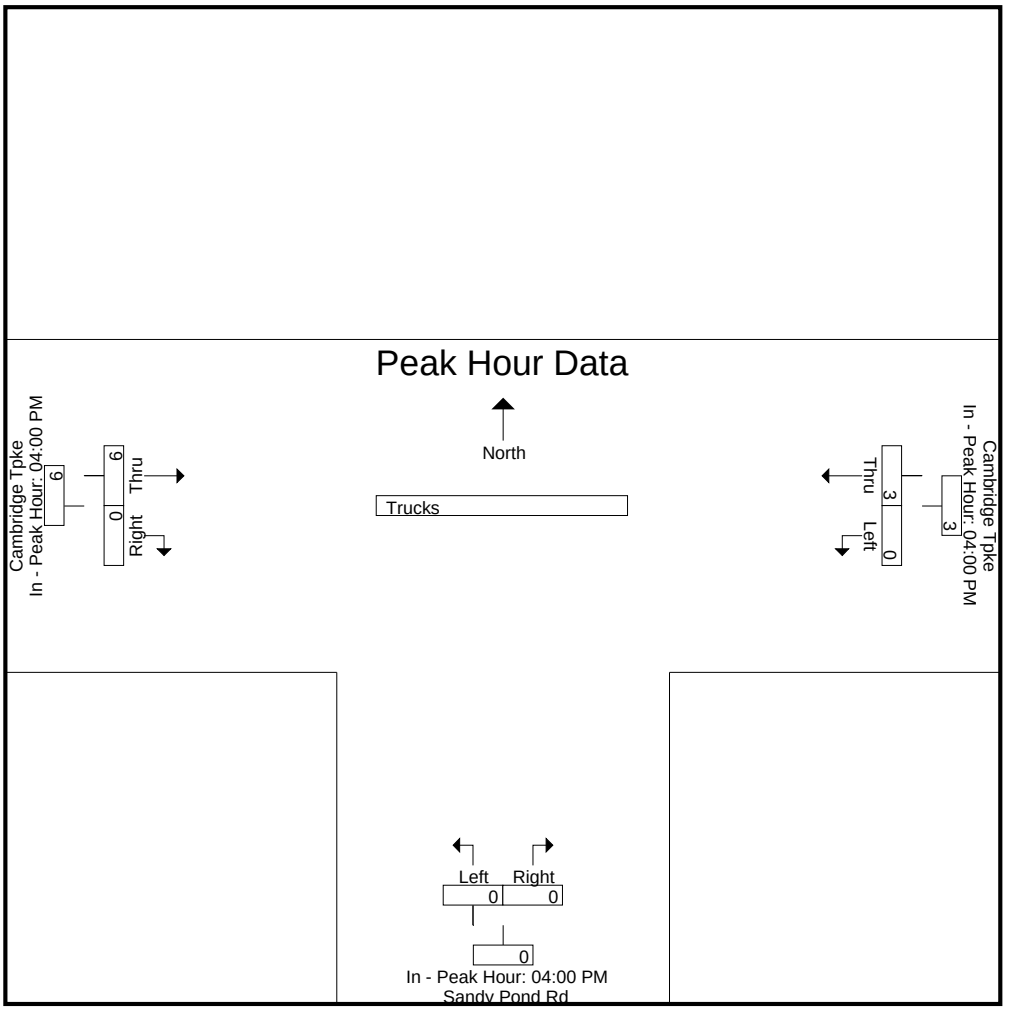


Accurate Counts
978-664-2565

N/S Street : Sandy Pond Road
E/W Street : Cambridge Turnpike
City/State : Concord, MA
Weather : Cloudy

File Name : 440A0002
Site Code : 440A0002
Start Date : 9/27/2012
Page No : 2

	Cambridge Tpke From East			Sandy Pond Rd From South			Cambridge Tpke From West			
Start Time	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 04:45 PM - Peak 1 of 1										
Peak Hour for Each Approach Begins at:										
	04:00 PM			04:00 PM			04:00 PM			
+0 mins.	0	**2**	**2**	0	0	0	0	0	0	
+15 mins.	0	1	1	0	0	0	1	0	1	
+30 mins.	0	0	0	0	0	0	**4**	0	**4**	
+45 mins.	0	0	0	0	0	0	1	0	1	
Total Volume	0	3	3	0	0	0	6	0	6	
% App. Total	0	100		0	0		100	0		
PHF	.000	.375	.375	.000	.000	.000	.375	.000	.375	



Accurate Counts
978-664-2565

N/S Street : Hawthorne Ln / Mildred Cr
E/W Street : Cambridge Turnpike
City/State : Concord, MA
Weather : Cloudy

File Name : 440A0003
Site Code : 440A0003
Start Date : 9/27/2012
Page No : 1

Groups Printed- Cars - Trucks

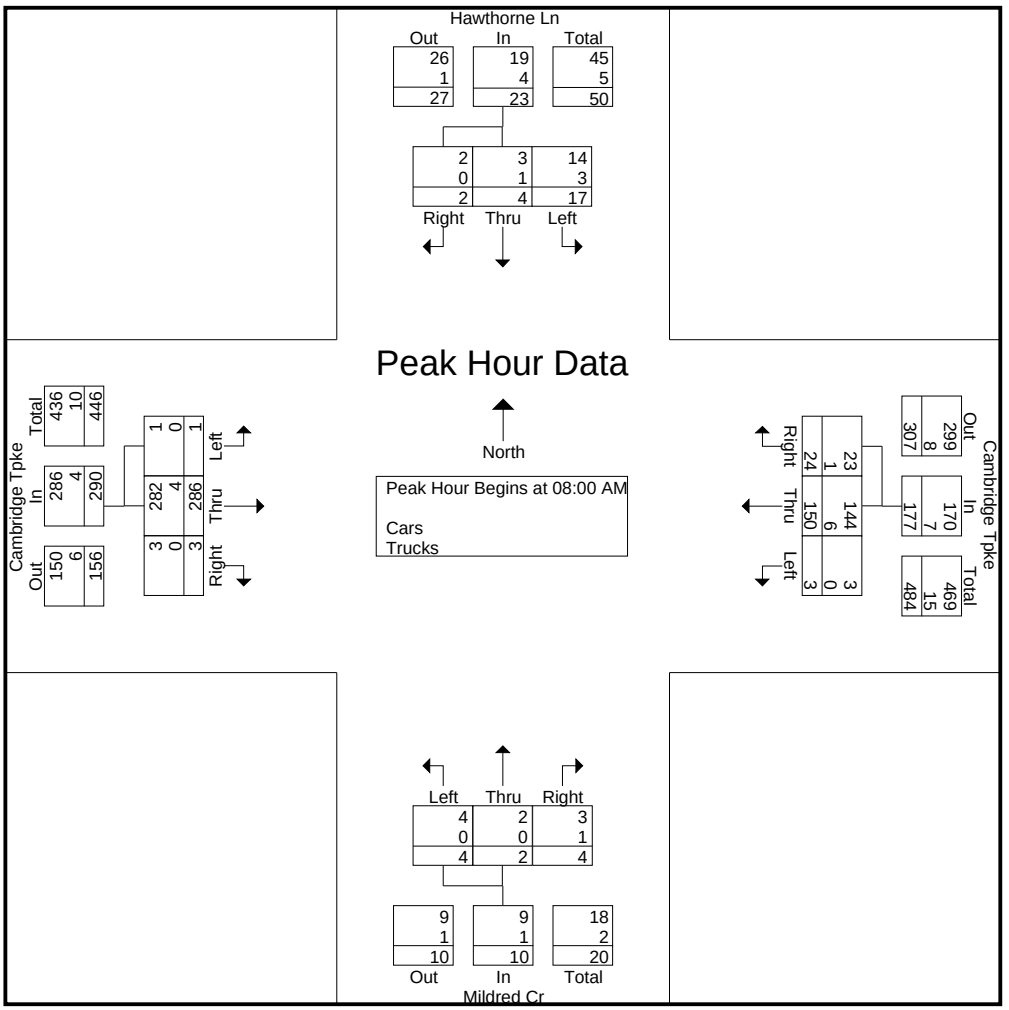
	Hawthorne Ln From North			Cambridge Tpke From East			Mildred Cr From South			Cambridge Tpke From West			
Start Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Int. Total
08:00 AM	5	0	0	0	30	4	2	0	0	1	72	0	114
08:15 AM	4	1	1	3	36	2	1	0	0	0	67	2	117
08:30 AM	3	1	1	0	42	14	1	1	2	0	78	1	144
08:45 AM	5	2	0	0	42	4	0	1	2	0	69	0	125
Total	17	4	2	3	150	24	4	2	4	1	286	3	500
Grand Total	17	4	2	3	150	24	4	2	4	1	286	3	500
Apprch %	73.9	17.4	8.7	1.7	84.7	13.6	40	20	40	0.3	98.6	1	
Total %	3.4	0.8	0.4	0.6	30	4.8	0.8	0.4	0.8	0.2	57.2	0.6	
Cars	14	3	2	3	144	23	4	2	3	1	282	3	484
% Cars	82.4	75	100	100	96	95.8	100	100	75	100	98.6	100	96.8
Trucks	3	1	0	0	6	1	0	0	1	0	4	0	16
% Trucks	17.6	25	0	0	4	4.2	0	0	25	0	1.4	0	3.2

	Hawthorne Ln From North				Cambridge Tpke From East				Mildred Cr From South				Cambridge Tpke From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 08:00 AM to 08:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 08:00 AM																	
08:00 AM	**5**	0	0	5	0	30	4	34	**2**	0	0	2	**1**	72	0	73	114
08:15 AM	4	1	**1**	6	**3**	36	2	41	1	0	0	1	0	67	**2**	69	117
08:30 AM	3	1	1	5	0	**42**	**14**	**56**	1	**1**	**2**	**4**	0	**78**	1	**79**	**144**
08:45 AM	5	**2**	0	**7**	0	42	4	46	0	1	2	3	0	69	0	69	125
Total Volume	17	4	2	23	3	150	24	177	4	2	4	10	1	286	3	290	500
% App. Total	73.9	17.4	8.7		1.7	84.7	13.6		40	20	40		0.3	98.6	1		
PHF	.850	.500	.500	.821	.250	.893	.429	.790	.500	.500	.500	.625	.250	.917	.375	.918	.868
Cars	14	3	2	19	3	144	23	170	4	2	3	9	1	282	3	286	484
% Cars	82.4	75.0	100	82.6	100	96.0	95.8	96.0	100	100	75.0	90.0	100	98.6	100	98.6	96.8
Trucks	3	1	0	4	0	6	1	7	0	0	1	1	0	4	0	4	16
% Trucks	17.6	25.0	0	17.4	0	4.0	4.2	4.0	0	0	25.0	10.0	0	1.4	0	1.4	3.2

Accurate Counts
978-664-2565

N/S Street : Hawthorne Ln / Mildred Cr
E/W Street : Cambridge Turnpike
City/State : Concord, MA
Weather : Cloudy

File Name : 440A0003
Site Code : 440A0003
Start Date : 9/27/2012
Page No : 2



Peak Hour Analysis From 08:00 AM to 08:45 AM - Peak 1 of 1

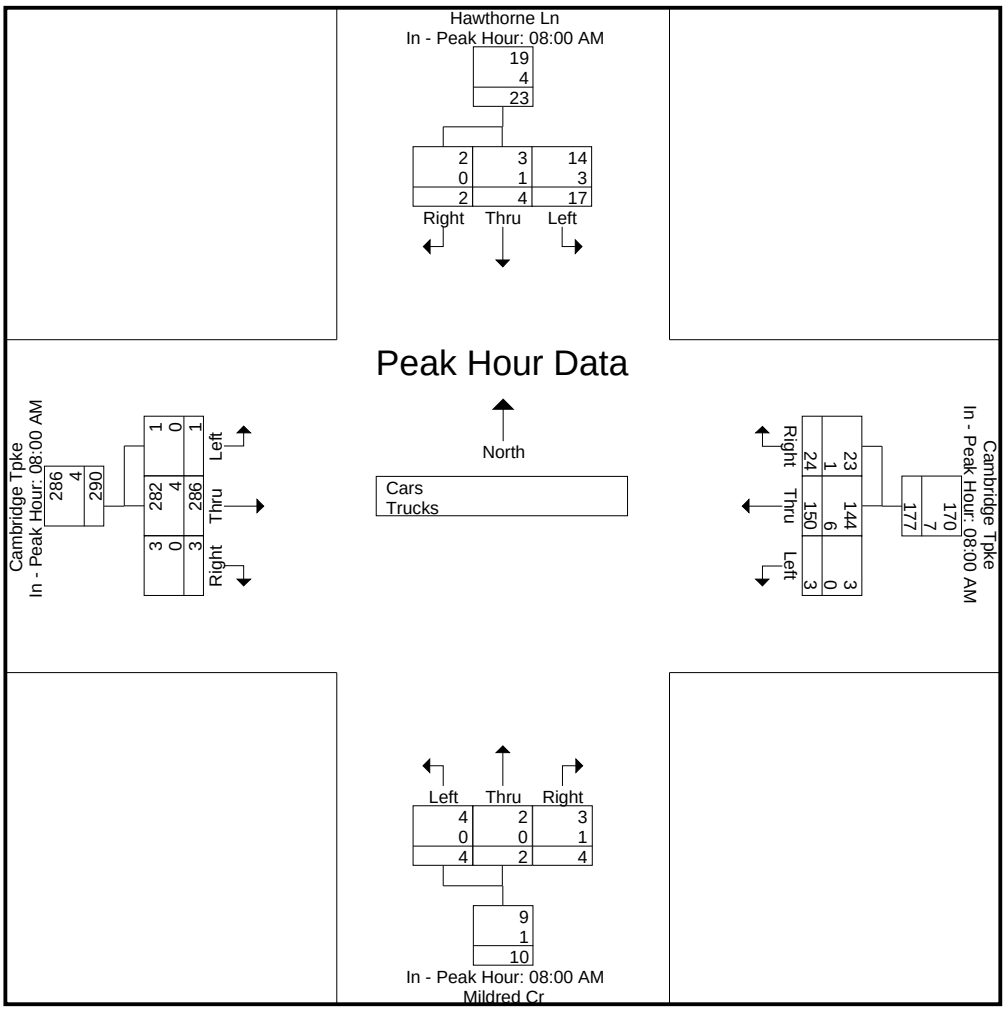
Peak Hour for Each Approach Begins at:

	08:00 AM				08:00 AM				08:00 AM				08:00 AM			
+0 mins.	**5**	0	0	5	0	30	4	34	**2**	0	0	2	**1**	72	0	73
+15 mins.	4	1	**1**	6	**3**	36	2	41	1	0	0	1	0	67	**2**	69
+30 mins.	3	1	1	5	0	**42**	**14**	**56**	1	**1**	**2**	**4**	0	**78**	1	**79**
+45 mins.	5	**2**	0	**7**	0	42	4	46	0	1	2	3	0	69	0	69
Total Volume	17	4	2	23	3	150	24	177	4	2	4	10	1	286	3	290
% App. Total	73.9	17.4	8.7		1.7	84.7	13.6		40	20	40		0.3	98.6	1	
PHF	.850	.500	.500	.821	.250	.893	.429	.790	.500	.500	.500	.625	.250	.917	.375	.918
Cars	14	3	2	19	3	144	23	170	4	2	3	9	1	282	3	286
% Cars	82.4	75	100	82.6	100	96	95.8	96	100	100	75	90	100	98.6	100	98.6
Trucks	3	1	0	4	0	6	1	7	0	0	1	1	0	4	0	4
% Trucks	17.6	25	0	17.4	0	4	4.2	4	0	0	25	10	0	1.4	0	1.4

Accurate Counts
978-664-2565

N/S Street : Hawthorne Ln / Mildred Cr
E/W Street : Cambridge Turnpike
City/State : Concord, MA
Weather : Cloudy

File Name : 440A0003
Site Code : 440A0003
Start Date : 9/27/2012
Page No : 3



Accurate Counts
978-664-2565

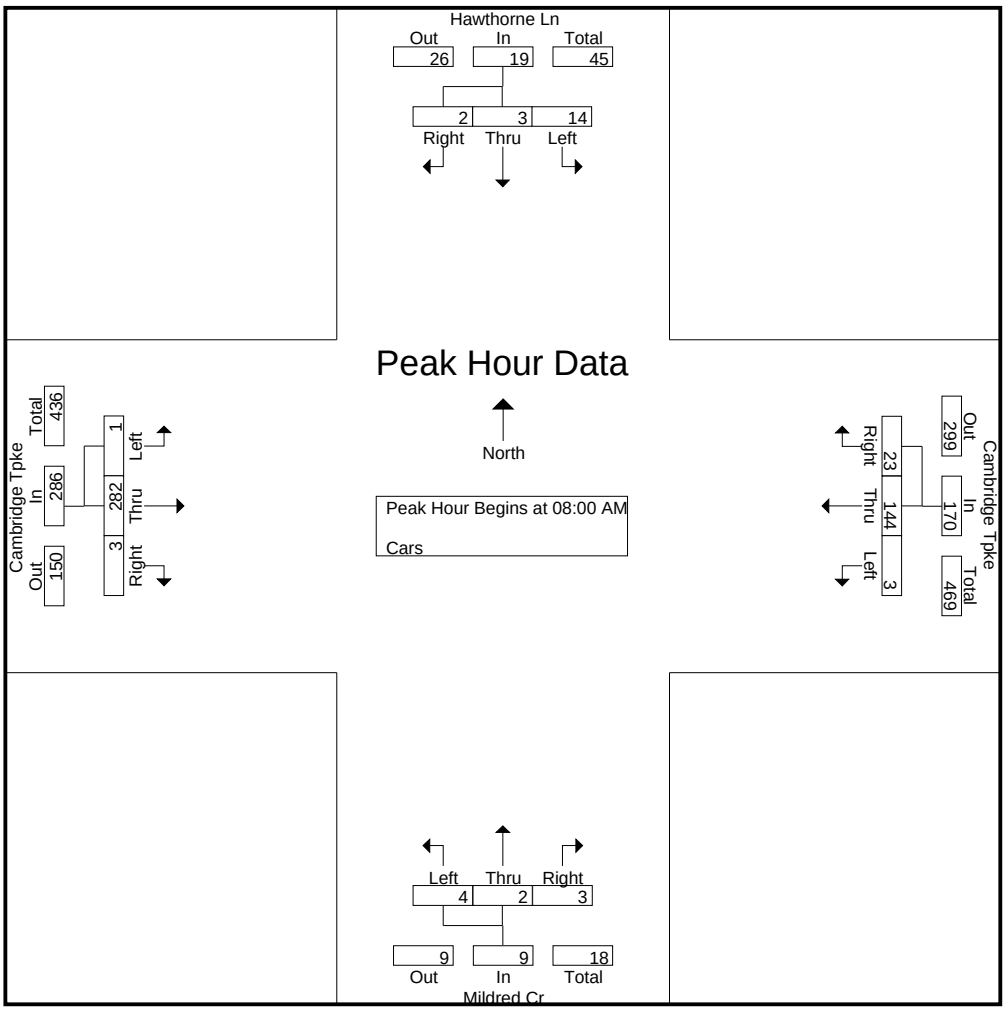
N/S Street : Hawthorne Ln / Mildred Cr
E/W Street : Cambridge Turnpike
City/State : Concord, MA
Weather : Cloudy

File Name : 440A0003
Site Code : 440A0003
Start Date : 9/27/2012
Page No : 1

Groups Printed- Cars

	Hawthorne Ln From North			Cambridge Tpke From East			Mildred Cr From South			Cambridge Tpke From West			
Start Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Int. Total
08:00 AM	4	0	0	0	30	4	2	0	0	1	71	0	112
08:15 AM	4	1	1	3	36	2	1	0	0	0	66	2	116
08:30 AM	2	0	1	0	37	13	1	1	1	0	78	1	135
08:45 AM	4	2	0	0	41	4	0	1	2	0	67	0	121
Total	14	3	2	3	144	23	4	2	3	1	282	3	484
Grand Total	14	3	2	3	144	23	4	2	3	1	282	3	484
Apprch %	73.7	15.8	10.5	1.8	84.7	13.5	44.4	22.2	33.3	0.3	98.6	1	
Total %	2.9	0.6	0.4	0.6	29.8	4.8	0.8	0.4	0.6	0.2	58.3	0.6	

	Hawthorne Ln From North				Cambridge Tpke From East				Mildred Cr From South				Cambridge Tpke From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 08:00 AM to 08:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 08:00 AM																	
08:00 AM	**4**	0	0	4	0	30	4	34	**2**	0	0	2	**1**	71	0	72	112
08:15 AM	4	1	**1**	**6**	**3**	36	2	41	1	0	0	1	0	66	**2**	68	116
08:30 AM	2	0	1	3	0	37	**13**	**50**	1	**1**	1	**3**	0	**78**	1	**79**	**135**
08:45 AM	4	**2**	0	6	0	**41**	4	45	0	1	**2**	3	0	67	0	67	121
Total Volume	14	3	2	19	3	144	23	170	4	2	3	9	1	282	3	286	484
% App. Total	73.7	15.8	10.5		1.8	84.7	13.5		44.4	22.2	33.3		0.3	98.6	1		
PHF	.875	.375	.500	.792	.250	.878	.442	.850	.500	.500	.375	.750	.250	.904	.375	.905	.896

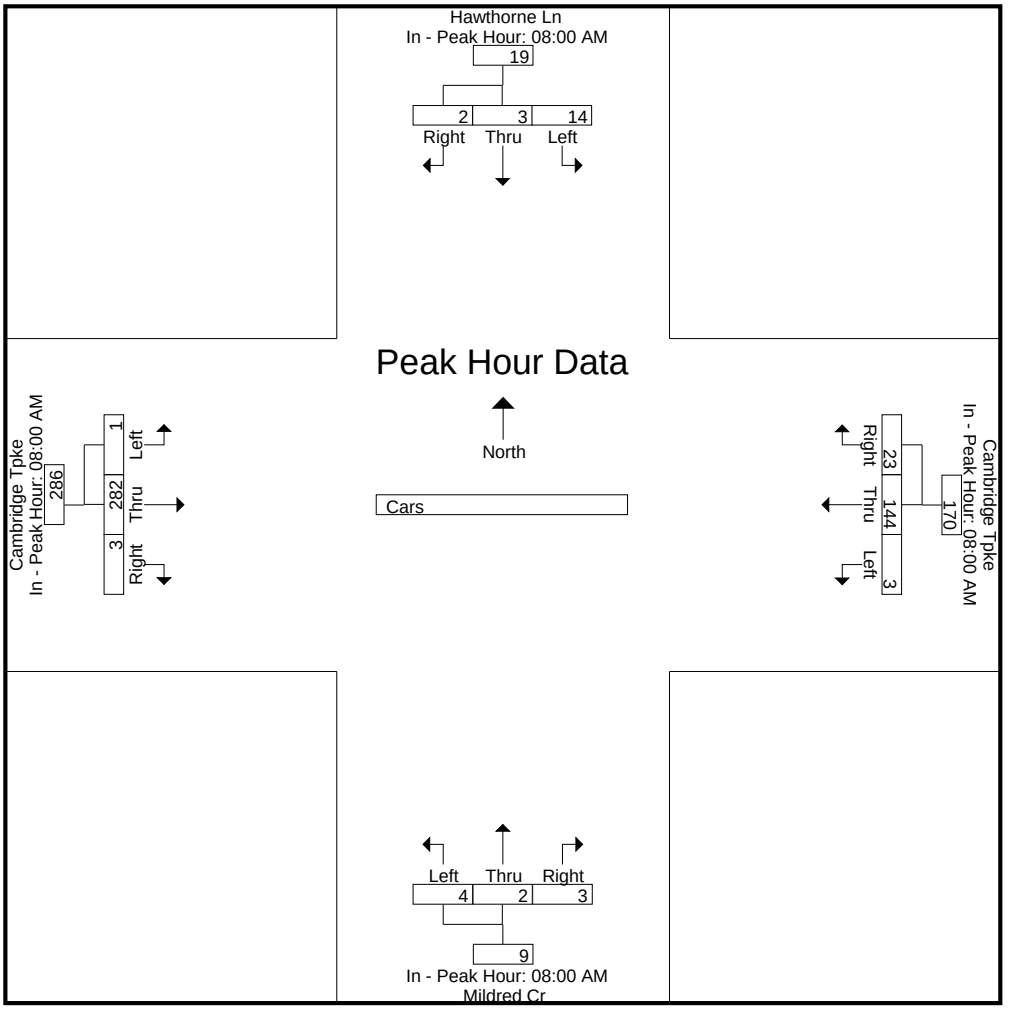


Accurate Counts
978-664-2565

N/S Street : Hawthorne Ln / Mildred Cr
E/W Street : Cambridge Turnpike
City/State : Concord, MA
Weather : Cloudy

File Name : 440A0003
Site Code : 440A0003
Start Date : 9/27/2012
Page No : 2

	Hawthorne Ln From North				Cambridge Tpke From East				Mildred Cr From South				Cambridge Tpke From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 08:00 AM to 08:45 AM - Peak 1 of 1																	
Peak Hour for Each Approach Begins at:																	
	08:00 AM				08:00 AM				08:00 AM				08:00 AM				
+0 mins.	**4**	0	0	4	0	30	4	34	**2**	0	0	2	**1**	71	0	72	
+15 mins.	4	1	**1**	**6**	**3**	36	2	41	1	0	0	1	0	66	**2**	68	
+30 mins.	2	0	1	3	0	37	**13**	**50**	1	**1**	1	**3**	0	**78**	1	**79**	
+45 mins.	4	**2**	0	6	0	**41**	4	45	0	1	**2**	3	0	67	0	67	
Total Volume	14	3	2	19	3	144	23	170	4	2	3	9	1	282	3	286	
% App. Total	73.7	15.8	10.5		1.8	84.7	13.5		44.4	22.2	33.3		0.3	98.6	1		
PHF	.875	.375	.500	.792	.250	.878	.442	.850	.500	.500	.375	.750	.250	.904	.375	.905	



Accurate Counts
978-664-2565

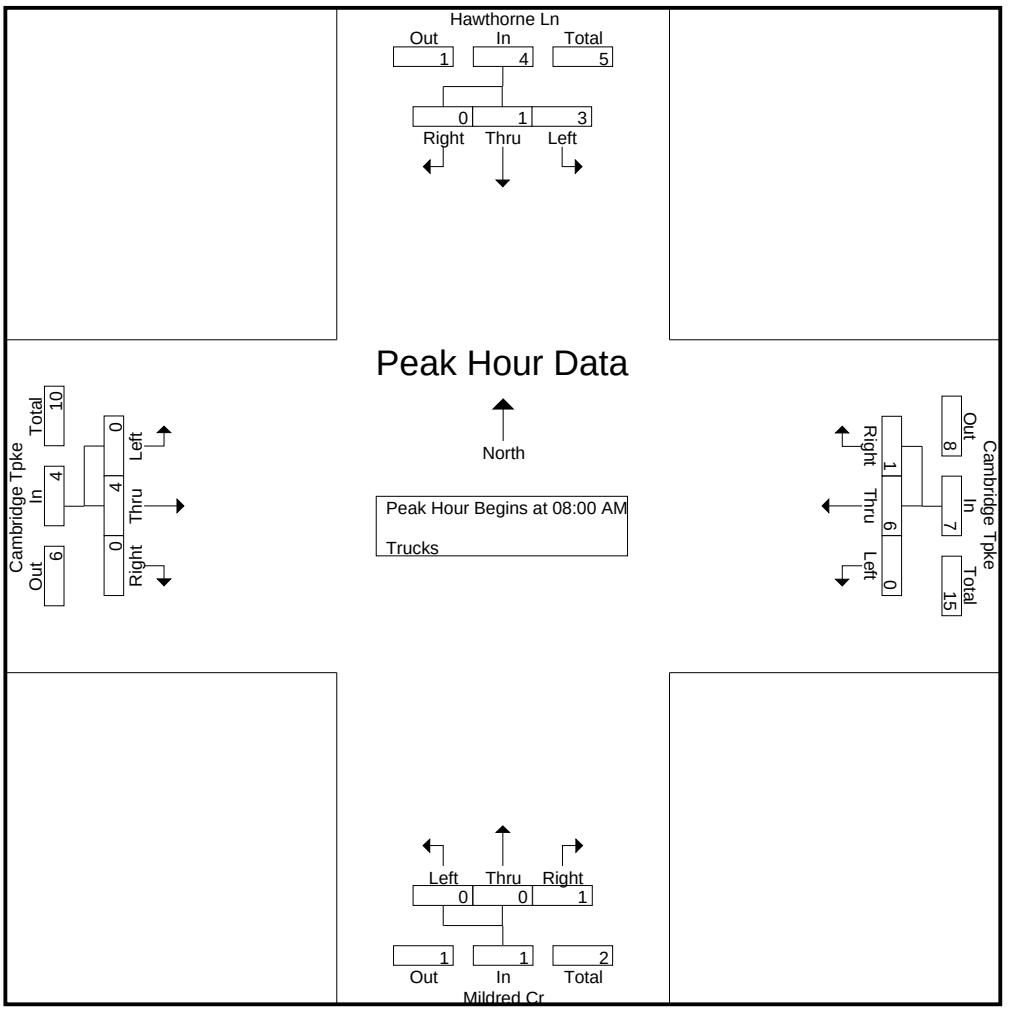
N/S Street : Hawthorne Ln / Mildred Cr
E/W Street : Cambridge Turnpike
City/State : Concord, MA
Weather : Cloudy

File Name : 440A0003
Site Code : 440A0003
Start Date : 9/27/2012
Page No : 1

Groups Printed- Trucks

	Hawthorne Ln From North			Cambridge Tpke From East			Mildred Cr From South			Cambridge Tpke From West			
Start Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Int. Total
08:00 AM	1	0	0	0	0	0	0	0	0	0	1	0	2
08:15 AM	0	0	0	0	0	0	0	0	0	0	1	0	1
08:30 AM	1	1	0	0	5	1	0	0	1	0	0	0	9
08:45 AM	1	0	0	0	1	0	0	0	0	0	2	0	4
Total	3	1	0	0	6	1	0	0	1	0	4	0	16
Grand Total	3	1	0	0	6	1	0	0	1	0	4	0	16
Apprch %	75	25	0	0	85.7	14.3	0	0	100	0	100	0	
Total %	18.8	6.2	0	0	37.5	6.2	0	0	6.2	0	25	0	

	Hawthorne Ln From North				Cambridge Tpke From East				Mildred Cr From South				Cambridge Tpke From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 08:00 AM to 08:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 08:00 AM																	
08:00 AM	**1**	0	0	1	0	0	0	0	0	0	0	0	0	1	0	1	2
08:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1
08:30 AM	1	**1**	0	**2**	0	**5**	**1**	**6**	0	0	**1**	**1**	0	0	0	0	**9**
08:45 AM	1	0	0	1	0	1	0	1	0	0	0	0	0	**2**	0	**2**	4
Total Volume	3	1	0	4	0	6	1	7	0	0	1	1	0	4	0	4	16
% App. Total	75	25	0		0	85.7	14.3		0	0	100		0	100	0		
PHF	.750	.250	.000	.500	.000	.300	.250	.292	.000	.000	.250	.250	.000	.500	.000	.500	.444

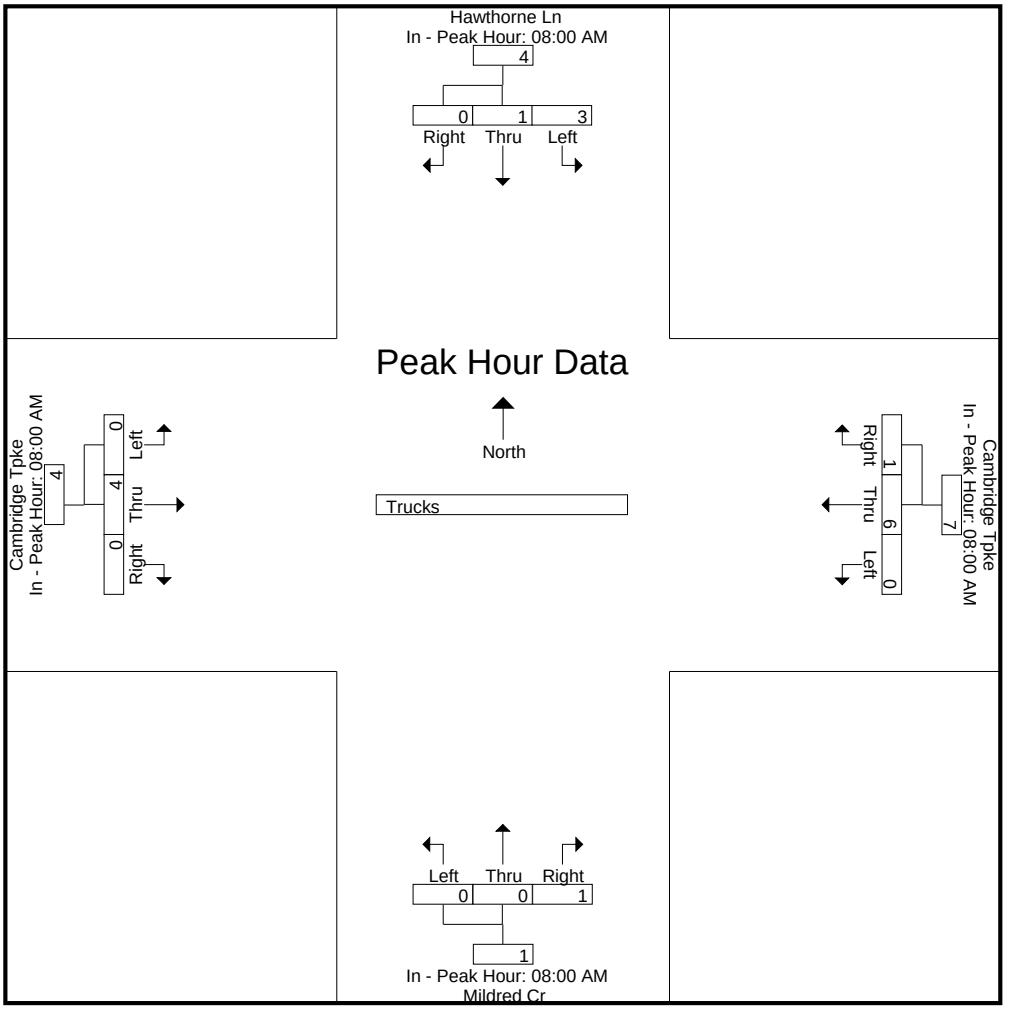


Accurate Counts
978-664-2565

N/S Street : Hawthorne Ln / Mildred Cr
E/W Street : Cambridge Turnpike
City/State : Concord, MA
Weather : Cloudy

File Name : 440A0003
Site Code : 440A0003
Start Date : 9/27/2012
Page No : 2

	Hawthorne Ln From North				Cambridge Tpke From East				Mildred Cr From South				Cambridge Tpke From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 08:00 AM to 08:45 AM - Peak 1 of 1																	
Peak Hour for Each Approach Begins at:																	
	08:00 AM				08:00 AM				08:00 AM				08:00 AM				
+0 mins.	**1**	0	0	1	0	0	0	0	0	0	0	0	0	1	0	1	
+15 mins.	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	
+30 mins.	1	**1**	0	**2**	0	**5**	**1**	**6**	0	0	**1**	**1**	0	0	0	0	
+45 mins.	1	0	0	1	0	1	0	1	0	0	0	0	0	**2**	0	**2**	
Total Volume	3	1	0	4	0	6	1	7	0	0	1	1	0	4	0	4	
% App. Total	75	25	0		0	85.7	14.3		0	0	100		0	100	0		
PHF	.750	.250	.000	.500	.000	.300	.250	.292	.000	.000	.250	.250	.000	.500	.000	.500	



Accurate Counts
978-664-2565

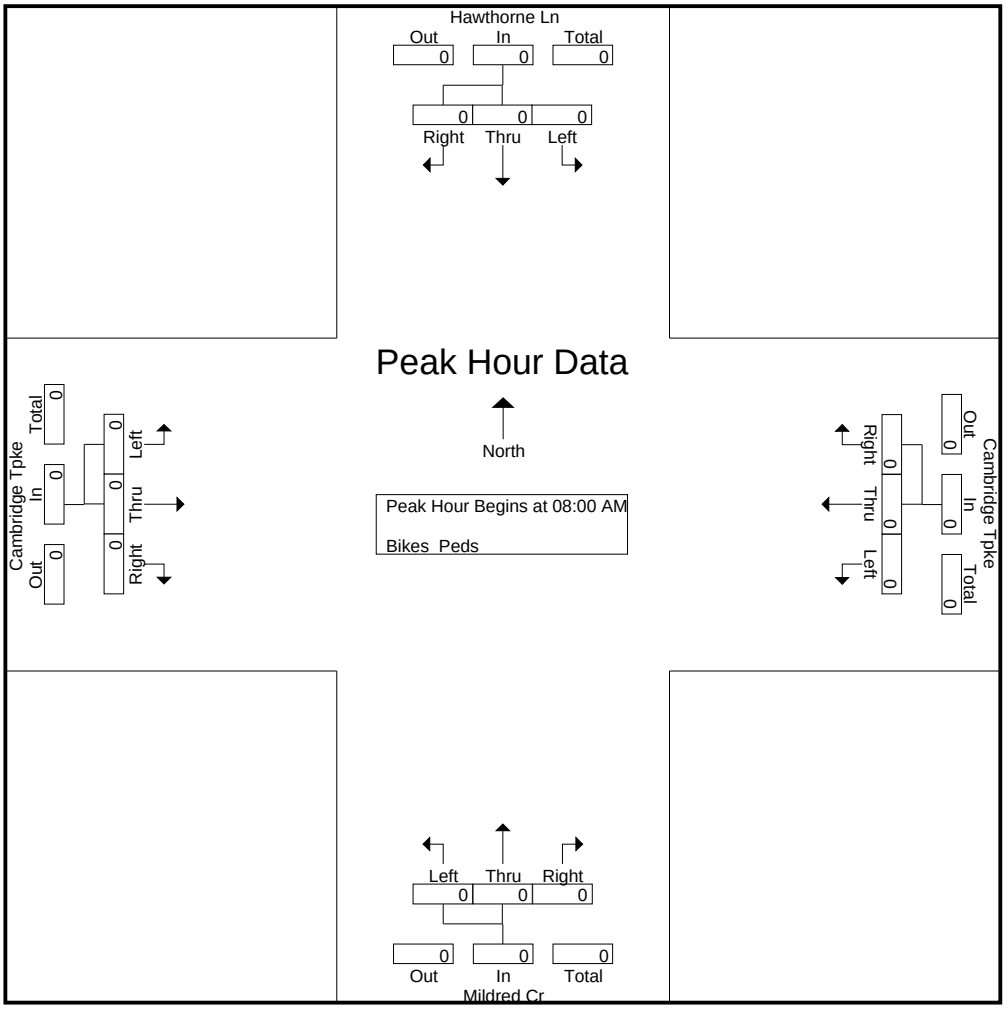
N/S Street : Hawthorne Ln / Mildred Cr
E/W Street : Cambridge Turnpike
City/State : Concord, MA
Weather : Cloudy

File Name : 440A0003
Site Code : 440A0003
Start Date : 9/27/2012
Page No : 1

Groups Printed- Bikes Peds

	Hawthorne Ln From North				Cambridge Tpke From East				Mildred Cr From South				Cambridge Tpke From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
08:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:15 AM	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
08:30 AM	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	2	0	2
08:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3	0	3
Total	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	4	6	0	6
Grand Total	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	4	6	0	6
Apprch %	0	0	0		0	0	0		0	0	0		0	0	0				
Total %																	100	0	

	Hawthorne Ln From North				Cambridge Tpke From East				Mildred Cr From South				Cambridge Tpke From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 08:00 AM to 08:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 08:00 AM																	
08:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Volume	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% App. Total	0	0	0		0	0	0		0	0	0		0	0	0		
PHF	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000



Accurate Counts
978-664-2565

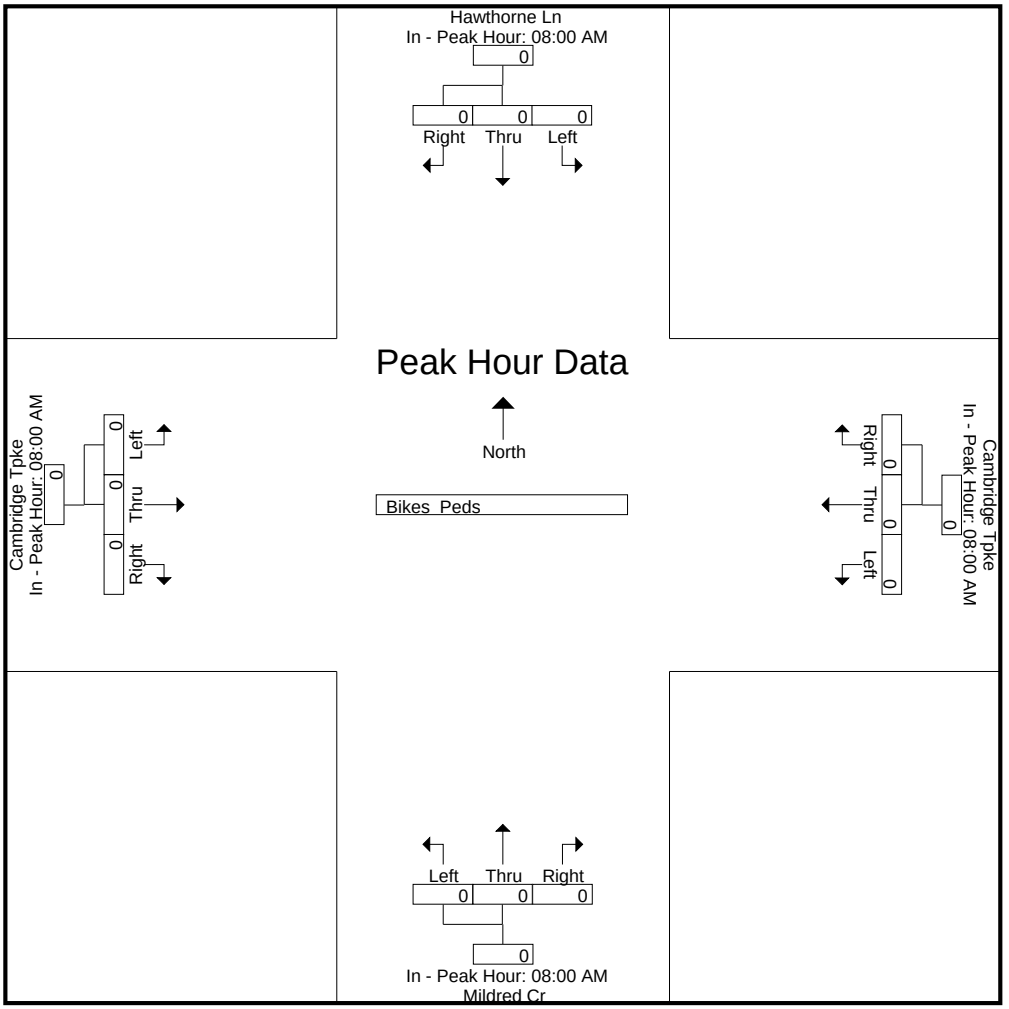
N/S Street : Hawthorne Ln / Mildred Cr
E/W Street : Cambridge Turnpike
City/State : Concord, MA
Weather : Cloudy

File Name : 440A0003
Site Code : 440A0003
Start Date : 9/27/2012
Page No : 2

	Hawthorne Ln From North				Cambridge Tpke From East				Mildred Cr From South				Cambridge Tpke From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total

Peak Hour Analysis From 08:00 AM to 08:45 AM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	08:00 AM				08:00 AM				08:00 AM				08:00 AM			
+0 mins.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+15 mins.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+30 mins.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+45 mins.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Volume	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% App. Total	0	0	0		0	0	0		0	0	0		0	0	0	
PHF	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000



Accurate Counts
978-664-2565

N/S Street : Hawthorne Ln / Mildred Cr
E/W Street : Cambridge Turnpike
City/State : Concord, MA
Weather : Cloudy

File Name : 440A0003
Site Code : 440A0003
Start Date : 9/27/2012
Page No : 1

Groups Printed- Cars - Trucks

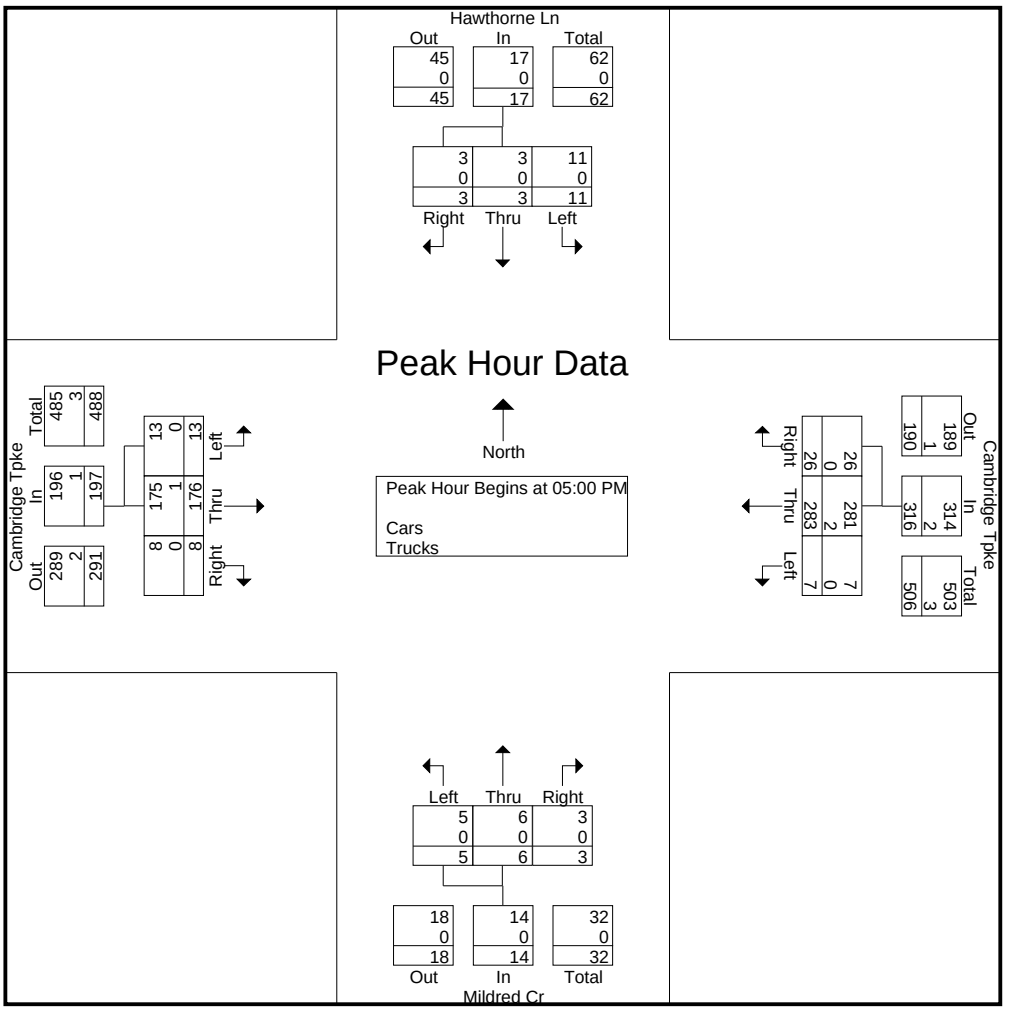
	Hawthorne Ln From North			Cambridge Tpke From East			Mildred Cr From South			Cambridge Tpke From West			
Start Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Int. Total
05:00 PM	1	0	1	2	72	5	1	2	1	3	37	4	129
05:15 PM	2	1	1	1	71	8	0	1	0	5	39	2	131
05:30 PM	3	1	0	2	68	8	3	2	1	1	58	2	149
05:45 PM	5	1	1	2	72	5	1	1	1	4	42	0	135
Total	11	3	3	7	283	26	5	6	3	13	176	8	544
Grand Total	11	3	3	7	283	26	5	6	3	13	176	8	544
Apprch %	64.7	17.6	17.6	2.2	89.6	8.2	35.7	42.9	21.4	6.6	89.3	4.1	
Total %	2	0.6	0.6	1.3	52	4.8	0.9	1.1	0.6	2.4	32.4	1.5	
Cars	11	3	3	7	281	26	5	6	3	13	175	8	541
% Cars	100	100	100	100	99.3	100	100	100	100	100	99.4	100	99.4
Trucks	0	0	0	0	2	0	0	0	0	0	1	0	3
% Trucks	0	0	0	0	0.7	0	0	0	0	0	0.6	0	0.6

	Hawthorne Ln From North				Cambridge Tpke From East				Mildred Cr From South				Cambridge Tpke From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 05:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 05:00 PM																	
05:00 PM	1	0	**1**	2	**2**	**72**	5	79	1	**2**	**1**	4	3	37	**4**	44	129
05:15 PM	2	**1**	1	4	1	71	**8**	**80**	0	1	0	1	**5**	39	2	46	131
05:30 PM	3	1	0	4	2	68	8	78	**3**	2	1	**6**	1	**58**	2	**61**	**149**
05:45 PM	**5**	1	1	**7**	2	72	5	79	1	1	1	3	4	42	0	46	135
Total Volume	11	3	3	17	7	283	26	316	5	6	3	14	13	176	8	197	544
% App. Total	64.7	17.6	17.6		2.2	89.6	8.2		35.7	42.9	21.4		6.6	89.3	4.1		
PHF	.550	.750	.750	.607	.875	.983	.813	.988	.417	.750	.750	.583	.650	.759	.500	.807	.913
Cars	11	3	3	17	7	281	26	314	5	6	3	14	13	175	8	196	541
% Cars	100	100	100	100	100	99.3	100	99.4	100	100	100	100	100	99.4	100	99.5	99.4
Trucks	0	0	0	0	0	2	0	2	0	0	0	0	0	1	0	1	3
% Trucks	0	0	0	0	0	0.7	0	0.6	0	0	0	0	0	0.6	0	0.5	0.6

Accurate Counts
978-664-2565

N/S Street : Hawthorne Ln / Mildred Cr
E/W Street : Cambridge Turnpike
City/State : Concord, MA
Weather : Cloudy

File Name : 440A0003
Site Code : 440A0003
Start Date : 9/27/2012
Page No : 2



Peak Hour Analysis From 05:00 PM to 05:45 PM - Peak 1 of 1

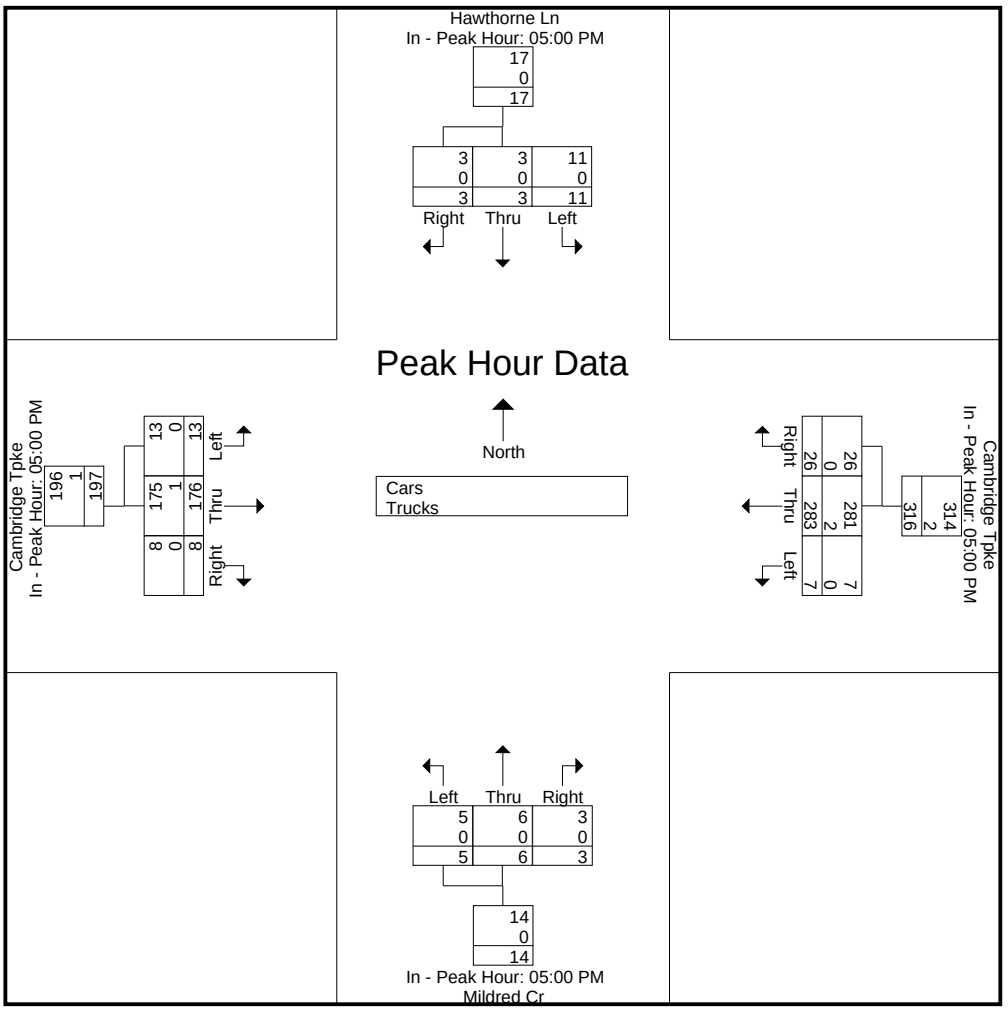
Peak Hour for Each Approach Begins at:

	05:00 PM				05:00 PM				05:00 PM				05:00 PM			
+0 mins.	1	0	**1**	2	**2**	**72**	5	79	1	**2**	**1**	4	3	37	**4**	44
+15 mins.	2	**1**	1	4	1	71	**8**	**80**	0	1	0	1	**5**	39	2	46
+30 mins.	3	1	0	4	2	68	8	78	**3**	2	1	**6**	1	**58**	2	**61**
+45 mins.	**5**	1	1	**7**	2	72	5	79	1	1	1	3	4	42	0	46
Total Volume	11	3	3	17	7	283	26	316	5	6	3	14	13	176	8	197
% App. Total	64.7	17.6	17.6		2.2	89.6	8.2		35.7	42.9	21.4		6.6	89.3	4.1	
PHF	.550	.750	.750	.607	.875	.983	.813	.988	.417	.750	.750	.583	.650	.759	.500	.807
Cars	11	3	3	17	7	281	26	314	5	6	3	14	13	175	8	196
% Cars	100	100	100	100	100	99.3	100	99.4	100	100	100	100	100	99.4	100	99.5
Trucks	0	0	0	0	0	2	0	2	0	0	0	0	0	1	0	1
% Trucks	0	0	0	0	0	0.7	0	0.6	0	0	0	0	0	0.6	0	0.5

Accurate Counts
978-664-2565

N/S Street : Hawthorne Ln / Mildred Cr
E/W Street : Cambridge Turnpike
City/State : Concord, MA
Weather : Cloudy

File Name : 440A0003
Site Code : 440A0003
Start Date : 9/27/2012
Page No : 3



Accurate Counts
978-664-2565

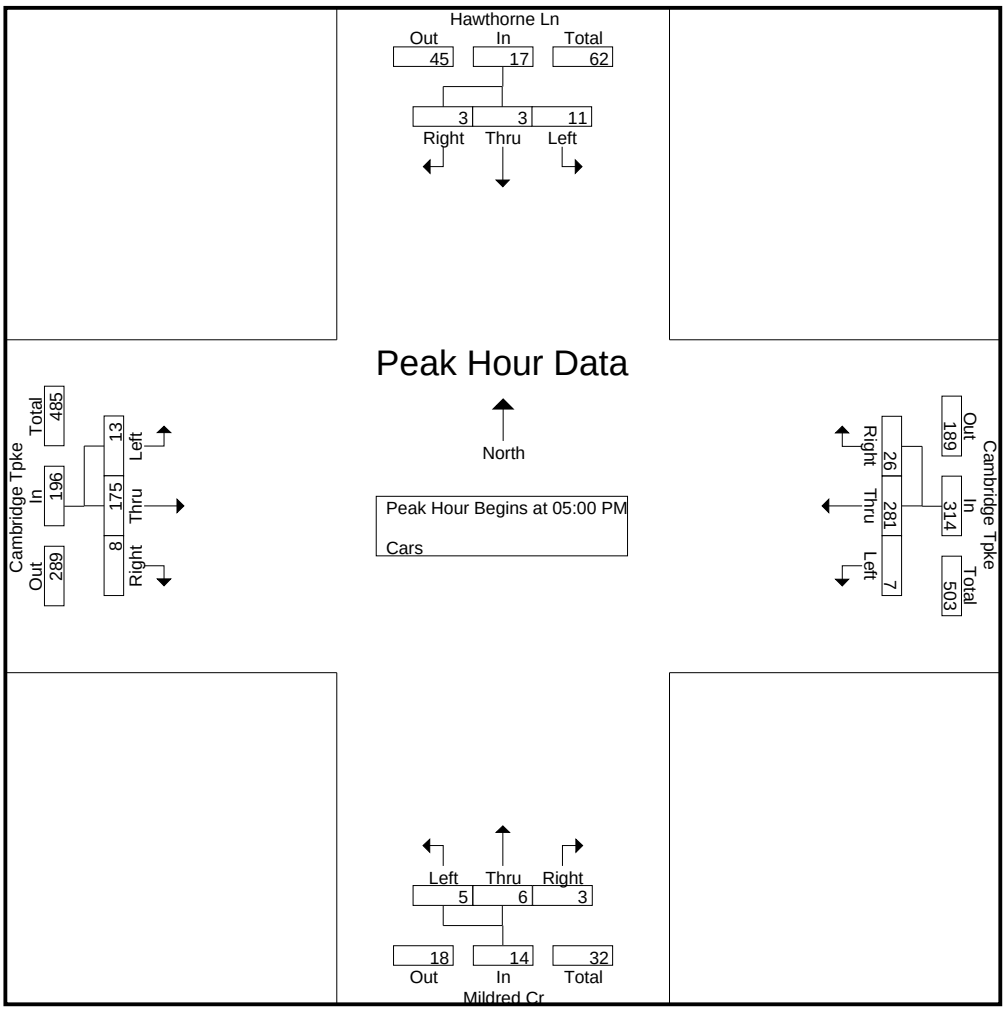
N/S Street : Hawthorne Ln / Mildred Cr
E/W Street : Cambridge Turnpike
City/State : Concord, MA
Weather : Cloudy

File Name : 440A0003
Site Code : 440A0003
Start Date : 9/27/2012
Page No : 1

Groups Printed- Cars

	Hawthorne Ln From North			Cambridge Tpke From East			Mildred Cr From South			Cambridge Tpke From West			
Start Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Int. Total
05:00 PM	1	0	1	2	72	5	1	2	1	3	37	4	129
05:15 PM	2	1	1	1	71	8	0	1	0	5	39	2	131
05:30 PM	3	1	0	2	66	8	3	2	1	1	58	2	147
05:45 PM	5	1	1	2	72	5	1	1	1	4	41	0	134
Total	11	3	3	7	281	26	5	6	3	13	175	8	541
Grand Total	11	3	3	7	281	26	5	6	3	13	175	8	541
Apprch %	64.7	17.6	17.6	2.2	89.5	8.3	35.7	42.9	21.4	6.6	89.3	4.1	
Total %	2	0.6	0.6	1.3	51.9	4.8	0.9	1.1	0.6	2.4	32.3	1.5	

	Hawthorne Ln From North				Cambridge Tpke From East				Mildred Cr From South				Cambridge Tpke From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 05:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 05:00 PM																	
05:00 PM	1	0	**1**	2	**2**	**72**	5	79	1	**2**	**1**	4	3	37	**4**	44	129
05:15 PM	2	**1**	1	4	1	71	**8**	**80**	0	1	0	1	**5**	39	2	46	131
05:30 PM	3	1	0	4	2	66	8	76	**3**	2	1	**6**	1	**58**	2	**61**	**147**
05:45 PM	**5**	1	1	**7**	2	72	5	79	1	1	1	3	4	41	0	45	134
Total Volume	11	3	3	17	7	281	26	314	5	6	3	14	13	175	8	196	541
% App. Total	64.7	17.6	17.6		2.2	89.5	8.3		35.7	42.9	21.4		6.6	89.3	4.1		
PHF	.550	.750	.750	.607	.875	.976	.813	.981	.417	.750	.750	.583	.650	.754	.500	.803	.920

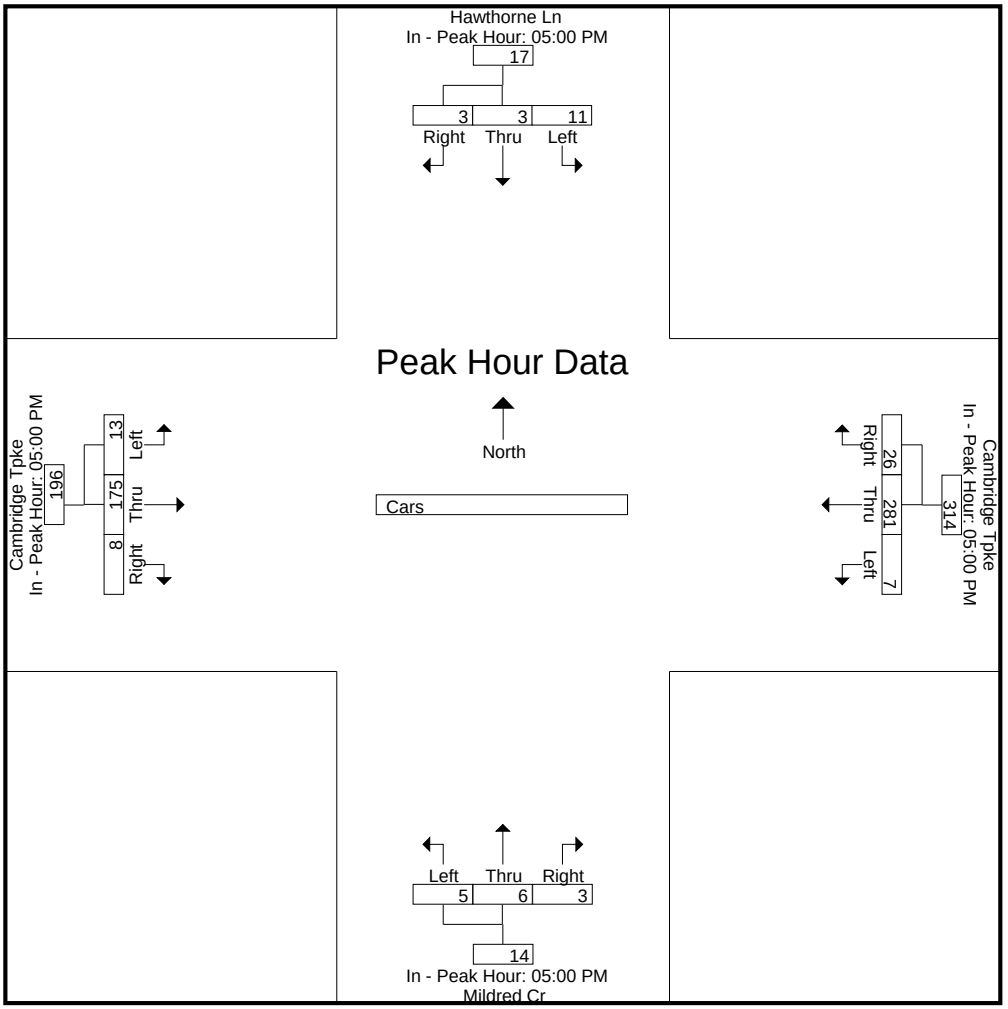


Accurate Counts
978-664-2565

N/S Street : Hawthorne Ln / Mildred Cr
E/W Street : Cambridge Turnpike
City/State : Concord, MA
Weather : Cloudy

File Name : 440A0003
Site Code : 440A0003
Start Date : 9/27/2012
Page No : 2

	Hawthorne Ln From North				Cambridge Tpke From East				Mildred Cr From South				Cambridge Tpke From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 05:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Each Approach Begins at:																	
	05:00 PM				05:00 PM				05:00 PM				05:00 PM				
+0 mins.	1	0	**1**	2	**2**	**72**	5	79	1	**2**	**1**	4	3	37	**4**	44	
+15 mins.	2	**1**	1	4	1	71	**8**	**80**	0	1	0	1	**5**	39	2	46	
+30 mins.	3	1	0	4	2	66	8	76	**3**	2	1	**6**	1	**58**	2	**61**	
+45 mins.	**5**	1	1	**7**	2	72	5	79	1	1	1	3	4	41	0	45	
Total Volume	11	3	3	17	7	281	26	314	5	6	3	14	13	175	8	196	
% App. Total	64.7	17.6	17.6		2.2	89.5	8.3		35.7	42.9	21.4		6.6	89.3	4.1		
PHF	.550	.750	.750	.607	.875	.976	.813	.981	.417	.750	.750	.583	.650	.754	.500	.803	



Accurate Counts
978-664-2565

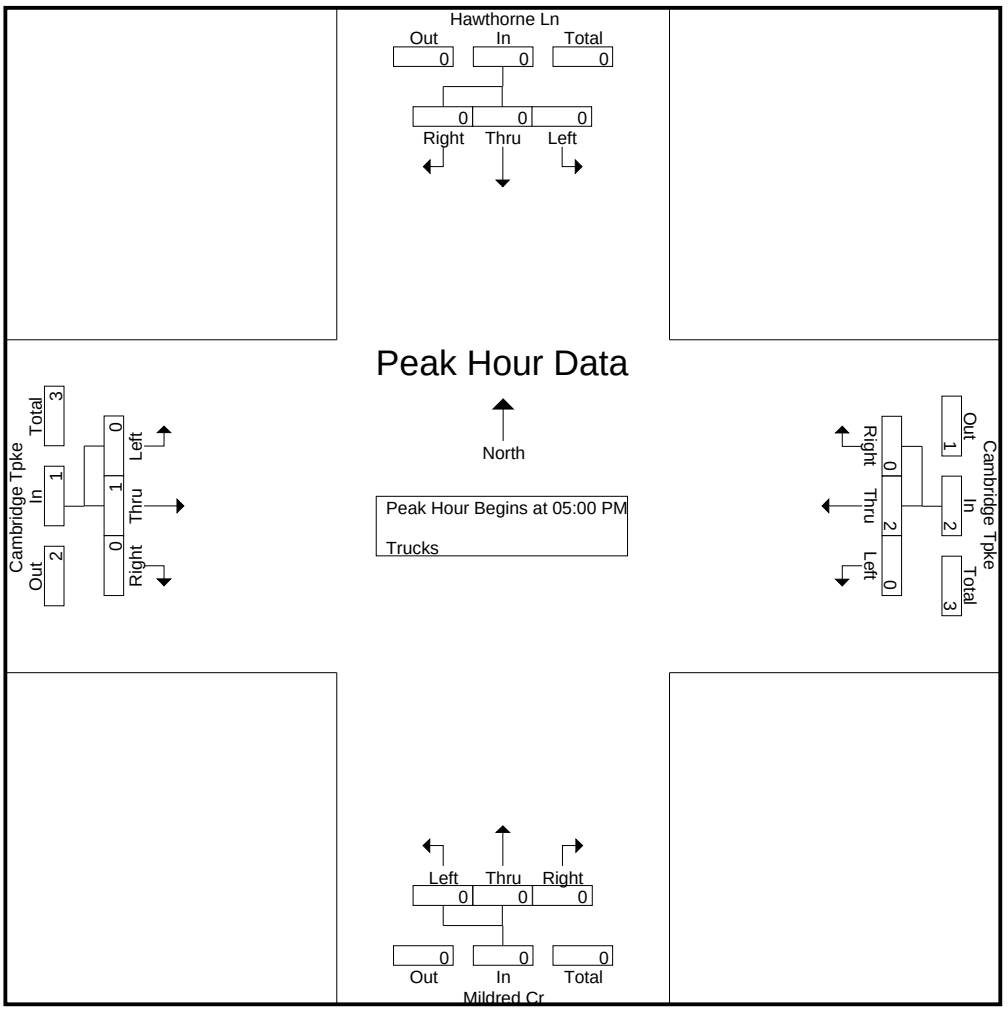
N/S Street : Hawthorne Ln / Mildred Cr
E/W Street : Cambridge Turnpike
City/State : Concord, MA
Weather : Cloudy

File Name : 440A0003
Site Code : 440A0003
Start Date : 9/27/2012
Page No : 1

Groups Printed- Trucks

	Hawthorne Ln From North			Cambridge Tpke From East			Mildred Cr From South			Cambridge Tpke From West			
Start Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Int. Total
05:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
05:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
05:30 PM	0	0	0	0	2	0	0	0	0	0	0	0	2
05:45 PM	0	0	0	0	0	0	0	0	0	0	1	0	1
Total	0	0	0	0	2	0	0	0	0	0	1	0	3
Grand Total	0	0	0	0	2	0	0	0	0	0	1	0	3
Apprch %	0	0	0	0	100	0	0	0	0	0	100	0	
Total %	0	0	0	0	66.7	0	0	0	0	0	33.3	0	

	Hawthorne Ln From North				Cambridge Tpke From East				Mildred Cr From South				Cambridge Tpke From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 05:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 05:00 PM																	
05:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:30 PM	0	0	0	0	0	**2**	0	**2**	0	0	0	0	0	0	0	0	**2**
05:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	**1**	0	**1**	1
Total Volume	0	0	0	0	0	2	0	2	0	0	0	0	0	1	0	1	3
% App. Total	0	0	0		0	100	0		0	0	0		0	100	0		
PHF	.000	.000	.000	.000	.000	.250	.000	.250	.000	.000	.000	.000	.000	.250	.000	.250	.375

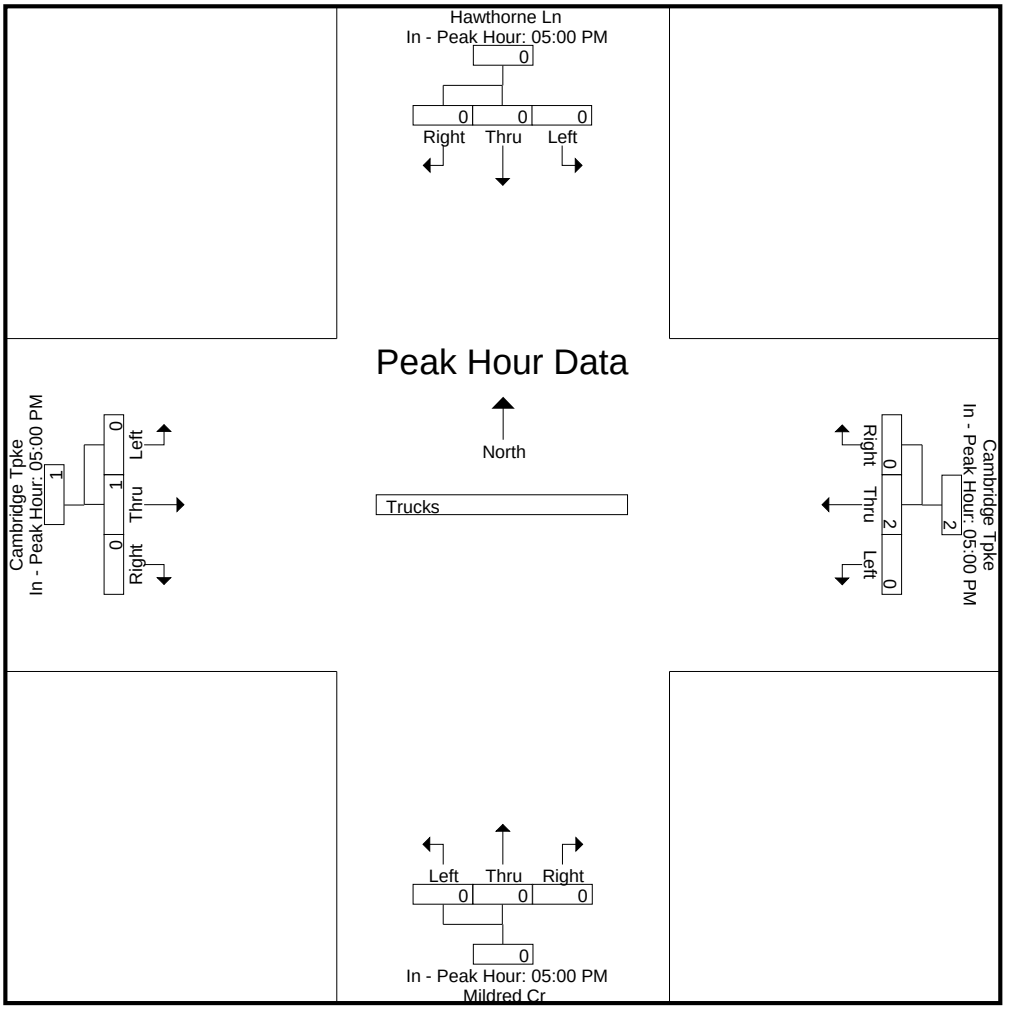


Accurate Counts
978-664-2565

N/S Street : Hawthorne Ln / Mildred Cr
E/W Street : Cambridge Turnpike
City/State : Concord, MA
Weather : Cloudy

File Name : 440A0003
Site Code : 440A0003
Start Date : 9/27/2012
Page No : 2

	Hawthorne Ln From North				Cambridge Tpke From East				Mildred Cr From South				Cambridge Tpke From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 05:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Each Approach Begins at:																	
	05:00 PM				05:00 PM				05:00 PM				05:00 PM				
+0 mins.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
+15 mins.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
+30 mins.	0	0	0	0	0	**2**	0	**2**	0	0	0	0	0	0	0	0	
+45 mins.	0	0	0	0	0	0	0	0	0	0	0	0	0	**1**	0	**1**	
Total Volume	0	0	0	0	0	2	0	2	0	0	0	0	0	1	0	1	
% App. Total	0	0	0		0	100	0		0	0	0		0	100	0		
PHF	.000	.000	.000	.000	.000	.250	.000	.250	.000	.000	.000	.000	.000	.250	.000	.250	



Accurate Counts
978-664-2565

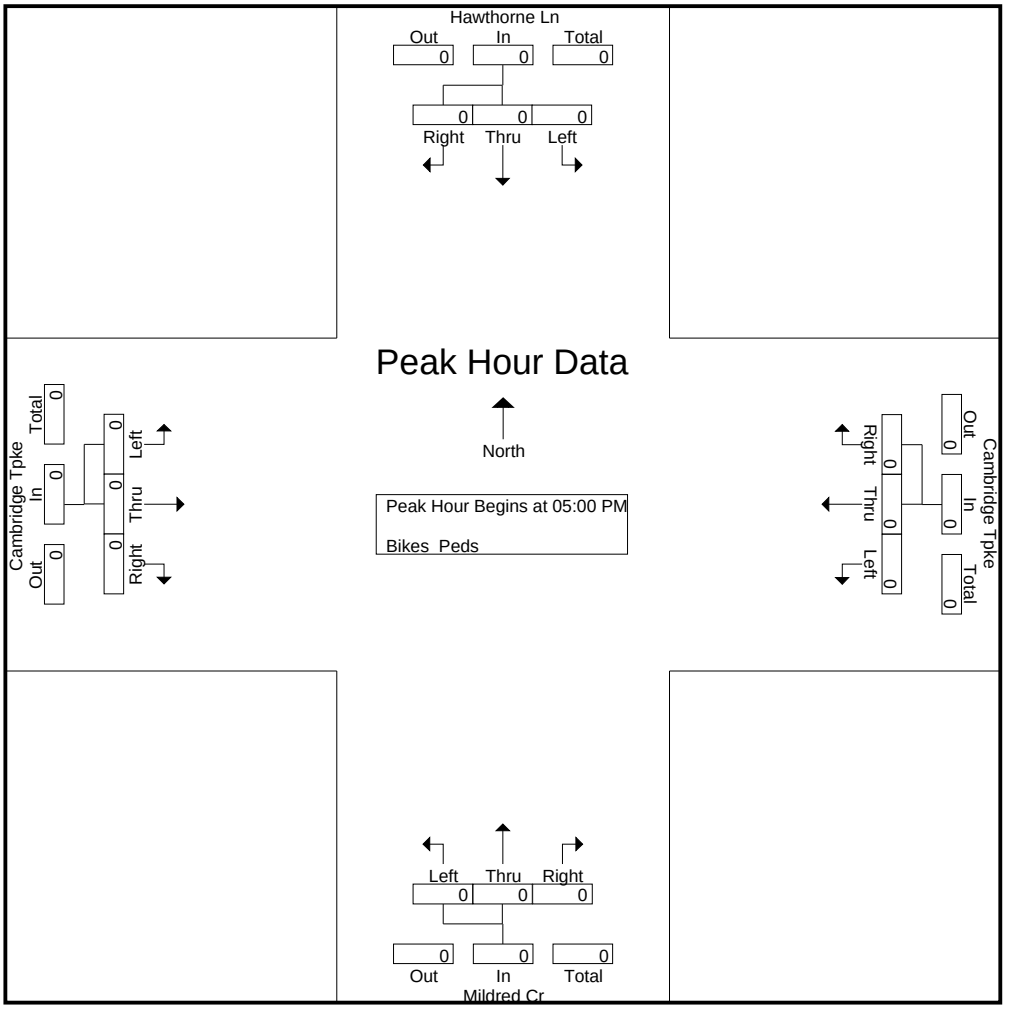
N/S Street : Hawthorne Ln / Mildred Cr
E/W Street : Cambridge Turnpike
City/State : Concord, MA
Weather : Cloudy

File Name : 440A0003
Site Code : 440A0003
Start Date : 9/27/2012
Page No : 1

Groups Printed- Bikes Peds

	Hawthorne Ln From North				Cambridge Tpke From East				Mildred Cr From South				Cambridge Tpke From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
05:00 PM	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1
05:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1
Grand Total	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1
Apprch %	0	0	0		0	0	0		0	0	0		0	0	0				
Total %																	100	0	

	Hawthorne Ln From North				Cambridge Tpke From East				Mildred Cr From South				Cambridge Tpke From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 05:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 05:00 PM																	
05:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Volume	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% App. Total	0	0	0		0	0	0		0	0	0		0	0	0		
PHF	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000



Accurate Counts
978-664-2565

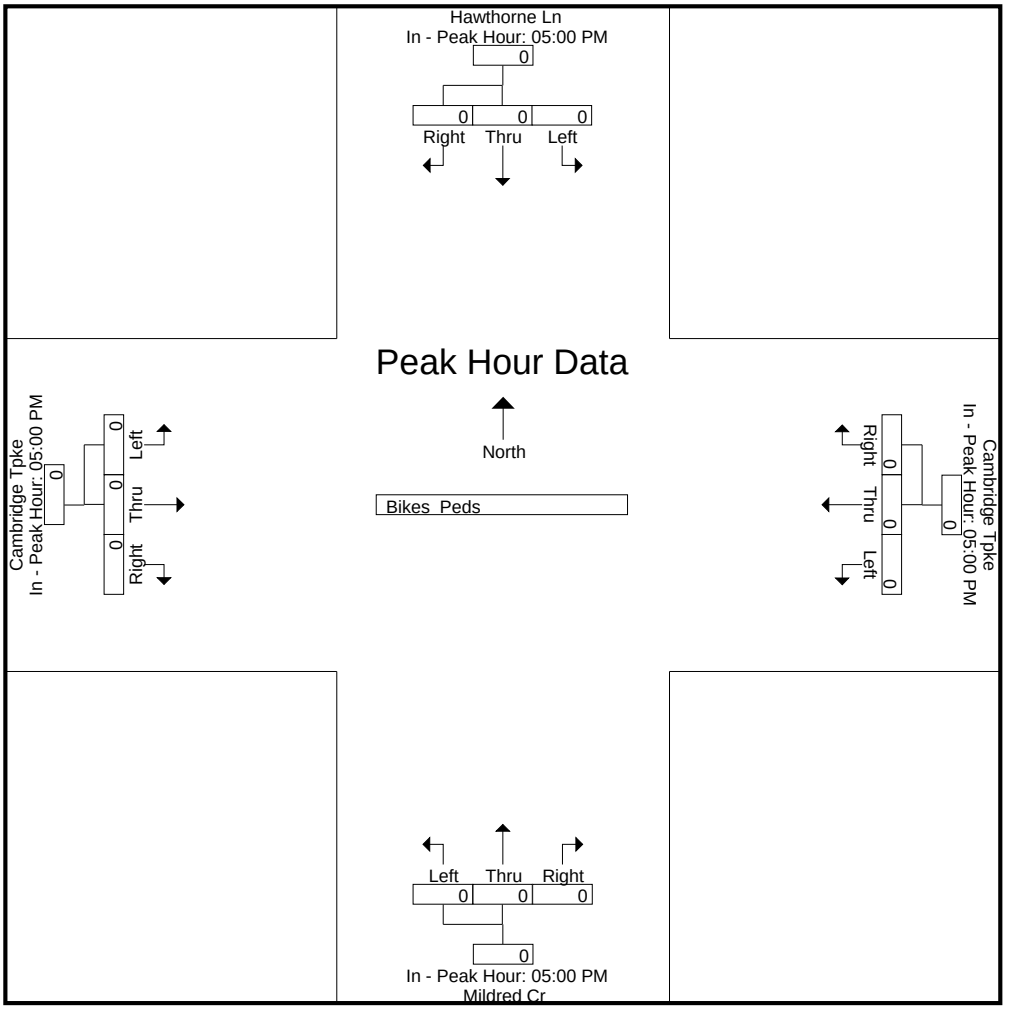
N/S Street : Hawthorne Ln / Mildred Cr
E/W Street : Cambridge Turnpike
City/State : Concord, MA
Weather : Cloudy

File Name : 440A0003
Site Code : 440A0003
Start Date : 9/27/2012
Page No : 2

	Hawthorne Ln From North				Cambridge Tpke From East				Mildred Cr From South				Cambridge Tpke From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total

Peak Hour Analysis From 05:00 PM to 05:45 PM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	05:00 PM				05:00 PM				05:00 PM				05:00 PM			
+0 mins.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+15 mins.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+30 mins.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+45 mins.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Volume	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% App. Total	0	0	0		0	0	0		0	0	0		0	0	0	
PHF	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000



Accurate Counts
978-664-2565

Location : Cambridge Turnpike
Location : Northwest of Millbrook Farm
City/State: Concord, MA

Start	26-Sep-12	SE		Hour Totals		NW		Hour Totals		Combined Totals	
Time	Wed	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon
12:00		2	40			4	36				
12:15		1	40			5	45				
12:30		2	42			2	28				
12:45		1	35	6	157	3	24	14	133	20	290
01:00		1	29			2	37				
01:15		3	36			0	34				
01:30		2	40			1	33				
01:45		0	40	6	145	0	49	3	153	9	298
02:00		0	29			1	46				
02:15		2	38			1	43				
02:30		1	44			2	54				
02:45		1	43	4	154	1	61	5	204	9	358
03:00		0	40			0	57				
03:15		1	41			0	62				
03:30		1	51			1	57				
03:45		1	37	3	169	0	57	1	233	4	402
04:00		1	42			2	51				
04:15		1	38			1	86				
04:30		3	52			0	79				
04:45		2	48	7	180	0	78	3	294	10	474
05:00		5	49			3	71				
05:15		7	72			1	80				
05:30		9	48			2	62				
05:45		18	38	39	207	5	77	11	290	50	497
06:00		26	43			5	90				
06:15		40	49			7	75				
06:30		49	39			17	62				
06:45		69	23	184	154	23	71	52	298	236	452
07:00		75	19			24	48				
07:15		96	24			22	45				
07:30		106	18			48	36				
07:45		72	15	349	76	50	36	144	165	493	241
08:00		68	18			37	23				
08:15		61	8			38	32				
08:30		64	12			31	26				
08:45		59	7	252	45	51	26	157	107	409	152
09:00		47	15			29	27				
09:15		44	16			34	31				
09:30		60	11			38	18				
09:45		46	9	197	51	40	33	141	109	338	160
10:00		34	10			34	13				
10:15		35	5			35	21				
10:30		41	11			28	12				
10:45		29	5	139	31	38	10	135	56	274	87
11:00		31	4			34	8				
11:15		37	8			40	10				
11:30		38	2			19	10				
11:45		40	1	146	15	28	2	121	30	267	45
Total		1332	1384			787	2072			2119	3456
Percent		49.0%	51.0%			27.5%	72.5%			38.0%	62.0%

Accurate Counts
978-664-2565

Location : Cambridge Turnpike
Location : Northwest of Millbrook Farm
City/State: Concord, MA

Start	27-Sep-12	SE		Hour Totals		NW		Hour Totals		Combined Totals	
Time	Thu	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon
12:00		0	38			4	48				
12:15		1	38			10	52				
12:30		1	35			2	38				
12:45		1	41	3	152	5	40	21	178	24	330
01:00		0	35			3	40				
01:15		2	32			1	31				
01:30		4	33			0	37				
01:45		1	33	7	133	0	32	4	140	11	273
02:00		0	33			2	46				
02:15		1	36			0	40				
02:30		0	40			2	47				
02:45		1	34	2	143	0	56	4	189	6	332
03:00		0	45			0	51				
03:15		0	48			1	61				
03:30		2	59			0	72				
03:45		0	26	2	178	0	69	1	253	3	431
04:00		2	51			1	90				
04:15		1	59			0	88				
04:30		1	38			0	105				
04:45		6	49	10	197	2	68	3	351	13	548
05:00		2	41			2	80				
05:15		8	57			0	69				
05:30		8	47			2	77				
05:45		18	52	36	197	2	79	6	305	42	502
06:00		25	45			3	86				
06:15		43	47			5	89				
06:30		42	39			13	80				
06:45		95	43	205	174	28	93	49	348	254	522
07:00		79	29			30	83				
07:15		93	23			45	59				
07:30		110	36			34	50				
07:45		89	28	371	116	38	43	147	235	518	351
08:00		76	14			37	36				
08:15		70	24			42	37				
08:30		72	18			28	27				
08:45		78	13	296	69	51	20	158	120	454	189
09:00		58	24			56	30				
09:15		49	26			53	24				
09:30		62	20			37	31				
09:45		43	15	212	85	32	32	178	117	390	202
10:00		42	22			43	35				
10:15		30	20			29	23				
10:30		51	7			30	26				
10:45		32	21	155	70	40	22	142	106	297	176
11:00		44	17			31	12				
11:15		37	8			35	8				
11:30		48	9			48	9				
11:45		37	3	166	37	52	9	166	38	332	75
Total		1465	1551			879	2380			2344	3931
Percent		48.6%	51.4%			27.0%	73.0%			37.4%	62.6%
Grand Total		2797	2935			1666	4452			4463	7387
Percent		48.8%	51.2%			27.2%	72.8%			37.7%	62.3%
ADT		ADT 5,925		AADT 5,925							

Accurate Counts
978-664-2565

Location : Cambridge Turnpike
Location : Northwest of Millbrook Farm
City/State: Concord, MA

Start	24-Sep-12		Tue		Wed		Thu		Fri		Sat		Sun		Week Average	
Time	SE	NW	SE	NW	SE	NW	SE	NW	SE	NW	SE	NW	SE	NW	SE	NW
12:00 AM	*	*	*	*	6	14	3	21	*	*	*	*	*	*	4	18
01:00	*	*	*	*	6	3	7	4	*	*	*	*	*	*	6	4
02:00	*	*	*	*	4	5	2	4	*	*	*	*	*	*	3	4
03:00	*	*	*	*	3	1	2	1	*	*	*	*	*	*	2	1
04:00	*	*	*	*	7	3	10	3	*	*	*	*	*	*	8	3
05:00	*	*	*	*	39	11	36	6	*	*	*	*	*	*	38	8
06:00	*	*	*	*	184	52	205	49	*	*	*	*	*	*	194	50
07:00	*	*	*	*	**349**	144	**371**	147	*	*	*	*	*	*	**360**	146
08:00	*	*	*	*	252	**157**	296	158	*	*	*	*	*	*	274	158
09:00	*	*	*	*	197	141	212	**178**	*	*	*	*	*	*	204	**160**
10:00	*	*	*	*	139	135	155	142	*	*	*	*	*	*	147	138
11:00	*	*	*	*	146	121	166	166	*	*	*	*	*	*	156	144
12:00 PM	*	*	*	*	157	133	152	178	*	*	*	*	*	*	154	156
01:00	*	*	*	*	145	153	133	140	*	*	*	*	*	*	139	146
02:00	*	*	*	*	154	204	143	189	*	*	*	*	*	*	148	196
03:00	*	*	*	*	169	233	178	253	*	*	*	*	*	*	174	243
04:00	*	*	*	*	180	294	**197**	**351**	*	*	*	*	*	*	188	322
05:00	*	*	*	*	**207**	290	197	305	*	*	*	*	*	*	**202**	298
06:00	*	*	*	*	154	**298**	174	348	*	*	*	*	*	*	164	**323**
07:00	*	*	*	*	76	165	116	235	*	*	*	*	*	*	96	200
08:00	*	*	*	*	45	107	69	120	*	*	*	*	*	*	57	114
09:00	*	*	*	*	51	109	85	117	*	*	*	*	*	*	68	113
10:00	*	*	*	*	31	56	70	106	*	*	*	*	*	*	50	81
11:00	*	*	*	*	15	30	37	38	*	*	*	*	*	*	26	34
Lane	0	0	0	0	2716	2859	3016	3259	0	0	0	0	0	0	2862	3060
Day	0		0		5575		6275		0		0		0		5922	
AM Peak	-	-	-	-	07:00	08:00	07:00	09:00	-	-	-	-	-	-	07:00	09:00
Vol.	-	-	-	-	349	157	371	178	-	-	-	-	-	-	360	160
PM Peak	-	-	-	-	17:00	18:00	16:00	16:00	-	-	-	-	-	-	17:00	18:00
Vol.	-	-	-	-	207	298	197	351	-	-	-	-	-	-	202	323

Comb. Total	0	0	5575	6275	0	0	0	5922

ADT ADT 5,925 AADT 5,925

Accurate Counts
978-664-2565

Location : Cambridge Turnpike
Location : Northwest of Millbrook Farm
City/State: Concord, MA
Southeast

Start Time	1 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 999	Total	85th Percent	95th Percent
09/26/12	0	0	0	0	0	3	2	1	0	0	0	0	0	0	6	45	48
01:00	0	0	0	1	0	1	2	2	0	0	0	0	0	0	6	47	49
02:00	0	0	0	0	0	2	1	1	0	0	0	0	0	0	4	47	49
03:00	0	0	0	0	0	1	0	2	0	0	0	0	0	0	3	49	50
04:00	0	0	0	0	0	3	3	0	0	0	**1**	0	0	0	7	46	63
05:00	0	0	0	0	3	14	17	3	2	0	0	0	0	0	39	45	50
06:00	2	0	1	1	9	89	73	8	1	0	0	0	0	0	184	43	46
07:00	0	0	1	5	19	**157**	**133**	**33**	1	0	0	0	0	0	**349**	44	47
08:00	2	0	2	2	22	107	94	20	**3**	0	0	0	0	0	252	44	47
09:00	**3**	0	1	4	15	73	82	15	3	**1**	0	0	0	0	197	44	48
10:00	0	0	0	4	24	65	35	11	0	0	0	0	0	0	139	43	46
11:00	2	0	**3**	**7**	**30**	70	32	1	1	0	0	0	0	0	146	41	44
12 PM	2	**1**	1	9	22	74	36	10	2	0	0	0	0	0	157	43	47
13:00	3	1	1	8	27	55	45	5	0	0	0	0	0	0	145	43	45
14:00	**6**	0	1	5	31	72	33	5	1	0	0	0	0	0	154	42	45
15:00	3	0	1	**10**	**38**	66	42	9	0	0	0	0	0	0	169	43	45
16:00	6	1	**3**	4	37	61	50	**15**	**3**	0	0	0	0	0	180	44	47
17:00	4	1	2	8	35	**79**	**64**	12	2	0	0	0	0	0	**207**	43	46
18:00	4	0	0	0	17	72	52	9	0	0	0	0	0	0	154	43	46
19:00	1	0	0	1	15	33	22	3	1	0	0	0	0	0	76	43	46
20:00	1	0	0	0	10	17	12	4	0	**1**	0	0	0	0	45	44	48
21:00	1	0	0	3	13	16	16	1	1	0	0	0	0	0	51	43	45
22:00	1	0	0	0	8	12	9	1	0	0	0	0	0	0	31	42	45
23:00	0	0	1	0	2	7	3	2	0	0	0	0	0	0	15	44	48
Total	41	4	18	72	377	1149	858	173	21	2	1	0	0	0	2716		
Percent	1.5%	0.1%	0.7%	2.7%	13.9%	42.3%	31.6%	6.4%	0.8%	0.1%	0.0%	0.0%	0.0%	0.0%			
AM Peak	09:00		11:00	11:00	11:00	07:00	07:00	07:00	08:00	09:00	04:00				07:00		
Vol.	3		3	7	30	157	133	33	3	1	1				349		
PM Peak	14:00	12:00	16:00	15:00	15:00	17:00	17:00	16:00	16:00	20:00					17:00		
Vol.	6	1	3	10	38	79	64	15	3	1					207		

Accurate Counts
978-664-2565

Location : Cambridge Turnpike
Location : Northwest of Millbrook Farm
City/State: Concord, MA
Southeast

Start Time	1 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 999	Total	85th Percent	95th Percent
09/27/12	0	0	0	0	0	1	2	0	0	0	0	0	0	0	3	44	45
01:00	0	0	0	0	0	6	0	1	0	0	0	0	0	0	7	41	48
02:00	0	0	0	0	0	2	0	0	0	0	0	0	0	0	2	39	40
03:00	0	0	0	0	0	0	1	1	0	0	0	0	0	0	2	48	50
04:00	0	0	0	0	2	3	5	0	0	0	0	0	0	0	10	43	45
05:00	0	0	0	0	3	14	11	5	2	**1**	0	0	0	0	36	47	52
06:00	4	0	1	0	11	107	76	6	0	0	0	0	0	0	205	43	45
07:00	**11**	0	2	3	32	**152**	139	29	3	0	0	0	0	0	**371**	44	47
08:00	6	**2**	1	1	7	82	**151**	**42**	3	0	**1**	0	0	0	296	45	48
09:00	5	0	0	3	25	87	70	17	**4**	1	0	0	0	0	212	44	48
10:00	1	0	**4**	5	**33**	60	42	9	1	0	0	0	0	0	155	43	46
11:00	2	0	1	**6**	25	76	49	6	1	0	0	0	0	0	166	43	45
12 PM	3	1	4	**12**	37	54	33	5	**3**	0	0	0	0	0	152	42	46
13:00	2	1	0	10	25	49	40	5	1	0	0	0	0	0	133	43	45
14:00	1	0	0	10	40	63	26	3	0	0	0	0	0	0	143	41	44
15:00	**11**	0	0	8	41	76	35	7	0	0	0	0	0	0	178	41	45
16:00	10	0	1	10	**52**	82	36	4	2	0	0	0	0	0	**197**	41	44
17:00	6	1	1	12	31	**89**	**49**	7	1	0	0	0	0	0	197	42	45
18:00	3	1	0	9	36	77	39	**8**	1	0	0	0	0	0	174	42	45
19:00	3	**3**	**6**	3	27	50	15	7	1	**1**	0	0	0	0	116	42	47
20:00	0	0	0	3	25	28	13	0	0	0	0	0	0	0	69	41	43
21:00	2	0	0	3	18	40	16	6	0	0	0	0	0	0	85	42	46
22:00	1	0	1	5	11	38	12	2	0	0	0	0	0	0	70	41	44
23:00	0	0	0	2	7	16	8	3	1	0	0	0	0	0	37	44	48
Total	71	9	22	105	488	1252	868	173	24	3	1	0	0	0	3016		
Percent	2.4%	0.3%	0.7%	3.5%	16.2%	41.5%	28.8%	5.7%	0.8%	0.1%	0.0%	0.0%	0.0%	0.0%			
AM Peak	07:00	08:00	10:00	11:00	10:00	07:00	08:00	08:00	09:00	05:00	08:00				07:00		
Vol.	11	2	4	6	33	152	151	42	4	1	1				371		
PM Peak	15:00	19:00	19:00	12:00	16:00	17:00	17:00	18:00	12:00	19:00					16:00		
Vol.	11	3	6	12	52	89	49	8	3	1					197		
Total	112	13	40	177	865	2401	1726	346	45	5	2	0	0	0	5732		
Percent	2.0%	0.2%	0.7%	3.1%	15.1%	41.9%	30.1%	6.0%	0.8%	0.1%	0.0%	0.0%	0.0%	0.0%			

15th Percentile :	32 MPH
50th Percentile :	38 MPH
85th Percentile :	43 MPH
95th Percentile :	46 MPH

Stats	
10 MPH Pace Speed :	35-44 MPH
Number in Pace :	3775
Percent in Pace :	65.9%
Number of Vehicles > 40 MPH :	2124
Percent of Vehicles > 40 MPH :	37.1%
Mean Speed(Average) :	38 MPH

Accurate Counts
978-664-2565

Location : Cambridge Turnpike
Location : Northwest of Millbrook Farm
City/State: Concord, MA
Northwest

Start Time	1 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 999	Total	85th Percent	95th Percent
09/26/12	0	0	0	0	4	4	3	2	0	**1**	0	0	0	0	14	47	56
01:00	0	0	0	0	0	2	0	0	1	0	0	0	0	0	3	52	54
02:00	0	0	0	0	0	2	3	0	0	0	0	0	0	0	5	43	45
03:00	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	29	30
04:00	0	0	0	0	0	0	3	0	0	0	0	0	0	0	3	44	45
05:00	0	0	0	0	2	5	4	0	0	0	0	0	0	0	11	42	44
06:00	1	0	0	1	5	28	14	3	0	0	0	0	0	0	52	43	46
07:00	1	0	**7**	1	14	61	**48**	**9**	1	1	**1**	0	0	0	144	44	47
08:00	2	**1**	1	**6**	28	**68**	44	7	0	0	0	0	0	0	**157**	43	45
09:00	**3**	0	0	1	19	62	48	6	**2**	0	0	0	0	0	141	43	46
10:00	2	0	0	2	34	59	31	6	1	0	0	0	0	0	135	42	45
11:00	2	1	1	4	**38**	49	20	4	2	0	0	0	0	0	121	41	45
12 PM	2	0	1	8	26	64	27	5	0	0	0	0	0	0	133	42	45
13:00	3	1	3	8	27	70	37	4	0	0	0	0	0	0	153	42	45
14:00	4	0	3	16	74	81	24	2	0	0	0	0	0	0	204	40	43
15:00	**5**	0	2	13	71	96	40	6	0	0	0	0	0	0	233	41	44
16:00	5	0	3	7	**89**	141	45	4	0	0	0	0	0	0	294	40	43
17:00	4	**7**	**11**	**19**	85	124	36	4	0	0	0	0	0	0	290	40	43
18:00	2	0	2	12	82	**162**	35	3	0	0	0	0	0	0	**298**	40	43
19:00	1	0	1	1	17	83	**50**	**10**	**2**	0	0	0	0	0	165	43	46
20:00	1	0	0	5	17	44	32	6	2	0	0	0	0	0	107	43	47
21:00	0	0	0	0	16	46	41	6	0	0	0	0	0	0	109	43	46
22:00	1	0	1	0	10	18	19	7	0	0	0	0	0	0	56	44	47
23:00	0	0	0	0	2	6	16	5	1	0	0	0	0	0	30	46	49
Total	39	10	36	105	660	1275	620	99	12	2	1	0	0	0	2859		
Percent	1.4%	0.3%	1.3%	3.7%	23.1%	44.6%	21.7%	3.5%	0.4%	0.1%	0.0%	0.0%	0.0%	0.0%			
AM Peak	09:00	08:00	07:00	08:00	11:00	08:00	07:00	07:00	09:00	00:00	07:00				08:00		
Vol.	3	1	7	6	38	68	48	9	2	1	1				157		
PM Peak	15:00	17:00	17:00	17:00	16:00	18:00	19:00	19:00	19:00						18:00		
Vol.	5	7	11	19	89	162	50	10	2						298		

Accurate Counts
978-664-2565

Location : Cambridge Turnpike
Location : Northwest of Millbrook Farm
City/State: Concord, MA
Northwest

Start Time	1 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 999	Total	85th Percent	95th Percent
09/27/12	0	0	0	0	1	5	9	4	**2**	0	0	0	0	0	21	48	52
01:00	0	0	0	1	0	3	0	0	0	0	0	0	0	0	4	39	40
02:00	0	0	0	0	0	2	2	0	0	0	0	0	0	0	4	43	45
03:00	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	44	45
04:00	0	0	0	0	1	1	1	0	0	0	0	0	0	0	3	42	44
05:00	0	0	0	0	3	1	1	1	0	0	0	0	0	0	6	45	48
06:00	3	0	0	1	7	23	15	0	0	0	0	0	0	0	49	42	44
07:00	**10**	0	0	**7**	13	67	40	9	0	**1**	0	0	0	0	147	43	46
08:00	9	**1**	**4**	1	18	51	**55**	**18**	1	0	0	0	0	0	158	44	47
09:00	5	1	1	1	27	**90**	40	11	2	0	0	0	0	0	**178**	43	46
10:00	1	0	2	5	**30**	65	29	9	1	0	0	0	0	0	142	43	46
11:00	5	0	0	6	29	81	40	5	0	0	0	0	0	0	166	42	45
12 PM	3	0	4	15	29	85	31	**10**	1	0	0	0	0	0	178	42	46
13:00	2	0	2	14	29	56	27	8	2	0	0	0	0	0	140	42	46
14:00	6	0	2	3	43	85	42	7	1	0	0	0	0	0	189	42	45
15:00	**7**	**5**	1	13	53	108	55	8	**3**	0	0	0	0	0	253	42	45
16:00	7	0	5	14	87	**182**	51	5	0	0	0	0	0	0	**351**	40	43
17:00	3	0	0	19	89	124	**59**	10	1	0	0	0	0	0	305	42	45
18:00	4	2	**9**	**35**	**138**	118	39	3	0	0	0	0	0	0	348	39	43
19:00	5	0	0	3	57	124	43	3	0	0	0	0	0	0	235	41	44
20:00	1	0	0	3	28	51	31	4	2	0	0	0	0	0	120	43	46
21:00	0	0	0	7	20	52	28	10	0	0	0	0	0	0	117	43	47
22:00	0	0	0	2	17	48	32	7	0	0	0	0	0	0	106	43	46
23:00	1	0	0	1	4	18	11	2	1	0	0	0	0	0	38	43	47
Total	72	9	30	151	723	1440	682	134	17	1	0	0	0	0	3259		
Percent	2.2%	0.3%	0.9%	4.6%	22.2%	44.2%	20.9%	4.1%	0.5%	0.0%	0.0%	0.0%	0.0%	0.0%			
AM Peak	07:00	08:00	08:00	07:00	10:00	09:00	08:00	08:00	00:00	07:00					09:00		
Vol.	10	1	4	7	30	90	55	18	2	1					178		
PM Peak	15:00	15:00	18:00	18:00	18:00	16:00	17:00	12:00	15:00						16:00		
Vol.	7	5	9	35	138	182	59	10	3						351		
Total	111	19	66	256	1383	2715	1302	233	29	3	1	0	0	0	6118		
Percent	1.8%	0.3%	1.1%	4.2%	22.6%	44.4%	21.3%	3.8%	0.5%	0.0%	0.0%	0.0%	0.0%	0.0%			

15th Percentile :	31 MPH
50th Percentile :	37 MPH
85th Percentile :	42 MPH
95th Percentile :	45 MPH

Stats	
10 MPH Pace Speed :	33-42 MPH
Number in Pace :	4001
Percent in Pace :	65.4%
Number of Vehicles > 40 MPH :	1568
Percent of Vehicles > 40 MPH :	25.6%
Mean Speed(Average) :	37 MPH

Accurate Counts
978-664-2565

Location : Cambridge Turnpike
Location : Northwest of Millbrook Farm
City/State: Concord, MA
Southeast, Northwest

Start Time	1 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 999	Total	85th Percent	95th Percent
09/26/12	0	0	0	0	4	7	5	3	0	**1**	0	0	0	0	20	46	51
01:00	0	0	0	1	0	3	2	2	1	0	0	0	0	0	9	49	52
02:00	0	0	0	0	0	4	4	1	0	0	0	0	0	0	9	45	47
03:00	0	0	0	1	0	1	0	2	0	0	0	0	0	0	4	48	50
04:00	0	0	0	0	0	3	6	0	0	0	**1**	0	0	0	10	45	62
05:00	0	0	0	0	5	19	21	3	2	0	0	0	0	0	50	44	49
06:00	3	0	1	2	14	117	87	11	1	0	0	0	0	0	236	43	46
07:00	1	0	**8**	6	33	**218**	**181**	**42**	2	1	1	0	0	0	**493**	44	47
08:00	4	**1**	3	8	50	175	138	27	3	0	0	0	0	0	409	44	46
09:00	**6**	0	1	5	34	135	130	21	**5**	1	0	0	0	0	338	44	47
10:00	2	0	0	6	58	124	66	17	1	0	0	0	0	0	274	43	46
11:00	4	1	4	**11**	**68**	119	52	5	3	0	0	0	0	0	267	41	45
12 PM	4	1	2	17	48	138	63	15	2	0	0	0	0	0	290	42	46
13:00	6	2	4	16	54	125	82	9	0	0	0	0	0	0	298	42	45
14:00	10	0	4	21	105	153	57	7	1	0	0	0	0	0	358	41	44
15:00	8	0	3	23	109	162	82	15	0	0	0	0	0	0	402	42	45
16:00	**11**	1	6	11	**126**	202	95	**19**	**3**	0	0	0	0	0	474	42	45
17:00	8	**8**	**13**	**27**	120	203	**100**	16	2	0	0	0	0	0	**497**	42	45
18:00	6	0	2	12	99	**234**	87	12	0	0	0	0	0	0	452	41	44
19:00	2	0	1	2	32	116	72	13	3	0	0	0	0	0	241	43	46
20:00	2	0	0	5	27	61	44	10	2	**1**	0	0	0	0	152	44	47
21:00	1	0	0	3	29	62	57	7	1	0	0	0	0	0	160	43	46
22:00	2	0	1	0	18	30	28	8	0	0	0	0	0	0	87	44	47
23:00	0	0	1	0	4	13	19	7	1	0	0	0	0	0	45	46	49
Total	80	14	54	177	1037	2424	1478	272	33	4	2	0	0	0	5575		
Percent	1.4%	0.3%	1.0%	3.2%	18.6%	43.5%	26.5%	4.9%	0.6%	0.1%	0.0%	0.0%	0.0%	0.0%			
AM Peak	09:00	08:00	07:00	11:00	11:00	07:00	07:00	07:00	09:00	00:00	04:00				07:00		
Vol.	6	1	8	11	68	218	181	42	5	1	1				493		
PM Peak	16:00	17:00	17:00	17:00	16:00	18:00	17:00	16:00	16:00	20:00					17:00		
Vol.	11	8	13	27	126	234	100	19	3	1					497		

Accurate Counts
978-664-2565

Location : Cambridge Turnpike
Location : Northwest of Millbrook Farm
City/State: Concord, MA
Southeast, Northwest

Start Time	1 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 999	Total	85th Percent	95th Percent
09/27/12	0	0	0	0	1	6	11	4	2	0	0	0	0	0	24	47	51
01:00	0	0	0	1	0	9	0	1	0	0	0	0	0	0	11	40	47
02:00	0	0	0	0	0	4	2	0	0	0	0	0	0	0	6	42	44
03:00	0	0	0	0	0	0	2	1	0	0	0	0	0	0	3	47	49
04:00	0	0	0	0	3	4	6	0	0	0	0	0	0	0	13	43	45
05:00	0	0	0	0	6	15	12	6	2	**1**	0	0	0	0	42	47	52
06:00	7	0	1	1	18	130	91	6	0	0	0	0	0	0	254	43	45
07:00	**21**	0	2	10	45	**219**	179	38	3	1	0	0	0	0	**518**	44	47
08:00	15	**3**	5	2	25	133	**206**	**60**	4	0	**1**	0	0	0	454	45	48
09:00	10	1	1	4	52	177	110	28	**6**	1	0	0	0	0	390	44	47
10:00	2	0	**6**	10	**63**	125	71	18	2	0	0	0	0	0	297	43	46
11:00	7	0	1	**12**	54	157	89	11	1	0	0	0	0	0	332	42	45
12 PM	6	1	8	27	66	139	64	15	**4**	0	0	0	0	0	330	42	46
13:00	4	1	2	24	54	105	67	13	3	0	0	0	0	0	273	43	46
14:00	7	0	2	13	83	148	68	10	1	0	0	0	0	0	332	42	45
15:00	**18**	**5**	1	21	94	184	90	15	3	0	0	0	0	0	431	42	45
16:00	17	0	6	24	139	**264**	87	9	2	0	0	0	0	0	**548**	41	44
17:00	9	1	1	31	120	213	**108**	**17**	2	0	0	0	0	0	502	42	45
18:00	7	3	**9**	**44**	**174**	195	78	11	1	0	0	0	0	0	522	40	44
19:00	8	3	6	6	84	174	58	10	1	**1**	0	0	0	0	351	41	44
20:00	1	0	0	6	53	79	44	4	2	0	0	0	0	0	189	42	45
21:00	2	0	0	10	38	92	44	16	0	0	0	0	0	0	202	43	46
22:00	1	0	1	7	28	86	44	9	0	0	0	0	0	0	176	43	45
23:00	1	0	0	3	11	34	19	5	2	0	0	0	0	0	75	43	48
Total	143	18	52	256	1211	2692	1550	307	41	4	1	0	0	0	6275		
Percent	2.3%	0.3%	0.8%	4.1%	19.3%	42.9%	24.7%	4.9%	0.7%	0.1%	0.0%	0.0%	0.0%	0.0%			
AM Peak	07:00	08:00	10:00	11:00	10:00	07:00	08:00	08:00	09:00	05:00	08:00				07:00		
Vol.	21	3	6	12	63	219	206	60	6	1	1				518		
PM Peak	15:00	15:00	18:00	18:00	18:00	16:00	17:00	17:00	12:00	19:00					16:00		
Vol.	18	5	9	44	174	264	108	17	4	1					548		
Total	223	32	106	433	2248	5116	3028	579	74	8	3	0	0	0	11850		
Percent	1.9%	0.3%	0.9%	3.7%	19.0%	43.2%	25.6%	4.9%	0.6%	0.1%	0.0%	0.0%	0.0%	0.0%			

15th Percentile :	31 MPH
50th Percentile :	37 MPH
85th Percentile :	43 MPH
95th Percentile :	46 MPH

Stats	
10 MPH Pace Speed :	34-43 MPH
Number in Pace :	7706
Percent in Pace :	65.0%
Number of Vehicles > 40 MPH :	3692
Percent of Vehicles > 40 MPH :	31.2%
Mean Speed(Average) :	37 MPH

Accurate Counts
978-664-2565

Location : Cambridge Turnpike
Location : Southeast of Hawthorne Lane
City/State: Concord, MA

Start	26-Sep-12	SE		Hour Totals		NW		Hour Totals		Combined Totals	
Time	Wed	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon
12:00		1	40			3	35				
12:15		1	40			5	44				
12:30		2	42			4	28				
12:45		1	28	5	150	1	26	13	133	18	283
01:00		2	31			2	34				
01:15		3	38			0	40				
01:30		1	35			1	39				
01:45		0	46	6	150	0	46	3	159	9	309
02:00		0	26			2	51				
02:15		2	47			0	50				
02:30		1	45			2	55				
02:45		1	47	4	165	1	55	5	211	9	376
03:00		0	40			0	59				
03:15		1	41			0	53				
03:30		2	54			2	58				
03:45		1	33	4	168	1	57	3	227	7	395
04:00		1	39			2	60				
04:15		2	43			1	88				
04:30		5	53			0	83				
04:45		3	48	11	183	1	81	4	312	15	495
05:00		6	56			2	77				
05:15		7	69			1	81				
05:30		9	50			4	82				
05:45		21	55	43	230	6	89	13	329	56	559
06:00		31	45			5	87				
06:15		42	42			8	69				
06:30		55	33			20	70				
06:45		75	34	203	154	24	67	57	293	260	447
07:00		75	17			22	38				
07:15		98	24			33	49				
07:30		102	17			50	40				
07:45		71	18	346	76	56	35	161	162	507	238
08:00		64	15			48	35				
08:15		63	10			39	31				
08:30		72	13			40	30				
08:45		62	6	261	44	44	29	171	125	432	169
09:00		44	20			36	28				
09:15		55	13			31	25				
09:30		55	8			39	29				
09:45		44	14	198	55	39	22	145	104	343	159
10:00		34	6			41	18				
10:15		36	11			30	20				
10:30		40	6			30	11				
10:45		30	7	140	30	38	12	139	61	279	91
11:00		31	5			35	8				
11:15		40	7			33	13				
11:30		34	2			21	10				
11:45		43	1	148	15	33	4	122	35	270	50
Total		1369	1420			836	2151			2205	3571
Percent		49.1%	50.9%			28.0%	72.0%			38.2%	61.8%

Accurate Counts
978-664-2565

Location : Cambridge Turnpike
Location : Southeast of Hawthorne Lane
City/State: Concord, MA

Start Time	27-Sep-12 Thu	SE Morning	SE Afternoon	Hour Totals Morning	Hour Totals Afternoon	NW Morning	NW Afternoon	Hour Totals Morning	Hour Totals Afternoon	Combined Totals Morning	Combined Totals Afternoon
12:00		1	31			5	40				
12:15		2	39			8	50				
12:30		2	38			3	42				
12:45		0	39	5	147	4	42	20	174	25	321
01:00		0	32			3	36				
01:15		6	34			1	28				
01:30		0	30			0	31				
01:45		1	37	7	133	1	37	5	132	12	265
02:00		1	32			1	54				
02:15		0	48			1	43				
02:30		0	36			1	51				
02:45		1	36	2	152	0	63	3	211	5	363
03:00		1	48			0	58				
03:15		0	43			1	76				
03:30		3	53			0	75				
03:45		1	34	5	178	0	77	1	286	6	464
04:00		2	54			1	92				
04:15		1	56			0	106				
04:30		5	37			1	91				
04:45		5	43	13	190	2	80	4	369	17	559
05:00		3	34			1	84				
05:15		9	61			1	77				
05:30		13	51			2	84				
05:45		22	56	47	202	5	84	9	329	56	531
06:00		24	58			3	97				
06:15		47	39			7	87				
06:30		59	42			18	93				
06:45		99	38	229	177	32	87	60	364	289	541
07:00		79	25			35	83				
07:15		96	30			40	61				
07:30		113	28			46	40				
07:45		66	30	354	113	52	45	173	229	527	342
08:00		89	8			35	38				
08:15		69	28			38	33				
08:30		84	16			54	23				
08:45		75	21	317	73	48	24	175	118	492	191
09:00		64	27			63	29				
09:15		56	24			54	33				
09:30		46	13			33	28				
09:45		51	24	217	88	34	43	184	133	401	221
10:00		34	18			45	29				
10:15		34	17			27	26				
10:30		46	13			31	22				
10:45		43	17	157	65	35	23	138	100	295	165
11:00		37	18			31	9				
11:15		42	7			46	12				
11:30		50	8			46	10				
11:45		42	4	171	37	46	7	169	38	340	75
Total		1524	1555			941	2483			2465	4038
Percent		49.5%	50.5%			27.5%	72.5%			37.9%	62.1%
Grand Total		2893	2975			1777	4634			4670	7609
Percent		49.3%	50.7%			27.7%	72.3%			38.0%	62.0%
ADT		ADT 6,140		AADT 6,140							

Accurate Counts
978-664-2565

Location : Cambridge Turnpike
Location : Southeast of Hawthorne Lane
City/State: Concord, MA

Start	24-Sep-12		Tue		Wed		Thu		Fri		Sat		Sun		Week Average	
Time	SE	NW	SE	NW	SE	NW	SE	NW	SE	NW	SE	NW	SE	NW	SE	NW
12:00 AM	*	*	*	*	5	13	5	20	*	*	*	*	*	*	5	16
01:00	*	*	*	*	6	3	7	5	*	*	*	*	*	*	6	4
02:00	*	*	*	*	4	5	2	3	*	*	*	*	*	*	3	4
03:00	*	*	*	*	4	3	5	1	*	*	*	*	*	*	4	2
04:00	*	*	*	*	11	4	13	4	*	*	*	*	*	*	12	4
05:00	*	*	*	*	43	13	47	9	*	*	*	*	*	*	45	11
06:00	*	*	*	*	203	57	229	60	*	*	*	*	*	*	216	58
07:00	*	*	*	*	**346**	161	**354**	173	*	*	*	*	*	*	**350**	167
08:00	*	*	*	*	261	**171**	317	175	*	*	*	*	*	*	289	**173**
09:00	*	*	*	*	198	145	217	**184**	*	*	*	*	*	*	208	164
10:00	*	*	*	*	140	139	157	138	*	*	*	*	*	*	148	138
11:00	*	*	*	*	148	122	171	169	*	*	*	*	*	*	160	146
12:00 PM	*	*	*	*	150	133	147	174	*	*	*	*	*	*	148	154
01:00	*	*	*	*	150	159	133	132	*	*	*	*	*	*	142	146
02:00	*	*	*	*	165	211	152	211	*	*	*	*	*	*	158	211
03:00	*	*	*	*	168	227	178	286	*	*	*	*	*	*	173	256
04:00	*	*	*	*	183	312	190	**369**	*	*	*	*	*	*	186	**340**
05:00	*	*	*	*	**230**	**329**	**202**	329	*	*	*	*	*	*	**216**	329
06:00	*	*	*	*	154	293	177	364	*	*	*	*	*	*	166	328
07:00	*	*	*	*	76	162	113	229	*	*	*	*	*	*	94	196
08:00	*	*	*	*	44	125	73	118	*	*	*	*	*	*	58	122
09:00	*	*	*	*	55	104	88	133	*	*	*	*	*	*	72	118
10:00	*	*	*	*	30	61	65	100	*	*	*	*	*	*	48	80
11:00	*	*	*	*	15	35	37	38	*	*	*	*	*	*	26	36
Lane	0	0	0	0	2789	2987	3079	3424	0	0	0	0	0	0	2933	3203
Day	0		0		5776		6503		0		0		0		6136	
AM Peak	-	-	-	-	07:00	08:00	07:00	09:00	-	-	-	-	-	-	07:00	08:00
Vol.	-	-	-	-	346	171	354	184	-	-	-	-	-	-	350	173
PM Peak	-	-	-	-	17:00	17:00	17:00	16:00	-	-	-	-	-	-	17:00	16:00
Vol.	-	-	-	-	230	329	202	369	-	-	-	-	-	-	216	340

Comb. Total	0	0	5776	6503	0	0	0	6136

ADT ADT 6,140 AADT 6,140

Accurate Counts
978-664-2565

Location : Cambridge Turnpike
Location : Southeast of Hawthorne Lane
City/State: Concord, MA
Southeast

Start Time	1 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 999	Total	85th Percent	95th Percent
09/26/12	0	0	0	0	0	2	2	1	0	0	0	0	0	0	5	46	48
01:00	0	0	0	1	0	2	0	3	0	0	0	0	0	0	6	48	50
02:00	0	0	0	0	0	1	0	3	0	0	0	0	0	0	4	49	50
03:00	0	0	0	0	1	0	1	2	0	0	0	0	0	0	4	48	50
04:00	0	0	0	0	1	3	4	2	0	0	**1**	0	0	0	11	48	62
05:00	0	0	0	0	3	12	19	6	2	**1**	0	0	0	0	43	47	52
06:00	**5**	0	**1**	0	9	69	92	26	1	0	0	0	0	0	203	45	48
07:00	2	**1**	1	2	34	**127**	**134**	**40**	**5**	0	0	0	0	0	**346**	45	48
08:00	4	0	0	2	31	92	102	25	5	0	0	0	0	0	261	44	48
09:00	3	0	0	4	14	69	77	27	4	0	0	0	0	0	198	45	49
10:00	4	0	0	4	24	43	48	17	0	0	0	0	0	0	140	44	47
11:00	5	0	0	**7**	**36**	50	37	12	1	0	0	0	0	0	148	43	47
12 PM	1	0	2	5	26	55	44	14	**3**	0	0	0	0	0	150	44	48
13:00	3	**2**	3	**24**	38	61	19	0	0	0	0	0	0	0	150	40	42
14:00	4	0	0	10	39	68	37	7	0	0	0	0	0	0	165	42	45
15:00	7	0	**6**	16	34	64	36	5	0	0	0	0	0	0	168	42	45
16:00	4	1	4	18	42	56	47	8	1	**2**	0	0	0	0	183	43	46
17:00	3	2	0	7	**50**	**85**	**66**	**15**	2	0	0	0	0	0	**230**	43	46
18:00	**8**	0	0	3	18	59	52	13	1	0	0	0	0	0	154	44	47
19:00	0	0	1	1	13	30	23	7	1	0	0	0	0	0	76	44	48
20:00	0	0	0	1	9	11	17	4	1	0	**1**	0	0	0	44	45	50
21:00	0	0	0	5	16	15	14	3	2	0	0	0	0	0	55	43	48
22:00	0	0	1	0	9	11	6	3	0	0	0	0	0	0	30	43	47
23:00	0	0	0	1	2	5	4	2	1	0	0	0	0	0	15	46	51
Total	53	6	19	111	449	990	881	245	30	3	2	0	0	0	2789		
Percent	1.9%	0.2%	0.7%	4.0%	16.1%	35.5%	31.6%	8.8%	1.1%	0.1%	0.1%	0.0%	0.0%	0.0%			
AM Peak	06:00	07:00	06:00	11:00	11:00	07:00	07:00	07:00	07:00	05:00	04:00				07:00		
Vol.	5	1	1	7	36	127	134	40	5	1	1				346		
PM Peak	18:00	13:00	15:00	13:00	17:00	17:00	17:00	17:00	12:00	16:00	20:00				17:00		
Vol.	8	2	6	24	50	85	66	15	3	2	1				230		

Accurate Counts
978-664-2565

Location : Cambridge Turnpike
Location : Southeast of Hawthorne Lane
City/State: Concord, MA
Southeast

Start Time	1 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 999	Total	85th Percent	95th Percent
09/27/12	0	0	0	0	1	2	2	0	0	0	0	0	0	0	5	43	44
01:00	0	0	0	0	0	6	1	0	0	0	0	0	0	0	7	40	43
02:00	0	0	0	0	0	1	1	0	0	0	0	0	0	0	2	43	45
03:00	0	0	1	0	0	2	1	1	0	0	0	0	0	0	5	46	48
04:00	0	0	0	0	1	3	7	2	0	0	0	0	0	0	13	45	48
05:00	0	0	0	0	1	13	21	8	4	0	0	0	0	0	47	48	52
06:00	4	0	0	1	16	80	104	22	2	0	0	0	0	0	229	44	47
07:00	7	2	4	10	23	**109**	**143**	**51**	5	0	0	0	0	0	**354**	45	48
08:00	**9**	**12**	**13**	15	25	91	109	36	**7**	0	0	0	0	0	317	45	48
09:00	6	1	5	14	**60**	65	56	8	2	0	0	0	0	0	217	42	45
10:00	0	0	8	21	38	54	30	5	1	0	0	0	0	0	157	42	45
11:00	7	0	6	**33**	46	57	18	2	1	**1**	0	0	0	0	171	40	43
12 PM	2	**5**	**6**	10	51	50	19	4	0	0	0	0	0	0	147	40	44
13:00	2	0	2	16	49	34	29	1	0	0	0	0	0	0	133	41	44
14:00	6	0	3	**26**	56	43	17	1	0	0	0	0	0	0	152	39	42
15:00	6	2	3	15	42	**83**	25	2	0	0	0	0	0	0	178	40	43
16:00	4	1	2	16	**70**	63	27	7	0	0	0	0	0	0	190	41	44
17:00	**9**	1	3	6	37	72	**61**	11	**2**	0	0	0	0	0	**202**	43	46
18:00	7	1	0	2	34	63	54	**13**	2	0	0	**1**	0	0	177	44	47
19:00	3	0	4	3	22	44	26	9	1	**1**	0	0	0	0	113	43	47
20:00	2	0	0	1	18	29	19	4	0	0	0	0	0	0	73	43	46
21:00	1	0	0	1	22	30	23	9	2	0	0	0	0	0	88	44	48
22:00	0	0	0	2	20	23	15	4	1	0	0	0	0	0	65	43	47
23:00	0	0	0	1	9	12	11	3	0	0	**1**	0	0	0	37	44	48
Total	75	25	60	193	641	1029	819	203	30	2	1	1	0	0	3079		
Percent	2.4%	0.8%	1.9%	6.3%	20.8%	33.4%	26.6%	6.6%	1.0%	0.1%	0.0%	0.0%	0.0%	0.0%			
AM Peak	08:00	08:00	08:00	11:00	09:00	07:00	07:00	07:00	08:00	11:00					07:00		
Vol.	9	12	13	33	60	109	143	51	7	1					354		
PM Peak	17:00	12:00	12:00	14:00	16:00	15:00	17:00	18:00	17:00	19:00	23:00	18:00			17:00		
Vol.	9	5	6	26	70	83	61	13	2	1	1	1			202		
Total	128	31	79	304	1090	2019	1700	448	60	5	3	1	0	0	5868		
Percent	2.2%	0.5%	1.3%	5.2%	18.6%	34.4%	29.0%	7.6%	1.0%	0.1%	0.1%	0.0%	0.0%	0.0%			

15th Percentile :	30 MPH
50th Percentile :	38 MPH
85th Percentile :	44 MPH
95th Percentile :	47 MPH

Stats	
10 MPH Pace Speed :	35-44 MPH
Number in Pace :	3441
Percent in Pace :	58.6%
Number of Vehicles > 40 MPH :	2217
Percent of Vehicles > 40 MPH :	37.8%
Mean Speed(Average) :	37 MPH

Accurate Counts
978-664-2565

Location : Cambridge Turnpike
Location : Southeast of Hawthorne Lane
City/State: Concord, MA
Northwest

Start Time	1 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 999	Total	85th Percent	95th Percent
09/26/12	0	0	0	0	1	1	6	4	0	**1**	0	0	0	0	13	49	56
01:00	0	0	0	0	0	0	1	1	1	0	0	0	0	0	3	52	54
02:00	0	0	0	0	0	2	2	1	0	0	0	0	0	0	5	46	48
03:00	0	0	0	0	1	0	1	1	0	0	0	0	0	0	3	47	49
04:00	0	0	0	0	0	1	3	0	0	0	0	0	0	0	4	44	45
05:00	0	0	0	0	1	8	3	1	0	0	0	0	0	0	13	43	46
06:00	3	0	0	1	2	26	16	9	0	0	0	0	0	0	57	45	48
07:00	3	**1**	1	1	**17**	57	61	19	0	0	**1**	0	0	0	161	45	48
08:00	**4**	0	2	**3**	10	51	**76**	**25**	0	0	0	0	0	0	**171**	45	48
09:00	1	0	0	1	11	56	53	21	**2**	0	0	0	0	0	145	45	48
10:00	3	0	**3**	0	12	52	62	7	0	0	0	0	0	0	139	44	46
11:00	4	0	0	3	15	**62**	26	12	0	0	0	0	0	0	122	43	47
12 PM	1	0	2	1	23	58	43	5	0	0	0	0	0	0	133	43	45
13:00	2	**1**	**4**	11	30	70	35	6	0	0	0	0	0	0	159	42	45
14:00	2	0	0	1	36	114	52	5	1	0	0	0	0	0	211	42	45
15:00	4	0	3	**13**	**44**	93	59	11	0	0	0	0	0	0	227	43	45
16:00	**7**	0	0	1	27	**175**	90	11	1	0	0	0	0	0	312	43	45
17:00	7	0	1	4	25	143	**119**	**29**	1	0	0	0	0	0	**329**	44	47
18:00	2	0	0	3	24	135	104	25	0	0	0	0	0	0	293	44	47
19:00	0	0	0	0	6	48	88	17	2	**1**	0	0	0	0	162	45	48
20:00	0	0	1	4	4	47	50	18	1	0	0	0	0	0	125	45	48
21:00	0	0	0	1	6	35	45	15	2	0	0	0	0	0	104	45	49
22:00	0	0	0	0	3	16	28	12	2	0	0	0	0	0	61	47	50
23:00	0	0	1	0	0	6	17	7	**4**	0	0	0	0	0	35	49	52
Total	43	2	18	48	298	1256	1040	262	17	2	1	0	0	0	2987		
Percent	1.4%	0.1%	0.6%	1.6%	10.0%	42.0%	34.8%	8.8%	0.6%	0.1%	0.0%	0.0%	0.0%	0.0%			
AM Peak	08:00	07:00	10:00	08:00	07:00	11:00	08:00	08:00	09:00	00:00	07:00				08:00		
Vol.	4	1	3	3	17	62	76	25	2	1	1				171		
PM Peak	16:00	13:00	13:00	15:00	15:00	16:00	17:00	17:00	23:00	19:00					17:00		
Vol.	7	1	4	13	44	175	119	29	4	1					329		

Accurate Counts
978-664-2565

Location : Cambridge Turnpike
Location : Southeast of Hawthorne Lane
City/State: Concord, MA
Northwest

Start Time	1 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 999	Total	85th Percent	95th Percent
09/27/12	0	0	0	0	2	2	5	9	1	0	**1**	0	0	0	20	49	58
01:00	0	0	0	0	0	2	1	2	0	0	0	0	0	0	5	48	49
02:00	0	0	0	0	0	2	0	1	0	0	0	0	0	0	3	47	49
03:00	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	49	50
04:00	0	0	0	0	1	1	2	0	0	0	0	0	0	0	4	43	45
05:00	0	0	0	1	2	4	1	1	0	0	0	0	0	0	9	43	47
06:00	3	0	0	2	3	18	29	5	0	0	0	0	0	0	60	44	46
07:00	**4**	0	**3**	1	12	65	**75**	**12**	1	0	0	0	0	0	173	44	46
08:00	3	**1**	3	**12**	29	62	51	12	**2**	0	0	0	0	0	175	43	47
09:00	4	0	0	3	58	**85**	29	4	1	0	0	0	0	0	**184**	41	44
10:00	4	0	0	4	33	68	21	6	2	0	0	0	0	0	138	41	46
11:00	2	0	1	4	**70**	78	13	1	0	0	0	0	0	0	169	39	42
12 PM	2	**1**	1	7	**59**	74	25	5	0	0	0	0	0	0	174	41	44
13:00	2	0	1	5	30	58	26	10	0	0	0	0	0	0	132	43	46
14:00	2	0	0	**18**	51	93	38	9	0	0	0	0	0	0	211	41	45
15:00	10	0	**7**	4	41	136	74	14	0	0	0	0	0	0	286	42	45
16:00	3	1	0	4	35	**184**	131	11	0	0	0	0	0	0	**369**	43	45
17:00	**16**	0	0	0	25	110	**146**	**30**	2	0	0	0	0	0	329	44	47
18:00	11	0	0	3	44	155	118	29	**4**	0	0	0	0	0	364	44	47
19:00	5	0	0	3	23	92	89	16	1	0	0	0	0	0	229	44	46
20:00	0	0	0	2	7	44	47	17	0	0	**1**	0	0	0	118	45	48
21:00	2	0	0	1	9	36	63	20	2	0	0	0	0	0	133	45	48
22:00	0	0	0	0	5	35	44	13	3	0	0	0	0	0	100	45	49
23:00	0	0	0	0	3	17	9	9	0	0	0	0	0	0	38	46	49
Total	73	3	16	74	542	1421	1037	237	19	0	2	0	0	0	3424		
Percent	2.1%	0.1%	0.5%	2.2%	15.8%	41.5%	30.3%	6.9%	0.6%	0.0%	0.1%	0.0%	0.0%	0.0%			
AM Peak	07:00	08:00	07:00	08:00	11:00	09:00	07:00	07:00	08:00		00:00				09:00		
Vol.	4	1	3	12	70	85	75	12	2		1				184		
PM Peak	17:00	12:00	15:00	14:00	12:00	16:00	17:00	17:00	18:00		20:00				16:00		
Vol.	16	1	7	18	59	184	146	30	4		1				369		
Total	116	5	34	122	840	2677	2077	499	36	2	3	0	0	0	6411		
Percent	1.8%	0.1%	0.5%	1.9%	13.1%	41.8%	32.4%	7.8%	0.6%	0.0%	0.0%	0.0%	0.0%	0.0%			

15th Percentile :	33 MPH
50th Percentile :	38 MPH
85th Percentile :	44 MPH
95th Percentile :	47 MPH

Stats	
10 MPH Pace Speed :	35-44 MPH
Number in Pace :	4306
Percent in Pace :	67.2%
Number of Vehicles > 40 MPH :	2617
Percent of Vehicles > 40 MPH :	40.8%
Mean Speed(Average) :	39 MPH

Accurate Counts
978-664-2565

Location : Cambridge Turnpike
Location : Southeast of Hawthorne Lane
City/State: Concord, MA
Southeast, Northwest

Start Time	1 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 999	Total	85th Percent	95th Percent
09/26/12	0	0	0	0	1	3	8	5	0	**1**	0	0	0	0	18	48	54
01:00	0	0	0	1	0	2	1	4	1	0	0	0	0	0	9	50	52
02:00	0	0	0	0	0	3	2	4	0	0	0	0	0	0	9	48	50
03:00	0	0	0	0	2	0	2	3	0	0	0	0	0	0	7	48	50
04:00	0	0	0	0	1	4	7	2	0	0	**1**	0	0	0	15	46	61
05:00	0	0	0	0	4	20	22	7	2	1	0	0	0	0	56	46	50
06:00	8	0	1	1	11	95	108	35	1	0	0	0	0	0	260	45	48
07:00	5	**2**	2	3	**51**	**184**	**195**	**59**	5	0	1	0	0	0	**507**	45	48
08:00	8	0	2	5	41	143	178	50	5	0	0	0	0	0	432	45	48
09:00	4	0	0	5	25	125	130	48	**6**	0	0	0	0	0	343	45	48
10:00	7	0	**3**	4	36	95	110	24	0	0	0	0	0	0	279	44	47
11:00	**9**	0	0	**10**	51	112	63	24	1	0	0	0	0	0	270	43	47
12 PM	2	0	4	6	49	113	87	19	3	0	0	0	0	0	283	43	47
13:00	5	**3**	7	**35**	68	131	54	6	0	0	0	0	0	0	309	41	44
14:00	6	0	0	11	75	182	89	12	1	0	0	0	0	0	376	42	45
15:00	**11**	0	**9**	29	**78**	157	95	16	0	0	0	0	0	0	395	42	45
16:00	11	1	4	19	69	**231**	137	19	2	**2**	0	0	0	0	495	43	45
17:00	10	2	1	11	75	228	**185**	**44**	3	0	0	0	0	0	**559**	44	47
18:00	10	0	0	6	42	194	156	38	1	0	0	0	0	0	447	44	47
19:00	0	0	1	1	19	78	111	24	3	1	0	0	0	0	238	45	48
20:00	0	0	1	5	13	58	67	22	2	0	**1**	0	0	0	169	45	48
21:00	0	0	0	6	22	50	59	18	4	0	0	0	0	0	159	45	49
22:00	0	0	1	0	12	27	34	15	2	0	0	0	0	0	91	46	49
23:00	0	0	1	1	2	11	21	9	**5**	0	0	0	0	0	50	48	52
Total	96	8	37	159	747	2246	1921	507	47	5	3	0	0	0	5776		
Percent	1.7%	0.1%	0.6%	2.8%	12.9%	38.9%	33.3%	8.8%	0.8%	0.1%	0.1%	0.0%	0.0%	0.0%			
AM Peak	11:00	07:00	10:00	11:00	07:00	07:00	07:00	07:00	09:00	00:00	04:00				07:00		
Vol.	9	2	3	10	51	184	195	59	6	1	1				507		
PM Peak	15:00	13:00	15:00	13:00	15:00	16:00	17:00	17:00	23:00	16:00	20:00				17:00		
Vol.	11	3	9	35	78	231	185	44	5	2	1				559		

Accurate Counts
978-664-2565

Location : Cambridge Turnpike
Location : Southeast of Hawthorne Lane
City/State: Concord, MA
Southeast, Northwest

Start Time	1 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 999	Total	85th Percent	95th Percent
09/27/12	0	0	0	0	3	4	7	9	1	0	**1**	0	0	0	25	49	53
01:00	0	0	0	0	0	8	2	2	0	0	0	0	0	0	12	45	48
02:00	0	0	0	0	0	3	1	1	0	0	0	0	0	0	5	46	48
03:00	0	0	1	0	0	2	1	2	0	0	0	0	0	0	6	47	49
04:00	0	0	0	0	2	4	9	2	0	0	0	0	0	0	17	45	47
05:00	0	0	0	1	3	17	22	9	4	0	0	0	0	0	56	47	51
06:00	7	0	0	3	19	98	133	27	2	0	0	0	0	0	289	44	47
07:00	11	2	7	11	35	**174**	**218**	**63**	6	0	0	0	0	0	**527**	45	48
08:00	**12**	**13**	**16**	27	54	153	160	48	**9**	0	0	0	0	0	492	44	48
09:00	10	1	5	17	**118**	150	85	12	3	0	0	0	0	0	401	42	45
10:00	4	0	8	25	71	122	51	11	3	0	0	0	0	0	295	41	45
11:00	9	0	7	**37**	116	135	31	3	1	**1**	0	0	0	0	340	39	43
12 PM	4	**6**	7	17	**110**	124	44	9	0	0	0	0	0	0	321	40	44
13:00	4	0	3	21	79	92	55	11	0	0	0	0	0	0	265	42	45
14:00	8	0	3	**44**	107	136	55	10	0	0	0	0	0	0	363	41	44
15:00	16	2	**10**	19	83	219	99	16	0	0	0	0	0	0	464	42	45
16:00	7	2	2	20	105	**247**	158	18	0	0	0	0	0	0	**559**	42	45
17:00	**25**	1	3	6	62	182	**207**	41	4	0	0	0	0	0	531	44	47
18:00	18	1	0	5	78	218	172	**42**	**6**	0	0	**1**	0	0	541	44	47
19:00	8	0	4	6	45	136	115	25	2	**1**	0	0	0	0	342	44	47
20:00	2	0	0	3	25	73	66	21	0	0	**1**	0	0	0	191	44	47
21:00	3	0	0	2	31	66	86	29	4	0	0	0	0	0	221	45	48
22:00	0	0	0	2	25	58	59	17	4	0	0	0	0	0	165	45	48
23:00	0	0	0	1	12	29	20	12	0	0	1	0	0	0	75	45	49
Total	148	28	76	267	1183	2450	1856	440	49	2	3	1	0	0	6503		
Percent	2.3%	0.4%	1.2%	4.1%	18.2%	37.7%	28.5%	6.8%	0.8%	0.0%	0.0%	0.0%	0.0%	0.0%			
AM Peak	08:00	08:00	08:00	11:00	09:00	07:00	07:00	07:00	08:00	11:00	00:00				07:00		
Vol.	12	13	16	37	118	174	218	63	9	1	1				527		
PM Peak	17:00	12:00	15:00	14:00	12:00	16:00	17:00	18:00	18:00	19:00	20:00	18:00			16:00		
Vol.	25	6	10	44	110	247	207	42	6	1	1	1			559		
Total	244	36	113	426	1930	4696	3777	947	96	7	6	1	0	0	12279		
Percent	2.0%	0.3%	0.9%	3.5%	15.7%	38.2%	30.8%	7.7%	0.8%	0.1%	0.0%	0.0%	0.0%	0.0%			

15th Percentile :	32 MPH
50th Percentile :	38 MPH
85th Percentile :	44 MPH
95th Percentile :	47 MPH

Stats	
10 MPH Pace Speed :	35-44 MPH
Number in Pace :	7745
Percent in Pace :	63.1%
Number of Vehicles > 40 MPH :	4834
Percent of Vehicles > 40 MPH :	39.4%
Mean Speed(Average) :	38 MPH

Accurate Counts
978-664-2565

Location : Cambridge Turnpike
Location : Southeast of Sandy Pond Road
City/State: Concord, MA

Start	26-Sep-12	SE		Hour Totals		NW		Hour Totals		Combined Totals	
Time	Wed	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon
12:00		4	41			4	29				
12:15		0	39			5	42				
12:30		3	41			4	30				
12:45		1	29	8	150	1	27	14	128	22	278
01:00		1	33			2	36				
01:15		3	33			0	36				
01:30		2	39			1	36				
01:45		0	43	6	148	0	44	3	152	9	300
02:00		0	29			1	48				
02:15		3	43			2	51				
02:30		1	47			2	52				
02:45		1	43	5	162	1	62	6	213	11	375
03:00		0	41			0	62				
03:15		1	42			0	54				
03:30		2	48			2	52				
03:45		1	34	4	165	0	56	2	224	6	389
04:00		1	34			3	59				
04:15		2	35			1	81				
04:30		3	59			0	85				
04:45		4	51	10	179	0	84	4	309	14	488
05:00		6	51			3	82				
05:15		7	72			1	73				
05:30		9	51			3	84				
05:45		17	46	39	220	5	77	12	316	51	536
06:00		28	44			6	89				
06:15		45	45			8	76				
06:30		52	37			14	63				
06:45		71	33	196	159	27	71	55	299	251	458
07:00		73	22			24	46				
07:15		94	23			19	49				
07:30		66	13			42	44				
07:45		82	22	315	80	43	36	128	175	443	255
08:00		83	15			42	25				
08:15		64	7			40	33				
08:30		75	15			35	33				
08:45		62	8	284	45	43	26	160	117	444	162
09:00		48	15			29	30				
09:15		47	14			34	32				
09:30		62	10			42	23				
09:45		45	11	202	50	40	30	145	115	347	165
10:00		35	8			33	21				
10:15		34	6			40	18				
10:30		40	13			31	14				
10:45		34	5	143	32	41	13	145	66	288	98
11:00		28	5			41	9				
11:15		40	7			36	11				
11:30		41	4			21	11				
11:45		34	0	143	16	31	4	129	35	272	51
Total		1355	1406			803	2149			2158	3555
Percent		49.1%	50.9%			27.2%	72.8%			37.8%	62.2%

Accurate Counts
978-664-2565

Location : Cambridge Turnpike
Location : Southeast of Sandy Pond Road
City/State: Concord, MA

Start	27-Sep-12	SE		Hour Totals		NW		Hour Totals		Combined Totals	
Time	Thu	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon
12:00		2	39			5	46				
12:15		3	36			11	53				
12:30		1	36			2	35				
12:45		1	36	7	147	5	42	23	176	30	323
01:00		0	32			3	39				
01:15		2	36			1	27				
01:30		4	36			0	37				
01:45		1	30	7	134	0	32	4	135	11	269
02:00		0	43			2	47				
02:15		1	29			0	50				
02:30		0	47			2	47				
02:45		1	36	2	155	0	65	4	209	6	364
03:00		1	49			0	58				
03:15		0	50			1	73				
03:30		2	58			0	64				
03:45		1	27	4	184	0	73	1	268	5	452
04:00		3	49			1	89				
04:15		1	49			0	100				
04:30		1	42			0	103				
04:45		7	46	12	186	2	76	3	368	15	554
05:00		4	37			2	90				
05:15		8	51			1	77				
05:30		7	50			2	85				
05:45		23	55	42	193	3	80	8	332	50	525
06:00		25	59			4	89				
06:15		38	49			7	98				
06:30		49	43			12	87				
06:45		96	44	208	195	30	86	53	360	261	555
07:00		82	34			29	97				
07:15		93	23			41	58				
07:30		71	29			40	50				
07:45		80	32	326	118	33	40	143	245	469	363
08:00		73	18			32	43				
08:15		84	21			23	33				
08:30		74	16			38	34				
08:45		72	15	303	70	36	22	129	132	432	202
09:00		64	22			48	30				
09:15		57	29			49	28				
09:30		61	18			38	35				
09:45		41	16	223	85	34	39	169	132	392	217
10:00		48	22			50	32				
10:15		28	17			28	25				
10:30		54	9			29	28				
10:45		32	20	162	68	34	25	141	110	303	178
11:00		45	20			32	12				
11:15		40	10			37	9				
11:30		56	10			50	10				
11:45		35	4	176	44	42	9	161	40	337	84
Total		1472	1579			839	2507			2311	4086
Percent		48.2%	51.8%			25.1%	74.9%			36.1%	63.9%
Grand Total		2827	2985			1642	4656			4469	7641
Percent		48.6%	51.4%			26.1%	73.9%			36.9%	63.1%
ADT		ADT 6,055		AADT 6,055							

Accurate Counts
978-664-2565

Location : Cambridge Turnpike
Location : Southeast of Sandy Pond Road
City/State: Concord, MA

Start	24-Sep-12		Tue		Wed		Thu		Fri		Sat		Sun		Week Average	
Time	SE	NW	SE	NW	SE	NW	SE	NW	SE	NW	SE	NW	SE	NW	SE	NW
12:00 AM	*	*	*	*	8	14	7	23	*	*	*	*	*	*	8	18
01:00	*	*	*	*	6	3	7	4	*	*	*	*	*	*	6	4
02:00	*	*	*	*	5	6	2	4	*	*	*	*	*	*	4	5
03:00	*	*	*	*	4	2	4	1	*	*	*	*	*	*	4	2
04:00	*	*	*	*	10	4	12	3	*	*	*	*	*	*	11	4
05:00	*	*	*	*	39	12	42	8	*	*	*	*	*	*	40	10
06:00	*	*	*	*	196	55	208	53	*	*	*	*	*	*	202	54
07:00	*	*	*	*	**315**	128	**326**	143	*	*	*	*	*	*	**320**	136
08:00	*	*	*	*	284	**160**	303	129	*	*	*	*	*	*	294	144
09:00	*	*	*	*	202	145	223	**169**	*	*	*	*	*	*	212	**157**
10:00	*	*	*	*	143	145	162	141	*	*	*	*	*	*	152	143
11:00	*	*	*	*	143	129	176	161	*	*	*	*	*	*	160	145
12:00 PM	*	*	*	*	150	128	147	176	*	*	*	*	*	*	148	152
01:00	*	*	*	*	148	152	134	135	*	*	*	*	*	*	141	144
02:00	*	*	*	*	162	213	155	209	*	*	*	*	*	*	158	211
03:00	*	*	*	*	165	224	184	268	*	*	*	*	*	*	174	246
04:00	*	*	*	*	179	309	186	**368**	*	*	*	*	*	*	182	**338**
05:00	*	*	*	*	**220**	**316**	193	332	*	*	*	*	*	*	**206**	324
06:00	*	*	*	*	159	299	**195**	360	*	*	*	*	*	*	177	330
07:00	*	*	*	*	80	175	118	245	*	*	*	*	*	*	99	210
08:00	*	*	*	*	45	117	70	132	*	*	*	*	*	*	58	124
09:00	*	*	*	*	50	115	85	132	*	*	*	*	*	*	68	124
10:00	*	*	*	*	32	66	68	110	*	*	*	*	*	*	50	88
11:00	*	*	*	*	16	35	44	40	*	*	*	*	*	*	30	38
Lane	0	0	0	0	2761	2952	3051	3346	0	0	0	0	0	0	2904	3151
Day	0		0		5713		6397		0		0		0		6055	
AM Peak	-	-	-	-	07:00	08:00	07:00	09:00	-	-	-	-	-	-	07:00	09:00
Vol.	-	-	-	-	315	160	326	169	-	-	-	-	-	-	320	157
PM Peak	-	-	-	-	17:00	17:00	18:00	16:00	-	-	-	-	-	-	17:00	16:00
Vol.	-	-	-	-	220	316	195	368	-	-	-	-	-	-	206	338

Comb. Total	0	0	5713	6397	0	0	0	6055

ADT ADT 6,055 AADT 6,055

Accurate Counts
978-664-2565

Location : Cambridge Turnpike
Location : Southeast of Sandy Pond Road
City/State: Concord, MA
Southeast

Start Time	1 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 999	Total	85th Percent	95th Percent
09/26/12	0	0	0	0	0	1	4	1	2	0	0	0	0	0	8	52	54
01:00	0	0	0	0	1	1	0	3	1	0	0	0	0	0	6	50	53
02:00	0	0	0	0	0	1	0	1	2	0	**1**	0	0	0	5	61	63
03:00	0	0	0	0	0	0	1	2	1	0	0	0	0	0	4	52	54
04:00	0	0	0	0	1	1	4	2	0	1	1	0	0	0	10	57	62
05:00	1	0	0	0	2	3	14	10	8	1	0	0	0	0	39	51	54
06:00	2	0	0	0	1	19	**98**	**64**	10	2	0	0	0	0	196	48	51
07:00	**159**	**14**	**6**	**8**	9	33	63	19	4	0	0	0	0	0	**315**	41	45
08:00	83	11	4	4	10	**52**	83	25	11	1	0	0	0	0	284	44	48
09:00	9	0	0	1	2	32	87	55	**12**	**4**	0	0	0	0	202	48	52
10:00	0	1	0	2	4	30	64	36	6	0	0	0	0	0	143	47	50
11:00	1	0	0	0	**11**	30	69	27	5	0	0	0	0	0	143	46	50
12 PM	3	0	0	5	9	29	62	31	9	**2**	0	0	0	0	150	48	51
13:00	3	0	0	0	6	34	60	38	7	0	0	0	0	0	148	47	50
14:00	4	0	0	0	8	**45**	65	33	7	0	0	0	0	0	162	47	50
15:00	1	0	0	1	17	39	66	31	9	1	0	0	0	0	165	47	51
16:00	5	0	0	2	7	35	**72**	44	**13**	1	0	0	0	0	179	48	51
17:00	10	**2**	**5**	**21**	**35**	41	65	34	5	2	0	0	0	0	**220**	46	49
18:00	**11**	0	1	1	0	22	64	**49**	10	1	0	0	0	0	159	48	51
19:00	2	0	0	0	2	21	30	18	7	0	0	0	0	0	80	48	52
20:00	1	0	0	0	8	7	16	10	2	1	0	0	0	0	45	48	51
21:00	0	0	0	1	0	18	16	12	1	2	0	0	0	0	50	48	52
22:00	0	0	0	0	0	8	15	7	2	0	0	0	0	0	32	47	51
23:00	0	0	0	1	2	2	5	5	0	1	0	0	0	0	16	48	55
Total	295	28	16	47	135	504	1023	557	134	20	2	0	0	0	2761		
Percent	10.7%	1.0%	0.6%	1.7%	4.9%	18.3%	37.1%	20.2%	4.9%	0.7%	0.1%	0.0%	0.0%	0.0%			
AM Peak	07:00	07:00	07:00	07:00	11:00	08:00	06:00	06:00	09:00	09:00	02:00				07:00		
Vol.	159	14	6	8	11	52	98	64	12	4	1				315		
PM Peak	18:00	17:00	17:00	17:00	17:00	14:00	16:00	18:00	16:00	12:00					17:00		
Vol.	11	2	5	21	35	45	72	49	13	2					220		

Accurate Counts
978-664-2565

Location : Cambridge Turnpike
Location : Southeast of Sandy Pond Road
City/State: Concord, MA
Southeast

Start Time	1 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 999	Total	85th Percent	95th Percent
09/27/12	0	0	0	0	1	1	3	2	0	0	0	0	0	0	7	47	49
01:00	0	0	0	0	0	1	2	4	0	0	0	0	0	0	7	48	50
02:00	0	0	0	0	0	0	2	0	0	0	0	0	0	0	2	44	45
03:00	0	0	0	0	1	0	0	2	1	0	0	0	0	0	4	51	54
04:00	0	0	0	0	1	2	2	4	2	**1**	0	0	0	0	12	52	56
05:00	0	0	0	0	0	4	19	11	7	0	**1**	0	0	0	42	51	54
06:00	5	0	2	1	11	52	**80**	**49**	7	1	0	0	0	0	208	47	50
07:00	142	6	5	10	**27**	**54**	60	21	1	0	0	0	0	0	**326**	41	45
08:00	**293**	**10**	0	0	0	0	0	0	0	0	0	0	0	0	303	12	14
09:00	136	10	**7**	**11**	16	16	19	6	2	0	0	0	0	0	223	32	42
10:00	4	0	0	1	12	40	55	40	**10**	0	0	0	0	0	162	48	51
11:00	5	0	0	1	8	36	74	45	5	0	1	**1**	0	0	176	47	50
12 PM	1	**1**	**2**	**3**	6	33	54	38	8	1	0	0	0	0	147	48	51
13:00	0	0	0	0	1	33	53	33	**13**	1	0	0	0	0	134	49	52
14:00	5	0	1	0	**11**	38	62	28	8	1	**1**	0	0	0	155	47	51
15:00	10	0	0	0	8	39	84	34	9	0	0	0	0	0	184	47	50
16:00	**12**	0	0	0	7	42	66	**49**	8	2	0	0	0	0	186	48	51
17:00	5	0	1	0	4	44	**88**	43	8	0	0	0	0	0	193	47	50
18:00	7	0	1	3	9	**45**	75	40	12	1	1	**1**	0	0	**195**	48	52
19:00	5	0	0	1	6	35	43	22	3	**3**	0	0	0	0	118	47	51
20:00	1	0	0	0	2	27	25	11	3	1	0	0	0	0	70	46	51
21:00	0	0	0	1	5	17	34	18	9	1	0	0	0	0	85	49	53
22:00	1	0	0	2	3	20	23	14	5	0	0	0	0	0	68	48	51
23:00	2	0	0	0	0	7	18	12	4	0	0	1	0	0	44	49	53
Total	634	27	19	34	139	586	941	526	125	13	4	3	0	0	3051		
Percent	20.8%	0.9%	0.6%	1.1%	4.6%	19.2%	30.8%	17.2%	4.1%	0.4%	0.1%	0.1%	0.0%	0.0%			
AM Peak	08:00	08:00	09:00	09:00	07:00	07:00	06:00	06:00	10:00	04:00	05:00	11:00			07:00		
Vol.	293	10	7	11	27	54	80	49	10	1	1	1			326		
PM Peak	16:00	12:00	12:00	12:00	14:00	18:00	17:00	16:00	13:00	19:00	14:00	18:00			18:00		
Vol.	12	1	2	3	11	45	88	49	13	3	1	1			195		
Total	929	55	35	81	274	1090	1964	1083	259	33	6	3	0	0	5812		
Percent	16.0%	0.9%	0.6%	1.4%	4.7%	18.8%	33.8%	18.6%	4.5%	0.6%	0.1%	0.1%	0.0%	0.0%			

15th Percentile :	8 MPH
50th Percentile :	39 MPH
85th Percentile :	46 MPH
95th Percentile :	50 MPH

Stats

10 MPH Pace Speed :	38-47 MPH
Number in Pace :	2694
Percent in Pace :	46.4%
Number of Vehicles > 40 MPH :	3348
Percent of Vehicles > 40 MPH :	57.6%
Mean Speed(Average) :	34 MPH

Accurate Counts
978-664-2565

Location : Cambridge Turnpike
Location : Southeast of Sandy Pond Road
City/State: Concord, MA
Northwest

Start Time	1 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 999	Total	85th Percent	95th Percent
09/26/12	0	0	0	0	2	1	2	5	2	2	0	0	0	0	14	54	58
01:00	0	0	0	0	0	1	0	1	1	0	0	0	0	0	3	52	54
02:00	0	0	0	0	0	2	3	0	1	0	0	0	0	0	6	49	53
03:00	0	0	0	0	0	1	0	0	1	0	0	0	0	0	2	53	55
04:00	0	0	0	0	0	1	0	3	0	0	0	0	0	0	4	49	50
05:00	1	0	0	0	1	2	5	3	0	0	0	0	0	0	12	46	49
06:00	1	0	0	1	2	9	30	11	1	0	0	0	0	0	55	46	49
07:00	**48**	0	**2**	0	2	22	34	14	5	0	0	**1**	0	0	128	44	49
08:00	17	**1**	1	**3**	3	**36**	**67**	30	2	0	0	0	0	0	**160**	46	49
09:00	10	0	0	1	1	33	62	27	**10**	1	0	0	0	0	145	47	51
10:00	4	1	1	0	**10**	35	65	24	5	0	0	0	0	0	145	46	49
11:00	5	0	0	0	8	25	52	**31**	5	**3**	0	0	0	0	129	48	51
12 PM	2	0	0	0	4	35	56	27	4	0	0	0	0	0	128	47	50
13:00	3	0	0	1	7	24	63	42	12	0	0	0	0	0	152	48	51
14:00	**4**	0	0	**2**	8	54	97	39	9	0	0	0	0	0	213	46	50
15:00	1	0	1	2	6	49	98	53	11	2	**1**	0	0	0	224	48	51
16:00	4	0	0	2	7	46	**144**	**85**	**19**	1	1	0	0	0	309	48	51
17:00	2	0	**2**	0	**21**	**97**	138	44	11	1	0	0	0	0	**316**	46	50
18:00	4	0	0	1	10	79	119	69	14	**3**	0	0	0	0	299	47	51
19:00	1	0	0	1	3	34	84	41	10	1	0	0	0	0	175	48	51
20:00	1	0	0	1	3	29	39	37	6	0	0	0	0	**1**	117	48	51
21:00	0	0	1	0	3	29	51	26	5	0	0	0	0	0	115	47	50
22:00	0	0	0	0	2	13	23	24	4	0	0	0	0	0	66	48	51
23:00	0	0	0	0	1	2	17	10	3	2	0	0	0	0	35	50	55
Total	108	2	8	15	104	659	1249	646	141	16	2	1	0	1	2952		
Percent	3.7%	0.1%	0.3%	0.5%	3.5%	22.3%	42.3%	21.9%	4.8%	0.5%	0.1%	0.0%	0.0%	0.0%			
AM Peak	07:00	08:00	07:00	08:00	10:00	08:00	08:00	11:00	09:00	11:00		07:00			08:00		
Vol.	48	1	2	3	10	36	67	31	10	3		1			160		
PM Peak	14:00		17:00	14:00	17:00	17:00	16:00	16:00	16:00	18:00	15:00			20:00	17:00		
Vol.	4		2	2	21	97	144	85	19	3	1			1	316		

Accurate Counts
978-664-2565

Location : Cambridge Turnpike
Location : Southeast of Sandy Pond Road
City/State: Concord, MA
Northwest

Start Time	1 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 999	Total	85th Percent	95th Percent
09/27/12	0	0	0	0	2	3	7	5	5	0	**1**	0	0	0	23	52	56
01:00	0	0	0	0	0	0	3	1	0	0	0	0	0	0	4	47	49
02:00	0	0	0	0	0	0	2	1	1	0	0	0	0	0	4	52	54
03:00	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	49	50
04:00	0	0	0	0	0	1	2	0	0	0	0	0	0	0	3	44	45
05:00	0	0	0	1	2	2	1	1	1	0	0	0	0	0	8	48	52
06:00	6	0	**1**	1	1	18	17	9	0	0	0	0	0	0	53	45	48
07:00	37	0	1	**3**	8	36	38	19	1	0	0	0	0	0	143	44	47
08:00	**64**	0	1	3	**19**	11	25	5	1	0	0	0	0	0	129	40	44
09:00	36	0	0	1	13	**42**	64	11	2	0	0	0	0	0	**169**	43	46
10:00	7	0	0	0	10	25	59	**33**	**6**	**1**	0	0	0	0	141	47	50
11:00	3	0	0	2	17	41	**78**	17	3	0	0	0	0	0	161	45	48
12 PM	3	0	**1**	0	5	45	70	44	6	2	0	0	0	0	176	47	50
13:00	1	0	1	2	8	27	54	30	11	0	**1**	0	0	0	135	48	52
14:00	4	0	0	3	7	37	103	48	6	0	1	0	0	0	209	47	50
15:00	**8**	0	1	**5**	**11**	39	102	86	13	**3**	0	0	0	0	268	48	51
16:00	7	0	0	1	8	56	**186**	85	**21**	3	0	**1**	0	0	**368**	48	51
17:00	7	0	0	1	10	48	138	**109**	18	1	0	0	0	0	332	48	51
18:00	5	0	0	0	10	**102**	151	77	14	1	0	0	0	0	360	47	50
19:00	2	0	0	0	6	92	115	22	7	1	0	0	0	0	245	45	49
20:00	3	0	0	1	5	27	51	39	6	0	0	0	0	0	132	48	50
21:00	0	0	0	0	11	24	54	36	6	1	0	0	0	0	132	48	51
22:00	1	0	0	0	1	24	52	25	6	1	0	0	0	0	110	48	51
23:00	0	0	0	0	1	11	14	11	3	0	0	0	0	0	40	48	51
Total	194	0	6	24	155	711	1386	715	137	14	3	1	0	0	3346		
Percent	5.8%	0.0%	0.2%	0.7%	4.6%	21.2%	41.4%	21.4%	4.1%	0.4%	0.1%	0.0%	0.0%	0.0%			
AM Peak	08:00		06:00	07:00	08:00	09:00	11:00	10:00	10:00	10:00	00:00				09:00		
Vol.	64		1	3	19	42	78	33	6	1	1				169		
PM Peak	15:00		12:00	15:00	15:00	18:00	16:00	17:00	16:00	15:00	13:00	16:00			16:00		
Vol.	8		1	5	11	102	186	109	21	3	1	1			368		
Total	302	2	14	39	259	1370	2635	1361	278	30	5	2	0	1	6298		
Percent	4.8%	0.0%	0.2%	0.6%	4.1%	21.8%	41.8%	21.6%	4.4%	0.5%	0.1%	0.0%	0.0%	0.0%			

15th Percentile :	34 MPH
50th Percentile :	41 MPH
85th Percentile :	47 MPH
95th Percentile :	50 MPH

Stats	
10 MPH Pace Speed :	38-47 MPH
Number in Pace :	3853
Percent in Pace :	61.2%
Number of Vehicles > 40 MPH :	4312
Percent of Vehicles > 40 MPH :	68.5%
Mean Speed(Average) :	40 MPH

Accurate Counts
978-664-2565

Location : Cambridge Turnpike
Location : Southeast of Sandy Pond Road
City/State: Concord, MA
Southeast, Northwest

Start Time	1 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 999	Total	85th Percent	95th Percent
09/26/12	0	0	0	0	2	2	6	6	4	2	0	0	0	0	22	53	57
01:00	0	0	0	0	1	2	0	4	2	0	0	0	0	0	9	51	54
02:00	0	0	0	0	0	3	3	1	3	0	**1**	0	0	0	11	54	62
03:00	0	0	0	0	0	1	1	2	2	0	0	0	0	0	6	52	54
04:00	0	0	0	0	1	2	4	5	0	1	1	0	0	0	14	51	61
05:00	2	0	0	0	3	5	19	13	8	1	0	0	0	0	51	50	54
06:00	3	0	0	1	3	28	128	75	11	2	0	0	0	0	251	48	51
07:00	**207**	**14**	**8**	**8**	11	55	97	33	9	0	0	**1**	0	0	443	42	46
08:00	100	12	5	7	13	**88**	**150**	55	13	1	0	0	0	0	**444**	45	49
09:00	19	0	0	2	3	65	149	**82**	**22**	**5**	0	0	0	0	347	48	52
10:00	4	2	1	2	14	65	129	60	11	0	0	0	0	0	288	47	50
11:00	6	0	0	0	**19**	55	121	58	10	3	0	0	0	0	272	47	50
12 PM	5	0	0	5	13	64	118	58	13	2	0	0	0	0	278	47	51
13:00	6	0	0	1	13	58	123	80	19	0	0	0	0	0	300	48	51
14:00	8	0	0	2	16	99	162	72	16	0	0	0	0	0	375	47	50
15:00	2	0	1	3	23	88	164	84	20	3	**1**	0	0	0	389	47	51
16:00	9	0	0	4	14	81	**216**	**129**	**32**	2	1	0	0	0	488	48	51
17:00	12	**2**	**7**	**21**	**56**	**138**	203	78	16	3	0	0	0	0	**536**	46	49
18:00	**15**	0	1	2	10	101	183	118	24	**4**	0	0	0	0	458	48	51
19:00	3	0	0	1	5	55	114	59	17	1	0	0	0	0	255	48	51
20:00	2	0	0	1	11	36	55	47	8	1	0	0	0	**1**	162	48	51
21:00	0	0	1	1	3	47	67	38	6	2	0	0	0	0	165	47	50
22:00	0	0	0	0	2	21	38	31	6	0	0	0	0	0	98	48	51
23:00	0	0	0	1	3	4	22	15	3	3	0	0	0	0	51	49	55
Total	403	30	24	62	239	1163	2272	1203	275	36	4	1	0	1	5713		
Percent	7.1%	0.5%	0.4%	1.1%	4.2%	20.4%	39.8%	21.1%	4.8%	0.6%	0.1%	0.0%	0.0%	0.0%			
AM Peak	07:00	07:00	07:00	07:00	11:00	08:00	08:00	09:00	09:00	09:00	02:00	07:00			08:00		
Vol.	207	14	8	8	19	88	150	82	22	5	1	1			444		
PM Peak	18:00	17:00	17:00	17:00	17:00	17:00	16:00	16:00	16:00	18:00	15:00			20:00	17:00		
Vol.	15	2	7	21	56	138	216	129	32	4	1			1	536		

Accurate Counts
978-664-2565

Location : Cambridge Turnpike
Location : Southeast of Sandy Pond Road
City/State: Concord, MA
Southeast, Northwest

Start Time	1 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 999	Total	85th Percent	95th Percent
09/27/12	0	0	0	0	3	4	10	7	5	0	**1**	0	0	0	30	51	55
01:00	0	0	0	0	0	1	5	5	0	0	0	0	0	0	11	48	50
02:00	0	0	0	0	0	0	4	1	1	0	0	0	0	0	6	50	53
03:00	0	0	0	0	1	0	0	3	1	0	0	0	0	0	5	51	53
04:00	0	0	0	0	1	3	4	4	2	**1**	0	0	0	0	15	51	56
05:00	0	0	0	1	2	6	20	12	8	0	1	0	0	0	50	51	54
06:00	11	0	3	2	12	70	97	58	7	1	0	0	0	0	261	47	50
07:00	179	6	6	**13**	**35**	**90**	98	40	2	0	0	0	0	0	**469**	42	46
08:00	**357**	**10**	1	3	19	11	25	5	1	0	0	0	0	0	432	14	37
09:00	172	10	**7**	12	29	58	83	17	4	0	0	0	0	0	392	41	45
10:00	11	0	0	1	22	65	114	**73**	**16**	1	0	0	0	0	303	47	51
11:00	8	0	0	3	25	77	**152**	62	8	0	1	**1**	0	0	337	46	49
12 PM	4	**1**	**3**	3	11	78	124	82	14	3	0	0	0	0	323	48	51
13:00	1	0	1	2	9	60	107	63	24	1	1	0	0	0	269	48	52
14:00	9	0	1	3	18	75	165	76	14	1	**2**	0	0	0	364	47	50
15:00	18	0	1	**5**	**19**	78	186	120	22	3	0	0	0	0	452	48	51
16:00	**19**	0	0	1	15	98	**252**	134	**29**	**5**	0	**1**	0	0	554	48	51
17:00	12	0	1	1	14	92	226	**152**	26	1	0	0	0	0	525	48	51
18:00	12	0	1	3	19	**147**	226	117	26	2	1	1	0	0	**555**	47	51
19:00	7	0	0	1	12	127	158	44	10	4	0	0	0	0	363	45	49
20:00	4	0	0	1	7	54	76	50	9	1	0	0	0	0	202	47	50
21:00	0	0	0	1	16	41	88	54	15	2	0	0	0	0	217	48	52
22:00	2	0	0	2	4	44	75	39	11	1	0	0	0	0	178	48	51
23:00	2	0	0	0	1	18	32	23	7	0	0	1	0	0	84	49	52
Total	828	27	25	58	294	1297	2327	1241	262	27	7	4	0	0	6397		
Percent	12.9%	0.4%	0.4%	0.9%	4.6%	20.3%	36.4%	19.4%	4.1%	0.4%	0.1%	0.1%	0.0%	0.0%			
AM Peak	08:00	08:00	09:00	07:00	07:00	07:00	11:00	10:00	10:00	04:00	00:00	11:00			07:00		
Vol.	357	10	7	13	35	90	152	73	16	1	1	1			469		
PM Peak	16:00	12:00	12:00	15:00	15:00	18:00	16:00	17:00	16:00	16:00	14:00	16:00			18:00		
Vol.	19	1	3	5	19	147	252	152	29	5	2	1			555		
Total	1231	57	49	120	533	2460	4599	2444	537	63	11	5	0	1	12110		
Percent	10.2%	0.5%	0.4%	1.0%	4.4%	20.3%	38.0%	20.2%	4.4%	0.5%	0.1%	0.0%	0.0%	0.0%			

15th Percentile :	12 MPH
50th Percentile :	41 MPH
85th Percentile :	47 MPH
95th Percentile :	50 MPH

Stats	
10 MPH Pace Speed :	38-47 MPH
Number in Pace :	6508
Percent in Pace :	53.7%
Number of Vehicles > 40 MPH :	7660
Percent of Vehicles > 40 MPH :	63.3%
Mean Speed(Average) :	37 MPH

Accurate Counts
978-664-2565

Location : Lexington Road
Location : East of Cambridge Turnpike
City/State: Concord, MA

Start	26-Sep-12	WB		Hour Totals		EB		Hour Totals		Combined Totals	
Time	Wed	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon
12:00		3	54			1	72				
12:15		0	77			0	70				
12:30		0	68			0	67				
12:45		1	64	4	263	0	71	1	280	5	543
01:00		3	77			1	67				
01:15		1	54			1	92				
01:30		1	77			1	70				
01:45		1	66	6	274	0	83	3	312	9	586
02:00		0	80			0	69				
02:15		0	80			0	91				
02:30		0	78			0	88				
02:45		1	93	1	331	0	65	0	313	1	644
03:00		0	131			1	75				
03:15		0	124			0	97				
03:30		0	138			0	83				
03:45		0	128	0	521	0	80	1	335	1	856
04:00		1	163			2	77				
04:15		1	139			2	75				
04:30		1	103			3	65				
04:45		0	137	3	542	3	84	10	301	13	843
05:00		2	121			2	86				
05:15		5	136			9	108				
05:30		9	105			13	72				
05:45		12	156	28	518	21	55	45	321	73	839
06:00		15	130			35	63				
06:15		9	84			56	51				
06:30		23	79			86	42				
06:45		37	93	84	386	146	40	323	196	407	582
07:00		43	68			164	41				
07:15		51	34			199	38				
07:30		58	38			193	44				
07:45		79	21	231	161	235	17	791	140	1022	301
08:00		59	25			214	11				
08:15		80	21			190	14				
08:30		74	19			184	27				
08:45		76	25	289	90	149	20	737	72	1026	162
09:00		72	17			121	21				
09:15		51	14			107	15				
09:30		45	12			94	18				
09:45		53	9	221	52	62	10	384	64	605	116
10:00		40	4			54	8				
10:15		43	5			48	10				
10:30		55	6			62	10				
10:45		45	6	183	21	51	9	215	37	398	58
11:00		50	6			70	0				
11:15		53	2			66	3				
11:30		73	3			62	5				
11:45		70	1	246	12	70	1	268	9	514	21
Total		1296	3171			2778	2380			4074	5551
Percent		29.0%	71.0%			53.9%	46.1%			42.3%	57.7%

Accurate Counts
978-664-2565

Location : Lexington Road
Location : East of Cambridge Turnpike
City/State: Concord, MA

Start	27-Sep-12	WB		Hour Totals		EB		Hour Totals		Combined Totals	
Time	Thu	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon
12:00		2	78			1	80				
12:15		2	59			2	82				
12:30		1	74			0	79				
12:45		1	61	6	272	0	61	3	302	9	574
01:00		0	49			0	70				
01:15		0	68			0	56				
01:30		1	62			0	65				
01:45		1	68	2	247	0	61	0	252	2	499
02:00		0	72			1	69				
02:15		0	67			0	79				
02:30		0	74			0	63				
02:45		0	89	0	302	1	66	2	277	2	579
03:00		0	126			0	77				
03:15		0	125			0	76				
03:30		0	132			0	78				
03:45		0	130	0	513	0	83	0	314	0	827
04:00		0	147			1	84				
04:15		0	155			1	68				
04:30		1	150			2	85				
04:45		1	143	2	595	2	91	6	328	8	923
05:00		0	128			6	75				
05:15		5	122			11	99				
05:30		10	125			10	79				
05:45		17	113	32	488	26	76	53	329	85	817
06:00		19	131			37	69				
06:15		14	157			59	55				
06:30		18	108			107	65				
06:45		32	79	83	475	152	50	355	239	438	714
07:00		50	65			186	52				
07:15		57	44			230	34				
07:30		66	45			236	39				
07:45		100	43	273	197	234	32	886	157	1159	354
08:00		73	27			229	35				
08:15		83	18			214	24				
08:30		84	25			209	25				
08:45		73	22	313	92	231	36	883	120	1196	212
09:00		84	25			133	25				
09:15		44	23			109	20				
09:30		64	9			96	21				
09:45		38	10	230	67	97	19	435	85	665	152
10:00		39	12			61	14				
10:15		34	6			54	9				
10:30		63	7			60	19				
10:45		49	9	185	34	61	6	236	48	421	82
11:00		60	6			56	4				
11:15		65	5			70	1				
11:30		81	3			57	2				
11:45		53	3	259	17	72	1	255	8	514	25
Total		1385	3299			3114	2459			4499	5758
Percent		29.6%	70.4%			55.9%	44.1%			43.9%	56.1%

Accurate Counts
978-664-2565

Location : Lexington Road
Location : East of Cambridge Turnpike
City/State: Concord, MA

Start	28-Sep-12	WB		Hour Totals		EB		Hour Totals		Combined Totals	
Time	Fri	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon
12:00		0	*			2	*				
12:15		*	*	*	*	*	*	*	*	*	*
12:30		*	*	*	*	*	*	*	*	*	*
12:45		*	*	*	*	*	*	*	*	*	*
01:00		*	*	*	*	*	*	*	*	*	*
01:15		*	*	*	*	*	*	*	*	*	*
01:30		*	*	*	*	*	*	*	*	*	*
01:45		*	*	*	*	*	*	*	*	*	*
02:00		*	*	*	*	*	*	*	*	*	*
02:15		*	*	*	*	*	*	*	*	*	*
02:30		*	*	*	*	*	*	*	*	*	*
02:45		*	*	*	*	*	*	*	*	*	*
03:00		*	*	*	*	*	*	*	*	*	*
03:15		*	*	*	*	*	*	*	*	*	*
03:30		*	*	*	*	*	*	*	*	*	*
03:45		*	*	*	*	*	*	*	*	*	*
04:00		*	*	*	*	*	*	*	*	*	*
04:15		*	*	*	*	*	*	*	*	*	*
04:30		*	*	*	*	*	*	*	*	*	*
04:45		*	*	*	*	*	*	*	*	*	*
05:00		*	*	*	*	*	*	*	*	*	*
05:15		*	*	*	*	*	*	*	*	*	*
05:30		*	*	*	*	*	*	*	*	*	*
05:45		*	*	*	*	*	*	*	*	*	*
06:00		*	*	*	*	*	*	*	*	*	*
06:15		*	*	*	*	*	*	*	*	*	*
06:30		*	*	*	*	*	*	*	*	*	*
06:45		*	*	*	*	*	*	*	*	*	*
07:00		*	*	*	*	*	*	*	*	*	*
07:15		*	*	*	*	*	*	*	*	*	*
07:30		*	*	*	*	*	*	*	*	*	*
07:45		*	*	*	*	*	*	*	*	*	*
08:00		*	*	*	*	*	*	*	*	*	*
08:15		*	*	*	*	*	*	*	*	*	*
08:30		*	*	*	*	*	*	*	*	*	*
08:45		*	*	*	*	*	*	*	*	*	*
09:00		*	*	*	*	*	*	*	*	*	*
09:15		*	*	*	*	*	*	*	*	*	*
09:30		*	*	*	*	*	*	*	*	*	*
09:45		*	*	*	*	*	*	*	*	*	*
10:00		*	*	*	*	*	*	*	*	*	*
10:15		*	*	*	*	*	*	*	*	*	*
10:30		*	*	*	*	*	*	*	*	*	*
10:45		*	*	*	*	*	*	*	*	*	*
11:00		*	*	*	*	*	*	*	*	*	*
11:15		*	*	*	*	*	*	*	*	*	*
11:30		*	*	*	*	*	*	*	*	*	*
11:45		*	*	*	*	*	*	*	*	*	*
Total		0	0			2	0			0	0
Percent		0.0%	0.0%			100.0%	0.0%			0.0%	0.0%
Grand Total		2681	6470			5894	4839			8573	11309
Percent		29.3%	70.7%			54.9%	45.1%			43.1%	56.9%
ADT		ADT 9,941		AADT 9,941							

Accurate Counts
978-664-2565

Location : Lexington Road
Location : East of Cambridge Turnpike
City/State: Concord, MA

Start	24-Sep-12		Tue		Wed		Thu		Fri		Sat		Sun		Week Average	
Time	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB
12:00 AM	*	*	*	*	4	1	6	3	**6**	**6**	*	*	*	*	5	3
01:00	*	*	*	*	6	3	2	0	*	*	*	*	*	*	4	2
02:00	*	*	*	*	1	0	0	2	*	*	*	*	*	*	0	1
03:00	*	*	*	*	0	1	0	0	*	*	*	*	*	*	0	0
04:00	*	*	*	*	3	10	2	6	*	*	*	*	*	*	2	8
05:00	*	*	*	*	28	45	32	53	*	*	*	*	*	*	30	49
06:00	*	*	*	*	84	323	83	355	*	*	*	*	*	*	84	339
07:00	*	*	*	*	231	**791**	273	**886**	*	*	*	*	*	*	252	**838**
08:00	*	*	*	*	**289**	737	**313**	883	*	*	*	*	*	*	**301**	810
09:00	*	*	*	*	221	384	230	435	*	*	*	*	*	*	226	410
10:00	*	*	*	*	183	215	185	236	*	*	*	*	*	*	184	226
11:00	*	*	*	*	246	268	259	255	*	*	*	*	*	*	252	262
12:00 PM	*	*	*	*	263	280	272	302	*	*	*	*	*	*	268	291
01:00	*	*	*	*	274	312	247	252	*	*	*	*	*	*	260	282
02:00	*	*	*	*	331	313	302	277	*	*	*	*	*	*	316	295
03:00	*	*	*	*	521	**335**	513	314	*	*	*	*	*	*	517	324
04:00	*	*	*	*	**542**	301	**595**	328	*	*	*	*	*	*	**568**	314
05:00	*	*	*	*	518	321	488	**329**	*	*	*	*	*	*	503	**325**
06:00	*	*	*	*	386	196	475	239	*	*	*	*	*	*	430	218
07:00	*	*	*	*	161	140	197	157	*	*	*	*	*	*	179	148
08:00	*	*	*	*	90	72	92	120	*	*	*	*	*	*	91	96
09:00	*	*	*	*	52	64	67	85	*	*	*	*	*	*	60	74
10:00	*	*	*	*	21	37	34	48	*	*	*	*	*	*	28	42
11:00	*	*	*	*	12	9	17	8	*	*	*	*	*	*	14	8
Lane	0	0	0	0	4467	5158	4684	5573	6	6	0	0	0	0	4574	5365
Day	0		0		9625		10257		12		0		0		9939	
AM Peak	-	-	-	-	08:00	07:00	08:00	07:00	00:00	00:00	-	-	-	-	08:00	07:00
Vol.	-	-	-	-	289	791	313	886	6	6	-	-	-	-	301	838
PM Peak	-	-	-	-	16:00	15:00	16:00	17:00	-	-	-	-	-	-	16:00	17:00
Vol.	-	-	-	-	542	335	595	329	-	-	-	-	-	-	568	325

Comb. Total	0	0	9625	10257	12	0	0	9939

ADT ADT 9,941 AADT 9,941

Accurate Counts
978-664-2565

Location : Cambridge Turnpike
Location : Southeast of Lexington Road
City/State: Concord, MA

Start	26-Sep-12	NW		Hour Totals		SE		Hour Totals		Combined Totals	
Time	Wed	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon
12:00		4	47			1	31				
12:15		4	56			2	33				
12:30		2	36			4	32				
12:45		1	40	11	179	1	20	8	116	19	295
01:00		1	45			2	24				
01:15		0	60			2	20				
01:30		1	45			1	24				
01:45		0	75	2	225	0	17	5	85	7	310
02:00		1	64			0	10				
02:15		1	75			2	28				
02:30		2	78			1	30				
02:45		1	74	5	291	1	27	4	95	9	386
03:00		0	87			0	27				
03:15		0	71			1	29				
03:30		1	69			1	43				
03:45		1	71	2	298	1	31	3	130	5	428
04:00		1	65			1	36				
04:15		1	81			1	19				
04:30		0	71			4	7				
04:45		0	57	2	274	2	2	8	64	10	338
05:00		2	71			7	8				
05:15		0	67			8	12				
05:30		1	64			10	4				
05:45		1	60	4	262	25	9	50	33	54	295
06:00		4	71			29	0				
06:15		6	53			38	39				
06:30		17	79			60	21				
06:45		18	81	45	284	82	25	209	85	254	369
07:00		16	40			77	17				
07:15		26	46			101	18				
07:30		33	43			110	17				
07:45		30	35	105	164	85	11	373	63	478	227
08:00		23	25			77	15				
08:15		27	32			70	9				
08:30		35	28			59	13				
08:45		35	31	120	116	68	5	274	42	394	158
09:00		23	28			47	17				
09:15		22	23			61	14				
09:30		23	27			67	7				
09:45		35	23	103	101	44	12	219	50	322	151
10:00		26	17			39	6				
10:15		27	21			34	7				
10:30		35	12			32	4				
10:45		51	11	139	61	16	6	121	23	260	84
11:00		46	6			25	5				
11:15		47	12			33	7				
11:30		42	8			20	1				
11:45		54	3	189	29	22	1	100	14	289	43
Total		727	2284			1374	800			2101	3084
Percent		24.1%	75.9%			63.2%	36.8%			40.5%	59.5%

Accurate Counts
978-664-2565

Location : Cambridge Turnpike
Location : Southeast of Lexington Road
City/State: Concord, MA

Start	27-Sep-12	NW		Hour Totals		SE		Hour Totals		Combined Totals	
Time	Thu	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon
12:00		5	73			0	18				
12:15		8	55			1	38				
12:30		4	50			1	38				
12:45		3	57	20	235	0	28	2	122	22	357
01:00		2	41			0	24				
01:15		1	42			6	23				
01:30		0	44			0	27				
01:45		1	48	4	175	1	30	7	104	11	279
02:00		1	63			1	14				
02:15		1	79			0	6				
02:30		1	81			0	16				
02:45		0	89	3	312	1	9	2	45	5	357
03:00		0	93			0	21				
03:15		1	88			0	37				
03:30		0	87			2	45				
03:45		0	77	1	345	1	31	3	134	4	479
04:00		1	100			1	45				
04:15		0	72			1	23				
04:30		0	46			5	6				
04:45		0	47	1	265	8	12	15	86	16	351
05:00		2	51			3	9				
05:15		0	67			11	12				
05:30		11	60			1	15				
05:45		2	72	15	250	20	7	35	43	50	293
06:00		8	55			18	9				
06:15		14	40			37	6				
06:30		13	55			63	5				
06:45		30	83	65	233	104	37	222	57	287	290
07:00		22	89			79	23				
07:15		47	50			95	47				
07:30		35	36			107	35				
07:45		49	27	153	202	65	36	346	141	499	343
08:00		34	39			84	9				
08:15		35	28			71	23				
08:30		28	15			82	27				
08:45		38	14	135	96	75	25	312	84	447	180
09:00		28	20			84	36				
09:15		43	20			67	32				
09:30		27	10			49	22				
09:45		34	17	132	67	53	41	253	131	385	198
10:00		46	17			27	31				
10:15		31	20			36	20				
10:30		62	19			20	16				
10:45		58	8	197	64	23	23	106	90	303	154
11:00		52	7			25	18				
11:15		51	4			40	13				
11:30		80	0			28	16				
11:45		82	3	265	14	19	7	112	54	377	68
Total		991	2258			1415	1091			2406	3349
Percent		30.5%	69.5%			56.5%	43.5%			41.8%	58.2%

Accurate Counts
978-664-2565

Location : Cambridge Turnpike
Location : Southeast of Lexington Road
City/State: Concord, MA

Start	28-Sep-12	NW		Hour Totals		SE		Hour Totals		Combined Totals	
Time	Fri	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon
12:00		1	*			6	*				
12:15		*	*	*	*	*	*	*	*	*	*
12:30		*	*	*	*	*	*	*	*	*	*
12:45		*	*	*	*	*	*	*	*	*	*
01:00		*	*	*	*	*	*	*	*	*	*
01:15		*	*	*	*	*	*	*	*	*	*
01:30		*	*	*	*	*	*	*	*	*	*
01:45		*	*	*	*	*	*	*	*	*	*
02:00		*	*	*	*	*	*	*	*	*	*
02:15		*	*	*	*	*	*	*	*	*	*
02:30		*	*	*	*	*	*	*	*	*	*
02:45		*	*	*	*	*	*	*	*	*	*
03:00		*	*	*	*	*	*	*	*	*	*
03:15		*	*	*	*	*	*	*	*	*	*
03:30		*	*	*	*	*	*	*	*	*	*
03:45		*	*	*	*	*	*	*	*	*	*
04:00		*	*	*	*	*	*	*	*	*	*
04:15		*	*	*	*	*	*	*	*	*	*
04:30		*	*	*	*	*	*	*	*	*	*
04:45		*	*	*	*	*	*	*	*	*	*
05:00		*	*	*	*	*	*	*	*	*	*
05:15		*	*	*	*	*	*	*	*	*	*
05:30		*	*	*	*	*	*	*	*	*	*
05:45		*	*	*	*	*	*	*	*	*	*
06:00		*	*	*	*	*	*	*	*	*	*
06:15		*	*	*	*	*	*	*	*	*	*
06:30		*	*	*	*	*	*	*	*	*	*
06:45		*	*	*	*	*	*	*	*	*	*
07:00		*	*	*	*	*	*	*	*	*	*
07:15		*	*	*	*	*	*	*	*	*	*
07:30		*	*	*	*	*	*	*	*	*	*
07:45		*	*	*	*	*	*	*	*	*	*
08:00		*	*	*	*	*	*	*	*	*	*
08:15		*	*	*	*	*	*	*	*	*	*
08:30		*	*	*	*	*	*	*	*	*	*
08:45		*	*	*	*	*	*	*	*	*	*
09:00		*	*	*	*	*	*	*	*	*	*
09:15		*	*	*	*	*	*	*	*	*	*
09:30		*	*	*	*	*	*	*	*	*	*
09:45		*	*	*	*	*	*	*	*	*	*
10:00		*	*	*	*	*	*	*	*	*	*
10:15		*	*	*	*	*	*	*	*	*	*
10:30		*	*	*	*	*	*	*	*	*	*
10:45		*	*	*	*	*	*	*	*	*	*
11:00		*	*	*	*	*	*	*	*	*	*
11:15		*	*	*	*	*	*	*	*	*	*
11:30		*	*	*	*	*	*	*	*	*	*
11:45		*	*	*	*	*	*	*	*	*	*
Total		1	0			6	0			0	0
Percent		100.0%	0.0%			100.0%	0.0%			0.0%	0.0%
Grand Total		1719	4542			2795	1891			4507	6433
Percent		27.5%	72.5%			59.6%	40.4%			41.2%	58.8%
ADT		ADT 5,493		AADT 5,493							

Accurate Counts
978-664-2565

Location : Cambridge Turnpike
Location : Southeast of Lexington Road
City/State: Concord, MA

Start	24-Sep-12		Tue		Wed		Thu		Fri		Sat		Sun		Week Average	
Time	NW	SE	NW	SE	NW	SE	NW	SE	NW	SE	NW	SE	NW	SE	NW	SE
12:00 AM	*	*	*	*	11	8	20	2	**6**	**6**	*	*	*	*	12	5
01:00	*	*	*	*	2	5	4	7	*	*	*	*	*	*	3	6
02:00	*	*	*	*	5	4	3	2	*	*	*	*	*	*	4	3
03:00	*	*	*	*	2	3	1	3	*	*	*	*	*	*	2	3
04:00	*	*	*	*	2	8	1	15	*	*	*	*	*	*	2	12
05:00	*	*	*	*	4	50	15	35	*	*	*	*	*	*	10	42
06:00	*	*	*	*	45	209	65	222	*	*	*	*	*	*	55	216
07:00	*	*	*	*	105	**373**	153	**346**	*	*	*	*	*	*	129	**360**
08:00	*	*	*	*	120	274	135	312	*	*	*	*	*	*	128	293
09:00	*	*	*	*	103	219	132	253	*	*	*	*	*	*	118	236
10:00	*	*	*	*	139	121	197	106	*	*	*	*	*	*	168	114
11:00	*	*	*	*	**189**	100	**265**	112	*	*	*	*	*	*	**227**	106
12:00 PM	*	*	*	*	179	116	235	122	*	*	*	*	*	*	207	119
01:00	*	*	*	*	225	85	175	104	*	*	*	*	*	*	200	94
02:00	*	*	*	*	291	95	312	45	*	*	*	*	*	*	302	70
03:00	*	*	*	*	**298**	**130**	**345**	134	*	*	*	*	*	*	**322**	**132**
04:00	*	*	*	*	274	64	265	86	*	*	*	*	*	*	270	75
05:00	*	*	*	*	262	33	250	43	*	*	*	*	*	*	256	38
06:00	*	*	*	*	284	85	233	57	*	*	*	*	*	*	258	71
07:00	*	*	*	*	164	63	202	**141**	*	*	*	*	*	*	183	102
08:00	*	*	*	*	116	42	96	84	*	*	*	*	*	*	106	63
09:00	*	*	*	*	101	50	67	131	*	*	*	*	*	*	84	90
10:00	*	*	*	*	61	23	64	90	*	*	*	*	*	*	62	56
11:00	*	*	*	*	29	14	14	54	*	*	*	*	*	*	22	34
Lane	0	0	0	0	3011	2174	3249	2506	6	6	0	0	0	0	3130	2340
Day	0		0		5185		5755		12		0		0		5470	
AM Peak	-	-	-	-	11:00	07:00	11:00	07:00	00:00	00:00	-	-	-	-	11:00	07:00
Vol.	-	-	-	-	189	373	265	346	6	6	-	-	-	-	227	360
PM Peak	-	-	-	-	15:00	15:00	15:00	19:00	-	-	-	-	-	-	15:00	15:00
Vol.	-	-	-	-	298	130	345	141	-	-	-	-	-	-	322	132

Comb. Total	0	0	5185	5755	12	0	0	5470

ADT ADT 5,493 AADT 5,493

Accurate Counts
978-664-2565

Location : Lexington Road
Location : West of Cambridge Turnpike
City/State: Concord, MA

Start	26-Sep-12	EB		Hour Totals		WB		Hour Totals		Combined Totals	
Time	Wed	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon
12:00		1	105			7	93				
12:15		1	108			5	109				
12:30		3	110			4	93				
12:45		1	92	6	415	2	104	18	399	24	814
01:00		3	93			4	108				
01:15		4	124			1	92				
01:30		3	96			3	102				
01:45		0	119	10	432	1	113	9	415	19	847
02:00		0	99			1	121				
02:15		2	122			1	142				
02:30		2	128			2	122				
02:45		0	104	4	453	2	151	6	536	10	989
03:00		1	118			0	182				
03:15		1	131			0	182				
03:30		1	127			1	190				
03:45		1	114	4	490	0	195	1	749	5	1239
04:00		3	102			3	214				
04:15		3	98			2	214				
04:30		8	103			1	180				
04:45		6	121	20	424	1	209	7	817	27	1241
05:00		8	131			6	198				
05:15		17	165			6	201				
05:30		23	104			12	174				
05:45		43	102	91	502	16	245	40	818	131	1320
06:00		61	101			18	237				
06:15		91	94			17	170				
06:30		139	67			45	144				
06:45		220	66	511	328	60	175	140	726	651	1054
07:00		225	59			76	108				
07:15		285	57			86	78				
07:30		288	69			105	72				
07:45		276	30	1074	215	141	61	408	319	1482	534
08:00		261	26			113	48				
08:15		220	24			137	55				
08:30		230	39			112	45				
08:45		182	23	893	112	146	53	508	201	1401	313
09:00		163	40			102	47				
09:15		145	29			94	37				
09:30		139	25			79	36				
09:45		102	21	549	115	99	33	374	153	923	268
10:00		88	14			76	23				
10:15		72	19			82	23				
10:30		105	16			78	15				
10:45		82	15	347	64	83	16	319	77	666	141
11:00		101	6			89	12				
11:15		99	9			95	15				
11:30		99	6			101	9				
11:45		104	2	403	23	113	6	398	42	801	65
Total		3912	3573			2228	5252			6140	8825
Percent		52.3%	47.7%			29.8%	70.2%			41.0%	59.0%

Accurate Counts
978-664-2565

Location : Lexington Road
Location : West of Cambridge Turnpike
City/State: Concord, MA

Start	27-Sep-12	EB		Hour Totals		WB		Hour Totals		Combined Totals	
Time	Thu	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon
12:00		1	113			5	122				
12:15		3	95			12	130				
12:30		2	117			4	122				
12:45		0	100	6	425	5	103	26	477	32	902
01:00		0	101			2	81				
01:15		6	90			1	100				
01:30		0	89			1	94				
01:45		1	102	7	382	2	93	6	368	13	750
02:00		1	91			0	115				
02:15		0	113			1	111				
02:30		0	104			1	121				
02:45		2	107	3	415	0	148	2	495	5	910
03:00		0	123			0	161				
03:15		0	106			1	200				
03:30		2	128			0	211				
03:45		1	110	3	467	0	214	1	786	4	1253
04:00		2	117			1	220				
04:15		2	122			0	238				
04:30		7	104			2	231				
04:45		6	120	17	463	5	226	8	915	25	1378
05:00		9	109			2	212				
05:15		22	141			6	210				
05:30		19	104			12	216				
05:45		43	124	93	478	16	204	36	842	129	1320
06:00		61	110			22	213				
06:15		103	99			23	239				
06:30		151	91			47	242				
06:45		240	89	555	389	74	173	166	867	721	1256
07:00		197	75			129	147				
07:15		300	70			120	109				
07:30		320	65			114	85				
07:45		278	56	1095	266	160	81	523	422	1618	688
08:00		285	48			126	77				
08:15		256	47			140	45				
08:30		245	38			155	50				
08:45		288	55	1074	188	125	47	546	219	1620	407
09:00		187	53			156	55				
09:15		163	43			114	52				
09:30		139	29			100	38				
09:45		149	39	638	164	86	41	456	186	1094	350
10:00		91	36			84	44				
10:15		90	22			70	32				
10:30		96	30			82	33				
10:45		102	22	379	110	90	30	326	139	705	249
11:00		90	21			99	16				
11:15		109	9			94	14				
11:30		96	8			130	14				
11:45		98	4	393	42	127	7	450	51	843	93
Total		4263	3789			2546	5767			6809	9556
Percent		52.9%	47.1%			30.6%	69.4%			41.6%	58.4%

Accurate Counts
978-664-2565

Location : Lexington Road
Location : West of Cambridge Turnpike
City/State: Concord, MA

Start	28-Sep-12	EB		Hour Totals		WB		Hour Totals		Combined Totals	
Time	Fri	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon
12:00		2	*			6	*				
12:15		*	*	*	*	*	*	*	*	*	*
12:30		*	*	*	*	*	*	*	*	*	*
12:45		*	*	*	*	*	*	*	*	*	*
01:00		*	*	*	*	*	*	*	*	*	*
01:15		*	*	*	*	*	*	*	*	*	*
01:30		*	*	*	*	*	*	*	*	*	*
01:45		*	*	*	*	*	*	*	*	*	*
02:00		*	*	*	*	*	*	*	*	*	*
02:15		*	*	*	*	*	*	*	*	*	*
02:30		*	*	*	*	*	*	*	*	*	*
02:45		*	*	*	*	*	*	*	*	*	*
03:00		*	*	*	*	*	*	*	*	*	*
03:15		*	*	*	*	*	*	*	*	*	*
03:30		*	*	*	*	*	*	*	*	*	*
03:45		*	*	*	*	*	*	*	*	*	*
04:00		*	*	*	*	*	*	*	*	*	*
04:15		*	*	*	*	*	*	*	*	*	*
04:30		*	*	*	*	*	*	*	*	*	*
04:45		*	*	*	*	*	*	*	*	*	*
05:00		*	*	*	*	*	*	*	*	*	*
05:15		*	*	*	*	*	*	*	*	*	*
05:30		*	*	*	*	*	*	*	*	*	*
05:45		*	*	*	*	*	*	*	*	*	*
06:00		*	*	*	*	*	*	*	*	*	*
06:15		*	*	*	*	*	*	*	*	*	*
06:30		*	*	*	*	*	*	*	*	*	*
06:45		*	*	*	*	*	*	*	*	*	*
07:00		*	*	*	*	*	*	*	*	*	*
07:15		*	*	*	*	*	*	*	*	*	*
07:30		*	*	*	*	*	*	*	*	*	*
07:45		*	*	*	*	*	*	*	*	*	*
08:00		*	*	*	*	*	*	*	*	*	*
08:15		*	*	*	*	*	*	*	*	*	*
08:30		*	*	*	*	*	*	*	*	*	*
08:45		*	*	*	*	*	*	*	*	*	*
09:00		*	*	*	*	*	*	*	*	*	*
09:15		*	*	*	*	*	*	*	*	*	*
09:30		*	*	*	*	*	*	*	*	*	*
09:45		*	*	*	*	*	*	*	*	*	*
10:00		*	*	*	*	*	*	*	*	*	*
10:15		*	*	*	*	*	*	*	*	*	*
10:30		*	*	*	*	*	*	*	*	*	*
10:45		*	*	*	*	*	*	*	*	*	*
11:00		*	*	*	*	*	*	*	*	*	*
11:15		*	*	*	*	*	*	*	*	*	*
11:30		*	*	*	*	*	*	*	*	*	*
11:45		*	*	*	*	*	*	*	*	*	*
Total		2	0			6	0			0	0
Percent		100.0%	0.0%			100.0%	0.0%			0.0%	0.0%
Grand Total		8177	7362			4780	11019			12949	18381
Percent		52.6%	47.4%			30.3%	69.7%			41.3%	58.7%
ADT		ADT 15,665		AADT 15,665							

Accurate Counts
978-664-2565

Location : Lexington Road
Location : West of Cambridge Turnpike
City/State: Concord, MA

Start	24-Sep-12		Tue		Wed		Thu		Fri		Sat		Sun		Week Average	
Time	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB
12:00 AM	*	*	*	*	6	18	6	26	**6**	**17**	*	*	*	*	6	20
01:00	*	*	*	*	10	9	7	6	*	*	*	*	*	*	8	8
02:00	*	*	*	*	4	6	3	2	*	*	*	*	*	*	4	4
03:00	*	*	*	*	4	1	3	1	*	*	*	*	*	*	4	1
04:00	*	*	*	*	20	7	17	8	*	*	*	*	*	*	18	8
05:00	*	*	*	*	91	40	93	36	*	*	*	*	*	*	92	38
06:00	*	*	*	*	511	140	555	166	*	*	*	*	*	*	533	153
07:00	*	*	*	*	**1074**	408	**1095**	523	*	*	*	*	*	*	**1084**	466
08:00	*	*	*	*	893	**508**	1074	**546**	*	*	*	*	*	*	984	**527**
09:00	*	*	*	*	549	374	638	456	*	*	*	*	*	*	594	415
10:00	*	*	*	*	347	319	379	326	*	*	*	*	*	*	363	322
11:00	*	*	*	*	403	398	393	450	*	*	*	*	*	*	398	424
12:00 PM	*	*	*	*	415	399	425	477	*	*	*	*	*	*	420	438
01:00	*	*	*	*	432	415	382	368	*	*	*	*	*	*	407	392
02:00	*	*	*	*	453	536	415	495	*	*	*	*	*	*	434	516
03:00	*	*	*	*	490	749	467	786	*	*	*	*	*	*	478	768
04:00	*	*	*	*	424	817	463	**915**	*	*	*	*	*	*	444	**866**
05:00	*	*	*	*	**502**	**818**	**478**	842	*	*	*	*	*	*	**490**	830
06:00	*	*	*	*	328	726	389	867	*	*	*	*	*	*	358	796
07:00	*	*	*	*	215	319	266	422	*	*	*	*	*	*	240	370
08:00	*	*	*	*	112	201	188	219	*	*	*	*	*	*	150	210
09:00	*	*	*	*	115	153	164	186	*	*	*	*	*	*	140	170
10:00	*	*	*	*	64	77	110	139	*	*	*	*	*	*	87	108
11:00	*	*	*	*	23	42	42	51	*	*	*	*	*	*	32	46
Lane	0	0	0	0	7485	7480	8052	8313	6	17	0	0	0	0	7768	7896
Day	0		0		14965		16365		23		0		0		15664	
AM Peak	-	-	-	-	07:00	08:00	07:00	08:00	00:00	00:00	-	-	-	-	07:00	08:00
Vol.	-	-	-	-	1074	508	1095	546	6	17	-	-	-	-	1084	527
PM Peak	-	-	-	-	17:00	17:00	17:00	16:00	-	-	-	-	-	-	17:00	16:00
Vol.	-	-	-	-	502	818	478	915	-	-	-	-	-	-	490	866

Comb. Total	0	0	14965	16365	23	0	0	15664

ADT ADT 15,665 AADT 15,665

MassDOT

Traffic Data Collection

Location ID	4166	Located On	CAMBRIDGE TURNPIKE	Community	CONCORD
Counted By	TCDS_Combined	Between		County	MIDDLESEX
Start Date	7/17/2007	And		Module	
Start Time	11:00:00 AM	Direction	2-WAY	Agency	MHD
		Source	syst_combine	Owner ID	wjt

FHWA-Scheme F Classification

Start Time	Motor cycle	Car	Pick up	Bus	2A SU	3A SU	>3A SU	<5A 2U	5A 2U	>5A 2U	<6A >2U	6A >2U	>6A >2U	14	15	Total
12:00 AM	0	28	4	0	0	0	0	0	0	0	0	0	0	0	0	32
1:00 AM	0	27	2	0	0	0	0	0	0	0	0	0	0	0	0	29
2:00 AM	0	14	0	0	0	0	0	0	0	0	0	0	0	0	0	14
3:00 AM	0	11	0	0	0	0	0	0	0	0	0	0	0	0	0	11
4:00 AM	1	12	1	0	0	0	0	0	1	0	0	0	0	0	0	15
5:00 AM	0	49	7	0	0	0	0	0	0	0	0	0	0	0	0	56
6:00 AM	1	279	40	0	3	2	0	0	3	0	0	0	0	0	0	328
7:00 AM	1	455	53	1	2	3	0	1	1	0	0	0	0	0	0	517
8:00 AM	6	474	51	3	6	4	2	0	0	0	1	0	0	0	0	547
9:00 AM	10	360	58	1	1	2	0	1	1	0	0	1	0	0	0	435
10:00 AM	1	244	29	0	3	0	0	0	1	0	0	0	1	0	0	279
11:00 AM	1	273	37	0	2	7	1	1	1	0	0	0	0	0	0	323
12:00 PM	2	313	37	2	5	8	3	0	0	0	0	0	0	0	0	370
1:00 PM	1	306	32	1	4	8	1	0	1	0	0	0	0	0	0	354
2:00 PM	2	362	44	0	3	3	3	0	0	0	0	0	0	0	0	417
3:00 PM	2	429	46	4	2	1	0	0	1	0	0	0	0	0	0	485
4:00 PM	8	519	48	7	1	0	0	0	0	0	0	1	0	0	1	585
5:00 PM	3	578	38	8	3	0	1	2	1	0	0	0	0	0	0	634
6:00 PM	5	492	18	1	0	1	0	0	1	0	0	0	0	0	0	518
7:00 PM	4	328	11	3	1	0	0	0	0	0	0	0	0	0	0	347
8:00 PM	0	252	9	1	0	0	0	0	0	0	0	0	0	0	0	262
9:00 PM	2	167	15	0	0	0	0	0	0	0	0	0	0	0	0	184
10:00 PM	1	145	3	0	0	0	0	0	0	0	0	0	0	0	0	149
11:00 PM	2	99	2	0	0	0	0	0	0	0	0	0	0	0	0	103
TOTAL	53	6216	585	32	36	39	11	5	12	0	1	2	1	0	1	6994

APPENDIX B

CRASH RATE WORKSHEETS

INTERSECTION CRASH RATE WORKSHEET

CITY/TOWN : Concord COUNT DATE : Sep-12

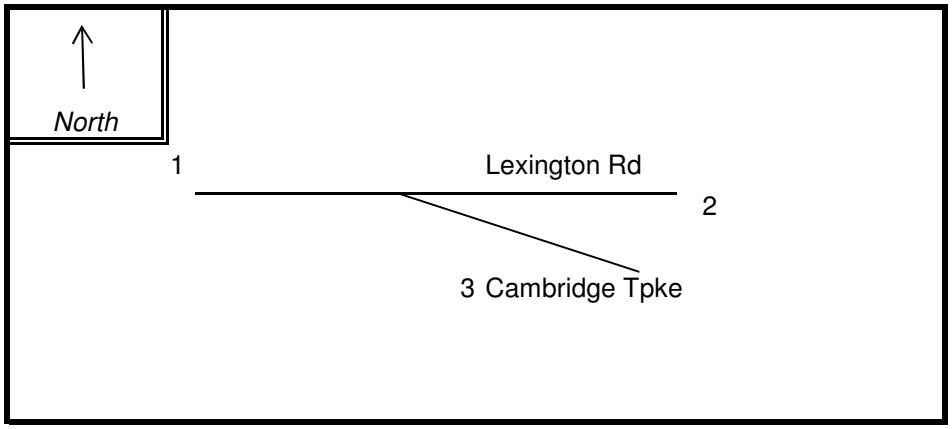
DISTRICT : 4 UNSIGNALIZED : x SIGNALIZED :

~ INTERSECTION DATA ~

MAJOR STREET : Lexington Road

MINOR STREET(S) : Cambridge Turnpike

INTERSECTION DIAGRAM (Label Approaches)



PEAK HOUR VOLUMES

APPROACH :	1	2	3	4	5	Total Peak Hourly Approach Volume
DIRECTION :	EB	WB	NW			
PEAK HOURLY VOLUMES (AM/**PM**) :	483	719	370			**1,572**

" K " FACTOR : **0.098** INTERSECTION ADT (**V**) = TOTAL DAILY APPROACH VOLUME : **16,041**

TOTAL # OF CRASHES : 7 # OF YEARS : 3 AVERAGE # OF CRASHES PER YEAR (**A**) : **2.33**

CRASH RATE CALCULATION : 0.40

$$\text{RATE} = \frac{(A * 1{,}000{,}000)}{(V * 365)}$$

Comments :

Project Title & Date: Cambridge Turnpike PDR, October 2012

INTERSECTION CRASH RATE WORKSHEET

CITY/TOWN : Concord COUNT DATE : Sep-12

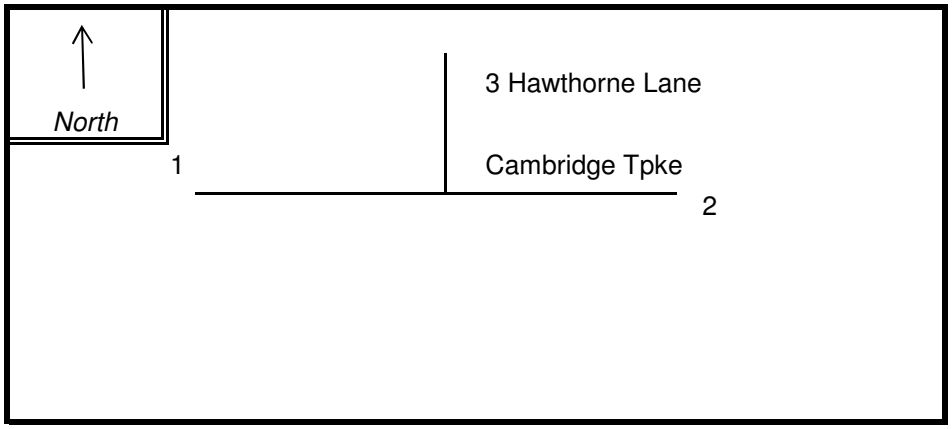
DISTRICT : 4 UNSIGNALIZED : x SIGNALIZED :

~ INTERSECTION DATA ~

MAJOR STREET : Cambridge Turnpike

MINOR STREET(S) : Hawthorne Lane

INTERSECTION DIAGRAM (Label Approaches)



PEAK HOUR VOLUMES

APPROACH :	1	2	3	4	5	Total Peak Hourly Approach Volume
DIRECTION :	EB	WB	NB			
PEAK HOURLY VOLUMES (AM/**PM**) :	197	316	17			**530**

" K " FACTOR : **0.090** INTERSECTION ADT (**V**) = TOTAL DAILY APPROACH VOLUME : **5,889**

TOTAL # OF CRASHES : 2 # OF YEARS : 3 AVERAGE # OF CRASHES PER YEAR (**A**) : **0.67**

CRASH RATE CALCULATION : 0.31

$$\text{RATE} = \frac{(A * 1{,}000{,}000)}{(V * 365)}$$

Comments :

Project Title & Date: Cambridge Turnpike PDR, October 2012

INTERSECTION CRASH RATE WORKSHEET

CITY/TOWN : Concord COUNT DATE : Sep-12

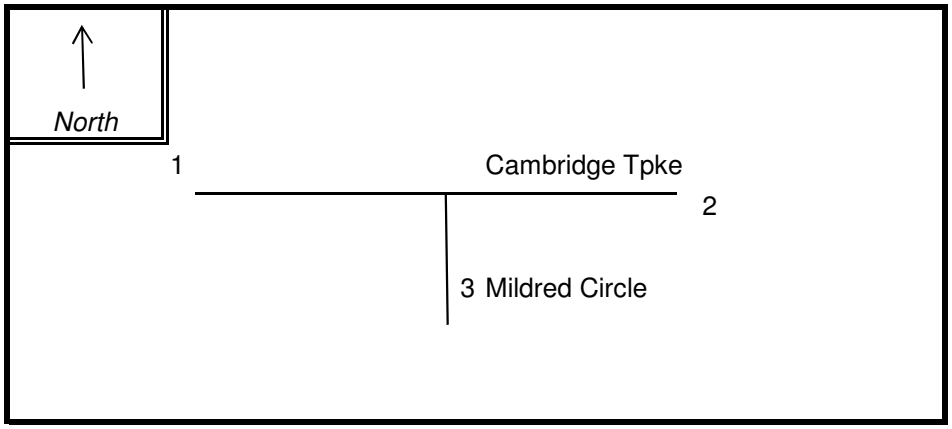
DISTRICT : 4 UNSIGNALIZED : x SIGNALIZED :

~ INTERSECTION DATA ~

MAJOR STREET : Cambridge Turnpike

MINOR STREET(S) : Mildred Circle

INTERSECTION DIAGRAM
(Label Approaches)



PEAK HOUR VOLUMES

APPROACH :	1	2	3	4	5	Total Peak Hourly Approach Volume
DIRECTION :	EB	WB	NB			
PEAK HOURLY VOLUMES (AM/**PM**) :	197	316	14			**527**

" K " FACTOR : **0.090** INTERSECTION ADT (**V**) = TOTAL DAILY APPROACH VOLUME : **5,856**

TOTAL # OF CRASHES : 1 # OF YEARS : 3 AVERAGE # OF CRASHES PER YEAR (**A**) : **0.33**

CRASH RATE CALCULATION : 0.16

$$\text{RATE} = \frac{(A * 1{,}000{,}000)}{(V * 365)}$$

Comments :

Project Title & Date: Cambridge Turnpike PDR, October 2012

INTERSECTION CRASH RATE WORKSHEET

CITY/TOWN : Concord COUNT DATE : Sep-12

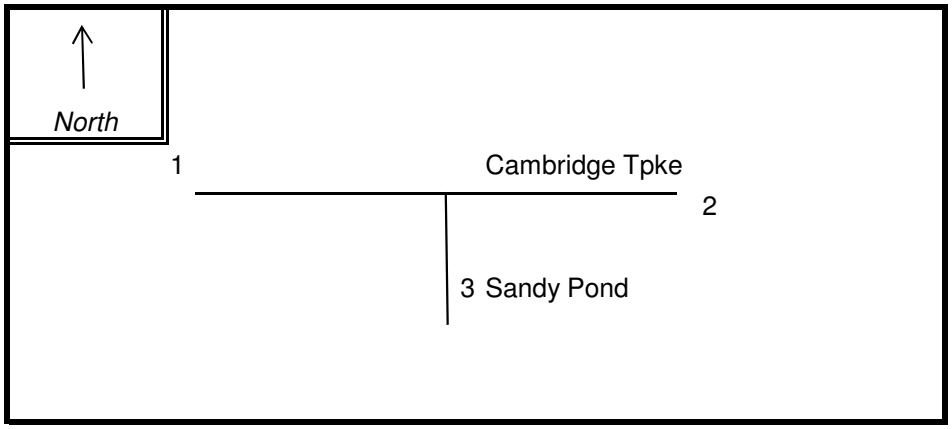
DISTRICT : 4 UNSIGNALIZED : x SIGNALIZED :

~ INTERSECTION DATA ~

MAJOR STREET : Cambridge Turnpike

MINOR STREET(S) : Sandy Pond Road

INTERSECTION DIAGRAM
(Label Approaches)



PEAK HOUR VOLUMES

APPROACH :	1	2	3	4	5	Total Peak Hourly Approach Volume
DIRECTION :	EB	WB	NB			
PEAK HOURLY VOLUMES (AM/**PM**) :	191	376	2			**569**

" K " FACTOR : **0.090**

INTERSECTION ADT (**V**) = TOTAL DAILY APPROACH VOLUME : **6,322**

TOTAL # OF CRASHES : 2

OF YEARS : 3

AVERAGE # OF CRASHES PER YEAR (**A**) : **0.67**

CRASH RATE CALCULATION : 0.29

$$\text{RATE} = \frac{(A * 1{,}000{,}000)}{(V * 365)}$$

Comments :

Project Title & Date: Cambridge Turnpike PDR, October 2012

APPENDIX C

SIGNAL WARRANT ANALYSIS

Cambridge Turnpike @ Lexington Road

Warrant 1A. Eight-Hour Vehicular Volume - Condition A

Motivation: Volume of intersecting traffic is principal reason for considering signal installation

Inputs:	**Major**	**Minor**	
# of lanes for moving traffic:	1	1	**on the approach - number of turning lan
Intersection meets 70% requirement (Y/N)?		**N**	Population over 17,000
(Major street speed exceeds 40 MPH)		**N**	35 mph posted

Wednesday, Sept 26th ATR Counts
(vehicles/hour)

Begin Time	Major St. EB	Major St. WB	Major St. Total	Minor St. NB	Minor St. SB	Total Ent Volume	Condition A: Major St. Total	Condition A: Minor St. Greater
							500	150
0:00	6	4	10	11	0	21	0	0
1:00	10	6	16	2	0	18	0	0
2:00	4	1	5	5	0	10	0	0
3:00	4	0	4	2	0	6	0	0
4:00	20	3	23	2	0	25	0	0
5:00	91	28	119	4	0	123	0	0
6:00	511	84	595	45	0	640	1	0
7:00	1074	231	1305	105	0	1410	1	0
8:00	893	289	1182	120	0	1302	1	0
9:00	549	221	770	103	0	873	1	0
10:00	347	183	530	139	0	669	1	0
11:00	403	246	649	189	0	838	1	1
12:00	415	263	678	179	0	857	1	1
13:00	432	274	706	225	0	931	1	1
14:00	453	334	787	291	0	1078	1	1
15:00	490	521	1011	298	0	1309	1	1
16:00	424	542	966	274	0	1240	1	1
17:00	502	518	1020	262	0	1282	1	1
18:00	328	386	714	284	0	998	1	1
19:00	215	161	376	164	0	540	0	1
20:00	112	90	202	116	0	318	0	0
21:00	115	52	167	101	0	268	0	0
22:00	64	21	85	61	0	146	0	0
23:00	23	12	35	29	0	64	0	0
						HOURS MET	**13**	**9**

Warrant 1- Condition A Satisfied? **YES**

Cambridge Turnpike @ Lexington Road

Warrant 1B. Interruption of Continuous Traffic - Condition B

Motivation: Volume on major street so heavy that traffic on minor intersection street suffers excessive delay or hazard in entering or crossing the major street

Wednesday, Sept 26th ATR Counts
(vehicles/hour)

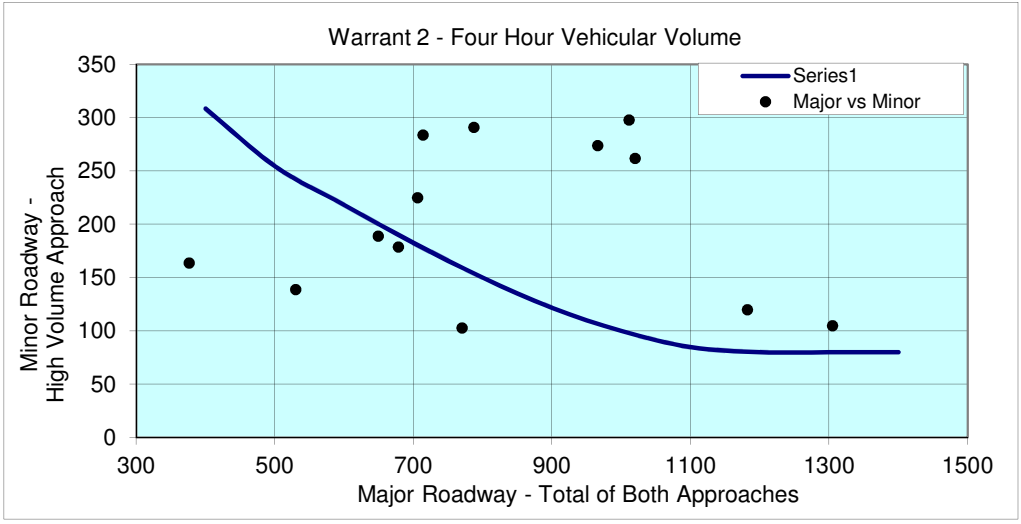
Begin Time	Major St. EB	Major St. WB	Major St. Total	Minor St. NB	Minor St. SB	Total Ent Volume	Condition B: Major St. Total	Condition B: Minor St. Greater
							750	75
0:00	6	4	10	11	0	21	0	0
1:00	10	6	16	2	0	18	0	0
2:00	4	1	5	5	0	10	0	0
3:00	4	0	4	2	0	6	0	0
4:00	20	3	23	2	0	25	0	0
5:00	91	28	119	4	0	123	0	0
6:00	511	84	595	45	0	640	**0**	0
7:00	1074	231	1305	105	0	1410	**1**	**1**
8:00	893	289	1182	120	0	1302	**1**	**1**
9:00	549	221	770	103	0	873	**1**	**1**
10:00	347	183	530	139	0	669	**0**	**1**
11:00	403	246	649	189	0	838	**0**	**1**
12:00	415	263	678	179	0	857	**0**	**1**
13:00	432	274	706	225	0	931	**0**	**1**
14:00	453	334	787	291	0	1078	**1**	**1**
15:00	490	521	1011	298	0	1309	**1**	**1**
16:00	424	542	966	274	0	1240	**1**	**1**
17:00	502	518	1020	262	0	1282	**1**	**1**
18:00	328	386	714	284	0	998	**0**	**1**
19:00	215	161	376	164	0	540	0	**1**
20:00	112	90	202	116	0	318	0	**1**
21:00	115	52	167	101	0	268	0	**1**
22:00	64	21	85	61	0	146	0	0
23:00	23	12	35	29	0	64	0	0
						HOURS MET	**7**	**15**

Warrant 1- Condition B Satisfied? NO

Cambridge Turnpike @ Lexington Road

Warrant 2. Four-Hour Vehicular Volume

Begin Time	Major St. EB	Major St. WB	Major St. Total	Minor St. NB	Fall above the curve? No 70% Exception
7:00	1074	231	1305	105	**Y**
8:00	893	289	1182	120	**Y**
9:00	549	221	770	103	**N**
10:00	347	183	530	139	**N**
11:00	403	246	649	189	**N**
12:00	415	263	678	179	**N**
13:00	432	274	706	225	**Y**
14:00	453	334	787	291	**Y**
15:00	490	521	1011	298	**Y**
16:00	424	542	966	274	**Y**
17:00	502	518	1020	262	**Y**
18:00	328	386	714	284	**Y**
19:00	215	161	376	164	**N**
					8 Hours



WARRANT 2 SATISFIED? **YES**

Cambridge Turnpike @ Lexington Road

Warrant 3. Peak Hour Delay

Motivation: Traffic conditions are such that for one hour of the day, minor street traffic suffers undue delay in entering or crossing the major street.

NOTE: MUTCD states "This signal warrant shall be applied only in unusual cases. Such cases include, but are not limited to, office complexes, manufacturing plants, industrial complexes, or high-occupancy vehicle facilities that attract or discharge large numbers of vehicles over a short time."

Condition A

1. Minor Approach Peak Hour Delay:

	AM	PM	
No. Lanes, Minor Approach:	**1**	1	
Pk Hr Veh on Minor Appr:	181	370	
Approach Delay (s/veh):	**2431**	**1645**	--> from Synchro output
Total Veh-Hrs. of Delay:	122.23	169.10	
Required:	4	4	
Warrant Satified?:	**YES**	**YES**	

2. Minor Approach Peak Hour Volume:

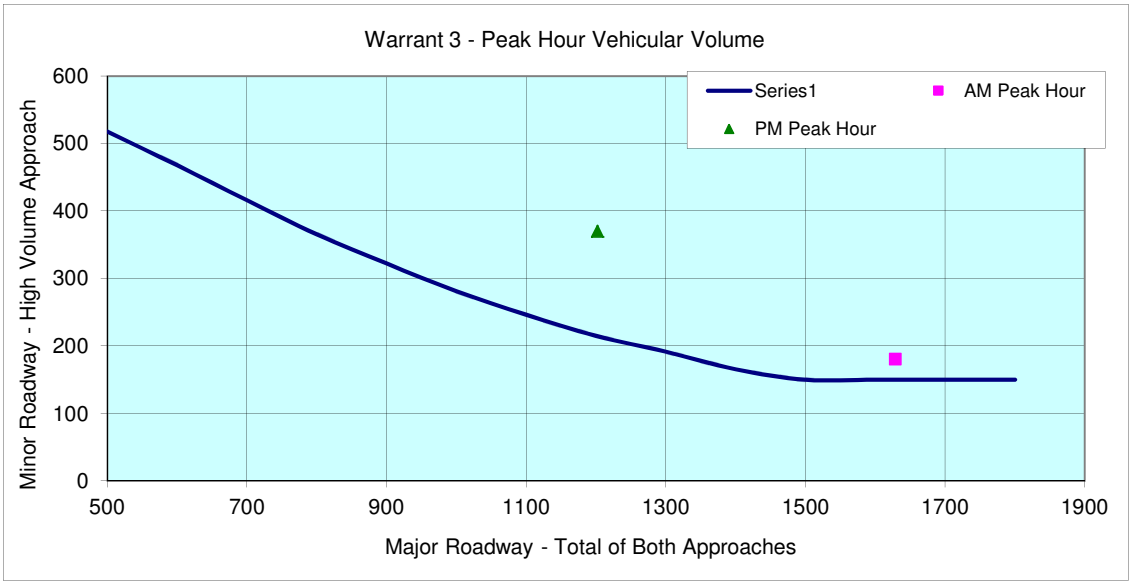
Minor Approach Volume:	181	370
Required:	100	100
Warrant Satified?:	**YES**	**YES**

3. Intersection Peak Hour Volume:

Number of Approaches:	**3**	**3**
Major Street Volume:	**1628**	**1202**
Total Intersection Volume:	1809	1572
Required:	650	650
Warrant Satified?:	**YES**	**YES**

Condition B

High volume(s) above line (yes/no)? **Yes**



Cambridge Turnpike @ Lexington Road

Warrant 4. Pedestrian Volmes

Not Applicable.

Warrant 5. School Crossing

Not Applicable

Warrant 6. Coordinated Signal System

Not Applicable

Warrant 7. Crash Experience

The Mass DOT shows 7 crashes; not a High Crash Location for 2008 - 2010.

Warrant 9. Intersection Near a Grade Crossing

The intersection is not within 140' of a RxR crossing.

Cambridge Turnpike @ Lexington Road

Warrant 8. Roadway Network

Motivation: Installing a traffic control signal at some intersections might be justified to encourage concentration and organization of traffic flow on a roadway network.

Wednesday, Sept 26th ATR Counts

(vehicles/hour)

Begin Time	Major St. EB	Major St. WB	Major St. Total	Minor St. NB	Minor St. SB	Total Ent Volume	Total Weekday 1000
0:00	6	4	10	11	0	21	0
1:00	10	6	16	2	0	18	0
2:00	4	1	5	5	0	10	0
3:00	4	0	4	2	0	6	0
4:00	20	3	23	2	0	25	0
5:00	91	28	119	4	0	123	0
6:00	511	84	595	45	0	640	0
7:00	1074	231	1305	105	0	1410	**1**
8:00	893	289	1182	120	0	1302	**1**
9:00	549	221	770	103	0	873	0
10:00	347	183	530	139	0	669	0
11:00	403	246	649	189	0	838	0
12:00	415	263	678	179	0	857	0
13:00	432	274	706	225	0	931	0
14:00	453	334	787	291	0	1078	**1**
15:00	490	521	1011	298	0	1309	**1**
16:00	424	542	966	274	0	1240	**1**
17:00	502	518	1020	262	0	1282	**1**
18:00	328	386	714	284	0	998	0
19:00	215	161	376	164	0	540	0
20:00	112	90	202	116	0	318	0
21:00	115	52	167	101	0	268	0
22:00	64	21	85	61	0	146	0
23:00	23	12	35	29	0	64	0
						HOURS MET	**6**

Warrant 8 Satisfied? YES

	Meets Criteria?
Warrant 1-A	YES
Warrant 1-B	NO
Warrant 2	YES
Warrant 3	YES
Warrant 4	N/A
Warrant 5	N/A
Warrant 6	N/A
Warrant 7	NO
Warrant 8	YES
Warrant 9	N/A

Warrants met: **4**

APPENDIX D

TRAFFIC ANALYSIS WORKSHEETS

No-Build Alternative at Lexington Road

HCS+: Unsignalized Intersections Release 5.6

TWO-WAY STOP CONTROL SUMMARY

Analyst: LBF
Agency/Co.: Louis Berger
Date Performed: 10/19/2012
Analysis Time Period: AM Peak
Intersection: Lexington & Cambridge
Jurisdiction: Town of Concord
Units: U. S. Customary
Analysis Year: 2012
Project ID: CKE440A0
East/West Street: Lexington Road
North/South Street: Cambridge Tpke
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		1286	0	2	340	
Peak-Hour Factor, PHF		0.96	0.96	0.96	0.96	
Hourly Flow Rate, HFR		1339	0	2	354	
Percent Heavy Vehicles		--	--	2	--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes		1	0	0	1	
Configuration			TR		LT	
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	175	0	6			
Peak Hour Factor, PHF	0.96	1.00	0.96			
Hourly Flow Rate, HFR	182	0	6			
Percent Heavy Vehicles	2	2	2			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No	/		/
Lanes	0	1	0			
Configuration		LTR				

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		LT		LTR				
v (vph)		2		188				
C(m) (vph)		515		104				
v/c		0.00		1.81				
95% queue length		0.01		15.15				
Control Delay		12.0		468.7				
LOS		B		F				
Approach Delay				468.7				
Approach LOS				F				

HCS+: Unsignalized Intersections Release 5.6

Phone: Fax:
E-Mail:

TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst: LBF
Agency/Co.: Louis Berger
Date Performed: 10/19/2012
Analysis Time Period: AM Peak
Intersection: Lexington & Cambridge
Jurisdiction: Town of Concord
Units: U. S. Customary
Analysis Year: 2012
Project ID: CKE440A0
East/West Street: Lexington Road
North/South Street: Cambridge Tpke
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street Movements	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		1286	0	2	340	
Peak-Hour Factor, PHF		0.96	0.96	0.96	0.96	
Peak-15 Minute Volume		335	0	1	89	
Hourly Flow Rate, HFR		1339	0	2	354	
Percent Heavy Vehicles		--	--	2	--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes		1	0	0	1	
Configuration			TR		LT	
Upstream Signal?		No			No	

Minor Street Movements	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	175	0	6			
Peak Hour Factor, PHF	0.96	1.00	0.96			
Peak-15 Minute Volume	46	0	2			
Hourly Flow Rate, HFR	182	0	6			
Percent Heavy Vehicles	2	2	2			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No	/		/
RT Channelized?						
Lanes	0	1	0			
Configuration		LTR				

Pedestrian Volumes and Adjustments

Movements	13	14	15	16
Flow (ped/hr)	0	0	0	0

Lane Width (ft)	12.0	12.0	12.0	12.0
Walking Speed (ft/sec)	4.0	4.0	4.0	4.0
Percent Blockage	0	0	0	0

Upstream Signal Data

	Prog. Flow vph	Sat Flow vph	Arrival Type	Green Time sec	Cycle Length sec	Prog. Speed mph	Distance to Signal feet
S2 Left-Turn							
Through							
S5 Left-Turn							
Through							

Worksheet 3-Data for Computing Effect of Delay to Major Street Vehicles

	Movement 2	Movement 5
Shared ln volume, major th vehicles:		354
Shared ln volume, major rt vehicles:		0
Sat flow rate, major th vehicles:		1700
Sat flow rate, major rt vehicles:		1700
Number of major street through lanes:		1

Worksheet 4-Critical Gap and Follow-up Time Calculation

Critical Gap Calculation

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(c,base)		4.1	7.1	6.5	6.2			
t(c,hv)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(hv)		2	2	2	2			
t(c,g)			0.20	0.20	0.10	0.20	0.20	0.10
Percent Grade			0.00	0.00	0.00	0.00	0.00	0.00
t(3,lt)		0.00	0.70	0.00	0.00			
t(c,T): 1-stage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-stage	0.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
t(c) 1-stage		4.1	6.4	6.5	6.2			
2-stage								

Follow-Up Time Calculations

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(f,base)		2.20	3.50	4.00	3.30			
t(f,HV)	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
P(HV)		2	2	2	2			
t(f)		2.2	3.5	4.0	3.3			

Worksheet 5-Effect of Upstream Signals

Computation 1-Queue Clearance Time at Upstream Signal

	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
V prog				

Total Saturation Flow Rate, s (vph)	
Arrival Type	
Effective Green, g (sec)	
Cycle Length, C (sec)	
Rp (from Exhibit 16-11)	
Proportion vehicles arriving on green P	
g(q1)	
g(q2)	
g(q)	

Computation 2-Proportion of TWSC Intersection Time blocked	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
alpha				
beta				
Travel time, t(a) (sec)				
Smoothing Factor, F				
Proportion of conflicting flow, f				
Max platooned flow, V(c,max)				
Min platooned flow, V(c,min)				
Duration of blocked period, t(p)				
Proportion time blocked, p	0.000		0.000	

Computation 3-Platoon Event Periods	Result
p(2)	0.000
p(5)	0.000
p(dom)	
p(subo)	
Constrained or unconstrained?	

Proportion unblocked for minor movements, p(x)	(1) Single-stage Process	(2) Two-Stage Process Stage I	(3) Stage II
p(1)			
p(4)			
p(7)			
p(8)			
p(9)			
p(10)			
p(11)			
p(12)			

Computation 4 and 5

Single-Stage Process

Movement	1	4	7	8	9	10	11	12
	L	L	L	T	R	L	T	R
V c,x		1339	1697	1697	1339			
s								
Px								
V c,u,x								
C r,x								
C plat,x								

Two-Stage Process

7	8	10	11

	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2
V(c,x)								
s		1500		1500				
P(x)								
V(c,u,x)								
C(r,x)								
C(plat,x)								

Worksheet 6-Impedance and Capacity Equations

Step 1: RT from Minor St.	9	12
Conflicting Flows	1339	
Potential Capacity	187	
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity	187	
Probability of Queue free St.	0.97	1.00
Step 2: LT from Major St.	**4**	**1**
Conflicting Flows	1339	
Potential Capacity	515	
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity	515	
Probability of Queue free St.	1.00	1.00
Maj L-Shared Prob Q free St.	1.00	
Step 3: TH from Minor St.	**8**	**11**
Conflicting Flows	1697	
Potential Capacity	92	
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	1.00	1.00
Movement Capacity	92	
Probability of Queue free St.	1.00	1.00
Step 4: LT from Minor St.	**7**	**10**
Conflicting Flows	1697	
Potential Capacity	102	
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor		1.00
Maj. L, Min T Adj. Imp Factor.		1.00
Cap. Adj. factor due to Impeding mvmnt	1.00	0.96
Movement Capacity	102	

Worksheet 7-Computation of the Effect of Two-stage Gap Acceptance

Step 3: TH from Minor St.	8	11
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Probability of Queue free St.		

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 3 - Single Stage		
Conflicting Flows	1697	
Potential Capacity	92	
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	1.00	1.00
Movement Capacity	92	

Result for 2 stage process:		
a		
y		
C t	92	
Probability of Queue free St.	1.00	1.00

Step 4: LT from Minor St.	7	10

Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 3 - Single Stage		
Conflicting Flows	1697	
Potential Capacity	102	
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor		1.00
Maj. L, Min T Adj. Imp Factor.		1.00
Cap. Adj. factor due to Impeding mvmnt	1.00	0.96
Movement Capacity	102	

Results for Two-stage process:	
a	
y	
C t	102

Worksheet 8-Shared Lane Calculations

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (vph)	182	0	6			
Movement Capacity (vph)	102	92	187			
Shared Lane Capacity (vph)		104				

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
C sep	102	92	187			
Volume	182	0	6			
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						
n max						
C sh		104				
SUM C sep						
n						
C act						

Worksheet 10-Delay, Queue Length, and Level of Service

Movement	1	4	7	8	9	10	11	12
Lane Config		LT		LTR				
v (vph)		2		188				
C(m) (vph)		515		104				
v/c		0.00		1.81				
95% queue length		0.01		15.15				
Control Delay		12.0		468.7				
LOS		B		F				
Approach Delay				468.7				
Approach LOS				F				

Worksheet 11-Shared Major LT Impedance and Delay

	Movement 2	Movement 5
p(oj)	1.00	1.00
v(il), Volume for stream 2 or 5		354
v(i2), Volume for stream 3 or 6		0
s(il), Saturation flow rate for stream 2 or 5		1700
s(i2), Saturation flow rate for stream 3 or 6		1700
P*(oj)		1.00
d(M,LT), Delay for stream 1 or 4		12.0
N, Number of major street through lanes		1
d(rank,1) Delay for stream 2 or 5		0.1

HCS+: Unsignalized Intersections Release 5.6

TWO-WAY STOP CONTROL SUMMARY

Analyst: LBF
Agency/Co.: Louis Berger
Date Performed: 11/13/2012
Analysis Time Period: PM Peak
Intersection: Lexington & Cambridge
Jurisdiction: Town of Concord
Units: U. S. Customary
Analysis Year: 2012
Project ID: CKE440A0
East/West Street: Lexington Road
North/South Street: Cambridge Tpke
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		483	0	5	714	
Peak-Hour Factor, PHF		0.98	0.98	0.98	0.98	
Hourly Flow Rate, HFR		492	0	5	728	
Percent Heavy Vehicles		--	--	1	--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes		1	0	0	1	
Configuration			TR		LT	
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	364	0	6			
Peak Hour Factor, PHF	0.98	1.00	0.98			
Hourly Flow Rate, HFR	371	0	6			
Percent Heavy Vehicles	1	1	1			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No	/		/
Lanes	0	1	0			
Configuration		LTR				

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		LT		LTR				
v (vph)		5		377				
C(m) (vph)		1077		198				
v/c		0.00		1.90				
95% queue length		0.01		27.51				
Control Delay		8.4		465.2				
LOS		A		F				
Approach Delay				465.2				
Approach LOS				F				

HCS+: Unsignalized Intersections Release 5.6

Phone: Fax:
E-Mail:

TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst: LBF
Agency/Co.: Louis Berger
Date Performed: 11/13/2012
Analysis Time Period: PM Peak
Intersection: Lexington & Cambridge
Jurisdiction: Town of Concord
Units: U. S. Customary
Analysis Year: 2012
Project ID: CKE440A0
East/West Street: Lexington Road
North/South Street: Cambridge Tpke
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street Movements	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		483	0	5	714	
Peak-Hour Factor, PHF		0.98	0.98	0.98	0.98	
Peak-15 Minute Volume		123	0	1	182	
Hourly Flow Rate, HFR		492	0	5	728	
Percent Heavy Vehicles		--	--	1	--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes		1	0	0	1	
Configuration			TR	LT		
Upstream Signal?		No			No	

Minor Street Movements	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	364	0	6			
Peak Hour Factor, PHF	0.98	1.00	0.98			
Peak-15 Minute Volume	93	0	2			
Hourly Flow Rate, HFR	371	0	6			
Percent Heavy Vehicles	1	1	1			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No	/		/
RT Channelized?						
Lanes	0	1	0			
Configuration		LTR				

Pedestrian Volumes and Adjustments

Movements	13	14	15	16
Flow (ped/hr)	0	0	0	0

Lane Width (ft)	12.0	12.0	12.0	12.0
Walking Speed (ft/sec)	4.0	4.0	4.0	4.0
Percent Blockage	0	0	0	0

Upstream Signal Data

	Prog. Flow vph	Sat Flow vph	Arrival Type	Green Time sec	Cycle Length sec	Prog. Speed mph	Distance to Signal feet
S2 Left-Turn							
Through							
S5 Left-Turn							
Through							

Worksheet 3-Data for Computing Effect of Delay to Major Street Vehicles

	Movement 2	Movement 5
Shared ln volume, major th vehicles:		728
Shared ln volume, major rt vehicles:		0
Sat flow rate, major th vehicles:		1700
Sat flow rate, major rt vehicles:		1700
Number of major street through lanes:		1

Worksheet 4-Critical Gap and Follow-up Time Calculation

Critical Gap Calculation

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(c,base)		4.1	7.1	6.5	6.2			
t(c,hv)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(hv)		1	1	1	1			
t(c,g)			0.20	0.20	0.10	0.20	0.20	0.10
Percent Grade			0.00	0.00	0.00	0.00	0.00	0.00
t(3,lt)		0.00	0.70	0.00	0.00			
t(c,T): 1-stage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-stage	0.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
t(c) 1-stage		4.1	6.4	6.5	6.2			
2-stage								

Follow-Up Time Calculations

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(f,base)		2.20	3.50	4.00	3.30			
t(f,HV)	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
P(HV)		1	1	1	1			
t(f)		2.2	3.5	4.0	3.3			

Worksheet 5-Effect of Upstream Signals

Computation 1-Queue Clearance Time at Upstream Signal

	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
V prog				

Total Saturation Flow Rate, s (vph)	
Arrival Type	
Effective Green, g (sec)	
Cycle Length, C (sec)	
Rp (from Exhibit 16-11)	
Proportion vehicles arriving on green P	
g(q1)	
g(q2)	
g(q)	

Computation 2-Proportion of TWSC Intersection Time blocked	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
alpha				
beta				
Travel time, t(a) (sec)				
Smoothing Factor, F				
Proportion of conflicting flow, f				
Max platooned flow, V(c,max)				
Min platooned flow, V(c,min)				
Duration of blocked period, t(p)				
Proportion time blocked, p	0.000		0.000	

Computation 3-Platoon Event Periods	Result
p(2)	0.000
p(5)	0.000
p(dom)	
p(subo)	
Constrained or unconstrained?	

Proportion unblocked for minor movements, p(x)	(1) Single-stage Process	(2) Two-Stage Process Stage I	(3) Stage II
p(1)			
p(4)			
p(7)			
p(8)			
p(9)			
p(10)			
p(11)			
p(12)			

Computation 4 and 5

Single-Stage Process

Movement	1	4	7	8	9	10	11	12
	L	L	L	T	R	L	T	R
V c,x		492	1230	1230	492			
s								
Px								
V c,u,x								
C r,x								
C plat,x								

Two-Stage Process

7	8	10	11

	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2
V(c,x)								
s		1500		1500				
P(x)								
V(c,u,x)								
C(r,x)								
C(plat,x)								

Worksheet 6-Impedance and Capacity Equations

Step 1: RT from Minor St.	9	12
Conflicting Flows	492	
Potential Capacity	579	
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity	579	
Probability of Queue free St.	0.99	1.00

Step 2: LT from Major St.	4	1
Conflicting Flows	492	
Potential Capacity	1077	
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity	1077	
Probability of Queue free St.	1.00	1.00
Maj L-Shared Prob Q free St.	0.99	

Step 3: TH from Minor St.	8	11
Conflicting Flows	1230	
Potential Capacity	178	
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.99	0.99
Movement Capacity	177	
Probability of Queue free St.	1.00	1.00

Step 4: LT from Minor St.	7	10
Conflicting Flows	1230	
Potential Capacity	197	
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor		0.99
Maj. L, Min T Adj. Imp Factor.		0.99
Cap. Adj. factor due to Impeding mvmnt	1.00	0.98
Movement Capacity	196	

Worksheet 7-Computation of the Effect of Two-stage Gap Acceptance

Step 3: TH from Minor St.	8	11
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Probability of Queue free St.		

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 3 - Single Stage		
Conflicting Flows	1230	
Potential Capacity	178	
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.99	0.99
Movement Capacity	177	

Result for 2 stage process:		
a		
y		
C t	177	
Probability of Queue free St.	1.00	1.00

Step 4: LT from Minor St.	7	10

Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 3 - Single Stage		
Conflicting Flows	1230	
Potential Capacity	197	
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor		0.99
Maj. L, Min T Adj. Imp Factor.		0.99
Cap. Adj. factor due to Impeding mvmnt	1.00	0.98
Movement Capacity	196	

Results for Two-stage process:		
a		
y		
C t	196	

Worksheet 8-Shared Lane Calculations

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (vph)	371	0	6			
Movement Capacity (vph)	196	177	579			
Shared Lane Capacity (vph)		198				

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
C sep	196	177	579			
Volume	371	0	6			
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						
n max						
C sh		198				
SUM C sep						
n						
C act						

Worksheet 10-Delay, Queue Length, and Level of Service

Movement	1	4	7	8	9	10	11	12
Lane Config		LT		LTR				
v (vph)		5		377				
C(m) (vph)		1077		198				
v/c		0.00		1.90				
95% queue length		0.01		27.51				
Control Delay		8.4		465.2				
LOS		A		F				
Approach Delay				465.2				
Approach LOS				F				

Worksheet 11-Shared Major LT Impedance and Delay

	Movement 2	Movement 5
p(oj)	1.00	1.00
v(il), Volume for stream 2 or 5		728
v(i2), Volume for stream 3 or 6		0
s(il), Saturation flow rate for stream 2 or 5		1700
s(i2), Saturation flow rate for stream 3 or 6		1700
P*(oj)		0.99
d(M,LT), Delay for stream 1 or 4		8.4
N, Number of major street through lanes		1
d(rank,1) Delay for stream 2 or 5		0.1

HCS+: Unsignalized Intersections Release 5.6

TWO-WAY STOP CONTROL SUMMARY

Analyst: LBF
Agency/Co.: Louis Berger
Date Performed: 11/13/2012
Analysis Time Period: AM Peak
Intersection: Lexington & Cambridge
Jurisdiction: Town of Concord
Units: U. S. Customary
Analysis Year: 2030
Project ID: CKE440A0
East/West Street: Lexington Road
North/South Street: Cambridge Tpke
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		1406	0	2	372	
Peak-Hour Factor, PHF		0.96	0.96	0.96	0.96	
Hourly Flow Rate, HFR		1464	0	2	387	
Percent Heavy Vehicles		--	--	2	--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes		1	0	0	1	
Configuration			TR		LT	
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	191	0	7			
Peak Hour Factor, PHF	0.96	1.00	0.96			
Hourly Flow Rate, HFR	198	0	7			
Percent Heavy Vehicles	2	2	2			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No	/		/
Lanes	0	1	0			
Configuration		LTR				

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		LT		LTR				
v (vph)		2		205				
C(m) (vph)		461		82				
v/c		0.00		2.50				
95% queue length		0.01		19.35				
Control Delay		12.8		790.5				
LOS		B		F				
Approach Delay				790.5				
Approach LOS				F				

HCS+: Unsignalized Intersections Release 5.6

Phone: Fax:
E-Mail:

TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst: LBF
Agency/Co.: Louis Berger
Date Performed: 11/13/2012
Analysis Time Period: AM Peak
Intersection: Lexington & Cambridge
Jurisdiction: Town of Concord
Units: U. S. Customary
Analysis Year: 2030
Project ID: CKE440A0
East/West Street: Lexington Road
North/South Street: Cambridge Tpke
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street Movements	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		1406	0	2	372	
Peak-Hour Factor, PHF		0.96	0.96	0.96	0.96	
Peak-15 Minute Volume		366	0	1	97	
Hourly Flow Rate, HFR		1464	0	2	387	
Percent Heavy Vehicles		--	--	2	--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes		1	0	0	1	
Configuration			TR	LT		
Upstream Signal?		No			No	

Minor Street Movements	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	191	0	7			
Peak Hour Factor, PHF	0.96	1.00	0.96			
Peak-15 Minute Volume	50	0	2			
Hourly Flow Rate, HFR	198	0	7			
Percent Heavy Vehicles	2	2	2			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No	/		/
RT Channelized?						
Lanes	0	1	0			
Configuration		LTR				

Pedestrian Volumes and Adjustments

Movements	13	14	15	16
Flow (ped/hr)	0	0	0	0

Lane Width (ft)	12.0	12.0	12.0	12.0
Walking Speed (ft/sec)	4.0	4.0	4.0	4.0
Percent Blockage	0	0	0	0

Upstream Signal Data

	Prog. Flow vph	Sat Flow vph	Arrival Type	Green Time sec	Cycle Length sec	Prog. Speed mph	Distance to Signal feet
S2 Left-Turn							
Through							
S5 Left-Turn							
Through							

Worksheet 3-Data for Computing Effect of Delay to Major Street Vehicles

	Movement 2	Movement 5
Shared ln volume, major th vehicles:		387
Shared ln volume, major rt vehicles:		0
Sat flow rate, major th vehicles:		1700
Sat flow rate, major rt vehicles:		1700
Number of major street through lanes:		1

Worksheet 4-Critical Gap and Follow-up Time Calculation

Critical Gap Calculation

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(c,base)		4.1	7.1	6.5	6.2			
t(c,hv)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(hv)		2	2	2	2			
t(c,g)			0.20	0.20	0.10	0.20	0.20	0.10
Percent Grade			0.00	0.00	0.00	0.00	0.00	0.00
t(3,lt)		0.00	0.70	0.00	0.00			
t(c,T): 1-stage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-stage	0.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
t(c) 1-stage		4.1	6.4	6.5	6.2			
2-stage								

Follow-Up Time Calculations

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(f,base)		2.20	3.50	4.00	3.30			
t(f,HV)	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
P(HV)		2	2	2	2			
t(f)		2.2	3.5	4.0	3.3			

Worksheet 5-Effect of Upstream Signals

Computation 1-Queue Clearance Time at Upstream Signal

	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
V prog				

Total Saturation Flow Rate, s (vph)
Arrival Type
Effective Green, g (sec)
Cycle Length, C (sec)
Rp (from Exhibit 16-11)
Proportion vehicles arriving on green P
g(q1)
g(q2)
g(q)

Computation 2-Proportion of TWSC Intersection Time blocked	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
alpha				
beta				
Travel time, t(a) (sec)				
Smoothing Factor, F				
Proportion of conflicting flow, f				
Max platooned flow, V(c,max)				
Min platooned flow, V(c,min)				
Duration of blocked period, t(p)				
Proportion time blocked, p	0.000		0.000	

Computation 3-Platoon Event Periods	Result
p(2)	0.000
p(5)	0.000
p(dom)	
p(subo)	
Constrained or unconstrained?	

Proportion unblocked for minor movements, p(x)	(1) Single-stage Process	(2) Two-Stage Process Stage I	(3) Stage II
p(1)			
p(4)			
p(7)			
p(8)			
p(9)			
p(10)			
p(11)			
p(12)			

Computation 4 and 5
Single-Stage Process

Movement	1	4	7	8	9	10	11	12
	L	L	L	T	R	L	T	R
V c,x		1464	1855	1855	1464			
s								
Px								
V c,u,x								
C r,x								
C plat,x								

Two-Stage Process

7	8	10	11

	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2
V(c,x)								
s		1500		1500				
P(x)								
V(c,u,x)								
C(r,x)								
C(plat,x)								

Worksheet 6-Impedance and Capacity Equations

Step 1: RT from Minor St.	9	12
Conflicting Flows	1464	
Potential Capacity	158	
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity	158	
Probability of Queue free St.	0.96	1.00

Step 2: LT from Major St.	4	1
Conflicting Flows	1464	
Potential Capacity	461	
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity	461	
Probability of Queue free St.	1.00	1.00
Maj L-Shared Prob Q free St.	0.99	

Step 3: TH from Minor St.	8	11
Conflicting Flows	1855	
Potential Capacity	74	
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.99	0.99
Movement Capacity	74	
Probability of Queue free St.	1.00	1.00

Step 4: LT from Minor St.	7	10
Conflicting Flows	1855	
Potential Capacity	81	
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor		0.99
Maj. L, Min T Adj. Imp Factor.		1.00
Cap. Adj. factor due to Impeding mvmnt	1.00	0.95
Movement Capacity	81	

Worksheet 7-Computation of the Effect of Two-stage Gap Acceptance

Step 3: TH from Minor St.	8	11
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Probability of Queue free St.		

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 3 - Single Stage		
Conflicting Flows	1855	
Potential Capacity	74	
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.99	0.99
Movement Capacity	74	

Result for 2 stage process:		
a		
y		
C t	74	
Probability of Queue free St.	1.00	1.00

Step 4: LT from Minor St.	7	10

Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 3 - Single Stage		
Conflicting Flows	1855	
Potential Capacity	81	
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor		0.99
Maj. L, Min T Adj. Imp Factor.		1.00
Cap. Adj. factor due to Impeding mvmnt	1.00	0.95
Movement Capacity	81	

Results for Two-stage process:	
a	
y	
C t	81

Worksheet 8-Shared Lane Calculations

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (vph)	198	0	7			
Movement Capacity (vph)	81	74	158			
Shared Lane Capacity (vph)		82				

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
C sep	81	74	158			
Volume	198	0	7			
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						
n max						
C sh		82				
SUM C sep						
n						
C act						

Worksheet 10-Delay, Queue Length, and Level of Service

Movement	1	4	7	8	9	10	11	12
Lane Config		LT		LTR				
v (vph)		2		205				
C(m) (vph)		461		82				
v/c		0.00		2.50				
95% queue length		0.01		19.35				
Control Delay		12.8		790.5				
LOS		B		F				
Approach Delay				790.5				
Approach LOS				F				

Worksheet 11-Shared Major LT Impedance and Delay

	Movement 2	Movement 5
p(oj)	1.00	1.00
v(il), Volume for stream 2 or 5		387
v(i2), Volume for stream 3 or 6		0
s(il), Saturation flow rate for stream 2 or 5		1700
s(i2), Saturation flow rate for stream 3 or 6		1700
P*(oj)		0.99
d(M,LT), Delay for stream 1 or 4		12.8
N, Number of major street through lanes		1
d(rank,1) Delay for stream 2 or 5		0.1

HCS+: Unsignalized Intersections Release 5.6

TWO-WAY STOP CONTROL SUMMARY

Analyst: LBF
Agency/Co.: Louis Berger
Date Performed: 11/13/2012
Analysis Time Period: PM Peak
Intersection: Lexington & Cambridge
Jurisdiction: Town of Concord
Units: U. S. Customary
Analysis Year: 2030
Project ID: CKE440A0
East/West Street: Lexington Road
North/South Street: Cambridge Tpke
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		528	0	5	781	
Peak-Hour Factor, PHF		0.98	0.98	0.98	0.98	
Hourly Flow Rate, HFR		538	0	5	796	
Percent Heavy Vehicles		--	--	1	--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes		1	0	0	1	
Configuration			TR		LT	
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	398	0	7			
Peak Hour Factor, PHF	0.98	1.00	0.98			
Hourly Flow Rate, HFR	406	0	7			
Percent Heavy Vehicles	1	1	1			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No	/		/
Lanes	0	1	0			
Configuration		LTR				

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		LT		LTR				
v (vph)		5		413				
C(m) (vph)		1035		169				
v/c		0.00		2.44				
95% queue length		0.01		34.93				
Control Delay		8.5		710.3				
LOS		A		F				
Approach Delay				710.3				
Approach LOS				F				

HCS+: Unsignalized Intersections Release 5.6

Phone: Fax:
E-Mail:

TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst: LBF
Agency/Co.: Louis Berger
Date Performed: 11/13/2012
Analysis Time Period: PM Peak
Intersection: Lexington & Cambridge
Jurisdiction: Town of Concord
Units: U. S. Customary
Analysis Year: 2030
Project ID: CKE440A0
East/West Street: Lexington Road
North/South Street: Cambridge Tpke
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street Movements	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		528	0	5	781	
Peak-Hour Factor, PHF		0.98	0.98	0.98	0.98	
Peak-15 Minute Volume		135	0	1	199	
Hourly Flow Rate, HFR		538	0	5	796	
Percent Heavy Vehicles		--	--	1	--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes		1	0	0	1	
Configuration			TR	LT		
Upstream Signal?		No			No	

Minor Street Movements	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	398	0	7			
Peak Hour Factor, PHF	0.98	1.00	0.98			
Peak-15 Minute Volume	102	0	2			
Hourly Flow Rate, HFR	406	0	7			
Percent Heavy Vehicles	1	1	1			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No	/		/
RT Channelized?						
Lanes	0	1	0			
Configuration		LTR				

Pedestrian Volumes and Adjustments

Movements	13	14	15	16
Flow (ped/hr)	0	0	0	0

Lane Width (ft)	12.0	12.0	12.0	12.0
Walking Speed (ft/sec)	4.0	4.0	4.0	4.0
Percent Blockage	0	0	0	0

Upstream Signal Data

	Prog. Flow vph	Sat Flow vph	Arrival Type	Green Time sec	Cycle Length sec	Prog. Speed mph	Distance to Signal feet
S2 Left-Turn							
Through							
S5 Left-Turn							
Through							

Worksheet 3-Data for Computing Effect of Delay to Major Street Vehicles

	Movement 2	Movement 5
Shared ln volume, major th vehicles:		796
Shared ln volume, major rt vehicles:		0
Sat flow rate, major th vehicles:		1700
Sat flow rate, major rt vehicles:		1700
Number of major street through lanes:		1

Worksheet 4-Critical Gap and Follow-up Time Calculation

Critical Gap Calculation

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(c,base)		4.1	7.1	6.5	6.2			
t(c,hv)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(hv)		1	1	1	1			
t(c,g)			0.20	0.20	0.10	0.20	0.20	0.10
Percent Grade			0.00	0.00	0.00	0.00	0.00	0.00
t(3,lt)		0.00	0.70	0.00	0.00			
t(c,T): 1-stage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-stage	0.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
t(c) 1-stage		4.1	6.4	6.5	6.2			
2-stage								

Follow-Up Time Calculations

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(f,base)		2.20	3.50	4.00	3.30			
t(f,HV)	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
P(HV)		1	1	1	1			
t(f)		2.2	3.5	4.0	3.3			

Worksheet 5-Effect of Upstream Signals

Computation 1-Queue Clearance Time at Upstream Signal

	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
V prog				

Total Saturation Flow Rate, s (vph)	
Arrival Type	
Effective Green, g (sec)	
Cycle Length, C (sec)	
Rp (from Exhibit 16-11)	
Proportion vehicles arriving on green P	
g(q1)	
g(q2)	
g(q)	

Computation 2-Proportion of TWSC Intersection Time blocked	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
alpha				
beta				
Travel time, t(a) (sec)				
Smoothing Factor, F				
Proportion of conflicting flow, f				
Max platooned flow, V(c,max)				
Min platooned flow, V(c,min)				
Duration of blocked period, t(p)				
Proportion time blocked, p	0.000		0.000	

Computation 3-Platoon Event Periods	Result
p(2)	0.000
p(5)	0.000
p(dom)	
p(subo)	
Constrained or unconstrained?	

Proportion unblocked for minor movements, p(x)	(1) Single-stage Process	(2) Two-Stage Process Stage I	(3) Stage II
p(1)			
p(4)			
p(7)			
p(8)			
p(9)			
p(10)			
p(11)			
p(12)			

Computation 4 and 5

Single-Stage Process

Movement	1	4	7	8	9	10	11	12
	L	L	L	T	R	L	T	R
V c,x		538	1344	1344	538			
s								
Px								
V c,u,x								
C r,x								
C plat,x								

Two-Stage Process

7	8	10	11

	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2
V(c,x)								
s		1500		1500				
P(x)								
V(c,u,x)								
C(r,x)								
C(plat,x)								

Worksheet 6-Impedance and Capacity Equations

Step 1: RT from Minor St.	9	12
Conflicting Flows	538	
Potential Capacity	545	
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity	545	
Probability of Queue free St.	0.99	1.00

Step 2: LT from Major St.	4	1
Conflicting Flows	538	
Potential Capacity	1035	
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity	1035	
Probability of Queue free St.	1.00	1.00
Maj L-Shared Prob Q free St.	0.99	

Step 3: TH from Minor St.	8	11
Conflicting Flows	1344	
Potential Capacity	152	
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.99	0.99
Movement Capacity	151	
Probability of Queue free St.	1.00	1.00

Step 4: LT from Minor St.	7	10
Conflicting Flows	1344	
Potential Capacity	168	
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor		0.99
Maj. L, Min T Adj. Imp Factor.		0.99
Cap. Adj. factor due to Impeding mvmnt	1.00	0.98
Movement Capacity	167	

Worksheet 7-Computation of the Effect of Two-stage Gap Acceptance

Step 3: TH from Minor St.	8	11
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Probability of Queue free St.		

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 3 - Single Stage		
Conflicting Flows	1344	
Potential Capacity	152	
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.99	0.99
Movement Capacity	151	

Result for 2 stage process:		
a		
y		
C t	151	
Probability of Queue free St.	1.00	1.00

Step 4: LT from Minor St.	7	10

Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 3 - Single Stage		
Conflicting Flows	1344	
Potential Capacity	168	
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor		0.99
Maj. L, Min T Adj. Imp Factor.		0.99
Cap. Adj. factor due to Impeding mvmnt	1.00	0.98
Movement Capacity	167	

Results for Two-stage process:	
a	
y	
C t	167

Worksheet 8-Shared Lane Calculations

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (vph)	406	0	7			
Movement Capacity (vph)	167	151	545			
Shared Lane Capacity (vph)		169				

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
C sep	167	151	545			
Volume	406	0	7			
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						
n max						
C sh		169				
SUM C sep						
n						
C act						

Worksheet 10-Delay, Queue Length, and Level of Service

Movement	1	4	7	8	9	10	11	12
Lane Config		LT		LTR				
v (vph)		5		413				
C(m) (vph)		1035		169				
v/c		0.00		2.44				
95% queue length		0.01		34.93				
Control Delay		8.5		710.3				
LOS		A		F				
Approach Delay				710.3				
Approach LOS				F				

Worksheet 11-Shared Major LT Impedance and Delay

	Movement 2	Movement 5
p(oj)	1.00	1.00
v(il), Volume for stream 2 or 5		796
v(i2), Volume for stream 3 or 6		0
s(il), Saturation flow rate for stream 2 or 5		1700
s(i2), Saturation flow rate for stream 3 or 6		1700
P*(oj)		0.99
d(M,LT), Delay for stream 1 or 4		8.5
N, Number of major street through lanes		1
d(rank,1) Delay for stream 2 or 5		0.1

Alternative 1

at Lexington Road

HCS+: Unsignalized Intersections Release 5.6

TWO-WAY STOP CONTROL SUMMARY

Analyst: LBF
Agency/Co.: Louis Berger
Date Performed: 11/13/2012
Analysis Time Period: AM Peak
Intersection: Lexington & Cambridge
Jurisdiction: Town of Concord
Units: U. S. Customary
Analysis Year: 2012
Project ID: CKE440A0
East/West Street: Lexington Road
North/South Street: Cambridge Tpke
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		984	302	2	340	
Peak-Hour Factor, PHF		0.96	0.96	0.96	0.96	
Hourly Flow Rate, HFR		1025	314	2	354	
Percent Heavy Vehicles		--	--	2	--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes		1	0	0	1	
Configuration			TR		LT	
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	175	0	6			
Peak Hour Factor, PHF	0.96	1.00	0.96			
Hourly Flow Rate, HFR	182	0	6			
Percent Heavy Vehicles	2	2	2			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No	/		/
Lanes	0	1	0			
Configuration		LTR				

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		LT		LTR				
v (vph)		2		188				
C(m) (vph)		515		129				
v/c		0.00		1.46				
95% queue length		0.01		12.86				
Control Delay		12.0		305.8				
LOS		B		F				
Approach Delay				305.8				
Approach LOS				F				

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Phone: Fax:
E-Mail:

TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst: LBF
Agency/Co.: Louis Berger
Date Performed: 11/13/2012
Analysis Time Period: AM Peak
Intersection: Lexington & Cambridge
Jurisdiction: Town of Concord
Units: U. S. Customary
Analysis Year: 2012
Project ID: CKE440A0
East/West Street: Lexington Road
North/South Street: Cambridge Tpke
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street Movements	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		984	302	2	340	
Peak-Hour Factor, PHF		0.96	0.96	0.96	0.96	
Peak-15 Minute Volume		256	79	1	89	
Hourly Flow Rate, HFR		1025	314	2	354	
Percent Heavy Vehicles		--	--	2	--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes		1	0	0	1	
Configuration			TR		LT	
Upstream Signal?		No			No	

Minor Street Movements	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	175	0	6			
Peak Hour Factor, PHF	0.96	1.00	0.96			
Peak-15 Minute Volume	46	0	2			
Hourly Flow Rate, HFR	182	0	6			
Percent Heavy Vehicles	2	2	2			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No	/		/
RT Channelized?						
Lanes	0	1	0			
Configuration		LTR				

Pedestrian Volumes and Adjustments

Movements	13	14	15	16
Flow (ped/hr)	0	0	0	0

Lane Width (ft)	12.0	12.0	12.0	12.0
Walking Speed (ft/sec)	4.0	4.0	4.0	4.0
Percent Blockage	0	0	0	0

Upstream Signal Data

	Prog. Flow vph	Sat Flow vph	Arrival Type	Green Time sec	Cycle Length sec	Prog. Speed mph	Distance to Signal feet
S2 Left-Turn							
Through							
S5 Left-Turn							
Through							

Worksheet 3-Data for Computing Effect of Delay to Major Street Vehicles

	Movement 2	Movement 5
Shared ln volume, major th vehicles:		354
Shared ln volume, major rt vehicles:		0
Sat flow rate, major th vehicles:		1700
Sat flow rate, major rt vehicles:		1700
Number of major street through lanes:		1

Worksheet 4-Critical Gap and Follow-up Time Calculation

Critical Gap Calculation

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(c,base)		4.1	7.1	6.5	6.2			
t(c,hv)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(hv)		2	2	2	2			
t(c,g)			0.20	0.20	0.10	0.20	0.20	0.10
Percent Grade			0.00	0.00	0.00	0.00	0.00	0.00
t(3,lt)		0.00	0.70	0.00	0.00			
t(c,T): 1-stage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-stage	0.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
t(c) 1-stage		4.1	6.4	6.5	6.2			
2-stage								

Follow-Up Time Calculations

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(f,base)		2.20	3.50	4.00	3.30			
t(f,HV)	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
P(HV)		2	2	2	2			
t(f)		2.2	3.5	4.0	3.3			

Worksheet 5-Effect of Upstream Signals

Computation 1-Queue Clearance Time at Upstream Signal

	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
V prog				

Total Saturation Flow Rate, s (vph)
Arrival Type
Effective Green, g (sec)
Cycle Length, C (sec)
Rp (from Exhibit 16-11)
Proportion vehicles arriving on green P
g(q1)
g(q2)
g(q)

Computation 2-Proportion of TWSC Intersection Time blocked	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
alpha				
beta				
Travel time, t(a) (sec)				
Smoothing Factor, F				
Proportion of conflicting flow, f				
Max platooned flow, V(c,max)				
Min platooned flow, V(c,min)				
Duration of blocked period, t(p)				
Proportion time blocked, p	0.000		0.000	

Computation 3-Platoon Event Periods	Result
p(2)	0.000
p(5)	0.000
p(dom)	
p(subo)	
Constrained or unconstrained?	

Proportion unblocked for minor movements, p(x)	(1) Single-stage Process	(2) Two-Stage Process Stage I	(3) Stage II
p(1)			
p(4)			
p(7)			
p(8)			
p(9)			
p(10)			
p(11)			
p(12)			

Computation 4 and 5
Single-Stage Process

Movement	1	4	7	8	9	10	11	12
	L	L	L	T	R	L	T	R
V c,x		1339	1540	1540	1182			
s								
Px								
V c,u,x								
C r,x								
C plat,x								

Two-Stage Process

	7	8	10	11

	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2
V(c,x)								
s		1500		1500				
P(x)								
V(c,u,x)								
C(r,x)								
C(plat,x)								

Worksheet 6-Impedance and Capacity Equations

Step 1: RT from Minor St.	9	12
Conflicting Flows	1182	
Potential Capacity	231	
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity	231	
Probability of Queue free St.	0.97	1.00

Step 2: LT from Major St.	4	1
Conflicting Flows	1339	
Potential Capacity	515	
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity	515	
Probability of Queue free St.	1.00	1.00
Maj L-Shared Prob Q free St.	1.00	

Step 3: TH from Minor St.	8	11
Conflicting Flows	1540	
Potential Capacity	115	
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	1.00	1.00
Movement Capacity	114	
Probability of Queue free St.	1.00	1.00

Step 4: LT from Minor St.	7	10
Conflicting Flows	1540	
Potential Capacity	127	
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor		1.00
Maj. L, Min T Adj. Imp Factor.		1.00
Cap. Adj. factor due to Impeding mvmnt	1.00	0.97
Movement Capacity	127	

Worksheet 7-Computation of the Effect of Two-stage Gap Acceptance

Step 3: TH from Minor St.	8	11
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Probability of Queue free St.		

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 3 - Single Stage		
Conflicting Flows	1540	
Potential Capacity	115	
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	1.00	1.00
Movement Capacity	114	

Result for 2 stage process:		
a		
y		
C t	114	
Probability of Queue free St.	1.00	1.00

Step 4: LT from Minor St.	7	10

Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 3 - Single Stage		
Conflicting Flows	1540	
Potential Capacity	127	
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor		1.00
Maj. L, Min T Adj. Imp Factor.		1.00
Cap. Adj. factor due to Impeding mvmnt	1.00	0.97
Movement Capacity	127	

Results for Two-stage process:	
a	
y	
C t	127

Worksheet 8-Shared Lane Calculations

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (vph)	182	0	6			
Movement Capacity (vph)	127	114	231			
Shared Lane Capacity (vph)		129				

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
C sep	127	114	231			
Volume	182	0	6			
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						
n max						
C sh		129				
SUM C sep						
n						
C act						

Worksheet 10-Delay, Queue Length, and Level of Service

Movement	1	4	7	8	9	10	11	12
Lane Config		LT		LTR				
v (vph)		2		188				
C(m) (vph)		515		129				
v/c		0.00		1.46				
95% queue length		0.01		12.86				
Control Delay		12.0		305.8				
LOS		B		F				
Approach Delay				305.8				
Approach LOS				F				

Worksheet 11-Shared Major LT Impedance and Delay

	Movement 2	Movement 5
p(oj)	1.00	1.00
v(il), Volume for stream 2 or 5		354
v(i2), Volume for stream 3 or 6		0
s(il), Saturation flow rate for stream 2 or 5		1700
s(i2), Saturation flow rate for stream 3 or 6		1700
P*(oj)		1.00
d(M,LT), Delay for stream 1 or 4		12.0
N, Number of major street through lanes		1
d(rank,1) Delay for stream 2 or 5		0.1

HCS+: Unsignalized Intersections Release 5.6

TWO-WAY STOP CONTROL SUMMARY

Analyst: LBF
Agency/Co.: Louis Berger
Date Performed: 11/13/2012
Analysis Time Period: PM Peak
Intersection: Lexington & Cambridge
Jurisdiction: Town of Concord
Units: U. S. Customary
Analysis Year: 2012
Project ID: CKE440A0
East/West Street: Lexington Road
North/South Street: Cambridge Tpke
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		320	163	5	714	
Peak-Hour Factor, PHF		0.98	0.98	0.98	0.98	
Hourly Flow Rate, HFR		326	166	5	728	
Percent Heavy Vehicles		--	--	1	--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes		1	0	0	1	
Configuration			TR		LT	
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	364	0	6			
Peak Hour Factor, PHF	0.98	1.00	0.98			
Hourly Flow Rate, HFR	371	0	6			
Percent Heavy Vehicles	1	1	1			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No	/		/
Lanes	0	1	0			
Configuration		LTR				

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		LT		LTR				
v (vph)		5		377				
C(m) (vph)		1077		222				
v/c		0.00		1.70				
95% queue length		0.01		25.02				
Control Delay		8.4		370.8				
LOS		A		F				
Approach Delay				370.8				
Approach LOS				F				

HCS+: Unsignalized Intersections Release 5.6

Phone: Fax:
E-Mail:

TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst: LBF
Agency/Co.: Louis Berger
Date Performed: 11/13/2012
Analysis Time Period: PM Peak
Intersection: Lexington & Cambridge
Jurisdiction: Town of Concord
Units: U. S. Customary
Analysis Year: 2012
Project ID: CKE440A0
East/West Street: Lexington Road
North/South Street: Cambridge Tpke
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street Movements	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		320	163	5	714	
Peak-Hour Factor, PHF		0.98	0.98	0.98	0.98	
Peak-15 Minute Volume		82	42	1	182	
Hourly Flow Rate, HFR		326	166	5	728	
Percent Heavy Vehicles		--	--	1	--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes		1	0	0	1	
Configuration			TR	LT		
Upstream Signal?		No			No	

Minor Street Movements	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	364	0	6			
Peak Hour Factor, PHF	0.98	1.00	0.98			
Peak-15 Minute Volume	93	0	2			
Hourly Flow Rate, HFR	371	0	6			
Percent Heavy Vehicles	1	1	1			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No	/		/
RT Channelized?						
Lanes	0	1	0			
Configuration		LTR				

Pedestrian Volumes and Adjustments

Movements	13	14	15	16
Flow (ped/hr)	0	0	0	0

Lane Width (ft)	12.0	12.0	12.0	12.0
Walking Speed (ft/sec)	4.0	4.0	4.0	4.0
Percent Blockage	0	0	0	0

Upstream Signal Data

	Prog. Flow vph	Sat Flow vph	Arrival Type	Green Time sec	Cycle Length sec	Prog. Speed mph	Distance to Signal feet
S2 Left-Turn							
Through							
S5 Left-Turn							
Through							

Worksheet 3-Data for Computing Effect of Delay to Major Street Vehicles

	Movement 2	Movement 5
Shared ln volume, major th vehicles:		728
Shared ln volume, major rt vehicles:		0
Sat flow rate, major th vehicles:		1700
Sat flow rate, major rt vehicles:		1700
Number of major street through lanes:		1

Worksheet 4-Critical Gap and Follow-up Time Calculation

Critical Gap Calculation

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(c,base)		4.1	7.1	6.5	6.2			
t(c,hv)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(hv)		1	1	1	1			
t(c,g)			0.20	0.20	0.10	0.20	0.20	0.10
Percent Grade			0.00	0.00	0.00	0.00	0.00	0.00
t(3,lt)		0.00	0.70	0.00	0.00			
t(c,T): 1-stage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-stage	0.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
t(c) 1-stage		4.1	6.4	6.5	6.2			
2-stage								

Follow-Up Time Calculations

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(f,base)		2.20	3.50	4.00	3.30			
t(f,HV)	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
P(HV)		1	1	1	1			
t(f)		2.2	3.5	4.0	3.3			

Worksheet 5-Effect of Upstream Signals

Computation 1-Queue Clearance Time at Upstream Signal

	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
V prog				

Total Saturation Flow Rate, s (vph)				
Arrival Type				
Effective Green, g (sec)				
Cycle Length, C (sec)				
Rp (from Exhibit 16-11)				
Proportion vehicles arriving on green P				
g(q1)				
g(q2)				
g(q)				

Computation 2-Proportion of TWSC Intersection Time blocked	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
alpha				
beta				
Travel time, t(a) (sec)				
Smoothing Factor, F				
Proportion of conflicting flow, f				
Max platooned flow, V(c,max)				
Min platooned flow, V(c,min)				
Duration of blocked period, t(p)				
Proportion time blocked, p	0.000		0.000	

Computation 3-Platoon Event Periods	Result
p(2)	0.000
p(5)	0.000
p(dom)	
p(subo)	
Constrained or unconstrained?	

Proportion unblocked for minor movements, p(x)	(1) Single-stage Process	(2) Two-Stage Process Stage I	(3) Stage II
p(1)			
p(4)			
p(7)			
p(8)			
p(9)			
p(10)			
p(11)			
p(12)			

Computation 4 and 5

Single-Stage Process

Movement	1	4	7	8	9	10	11	12
	L	L	L	T	R	L	T	R
V c,x		492	1147	1147	409			
s								
Px								
V c,u,x								
C r,x								
C plat,x								

Two-Stage Process

7	8	10	11

	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2
V(c,x)								
s		1500		1500				
P(x)								
V(c,u,x)								
C(r,x)								
C(plat,x)								

Worksheet 6-Impedance and Capacity Equations

Step 1: RT from Minor St.	9	12
Conflicting Flows	409	
Potential Capacity	645	
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity	645	
Probability of Queue free St.	0.99	1.00
Step 2: LT from Major St.	**4**	**1**
Conflicting Flows	492	
Potential Capacity	1077	
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity	1077	
Probability of Queue free St.	1.00	1.00
Maj L-Shared Prob Q free St.	0.99	
Step 3: TH from Minor St.	**8**	**11**
Conflicting Flows	1147	
Potential Capacity	200	
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.99	0.99
Movement Capacity	198	
Probability of Queue free St.	1.00	1.00
Step 4: LT from Minor St.	**7**	**10**
Conflicting Flows	1147	
Potential Capacity	221	
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor		0.99
Maj. L, Min T Adj. Imp Factor.		0.99
Cap. Adj. factor due to Impeding mvmnt	1.00	0.98
Movement Capacity	220	

Worksheet 7-Computation of the Effect of Two-stage Gap Acceptance

Step 3: TH from Minor St.	8	11
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Probability of Queue free St.		

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 3 - Single Stage		
Conflicting Flows	1147	
Potential Capacity	200	
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.99	0.99
Movement Capacity	198	

Result for 2 stage process:		
a		
y		
C t	198	
Probability of Queue free St.	1.00	1.00

Step 4: LT from Minor St.	7	10

Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 3 - Single Stage		
Conflicting Flows	1147	
Potential Capacity	221	
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor		0.99
Maj. L, Min T Adj. Imp Factor.		0.99
Cap. Adj. factor due to Impeding mvmnt	1.00	0.98
Movement Capacity	220	

Results for Two-stage process:	
a	
y	
C t	220

Worksheet 8-Shared Lane Calculations

Movement	7 L	8 T	9 R	10 L	11 T	12 R
Volume (vph)	371	0	6			
Movement Capacity (vph)	220	198	645			
Shared Lane Capacity (vph)		222				

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
C sep	220	198	645			
Volume	371	0	6			
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						
n max						
C sh		222				
SUM C sep						
n						
C act						

Worksheet 10-Delay, Queue Length, and Level of Service

Movement	1	4	7	8	9	10	11	12
Lane Config		LT		LTR				
v (vph)		5		377				
C(m) (vph)		1077		222				
v/c		0.00		1.70				
95% queue length		0.01		25.02				
Control Delay		8.4		370.8				
LOS		A		F				
Approach Delay				370.8				
Approach LOS				F				

Worksheet 11-Shared Major LT Impedance and Delay

	Movement 2	Movement 5
p(oj)	1.00	1.00
v(il), Volume for stream 2 or 5		728
v(i2), Volume for stream 3 or 6		0
s(il), Saturation flow rate for stream 2 or 5		1700
s(i2), Saturation flow rate for stream 3 or 6		1700
P*(oj)		0.99
d(M,LT), Delay for stream 1 or 4		8.4
N, Number of major street through lanes		1
d(rank,1) Delay for stream 2 or 5		0.1

HCS+: Unsignalized Intersections Release 5.6

TWO-WAY STOP CONTROL SUMMARY

Analyst: LBF
Agency/Co.: Louis Berger
Date Performed: 11/13/2012
Analysis Time Period: AM Peak
Intersection: Lexington & Cambridge
Jurisdiction: Town of Concord
Units: U. S. Customary
Analysis Year: 2030
Project ID: CKE440A0
East/West Street: Lexington Road
North/South Street: Cambridge Tpke
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		1076	330	2	372	
Peak-Hour Factor, PHF		0.96	0.96	0.96	0.96	
Hourly Flow Rate, HFR		1120	343	2	387	
Percent Heavy Vehicles		--	--	2	--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes		1	0	0	1	
Configuration			TR		LT	
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	191	0	7			
Peak Hour Factor, PHF	0.96	1.00	0.96			
Hourly Flow Rate, HFR	198	0	7			
Percent Heavy Vehicles	2	2	2			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No	/		/
Lanes	0	1	0			
Configuration		LTR				

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		LT		LTR				
v (vph)		2		205				
C(m) (vph)		462		106				
v/c		0.00		1.93				
95% queue length		0.01		16.92				
Control Delay		12.8		520.6				
LOS		B		F				
Approach Delay				520.6				
Approach LOS				F				

HCS+: Unsignalized Intersections Release 5.6

Phone: Fax:
E-Mail:

TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst: LBF
Agency/Co.: Louis Berger
Date Performed: 11/13/2012
Analysis Time Period: AM Peak
Intersection: Lexington & Cambridge
Jurisdiction: Town of Concord
Units: U. S. Customary
Analysis Year: 2030
Project ID: CKE440A0
East/West Street: Lexington Road
North/South Street: Cambridge Tpke
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street Movements	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		1076	330	2	372	
Peak-Hour Factor, PHF		0.96	0.96	0.96	0.96	
Peak-15 Minute Volume		280	86	1	97	
Hourly Flow Rate, HFR		1120	343	2	387	
Percent Heavy Vehicles		--	--	2	--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes		1	0	0	1	
Configuration			TR	LT		
Upstream Signal?		No			No	

Minor Street Movements	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	191	0	7			
Peak Hour Factor, PHF	0.96	1.00	0.96			
Peak-15 Minute Volume	50	0	2			
Hourly Flow Rate, HFR	198	0	7			
Percent Heavy Vehicles	2	2	2			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No	/		/
RT Channelized?						
Lanes	0	1	0			
Configuration		LTR				

Pedestrian Volumes and Adjustments

Movements	13	14	15	16
Flow (ped/hr)	0	0	0	0

Lane Width (ft)	12.0	12.0	12.0	12.0
Walking Speed (ft/sec)	4.0	4.0	4.0	4.0
Percent Blockage	0	0	0	0

Upstream Signal Data

	Prog. Flow vph	Sat Flow vph	Arrival Type	Green Time sec	Cycle Length sec	Prog. Speed mph	Distance to Signal feet
S2 Left-Turn							
Through							
S5 Left-Turn							
Through							

Worksheet 3-Data for Computing Effect of Delay to Major Street Vehicles

	Movement 2	Movement 5
Shared ln volume, major th vehicles:		387
Shared ln volume, major rt vehicles:		0
Sat flow rate, major th vehicles:		1700
Sat flow rate, major rt vehicles:		1700
Number of major street through lanes:		1

Worksheet 4-Critical Gap and Follow-up Time Calculation

Critical Gap Calculation

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(c,base)		4.1	7.1	6.5	6.2			
t(c,hv)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(hv)		2	2	2	2			
t(c,g)			0.20	0.20	0.10	0.20	0.20	0.10
Percent Grade			0.00	0.00	0.00	0.00	0.00	0.00
t(3,lt)		0.00	0.70	0.00	0.00			
t(c,T): 1-stage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-stage	0.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
t(c) 1-stage		4.1	6.4	6.5	6.2			
2-stage								

Follow-Up Time Calculations

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(f,base)		2.20	3.50	4.00	3.30			
t(f,HV)	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
P(HV)		2	2	2	2			
t(f)		2.2	3.5	4.0	3.3			

Worksheet 5-Effect of Upstream Signals

Computation 1-Queue Clearance Time at Upstream Signal

	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
V prog				

Total Saturation Flow Rate, s (vph)
Arrival Type
Effective Green, g (sec)
Cycle Length, C (sec)
Rp (from Exhibit 16-11)
Proportion vehicles arriving on green P
g(q1)
g(q2)
g(q)

Computation 2-Proportion of TWSC Intersection Time blocked	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
alpha				
beta				
Travel time, t(a) (sec)				
Smoothing Factor, F				
Proportion of conflicting flow, f				
Max platooned flow, V(c,max)				
Min platooned flow, V(c,min)				
Duration of blocked period, t(p)				
Proportion time blocked, p	0.000		0.000	

Computation 3-Platoon Event Periods	Result
p(2)	0.000
p(5)	0.000
p(dom)	
p(subo)	
Constrained or unconstrained?	

Proportion unblocked for minor movements, p(x)	(1) Single-stage Process	(2) Two-Stage Process Stage I	(3) Stage II
p(1)			
p(4)			
p(7)			
p(8)			
p(9)			
p(10)			
p(11)			
p(12)			

Computation 4 and 5
Single-Stage Process

Movement	1	4	7	8	9	10	11	12
	L	L	L	T	R	L	T	R
V c,x		1463	1683	1683	1292			
s								
Px								
V c,u,x								
C r,x								
C plat,x								

Two-Stage Process

7	8	10	11

	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2
V(c,x)								
s		1500		1500				
P(x)								
V(c,u,x)								
C(r,x)								
C(plat,x)								

Worksheet 6-Impedance and Capacity Equations

Step 1: RT from Minor St.	9	12
Conflicting Flows	1292	
Potential Capacity	199	
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity	199	
Probability of Queue free St.	0.96	1.00
Step 2: LT from Major St.	**4**	**1**
Conflicting Flows	1463	
Potential Capacity	462	
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity	462	
Probability of Queue free St.	1.00	1.00
Maj L-Shared Prob Q free St.	0.99	
Step 3: TH from Minor St.	**8**	**11**
Conflicting Flows	1683	
Potential Capacity	94	
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.99	0.99
Movement Capacity	93	
Probability of Queue free St.	1.00	1.00
Step 4: LT from Minor St.	**7**	**10**
Conflicting Flows	1683	
Potential Capacity	104	
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor		0.99
Maj. L, Min T Adj. Imp Factor.		1.00
Cap. Adj. factor due to Impeding mvmnt	1.00	0.96
Movement Capacity	104	

Worksheet 7-Computation of the Effect of Two-stage Gap Acceptance

Step 3: TH from Minor St.	8	11
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Probability of Queue free St.		

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 3 - Single Stage		
Conflicting Flows	1683	
Potential Capacity	94	
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.99	0.99
Movement Capacity	93	

Result for 2 stage process:		
a		
y		
C t	93	
Probability of Queue free St.	1.00	1.00

Step 4: LT from Minor St.	7	10

Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 3 - Single Stage		
Conflicting Flows	1683	
Potential Capacity	104	
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor		0.99
Maj. L, Min T Adj. Imp Factor.		1.00
Cap. Adj. factor due to Impeding mvmnt	1.00	0.96
Movement Capacity	104	

Results for Two-stage process:	
a	
y	
C t	104

Worksheet 8-Shared Lane Calculations

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (vph)	198	0	7			
Movement Capacity (vph)	104	93	199			
Shared Lane Capacity (vph)		106				

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
C sep	104	93	199			
Volume	198	0	7			
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						
n max						
C sh		106				
SUM C sep						
n						
C act						

Worksheet 10-Delay, Queue Length, and Level of Service

Movement	1	4	7	8	9	10	11	12
Lane Config		LT		LTR				
v (vph)		2		205				
C(m) (vph)		462		106				
v/c		0.00		1.93				
95% queue length		0.01		16.92				
Control Delay		12.8		520.6				
LOS		B		F				
Approach Delay				520.6				
Approach LOS				F				

Worksheet 11-Shared Major LT Impedance and Delay

	Movement 2	Movement 5
p(oj)	1.00	1.00
v(il), Volume for stream 2 or 5		387
v(i2), Volume for stream 3 or 6		0
s(il), Saturation flow rate for stream 2 or 5		1700
s(i2), Saturation flow rate for stream 3 or 6		1700
P*(oj)		0.99
d(M,LT), Delay for stream 1 or 4		12.8
N, Number of major street through lanes		1
d(rank,1) Delay for stream 2 or 5		0.1

HCS+: Unsignalized Intersections Release 5.6

TWO-WAY STOP CONTROL SUMMARY

Analyst: LBF
Agency/Co.: Louis Berger
Date Performed: 11/13/2012
Analysis Time Period: PM Peak
Intersection: Lexington & Cambridge
Jurisdiction: Town of Concord
Units: U. S. Customary
Analysis Year: 2030
Project ID: CKE440A0
East/West Street: Lexington Road
North/South Street: Cambridge Tpke
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		350	178	5	781	
Peak-Hour Factor, PHF		0.98	0.98	0.98	0.98	
Hourly Flow Rate, HFR		357	181	5	796	
Percent Heavy Vehicles		--	--	1	--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes		1	0	0	1	
Configuration			TR		LT	
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	398	0	7			
Peak Hour Factor, PHF	0.98	1.00	0.98			
Hourly Flow Rate, HFR	406	0	7			
Percent Heavy Vehicles	1	1	1			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No	/		/
Lanes	0	1	0			
Configuration		LTR				

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		LT		LTR				
v (vph)		5		413				
C(m) (vph)		1035		192				
v/c		0.00		2.15				
95% queue length		0.01		32.40				
Control Delay		8.5		574.7				
LOS		A		F				
Approach Delay				574.7				
Approach LOS				F				

HCS+: Unsignalized Intersections Release 5.6

Phone: Fax:
E-Mail:

TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst: LBF
Agency/Co.: Louis Berger
Date Performed: 11/13/2012
Analysis Time Period: PM Peak
Intersection: Lexington & Cambridge
Jurisdiction: Town of Concord
Units: U. S. Customary
Analysis Year: 2030
Project ID: CKE440A0
East/West Street: Lexington Road
North/South Street: Cambridge Tpke
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street Movements	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		350	178	5	781	
Peak-Hour Factor, PHF		0.98	0.98	0.98	0.98	
Peak-15 Minute Volume		89	45	1	199	
Hourly Flow Rate, HFR		357	181	5	796	
Percent Heavy Vehicles		--	--	1	--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes		1	0	0	1	
Configuration			TR	LT		
Upstream Signal?		No			No	

Minor Street Movements	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	398	0	7			
Peak Hour Factor, PHF	0.98	1.00	0.98			
Peak-15 Minute Volume	102	0	2			
Hourly Flow Rate, HFR	406	0	7			
Percent Heavy Vehicles	1	1	1			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No	/		/
RT Channelized?						
Lanes	0	1	0			
Configuration		LTR				

Pedestrian Volumes and Adjustments

Movements	13	14	15	16
Flow (ped/hr)	0	0	0	0

Lane Width (ft)	12.0	12.0	12.0	12.0
Walking Speed (ft/sec)	4.0	4.0	4.0	4.0
Percent Blockage	0	0	0	0

Upstream Signal Data

	Prog. Flow vph	Sat Flow vph	Arrival Type	Green Time sec	Cycle Length sec	Prog. Speed mph	Distance to Signal feet
S2 Left-Turn							
Through							
S5 Left-Turn							
Through							

Worksheet 3-Data for Computing Effect of Delay to Major Street Vehicles

	Movement 2	Movement 5
Shared ln volume, major th vehicles:		796
Shared ln volume, major rt vehicles:		0
Sat flow rate, major th vehicles:		1700
Sat flow rate, major rt vehicles:		1700
Number of major street through lanes:		1

Worksheet 4-Critical Gap and Follow-up Time Calculation

Critical Gap Calculation

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(c,base)		4.1	7.1	6.5	6.2			
t(c,hv)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(hv)		1	1	1	1			
t(c,g)			0.20	0.20	0.10	0.20	0.20	0.10
Percent Grade			0.00	0.00	0.00	0.00	0.00	0.00
t(3,lt)		0.00	0.70	0.00	0.00			
t(c,T): 1-stage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-stage	0.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
t(c) 1-stage		4.1	6.4	6.5	6.2			
2-stage								

Follow-Up Time Calculations

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(f,base)		2.20	3.50	4.00	3.30			
t(f,HV)	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
P(HV)		1	1	1	1			
t(f)		2.2	3.5	4.0	3.3			

Worksheet 5-Effect of Upstream Signals

Computation 1-Queue Clearance Time at Upstream Signal

	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
V prog				

Total Saturation Flow Rate, s (vph)	
Arrival Type	
Effective Green, g (sec)	
Cycle Length, C (sec)	
Rp (from Exhibit 16-11)	
Proportion vehicles arriving on green P	
g(q1)	
g(q2)	
g(q)	

Computation 2-Proportion of TWSC Intersection Time blocked	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
alpha				
beta				
Travel time, t(a) (sec)				
Smoothing Factor, F				
Proportion of conflicting flow, f				
Max platooned flow, V(c,max)				
Min platooned flow, V(c,min)				
Duration of blocked period, t(p)				
Proportion time blocked, p	0.000		0.000	

Computation 3-Platoon Event Periods	Result
p(2)	0.000
p(5)	0.000
p(dom)	
p(subo)	
Constrained or unconstrained?	

Proportion unblocked for minor movements, p(x)	(1) Single-stage Process	(2) Two-Stage Process Stage I	(3) Stage II
p(1)			
p(4)			
p(7)			
p(8)			
p(9)			
p(10)			
p(11)			
p(12)			

Computation 4 and 5

Single-Stage Process

Movement	1	4	7	8	9	10	11	12
	L	L	L	T	R	L	T	R
V c,x		538	1254	1254	448			
s								
Px								
V c,u,x								
C r,x								
C plat,x								

Two-Stage Process

7	8	10	11

	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2
V(c,x)								
s		1500		1500				
P(x)								
V(c,u,x)								
C(r,x)								
C(plat,x)								

Worksheet 6-Impedance and Capacity Equations

Step 1: RT from Minor St.	9	12
Conflicting Flows	448	
Potential Capacity	613	
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity	613	
Probability of Queue free St.	0.99	1.00
Step 2: LT from Major St.	**4**	**1**
Conflicting Flows	538	
Potential Capacity	1035	
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity	1035	
Probability of Queue free St.	1.00	1.00
Maj L-Shared Prob Q free St.	0.99	
Step 3: TH from Minor St.	**8**	**11**
Conflicting Flows	1254	
Potential Capacity	173	
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.99	0.99
Movement Capacity	171	
Probability of Queue free St.	1.00	1.00
Step 4: LT from Minor St.	**7**	**10**
Conflicting Flows	1254	
Potential Capacity	191	
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor		0.99
Maj. L, Min T Adj. Imp Factor.		0.99
Cap. Adj. factor due to Impeding mvmnt	1.00	0.98
Movement Capacity	190	

Worksheet 7-Computation of the Effect of Two-stage Gap Acceptance

Step 3: TH from Minor St.	8	11
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Probability of Queue free St.		

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 3 - Single Stage		
Conflicting Flows	1254	
Potential Capacity	173	
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.99	0.99
Movement Capacity	171	

Result for 2 stage process:		
a		
y		
C t	171	
Probability of Queue free St.	1.00	1.00

Step 4: LT from Minor St.	7	10

Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 3 - Single Stage		
Conflicting Flows	1254	
Potential Capacity	191	
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor		0.99
Maj. L, Min T Adj. Imp Factor.		0.99
Cap. Adj. factor due to Impeding mvmnt	1.00	0.98
Movement Capacity	190	

Results for Two-stage process:		
a		
y		
C t	190	

Worksheet 8-Shared Lane Calculations

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (vph)	406	0	7			
Movement Capacity (vph)	190	171	613			
Shared Lane Capacity (vph)		192				

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
C sep	190	171	613			
Volume	406	0	7			
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						
n max						
C sh		192				
SUM C sep						
n						
C act						

Worksheet 10-Delay, Queue Length, and Level of Service

Movement	1	4	7	8	9	10	11	12
Lane Config		LT		LTR				
v (vph)		5		413				
C(m) (vph)		1035		192				
v/c		0.00		2.15				
95% queue length		0.01		32.40				
Control Delay		8.5		574.7				
LOS		A		F				
Approach Delay				574.7				
Approach LOS				F				

Worksheet 11-Shared Major LT Impedance and Delay

	Movement 2	Movement 5
p(oj)	1.00	1.00
v(il), Volume for stream 2 or 5		796
v(i2), Volume for stream 3 or 6		0
s(il), Saturation flow rate for stream 2 or 5		1700
s(i2), Saturation flow rate for stream 3 or 6		1700
P*(oj)		0.99
d(M,LT), Delay for stream 1 or 4		8.5
N, Number of major street through lanes		1
d(rank,1) Delay for stream 2 or 5		0.1

Alternative 2

at Lexington Road

Summary of All Intervals

Run Number	1	2	3	4	5	Avg
Start Time	6:50	6:50	6:50	6:50	6:50	6:50
End Time	8:00	8:00	8:00	8:00	8:00	8:00
Total Time (min)	70	70	70	70	70	70
Time Recorded (min)	60	60	60	60	60	60
# of Intervals	2	2	2	2	2	2
# of Recorded Intvls	1	1	1	1	1	1
Vehs Entered	1790	1922	1890	1807	1733	1829
Vehs Exited	1801	1916	1870	1801	1744	1827
Starting Vehs	0	0	0	0	0	0
Ending Vehs	46	52	54	50	38	47
Denied Entry Before	0	0	0	0	0	0
Denied Entry After	6	7	1	1	1	3
Travel Distance (mi)	1321	1382	1341	1252	1300	1319
Travel Time (hr)	51.9	56.8	53.6	49.7	50.2	52.5
Total Delay (hr)	11.8	14.9	13.3	11.7	10.8	12.5
Total Stops	717	728	800	689	594	707
Fuel Used (gal)	77.4	81.4	83.2	73.7	73.1	77.7

Interval #0 Information Seeding

Start Time	6:50
End Time	7:00
Total Time (min)	10

Volumes adjusted by Growth Factors.

No data recorded this interval.

Interval #1 Information Recording

Start Time	7:00
End Time	8:00
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	1	2	3	4	5	Avg
Vehs Entered	1790	1922	1890	1807	1733	1829
Vehs Exited	1801	1916	1870	1801	1744	1827
Starting Vehs	0	0	0	0	0	0
Ending Vehs	46	52	54	50	38	47
Denied Entry Before	0	0	0	0	0	0
Denied Entry After	6	7	1	1	1	3
Travel Distance (mi)	1321	1382	1341	1252	1300	1319
Travel Time (hr)	51.9	56.8	53.6	49.7	50.2	52.5
Total Delay (hr)	11.8	14.9	13.3	11.7	10.8	12.5
Total Stops	717	728	800	689	594	707
Fuel Used (gal)	77.4	81.4	83.2	73.7	73.1	77.7

4: Lexington Rd & Cambridge Tpke Performance by movement

Movement	EBT	EBR	WBT	NWL	All
Total Delay (hr)	5.9	1.6	0.2	1.0	8.7
Delay / Veh (s)	21.1	18.3	2.1	21.8	17.1
Total Stops	368	108	59	133	668
Travel Dist (mi)	207.6	64.9	8.0	4.6	285.1
Travel Time (hr)	12.0	3.8	0.4	1.3	17.5
Avg Speed (mph)	21	22	18	4	20
Fuel Used (gal)	12.8	4.4	0.6	0.9	18.8
HC Emissions (g)	37	14	1	2	55
CO Emissions (g)	646	362	41	39	1088
NOx Emissions (g)	65	25	5	7	102
Vehicles Entered	1008	314	342	170	1834
Vehicles Exited	998	310	341	170	1819
Hourly Exit Rate	998	310	341	170	1819
Denied Entry Before	0	0	0	0	0
Denied Entry After	2	1	0	0	3

5: Cambridge Tpke & Performance by movement

Movement	SBL	SET	NWT	NWR	All
Total Delay (hr)	0.0	0.0	0.7	0.0	0.8
Delay / Veh (s)	5.1	0.3	15.2	14.6	5.7
Total Stops	2	0	24	1	27
Travel Dist (mi)	0.0	8.5	256.4	6.3	271.3
Travel Time (hr)	0.0	0.6	8.3	0.2	9.1
Avg Speed (mph)	6	13	31	30	30
Fuel Used (gal)	0.0	2.0	10.2	0.2	12.5
HC Emissions (g)	0	8	22	1	31
CO Emissions (g)	0	446	399	9	855
NOx Emissions (g)	0	34	41	1	76
Vehicles Entered	2	311	178	5	496
Vehicles Exited	2	310	169	4	485
Hourly Exit Rate	2	310	169	4	485
Denied Entry Before	0	0	0	0	0
Denied Entry After	0	0	0	0	0

6: Lexington Rd & Performance by movement

Movement	EBT	WBL	WBT	NBR	All
Total Delay (hr)	0.4	0.0	0.1	0.0	0.5
Delay / Veh (s)	1.3	11.5	1.3	8.9	1.3
Total Stops	0	1	7	4	12
Travel Dist (mi)	25.5	0.2	36.5	0.0	62.3
Travel Time (hr)	1.1	0.0	1.2	0.0	2.4
Avg Speed (mph)	23	15	30	3	27
Fuel Used (gal)	3.4	0.0	2.1	0.0	5.6
HC Emissions (g)	9	0	5	0	14
CO Emissions (g)	335	2	243	0	581
NOx Emissions (g)	43	0	13	0	57
Vehicles Entered	1000	2	343	4	1349
Vehicles Exited	999	2	342	4	1347
Hourly Exit Rate	999	2	342	4	1347
Denied Entry Before	0	0	0	0	0
Denied Entry After	0	0	0	0	0

Total Network Performance

Total Delay (hr)	12.5
Delay / Veh (s)	24.3
Total Stops	707
Travel Dist (mi)	1319.2
Travel Time (hr)	52.5
Avg Speed (mph)	27
Fuel Used (gal)	77.7
HC Emissions (g)	194
CO Emissions (g)	6306
NOx Emissions (g)	481
Vehicles Entered	1874
Vehicles Exited	1827
Hourly Exit Rate	1827
Denied Entry Before	0
Denied Entry After	3

Intersection: 4: Lexington Rd & Cambridge Tpke

Movement	EB	EB	WB	NW
Directions Served	T	R	T	L
Maximum Queue (ft)	591	177	84	106
Average Queue (ft)	198	56	40	73
95th Queue (ft)	412	138	81	110
Link Distance (ft)	1099		67	79
Upstream Blk Time (%)			0.01	0.11
Queuing Penalty (veh)			4	19
Storage Bay Dist (ft)		150		
Storage Blk Time (%)	0.05	0.00		
Queuing Penalty (veh)	15	0		

Intersection: 5: Cambridge Tpke &

Movement	SB	NW
Directions Served	L	TR
Maximum Queue (ft)	22	124
Average Queue (ft)	2	20
95th Queue (ft)	12	75
Link Distance (ft)	17	7910
Upstream Blk Time (%)	0.00	
Queuing Penalty (veh)	0	
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 6: Lexington Rd &

Movement	WB	NB
Directions Served	LT	R
Maximum Queue (ft)	78	31
Average Queue (ft)	7	4
95th Queue (ft)	40	21
Link Distance (ft)	562	17
Upstream Blk Time (%)		0.01
Queuing Penalty (veh)		0
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Nework Summary

Network wide Queuing Penalty: 39

Intersection: 4: Lexington Rd & Cambridge Tpke

Phase	2	4	8
Movement(s) Served	NWL	EBT	WBT
Maximum Green (s)	10.0	42.0	42.0
Minimum Green (s)	4.0	4.0	4.0
Recall	Min	None	None
Avg. Green (s)	8.5	37.3	37.3
g/C Ratio	0.16	0.69	0.69
Cycles Skipped (%)	0	0	0
Cycles @ Minimum (%)	12	0	0
Cycles Maxed Out (%)	45	65	65
Cycles with Peds (%)	0	0	0

Controller Summary
Average Cycle Length (s): 53.8
Number of Complete Cycles : 66

Summary of All Intervals

Run Number	1	2	3	4	5	Avg
Start Time	6:50	6:50	6:50	6:50	6:50	6:50
End Time	8:00	8:00	8:00	8:00	8:00	8:00
Total Time (min)	70	70	70	70	70	70
Time Recorded (min)	60	60	60	60	60	60
# of Intervals	2	2	2	2	2	2
# of Recorded Intvls	1	1	1	1	1	1
Vehs Entered	1591	1641	1596	1538	1463	1566
Vehs Exited	1588	1640	1595	1549	1471	1569
Starting Vehs	0	0	0	0	0	0
Ending Vehs	55	46	46	35	44	44
Denied Entry Before	0	0	0	0	0	0
Denied Entry After	0	0	0	1	0	0
Travel Distance (mi)	1309	1355	1315	1268	1233	1296
Travel Time (hr)	49.5	51.6	49.2	47.9	46.0	48.8
Total Delay (hr)	9.9	10.6	9.7	9.5	8.7	9.7
Total Stops	895	914	892	838	801	868
Fuel Used (gal)	70.8	73.4	73.9	69.6	66.3	70.8

Interval #0 Information Seeding

Start Time	6:50
End Time	7:00
Total Time (min)	10

Volumes adjusted by Growth Factors.
No data recorded this interval.

Interval #1 Information Recording

Start Time	7:00
End Time	8:00
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	1	2	3	4	5	Avg
Vehs Entered	1591	1641	1596	1538	1463	1566
Vehs Exited	1588	1640	1595	1549	1471	1569
Starting Vehs	0	0	0	0	0	0
Ending Vehs	55	46	46	35	44	44
Denied Entry Before	0	0	0	0	0	0
Denied Entry After	0	0	0	1	0	0
Travel Distance (mi)	1309	1355	1315	1268	1233	1296
Travel Time (hr)	49.5	51.6	49.2	47.9	46.0	48.8
Total Delay (hr)	9.9	10.6	9.7	9.5	8.7	9.7
Total Stops	895	914	892	838	801	868
Fuel Used (gal)	70.8	73.4	73.9	69.6	66.3	70.8

4: Lexington Rd & Cambridge Tpke Performance by movement

Movement	EBT	EBR	WBT	NWL	All
Total Delay (hr)	0.8	0.3	1.0	1.3	3.5
Delay / Veh (s)	8.5	7.3	5.2	13.4	8.0
Total Stops	109	68	190	202	569
Travel Dist (mi)	66.4	34.6	16.6	9.8	127.4
Travel Time (hr)	2.7	1.5	1.5	1.8	7.6
Avg Speed (mph)	25	26	11	5	18
Fuel Used (gal)	3.7	2.2	2.0	1.5	9.4
HC Emissions (g)	11	6	5	4	26
CO Emissions (g)	399	239	106	67	810
NOx Emissions (g)	26	13	21	12	73
Vehicles Entered	321	167	715	357	1560
Vehicles Exited	319	165	714	356	1554
Hourly Exit Rate	319	165	714	356	1554
Denied Entry Before	0	0	0	0	0
Denied Entry After	0	0	0	0	0

5: Cambridge Tpke & Performance by movement

Movement	SBL	SET	NWT	NWR	All
Total Delay (hr)	0.0	0.0	2.9	0.0	2.9
Delay / Veh (s)	4.9	0.2	28.3	30.7	19.5
Total Stops	6	0	119	1	126
Travel Dist (mi)	0.1	4.5	536.9	7.7	549.2
Travel Time (hr)	0.0	0.3	18.7	0.3	19.3
Avg Speed (mph)	6	13	29	28	28
Fuel Used (gal)	0.0	1.1	21.6	0.3	23.0
HC Emissions (g)	0	5	46	1	51
CO Emissions (g)	1	257	811	11	1080
NOx Emissions (g)	0	19	79	1	98
Vehicles Entered	6	166	375	6	553
Vehicles Exited	6	165	357	5	533
Hourly Exit Rate	6	165	357	5	533
Denied Entry Before	0	0	0	0	0
Denied Entry After	0	0	0	0	0

6: Lexington Rd & Performance by movement

Movement	EBT	WBL	WBT	NBR	All
Total Delay (hr)	0.1	0.0	1.3	0.0	1.4
Delay / Veh (s)	1.1	5.7	6.4	2.8	4.8
Total Stops	0	2	167	4	173
Travel Dist (mi)	8.2	0.6	76.1	0.1	84.9
Travel Time (hr)	0.3	0.0	3.6	0.0	4.0
Avg Speed (mph)	24	20	22	6	22
Fuel Used (gal)	1.2	0.0	4.8	0.0	6.1
HC Emissions (g)	4	0	15	0	19
CO Emissions (g)	226	5	583	0	814
NOx Emissions (g)	19	0	35	0	55
Vehicles Entered	319	6	717	5	1047
Vehicles Exited	319	6	713	5	1043
Hourly Exit Rate	319	6	713	5	1043
Denied Entry Before	0	0	0	0	0
Denied Entry After	0	0	0	0	0

Total Network Performance

Total Delay (hr)	9.7
Delay / Veh (s)	21.9
Total Stops	868
Travel Dist (mi)	1295.8
Travel Time (hr)	48.8
Avg Speed (mph)	27
Fuel Used (gal)	70.8
HC Emissions (g)	181
CO Emissions (g)	6353
NOx Emissions (g)	474
Vehicles Entered	1613
Vehicles Exited	1569
Hourly Exit Rate	1569
Denied Entry Before	0
Denied Entry After	0

Intersection: 4: Lexington Rd & Cambridge Tpke

Movement	EB	EB	WB	NW
Directions Served	T	R	T	L
Maximum Queue (ft)	146	82	98	107
Average Queue (ft)	63	31	75	87
95th Queue (ft)	117	57	91	107
Link Distance (ft)	1099		67	79
Upstream Blk Time (%)			0.17	0.22
Queuing Penalty (veh)			121	79
Storage Bay Dist (ft)		150		
Storage Blk Time (%)	0.00			
Queuing Penalty (veh)	0			

Intersection: 5: Cambridge Tpke &

Movement	SB	NW
Directions Served	L	TR
Maximum Queue (ft)	28	270
Average Queue (ft)	5	78
95th Queue (ft)	22	185
Link Distance (ft)	17	7910
Upstream Blk Time (%)	0.01	
Queuing Penalty (veh)	0	
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 6: Lexington Rd &

Movement	WB	NB
Directions Served	LT	R
Maximum Queue (ft)	288	32
Average Queue (ft)	103	5
95th Queue (ft)	211	23
Link Distance (ft)	562	17
Upstream Blk Time (%)		0.00
Queuing Penalty (veh)		0
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Nework Summary

Network wide Queuing Penalty: 200

Intersection: 4: Lexington Rd & Cambridge Tpke

Phase	2	4	8
Movement(s) Served	NWL	EBT	WBT
Maximum Green (s)	16.0	36.0	36.0
Minimum Green (s)	4.0	4.0	4.0
Recall	Min	None	None
Avg. Green (s)	13.8	23.8	23.8
g/C Ratio	0.30	0.52	0.52
Cycles Skipped (%)	0	0	0
Cycles @ Minimum (%)	5	0	0
Cycles Maxed Out (%)	38	17	17
Cycles with Peds (%)	0	0	0

Controller Summary
Average Cycle Length (s): 45.4
Number of Complete Cycles : 78

Summary of All Intervals

Run Number	1	3	4	5	Avg
Start Time	6:50	6:50	6:50	6:50	6:50
End Time	8:00	8:00	8:00	8:00	8:00
Total Time (min)	70	70	70	70	70
Time Recorded (min)	60	60	60	60	60
# of Intervals	2	2	2	2	2
# of Recorded Intvls	1	1	1	1	1
Vehs Entered	1942	2048	1957	1902	1962
Vehs Exited	1950	2027	1949	1907	1959
Starting Vehs	0	0	0	0	0
Ending Vehs	56	59	58	49	54
Denied Entry Before	0	0	0	0	0
Denied Entry After	5	15	6	2	8
Travel Distance (mi)	1426	1464	1371	1414	1419
Travel Time (hr)	58.7	81.7	59.2	60.1	64.9
Total Delay (hr)	15.5	37.6	17.6	17.2	22.0
Total Stops	865	1610	1041	746	1064
Fuel Used (gal)	85.1	105.0	84.0	83.0	89.3

Interval #0 Information Seeding

Start Time	6:50
End Time	7:00
Total Time (min)	10

Volumes adjusted by Growth Factors.

No data recorded this interval.

Interval #1 Information Recording

Start Time	7:00
End Time	8:00
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	1	3	4	5	Avg
Vehs Entered	1942	2048	1957	1902	1962
Vehs Exited	1950	2027	1949	1907	1959
Starting Vehs	0	0	0	0	0
Ending Vehs	56	59	58	49	54
Denied Entry Before	0	0	0	0	0
Denied Entry After	5	15	6	2	8
Travel Distance (mi)	1426	1464	1371	1414	1419
Travel Time (hr)	58.7	81.7	59.2	60.1	64.9
Total Delay (hr)	15.5	37.6	17.6	17.2	22.0
Total Stops	865	1610	1041	746	1064
Fuel Used (gal)	85.1	105.0	84.0	83.0	89.3

4: Lexington Rd & Cambridge Tpke Performance by movement

Movement	EBT	EBR	WBT	NWL	All
Total Delay (hr)	12.2	3.5	0.2	1.4	17.3
Delay / Veh (s)	41.3	37.8	2.3	27.2	31.8
Total Stops	593	174	69	154	990
Travel Dist (mi)	220.3	68.7	8.8	5.1	302.9
Travel Time (hr)	18.7	5.8	0.5	1.7	26.7
Avg Speed (mph)	18	19	17	3	17
Fuel Used (gal)	17.8	5.8	0.7	1.2	25.5
HC Emissions (g)	61	21	2	3	86
CO Emissions (g)	772	375	41	53	1241
NOx Emissions (g)	85	30	6	10	131
Vehicles Entered	1069	333	378	187	1967
Vehicles Exited	1057	329	378	187	1951
Hourly Exit Rate	1057	329	378	187	1951
Denied Entry Before	0	0	0	0	0
Denied Entry After	6	2	0	0	8

5: Cambridge Tpke & Performance by movement

Movement	SBL	SET	NWT	NWR	All
Total Delay (hr)	0.0	0.0	1.1	0.0	1.2
Delay / Veh (s)	7.4	0.3	21.4	19.8	8.1
Total Stops	2	0	51	1	54
Travel Dist (mi)	0.0	9.0	282.2	8.4	299.7
Travel Time (hr)	0.0	0.7	9.4	0.3	10.4
Avg Speed (mph)	5	13	30	30	29
Fuel Used (gal)	0.0	2.1	11.4	0.3	13.8
HC Emissions (g)	0	9	24	1	34
CO Emissions (g)	0	468	442	13	923
NOx Emissions (g)	0	36	45	1	82
Vehicles Entered	2	329	197	6	534
Vehicles Exited	2	328	186	5	521
Hourly Exit Rate	2	328	186	5	521
Denied Entry Before	0	0	0	0	0
Denied Entry After	0	0	0	0	0

6: Lexington Rd & Performance by movement

Movement	EBT	WBL	WBT	NBR	All
Total Delay (hr)	0.4	0.0	0.2	0.0	0.6
Delay / Veh (s)	1.4	16.3	1.7	11.5	1.5
Total Stops	0	1	14	5	20
Travel Dist (mi)	27.0	0.2	40.3	0.1	67.6
Travel Time (hr)	1.2	0.0	1.4	0.0	2.6
Avg Speed (mph)	23	14	30	3	26
Fuel Used (gal)	3.7	0.0	2.4	0.0	6.1
HC Emissions (g)	9	0	6	0	15
CO Emissions (g)	329	3	264	1	597
NOx Emissions (g)	45	0	15	0	60
Vehicles Entered	1058	2	377	5	1442
Vehicles Exited	1056	2	377	5	1440
Hourly Exit Rate	1056	2	377	5	1440
Denied Entry Before	0	0	0	0	0
Denied Entry After	0	0	0	0	0

Total Network Performance

Total Delay (hr)	22.0
Delay / Veh (s)	39.8
Total Stops	1064
Travel Dist (mi)	1418.6
Travel Time (hr)	64.9
Avg Speed (mph)	25
Fuel Used (gal)	89.3
HC Emissions (g)	237
CO Emissions (g)	6829
NOx Emissions (g)	539
Vehicles Entered	2013
Vehicles Exited	1959
Hourly Exit Rate	1959
Denied Entry Before	0
Denied Entry After	8

Intersection: 4: Lexington Rd & Cambridge Tpke

Movement	EB	EB	WB	NW
Directions Served	T	R	T	L
Maximum Queue (ft)	842	185	81	98
Average Queue (ft)	348	73	46	80
95th Queue (ft)	828	174	85	109
Link Distance (ft)	1099		67	79
Upstream Blk Time (%)	0.01		0.02	0.21
Queuing Penalty (veh)	0		7	39
Storage Bay Dist (ft)		150		
Storage Blk Time (%)	0.09	0.00		
Queuing Penalty (veh)	28	0		

Intersection: 5: Cambridge Tpke &

Movement	SB	NW
Directions Served	L	TR
Maximum Queue (ft)	28	161
Average Queue (ft)	2	38
95th Queue (ft)	15	115
Link Distance (ft)	17	7910
Upstream Blk Time (%)	0.00	
Queuing Penalty (veh)	0	
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 6: Lexington Rd &

Movement	WB	NB
Directions Served	LT	R
Maximum Queue (ft)	138	31
Average Queue (ft)	13	5
95th Queue (ft)	66	24
Link Distance (ft)	562	17
Upstream Blk Time (%)		0.02
Queuing Penalty (veh)		0
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Nework Summary

Network wide Queuing Penalty: 75

Intersection: 4: Lexington Rd & Cambridge Tpke

Phase	2	4	8
Movement(s) Served	NWL	EBT	WBT
Maximum Green (s)	10.0	42.0	42.0
Minimum Green (s)	4.0	4.0	4.0
Recall	Min	None	None
Avg. Green (s)	8.8	39.9	39.9
g/C Ratio	0.15	0.70	0.70
Cycles Skipped (%)	0	0	0
Cycles @ Minimum (%)	6	0	0
Cycles Maxed Out (%)	57	84	84
Cycles with Peds (%)	0	0	0

Controller Summary
Average Cycle Length (s): 56.9
Number of Complete Cycles : 62

Summary of All Intervals

Run Number	1	2	3	4	5	Avg
Start Time	6:50	6:50	6:50	6:50	6:50	6:50
End Time	8:00	8:00	8:00	8:00	8:00	8:00
Total Time (min)	70	70	70	70	70	70
Time Recorded (min)	60	60	60	60	60	60
# of Intervals	2	2	2	2	2	2
# of Recorded Intvls	1	1	1	1	1	1
Vehs Entered	1732	1784	1743	1696	1581	1707
Vehs Exited	1728	1782	1738	1692	1595	1707
Starting Vehs	0	0	0	0	0	0
Ending Vehs	62	54	55	50	46	52
Denied Entry Before	0	0	0	0	0	0
Denied Entry After	0	0	2	0	0	0
Travel Distance (mi)	1422	1477	1438	1385	1320	1408
Travel Time (hr)	55.3	57.8	55.2	53.7	49.7	54.3
Total Delay (hr)	12.2	13.0	12.0	11.7	9.8	11.7
Total Stops	1068	1116	1046	973	866	1013
Fuel Used (gal)	77.7	80.5	81.5	74.9	71.5	77.2

Interval #0 Information Seeding

Start Time	6:50
End Time	7:00
Total Time (min)	10

Volumes adjusted by Growth Factors.

No data recorded this interval.

Interval #1 Information Recording

Start Time	7:00
End Time	8:00
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	1	2	3	4	5	Avg
Vehs Entered	1732	1784	1743	1696	1581	1707
Vehs Exited	1728	1782	1738	1692	1595	1707
Starting Vehs	0	0	0	0	0	0
Ending Vehs	62	54	55	50	46	52
Denied Entry Before	0	0	0	0	0	0
Denied Entry After	0	0	2	0	0	0
Travel Distance (mi)	1422	1477	1438	1385	1320	1408
Travel Time (hr)	55.3	57.8	55.2	53.7	49.7	54.3
Total Delay (hr)	12.2	13.0	12.0	11.7	9.8	11.7
Total Stops	1068	1116	1046	973	866	1013
Fuel Used (gal)	77.7	80.5	81.5	74.9	71.5	77.2

4: Lexington Rd & Cambridge Tpke Performance by movement

Movement	EBT	EBR	WBT	NWL	All
Total Delay (hr)	0.9	0.4	1.1	1.6	4.0
Delay / Veh (s)	9.1	7.4	5.2	15.0	8.5
Total Stops	121	70	189	217	597
Travel Dist (mi)	72.6	37.6	18.2	10.6	139.0
Travel Time (hr)	3.1	1.7	1.7	2.1	8.5
Avg Speed (mph)	25	26	11	5	17
Fuel Used (gal)	4.2	2.2	2.3	1.7	10.4
HC Emissions (g)	12	7	6	5	28
CO Emissions (g)	421	246	115	77	859
NOx Emissions (g)	28	14	24	15	81
Vehicles Entered	351	182	781	390	1704
Vehicles Exited	349	180	780	387	1696
Hourly Exit Rate	349	180	780	387	1696
Denied Entry Before	0	0	0	0	0
Denied Entry After	0	0	0	0	0

5: Cambridge Tpke & Performance by movement

Movement	SBL	SET	NWT	NWR	All
Total Delay (hr)	0.0	0.0	3.6	0.1	3.7
Delay / Veh (s)	5.0	0.2	32.6	34.1	22.5
Total Stops	6	0	173	2	181
Travel Dist (mi)	0.1	4.9	582.6	10.4	598.1
Travel Time (hr)	0.0	0.4	20.8	0.4	21.5
Avg Speed (mph)	6	13	28	28	28
Fuel Used (gal)	0.0	1.2	23.6	0.4	25.2
HC Emissions (g)	0	5	50	1	57
CO Emissions (g)	1	282	884	16	1182
NOx Emissions (g)	0	20	85	1	107
Vehicles Entered	6	180	407	8	601
Vehicles Exited	6	180	389	7	582
Hourly Exit Rate	6	180	389	7	582
Denied Entry Before	0	0	0	0	0
Denied Entry After	0	0	0	0	0

6: Lexington Rd & Performance by movement

Movement	EBT	WBL	WBT	NBR	All
Total Delay (hr)	0.1	0.0	1.8	0.0	1.9
Delay / Veh (s)	1.1	6.3	8.1	2.2	5.9
Total Stops	0	2	227	6	235
Travel Dist (mi)	8.9	0.6	83.0	0.1	92.6
Travel Time (hr)	0.4	0.0	4.3	0.0	4.7
Avg Speed (mph)	24	19	20	7	20
Fuel Used (gal)	1.3	0.0	5.6	0.0	6.9
HC Emissions (g)	5	0	17	0	21
CO Emissions (g)	228	5	603	0	836
NOx Emissions (g)	20	0	39	0	60
Vehicles Entered	349	6	784	7	1146
Vehicles Exited	349	6	779	7	1141
Hourly Exit Rate	349	6	779	7	1141
Denied Entry Before	0	0	0	0	0
Denied Entry After	0	0	0	0	0

Total Network Performance

Total Delay (hr)	11.7
Delay / Veh (s)	24.4
Total Stops	1013
Travel Dist (mi)	1408.4
Travel Time (hr)	54.3
Avg Speed (mph)	26
Fuel Used (gal)	77.2
HC Emissions (g)	197
CO Emissions (g)	6786
NOx Emissions (g)	516
Vehicles Entered	1759
Vehicles Exited	1707
Hourly Exit Rate	1707
Denied Entry Before	0
Denied Entry After	0

Intersection: 4: Lexington Rd & Cambridge Tpke

Movement	EB	EB	WB	NW
Directions Served	T	R	T	L
Maximum Queue (ft)	193	80	100	127
Average Queue (ft)	69	32	77	91
95th Queue (ft)	132	58	92	114
Link Distance (ft)	1099		67	79
Upstream Blk Time (%)			0.20	0.27
Queuing Penalty (veh)			153	107
Storage Bay Dist (ft)		150		
Storage Blk Time (%)	0.00	0.00		
Queuing Penalty (veh)	0	0		

Intersection: 5: Cambridge Tpke &

Movement	SB	NW
Directions Served	L	TR
Maximum Queue (ft)	28	304
Average Queue (ft)	5	105
95th Queue (ft)	22	234
Link Distance (ft)	17	7910
Upstream Blk Time (%)	0.01	
Queuing Penalty (veh)	0	
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 6: Lexington Rd &

Movement	WB	NB
Directions Served	LT	R
Maximum Queue (ft)	352	32
Average Queue (ft)	132	7
95th Queue (ft)	265	27
Link Distance (ft)	562	17
Upstream Blk Time (%)		0.01
Queuing Penalty (veh)		0
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Nework Summary

Network wide Queuing Penalty: 260

Intersection: 4: Lexington Rd & Cambridge Tpke

Phase	2	4	8
Movement(s) Served	NWL	EBT	WBT
Maximum Green (s)	16.0	36.0	36.0
Minimum Green (s)	4.0	4.0	4.0
Recall	Min	None	None
Avg. Green (s)	14.7	27.0	27.0
g/C Ratio	0.29	0.54	0.54
Cycles Skipped (%)	0	0	0
Cycles @ Minimum (%)	4	0	0
Cycles Maxed Out (%)	54	29	29
Cycles with Peds (%)	0	0	0

Controller Summary
Average Cycle Length (s): 49.9
Number of Complete Cycles : 71

Alternative 3

at Lexington Road

Summary of All Intervals

Run Number	1	2	3	4	5	Avg
Start Time	6:50	6:50	6:50	6:50	6:50	6:50
End Time	8:00	8:00	8:00	8:00	8:00	8:00
Total Time (min)	70	70	70	70	70	70
Time Recorded (min)	60	60	60	60	60	60
# of Intervals	2	2	2	2	2	2
# of Recorded Intvls	1	1	1	1	1	1
Vehs Entered	1767	1876	1820	1776	1744	1797
Vehs Exited	1760	1877	1821	1766	1746	1794
Starting Vehs	0	0	0	0	0	0
Ending Vehs	21	22	22	27	14	20
Denied Entry Before	0	0	0	0	0	0
Denied Entry After	0	0	0	0	0	0
Travel Distance (mi)	384	409	397	385	381	391
Travel Time (hr)	19.8	21.5	20.3	19.6	19.3	20.1
Total Delay (hr)	5.5	6.3	5.6	5.3	5.2	5.6
Total Stops	213	254	232	252	191	227
Fuel Used (gal)	45.3	46.2	45.8	43.1	42.7	44.6

Interval #0 Information Seeding

Start Time	6:50
End Time	7:00
Total Time (min)	10

Volumes adjusted by Growth Factors.

No data recorded this interval.

Interval #1 Information Recording

Start Time	7:00
End Time	8:00
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	1	2	3	4	5	Avg
Vehs Entered	1767	1876	1820	1776	1744	1797
Vehs Exited	1760	1877	1821	1766	1746	1794
Starting Vehs	0	0	0	0	0	0
Ending Vehs	21	22	22	27	14	20
Denied Entry Before	0	0	0	0	0	0
Denied Entry After	0	0	0	0	0	0
Travel Distance (mi)	384	409	397	385	381	391
Travel Time (hr)	19.8	21.5	20.3	19.6	19.3	20.1
Total Delay (hr)	5.5	6.3	5.6	5.3	5.2	5.6
Total Stops	213	254	232	252	191	227
Fuel Used (gal)	45.3	46.2	45.8	43.1	42.7	44.6

6: Lexington Rd & Performance by movement

Movement	EBT	EBR	WBL	WBT	NWL	NWR	All
Total Delay (hr)	3.2	0.8	0.0	0.5	0.5	0.0	5.1
Delay / Veh (s)	11.7	10.5	4.5	5.2	9.8	12.5	10.1
Total Stops	4	1	0	43	146	5	199
Travel Dist (mi)	79.8	23.7	0.1	31.6	18.3	0.7	154.2
Travel Time (hr)	5.7	1.7	0.0	1.5	1.2	0.1	10.2
Avg Speed (mph)	16	15	20	22	15	14	16
Fuel Used (gal)	6.5	1.9	0.0	2.8	1.6	0.1	12.9
HC Emissions (g)	17	5	0	9	5	0	36
CO Emissions (g)	359	107	1	403	191	6	1067
NOx Emissions (g)	50	15	0	28	13	0	107
Vehicles Entered	987	293	1	329	188	7	1805
Vehicles Exited	981	291	1	328	187	7	1795
Hourly Exit Rate	981	291	1	328	187	7	1795
Denied Entry Before	0	0	0	0	0	0	0
Denied Entry After	0	0	0	0	0	0	0

Total Network Performance

Total Delay (hr)	5.6
Delay / Veh (s)	11.1
Total Stops	227
Travel Dist (mi)	391.2
Travel Time (hr)	20.1
Avg Speed (mph)	20
Fuel Used (gal)	44.6
HC Emissions (g)	125
CO Emissions (g)	6320
NOx Emissions (g)	431
Vehicles Entered	1814
Vehicles Exited	1794
Hourly Exit Rate	1794
Denied Entry Before	0
Denied Entry After	0

Intersection: 6: Lexington Rd &

Movement	EB	WB	NW
Directions Served	UTR	ULT	ULR
Maximum Queue (ft)	87	61	108
Average Queue (ft)	4	26	54
95th Queue (ft)	32	55	90
Link Distance (ft)	428	507	517
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Nework Summary

Network wide Queuing Penalty: 0

Summary of All Intervals

Run Number	1	2	3	4	5	Avg
Start Time	6:50	6:50	6:50	6:50	6:50	6:50
End Time	8:00	8:00	8:00	8:00	8:00	8:00
Total Time (min)	70	70	70	70	70	70
Time Recorded (min)	60	60	60	60	60	60
# of Intervals	2	2	2	2	2	2
# of Recorded Intvls	1	1	1	1	1	1
Vehs Entered	1608	1611	1616	1552	1510	1580
Vehs Exited	1601	1607	1617	1548	1513	1578
Starting Vehs	0	0	0	0	0	0
Ending Vehs	21	15	19	19	15	18
Denied Entry Before	0	0	0	0	0	0
Denied Entry After	0	0	0	0	1	0
Travel Distance (mi)	352	352	354	339	331	346
Travel Time (hr)	17.2	16.9	17.0	16.4	15.7	16.6
Total Delay (hr)	4.0	3.6	3.7	3.7	3.3	3.6
Total Stops	535	470	440	455	401	458
Fuel Used (gal)	37.2	36.2	37.6	34.6	34.6	36.0

Interval #0 Information Seeding

Start Time	6:50
End Time	7:00
Total Time (min)	10

Volumes adjusted by Growth Factors.

No data recorded this interval.

Interval #1 Information Recording

Start Time	7:00
End Time	8:00
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	1	2	3	4	5	Avg
Vehs Entered	1608	1611	1616	1552	1510	1580
Vehs Exited	1601	1607	1617	1548	1513	1578
Starting Vehs	0	0	0	0	0	0
Ending Vehs	21	15	19	19	15	18
Denied Entry Before	0	0	0	0	0	0
Denied Entry After	0	0	0	0	1	0
Travel Distance (mi)	352	352	354	339	331	346
Travel Time (hr)	17.2	16.9	17.0	16.4	15.7	16.6
Total Delay (hr)	4.0	3.6	3.7	3.7	3.3	3.6
Total Stops	535	470	440	455	401	458
Fuel Used (gal)	37.2	36.2	37.6	34.6	34.6	36.0

6: Lexington Rd & Performance by movement

Movement	EBT	EBR	WBL	WBT	NWL	NWR	All
Total Delay (hr)	0.5	0.2	0.0	1.9	0.6	0.0	3.2
Delay / Veh (s)	5.2	4.1	7.8	9.6	6.0	4.9	7.3
Total Stops	1	1	2	288	147	1	440
Travel Dist (mi)	25.9	13.4	0.6	68.7	36.3	0.6	145.5
Travel Time (hr)	1.3	0.7	0.0	4.1	2.0	0.0	8.2
Avg Speed (mph)	20	20	18	17	18	19	18
Fuel Used (gal)	2.1	1.1	0.0	5.4	2.7	0.0	11.5
HC Emissions (g)	7	4	0	17	9	0	38
CO Emissions (g)	291	161	6	602	362	7	1429
NOx Emissions (g)	25	14	0	47	26	0	112
Vehicles Entered	319	166	6	718	372	6	1587
Vehicles Exited	317	165	6	714	369	6	1577
Hourly Exit Rate	317	165	6	714	369	6	1577
Denied Entry Before	0	0	0	0	0	0	0
Denied Entry After	0	0	0	0	0	0	0

Total Network Performance

Total Delay (hr)	3.6
Delay / Veh (s)	8.3
Total Stops	458
Travel Dist (mi)	345.5
Travel Time (hr)	16.6
Avg Speed (mph)	21
Fuel Used (gal)	36.0
HC Emissions (g)	116
CO Emissions (g)	6117
NOx Emissions (g)	407
Vehicles Entered	1596
Vehicles Exited	1578
Hourly Exit Rate	1578
Denied Entry Before	0
Denied Entry After	0

Intersection: 6: Lexington Rd &

Movement	EB	WB	NW
Directions Served	UTR	ULT	ULR
Maximum Queue (ft)	38	245	151
Average Queue (ft)	2	85	54
95th Queue (ft)	18	176	100
Link Distance (ft)	428	507	517
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Nework Summary

Network wide Queuing Penalty: 0

Summary of All Intervals

Run Number	1	2	3	4	5	Avg
Start Time	6:50	6:50	6:50	6:50	6:50	6:50
End Time	8:00	8:00	8:00	8:00	8:00	8:00
Total Time (min)	70	70	70	70	70	70
Time Recorded (min)	60	60	60	60	60	60
# of Intervals	2	2	2	2	2	2
# of Recorded Intvls	1	1	1	1	1	1
Vehs Entered	1872	2053	1963	1920	1895	1941
Vehs Exited	1878	2054	1966	1909	1896	1940
Starting Vehs	0	0	0	0	0	0
Ending Vehs	18	24	21	27	16	21
Denied Entry Before	0	0	0	0	0	0
Denied Entry After	0	3	0	0	0	0
Travel Distance (mi)	409	447	428	417	413	423
Travel Time (hr)	21.8	27.7	23.7	22.9	22.1	23.6
Total Delay (hr)	6.6	11.2	7.9	7.5	6.7	8.0
Total Stops	256	295	272	275	225	264
Fuel Used (gal)	47.4	54.5	50.2	48.0	49.3	49.9

Interval #0 Information Seeding

Start Time	6:50
End Time	7:00
Total Time (min)	10

Volumes adjusted by Growth Factors.

No data recorded this interval.

Interval #1 Information Recording

Start Time	7:00
End Time	8:00
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	1	2	3	4	5	Avg
Vehs Entered	1872	2053	1963	1920	1895	1941
Vehs Exited	1878	2054	1966	1909	1896	1940
Starting Vehs	0	0	0	0	0	0
Ending Vehs	18	24	21	27	16	21
Denied Entry Before	0	0	0	0	0	0
Denied Entry After	0	3	0	0	0	0
Travel Distance (mi)	409	447	428	417	413	423
Travel Time (hr)	21.8	27.7	23.7	22.9	22.1	23.6
Total Delay (hr)	6.6	11.2	7.9	7.5	6.7	8.0
Total Stops	256	295	272	275	225	264
Fuel Used (gal)	47.4	54.5	50.2	48.0	49.3	49.9

6: Lexington Rd & Performance by movement

Movement	EBT	EBR	WBL	WBT	NWL	NWR	All
Total Delay (hr)	4.8	1.3	0.0	0.6	0.7	0.0	7.4
Delay / Veh (s)	16.2	15.3	5.7	5.5	12.5	13.2	13.7
Total Stops	6	1	0	62	159	7	235
Travel Dist (mi)	86.5	25.7	0.1	34.9	18.4	0.9	166.6
Travel Time (hr)	7.5	2.3	0.0	1.7	1.4	0.1	12.9
Avg Speed (mph)	14	14	20	21	14	13	15
Fuel Used (gal)	7.6	2.3	0.0	3.1	1.7	0.1	14.7
HC Emissions (g)	21	7	0	10	5	0	44
CO Emissions (g)	341	102	2	462	204	10	1121
NOx Emissions (g)	50	15	0	31	14	1	111
Vehicles Entered	1069	318	1	365	189	9	1951
Vehicles Exited	1064	316	1	363	187	9	1940
Hourly Exit Rate	1064	316	1	363	187	9	1940
Denied Entry Before	0	0	0	0	0	0	0
Denied Entry After	0	0	0	0	0	0	0

Total Network Performance

Total Delay (hr)	8.0
Delay / Veh (s)	14.8
Total Stops	264
Travel Dist (mi)	422.8
Travel Time (hr)	23.6
Avg Speed (mph)	19
Fuel Used (gal)	49.9
HC Emissions (g)	137
CO Emissions (g)	6555
NOx Emissions (g)	464
Vehicles Entered	1961
Vehicles Exited	1940
Hourly Exit Rate	1940
Denied Entry Before	0
Denied Entry After	0

Intersection: 6: Lexington Rd &

Movement	EB	WB	NW
Directions Served	UTR	ULT	ULR
Maximum Queue (ft)	88	62	127
Average Queue (ft)	5	29	60
95th Queue (ft)	39	57	103
Link Distance (ft)	428	507	517
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Nework Summary

Network wide Queuing Penalty: 0

Summary of All Intervals

Run Number	1	2	3	4	5	Avg
Start Time	6:50	6:50	6:50	6:50	6:50	6:50
End Time	8:00	8:00	8:00	8:00	8:00	8:00
Total Time (min)	70	70	70	70	70	70
Time Recorded (min)	60	60	60	60	60	60
# of Intervals	2	2	2	2	2	2
# of Recorded Intvls	1	1	1	1	1	1
Vehs Entered	1730	1755	1747	1732	1628	1717
Vehs Exited	1730	1755	1754	1727	1622	1718
Starting Vehs	0	0	0	0	0	0
Ending Vehs	16	17	20	22	24	20
Denied Entry Before	0	0	0	0	0	0
Denied Entry After	0	0	0	0	0	0
Travel Distance (mi)	379	384	383	379	356	376
Travel Time (hr)	18.9	20.1	20.2	19.5	17.5	19.2
Total Delay (hr)	4.6	5.6	5.7	5.3	4.1	5.1
Total Stops	633	776	746	678	539	676
Fuel Used (gal)	41.4	39.4	41.3	41.1	38.1	40.3

Interval #0 Information Seeding

Start Time	6:50
End Time	7:00
Total Time (min)	10

Volumes adjusted by Growth Factors.

No data recorded this interval.

Interval #1 Information Recording

Start Time	7:00
End Time	8:00
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	1	2	3	4	5	Avg
Vehs Entered	1730	1755	1747	1732	1628	1717
Vehs Exited	1730	1755	1754	1727	1622	1718
Starting Vehs	0	0	0	0	0	0
Ending Vehs	16	17	20	22	24	20
Denied Entry Before	0	0	0	0	0	0
Denied Entry After	0	0	0	0	0	0
Travel Distance (mi)	379	384	383	379	356	376
Travel Time (hr)	18.9	20.1	20.2	19.5	17.5	19.2
Total Delay (hr)	4.6	5.6	5.7	5.3	4.1	5.1
Total Stops	633	776	746	678	539	676
Fuel Used (gal)	41.4	39.4	41.3	41.1	38.1	40.3

6: Lexington Rd & Performance by movement

Movement	EBT	EBR	WBL	WBT	NWL	NWR	All
Total Delay (hr)	0.5	0.2	0.0	2.7	1.0	0.0	4.5
Delay / Veh (s)	5.4	4.2	14.2	12.6	8.6	9.3	9.3
Total Stops	2	1	4	416	217	5	645
Travel Dist (mi)	28.6	14.2	0.5	74.7	39.7	0.7	158.4
Travel Time (hr)	1.5	0.7	0.0	5.1	2.5	0.0	9.9
Avg Speed (mph)	20	20	14	15	16	16	17
Fuel Used (gal)	2.4	1.2	0.0	6.0	3.2	0.1	12.9
HC Emissions (g)	8	4	0	18	10	0	41
CO Emissions (g)	326	167	4	579	393	7	1475
NOx Emissions (g)	29	14	0	46	28	1	118
Vehicles Entered	353	175	5	780	408	7	1728
Vehicles Exited	351	175	5	776	404	7	1718
Hourly Exit Rate	351	175	5	776	404	7	1718
Denied Entry Before	0	0	0	0	0	0	0
Denied Entry After	0	0	0	0	0	0	0

Total Network Performance

Total Delay (hr)	5.1
Delay / Veh (s)	10.6
Total Stops	676
Travel Dist (mi)	376.3
Travel Time (hr)	19.2
Avg Speed (mph)	20
Fuel Used (gal)	40.3
HC Emissions (g)	126
CO Emissions (g)	6481
NOx Emissions (g)	446
Vehicles Entered	1738
Vehicles Exited	1718
Hourly Exit Rate	1718
Denied Entry Before	0
Denied Entry After	0

Intersection: 6: Lexington Rd &

Movement	EB	WB	NW
Directions Served	UTR	ULT	ULR
Maximum Queue (ft)	35	330	179
Average Queue (ft)	2	118	74
95th Queue (ft)	17	242	139
Link Distance (ft)	428	507	517
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Nework Summary

Network wide Queuing Penalty: 0

Alternative 4 and 5

at Lexington Road

HCS+: Unsignalized Intersections Release 5.6

TWO-WAY STOP CONTROL SUMMARY

Analyst: LBF
Agency/Co.: Louis Berger
Date Performed: 11/13/2012
Analysis Time Period: AM Peak
Intersection: Lexington & Cambridge
Jurisdiction: Town of Concord
Units: U. S. Customary
Analysis Year: 2012
Project ID: CKE440A0
East/West Street: Lexington Road
North/South Street: Cambridge Tpke
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		1286	0	2	340	
Peak-Hour Factor, PHF		0.96	0.96	0.96	0.96	
Hourly Flow Rate, HFR		1339	0	2	354	
Percent Heavy Vehicles		--	--	2	--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes		1	0	0	1	
Configuration			TR		LT	
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	175	0	6			
Peak Hour Factor, PHF	0.96	1.00	0.96			
Hourly Flow Rate, HFR	182	0	6			
Percent Heavy Vehicles	2	2	2			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No	/		/
Lanes	0	1	0			
Configuration		LTR				

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		LT		LTR				
v (vph)		2		188				
C(m) (vph)		515		104				
v/c		0.00		1.81				
95% queue length		0.01		15.15				
Control Delay		12.0		468.7				
LOS		B		F				
Approach Delay				468.7				
Approach LOS				F				

HCS+: Unsignalized Intersections Release 5.6

Phone: Fax:
E-Mail:

TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst: LBF
Agency/Co.: Louis Berger
Date Performed: 11/13/2012
Analysis Time Period: AM Peak
Intersection: Lexington & Cambridge
Jurisdiction: Town of Concord
Units: U. S. Customary
Analysis Year: 2012
Project ID: CKE440A0
East/West Street: Lexington Road
North/South Street: Cambridge Tpke
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street Movements	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		1286	0	2	340	
Peak-Hour Factor, PHF		0.96	0.96	0.96	0.96	
Peak-15 Minute Volume		335	0	1	89	
Hourly Flow Rate, HFR		1339	0	2	354	
Percent Heavy Vehicles		--	--	2	--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes		1	0	0	1	
Configuration			TR	LT		
Upstream Signal?		No			No	

Minor Street Movements	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	175	0	6			
Peak Hour Factor, PHF	0.96	1.00	0.96			
Peak-15 Minute Volume	46	0	2			
Hourly Flow Rate, HFR	182	0	6			
Percent Heavy Vehicles	2	2	2			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No	/		/
RT Channelized?						
Lanes	0	1	0			
Configuration		LTR				

Pedestrian Volumes and Adjustments

Movements	13	14	15	16
Flow (ped/hr)	0	0	0	0

Lane Width (ft)	12.0	12.0	12.0	12.0
Walking Speed (ft/sec)	4.0	4.0	4.0	4.0
Percent Blockage	0	0	0	0

Upstream Signal Data

	Prog. Flow vph	Sat Flow vph	Arrival Type	Green Time sec	Cycle Length sec	Prog. Speed mph	Distance to Signal feet
S2 Left-Turn							
Through							
S5 Left-Turn							
Through							

Worksheet 3-Data for Computing Effect of Delay to Major Street Vehicles

	Movement 2	Movement 5
Shared ln volume, major th vehicles:		354
Shared ln volume, major rt vehicles:		0
Sat flow rate, major th vehicles:		1700
Sat flow rate, major rt vehicles:		1700
Number of major street through lanes:		1

Worksheet 4-Critical Gap and Follow-up Time Calculation

Critical Gap Calculation

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(c,base)		4.1	7.1	6.5	6.2			
t(c,hv)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(hv)		2	2	2	2			
t(c,g)			0.20	0.20	0.10	0.20	0.20	0.10
Percent Grade			0.00	0.00	0.00	0.00	0.00	0.00
t(3,lt)		0.00	0.70	0.00	0.00			
t(c,T): 1-stage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-stage	0.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
t(c) 1-stage		4.1	6.4	6.5	6.2			
2-stage								

Follow-Up Time Calculations

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(f,base)		2.20	3.50	4.00	3.30			
t(f,HV)	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
P(HV)		2	2	2	2			
t(f)		2.2	3.5	4.0	3.3			

Worksheet 5-Effect of Upstream Signals

Computation 1-Queue Clearance Time at Upstream Signal

	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
V prog				

Total Saturation Flow Rate, s (vph)	
Arrival Type	
Effective Green, g (sec)	
Cycle Length, C (sec)	
Rp (from Exhibit 16-11)	
Proportion vehicles arriving on green P	
g(q1)	
g(q2)	
g(q)	

Computation 2-Proportion of TWSC Intersection Time blocked	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
alpha				
beta				
Travel time, t(a) (sec)				
Smoothing Factor, F				
Proportion of conflicting flow, f				
Max platooned flow, V(c,max)				
Min platooned flow, V(c,min)				
Duration of blocked period, t(p)				
Proportion time blocked, p	0.000		0.000	

Computation 3-Platoon Event Periods	Result
p(2)	0.000
p(5)	0.000
p(dom)	
p(subo)	
Constrained or unconstrained?	

Proportion unblocked for minor movements, p(x)	(1) Single-stage Process	(2) Two-Stage Process Stage I	(3) Stage II
p(1)			
p(4)			
p(7)			
p(8)			
p(9)			
p(10)			
p(11)			
p(12)			

Computation 4 and 5

Single-Stage Process

Movement	1	4	7	8	9	10	11	12
	L	L	L	T	R	L	T	R
V c,x		1339	1697	1697	1339			
s								
Px								
V c,u,x								
C r,x								
C plat,x								

Two-Stage Process

7	8	10	11

	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2
V(c,x)								
s		1500		1500				
P(x)								
V(c,u,x)								
C(r,x)								
C(plat,x)								

Worksheet 6-Impedance and Capacity Equations

Step 1: RT from Minor St.	9	12
Conflicting Flows	1339	
Potential Capacity	187	
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity	187	
Probability of Queue free St.	0.97	1.00
Step 2: LT from Major St.	**4**	**1**
Conflicting Flows	1339	
Potential Capacity	515	
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity	515	
Probability of Queue free St.	1.00	1.00
Maj L-Shared Prob Q free St.	1.00	
Step 3: TH from Minor St.	**8**	**11**
Conflicting Flows	1697	
Potential Capacity	92	
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	1.00	1.00
Movement Capacity	92	
Probability of Queue free St.	1.00	1.00
Step 4: LT from Minor St.	**7**	**10**
Conflicting Flows	1697	
Potential Capacity	102	
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor		1.00
Maj. L, Min T Adj. Imp Factor.		1.00
Cap. Adj. factor due to Impeding mvmnt	1.00	0.96
Movement Capacity	102	

Worksheet 7-Computation of the Effect of Two-stage Gap Acceptance

Step 3: TH from Minor St.	8	11
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Probability of Queue free St.		

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 3 - Single Stage		
Conflicting Flows	1697	
Potential Capacity	92	
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	1.00	1.00
Movement Capacity	92	

Result for 2 stage process:		
a		
y		
C t	92	
Probability of Queue free St.	1.00	1.00

Step 4: LT from Minor St.	7	10

Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 3 - Single Stage		
Conflicting Flows	1697	
Potential Capacity	102	
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor		1.00
Maj. L, Min T Adj. Imp Factor.		1.00
Cap. Adj. factor due to Impeding mvmnt	1.00	0.96
Movement Capacity	102	

Results for Two-stage process:	
a	
y	
C t	102

Worksheet 8-Shared Lane Calculations

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (vph)	182	0	6			
Movement Capacity (vph)	102	92	187			
Shared Lane Capacity (vph)		104				

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
C sep	102	92	187			
Volume	182	0	6			
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						
n max						
C sh		104				
SUM C sep						
n						
C act						

Worksheet 10-Delay, Queue Length, and Level of Service

Movement	1	4	7	8	9	10	11	12
Lane Config		LT		LTR				
v (vph)		2		188				
C(m) (vph)		515		104				
v/c		0.00		1.81				
95% queue length		0.01		15.15				
Control Delay		12.0		468.7				
LOS		B		F				
Approach Delay				468.7				
Approach LOS				F				

Worksheet 11-Shared Major LT Impedance and Delay

	Movement 2	Movement 5
p(oj)	1.00	1.00
v(il), Volume for stream 2 or 5		354
v(i2), Volume for stream 3 or 6		0
s(il), Saturation flow rate for stream 2 or 5		1700
s(i2), Saturation flow rate for stream 3 or 6		1700
P*(oj)		1.00
d(M,LT), Delay for stream 1 or 4		12.0
N, Number of major street through lanes		1
d(rank,1) Delay for stream 2 or 5		0.1

HCS+: Unsignalized Intersections Release 5.6

TWO-WAY STOP CONTROL SUMMARY

Analyst: LBF
Agency/Co.: Louis Berger
Date Performed: 11/13/2012
Analysis Time Period: PM Peak
Intersection: Lexington & Cambridge
Jurisdiction: Town of Concord
Units: U. S. Customary
Analysis Year: 2012
Project ID: CKE440A0
East/West Street: Lexington Road
North/South Street: Cambridge Tpke
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		483	0	5	714	
Peak-Hour Factor, PHF		0.98	0.98	0.98	0.98	
Hourly Flow Rate, HFR		492	0	5	728	
Percent Heavy Vehicles		--	--	1	--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes		1	0	0	1	
Configuration			TR		LT	
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	364	0	6			
Peak Hour Factor, PHF	0.98	1.00	0.98			
Hourly Flow Rate, HFR	371	0	6			
Percent Heavy Vehicles	1	1	1			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No	/		/
Lanes	0	1	0			
Configuration		LTR				

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		LT		LTR				
v (vph)		5		377				
C(m) (vph)		1077		198				
v/c		0.00		1.90				
95% queue length		0.01		27.51				
Control Delay		8.4		465.2				
LOS		A		F				
Approach Delay				465.2				
Approach LOS				F				

HCS+: Unsignalized Intersections Release 5.6

Phone: Fax:
E-Mail:

TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst: LBF
Agency/Co.: Louis Berger
Date Performed: 11/13/2012
Analysis Time Period: PM Peak
Intersection: Lexington & Cambridge
Jurisdiction: Town of Concord
Units: U. S. Customary
Analysis Year: 2012
Project ID: CKE440A0
East/West Street: Lexington Road
North/South Street: Cambridge Tpke
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street Movements	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		483	0	5	714	
Peak-Hour Factor, PHF		0.98	0.98	0.98	0.98	
Peak-15 Minute Volume		123	0	1	182	
Hourly Flow Rate, HFR		492	0	5	728	
Percent Heavy Vehicles		--	--	1	--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes		1	0	0	1	
Configuration			TR	LT		
Upstream Signal?		No			No	

Minor Street Movements	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	364	0	6			
Peak Hour Factor, PHF	0.98	1.00	0.98			
Peak-15 Minute Volume	93	0	2			
Hourly Flow Rate, HFR	371	0	6			
Percent Heavy Vehicles	1	1	1			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No	/		/
RT Channelized?						
Lanes	0	1	0			
Configuration		LTR				

Pedestrian Volumes and Adjustments

Movements	13	14	15	16
Flow (ped/hr)	0	0	0	0

Lane Width (ft)	12.0	12.0	12.0	12.0
Walking Speed (ft/sec)	4.0	4.0	4.0	4.0
Percent Blockage	0	0	0	0

Upstream Signal Data

	Prog. Flow vph	Sat Flow vph	Arrival Type	Green Time sec	Cycle Length sec	Prog. Speed mph	Distance to Signal feet
S2 Left-Turn							
Through							
S5 Left-Turn							
Through							

Worksheet 3-Data for Computing Effect of Delay to Major Street Vehicles

	Movement 2	Movement 5
Shared ln volume, major th vehicles:		728
Shared ln volume, major rt vehicles:		0
Sat flow rate, major th vehicles:		1700
Sat flow rate, major rt vehicles:		1700
Number of major street through lanes:		1

Worksheet 4-Critical Gap and Follow-up Time Calculation

Critical Gap Calculation

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(c,base)		4.1	7.1	6.5	6.2			
t(c,hv)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(hv)		1	1	1	1			
t(c,g)			0.20	0.20	0.10	0.20	0.20	0.10
Percent Grade			0.00	0.00	0.00	0.00	0.00	0.00
t(3,lt)		0.00	0.70	0.00	0.00			
t(c,T): 1-stage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-stage	0.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
t(c) 1-stage		4.1	6.4	6.5	6.2			
2-stage								

Follow-Up Time Calculations

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(f,base)		2.20	3.50	4.00	3.30			
t(f,HV)	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
P(HV)		1	1	1	1			
t(f)		2.2	3.5	4.0	3.3			

Worksheet 5-Effect of Upstream Signals

Computation 1-Queue Clearance Time at Upstream Signal

	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
V prog				

Total Saturation Flow Rate, s (vph)	
Arrival Type	
Effective Green, g (sec)	
Cycle Length, C (sec)	
Rp (from Exhibit 16-11)	
Proportion vehicles arriving on green P	
g(q1)	
g(q2)	
g(q)	

Computation 2-Proportion of TWSC Intersection Time blocked	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
alpha				
beta				
Travel time, t(a) (sec)				
Smoothing Factor, F				
Proportion of conflicting flow, f				
Max platooned flow, V(c,max)				
Min platooned flow, V(c,min)				
Duration of blocked period, t(p)				
Proportion time blocked, p	0.000		0.000	

Computation 3-Platoon Event Periods	Result
p(2)	0.000
p(5)	0.000
p(dom)	
p(subo)	
Constrained or unconstrained?	

Proportion unblocked for minor movements, p(x)	(1) Single-stage Process	(2) Two-Stage Process Stage I	(3) Stage II
p(1)			
p(4)			
p(7)			
p(8)			
p(9)			
p(10)			
p(11)			
p(12)			

Computation 4 and 5

Single-Stage Process

Movement	1	4	7	8	9	10	11	12
	L	L	L	T	R	L	T	R
V c,x		492	1230	1230	492			
s								
Px								
V c,u,x								
C r,x								
C plat,x								

Two-Stage Process

7	8	10	11

	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2
V(c,x)								
s		1500		1500				
P(x)								
V(c,u,x)								
C(r,x)								
C(plat,x)								

Worksheet 6-Impedance and Capacity Equations

Step 1: RT from Minor St.	9	12
Conflicting Flows	492	
Potential Capacity	579	
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity	579	
Probability of Queue free St.	0.99	1.00

Step 2: LT from Major St.	4	1
Conflicting Flows	492	
Potential Capacity	1077	
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity	1077	
Probability of Queue free St.	1.00	1.00
Maj L-Shared Prob Q free St.	0.99	

Step 3: TH from Minor St.	8	11
Conflicting Flows	1230	
Potential Capacity	178	
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.99	0.99
Movement Capacity	177	
Probability of Queue free St.	1.00	1.00

Step 4: LT from Minor St.	7	10
Conflicting Flows	1230	
Potential Capacity	197	
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor		0.99
Maj. L, Min T Adj. Imp Factor.		0.99
Cap. Adj. factor due to Impeding mvmnt	1.00	0.98
Movement Capacity	196	

Worksheet 7-Computation of the Effect of Two-stage Gap Acceptance

Step 3: TH from Minor St.	8	11
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Probability of Queue free St.		

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 3 - Single Stage		
Conflicting Flows	1230	
Potential Capacity	178	
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.99	0.99
Movement Capacity	177	

Result for 2 stage process:		
a		
y		
C t	177	
Probability of Queue free St.	1.00	1.00

Step 4: LT from Minor St.	7	10

Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 3 - Single Stage		
Conflicting Flows	1230	
Potential Capacity	197	
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor		0.99
Maj. L, Min T Adj. Imp Factor.		0.99
Cap. Adj. factor due to Impeding mvmnt	1.00	0.98
Movement Capacity	196	

Results for Two-stage process:		
a		
y		
C t	196	

Worksheet 8-Shared Lane Calculations

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (vph)	371	0	6			
Movement Capacity (vph)	196	177	579			
Shared Lane Capacity (vph)		198				

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
C sep	196	177	579			
Volume	371	0	6			
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						
n max						
C sh		198				
SUM C sep						
n						
C act						

Worksheet 10-Delay, Queue Length, and Level of Service

Movement	1	4	7	8	9	10	11	12
Lane Config		LT		LTR				
v (vph)		5		377				
C(m) (vph)		1077		198				
v/c		0.00		1.90				
95% queue length		0.01		27.51				
Control Delay		8.4		465.2				
LOS		A		F				
Approach Delay				465.2				
Approach LOS				F				

Worksheet 11-Shared Major LT Impedance and Delay

	Movement 2	Movement 5
p(oj)	1.00	1.00
v(il), Volume for stream 2 or 5		728
v(i2), Volume for stream 3 or 6		0
s(il), Saturation flow rate for stream 2 or 5		1700
s(i2), Saturation flow rate for stream 3 or 6		1700
P*(oj)		0.99
d(M,LT), Delay for stream 1 or 4		8.4
N, Number of major street through lanes		1
d(rank,1) Delay for stream 2 or 5		0.1

HCS+: Unsignalized Intersections Release 5.6

TWO-WAY STOP CONTROL SUMMARY

Analyst: LBF
Agency/Co.: Louis Berger
Date Performed: 11/13/2012
Analysis Time Period: AM Peak
Intersection: Lexington & Cambridge
Jurisdiction: Town of Concord
Units: U. S. Customary
Analysis Year: 2030
Project ID: CKE440A0
East/West Street: Lexington Road
North/South Street: Cambridge Tpke
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		1406	0	2	372	
Peak-Hour Factor, PHF		0.96	0.96	0.96	0.96	
Hourly Flow Rate, HFR		1464	0	2	387	
Percent Heavy Vehicles		--	--	2	--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes		1	0	0	1	
Configuration			TR		LT	
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	191	0	7			
Peak Hour Factor, PHF	0.96	1.00	0.96			
Hourly Flow Rate, HFR	198	0	7			
Percent Heavy Vehicles	2	2	2			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No	/		/
Lanes	0	1	0			
Configuration		LTR				

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		LT		LTR				
v (vph)		2		205				
C(m) (vph)		461		82				
v/c		0.00		2.50				
95% queue length		0.01		19.35				
Control Delay		12.8		790.5				
LOS		B		F				
Approach Delay				790.5				
Approach LOS				F				

HCS+: Unsignalized Intersections Release 5.6

Phone: Fax:
E-Mail:

TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst: LBF
Agency/Co.: Louis Berger
Date Performed: 11/13/2012
Analysis Time Period: AM Peak
Intersection: Lexington & Cambridge
Jurisdiction: Town of Concord
Units: U. S. Customary
Analysis Year: 2030
Project ID: CKE440A0
East/West Street: Lexington Road
North/South Street: Cambridge Tpke
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street Movements	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		1406	0	2	372	
Peak-Hour Factor, PHF		0.96	0.96	0.96	0.96	
Peak-15 Minute Volume		366	0	1	97	
Hourly Flow Rate, HFR		1464	0	2	387	
Percent Heavy Vehicles		--	--	2	--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes		1	0	0	1	
Configuration			TR	LT		
Upstream Signal?		No			No	

Minor Street Movements	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	191	0	7			
Peak Hour Factor, PHF	0.96	1.00	0.96			
Peak-15 Minute Volume	50	0	2			
Hourly Flow Rate, HFR	198	0	7			
Percent Heavy Vehicles	2	2	2			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No	/		/
RT Channelized?						
Lanes	0	1	0			
Configuration		LTR				

Pedestrian Volumes and Adjustments

Movements	13	14	15	16
Flow (ped/hr)	0	0	0	0

Lane Width (ft)	12.0	12.0	12.0	12.0
Walking Speed (ft/sec)	4.0	4.0	4.0	4.0
Percent Blockage	0	0	0	0

Upstream Signal Data

	Prog. Flow vph	Sat Flow vph	Arrival Type	Green Time sec	Cycle Length sec	Prog. Speed mph	Distance to Signal feet
S2 Left-Turn							
Through							
S5 Left-Turn							
Through							

Worksheet 3-Data for Computing Effect of Delay to Major Street Vehicles

	Movement 2	Movement 5
Shared ln volume, major th vehicles:		387
Shared ln volume, major rt vehicles:		0
Sat flow rate, major th vehicles:		1700
Sat flow rate, major rt vehicles:		1700
Number of major street through lanes:		1

Worksheet 4-Critical Gap and Follow-up Time Calculation

Critical Gap Calculation

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(c,base)		4.1	7.1	6.5	6.2			
t(c,hv)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(hv)		2	2	2	2			
t(c,g)			0.20	0.20	0.10	0.20	0.20	0.10
Percent Grade			0.00	0.00	0.00	0.00	0.00	0.00
t(3,lt)		0.00	0.70	0.00	0.00			
t(c,T): 1-stage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-stage	0.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
t(c) 1-stage		4.1	6.4	6.5	6.2			
2-stage								

Follow-Up Time Calculations

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(f,base)		2.20	3.50	4.00	3.30			
t(f,HV)	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
P(HV)		2	2	2	2			
t(f)		2.2	3.5	4.0	3.3			

Worksheet 5-Effect of Upstream Signals

Computation 1-Queue Clearance Time at Upstream Signal

	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
V prog				

Total Saturation Flow Rate, s (vph)
Arrival Type
Effective Green, g (sec)
Cycle Length, C (sec)
Rp (from Exhibit 16-11)
Proportion vehicles arriving on green P
g(q1)
g(q2)
g(q)

Computation 2-Proportion of TWSC Intersection Time blocked	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
alpha				
beta				
Travel time, t(a) (sec)				
Smoothing Factor, F				
Proportion of conflicting flow, f				
Max platooned flow, V(c,max)				
Min platooned flow, V(c,min)				
Duration of blocked period, t(p)				
Proportion time blocked, p	0.000		0.000	

Computation 3-Platoon Event Periods	Result
p(2)	0.000
p(5)	0.000
p(dom)	
p(subo)	
Constrained or unconstrained?	

Proportion unblocked for minor movements, p(x)	(1) Single-stage Process	(2) Two-Stage Process Stage I	(3) Stage II
p(1)			
p(4)			
p(7)			
p(8)			
p(9)			
p(10)			
p(11)			
p(12)			

Computation 4 and 5
Single-Stage Process

Movement	1	4	7	8	9	10	11	12
	L	L	L	T	R	L	T	R
V c,x		1464	1855	1855	1464			
s								
Px								
V c,u,x								
C r,x								
C plat,x								

Two-Stage Process

7	8	10	11

	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2
V(c,x)								
s		1500		1500				
P(x)								
V(c,u,x)								
C(r,x)								
C(plat,x)								

Worksheet 6-Impedance and Capacity Equations

Step 1: RT from Minor St.	9	12
Conflicting Flows	1464	
Potential Capacity	158	
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity	158	
Probability of Queue free St.	0.96	1.00

Step 2: LT from Major St.	4	1
Conflicting Flows	1464	
Potential Capacity	461	
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity	461	
Probability of Queue free St.	1.00	1.00
Maj L-Shared Prob Q free St.	0.99	

Step 3: TH from Minor St.	8	11
Conflicting Flows	1855	
Potential Capacity	74	
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.99	0.99
Movement Capacity	74	
Probability of Queue free St.	1.00	1.00

Step 4: LT from Minor St.	7	10
Conflicting Flows	1855	
Potential Capacity	81	
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor		0.99
Maj. L, Min T Adj. Imp Factor.		1.00
Cap. Adj. factor due to Impeding mvmnt	1.00	0.95
Movement Capacity	81	

Worksheet 7-Computation of the Effect of Two-stage Gap Acceptance

Step 3: TH from Minor St.	8	11
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Probability of Queue free St.		

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 3 - Single Stage		
Conflicting Flows	1855	
Potential Capacity	74	
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.99	0.99
Movement Capacity	74	

Result for 2 stage process:		
a		
y		
C t	74	
Probability of Queue free St.	1.00	1.00

Step 4: LT from Minor St.	7	10

Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 3 - Single Stage		
Conflicting Flows	1855	
Potential Capacity	81	
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor		0.99
Maj. L, Min T Adj. Imp Factor.		1.00
Cap. Adj. factor due to Impeding mvmnt	1.00	0.95
Movement Capacity	81	

Results for Two-stage process:	
a	
y	
C t	81

Worksheet 8-Shared Lane Calculations

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (vph)	198	0	7			
Movement Capacity (vph)	81	74	158			
Shared Lane Capacity (vph)		82				

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
C sep	81	74	158			
Volume	198	0	7			
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						
n max						
C sh		82				
SUM C sep						
n						
C act						

Worksheet 10-Delay, Queue Length, and Level of Service

Movement	1	4	7	8	9	10	11	12
Lane Config		LT		LTR				
v (vph)		2		205				
C(m) (vph)		461		82				
v/c		0.00		2.50				
95% queue length		0.01		19.35				
Control Delay		12.8		790.5				
LOS		B		F				
Approach Delay				790.5				
Approach LOS				F				

Worksheet 11-Shared Major LT Impedance and Delay

	Movement 2	Movement 5
p(oj)	1.00	1.00
v(il), Volume for stream 2 or 5		387
v(i2), Volume for stream 3 or 6		0
s(il), Saturation flow rate for stream 2 or 5		1700
s(i2), Saturation flow rate for stream 3 or 6		1700
P*(oj)		0.99
d(M,LT), Delay for stream 1 or 4		12.8
N, Number of major street through lanes		1
d(rank,1) Delay for stream 2 or 5		0.1

HCS+: Unsignalized Intersections Release 5.6

TWO-WAY STOP CONTROL SUMMARY

Analyst: LBF
Agency/Co.: Louis Berger
Date Performed: 11/13/2012
Analysis Time Period: PM Peak
Intersection: Lexington & Cambridge
Jurisdiction: Town of Concord
Units: U. S. Customary
Analysis Year: 2030
Project ID: CKE440A0
East/West Street: Lexington Road
North/South Street: Cambridge Tpke
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		528	0	5	781	
Peak-Hour Factor, PHF		0.98	0.98	0.98	0.98	
Hourly Flow Rate, HFR		538	0	5	796	
Percent Heavy Vehicles		--	--	1	--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes		1	0	0	1	
Configuration			TR		LT	
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	398	0	7			
Peak Hour Factor, PHF	0.98	1.00	0.98			
Hourly Flow Rate, HFR	406	0	7			
Percent Heavy Vehicles	1	1	1			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No	/		/
Lanes	0	1	0			
Configuration		LTR				

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		LT		LTR				
v (vph)		5		413				
C(m) (vph)		1035		169				
v/c		0.00		2.44				
95% queue length		0.01		34.93				
Control Delay		8.5		710.3				
LOS		A		F				
Approach Delay				710.3				
Approach LOS				F				

HCS+: Unsignalized Intersections Release 5.6

Phone: Fax:
E-Mail:

TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst: LBF
Agency/Co.: Louis Berger
Date Performed: 11/13/2012
Analysis Time Period: PM Peak
Intersection: Lexington & Cambridge
Jurisdiction: Town of Concord
Units: U. S. Customary
Analysis Year: 2030
Project ID: CKE440A0
East/West Street: Lexington Road
North/South Street: Cambridge Tpke
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street Movements	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		528	0	5	781	
Peak-Hour Factor, PHF		0.98	0.98	0.98	0.98	
Peak-15 Minute Volume		135	0	1	199	
Hourly Flow Rate, HFR		538	0	5	796	
Percent Heavy Vehicles		--	--	1	--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes		1	0	0	1	
Configuration			TR	LT		
Upstream Signal?		No			No	

Minor Street Movements	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	398	0	7			
Peak Hour Factor, PHF	0.98	1.00	0.98			
Peak-15 Minute Volume	102	0	2			
Hourly Flow Rate, HFR	406	0	7			
Percent Heavy Vehicles	1	1	1			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No	/		/
RT Channelized?						
Lanes	0	1	0			
Configuration		LTR				

Pedestrian Volumes and Adjustments

Movements	13	14	15	16
Flow (ped/hr)	0	0	0	0

Lane Width (ft)	12.0	12.0	12.0	12.0
Walking Speed (ft/sec)	4.0	4.0	4.0	4.0
Percent Blockage	0	0	0	0

Upstream Signal Data

	Prog. Flow vph	Sat Flow vph	Arrival Type	Green Time sec	Cycle Length sec	Prog. Speed mph	Distance to Signal feet
S2 Left-Turn							
Through							
S5 Left-Turn							
Through							

Worksheet 3-Data for Computing Effect of Delay to Major Street Vehicles

	Movement 2	Movement 5
Shared ln volume, major th vehicles:		796
Shared ln volume, major rt vehicles:		0
Sat flow rate, major th vehicles:		1700
Sat flow rate, major rt vehicles:		1700
Number of major street through lanes:		1

Worksheet 4-Critical Gap and Follow-up Time Calculation

Critical Gap Calculation

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(c,base)		4.1	7.1	6.5	6.2			
t(c,hv)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(hv)		1	1	1	1			
t(c,g)			0.20	0.20	0.10	0.20	0.20	0.10
Percent Grade			0.00	0.00	0.00	0.00	0.00	0.00
t(3,lt)		0.00	0.70	0.00	0.00			
t(c,T): 1-stage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-stage	0.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
t(c) 1-stage		4.1	6.4	6.5	6.2			
2-stage								

Follow-Up Time Calculations

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(f,base)		2.20	3.50	4.00	3.30			
t(f,HV)	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
P(HV)		1	1	1	1			
t(f)		2.2	3.5	4.0	3.3			

Worksheet 5-Effect of Upstream Signals

Computation 1-Queue Clearance Time at Upstream Signal

	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
V prog				

Total Saturation Flow Rate, s (vph)	
Arrival Type	
Effective Green, g (sec)	
Cycle Length, C (sec)	
Rp (from Exhibit 16-11)	
Proportion vehicles arriving on green P	
g(q1)	
g(q2)	
g(q)	

Computation 2-Proportion of TWSC Intersection Time blocked	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
alpha				
beta				
Travel time, t(a) (sec)				
Smoothing Factor, F				
Proportion of conflicting flow, f				
Max platooned flow, V(c,max)				
Min platooned flow, V(c,min)				
Duration of blocked period, t(p)				
Proportion time blocked, p	0.000		0.000	

Computation 3-Platoon Event Periods	Result
p(2)	0.000
p(5)	0.000
p(dom)	
p(subo)	
Constrained or unconstrained?	

Proportion unblocked for minor movements, p(x)	(1) Single-stage Process	(2) Two-Stage Process Stage I	(3) Stage II
p(1)			
p(4)			
p(7)			
p(8)			
p(9)			
p(10)			
p(11)			
p(12)			

Computation 4 and 5

Single-Stage Process

Movement	1	4	7	8	9	10	11	12
	L	L	L	T	R	L	T	R
V c,x		538	1344	1344	538			
s								
Px								
V c,u,x								
C r,x								
C plat,x								

Two-Stage Process

7	8	10	11

	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2
V(c,x)								
s		1500		1500				
P(x)								
V(c,u,x)								
C(r,x)								
C(plat,x)								

Worksheet 6-Impedance and Capacity Equations

Step 1: RT from Minor St.	9	12
Conflicting Flows	538	
Potential Capacity	545	
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity	545	
Probability of Queue free St.	0.99	1.00

Step 2: LT from Major St.	4	1
Conflicting Flows	538	
Potential Capacity	1035	
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity	1035	
Probability of Queue free St.	1.00	1.00
Maj L-Shared Prob Q free St.	0.99	

Step 3: TH from Minor St.	8	11
Conflicting Flows	1344	
Potential Capacity	152	
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.99	0.99
Movement Capacity	151	
Probability of Queue free St.	1.00	1.00

Step 4: LT from Minor St.	7	10
Conflicting Flows	1344	
Potential Capacity	168	
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor		0.99
Maj. L, Min T Adj. Imp Factor.		0.99
Cap. Adj. factor due to Impeding mvmnt	1.00	0.98
Movement Capacity	167	

Worksheet 7-Computation of the Effect of Two-stage Gap Acceptance

Step 3: TH from Minor St.	8	11
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Probability of Queue free St.		

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 3 - Single Stage		
Conflicting Flows	1344	
Potential Capacity	152	
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.99	0.99
Movement Capacity	151	

Result for 2 stage process:		
a		
y		
C t	151	
Probability of Queue free St.	1.00	1.00

Step 4: LT from Minor St.	7	10

Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 3 - Single Stage		
Conflicting Flows	1344	
Potential Capacity	168	
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor		0.99
Maj. L, Min T Adj. Imp Factor.		0.99
Cap. Adj. factor due to Impeding mvmnt	1.00	0.98
Movement Capacity	167	

Results for Two-stage process:	
a	
y	
C t	167

Worksheet 8-Shared Lane Calculations

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (vph)	406	0	7			
Movement Capacity (vph)	167	151	545			
Shared Lane Capacity (vph)		169				

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
C sep	167	151	545			
Volume	406	0	7			
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						
n max						
C sh		169				
SUM C sep						
n						
C act						

Worksheet 10-Delay, Queue Length, and Level of Service

Movement	1	4	7	8	9	10	11	12
Lane Config		LT		LTR				
v (vph)		5		413				
C(m) (vph)		1035		169				
v/c		0.00		2.44				
95% queue length		0.01		34.93				
Control Delay		8.5		710.3				
LOS		A		F				
Approach Delay				710.3				
Approach LOS				F				

Worksheet 11-Shared Major LT Impedance and Delay

	Movement 2	Movement 5
p(oj)	1.00	1.00
v(il), Volume for stream 2 or 5		796
v(i2), Volume for stream 3 or 6		0
s(il), Saturation flow rate for stream 2 or 5		1700
s(i2), Saturation flow rate for stream 3 or 6		1700
P*(oj)		0.99
d(M,LT), Delay for stream 1 or 4		8.5
N, Number of major street through lanes		1
d(rank,1) Delay for stream 2 or 5		0.1