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March 17, 2010

Eric Berger
18 Hamilton Road
Apt. 205
Arlington, MA 02474

Subject: Consulting Services
Massachusetts Avenue (Route 3/2A) Reconstruction
Arlington, MA
Our Reference No. 09138

Dear Mr. Berger:

In response to your concerns regarding the proposed Massachusetts Avenue Reconstruction in East Arlington, Civilworks, Inc. has completed initial research and evaluation efforts and is pleased to submit the following letter report describing pertinent issues, findings to date, and observations for consideration and discussion.

INTRODUCTION

The proposed project limits extend from Pond Lane at the northerly terminus to Alewife Brook Parkway (Route 16) at the southerly terminus. The general proposal brought forth as a result of the Functional Design Report (FDR) prepared by Fay, Spofford & Thorndike, LLC and endorsed by the Town of Arlington Selectmen at their August 10th meeting, consists of the following key components:

- Reduction of vehicle travel lanes from the four (4) currently available to:
 - One (1) northbound lane from Sunapee Road to Pond Lane
 - One (1) southbound lane from Pond Lane to Harlow Street
 - Two (2) southbound lanes from Harlow Street to Alewife Brook Parkway

- Reduction of lane widths to 11 feet

- Addition of a five (5) foot wide bike lane, both northbound and southbound, between Pond Lane and Sunapee Road/Boulevard Road (approximately 200 ft. north of Alewife Brook Parkway)

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- Provisions for turn lanes and signal improvements at existing signalized intersections intended to improve efficiency of operation including new signal equipment at four (4) intersections;
- Installation of a new signal at the Bates/Marion Road intersection to be interconnected with the Foster Street/Linwood Street intersection;
- Signs and pavement markings associated with the above noted bikes lanes, left turn lanes and travel lanes;
- Cold planning of the existing surface and application of a new pavement overlay, curbing and sidewalk alterations, as well as addition of streetscape amenities.

The investigative effort undertaken by our office has included the following pertinent information to date:

- Review of the Town's website and materials on the "Mass. Ave. Corridor Project" link;
- A meeting with Laura Weiner at the Town's Planning and Community Development Department on January 22nd;
- Review of the findings and recommendations contained in the "Functional Design Report, Massachusetts Avenue (Route 3/2A), Arlington, Massachusetts"; prepared by Fay, Spofford, & Thorndike, LLC; Sept. 2009;
- Telephone conversations with Ms. Cara Siederman, City of Cambridge Planning on February 10th and February 16th re: bike lanes;
- A field visit was conducted on January 22nd to gain a better understanding of existing conditions along the project corridor.

This letter report will present the findings and observations resulting from our investigations to date regarding traffic congestion, with and without the proposed changes in the roadways operational characteristics, cyclist and pedestrian safety, neighborhood "cut-through" traffic, and other transportation-related issues.

DATA COLLECTIONS AND PROJECTIONS

We have reviewed the methodology and results of data collections as presented in the FDR. The methodology utilized to generate the traffic projections for 2018 appears to be in accordance with accepted engineering practices. Traffic count data gathering, including turning movement counts at peak hours on weekdays and Saturday mid-day, 48 hour automatic traffic recorders, as well as recording of pedestrian and bicycle activity was also completed and is documented in the report. The original data gathered in October, 2008 was supplemented by counts in May, 2009 at the request of the Town, due to concerns raised by local residents, and it was determined that the October, 2008 data was valid for the analysis. It was noted that bicycle volumes were significantly higher in the May, 2009 counts and this variation was deemed likely to be due to spring conditions and warmer weather. It was determined by comparison to permanent traffic recording stations located in the greater Boston area that October traffic volumes are higher than average; therefore, no adjustments were made. Growth in traffic volume was determined to be 1% per year based on historic data and review of studies in the area. This growth is reflected in the 2018 traffic volume projections.

Observation: While the methodology and time horizon utilized is in keeping with standard practice and Mass. Highway design criteria for Functional Design Reports, consideration should be given to the fact that final design and construction process will most likely not be completed until 2014, or four (4) years short of the FDR design year. It would be more appropriate to look at a design year 10 years into the from future completion of improvements or about 2024.

LEVEL OF SERVICE COMPARISON – NO-BUILD vs. BUILD

The FDR provides several detailed tables (12, 15, 17, 18 and 19) describing the results of analysis of the four (4) signalized intersections, utilizing the 2018 traffic volumes, with and without the proposed lane use and signalization improvements. Typically, the overall operational efficiency of an urban arterial roadway is dictated by the level of service offered by the signalized intersections and the ability of traffic to move unimpeded between the intersections.

In an effort to consolidate the various pieces of information, the following is a summary, by intersection, of the proposed improvements, and the key results as they affect delays and queues along Massachusetts Avenue and other major traffic movements. As appropriate, an observation regarding the findings is offered. Delay, in this document, refers to the average number of seconds between the arrival and departure at an intersection for a vehicle during the peak 15 minute period of the peak hour of the day. Queue data obtained from the FDR

reflects the distance, in feet, vehicles are anticipated to be stopped and waiting to pass thru an intersection. The 95th percentile queue is only exceeded 5 percent of the time and is a design criteria embraced by Mass. Highway per the 2006 Design Manual.

➤ **Linwood Street/Foster Street and Marion Road/Bates Road**

The Linwood Street/Foster Street intersection is currently signalized and is predicted to operate with minimal delays (less than 10 seconds) under the 2018 No-Build scenario. The nearby unsignalized Marion Road/Bates Road intersection, approximately 500 ft. to the east, experiences delays in excess of 50 seconds on the side street approaches. Per the 2000 Highway Capacity Manual (HCM) criteria, the Linwood Street/Foster Street intersection operates at level of service (LOA) A in 2018 (good), and the Marion Road/Bates Road intersection approaches operate at LOS F (bad) for the No-Build scenario.

The proposed improvements at these locations include changes in timing and phasing of the Linwood Street/Foster Street intersection and interconnection of this signal with a new signal at the Marion Road/Bates Road intersection. It should be noted that although the Linwood Street/Foster Street intersection does not meet warrants for a signal, public input determined that the signal should be retained and upgraded to current standards.

Observation: While the proposal does not adversely affect the Massachusetts Avenue northbound traffic during either the A.M. or P.M. peak hours, the delays and queues for the Mass. Ave. southbound, Linwood eastbound, and Foster westbound traffic all increase significantly in the A.M. and P.M. peak hours. The 95th percentile queue increases from 86 feet under the No-Build scenario to 493 feet in the A.M. and from 72 feet to 225 feet respectively in the P.M. This translates to a southbound back-up extending to Wyman Terrace in the A.M. The LOS at this intersection drops off from A (less than 10 sec. delay) to D (35.1 to 50 sec. delay) for A.M. and P.M. peak hours.

Observation: Similarly, at the new Bates/Marion Road signal, the 2018 Build scenario indicates lengthy queues in both directions for both the A.M. and P.M. peak hours. The 95th percentile queue for southbound traffic is calculated to be 876 feet and 746 feet for A.M. and P.M. respectively. This translates to a southbound backup through the Linwood Street/Foster Street intersection.

➤ **Massachusetts Avenue/Lake Street/Winter Street**

This intersection is located in the Business Center and is currently signalized. Lake Street is two-way while Winter Street is one-way running eastbound or away from Mass. Ave.

Under the 2018 No-Build scenario, this intersection operates at a LOS F (bad) during both the A.M. and P.M. peak hours. Delays northbound on Mass. Ave. are 141 to 148 seconds and queue lengths are 377 to 428 feet for the A.M. and P.M. respectively. Southbound, the calculated delay for thru- and left-turn (into Winter Street) lanes is 77 secs. in the A.M. and 25.9 secs. in the P.M. with queue lengths of 396 and 218 feet, respectively. The right-turn delay is 37.4 secs. in the A.M. and 19.2 secs. in the P.M. with queue lengths of 246 feet and 78 feet, respectively.

Observation: *As a result of the proposed improvements the northbound left-turn movement into Lake Street experiences reduced delays and queues; however, the single thru- and right-turn lane experiences significantly longer queue lengths of 444 ft. and 543 ft. in the A.M. and P.M. peak hours, respectively. This queue would translate to a back-up to approximately mid-block at Marathon and Trowbridge Streets.*

Observation: *Southbound right-turning vehicles will experience similar delays and slightly longer queues as compared to the No-Build scenario. Southbound left-turning vehicles (into Winter Street) will experience shorter delays and queues due to an exclusive lane. Southbound thru-movement vehicles should experience shorter delays with similar queue lengths as compared to the No-Build condition.*

Observation: *The analysis does not speak to an existing condition noted in the FDR regarding the traffic signal at Brooks Avenue, near the Hardy School. Field investigations along Lake Street indicate that "it is likely that the lack of coordination with the Lake Street signal at Massachusetts Avenue contributes to the constant vehicle queues and blockage along Lake Street." According to our conversation with a Town representative, there are no plans to study this situation further or inclusion of any "coordination" work in the improvements currently considered for the Mass. Avenue/Lake Street intersection. Failure to account for this existing condition in the FDR analysis may result in misleading conclusions particularly with regard to claims of improved delay and queueing conditions for Mass. Ave. northbound left turns and southbound right turns. Impacts to queue lengths for these turning movements on Mass. Ave. due to the Lake Street condition could also have significant consequences with regard to efficiency of thru movements on Mass. Ave.*

➤ Thorndike Street and Teal Street

According to the signal warrant analysis presented in the FDR, this intersection does not meet warrants for signalization. Based on public meetings and meetings with Mass. Highway it was agreed to maintain this signal and to bring the signal into conformance with current MUTCD standards to improve efficiency.

Observation: Under the 2018 No-Build scenario, the Mass. Ave. northbound traffic experienced a 1.7 sec. delay and 36 ft. 95th percentile queue in the A.M. peak hour and 1.6 sec. delay and 59 ft. queue in the P.M. peak hour. With improvements to the signal and implementation of the single northbound lane/bike lane striping, the delay increases to 5.6 secs., which is acceptable, but the 95th percentile queue length increases to 297 ft. in the A.M. Similarly, the delay in the P.M. peak hour increases to 11.5 secs., and the 95th percentile queue is 577 ft., or roughly a ten-fold increase and extending back to Sunapee Road. This is the point where the northbound lane reduction (from 2 lanes to 1 lane) leaving the Alewife Brook Parkway intersection takes place.

This condition could have an adverse impact on the Alewife Brook Parkway intersection.

➤ Alewife Brook Parkway

This intersection is located at the southerly end of the subject project. The existing lane configuration is slated to remain unchanged and the only recommendation at this time is to adjust the signal timing.

Observation: The proposed signal timing change will not appreciably alter the delays or queues currently experienced by the Mass. Ave. southbound traffic (in Arlington). Delays will continue to be 75 secs. in the A.M. and 60 secs., more or less, in the P.M. on this leg of the intersection. Queues will be approximately 560 ft. in the A.M. and 380 ft., more or less, in the P.M. In both time periods, the 95th percentile queue, as well as the 50th percentile queue, blocks access to Lafayette Street and Boulevard Road. The 50th percentile queue will continue to block access to Boulevard Road in the P.M. peak hour.

Observation:

The aforementioned condition coupled with the proposal to taper from 2 lanes to 1 lane northbound before Sunapee Road, thereby eliminating the opportunity to bypass

left-turning traffic accessing Lafayette Street, Boulevard Road, or private driveways on the southerly side of Mass. Ave., could result in a backup or, at best, a slowing in northbound traffic progression which will adversely affect the Alewife Brook Parkway intersection

Observation: *Per a meeting with Town representatives on January 22, 2010, the "re-timing" of this intersection is the responsibility of the City of Cambridge and not in the scope of the Arlington project.*

There are overriding concerns arising from the compound effect of the above observations regarding queues and delays that should be investigated further include:

- Excessive queue lengths, or backups, at signalized intersections along the project corridor may lead to the increased use of adjacent neighborhood streets to bypass congestion. An analysis of this likelihood and methods to deter motorists from using neighborhood streets, such as traffic calming to slow traffic thereby increasing travel times along alternative routes, should be discussed in the Functional Design Report or otherwise documented. This concern for reduction of thru traffic on neighborhood streets is identified as a goal by the Arlington Transportation Advisory Committee; however, it is not addressed in the FDR.
- There is no discussion of the environmental impacts of increased traffic delays. Specifically, an analysis and discussion of air quality impacts due to delays should be included in the Functional Design Report.
- The proposed lane reductions, both in number and width, could create additional delays for emergency response vehicles. This concern should be address by qualified experts.
- No mention is made in the FDR of an analysis of interconnection of all new or upgraded signals to create a coordinated system. The system should also include an emergency pre-empt capability.

SAFETY

The FDR contains a review and analysis of crash history for the three-year period between 2004 and 2006. The following are pertinent with regard to the data provided.

- During the time period reviewed (3 years) there were 59 crashes at the intersections within the study corridor. Of these, 29, or nearly 50 percent, occurred at the Alewife

Brook Parkway intersection which is not scheduled for any substantive improvements other than signal retiming to be accomplished by the City of Cambridge.

- During the time period reviewed, there was one pedestrian “crash” (at the Lake Street/Winter Street intersection) and there were no bicyclists “crashes”. In the FDR, it is reported that the “Massachusetts Avenue/Lake Street/Winter Street intersection has the majority of pedestrian and bicycle accidents”.
- The link between Lake Street and Teel Street experienced nearly 55 percent of the total “link” accidents (between intersections). This link experienced all of the pedestrian and bicycle crashes, or one (1) each. This link also has twelve (12) unsignalized public street intersections, the largest number of intersections among the links identified; thus, the largest number of potential conflict points.
- The FDR presents findings regarding crash rates for the study intersections. The crash rates were calculated using Mass Highway’s Crash Rate Worksheet and compared to the average crash rate within Mass Highway District 4 which, according to the FDR, is 0.88 crashes for every million entering vehicles (MEV) for a signalized intersection and 0.63 crashes per MEV at an unsignalized intersection. This calculation shows that the Alewife Brook Parkway crash rate equals the average rate. All of the other intersections experienced crash rates below the average with rates ranging from 0.13 to 0.75 MEV.

Observation: Based on the data provided in the FDR, the project corridor does not display any unique crash rate statistic which would infer an inherently unsafe condition currently exists.

The commonly used description of the overall concept of the proposed project is a “road diet”. This typically involves conversion of an existing four-lane undivided highway into a three-lane cross section with two through lanes and a center turn lane. This “narrowing” of the vehicular movements typically facilitates bike lanes, wider sidewalks, etc. through restriping. While the subject project does not strictly follow this definition, it does offer a variation with regard to lane usage which aspires to the same goal.

According to a USDOT, Federal Highway Administration Techbrief FHWA-HRT-04-082 entitled “Summary Report: Evaluation of Lane Reduction ‘Road Diet’ Measures and Their Effects on Crashes and Injuries”, crash rates did not change significantly from the pre- to post-“road diet” scenario.

Observation: *One of the goals for the subject project as stated by the Arlington Transportation Advisory Committee in a timeline and goal informational sheet issued in 2009 is to create a safer and more orderly traffic flow. Given the low existing crash rate data and the documentation published by FHWA which indicates no significant change due to road diets, it does not appear the proposal necessarily addresses this goal.*

Bicycle Accommodations

The Mass Highway Design Manual encourages consideration of bicycle accommodations consistent with the project context, roadway characteristics, community plans, etc. The manual continues by offering alternative methodologies to incorporate bicycle accommodations including bicycle lanes, use of shoulders, and shared roadways. The FHWA provides design guidance with regard to this component and recognizes the challenges in balancing the needs of motorists, bicyclists, and pedestrians particularly in conditions where there is limited right of way available. The Transportation Equity Act for the 21st Century (TEA-21) and the United States Department of Transportation (USDOT) Design Guidance requires that "bicycling [and walking] facilities will be incorporated into all transportation projects unless exceptional circumstances exist."

Towards this end, the FDR incorporates two (2) 5 ft. wide bike lanes, one in each direction, over the length of the project corridor, with the exception of the last 200 ft., more or less, at the easterly and westerly terminus. At the time of this writing, based on conversations with local officials, there are no definitive plans to continue a similar bike lane northerly into Arlington or southerly into Cambridge along Mass. Ave.

Observations:

- *No mention is made with regard to enhancing usage of the Minuteman Bikeway which crosses the Mass Avenue corridor north of the subject project terminus. This option should be discussed in more detail.*
- *The current design leaves a ¼ mile "gap" between the northerly end of the proposed bike lanes and the Bikeway crossing of Mass. Ave., thus affording no consistent allocation of space in the roadway for cyclists and an inconsistent expectancy of the presence of bicycle traffic by motorists.*
- *The southerly terminus of the bike lanes does not address the needs of bicyclists arriving at or departing from the Alewife Brook Parkway intersection; furthermore, at this time there are no firm plans for bike lanes continuing along Mass. Avenue in Cambridge.*

- *The lack of bike lanes at either end of the project create a false sense of security for young or novice riders when that leaves them in dangerous circumstances that they might not necessarily anticipate.*
- *A shared bike lane should be considered in conjunction with recommendations contained later in this letter with regard to lane widths and configurations. A shared lane would comply with regulatory mandates and would provide for experienced bicyclists travel within the vehicular traffic flow without promoting usage by young or less experienced riders.*
- *Provision of bike lanes as roadway improvements are implemented and monies are made available is a typical and somewhat reasonable response to mandates and policies of government agencies; however, discontinuous facilities which result may leave bicyclists in situations where they are "stranded". A more prudent approach may be to identify high demand corridors and create continuous low-cost and low-impact bicycle facilities on a regional or corridor basis rather than a project-by-project basis.*

Pedestrian Accommodations

Pedestrian safety and mobility provisions are proposed to be addressed by wider sidewalks and shorter crosswalks at signalized intersections. Pedestrian safety is also addressed by retention and upgrade of existing unwarranted signals as well as actuated pedestrian phases at new signals. Both of these methods are reasonable and prudent. Midblock crosswalks, made shorter by bump outs, will be effective only with proper signage, and lighting adequate and well-maintained markings, and proper and effective law enforcement.

SUMMARY

In my professional opinion, the Functional Design Report, while addressing the basic issues typically pertinent to the operations of an urban arterial highway, should address significant and more regional points in order to ensure the function of the final design for the Massachusetts Avenue corridor, as well as the adjoining local street network, performs at the highest level possible for vehicular traffic, pedestrians, cyclists, and emergency response vehicles.

- The capacity analyses for the signalized intersections indicate queues and delays are not appreciably shorter or, in some cases, are actually longer.

- The successful operation of two (2) intersections is contingent upon improvements that are not currently within the project construction scope.
- Given the anticipated queues and delays at signalized intersections along Mass. Ave., the Functional Design Report should evaluate the potential for re-routing or "short-cutting" by motorists through adjoining neighborhood streets in an effort to save time and the effects of additional traffic volumes and increased speeds on these streets.
- Queue lengths at certain intersections restrict traffic movements in or out of unsignalized side streets and commercial drives. Left-turning vehicles, especially where a single northbound lane is proposed, will cause additional "mid-block" queues and delays which are not addressed in the report.
- The proposed improvements may have an adverse effect on response times for emergency vehicles given potential queue lengths and reductions of available travel space due to reduction of lanes and lane widths. This potential impact warrants further analysis and discussion in the Functional Design Report.
- The accident history documented in the report does not appear to indicate that the corridor experiences locations of uniquely high crash frequency or severity. Insufficient information is presented regarding the conditions or causes surrounding the single bicycle and pedestrian accidents reported between 2006 and 2009.
- The incorporation of a bike lane in the design should require a more regional analysis of user demand, available pavement widths, and alternative routes and should include the FHWA's Bicycle Compatibility Index to determine the most suitable bicycle accommodation.
- Failure to address a reasonably safe means for bicyclists to navigate the Alewife Brook Parkway intersection or to travel between the northerly terminus of the bike lane and the Minuteman Bikeway could create a more unsafe condition for bicyclists than currently exists.
- Alternatives are available, and should be analyzed, to accommodate four (4) lanes of vehicular travel, bicycle use, parking where appropriate, and adequate pedestrian space, while still accommodating left turn lanes, short-term delivery vehicle parking, and reasonable space within the travel way to minimize emergency vehicle response times. More specifically, consideration should be given to:

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- A four (4) lane section with a 14 ft. wide travel (right) and an 11 ft. passing (left) lane in each direction;
- Incorporation of a shared bicycle lane as part of the 14 ft. wide travel lane (see Section 5.3.2.3, Shared Lanes, of the Mass Highway Design Manual);
- Nine (9) ft. wide parking spaces;
- Bump outs at key pedestrian crossings would remain as part of the design (max. crosswalk length = 60 ft.);
- Ten (10) ft. left turn lanes would still be incorporated where required;
- Max. curb to curb width would be 78 ft. where 73 ft. is currently called for on the typical sections;
- Pedestrian Zone/Concrete Walkways would need to be slightly reduced in width from the current proposal, but would still exceed the existing sidewalk width.

Prior to moving forward with acceptance with the 25% design and preparation of the 75% design documents, the concerns and comments contained in this letter should be addressed.

We understand further documentation may become available in the coming weeks and months. We welcome the opportunity to review and analyze this material to determine if it warrants modification of the observations and opinions contained herein. In the meantime, if you wish, we are available to meet and discuss the contents of this letter.

Best Regards,
CIVILWORKS, INC.



Dana C. Lynch, P.E.

DCL/lrd

cc: Michael J. Rossi, Esq.
William Hunt, Esq.