



TRANSPORTATION ADVISORY COMMITTEE

7 Twin Circle Drive, Arlington, MA 02474

To: Board of Selectmen, Arlington, Mass

From: Transportation Advisory Committee (TAC)

Subject: Crosswalk at Mass Ave/Water St/Spengler Way

Date: 24 January 2011

At the request of the Board, the TAC formed a Working Group to study this intersection. The Working Group consisted of Jeff Maxtutis, Howard Muise, Scott Smith, Mike Rademacher, Corey Rateau, and Ed Starr. The attached report shows the data collected and the analyses performed.

As a result of this work, the TAC voted unanimously on 20 January 2011 to recommend Phase 1 for immediate action. After the proposed 6 month trial period, the situation will be evaluated and brought again to the Board for a decision, and for consideration of Phases 2 and 3. The justifications for these recommendations are contained in Section 4 of the report.

Phase I Quick and Inexpensive

1. A six month trial of right-turn only from Spengler Way to Mass Ave and concurrent six month trial of right-turn only from Water Street to Mass Ave with appropriate signage. Evaluate after 6 months.
2. Add signage "Do Not Block Intersection" for eastbound Mass Ave traffic.
3. Move advance yield markings to at least 14 ft from crosswalk both east and west.
4. On the eastbound approach of Mass Ave to Spengler Way, post no parking within 40' of the crosswalk. This will require the removal of one space.

Phase 2 More Expensive

5. Add six-foot curb extension on southwest corner of intersection by the library. With a curb extension installed, the parking lane will also need to be marked. Consider a curb extension on northeast corner as well.

Phase 3 Much More Expensive/More Engineering

6. Add high intensity pedestrian-actuated flashing light(s) for crosswalk

Respectfully submitted,

Ed Starr – Working Group Lead and TAC Co-Chair

Jeff Maxtutis – TAC Co-Chair

Transportation Advisory Committee Members:

Elisabeth Carr-Jones, Jean Clark, Steve Kurland, Officer Corey Rateau, Jeff Maxtutis, Howard Muise, Michael Rademacher, Scott Smith, Edward Starr, Richard Turcotte, and Laura Wiener

Web site; www.arlingtonma.gov/tac

Pedestrian Crossing of Mass Ave at Water Street and Spengler Way

1. Background

The intersection of Mass/Water/Spengler is controlled with stop signs at Water and Spengler. Spengler Way provides the sole vehicular access to the library and Water Street carries traffic exiting from the Post Office on Court Street, which is one way away from Mass Ave. This intersection is non-standard in that Water Street is offset from Spengler Way by about 15 ft. The crosswalk crosses Mass Ave between the NE corner of Water and Mass and the SW corner of Mass and Spengler Way. Because of the offset in the two side streets, the crosswalk is roughly perpendicular to the flow of traffic. There are crosswalks on Mass Ave across both the Water and Spengler Way approaches. There is a median on Mass Ave approximately 80 ft east of the crosswalk. An MBTA bus stop is located on the south side of Mass Ave east of Spengler Way.

Mass Ave carries heavy traffic with a signalized intersection approximately 300 feet to the east but no control to the west until the Mill St signal. Most turning movements are heavily used during a normal day, creating a complex interaction of traffic going straight, turning, pedestrians crossing, and bicycle movements. Four pedestrians have been injured in the last 3 ³/₄ years in three incidents. Onsite data collection during this study observed many near misses.

Improvements have been made incrementally to this intersection over the last several years:

2002 – Parking space in front of Domino’s Pizza removed

2004 – Thermoplastic crosswalk installed

2006 – Mass Ave at Crosswalk

- Bollard installed
- Added crosswalk across Spengler Way at Mass Ave
- “No Parking Here to Corner” sign on Mass Ave 20’ west of Spengler Way
- Trimmed hedges on library side

Mass Ave –Westbound

- Cut/removed low hedges and removed low tree branches in median

2008 – Widened crosswalk markings and installed Advanced Yield markings

Summarized Recommendations

Phase I Quick and Inexpensive

1. Six month trial of right-turn only from Spengler Way to Mass Ave and concurrent six month trial of right-turn only from Water Street to Mass Ave with signage.
2. Add signage "Do Not Block Intersection" for eastbound Mass Ave traffic.
3. Move advance yield markings to at least 14 ft from crosswalk both east and west.
4. On the eastbound approach of Mass Ave to Spengler Way, post no parking within 40' of the crosswalk. This will require the removal of one space.

Phase 2 More Expensive

5. Add six-foot curb extension on southwest corner of intersection by the library. With a curb extension installed, the parking lane will also need to be marked. Consider a curb extension on northeast corner as well.

Phase 3 Much More Expensive/More Engineering

6. Add high intensity pedestrian-actuated flashing light(s) for crosswalk

Future

7. If safety still a problem, consider adding a full traffic signal coordinated with Mass/Rt 60.

2. Data

Crash Data

Arlington Police data from 1/1/2007 to 11/10/2010 shows 14 crashes with four involving pedestrians hit in the crosswalk. Averages are over 3 auto crashes and 1 pedestrian crash per year. Most crashes were in the afternoon and evening with no clear day of the week pattern.

The crashes involved the following movements:

- 2 left turns from Water to Mass, one involving a pedestrian
- 2 turns from Mass to Water, one left turn and one right
- 1 left turn from Spengler to Mass involving a pedestrian
- 4 incidents on Mass Ave, one involving two pedestrians
- 5 crashes without detailed data, one involving a pedestrian

Traffic and Turning Movements

Turning movements were collected over four one-hour periods at various times of the weekday and on Saturday, as well as a 24-hour volume measurement on Water Street on 11/16/2010. Turning movements were taken on:

- Saturday 11/13 from 1 to 2 PM
- Tuesday 11/16 from 12 to 1PM
- Tuesday 11/16 from 2 to 3PM
- Thursday 11/18 from 8 to 9AM

This data is provided in the Appendix and summarized below and in Table 1:

1. The majority of the traffic on Water Street is southbound (74%) and two thirds of that makes a right turn. One-third turns left onto Mass Ave. Total traffic on Water Street over a 24-hour period was measured as 1,969 vehicles southbound and 703 northbound, for a total of 2,672 vehicles.
2. Exits from Spengler Way to Mass Ave are again about two thirds right turns and one third left turns. Saturday data was an exception with the turns more balanced.
3. Traffic entering both Spengler Way and Water Street from Mass Ave is roughly balanced between left turns in and right turns in.

Pedestrian Movements

Pedestrian movements related to the crosswalk were collected over four one-hour periods at various times of the day:

- Saturday 11/13/10 from 1 to 2PM
- Tuesday 11/16/10 from 12 to 1
- Tuesday 11/16/10 from 2 to 3PM
- Thursday 11/18/10 from 8 to 9AM

This data is shown in the Appendix and summarized in the Table 2
Conclusions from this data are:

1. Highest volume of pedestrians using the crosswalk in an hour was on Saturday 1 to 2PM (103), next highest was Wednesday from 2 to 3 PM (51). Lowest was Thursday 8 to 9 AM (27).
2. The Library is the destination of the large majority of the pedestrians crossing from north to south.

3. Upon crossing to the north, there is roughly a balance between pedestrians turning right or left on the Mass Ave sidewalk.
4. Significant jaywalking was observed, mostly traveling between either the NW corner to the SW corner or from the NE corner to the SE corner.

Table 1 Vehicular Data

| | | | | Vehicle Data Summary Mass/Water/Spengler | | | |
|-----------------------------|-------------------|--------|-------|---|-------------|------------|-------------|
| | | | | fraction | | | |
| Turns to Mass Ave from .. | driving direction | | | From Speng | | From Water | |
| | Speng | Water | | N | S | N | S |
| 8-9 AM Thur 11/18 | 35 | 166 | right | 26 | 0.74 | 114 | 0.69 |
| | | | left | 9 | 0.26 | 52 | 0.31 |
| | | | total | 35 | | 166 | |
| 12-1 PM Tues 11/16 | 37 | 111 | right | 25 | 0.68 | 81 | 0.73 |
| | | | left | 12 | 0.32 | 30 | 0.27 |
| | | | total | 37 | | 111 | |
| 1-2 PM Sat 11/13 | 62 | 109 | right | 35 | 0.56 | 78 | 0.72 |
| | | | left | 27 | 0.44 | 31 | 0.28 |
| | | | total | 62 | | 109 | |
| 2-3 PM Tues 11/16 | 64 | 133 | right | 43 | 0.67 | 92 | 0.69 |
| | | | left | 21 | 0.33 | 41 | 0.31 |
| | | | total | 64 | | 133 | |
| TOTALS - 4 hrs | 198 | 519 | right | 129 | 0.65 | 365 | 0.70 |
| Average hour | 49.5 | 129.75 | left | 69 | 0.35 | 154 | 0.30 |
| | | | total | 198 | | 519 | |
| Turns from Mass Ave into... | Speng | Water | | Speng | | Water | |
| | S | N | | N | S | S | N |
| 8-9 AM Thur 11/18 | 57 | 36 | right | 27 | 0.47 | 17 | 0.47 |
| | | | left | 30 | 0.53 | 19 | 0.53 |
| | | | total | 57 | | 36 | |
| 12-1 PM Tues 11/16 | 36 | 44 | right | 14 | 0.39 | 26 | 0.59 |
| | | | left | 22 | 0.61 | 18 | 0.41 |
| | | | total | 36 | | 44 | |
| 1-2 PM Sat 11/13 | 61 | 28 | right | 33 | 0.54 | 16 | 0.57 |
| | | | left | 28 | 0.46 | 12 | 0.43 |
| | | | total | 61 | | 28 | |
| 2-3 PM Tues 11/16 | 49 | 50 | right | 24 | 0.49 | 19 | 0.38 |
| | | | left | 25 | 0.51 | 31 | 0.62 |
| | | | total | 49 | | 50 | |
| TOTALS - 4 hrs | 203 | 158 | right | 98 | 0.48 | 78 | 0.49 |
| average hour | 50.75 | 39.5 | left | 105 | 0.52 | 80 | 0.51 |
| | | | total | 203 | | 158 | |
| Water Street | N | S | total | | | | |
| Day Totals Tues 11/16 | 703 | 1969 | 2672 | | | | |

Table 2 Pedestrian Data

| Pedestrian use of Crosswalk -2010 Mass/Water/Spengler | | | |
|--|------------------------|-----------|-------------|
| | Using Crosswalk moving | | Total |
| | South | North | |
| 11/18 Thur | | | |
| 8 to 9 AM | 18 | 9 | 27 |
| turn east | 12 | 5 | |
| turn west | 3 | 3 | |
| thru | 3 | 1 | |
| 11/17 Wednesday | | | |
| 12 to 1 PM | 20 | 31 | 51 |
| turn east | 3 | 12 | |
| turn west | 3 | 15 | |
| thru | 14 | 4 | |
| 11/13 Saturday | | | |
| 1 to 2 PM | 44 | 59 | 103 |
| turn east | | 35 | |
| turn west | | 24 | |
| thru | ++++ | | |
| jaywalk | 19 | | |
| 11/17 Wed | | | |
| 2 to 3 PM | 28 | 17 | 45 |
| turn east | 5 | 6 | |
| turn west | 4 | 5 | |
| thru | 19 | 6 | |
| 4 hr Totals | | | |
| totals | 110 | 116 | 226 |
| turn east | | 58 | |
| turn west | | 47 | |
| thru | | | |
| Ave per hour | 27.5 | 29 | 56.5 |

3. Discussion

There is much to distract a driver approaching this intersection. There are a total of 12 individual turning/straight-through movements plus the crosswalk. For the 4 hours where turning movements were taken, the average activity per minute for each of these movements is:

Crosswalk use (both ways) = one pedestrian every minute

Mass Ave traveling east and west – between 10 and 50 vehicles/minute

Mass traveling east turning left to Water = about one vehicle every 3 minutes

Mass traveling east turning right to Spengler = one vehicle every minute

Mass traveling west turning right to Water = one vehicle every 2 ½ minutes

Mass traveling west turning left to Spengler = one vehicle every 2 ½ minutes

Water traveling south turning right to Mass = 1.5 vehicles every minute

Water traveling south turning left to Mass = more than one vehicle every 2 minutes

Water traveling south crossing to Spengler = infrequent

Spengler traveling north turning right to Mass = one vehicle every 2 minutes

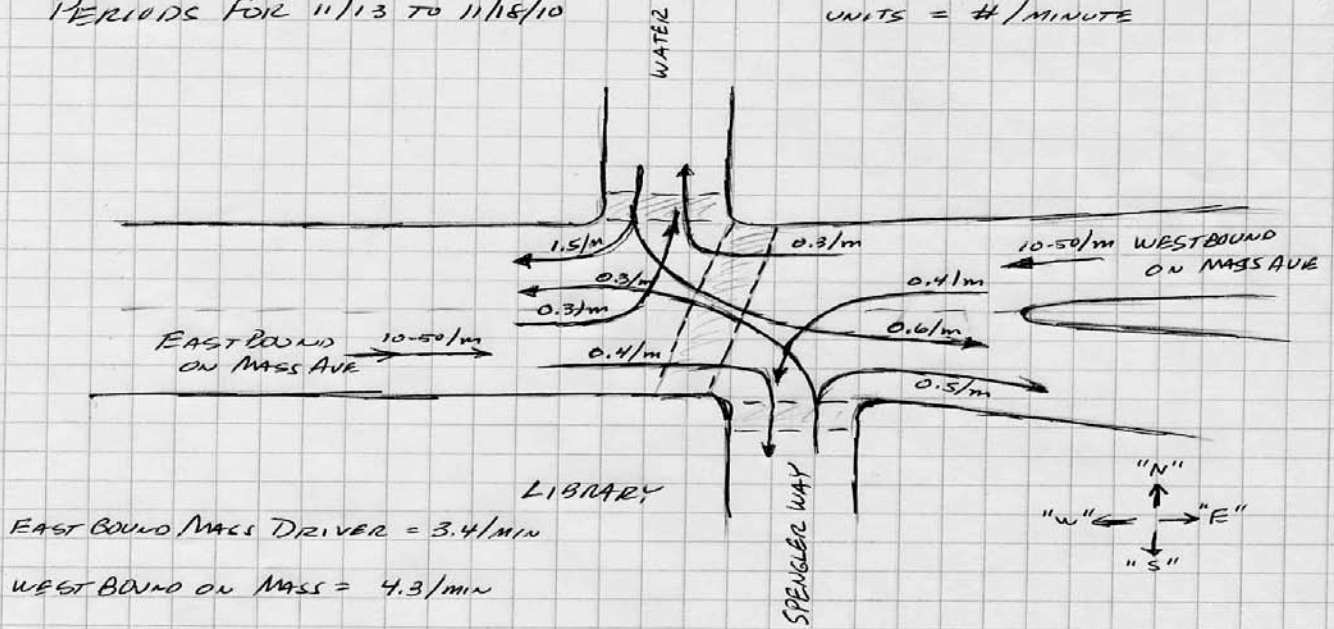
Spengler traveling north turning left to Mass = one vehicle every 3 minutes

Spengler traveling north crossing to Water = infrequent

As shown on the attached sketch (fig 1), navigating the intersection can be very challenging for drivers. An eastbound driver on Mass Ave approaching this intersection during the measurement hours could face on average 3.4 movements per minute, not even considering the activities of cars moving east and west on Mass Ave, jaywalkers, bicycles or parking cars. A driver travelling westbound on Mass Ave faces 4.3 events per minute. Any driver crossing Mass Ave traffic from a side street will face many more movements per minute due to the high level of Mass Ave traffic.

More importantly, a driver making a left turn from Water Street onto Mass Ave could face between 22.2 to 102.2 movements per minute depending upon the traffic on Mass Ave. Also, a driver making a left turn from Spengler Way onto Mass Ave could face between 23.2 up to 103.2 movements per minute. **Reducing the driver's task and potential confusion is a major goal.**

FIG. 1 TURNING MOVEMENTS AND CROSSWALK USE - AVERAGE OF 4ea 1 HOUR PERIODS FOR 11/13 TO 11/18/10 UNITS = #/MINUTE



The second major goal is to increase the visibility of the crosswalk and the pedestrians in it. Visibility of pedestrians on the south side of the crosswalk is poor for eastbound approaching traffic. Parked SUVs and vans can block the view of a pedestrian. The approach from Mass westbound is better (unless a car is parked illegally in front of Domino's Pizza, which happens frequently).

During the course of this investigation, we have considered many possible mitigation measures:

- No left turns each from Water Street, Spengler Way, and Mass Ave
- Lane modifications on Mass Ave
- Additional warning signage
- Warning beacons
- Move bus stop to provide better visibility
- Extending existing median to the west and moving crosswalk to it
- Curb extensions for crosswalk
- Deletion of specific parking to enhance visibility
- In-roadway warning lights
- Raised crosswalk
- Pedestrian signal coordinated with Mass/Rt 60
- Traffic signal coordinated with Mass/Rt 60

From these, we make the following recommendations in several phases.

4. Recommendations

Phase 1 Mitigation measures that can be done inexpensively and quickly

1. Six month trial of right-turn only from Spengler Way to Mass Ave and concurrent six month trial of right-turn only from Water Street to Mass Ave with signage.

Left turn movements from Spengler Way or Water Street conflict directly with the crosswalk and Mass Ave. traffic flow, and increase the need for driver attention. These are the most dangerous movements in the intersection. Their restriction would reduce by two the movements that an approaching driver on Mass Ave or a pedestrian in the crosswalk must watch. It would reduce the activity per minute for a driver approaching eastbound on Mass Ave from 3.4 to 2.5/min, a 25 percent decrease, and westbound from 4.3 to 3.4/min, a 21 percent decrease. It would also eliminate the most dangerous of the vehicular movements for this intersection.

These measures will also increase the mobility for right turners from both streets since the wait required to make left turns slows the queue. There are reasonable alternate paths for drivers to reach their destinations. The alternate paths are longer but do not pose an unreasonable burden. Table 3 contains an impact assessment on motorists destined to various parts of Arlington.

Table 3 Mobility Impacts of Left Turn Restrictions

| Quadrant of Arlington | No left from Spengler | No left from Water |
|---|--|---|
| Northeast (Thompson School area) | Positive, due to less delay for right-turning motorists | Neutral. Travel to Warren via Russell, Mystic and Chestnut is a reasonable alternate already being used |
| Southeast (Hardy School area) | Positive, due to less delay for right-turning motorists | Negative. Alternate routes are somewhat less direct |
| West (Dallin and Brackett areas) | Neutral. Other routes are available (Gray, Route 2 service road) | Positive, due to less delay for right-turning motorists |
| Northwest (Turkey Hill, Stratton School area) | Negative. Alternate routes are somewhat less direct | Positive, due to less delay for right-turning motorists |

We recommend maintaining the left turns from Mass Ave into Spengler Way and into Water Street. These turns do not conflict with the crosswalk. They would be easier without left turns from Water and Spengler to Mass Ave. They do add to the congestion and can be difficult to make, but if these turns were restricted, the alternate routes are very difficult.

2. Add signage “Do Not Block Intersection” for eastbound Mass Ave traffic.
3. Move advance yield markings to at least 14 ft from crosswalk both east and west.

For four lane roadways, pedestrian crashes can happen when the auto in one lane stops, but the driver in the other lane doesn’t see the pedestrian that is visually blocked by the first auto. This happened for one of the pedestrian crashes in 2008. Advanced markings encourage motorists to stop farther from crosswalk so drivers approaching in an adjoining lane have a chance to see the pedestrian in the crosswalk.

4. On the eastbound approach of Mass Ave to Spengler Way, post no parking within 40’ of the crosswalk. This will require the removal of one space.

The goal of this is to increase crosswalk and pedestrian visibility for eastbound traffic, and reduce parking congestion at the intersection. Parking

is valuable in the area, but there is the municipal lot within a short walking distance.

Phase 2 More Expensive

5. Add a six-foot curb extension on southwest corner of intersection by the library. With a curb extension installed, the parking lane will also need to be marked. Consider a curb extension on northeast corner as well.

This will increase the visibility of pedestrians for eastbound traffic without impacting travel. Better visibility is very much needed. The curb extension, by improving pedestrian/motorist visibility, may enable the parking space removed in recommendation 4 to be retained. An extension on the northwest corner should be concurrently evaluated. It would prevent cars from parking in the no parking area and blocking visibility. It would also provide space for equipment needed for Phase 3 mitigation.

Phase 3 More Expensive and Significant Engineering

6. Add high intensity pedestrian-actuated flashing beacon for crosswalk.

Two different forms of beacons were discussed: a) an overhead flashing strobe light, b) a pole on each side with flashing beacon possibly using pedestrian detection technology as is being considered for the bikeway at Mill Street.

Future

7. If safety is still a problem, consider adding a full traffic signal coordinated with intersection at Mass/Rte 60.

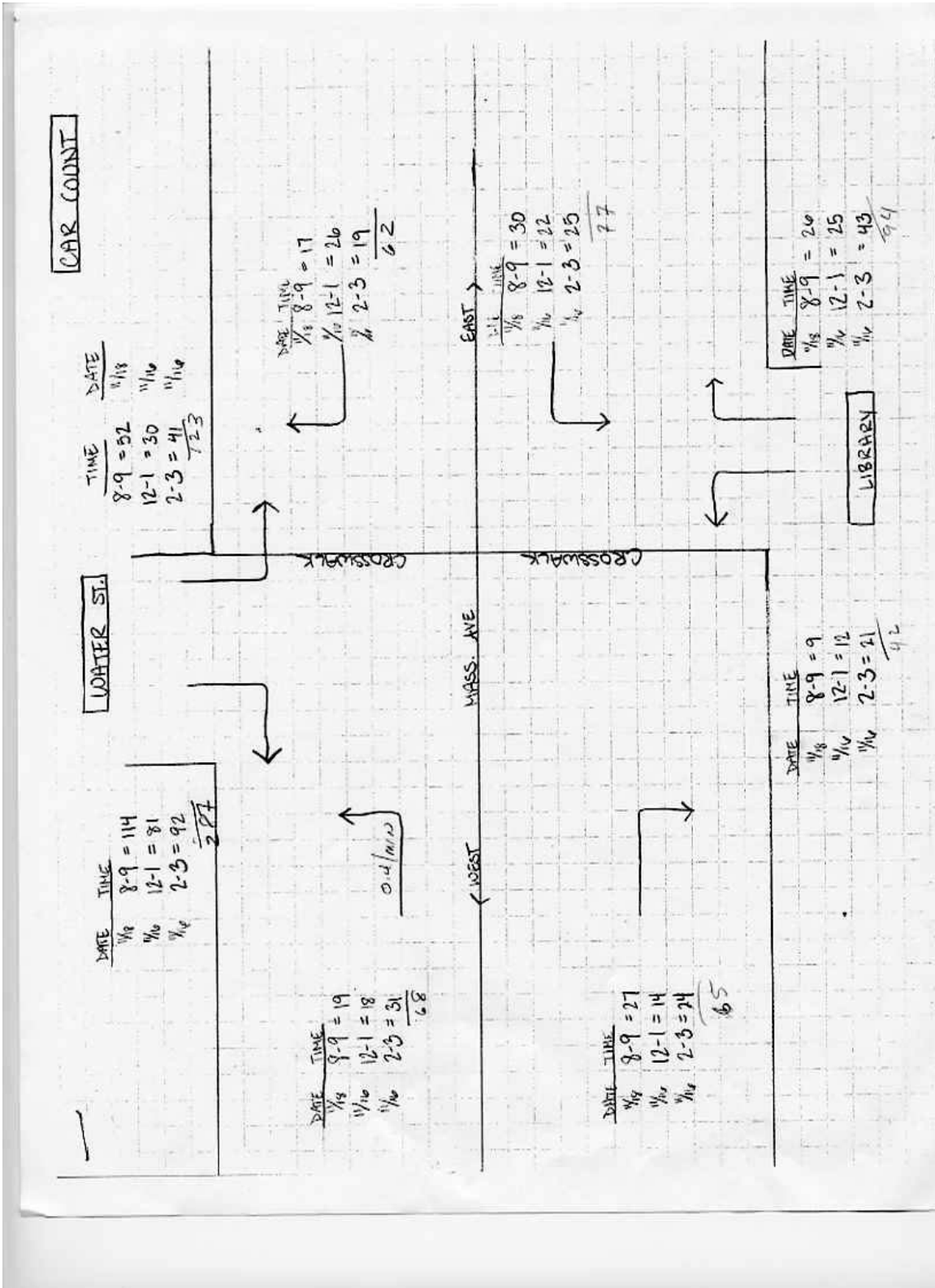
See Table 4 for summary

Table 4

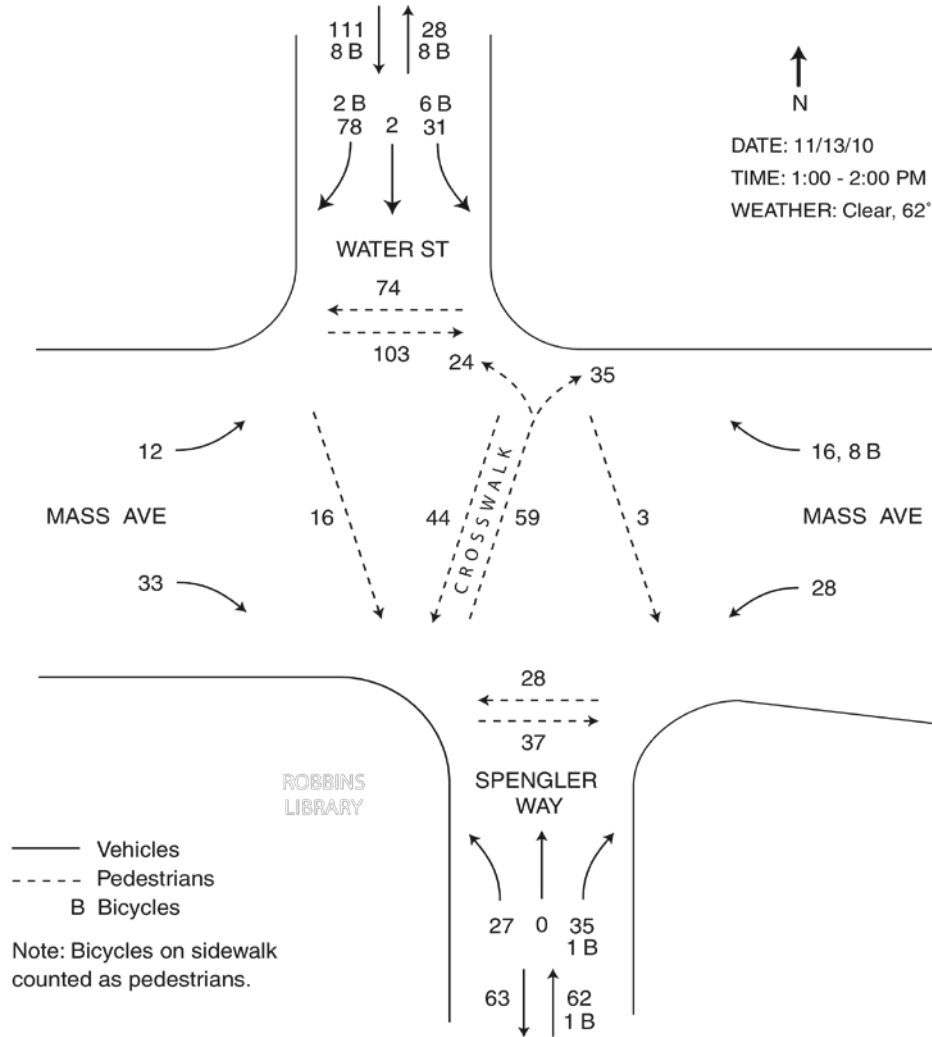
| Action | Justification | Concerns | Opinion |
|---|--|--|--------------------------------------|
| No left turn from Water Street | Less crosswalk conflicts, simplify motorist task, assists motorist mobility for right turns | Alternate route for motorists and cyclists¹, Enforcement | Yes, 6-month trial in Phase 1 |
| No left turn from Spengler Way | Less crosswalk conflicts, simplify motorist task, better motorist visibility, assists motorist mobility for right turns | Alternate route for motorists, Enforcement | Yes, 6-month trial in Phase 1 |
| Curb extensions | Improve ped visibility, reduce ped exposure, prevent illegal parking | Will need to mark parking lane | Yes, in Phase 2 |
| “Do not block “ intersection signage on Mass Ave eastbound | Will help reduce intersection congestion due to blocked left turns into side streets | None | Yes, in Phase 1 |
| Advanced stop treatment farther from crosswalk | Helps motorist see ped after adjacent auto has stopped | None | Yes, in Phase 1 |
| Warning beacon, with detection | Attracts motorist attention effectively to peds | Expensive, maintenance, how to activate? | Yes, in Phase 3 |
| Traffic signal | Simplify motorist and ped task. Appears to meet signal warrants | Expensive, need to coordinate with signal at Mass Ave/Rte 60 | Review for future |

¹ Published literature for the Minuteman Bikeway has suggested several routes to navigate the gap in Arlington Center. One of the published routes includes the left turn from Water Street to Mass Ave.

Appendix Data sheets for vehicles and pedestrians



TURNING & PEDESTRIAN COUNTS
 MASS AVE, WATER ST & PEG SPENGLER WAY



OBSERVATIONS:

- Most pedestrians to/from library and Henry Bear's Park
- 1 very near miss - left turn from Spengler / left turn from Mass EB / right turn from Water
- Several other close calls, including some with pedestrians
- Substantial number of bicycles on Mass Ave through movements.

