Memorandum

BETA Group, Inc.
Engineers • Planners • Landscape Architects • Scientists

Date: April 6, 2011
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Town of Westwood, MA
50 Carby Street
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Subject: Traffic Calming Evaluation
High Rock/Dover/Conant/Country Neighborhood

INTRODUCTION

BETA Group, Inc. (BETA), on behalf of the Town of Westwood (Town) has conducted a Traffic Calming Needs Assessment within the High Rock Street, Dover Road, Conant Road and Country Lane neighborhoods. This assessment provides a summary of existing traffic conditions within the neighborhoods and quantifies the need for the implementation of a traffic calming program. By definition, traffic calming *involves changes in street alignment, installation of barriers, and other physical measures to reduce traffic speeds and/or cut-through volumes, in the interest of street safety, livability, and other public purposes*.[1] If justified, this document will also provide a description of commonly used applicable traffic calming devices and a preliminary traffic calming plan to act as a starting point for discussion.

The adoption of any traffic calming plan can only occur as a result of a structured process. This process is heavily dependent upon the input of the residents within the neighborhoods which abut the subject area. If a traffic calming program is found to be justified through this assessment, the eventual preferred plan is then developed through close coordination between the Town, the residents and the engineers. It is important to note that for the plan to successfully be adopted as the guiding plan for the future implementation of traffic calming devices requires the direct approval of the majority of the affected residents. As such it is critical that the public play an active role in the traffic calming planning process.

The details of the traffic calming process as they specifically pertain to this project will be an integral part of the first neighborhood meeting to discuss the project. This meeting is scheduled for the evening of May 4, 2011.

The subsequent portions of this memorandum summarize BETA's initial findings as part of the traffic calming needs assessment.

SUMMARY

[1] Ewing, Reid, "Overview: Legal Aspects of Traffic Calming," Compendium of Reference Papers, 1998 ITE Annual

Residents within the High Rock Street, Dover Road, Conant Road and Country Lane neighborhoods have expressed concern that these local roadways are actively being used as a cut-through by traffic seeking to avoid peak period congestion along High Street (Route 109), resulting in speed and safety issues within their neighborhoods. The Town has agreed to consider addressing these concerns through the development of a traffic calming plan with the stipulations that

1. An independent assessment validates the cut-through concerns and the applicability of traffic calming measures.
2. If justified, any traffic calming program implemented will not have the potential to create detrimental impacts elsewhere.
3. The majority of residents within the neighborhoods affected directly express their approval for the traffic calming plan.
4. It is recognized that there is currently no funding identified to implement the plan.

To address these concerns the Town has retained BETA to oversee the traffic calming planning process. Based on our investigation, the need for a traffic calming program is justified. The traffic volumes documented herein utilizing these roadways during peak hours **clearly indicate the presence of a cut-through route**. Furthermore vehicle speeds are consistently higher than the posted speed limits along these roadways. Field measurements reveal that use of the cut-through has the potential to reduce travel time significantly when compared to utilizing High Street only, particularly during the morning peak period.

Congestion along High Street (Route 109) is clearly the driving factor behind the utilization of these neighborhood roads as a cut-through route. High Street provides an important connection to Route 128/I-95 for communities to the west. Due to growth within these communities, and the lack of other strong east-west connections to the interstate highway system in the area, High Street has become oversaturated during peak commuting periods. While beyond the scope of this traffic calming exercise, it should be noted that addressing this root congestion would be the most effective means by which to reduce the desirability of the cut-through routes and calm traffic within the subject neighborhoods. This however would require a substantial capital investment to improve capacity along High Street and a long term engineering process.

It is worth noting that potential traffic calming measures which physically divert traffic will not be considered applicable for use in this project. Restricting movements would likely divert vehicles onto High Street, exacerbating an already congested condition, or creating impacts within other neighborhoods. Therefore, this study will focus on the application of speed control measures within these neighborhoods.

STUDY AREA

The main study area consists of the following sections of roadway and intersections. The study area is also shown on **Figure 1**.

ROADWAY

High Rock Street – High Rock Street is classified by MassDOT as an urban collector and runs east-west within the study area. The average daily traffic (ADT) along High Rock Street is approximately 3,300 vehicles per day. The posted speed limit on the westbound approach is 30 mph. The approximate width is of High Rock Street is 22 feet and consists of one 9.5 feet travel lane and 1.5 feet shoulder in each direction separated by a double yellow centerline (DYCL). A bituminous concrete sidewalk exists along the southern section of High Rock Street from High Street to Hartford Street. There are sight distance restrictions at the stop controlled approach to Dover Road.

Dover Road – The limits of Dover Road included as part of this study are from its intersection with High Rock Street and its intersection with High Street. Dover Road is classified by MassDOT as an urban collector and runs north-south within the study area. The ADT along Dover Road is approximately 3,050 vehicles per day. The posted speed limit in both the northbound and southbound direction is 25 mph. The width of Dover Road is 22 feet and consists of one 11 feet travel lane in each direction separated by a single solid yellow centerline. There are no sidewalks along Dover Road in the study area. Utility poles, guardrail and fencing abut a considerable amount of the edge of pavement along Dover Road.

Conant Road – Conant Road is classified as a local road by MassDOT and runs north-south from Dover Road to Lynn Terrace and east-west from Lynn Terrace to High Street. The ADT along Conant Road is approximately 2,050 vehicles per day. The posted speed limit on the northbound approach is 30 mph. The width of Conant Road is 25 feet and consists of one travel lane in each direction. There are no pavement markings or sidewalks along Conant Road in the study area.

Country Lane – Country Lane runs from Conant Road to Summer Street and is approximately 24 feet wide. There is no posted speed limit and there are no pavement markings or sidewalks in the study area.

All study area roadways are under the jurisdiction of the Town of Westwood.

FIELD OBSERVATIONS

During field observations made in March of 2011, roadway and intersection geometric configurations / physical features were recorded. These features include sight lines, pavement markings, width of pavement, posted speeds, location of sidewalks, crosswalks and the general nature of pavement condition and traffic operations. On-site observations were made during the morning and afternoon commuting peak periods.

Queues were also observed during the morning and evening peak traffic periods. Notable queues[2] consist of:

- 16 vehicles along Conant Road eastbound at High Street during the morning peak period
- 13 vehicles along Hartford Street eastbound at High Rock Street during the morning peak period
- 7 vehicles along High Rock Street southbound at Hartford Street during the evening peak period
- Queues of 5 vehicles or less along all other approaches

The queues reported above represent classic standing queues. At other locations persistent *rolling queues* were observed and present their own operational difficulties. A rolling queue is a platoon of vehicles that never fully stops but are bunched together, traveling at a consistent low level speed. The presence of these rolling queues is primarily due to the lack of opposing volume at intersections within the study area.

During field observations, BETA also measured the travel time through the High Street corridor between High Rock Street and Summer Street. These measurements were made in the northbound direction during the morning peak period and the southbound direction during the evening peak period to be consistent with the predominant traffic flows and cut-through activity. Measured travel times were approximately 11 minutes and 4 minutes 32 seconds, during the morning and evening peak periods respectively. BETA additionally measured the travel time of the neighborhood cut-through during the morning peak period and in reverse during the evening peak period. Travel times were 6 minutes and 3 minutes 50 seconds, respectively. A summary of the travel time information is presented in **Table 1** below.

Table 1 Travel Time Summary

	Route 109	**Dover Road (cut-through)**	**Time Difference**
AM	11:00	6:00	5:00
PM	4:32	3:50	0:42

As can be seen in **Table 1** the time savings for a vehicle to use the cut-through during the morning peak period is approximately 5 minutes and 42 seconds during the evening peak period. The difference between time savings appears to be related to the location of the congestion on High Street during the two time periods. In the morning the congestion builds in the northbound direction, towards Rt 128/I-95. During this period vehicles are presented with the option of utilizing the cut-through route at point relatively near the beginning point of the congestion on High Street, giving the driver a significant incentive. During the evening peak period the congestion builds back towards Rt 128/I-95 in the southbound direction. In this case drivers do not have the option to utilize the cut-through route until a point much further along into the congestion, thus lowering the incentive to do so. This point is reinforced by the observed traffic volumes as presented subsequently in this memorandum.

[2] Maximum observed queues during the given time period

Residents have noted that the use of the cut-through route during the evening period is enhanced during the warmer weather months when pedestrian activity along High Street increases.

During the morning peak period, several school aged children and adults were observed in the area of the Conant Road at Country Lane intersection and along Conant Road in the Lynn Terrace area. There are currently no sidewalks or crosswalks in this area.

TRAFFIC DATA

To assess existing traffic conditions in the study area, peak hour turning movement counts (TMC) were conducted on Tuesday, March 22nd, 2011 from 7:00-9:00AM and 4:00-6:00PM. These periods represent the most critical traffic volume conditions. Concurrent with the TMCs, automatic traffic recorder (ATR) counts were conducted along High Rock Street, Dover Road and Conant Road, collecting weekday data over a 48-hour period. The ATR's collected continuous traffic volume data, speed data and vehicle classification information at the following locations:

1. High Rock Street between #102 High Rock and the intersection of Westchester Road
2. Dover Road between #267 and #195
3. Conant Road between #223 and #175

A review of the data indicated that the weekday morning peak period occurred from 7:15 AM to 8:15 AM and the weekday evening peak period occurred 5:15 PM to 6:15 PM. **Figure 1** provides the 2011 existing weekday morning and evening peak hour traffic volumes. A summary of the ATR data is presented in **Table 2** and graphically also on **Figure 1** below.

Table 2: ATR Data Summary

	Daily	Weekday Morning Peak Hour			Weekday Evening Peak Hour		
Location	Weekday	Volume	K Factor	Dir. Dist.	Volume	K Factor	Dir. Dist.
High Rock	3,300	603	18.3%	SB 52%	370	11.2%	SB 53%
Dover Rd	3,050	660	21.6%	EB 94%	367	12.0%	WB 89%
Conant Rd	2,050	587	28.4%	SB 53%	259	12.5%	SB 54%

The ATRs also recorded operational 85th percentile speeds, the speed at which 85% of vehicles are at or below. A summary of the posted and 85th percentile speeds is provided in **Table 3**.

Table 3 Speed Data Summary

	Posted Speed Limit	85th% Speed
High Rock Street	30	39 mph NB / 39 mph SB
Dover Road	25	36 mph EB / 34 mph WB
Conant Road	30	37 mph NB / 36 mph SB

As can be seen in **Table 3** the operational speeds along the subject roadways are generally 10 mph over the posted speed limit.

Finally, a tracking study was performed on March 22, 2011 during the peak periods to validate the level of cut-through traffic. Vehicle tracking was conducted at the following locations:

1. High Rock Street at Hartford Street
2. Conant Road at High Street
3. Dover Road at High Street
4. Country Lane at Sunset Road

The results of the tracking study for each peak period are provided in **Table 4** below and graphically on **Figure 2**.

Table 4 License Plate Survey Results

	High Rock St	**Conant Rd**	**Dover Rd**	**Country Ln**	**Total cut-through (%)**
	Origin	Destination	Destination	Destination	
Direction	*NB*	*EB*	*EB*	*NB*	
AM Volumes	845				
cut-through (%)		33%	9%	53%	94%
	Destination	Origin	Origin	Origin	
Direction	*SB*	*WB*	*WB*	*SB*	
PM Volumes	501				
cut-through (%)		9%	26%	49%	83%

Based on the license plate study results during the morning and evening peak periods, approximately 94% and 83% of vehicles travelling on High Rock Street are using the study neighborhood as a cut-through, respectively. It should be noted that the volume utilizing the cut-through is significantly higher during the morning peak period. In the morning approximately 60% of the traffic enters the cut-through route primarily as a left turn from Hartford Street, 25% enters from High Street, the remain 15% diffuses into the cut-through route from the residential roadways along High Rock Street between Hartford Street and Dover Road, presumably as traffic from Hartford Street seek to avoid congestion along this road as it approaches High Rock Street. As seen in **Table 4** the majority (53%) of the cut-through traffic is destined towards Country Lane and Sunset Road, presumably towards Summer Street from where it will re-access High Street via the signalized intersection. About one third of the cut-through traffic chooses to re-enter High Street via the unsignalized intersection at Conant Road. Only a minor portion (9%) stays on Dover Road to re-enter High Street. In the evening the majority of traffic utilizing the cut-through route enters from Summer Street via Country Lane or Sunset Road. About one quarter enter via Dover Road. About two thirds of the traffic utilizing the cut-through in the evening are destined for Hartford Street westbound, the other third re-enters High Street from High Rock Road.

TYPICAL TRAFFIC CALMING MEASURES

Commonly used traffic calming measures are described below. Advanced visual cues are necessary to warn drivers of many of these measures.

- **PAVEMENT MARKINGS**
  Pavement Markings can be used as traffic calming measures that regulate traffic movements in lieu of physical changes to the roadway. The addition of striping a defined centerline and shoulder inherently have been shown to calm traffic. In certain applications, these measures may produce the same effect as the physical traffic calming measures. However, police enforcement is often required to ensure motorist compliance.

- **CURB EXTENSIONS - BULB-OUTS, NECKDOWNS, CHOKERS, MID-BLOCK CROSSINGS**
  These are physical devices placed in the roadway to create horizontal deflections by narrowing points along the roadway by expanding the curbing. Narrowing sections of the roadway is referred to as a choker or mid-clock crossing; narrowing at an intersection is referred to as a neckdown or bulb-out. These techniques can be used to narrow lanes and slow traffic. Curb extensions along a roadway force vehicles to slow while maneuvering the narrow points while curb extensions at an intersection lead to tighter turning radii, forcing vehicles to slow.

  These devices are appropriate for local roads with little heavy vehicle traffic.

- **CHICANES**
  Chicanes are S-shaped curve realignments of a normally straight roadway, which encourages slower speeds.

- **CENTER ISLAND**
  Center islands are usually raised islands (also called medians) within the roadway centerline. They usually narrow the travel lane at that location and separate opposing traffic movements. When landscaped, they can improve the aesthetics of the corridor. They are feasible without major roadway changes when the right-of-way is available within the existing pavement width. Center islands may also be painted, but these are less effective than raised center islands, since vehicles can traverse a painted island.

- **GATEWAY**
  Gateway features can be used to identify a change in the environment for vehicles entering the traffic calming management area. Monuments or other landscaping devices can be used to signify a change in the area type.

- **MINI TRAFFIC CIRCLE**
  Mini traffic circles are raised islands placed in intersections. Traffic circulates counterclockwise around these islands. They are especially good for calming intersections within neighborhoods where speeds, volumes, and safety are problems. Mini traffic circles usually have 4-way stop control.

- **SPEED HUMPS AND TABLES**
  Speed humps are asphalt or rubber mounds that cover the full width of the roadway. Speed tables are essentially speed humps that have been modified with a flat top. The flat top is typically long enough for the entire wheelbase of a passenger car to rest on and the ramps are sloped more gently for a more gradual slowing of vehicles than speed humps. The flat top allows a higher design speed and smoother ride than humps. Speed tables are more desirable to emergency vehicles.

- **SPEED CUSHIONS/LUMPS**
  Speed cushions/lumps are designed as three separate speed humps. They effectively slow vehicles down and allow wider axle emergency vehicles to pass without slowing them down.

- **RAISED INTERSECTIONS/CROSSWALKS**
  A raised intersection/crosswalk is a raised plateau, usually three to four inches above adjacent streets and are good for high-pedestrian areas.

- **DYNAMIC SPEED DISPLAYS AND VEHICLE ACTUATED SIGNS**
  Radar activated signs that dynamically display approaching speeds for individual vehicles or display messages such as "SLOW DOWN" or "REDUCE SPEED" when a vehicle exceeds a certain speed. They alert drivers that they are speeding and create a sense of being monitored. They can be portable or permanent.

It should also be noted that during inclement weather, particularly snowy conditions, maintenance/plowing crews need to be mindful of vertical traffic calming device locations. Vertical traffic calming devices such as speed humps, tables, cushions and unexpected curb extensions need to be clearly identified with advanced warning signs and/or a reflectorized object markers or plastic bollards at each location. Snow plows must reduce speed to a minimal condition when plowing these vertical traffic calming devices.

Speed humps and cushions/lumps can be permanent (asphalt) or temporary (rubber). Rubber devices have the benefit that they can be pulled up and moved without being destroyed. This can be convenient for municipalities who may wish to store these devices during the winter months to eliminate the potential of snow plow damage.

PRELIMINARY TRAFFIC CALMING PLAN

BETA's observations and data collection support the use of traffic calming measures to target the reduction of vehicle speeds within the neighborhood. The recommendations presented below are approaches that BETA believes will successfully address the issues identified in this needs assessment. *This preliminary traffic calming plan is intended to foster discussion amongst all stakeholders. It will likely be refined as the traffic calming process progresses to address specific needs.* **Figure 3** presents the types of proposed traffic calming devices and their associated locations under this preliminary plan. Note that to achieve effective speed control vertical devices should be spaces approximately 400 feet apart.

LOCATIONS

High Rock Street

- Repaint double yellow centerline (DYCL) and shoulder pavement markings along the length of the road.
- Install a vertical speed control device in the vicinity of the midway point on High Rock Street between High Street and Hartford Street.
- Install a gateway along High Rock Street just north of Hartford Street
- Install a vertical speed control device approximately 400 feet north of Hartford Street
- Install dynamic speed limit signs in the area of 169 High Rock Street
- Add curb-extensions at the intersection with Westchester Drive
- Add curb-extensions at the intersection with Salisbury Drive

High Rock Street at Dover Road

- Safety improvements should be made to address awkward geometry and sight distance restrictions. Vegetation should be trimmed. Re-stripe stop bar and repair existing stop sign. Consideration should be given to installing a flashing beacon at this location.

Dover Road

- Paint double yellow centerline (DYCL) and shoulder pavement markings along the length of the road within the study area. Travel way width should be restricted.
- Install a vertical speed control device approximately 400 feet east of High Rock Street.
- Install dynamic speed limit signs approximately 800 feet east of High Rock Street
- Install a vertical speed control device approximately 800 feet west of Carby Street.
- Install a vertical speed control device approximately 400 feet west of Carby Street.
- Create a raised intersection at the intersection with Carby Street.
- Install a vertical speed control device approximately 400 feet south of Conant Road.

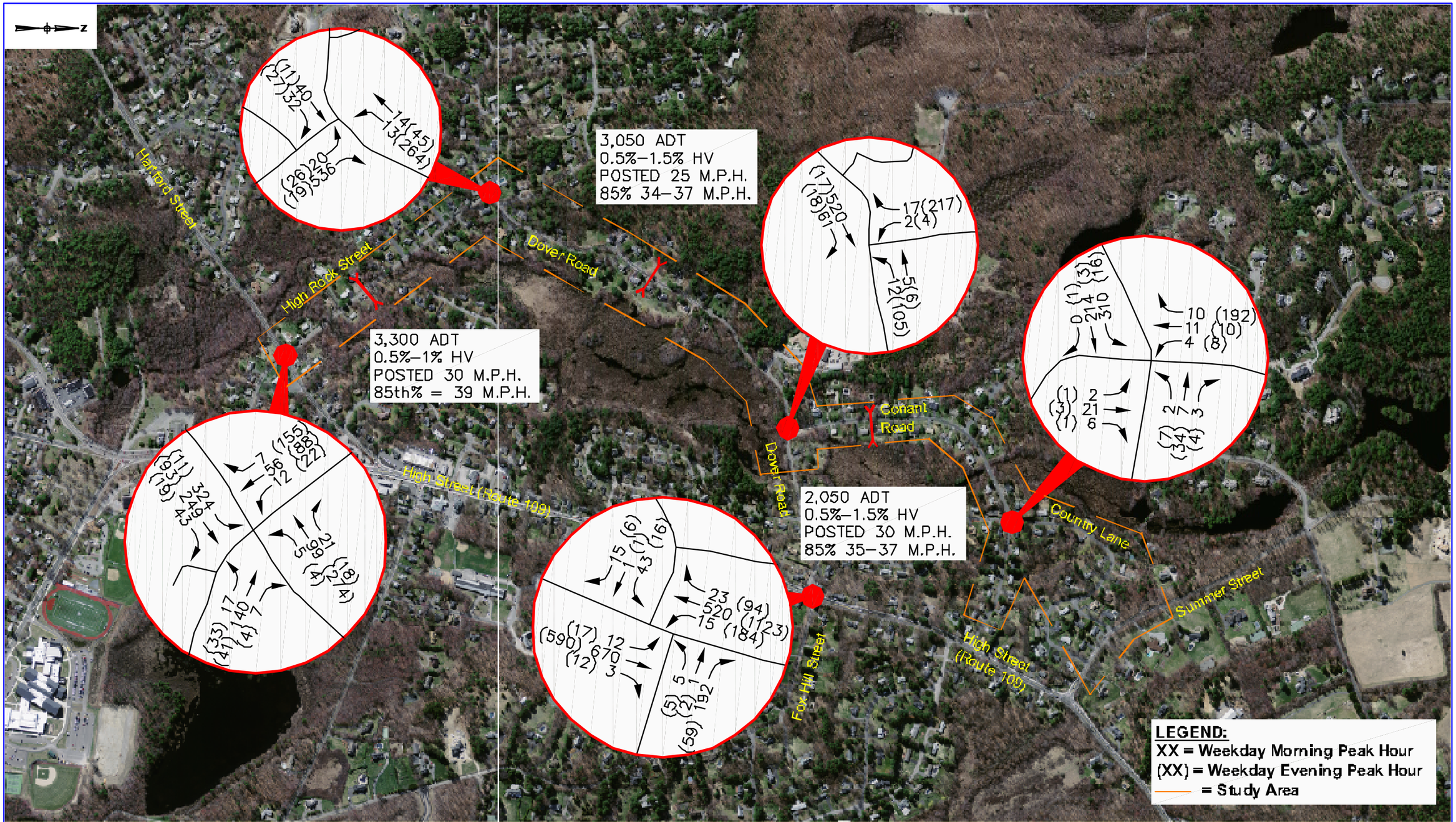
Dover Road at Conant Road

- Add curb extensions at the intersection.
- Add a median island to the Conant Road approach to reduce pavement width.

Conant Road

- Paint double yellow centerline (DYCL) and shoulder pavement markings along the length of the road within the study area. Travel way width should be restricted.

- Install a combined chocker and vertical speed control device approximately 400 feet east of Dover Road.
- Install a center median approximately 400 feet west of Lynn Terrace
- Create a raised intersection at the intersection with Lynn Terrace
- Install a vertical speed control device approximately 400 feet south-east of Lynn Terrace.
- Create a raised intersection at the intersection with Country Lane/Lorraine Road



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Traffic Flow Diagram
Traffic Calming Evaluation
High Rock Street/Dover Road/Conant Road/Country Lane Neighborhood
Westwood, Massachusetts

Figure 1
Existing 2011 AM & PM Peak Hour Traffic Data

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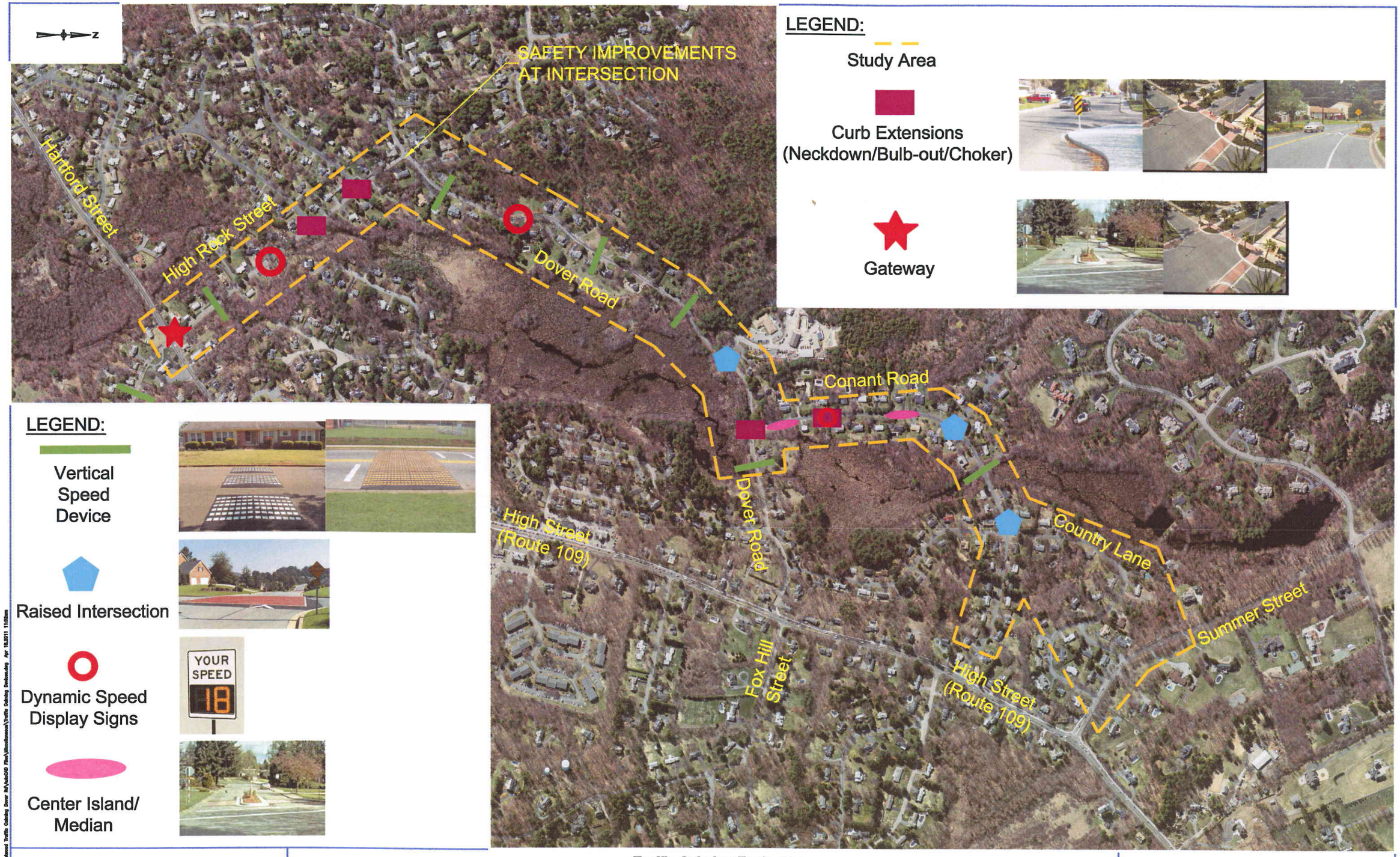
Traffic Calming Evaluation
High Rock Street/Dover Road/Conant Road/Country Lane Neighborhood
Westwood, Massachusetts

Figure 2
License Plate Survey Results



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Traffic Calming Evaluation
High Rock Street/Dover Road/Conant Road/Country Lane Neighborhood
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Figure 3
Proposed Traffic Calming Devices